GREASES

http://www.linkedin.com/groups/Benefits-polyurea-greases-1786018.S.141547594

polyurea is ideal for rolling element bearings

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Gareth Fish It is well known in the grease world that adding solid lubricants to grease and then failing to homogenize them properly causes an increase in storage bleed.
1 week storage at 40 °C in a lithium #2 with 3% moly should bleed <5% as measured by IP 121. If improperly homogenized, the grease could be expected to bleed up to 15% by the same test method. It could also be that the top of the grease in the barrel was not levelled off and the oil has a tendency to pool into the dips in the surface. This is a storage and handling education issue.

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Aluminum complex greases are popular for their utility across a wide range of temperatures, excellent water resistance and good extreme pressure performance. Their shortcoming is incompatibility with other types of greases (Li complex OK?).

These limitations create an opening in the market for overbased calcium sulfonate greases, which provides better performance in the extreme pressure, rust preventive and water resistance categories along with superior compatibility with other greases.

The term “overbased” refers to calcium carbonate’s amorphous, non-crystalline structure. In the manufacturing process, the carbonate is converted to a crystalline form, calcite, which possesses the desired properties. As more manufacturers begin offering this product, prices should come down as supply goes up.

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Question:
How would the consistency of grease change with a change in temperature?
Answer:
The penetration test is done at 25 degrees C (77 degrees F). If temperature is reduced to 0 degrees C (32 degrees F), grease will be firmer by one to two NLGI numbers.

Question:
What does “bleed” mean with respect to grease?
Answer:
When oil drains out of the thickener by gravity or centrifugal forces.

Question:
When would you consider using grease instead of oil as a lubricant?
Answer:
To decrease the frequency of lubrication, to seal out contaminants, for intermittent operation, to suspend solid lubricants, for shock loading and for low speeds/high loads.

Question:
Name three factors affecting the amount of grease to be applied to a bearing.
Answer:
Is the bearing subjected to: shock loading, heat, water, speed and external contamination.

Question:
What is the "dropping point" of a grease?
Answer:
The temperature at which the first drop of liquid separates from the grease when heated under prescribed conditions.

Question:
What are the principal thickeners used in grease manufacturing?

Answer:
Soaps of lithium, sodium, calcium, barium and aluminum. Organo-clay is used in some high-temperature, non-melting greases. Polyurea is often used in motor-bearing applications.

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Ultra High Base Oil Viscosity, Heavy Load Greases

FEATURES

Heavy oil film provides excellent protection against heavy loads at slow speeds.
Superior water, oxidation rust & anti - wear resistance.
Operating temperature range: -25°C to +130°C.

TYPICAL SPECIFICATIONS

Appearance .....Smooth - tacky black
Thickener..... Lithium complex
Base oil type & ISO viscosity..... Mineral ISO 1000
Base Oil viscosity, CST. ASTM D 445:-
@40°C 1000
@100°C 58
NLGI Grade .....2 & 00
Worked penetration ASTM D 217 …….....265 - 295 & 400 - 430
Drop point ASTM D 2265 .....>260°C & >200°C
Water washout ASTM D1264….....<3%
Wheel bearing test D 3527..... 140 hours
Oil Separation % ASTM D 1742..... 0
Copper corrosion test ASTM D 90 .....1B
Rust prevention ASTM D 1743..... Pass
Four ball load wear index ASTM D 2596... 120
Four ball wear scar mm ASTM D 2296 ..... 0.40
Four ball weld Load (Kgs) IP 239 ..... 800 Kgs

APPLICATIONS

Cement mill roller press bearings, slow speed sugar mill bearings & bushings, heavy turntable bearings, slow moving industrial & rolling element bearing, sponge iron briquette press bearings, heavy earth moving pins & bushes.

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http://www.slideshare.net/clarionlubricants/week-2-content-fundamentals-of-food-grade-greases-food-engineering-webinar-5-212014

1. Food Grade **Grease Fundamentals** Benjamin A. Briseño Product Manager May 21, 2014

- 2. Presentation Scope • Requirements for food grade lubricants • Differences between fluid and grease lubricants • Grease specifications • Food grade grease storage and handling
- 3. FOOD GRADE LUBRICANT REQUIREMENTS
- 4. Lube classification driven by intended uses Direct Food Contact NSF 3H Incidental Contact NSF H-1 No contact NSF H-2
- 5. No Food Contact Lubricants • NSF H2 – Lubricants with no possibility of food contact • Conventional lubricants fall in this category
- 6. Incidental food contact lubricants • Defined by FDA CFR 178.3570 – NSF H1 • Contact concentration limited – 10 ppm maximum contaminant
- 7. What is different in NSF H-1 food grade lubes? • Additives used are limited – Must meet NSF additive requirements (NSF HX-1) • FDA 21 CFR 178.3570 • Technology continues to improve – Additive improvements – Use of chemical synthetic base stocks • Offer high and low temperature

performance enhancement • Offer extended service life

- 8. HOW IS A GREASE DIFFERENT AND WHY USE IN PLACE OF FLUID?
- 9. What is a lubricant's function? • Lubricate/prevent wear • Seal • Remove heat/contaminants • Protect against rust/corrosion
- 10. What is a grease? • A liquid lubricant dispersed in a thickener system – ~60-90% fluid, ~10-40% thickener & additives – Advantage • Stays in place • Lubrication for hard to reach points • Seals – Disadvantage • Limited cleaning/cooling effect
- 11. Grease Components Food Grade Fluid Lube Component Thickener System Incidental Contact Food Machinery Grease • Synthetics (PAO, PAG, Esters) • White Mineral Oils • Vegetable oils • NSF HX-1 additives • Certain thickeners are not acceptable (Lithium)
- 12. Grease production needs heat • Heat induces component reactions to create grease fluid/thickener matrix – "cooking" process unreacted components
- 13. Properly Combined Oil/Thickener = Grease Anhydrous Calcium Aluminum Complex Calcium Sulfonate
- 14. Grease Thickener Type Influences • Dropping point temperature • Grease mobility • Stability • Water resistance • Compatibility • Cost
- 15. Fluid Base Type Influences • Operating temperature range • Low temperature mobility • Thermal stability • Oil separation • Load carrying capacity • Cost
- 16. Percentage of thickener in formulation 0 5 10 15 20 25 30 35 40 45 Aluminum Complex Calcium Complex Calcium Sulfonate
- 17. Aluminum Complex Dropping Point Pumpability Water resistance Oil separation Mechanical stability False set
- 18. Calcium Complex Dropping Point Low cost Low oil separation Water resistance
- 19. Calcium Sulfonate High Dropping Point Good mechanical stability Corrosion protection Wear protection Low oil separation
- 20. Grease Choice Application Considerations Operating Conditions Application Method Potential Contaminants
- 21. GREASE SPECIFICATIONS
- 22. What do the numbers mean?
- 23. Grease Specification Tests • Define grease physical properties and model performance characteristics – Consistency – Temperature effects – Tenacity – Wear protection – Corrosion protection
- 24. Grease Penetration, ASTM D-217 Unworked Penetration Worked-60 Penetration
- 25. NLGI Grease Grades NLGI WORKED PENETRATION Number Minimum Maximum 000 445 475 00 400 430 0 355 385 1 310 340 2 265 295 3 220 250 4 175 205 5 130 160 6 85 115 softer harder
- 26. Grease Consistency • Harder grease – High speed – Better sealing – Stays put better • Softer grease – Central lubrication systems – Colder applications
- 27. Grease Dropping Point • Temperature at which the oil and thickener separate • Operating temperature should be lower than dropping point
- 28. Water Washout, ASTM D 1264 • Evaluation of grease resistance to washout from a rolling element bearing • Better resistance indicated by lower water washout test values
- 29. Water Spray Off, ASTM D-4049 • Measures grease metal adherence tenacity • Grease coated on a metal panel is subjected to a direct spray of water – Grease loss is measured
- 30. Wear Testing, ASTM D2266, ASTM D 2596 • Four Ball Wear, ASTM D2266 • Four Ball EP Weld Point, ASTM D2596
- 31. Timken Test, ASTM D2509 • Timken OK Load
- 32. Rust Prevention Test, ASTM D1743 • Made more severe with synthetic sea water or salt solution
- 33. FOOD GRADE GREASE USE AND HANDLING
- 34. How does lubrication program fit in? HACCP System Prerequisite Programs HACCP Plan
- 35. Prerequisite Programs • Support the HACCP Plan • Include Good Manufacturing Practices

(GMPs) – GMP Examples • Chemical Control • Production Control • Raw Material Control • Sanitation and Maintenance • Pest Control

- 36. GMPs Where are food grade lubes needed? Who is responsible for lubrication? Where are lubricants stored/identified? Re-lube interval?
- 37. Where is food grade grease needed? • A detailed lubricant survey is essential to determine and document required use areas as well as frequency and quantity of lubrication
- 38. Typical areas for NSF H-1 grease use • Machinery whose operation has potential to contaminate food – Conveyor roller bearings – Pumps – Various machinery grease fittings
- 39. Proper training is important Proper Training Correct Product Correct Amount Correct Interval Correct Procedures
- 40. Potential Problem Areas • Over lubrication increases chance of contamination – Seal rupture due to excessive grease • Under lubrication increases chance of contamination – Can compromise equipment life – Frequent machine repair
- 41. Potential Problem Areas (cont'd) • Improper handling practices – Improper pump handling techniques • Pump stinger contamination – Improper re-lubrication methods • Dirty grease fittings,open containers – Improper storage • Contamination (water, dirt, other fluids) • Mislabeling, mixing
- 42. Re-lubrication interval • Purge contaminants • Temperature effects • Normal in service depletion – Release/reabsorb oil in use – Will "dry out" eventually
- 43. Effect of High Temperature Every 20°F rise in operating temperature Lubricant life is cut in half
- 44. Effect of High Temperature • Elevated operating temperatures will require consideration of increasing re-lubrication frequency. • Lubrication interval is halved every 20°F rise in operating temperature above 150°F.
- 45. Example Operating Temperature Lubrication Interval 150°F 180 days 170°F 90 days 190°F 45 days 210°F 25 days 230°F 12 days
- 46. High Temperature Grease Considerations • Appropriate grease dropping point • Consider heavier viscosity base fluid • Consider use of synthetic base fluid grease • Centralized lubrication system will assist with re- lubrication requirements
- 47. Effects of Low Operating Temperatures Low Operating Temperature Effects Decreased pumpability Poor slumping Higher starting torque
- 48. Low Temperature Grease Considerations • Use of a lower NLGI Grade • Use of grease with better mobility – Smooth, buttery texture • Use of a lower base fluid viscosity • Use of a synthetic base fluid component
- 49. Lubricant Storage • Keep food grade grease separate from non food grade greases • Color code or clearly label grease dispensers • Proper capacity to ensure proper inventory turnover • Store properly, control access (under lock)
- 50. Grease Mixing • Can compromise food grade grease quality – No longer food grade if mixed with conventional • Can compromise grease performance – Compatibility • Proper storage and labeling is essential • Conversion of all greases used to food grade is recommended if possible
- 51. Grease Compatibility Grease thickener types are often not compatible Source: "CITGO Greases,the Science of Flexibility" CITGO Petroleum Corp.
- 52. Conversion to Food Machinery Grease • Lube System – Inspect all grease dispensing equipment for proper operation – Draw down grease levels until containers empty – Remove as much grease as possible from pump stinger – Cycle lube system until remnants of previous grease are purged
- 53. Grease Conversion (Continued) • Application Point – Purge grease application points • Relief plugs should be removed – Run until excess grease ceases to emerge from relief plug. Clean and install relief plug.
- 54. Summary • Food grade greases are widely used in food production facilities – Various performance characteristics to consider • Proper practices are important – Application – Storage – Training
- 55. Thank You! 832-486-1699 babrise@citgo.com Benjamin A. Briseño Product Manager May 21, 2014

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Verghese PF Manager OEM Business at Indian Additives Ltd.

Soda a very old technology used before Aluminium and Lithium its very cheap soap to make grease with very poor water and temperature resistance. hence was replaced with Aluminium and later lithium. the customer use this grease will really be at bottom of the barrel.

Miguel Piedras Analista de procesos at Administradora Lux SA de CV

Old Al soap grease had more water resistance and less temperature resistance than old Na soap grease, but as already stated, those are old and cheap technologies.
Actually you will likely get Al complex grease, so the difference will depend on the particular product - compare the product data sheets on your case.

Hatim Kamal Managing Director at UNISILICONE

Sodium grease is produced from Tallow or Stearic acid using sodium Hydroxide
Aluminum grease from stearic acid using aluminum tri isopropyl oxide
There is a big difference in properties between them due to this chemical structure.

Syed Sadath Hussain Lubrication Field Engineer

Sodium (Na) soap grease has been an all time cheap grease with worst overall performance among thickeners, which exhibits poor pumpability and poor bleed & water resistance properties (forms emulsion with H2O & softens).
Al complex greases are fire resistant & H1 food grade greases, exhibits excellent oxidation stability with good resistance towards water & bleeding. However it illustrates poor shear stability and hardens on ageing & high temp operations.

George Abernathy

Na greases are very soluble (broken down) in water conditions. They've also been known to aid in corrosion in some environments.

Mohamed Moussaoui

If we look in economic terms there are a lot of customers are looking for cheap grease because the customer knows very well that he use this grease in low temperature and absence of the water, so why not go back to aluminum grease and soda grease!

Don McNeil Industrial Sales - STLE Certified Lubrication Specialist at Apache Oil Company

After more than 45 years of experience I have found that customers should not be looking for "Cheap Products" and people who try to market products that are the lowest price in the market can only be successful if their costs are lower than everyone else in the market and that is not always something you can control. What intelligent successful customers look for are products which have the lowest cost of ownership because they provide performance benefits that lower cost products cannot provide. Reduced maintenance expenses can more than offset any cost difference especially in grease. Have you ever looked at any of your customer's total maintenance budgets? In most case the lubricants they buy are less than 3 to 5% of their total maintenance budget. In some cases by increasing the total spend on their lubricants from 3% to 6% you can achieve a dramatic decrease in their total maintenance expenses by reducing failures through the use of high quality products and extending equipment life. You keep looking for the cheapest product to sell and very shortly you won't be selling to anyone because you will be out of business.

Mark O'Brien Lubrication Excellence Champion

The purchase price of lubricants represents 8% of the total cost to use the lubricant. The price should be the last question asked once the performance is matched to the application.
As training and certification keeps growing, this is easier to understand by the hands-on technicians and maintenance managers.

Tapas Dey Head Business Unit - Steel Industry at Klueber Lubrication India Pvt Ltd

Li and Na, both binds one molecule of fatty acid, on the other hand Al can bind three molecules of fatty acid.

On the second part of the question, regarding **price vs. value**:- If we calculate the total cost for using a particular lubricant, then initial cost becomes irrelevant, say for example, if by using a good lubricant (oil/grease), lubrication interval can be enhanced, customers does not mind to pay premium for the lubricant. In our organization we call it value selling.

V.S.S. Sarma

Grease-making started with simple **lime soap**. While making a lime-soap grease, water is used as a coupler. Water has a boiling point of 100 deg C and hence all lime based greases have dropping points below 100 Deg C. These greases are mainly used as Chassis greases.

The next development was **soda based grease**. This has provided higher dropping points to the extent of 170 Deg C. They are used in wheel bearings.

Lithium base was subsequently made with drop points of about 180 Deg c. This is a multi-purpose grease used both in chassis applications as well as wheel bearing applications.

Aluminium complex grease is made using a weak and strong soap complex. The drop points went up to almost 245 deg C. Further, it has low temperature operability, high temperature stability, high mechanical stability, etc. This grease is a truly multi-functional, multi-purpose grease.

George Abernathy

Good comment about soda grease VSS. They tend to "absorb" moisture(depending on climate/salt water) to keep the moisture from attacking/pitting the metal on the road-bearing failure.

==========

Overgreasing bearings or bearing housings can cause blown seals, which can lead to loss of lubricant, overheating, mechanical failure and safety concerns. A **pressure-relief fitting** can prevent overpressurization because this type of fitting will relieve and discharge grease when the proper internal pressure is obtained. These are commercially available from several suppliers such as grease fitting manufacturers. Bearing and seal manufacturers can recommend the maximum pressure level in order to obtain the proper relief setting.

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Brian Reed Technical manager UK at Jet-Lube, Inc.

Copper based antiseize compounds are widely used in various industries. If you use the type based on bentone grease, it will stay in place as it is essentially non-melting. Other types of grease thickener give greases that become liquid as they approach their Dropping Point (DP) temperature. Normal mineral oils start to evaporate above about 200°C so after some time at elevated temperature, only the flakes of Copper are left. Copper acts as a solid lubricant. Copper will soon oxidise to give Copper oxide & again it acts as a solid lubricant which is better than no lubricant at all. Above 900°C, only Copper oxide will be present.

George Abernathy Fluid Product Specialist at Steiner Metalworking & Industrial Supply Co.

Everyone had great advice. I prefer a copper, moly, graphite combination as "super steam" could create problems with copper(as said with oxides). For higher torque rates, the above would be better. They would cover ALL facets of this process.

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From "Grease Lubrication in Rolling Bearings":

The bleeding rate, which is the bleeding per unit of time, should ideally somehow match the starvation rate. In the beginning of bearing operation, the lubricant film will be relatively thick and no additional feed of base oil is required. A too high bleeding rate will exhaust the grease at an early stage, leading to short grease life. If the bleeding rate is too low, the contacts will starve rapidly, leading to early damage.

During most of its operational time, grease-lubricated rolling bearings are running under starved lubrication conditions. This means that the lubricant film thickness is primarily determined by the lubricant layer thickness in the running tracks. This layer thickness is determined by a flow balance. Lubricant flows outside the track by side flow due to overrolling by the rolling elements with a high pressure, but the layer thickness is also affected by flow due to centrifugal effects, cage scraping, evaporation, occasional oil droplets or grease lumps thrown off from the seals/cage/inner ring, oil bleeding, gravity, surface tension and/or air flow.
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With decreasing temperature, the tendency of grease to bleed decreases and the stiffness (consistency) of the grease increases. This may ultimately lead to an insufficient supply of lubricant to the contact surfaces of the rolling elements and raceways so the lubricating action of the base oil can be neglected for low temperatures. It will be the grease in its totality that will lubricate. Low temperatures will result in a high torque, which may cause slippage of the rolling elements and therefore wear. This point is called the low temperature limit (LTL).

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Use caution with grease lines that run out of the machine frame and are intended to provide easy lubrication access. Since these line extensions often carry more than a few shots of grease, the grease entering the bearing will not be robust and fresh. Vibration, time and temperature changes can lead to leaching of oil components from the grease thickener. The best approach is to provide access to the lube point as close to the bearing as possible. This enables the bearing to be inspected and ensures that fresh grease enters the lube cavity. (William Morgan, Morgan and Associates)

What additive can be effective in rising weld point of Li grease up to 700-900 kgf (from approx. 160 kgf)? It shouldn't also adversely affect AW properties. I'm thinking about inorganic borates

John Sander

VP of Technology at Lubrication Engineers, Inc.

Hi Elman. You will likely be able to be successful with your inorganic borates approach. I have seen very high weld points using boric acid, a very simple inorganic borate. I will caution that you consider where your grease will be marketed. Boric acid, for example, is coming under some scrutiny in some countries for toxicity. Yet, the same may not be true if you begin to consider some borate salts or metallic compounds. Also, boric acid is somewhat water soluble and may cause you to have potential metal corrosion challenges that you may also have to consider as part of your formulation. Perhaps one of the additive supplier might have more add, as I know that some of them even sell borated compounds that provide EP properties.

Elman Pendzhiev

head of R&D Dep. in "VMPAUTO" LLC

Top Contributor

Thanks, John. I was thinking about borax or K, Na pentaborates. We avoid usage of water-soluble acids because of corrosion. Do you have any considerations about optimum mean particle size for these subs? I assume that 1...20 mkm will be Ok.

Mehrdad Vajedi

Self Employed

I suggest you try Bismuth it will give you unbelievable characteristic for weld and specially 4 Ball and EP characteristics , it is also environment friendly metallic EP

Ron Balmain

General Manager at Chemetall Ges.m.b.H.

Hi Elman, with reference the comment from Mehrdad Vajedi we at Chemetall are producing many metal sulphide single and multi phased, giving excelent result, 4ball and EP, Bismuth sulphide can give excelent result as wel as Tin and Tungsten.

Felipe Abambres Lopes

Account Manager at Croda

Hi Elman,
I'm the technical assistant for Miracema-Nuodex in Brazil. We started the developement of bismuth additives back in early 90s as replacement for lead compounds. We have differente bismuth compounds that can provide really high values for 4-ball in different greases.

Constantin Madius

Technical Product Manager at Axel Americas LLC

Hi Elman,
Just adding some comments to your question.
There are a couple of important issues that need to be considered. Looking at two ways of boosting the weld load performance, (1) solid additives will probably decrease the wear protection substantially and (2) "chemical" additives might interfere with the chemical bonds in the thickener matrix decreasing mechanical stability and/or the ability to hit preferred consistency.
It is quite an extensive increase of weld load you are aiming at. Have you considered other thickeners with inherent EP properties, CaSX, LiCaX etc?

Hiromi.C.T. Awuy

Owner, Trinalia Pty.Ltd

Hi Elman, we are Trinalia pty ltd, manufacturer of Titanate, borated fatty epoxied (Elsbortine P 95), you may try this additives to your grease formulation, it is free of SAP, only it is in liquid phase, so adjustment should be made to reach the desire NLGI grade.
we are availabe in www.trinalia.com or you may contact me at awuy@trinalia.com

Ravindran Pillai.V

Grease Technologist. Total 34 years sound experience in formulating any lubricants & Greases

Hi Elman , Have you tried Zinc Borate?

penny li

International sales director

Hi Elman, you may try molybdenum disulfide, molybdenum disulfide is good additive for li-grease, some of our customers use molybdenum disulfide in their li- grease, thanks.

vijay deshmukh

General Manager R&D at Standard Greases & Specialties Pvt. Ltd.

Hi Elman,
Molybdenum disulfide alone may not give you weld load as high as 800 Kg or you may have to use high amt. of moly which may not be economical. You may try combination of graphite and moly at different %ge.

Kunal Kothari

Director Marketing at Anan Drug & Chem Ltd

We have a product named Lithium Complex Pre Formed Soap for high temperature grease. You can achieve your desired Necessities by using this product.

Calin Ladasiu

Research and Development and Chemical Engineering

Rhein Chemie supplies EP additives such as Additin RC 2310 or Additin RC 2315. You can also check their website for more information about EP additives.
www.rheinchemie.com

Ariel

Ariel Ackerman

Territory Manager

Check the GH-X, nanotechnology www.phibrochem.com

Suri Chetty

Director Business Development at Unichem Services Pty Ltd

Hi Elman,

I can only express my most recent expereince in acheiving weld load of 800 kg pass, and very acceptable wear scar around 0.5 mm. This is with a package specifically designed for us by Elco. Our base grease already has 5% molybdenum Disulphide. With the additiion of the Elco package I also get very good drop points - 270C plus. We are delighted with the results. I suggest you contact Dr Dave Millin at Elco corp to discuss developing a specific package to meet your needs.

Ron Balmain

General Manager at Chemetall Ges.m.b.H.

Hi Elman
We at Tribotecc (formally Chemetall) have continued our development of EP additives as mentioned previously; including various, Bismuth, Tungsten, single or multi phased metal sulfide in combination with Li Greases, can reach weld points in excess of 800+Kgf. Lower treat rates can also be achieved <5%.

vijay deshmukh

General Manager R&D at Standard Greases & Specialties Pvt. Ltd.

A combination of Moly and natural graphite of fine particle size can give you WL of around 800 Kg.But the grease will become dark.However there is another additive MBT a derivative of benzothiozol which also gives high WL.

George Abernathy

Fluid Product Specialist at Steiner Electric

Have you looked at any of the Di-thio Carbamates (Antimony or Molybdenums) which are fairly soluable and you could get the ADD in liquid form.

Ken Brown

Owner at Eco Fluid Center Ltd.

Be careful adding grease with solids. While they can be fine and work very well for slow moving heavily loaded hard contacts some types can cause more wear of softer materials like brass, bronze and babbitt. Also watch for plugging grease lines and/or distribution channels. There are different types of soluble antiwear additives like zinc and antimony phosphate compounds as well as the calcium compounds in calcium sulphonate greases. Try to stay away from more active extreme pressure additives if you have any copper alloys. Also chlorinated paraffins are being passed out because of safety concerns so be careful if someone is trying to unload some on you. Lastly consult a couple of your lubes supplier, hopefully Supply has not stuck with just one, and review the wear test (Timken, 4-Ball EP, 4-Ball Wear, Falex, etc). Recently we ran the 4-Ball Wear using brass and stainless steel balls instead of the standard 52100 steel balls so that we could better assess the required performance with copper alloys.

Velibor Karanovic

Teaching Assistant at Faculty of Technical Sciences

There are currently no clear lubrication alternatives to **molybdenum disulfide** that can resist temperatures higher than 350 °C in oxidizing environments.
Some of MoS2 characteristics:
- load capacity (ASTM 2625 B) 250 000 psi
- wear life (ASTM 2625 A) 250 min
- coefficient of friction (ASTM D1894) 0,19 static, 0,16 kinetic
- thickness 0,001 " - 0.003 "

Jean-Michel Demaret

Qualified Engineer / Senior Account Manager

Moly does not work well in water. Typical application a bucket articulation of a dredge or excavator boom working in water. Moly lose its low friction coefficient in wet environment. In this case it is better to use graphite grease.

==========
George Abernathy

Steiner MW& Industrial Supply Co.

I will agree with Mr. Sarma with the article-being NEW Polyureas. Base oil choices for an EMB are one of the most critical factors-over thickeners for your search.

Westinghouse, Reliance, Baldor, and GE motors long ago recommended this thickener for their EMB's(Electric Motor Bearings) because of a couple reasons; (1) once happy and greased properly it would flow/track better in the bearings, and (2)contained some ozone resistance in their compound(pre-oxidation resistance). In most general purpose greases, there is no counter resistance for this ozone generation in an electric motor.

The down side at the time, is that the grease would not do well in the shear stability testing-meaning it would go from an NLGI #2 to and NLGI #1 in 60(not 60,000) strokes. Great for motor bearings, but not for other applications.

Lastly, it has compatibility issues with anything else (other thickeners).

Danny Gibson

Lubricants Technical Advisor at Shell Oil Company

Agree with both George and VSS with one small addition regarding compatibility, Poly urea thickeners are not all the same, some have borderline compatability with other thickeners and one in particular (diurea) has excellent compatability with most conventional modern thickeners, but certainly not with some older technology, clay for example.

Andrew Monk

Managing Director - Lubrisolve Engineering Solutions Ltd.

Be very careful when stipulating that one type of based grease is suitable for any application as a grease does not only consist of its thickener. The type and viscosity of the base oil is also very important. There's also some very important comments being made in this thread that you should also take note of. I have a customer currently using a Calcium Sulphonate Complex grease in all their plants electric motor bearings and combined with condition monitoring of these bearings, they are all working well. I actually agreed with this philosophy as I considered compatibility with the previously used greases a serious point to consider.

Arupanjan Mukherji

General Manger Sales and Technical at Asianol Lubricants Limited

Polyurea is compatible with Calcium complex - but having said that it does not mean that the polyurea is the best chemistry to go with for motor bearing grease.
Shear Stability and choice of base oils from Mineral to PAO with a viscosity depending on the DN factor will be primary consideration for the grease besides the oxidation stability of the grease.

George Abernathy

Steiner MW& Industrial Supply Co.

Oscar is right, but I suggest that a larger HP motor(15-150 and up) may create problems at rest and start-ups. The reason I say this is because the weight of the stator at the 6 O'clock position harbors all of the weight of that stator until started. Once running there is less load as it is distributed more evenly throughout the bearing running on the "wedge/cushion" of grease. In coal fired power plants, they have what is called "running gear"(generally an oil system) on their turbines such that the bearing is not in a static position at 80,000#'s +.

Jim Sciascia

Technical Sales Manager at DA Lubricant Company

Urea's do not leave no residue- no heavy metals. Far better temperature ranges-no run-out, also reducing oxidation the product developed for electric bearings.

Oscar Tonatiuh Ramirez Castillo

Abrassives Specialist at KLINGSPOR Abrasivos S.A
However there is one trick some people use for high loads electric motors which have continue rest and star-up cycles.
A graphite or MoS2 grease could help in this applications, since particles adhere to internal parts of bearing, do not forget to use a thick base oils grease also.

George Abernathy

Steiner MW& Industrial Supply Co.

True Oscar, only IF the bearing has lost it's "C" fit in tolerance, and need a fix before one can change it out. I used this trick as well, as long as the thickener was the same. It is NOT to be used on an anti-friction bearing(unless it is a horizontal turret bearing at a furnace for casting steel --NSK recommendation) as it will also " CHOKE" a good or new

bearing(changing it's "C' Fit/tolerances). Would you agree?

Fernando Oscar Bilotti

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

Please see the information regarding Mobil Polyrex EM 103. The polyurea grease with NLGI 3 is one of the best option in high electric motor beaing lubrications, according to the comments detailed by the people in this site.

Oscar Tonatiuh Ramirez Castillo Fernando Diaz

Director Comercial en OLIPES

Hello Joko, I agree with our collegues. Lithium Complex, Calcium Complex and Polyurea are good options when choosing a good thickener for a grease, but do not forget what oil is made with this grease. I recommend you to see next article written by Mobil: http://www.mobilindustrial.com/ind/english/flies/tt-electric-motor-bearing-lubrication-guide.pdf

In most cases, a Lithium Complex grease made with an ISO VG 100 Synthetic PAO oil is enough, cheaper and easier to buy than a Polyurea grease. It's true that Polyurea forms less residues at a high temperature, and it is recommended when working tempereature could be higher than the grease dropping point when bearings are periodically relubricated.

Fernando Sosa Rodríguez

Wholesale Account Manager en DCM

Partner, greases based polyurea are recommended for use in applications that require extreme pressure protection, such as engine electric bearings, sealed bearings for life and other low load, but with high speed and high revolution. The Polyurea base greases have excellent shear stability, oxidation resistance and corrosion resistance to ensure maximum protection and long life in these applications mentioned. It also has excellent resistance to water washout.

Alexey Muralev

Head of Technical Service Department at Kulan Oil

Actually, I was discussing Mobil Polyrex EM and EM 103 with their engineers. NLGI #3 is used in vertically mounted electric motors, NLGI #2 for horizontally mounted for obvious reasons. Base oil and additives are the same.

I have a Customer (Cement Plant) who successfully uses Polyrex EM in large electric motors with change intervals around 2 years.

Walt Huysman

Oil Analysis Business Development Manager, Oil Analysis SME at Trico Corporation

Polyurea grease use in electric motor bearing – after reading all the responses, several items stick out:

1. Electric motors come already pre-lubricated with polyurea grease – changing to another grease would cause an almost immediate compatibility issue – purging would cause several issues, i.e., overgreased bearing can cause overheating and premature bearing failure, and you cannot remove 100% of the polyurea grease with purging anyway
2. Polyurea grease has 2 properties that lend themselves well to electric motors – 1) with no metallic component in it, it is electrically non-conductive – the number 1 issue with electric motors is overgreasing – the excess grease typically goes into the motor windings – being non-conductive, the polyurea grease will not cause commons problems due to this, and 2) polyurea thickened grease stays pliable much longer than other grease thickeners – when

electric motors are purchased they are typically stored in a warehouse for a period of time (could be 1 year or longer) – prolonged storage under sometimes less than desirable storage conditions can cause other grease thickeners to become hardened – when the motor is installed in this case, it may fail prematurely due to this

The following is a list of qualities of a good electric motor grease:
• Good channeling characteristics
• NLGI Grades 2 to 3
• Base oil viscosity of an ISO VG 100 to 150 or more specifically 90 to 120 cSt at 40°C
• High dropping point, 400°F minimum
• Low oil bleed characteristics, per D1742 or D6184
• Excellent resistance to high-temperature oxidation
• Good low-temperature torque characteristics
• Good antiwear performance (but not EP)

Polyurea greases typically fit the bill for these qualities.
Regarding compatibility, I do agree that you should not mix polyureas from different grease manufacturers – the way that the different polyurea thickeners are manufactured could cause compatibility issues – these issues are usually that the grease either hardens or softens – either of which can cause unnecessary problems in the bearings and premature bearing failures.
Another thing to consider is when sending electric motors out for repair – the type of grease to be used on the electric motor once repairs are completed should be specified in the purchase order and it should either be verified at the repair shop or the customer should supply the grease to the repair shop to ensure it is used – this helps avoid any compatibility issues when the electric motor is returned to service.

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From "Grease Lubrication in Rolling Bearings":
The bleeding rate, which is the bleeding per unit of time, should ideally somehow match the starvation rate. In the beginning of bearing operation, the lubricant film will be relatively thick and no additional feed of base oil is required. A too high bleeding rate will exhaust the grease at an early stage, leading to short grease life. If the bleeding rate is too low, the contacts will starve rapidly, leading to early damage.
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Roller bearings require a softer grease than ball bearings (on a horizontal shaft). Angular contact ball bearings pump grease through the bearing from the small inner ring diameter side ("low side") to the larger inner ring diameter side ("high side"). In order to prevent this, ideally a stiff grease is preferred on the "low side" and a softer grease on the "high side." Vertical shaft applications require a stiffer grease to prevent grease falling into the bearing.
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Aluminum Complex holds some heat reversion abilities you won't find naturally in other greases.
V.S.S. Sarma Technical Manager

In steel plant application wherein high temeperature, pumpability & slumpability are the key parameteres, Al complex greases are being used; so is in cement plant applications. Otherwise Lithium is a multi-purpose thickener.

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For choosing a proper grease for this application the Dn-number is an important guide line. Not only the ID and rpm are important but also the type of bearing. On basis of the ID and rpm a Dn-Number (= ID (in mm) x rpm) of 88000 is calculated. If the bearing is a ball bearing or a cylindrical roller bearing there is no correction. With such bearings a 460 cSt base oil grease should not cause the mentioned temperature increase. On the other hand if the bearing is of the spherical roller type the calculated Dn-number should be multiplied with 2.5-3. This is due to the higher sliding component of the rolling elements. In that case a 460 cSt base oil grease will run at a higher

temperature and a grease with a base oil viscosity around 200 cSt would be more appropriate.
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Mohamed Elosaily • Most silicone grease can only be used to lubricate metal-plastic, plastic-plastic interfaces not metal-metal, also have many other applications provides excellent lubrication and sealing properties for plug and gate valves, apply where copper or graphite-based compounds cannot be used, It's clear & clean won't carbonize, It's also an effective mould release for epoxy, polystyrene, polyvinyl chloride and polyester resins when spot lubrication is necessary, Ideally suited for subzero processing facilities and spiral freezer.
Its low volatility, non-melting thickener and high dielectric strength make it the compound of choice for proofing electrical connections from short circuits, moisture proofing of ignition systems, spark plug connections, electrical assemblies, cable and battery terminals and other similar applications.

Mohamed Elosaily • Dear Kaushik, Mechanical stability of silicone grease is lower than that of other synthetics where it behalves like Non-Newtonian, you will find a big difference between worked and unworked penetration, So if applied between two metal surfaces and under shear you will loose the film quickly and metal to metal contact leading to wear, etc.

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I got this application last year with one of my clients. We found "block grease" from Opti-Lube. If I remember well, there was lithium complex (NLGI 5-6) and sodium (NLGI 8-9). My client was using it to lubricate cables in a paper machine. 9 was pretty impressive, almost like a candle. I also saw "socks" greases where they put the grease in a nylon sock that gets rubbed in the casing like a wick.
By Frédéric Tremblay

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Outer-ring rotation causes very severe conditions for the grease in the bearing. The grease on the shields or covers is subjected to centrifugal forces exceeding the yield stress, resulting in the grease flowing continuously into the bearing and causing churning, heat development and high temperatures. Moreover, grease on the bearing outer-ring shoulders or seals will show accelerated oil bleeding. In the case of outer-ring rotation, the base oil/grease is easily lost, and good sealing is therefore a prerequisite.
==========
Richard Hassebrock • When dealing with compatibility of different grease types or products there are no certainties. Anyone telling you there is doesn't have much field experience. We can tell you that certain types of thickeners "should" be compatible or not, or they "might" be compatible, but until you actually put them together in an actual application you won't know for certain. Here's a link to a compatibility chart:
http://www.finalube.com/reference_material/grease_compatibility_chart.htm

It shows aluminum complex and lithium complex thickeners to be compatible, but not aluminum complex and lithium or lithium 12 hydroxy. However, it is always advisable to monitor bearings closely when making a change in grease products for signs of incompatibility, those signs would be a softening of the grease, and separation of the oil from the thickener, which will be evident by the oil/grease running out of the bearing. The best thing to do would be to remove the bearing and thoroughly clean all of the old grease, then re-install and re-lubricate it with the new grease product, but in actuality that almost never happens. The 2nd best thing is to closely monitor, and if signs of incompatibility show up, then increase the frequency of re-lubrication intervals to keep fresh grease in the bearing, until all of the old

grease has been purged and only the new product remains.

Here's an article on grease compatibility that my help:
http://www.machinerylubrication.com/Read/1865/grease-compatibility

If the application is critical and chances of incompatibility are not acceptable, then ask your grease supplier to run some tests in the lab on compatibility between the 2 products, so you will have some assurance that the 2 are compatible. Even after doing this, it is advisable, in my opinion, to monitor the bearings closely after making the change, and reapply grease if necessary to prevent lubricant starvation.

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Food Grade Grease For Electric Motor Bearing

Aluminum complex is usually the thickener of choice in FG applications whereas polyurea is the thickener of choice for electric motor bearings. Can anyone recommend a FG grease that also works well for elec motor bearings? If so should one think about changing grease interval?

Steve Lennox • Paul
Newer technology food grade greases are using Calcium Sulphonate Complex thickeners. The advantage being that the thickener also has EP properties, and the rheology is better for bearings. Food grade greases formulated with this calcium thickener perform as well as the general purpose EP greases (non-food grade), giving broad application and excellent performance. I trust this gives you an alternative option to address the limitations of Aluminium Complex, and benefits of Polyurea greases.

David Piangerelli • I concur with Steve Lennox, The calcium sulphonate thickener system is superior to the aluminum complex. And in my experience, you will not suffer reduced bearing life as long as proper attention is paid to the potential issues that nay be caused by incompatibility and overgreasing.

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Shoeb A. Petrochemical Engg. | Lubricants Sales

Aluminium complex grease is not so popular because is has a shorter life compared to Li complex grease. It also has relatively poor shear stability and pumpability.
To be more elaborative..
Aluminium grease is normally clear and has a somewhat stringy texture, more so when produced from high-viscosity oils. Under high temperature conditions, this stringiness increases and produces a rubberlike substance that pulls away from metal surfaces, "reducing lubrication" and "increasing power consumption".
Al grease has good water resistance, good adhesive properties, and inhibits rust without additives, but it tends to be short-lived specially in high-temperature, high-speed applications.
It has excellent inherent oxidation stability but relatively poor shear stability and pumpability.

John Morgan Manufaturer Rep

My experience and observation has been exactly opposite of what is reported. Are you selling lithium complex grease cause my observation has been the al grease is water proof and will not emulsify in the presence of moisture. My observation has been the al grease outlasts any lithium complex grease at least 2:1 and in some cases more. I believe AC grease is more expensive per unit but significantly reduces consumption in most cases reducing overall costs, however many people are uncomfortable with the price tag as opposed to evaluating overall operational costs.

David Piangerelli Professional Lubrication Consultant

I must agree with Mr. Morgan. Aluminum complex greases are the go to thickener type whenever moisture or high temperatures are factors in an application. In addition, they possess a unique characteristic, reversibility, such that permanent separation is resisted even under high temperatures.Effectively, the product reverts back to its original consistency after repeated heating

and cooling. This thickener system is also the default product used for food machinery grease and marine grease formulations.

The terms aluminum and aluminum complex should not be interchanged loosely. These are two separate thickener systems, each having different performance characteristics.
To answer the OP's question, I believe it is like most purchases, Li Complexes cost less to manufacture and sell and therefore own a larger portion of the market-simple as that- as we all know that the majority of lubricant purchases are price driven as opposed to performance based.

Abe Bassil Lean Consultant and Partner at Quality Lubricants

I agree with Mr. Morgan and Mr. Piangerilli. The majority of lubricant purchases are price driven, thus the lack of familiarity with many quality products on the market. The best Aluminum Complex greases provide an exceptional level of protection and long lubrication intervals. Of particular interest, SWEPCO 101 Trip-Plex Universal Grease is a high performance Aluminum Complex grease based on a proprietary Chemistry that yields a tighter molecular structure. The result is a buttery/tacky grease that provides superior resistance to heat, shock, water, and extreme pressure, as well as reliable pumpability even in cold weather. Price is higher than your average grease, but reduced consumption and extended equipment life result in lower total lubrication cost. Please feel free to contact me if you need more information or a product evaluation.

Larry Hajek senior lubricant technical manager at Citgo

the primary user of Al complex greases are the melt shops in steel mills. it has always had the reputation of resisting very high temps. now it is slowly being replaced by Li complex for pumping and stability without sacrificing anything.

Abe Bassil Lean Consultant and Partner at Quality Lubricants

As I mentioned before, not all Aluminum Complex greases are created equal. A superior quality grease like SWEPCO 121 benefits from a tighter molecular structure which gives it reliable pumpability with an operating temperature range of -30 deg F to 375 deg F continuous, while being suitable for intermittent temperature excursion up to 450 deg F!
This is one true "Universal Grease" unless you need to use it at temperatures over 450 deg F. At which point I would recommend true Hi Temp or non-melt grease based on the application.

John Morgan Manufaturer Rep

David P. says it. This OP did not ask for recommendations. I'm purposefully not mentioning the product line I rep. Lithium thickened greases are the largest selling greases in the world for one simple reason. Their cheap to make. Lithium is less expensive for the manufacturer to produce. They perform the basic function required. Equipment manufactures typically build specs around minimum requirements which the Lithium thickened greases meet. Minimum standards does not mean you have to use the lithium thickened grease, it means whatever grease is used has to meet the minimum standard. Most consumers don't know how greases are built or how they work. They simply look at the minimum specification, which typically calls for a Lithium Thickened grease and that's what they buy.

Stuart McKenzie

Experienced Engineering Manager and coach specialising in the practical use of Tribology to reduce risk.

Aluminium Complex is often the thickener used for food grade greases. The features that make it good for this purpose are that it is clear and transparent, with a smooth texture and insoluble in water. A number of formulations have been created that meet the US food and drug admin requirements. Sales of this were never huge but with more of an interest in food manufacturing it could be an opportunity to increase AlCx grease sales.
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The world's lubricant companies produced an impressive 2.47 billion pounds of lubricating grease in 2012, according to new data released last week by the National Lubricating Grease Institute. In 2011, the combined total reported worldwide was a slightly higher 2.56 billion pounds, according to the NLGI 2012 Grease Production Survey Report.
“Lithium soaps, including lithium and lithium complex, continue to be the foremost thickener type at 76.67 percent of the global total, followed by calcium-thickened greases and then polyurea greases,” Jark pointed out. “Those are the three most common types worldwide.”
There are some strong regional differences to this ranking, the survey demonstrates. Japan, for example, is a stronghold of polyurea-thickened greases, which have grown to almost 27 percent of its output. Africa and the Middle East favor calcium soap greases more than any other region does.
On a global basis, mineral oils represented 92 percent of the volume, synthetics and semi-synthetics were a bit over 7 percent, and biobased accounted for less than 1 percent.
North American producers who responded to this question said more than 15 percent of their volumes are synthetics and semi-synthetics. By contrast, India's grease producers say they use virtually 100 percent conventional mineral oil.
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If you lubricate with oil, you probably accept that the viscosity is the most important characteristic. If you lubricate with grease, you still lubricate with oil that is in the grease.
A common mistake is to put a multi-purpose EP grease where the oil viscosity could be 150-200 cSt at 40 °C into electric motor bearings where the oil viscosity should be 80 to 100 cSt and preferably no EP. Another mistake is use a multi-purpose grease in applications where heavy loads require much higher oil viscosity.
Oil viscosity in greases ranges from 29 cSt at 40 °C (Mobilgrease 28) to 4100 cSt (Shell Gadus S4 OGH 160) - just on my list, you might find even more extreme cases.

Andrew Monk • There are two schools of thought on grease lubrication. One is that the oil is the lubricant and that the thickener is just there as the lubricant's carrier. The other is that the grease as a whole is a lubricant. If you take the latter view then you can soon see why many greases with different thickeners and varying base oil types and viscosities perform in a multitude of applications. Viscosity is the most important parameter in an oil lubricant's characteristics. You get the viscsosity completely wrong and no amount of additives will compensate. However, in a grease the viscosity of the oil plays a significant part, but I would suggest that it isn't the complete picture.

Of course it is not the complete picture but the oil (including whatever it carries in it) viscosity gives you 'the ability to lubricate'. Two more aspects are common with liquid lubricants: quality of the base oil and the specific performance (e.g. EP - most of it comes from additives). Two more essential aspects concern greases: the type of thickener and consistency. Thus 5 main aspects, the rest is secondary and derived from the five.

Rainer Schade • Fully support the comments above and will add a few more, The thickener chemistry, quantity and structure plus additives, including solids such as Moly can also have an impact (either positive or negative) on "effective viscosity" and lubrication efficiency especially in a boundary lubrication scenario. Start up (channeling) and low temp performance can also be significantly impacted by the base oil viscosity and thickener.
Finally another area entirely is in grease manufacture - the base oil viscosity, viscosity index and

chemistry can have a significant impact on the % of soap required to achieve a particular consistency/penetration, the "ease" of manufacture and the "strength" of the grease structure

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Lubricating with moly is a different lubrication regime where oil viscosity loses its normal significance.
Otherwise, I can accept "effective viscosity", although to me it is unnecessary complication with minimum impact. I am just guarding against 'obvious' ideas like that hard grease is good for heavy loads and soft for light loads.

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toby taylor Having spent the last 6 years of a 15 project back in late 60 to renew the lapsed patent on Shell Alvania. The measurement of operating viscosity within grease lubricated bearings was evaluated by AR Wilson using the dielectric properties together with Dowson Higginson model. The whole process of grease manufacture is no longer "an art form" Its design and development has specific steps to evaluate the properties which bearing manufacturers specify and meet to be recommended. 15 years of research work for as grease!

Calcium sulphonate grease provide excellent corrosion protection. Polyureas tend to have not as good mechanical stability.

Andrew Monk • EP2 greases are found almost everywhere as their price often dictates their use, most obviously. Often they are found in applications where other greases would do a far better job, but the trouble often is that there are a lot of sales people out there who don't understand the effects that can be gained by using better quality, and more often, higher priced greases. Ken makes a very valid point about Calcium Sulphonate Greases (complex or not) as these are very under-rated in my opinion but excellent lubricants with very good properties. Polyurea greases also have a lot of distinct advantages. Then there's even the fluorinated hydrocarbon/PTFE greases that generally tend to be high cost but so long as the temperature does not go much above 260 deg C then these are very good lubricants indeed. There's also greases being developed now that get away from traditional soap types which are also very good. As usual there's a lot of choice out there but price will have some influence, usually, unless the technical meriots can be well argued.

Howard Taylor • Sorry gentlemen for the vague info, here is the situation and what solution we suggested.
A bearing carrying food/crop waste into a digester was suffering grease drop out, due to a general EP 2 grease used in a moisture laden environment at reasonable high acidity levels. The grease wasn't staying in the bearing long enough to do any good and reapplication was only effective daily if the recommended amount was doubled. I suggested a thicker grease and also one that had longer lasting and energy efficient properties. This gave a decrease in the grease used, increased bearing life and also a reduction in energy used to power the motor behind the bearing, due to increased a more efficient lubricant. Mobil XHP 222 if the budget is low and Mobil Polyrex 462 for the added benefit package. Cost of a new bearing is much higher against the slight rise in price of a more effective lubricant. This is in the UK.

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Though mixing of greases is not a good maintenance practice it can still happen in the field. A very good down and dirty field test for grease compatibility that I have found to work well in the field is to place a 50:50 mixture (or a close to equal amounts as possible)

of the two different greases in a smaller jar. Using a screwdriver this mixture is stirred together vigourously for a minute or two. Once stirred together set the jar aside preferrably with some type of lid covering it to keep out contamination for about 24 hours. If any separation or excessive oil bleeding is seen at the end of 24 hours the greases are not compatible with each other. Also if any softening is felt or seen while the mixture is stored this is also a sign that the two greases may not be compatible.

After this simple test you can then verify these results using the ASTM D-6185 Compatibility Test.

(PRV: I don't think that anybody has so far mentioned that there are compatibility tables, e.g. in http://www.elba-lubes.com/lube-info.html
However, that ignores the fact that compatibility (the nature of the thickener mainly) is just one aspect of the grease selection. Other 4 main aspects are the base oil (generally unimportant), oil viscosity (critical), NLGI number, and additives (EP or not - quite critical).)

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http://widman.biz/Seleccion/grasa.html

Evan Zabawski, CLS • The maximum service temperature of greases should be listed in most product spec sheets. If it isn't, you can use a very general rule of thumb of 50 °C less than the dropping point (ASTM D566, or D2265).
Most of the common greases top out around 150°C to 200°C, for higher service temperature you will need to look into specialty products.

Sivasubramaniam Sankaralingam •

1: The quantity of base oil differs with respect to the consistency of the grease like NLGI 0, 1, 2 and 3. It can range from 93% to 87 % .
2: Viscosity of the base oil used in grease range from 5.2 cSt (150 SN alone) to 19.5 cSt (500 SN 50% and 150 BS 50 %) at 100 deg C. The viscosity of the base oil is so important that it only decides the mobility, wettability and permeability of the grease.

Gareth Fish • This is my opinion and not necessarily that of my employer the Lubrizol, Sivasubramaniam Sankaralingam is correct about the approximate percentages of oil in lubricating greases but only as far as soap thickened greases are concerned. PTFE thickened greases have can have 30% thickener 70% base oil. Calcium sulphonate greases depending on consistency can be as high as 50% thickener 50% base oil.
Also for the most part with soap thickened greases, the base oil viscosity has little bearing on the grease consistency. With calcium sulphonates, the higher the base oil viscosity, the lower the penetration for the same thickener content.

Josef Barreto-Pohlen • This rule of thumb of subtracting 50 or 60 Deg C from the drop point does only work for simple soap greases, for complex soap greases it does not work. As an example you can take a look at Lithium complex greases. They usually have drop points exceeding 280 Deg C. Even if the grease is fully synthetic, the upper temperature limit is below 200 Deg C. Same with Aluminium complex grease. They have drop points around 250°C, but the upper temperature limit is 150 Deg C because of the thermal decomposition of the thickener.

http://www.astm.org/Standards/E2412.htmKen Brown • Some good comments but some are too simple. First what are you trying to grease and what are the consequences of exceeding the temperature limit? Does the grease run out or does it harder and are the safety limitations? Of course you have to stay a margin below the dropping point but consider also the following; base oil viscosity at that temperature, the oxidative stability of the grease, the volatility of the base oil, the thermal stability of the additives and if an EP grease the affect on any plastic retainers, etc. Your

grease supplier should be able to provide test data including at least D942 (oxidative stability), D3527 (bearing life), plus D4290 (wheel bearing leakage), mechanical stability and I would do oven tests on panels and/or beakers of grease. Generally if the grease is okay as you go up in temperature you have to increase your regreasing frequency. Is this possible? If your supplier gives you a temperature, ask what it is based on. Also, do not assume that your bearings can take the higher temperatures. Sometimes you have to with special steels.

Ed Snyder • While the upper temperature operational capability of the grease does depend to a large degree on the stability of the base fluid, there are greases that use perflurorinated oils as the base fluid and they are reported to be useable up to 600F. In that case, one must also consider the stability of the thickener and any other components such as lubircity or corrosion inhibitor additives as well as the stability of the base fluid.

David Benjamin • There many good comments that our colleagues have mentioned. In brief, this subject matter is a challenge due to that there are many concerns in two key areas of the grease science. (1). If you are a formulator, grease chemistry will be dependent on application in a narrow and broad scope. The selection of thickeners will determine where to started to obtain the desired service life couple with base oils then additives. The bearing operating environment is very important to understand. (2) if you are lubrication engineer product specifications will determine the end use application. The question of upper level limits I believe has been answered in this discussion, however, the overall application has to be kept in mind. There are many issues to be considered when specifying a high temp grease because each environment/application/lubrication frequency will require different overall formulation. For example, I have been exposed to some very simple lithium based chemistry with high performance additives and mineral base oils to deliver dropping points and oxidation resistance comparable to semi synthetic complex greases. In this example I would not want to use for a "lube for life" single fill sealed bearing. I would rather use a PTFE based or PAO if the investment made sense. Steel/Metals, Aviation, and Automotive components all possess speciation's that are required to use for a specific end use application. When one reviews the broad range of requirements, then you can better understand the temperature ranges, EP, Water Washout, oil bleed, seal capability, and oxidations options. Use the NLGI/ELGI for technical references to support your research.

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Grease for Steel Continious Casting Machine

Sulfonates / polyurea? what performance parameters like base oil VG/NLGI

Daniel Ríos • I would go for polyurea thickener, synthetic base oil ISO 460, plus EP and Molly; NLGI 1.5. A lithium complex mineral base ISO 460 EP NLGI 2 would do just fine and cost effective. Look for yu local suppliers availability, sure you can find something close to those mentioned. Ask the users about current product being applied and the performance they are experiencing. Re-greasing interval and quantity dispensed is key!

Arupanjan Mukherji • what about your thought with Ca Sulfonates with 320 Cst NLGI 1.5 - as over-based Ca Sulfonate is excellent in water/ good weld load, replacement for Moly, Nutrilises flux effect of the casting powder. The polyurea has higher Mechanical stability but mineral oil will oxidise fast in presence of water/steam and moisture and needs quick replenishments - what's your though on this?

Larry Ludwig, CLS, OMA, CMFS • For continous caster applications it has been my experience that aluminum complex base or calcium sulfonate complex base greases have worked the best. The greases should have a base oil viscosity of ISO 220 or 320. To further supplement the EP and anti-wear characteristics of the grease the use of 1 to 3% molybdenum disulfide or even boron nitride should be considered. You also need to avoid the use of greases that contain a high amount of tackifier in them. Finally, to insure proper application of the grease the use of a centralized lubrication should be considered.

Regarding the discussion in Machinery Lubrication and Maintenance, here is the way I calculate the amount of grease for bearings:

Initial fill amount: Refer to attached chart from bearing OEM books.

Relubrication grease amount (m) is calculated by the following formula:

m = D x B x K

D = Bearing outer diameter

B = Bearing width

K = Number that is related to the relubrication interval where

- €€€€€€€ K = 0.002 for weekly relubrication
- €€€€€€€ K = 0.003 for monthly relubrication
- €€€€€€€ K = 0.004 for annual lubrication

You can extrapolate other K numbers for semiannual 0.0035 or for continuous lubrication system 0.0015 as your judgment calls.

The issue for relubrication is the calculation for **relubrication interval** that is very complicated since it refers to the conditions of contamination, loading, vibration, moisture or water air current, PERFORMANCE OF GREASE, ETC, ETC, ETC.

Ricardo Hein, Conexo Inc., Acworth, GA, 678 792 4692, www.conexoinc.com, rhein@conexoinc.com

Corey Verstraete Interflon België nv

The standard rule for grease calculation on a bearing:

Filling = (((inner + outher diam.) : 2) X width) X 0,015 = amount in grams.

Regreasing = (((inner + outher diam.) : 2) X width) X 0,005 = amount in grams.

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Bearing calculator
http://www.skf.com/group/knowledge-centre/engineering-tools/skfbearingcalculator.html

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Jonathan Beldad • When an element bearing is first placed into service, the initial fill volume should be based on 1/3 to 2/3 of bearing net capacity, depending on expected shaft speed. The higher the speed the lower the initial fill volume.

The bearing net capacity is calculated as follows2.:

V = ((Pi/4) * W * (O.D. 2 – I.D. 2) * 10 -9 – G/7800)*10 6, where

V = volume in cubic centimeters,
OD = Bearing Outer Diameter, mm
ID = Bore Diameter, mm
W = Bearing Width, mm
G = Bearing weight, Kg (21.5)

I help you all that I in myconcern in proper lubrication maintenance to prevent downtime.

Generic Grease Replenishment Formula

300K for ball and roller type elements, ? 140K for spherical and thrust type elements

Where,
tf = Time in hours for replacement
K = Product of environmental correction factors
N = Shaft speed
D = Bearing bore in millimeters

Tf = K*[(14*10 exponent of 6 power/n*square root of D) - 4*D]

http://www.precisionlubrication.com/lubecoach.html

Ken Brown • Okay, the info you get from the bearing companies is generally the amount of grease required to lubricate a bearing. But this assumed that it had been done properly in the past. Because it is used equipment, you might have too little grease, too much grease, hardened grease, a cheap grease and/or an unknown grease thickener so that compatibility can be an issue.

What needs to be done depends on the cost and importance of the equipment. If possible it could be best to open one of the bearing housings and have a look. If not remove the grease fitting and use a cut straw or whatever to pull out a sample of grease. Determine the soap thickener (such as by acid digested ICP or FTIR) and try to determine the aging bu assessing the color, smell, consistency. Check also how the excess grease will be purged and make sure that the pathway is clear. Review also the relubrication method. Pump the grease very slowly, count the shots and know the grease gun delivery. Add about 50% of what you think is required and see if the temperature goes up. It should and then come down. Alternatively ultrasonics can be very helpful as well. If the

temperature does not go up, add more. If it goes up and comes down, leave it. If it goes up and stays up, remove the grease fitting and let the excess purge. Then check the bearing per the above in about half the time you estimate. The reason is in case of any grease incompatibility. After that you might be okay but nothing is certain because the bearings might already have been damaged. This is also a good case to get ultrasonic, SPM or some form of baseline vibration readings on the bearings to catch preexisting problems and so that you are not blamed.

Rex Burgner • Next---- What is the correct way to measure the volume of lubricant you are dispensing? For years, mechanics and technicians would count the number of cycles or strokes of their grease gun. the problem with this is that there are hundreds of different guns in the market and the displacement varies greatly. You might find to guns that look very similiar. One has an outout pressure of 1,800 psi with displacement at 1 ounce per 11 strokes. You will have the similar looking gun rated at 10,000psi and 1 ounce at 20 strokes. So with that, you cannot count the strokes unless you know exactly what gun you have. Also, if you have two people, it is possible that one may not take full strokes of the gun, thus not achieving the full displacement.
There are many manufacturers now of inline grease meters (see Alemite Corp's 3530). It can be installed inline on a hand operated, Battery operated or Pneumatic pump. It measures by volume passing through the oval gears and the electronics pick up the rotation and converts this to a measurement which is displayed on the LCD in CC or Ounces. It works very well.
Centralized Lubrication systems work very well on large application where performing lubrication of all the points is very time consuming or possibly dangerous for the technicians. There are very types systems, Injector, Progressive valve, Dual line where each has its own benefits.
So finding out how much grease you should put on your bearing point is very important, ensuring that you are actually applying that amount is even more important.
If there are some of you who have questions, there are many of us within this group who are very willing to assist in these systems.

Looking for **high quality water resistant grease**

Question:
Which grease types provide the best water resistance?
Answer:
Barium and aluminium complex

Silicone based greases are in fact the best option when it comes to water resistance, if you refer to water washout resistance then the "adhesion" of the grease needs to be considered, and here we could consider other options.
By Jesus Somoza

Specific Application Would Be nice Look For An Aluminun Complex Or Calcium Sulphonate Based Grease Will Give You Best Performance In Water But Still RPM Of Application Would Be Important.
By Dusty Wright

the soap structure is selected usually for 3 purposes the first economic, second temperature region and third is unique properties. Sodium is very grainy soap structure is effective up to 150 C but has low water resistance. So temperature we choose Calcium 95 C Drop point then sodium ,Lithium 180 C, complex 250 C and Bentonite is indeterminate. All bar Sodium have good water

resistance. Finally cost runs least from cal, sod, lith, complex, bentonite most expensive. Calcium Complexes are the front runners for best performance currently.
toby

I have found Bentonite greases to be very water resistant.

I like Lithium complex and Aluminum complex greases for many things, and generally standardize plants with 90% Lithium complex as it can handle most things and the fewer greases there are in a plant, the better the plant will run, as junior members normally end up with the task of greasing.

I like the Bentonite in extreme heat or wet conditions. Great for construction and agriculture where the equipment is in the water and mud. For that purpose I carry one with a 460 base oil that is very tacky. You can reduce re-greasing from every day to every week or so. But I won't recommend it for high speed bearings or central lube systems since would rather stick than pump.

No matter how "water-resistant" lithium and lithium complex greases are, they always turn milky at some point.
By Richard Widman

I would think in a calcium sulfonate based grease, however, the operating conditions of your device should dictate whether it is useful or not. Some PAO Li Complex greases are a good choice, too. Be careful when choosing.

By Ariel Hernandez

I think High TBN Calcium Sulphonate-Boric acid complex grease are truly water resistant and operate at temperature - 20 C to 250 C ,with no drop point. But you have to be careful considering your applications. calcium sulphonate grease has been successfully used in marine applications. It is available in 4.0 kg/18.0 kg and 182 kg packing.
By Dr Y K Gupta

Be VERY careful with Calcium Sulphonate in very cold applications.
By Troy Olmsted, CLS

Most greases based on polyurea thickener are highly water resistant. Calcium sulfonate based greases also. Mixed calcium and lithium greases are also good.
By Carol Bonde Gleeson

Josef Barreto-Pohlen • Please bear in mind that the upper temperature limits provided in data sheets are mostly based on laboratory life time tests, running up to eventually 1000h at the top temperature. For standard Lithium greases, mineral oil based this could be up to 140°C. For a machine running at 140°C you would never recommend a lithium mineral oil based grease for life-

time lubrication (except the expected life-time of the machine is less than 100h ;-)). So you have to re-lubricate regularly or you use a different grease like a fully synthetic. Type of thickener is depending on the application. In case of a ball-bearing it could be Polyurea, in case of roller bearing a Ca-sulfonate or eventually Li-complex.

Ed Snyder • While the upper temperature operational capability of the grease does depend to a large degree on the stability of the base fluid, there are greases that use perflurorinated oils as the base fluid and they are reported to be useable up to 600F. In that case, one must also consider the stability of the thickener and any other components such as lubircity or corrosion inhibitor additives as well as the stability of the base fluid.

Our marine customers use Mobil XHP 222. It is specifically formulated to be used in moisture rich environments and it does the job. Let me know what situation you need the grease to work in and I can be more specific on the product. This is not an underwater compatable product.
By Howard Taylor

Mobil XHP 222 is formulated with objective of water resistant of grease in bearing application.

Mike Cooper

Commercial Sales at Wilcox & Flegel Oil Co

Mobil shc polyrex series is **food grade** and also a polyurea thickend greases.
Chances are excellent that you would not have to worry about compatibilty issues and All Mobil SHC Polyrex greases are NSF H1 registered and also comply with Title 21 CFR 178.3570 by the Food and Drug Administration (USA) for lubricants with incidental food contact. Additionally, they meet the requirements of Kosher. Mobil SHC Polyrex Greases are manufactured at ISO 22000 certified facilities that also meet the requirements of ISO 21469 helping to ensure that the highest levels of product integrity are maintained.

Major OEM Polyuea grease comparison such as Chevron SRI VS Mobil Polyrex EM

#1 - They are compatible.

#2 - Mobil Polyrex EM is made in a continuous blending system (untouched by human hands) versus a batch blending system (humans add a bag of this and a bag of that). The result is the grease is the same from batch to batch.

#3 - Bearing manufacturers have found that the initial bearing vibration readings are much lower because the grease is cleaner.

#4 - Because of #2, Mobil Polyrex EM has replaced SRI as the initial fill for most motor manufacturers.

#5 - Because of #2, Mobil Polyrex EM is more shear stable - lasts longer.

Your best Food grade option is Mobil SHC Polyrex series grease. Especially for compatibiltiy.

http://www.mobil.com/USA-English/Lubes/PDS/GLXXENGRSMOMobil_SHC_Polyrex_Series.aspx

Jean-Michel Demaret

Qualified Engineer / Senior Account Manager

Why a **grease is not translucent or transparent**? Do we need to see through a grease (transparent) or the grease needs to be of a clear aspect (translucent) like silicone gel?
Let's consider that the oil used is transparent.
Lithium 12 fibers are opaque. The thicker the grease film the higher the probability that a ray of light is intercepted and absorbed by the fiber. A thin film of grease (a smear) is transparent I was looking at some pictures of fibers lattice, it seems that Lithium complex fibers were shorter.
May be it is easier to obtain a transparent/translucent grease NLGI000 than NLGI2
We can obtain shorter fibers by extra milling but likely the grease performance may deteriorate.
A chemist may be able to answer the question is there a combination of Lithium, fatty acid, alkali and salt able to crystallize in a non opaque crystal.

V.S.S. Sarma

Technical Manager

Top Contributor

Jean-Michel Demaret: Nice effort in answering, my friend. Thanks. I agree with your rationale. Perhaps, silicone oil should replace the mineral oil to get translucent grease. May be, Gr 3 base oils can give rise to lighter greases but mechanical stability can be an issue.

Stephen Boyde

Chemical Technology Consultant

Lithium soaps are scattering light, not absorbing it. To get an opticallly transparent Li grease you'd either have to blend an oil to match the RI of the thickener, or modify the thickener structure to get the dimensions smaller than the wavelength of visible light.

David Wedlock

Consultant - Base Oils and Lubricants

You make a transparent grease in exactly the same way as a transparent toothpaste - you refractive index match the continuous phase (oil) with the disperse phase (lithium soap particles). SInce the lithium soap is a given - you must find some oil-compatible agent which can be added to the base oil to make it equal the refractive index of the lithium soap - if it's really worth the trouble.

Kim Smallwood

Manager Product Line Grease

There has been some work in this area using a special version of Lithium I believe. As mentioned above the lighter the viscosity of the oil gets lighter color in group 1's, you would get better results in Group 3's as they are very light color. PAO's as well. Use of a fumed silica also works if that is acceptable.

V.S.S. Sarma

Technical Manager

Top Contributor

Don McNeil: Different perspective. Thanks. Just thinking aloud about the technical possibility. We Indians like things light in colour (may be because we are a little dark ourselves).

Kim Smallwood: "Fumed Silica". Heard first time. Will research about it. Thanks.

Gareth Fish

Strategic Technology Manager at The Lubrizol Corporation

This is from my own knowledge of making greases for 20+ years
The only way to make a clear lithium soap grease is to cook high purity 12-hydroxystearic acid into a naphthenic base oil. You may need to adjust your cooling rate / quench to get a clear structure. This should be followed by milling and vacuum de-arating. it needs to be close to neutel but slightly alkaline
If looking at other thickener types, silica gels will be clear. theye rae often called earogels as they are more gel like than grease like.
Straight calcium sulfonate greases should also be translucent. There is a good picture of clear sulfonate in my NLGI paper from 2011 on calcium sulfoante greases

V.S.S. Sarma

Gareth Fish: Brilliant input, my friend..Coming from a maker of grease...

Naphthenic base oil: Supply is a problem + Oxidation stability issue (?) May be we may have to boost Oxidation stability using additives like DBPC, Irganox L-57, Vanlube SL, Vanlube 601, Irganox L-101, Oleyl Sarcosine, Imidazoline, etc.

Silica gels: Stability (Oxidation, Mechanical, Shell Roll) to be commented upon.

Thanks.

Stephen Boyde

Chemical Technology Consultant

If you can't use naphthenics, and you can't use alternative thickeners as Gareth suggests, then another way to modify RI of oil phase is to blend in a bit of an aromatic synthetic - alkyl benzene, alkyl naphthalene or phthalate ester.

Ricardo Barreto Muskus

Presidente en Industrias Venoco C.A.

Silica gel greases (Aerosil fumed silica from Degussa) are transparent gels with remarkable thermal resistance, (no DP) and thermal reversibility, that means the ability of recovering its structure after cooling from being heated at temperatures above 200 C. One problem, they are not water resistant.

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Adavil Bicelli OEM Engineer and Technical Support, Klüber Lubrication South America

Lubrication of screw connections
Consistent coefficients of sliding friction in order to achieve a defined pre-tension are imperative for fault-free mounting of a screwed connection. Screws base on the principle of transferring a tightening torque [MA in Nm] into a pre-tension force [FV in N] in the screw shank with which the connecting parts are pressed together (clamping force).
In this case the transfer is effected by means of the screw thread between the head and the nut of the screw. Frictional resistances in the screw thread [µG] and at the screw head [µK] as a rule reduce the transfer of the tightening torque [MA] into the pre-tension [FV]. However, they also make a fastening thread, such as at a thread, self-locking. Weldings of the thread surface, so-called cold welding, can result time and again when screws are mounted, in particular at high-alloy steels (austenitic materials), so that a defined pretension can no longer be achieved or is prevented.
Problems also occur time and again when screw threaded connections are dismantled, for example through burningtogether at high operating temperatures (>200 °C).
In the process oxidation of the surface arises and layers of scale are formed that can result in a thread being blocked. At normal temperatures corrosion, caused by the capillary property

in the thread that lets moisture ingress, can make it impossible to open a screw without destroying it. (source OKS - A Freudenberg Company)

Pastes with graphite could provide a good humidity protection, but You need check the oil base and thickner existent too, like Polyglicol or PAO, Lythium, etc.

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I use chisel paste (graphite based grease) for lubrication of wire ropes. It's OK but what's the best type of grease for the application I mentioned, especially in humid climates?
Masoud Aghamasihi

Chris Nowlen Reliability/Sales Consultant at Lubrication Engineers

2001 Almasol wire rope lubricant.

Arupanjan Mukherji Regional Sales Manager

You can use a 00 consistency GREASE - which is manufactured by many companies and also use a high viscosity oil for this purpose - You need to look at the dispensing system being used and application method as well.

Sunil Salsankar

Business Developement Manager at Berkeley Petrochemicals Pvt Ltd

You can use LE 2001Monolec which is a highly penetrating oil reaching alm upto core strands & leaving a coat there. increses wire rope life & reduces breakages.

kapil verma Senior Executive - Technical Services (PAN India)

You can go ahead with Mobilarma 798 which gets penetrated into the wire strands due to its tenacious rust preventive film which help to reduce the negative effects of fresh water, salt water and mild acids.

Arupanjan Mukherji Regional Sales Manager

Keeping off the brands is highly recommended as this is not a selling platform - Lets add technical parameters if we know.
Having said that - depending on the diameter of the rope the oil viscosity is chosen. what is the size of the wire rope in question? water spray off test is important in case of exposition to rain and open air. SST is a good method to test if the rope is exposed to saline environment.
However in enclosed environment those are not very important but a clean rope is preferred.

Peter Weismann Technical Director bei OelCheck GmbH

The type and the viscosity of a wire rope lubricants mainly depends on the design and the application of the rope. Usually each rope contains a core fibre which is made out of silsal, jute or other oil-absorbing material, which acts as a reservoir for the oil so it is able to lubricate the steel fibres. See http://www.safetysling.com/wr.htm. Many of the rope lubricants like semifluid greases and very tacky asphaltic or graphite containing products are hanging on the outside of the rope and do not penetrate into the core. But outside lubrication of a rope will act only as a corrosion protection, but not for lubrication. Those products let have the impression that the rope is well lubricated but I will not lubricate the individual wires. As a result fretting corrosion will occur when the rope is bended on the rollers or winch drums. And a rope will usually not fail because of corrosion caused by humidity but mainly because of wear caused by the individual movements of the wires.The OEM's for wire ropes usually are using more than 10 different lubricants. Some of them are applied during the manufacturing process while they are heated and soaked into the core, some a vasoline like, some are just good ISO 320 gear oils. A rope lubricant used in the field must be able to penetrate and replace the original oil which was squeezed out from the core during use. Lubricants containing solid particles like graphite, greases or asphaltic products containing a

solvent will not help at all.

Andrew Monk Managing Director - Lubrisolve Engineering Solutions Ltd.

You need to consider the application of the lubricant very seriously. Think about a wrap around collar which is available that applies the lubricant by pressure so that the inner core is penetrated.

Don Howard, ICML MLA II Product Innovation-Mining at Bel-Ray Company

The type of lubricant selected depends on the rope application. Typical WRL's for running WR's are penetrating types that penetrate to the WR core protecting the inner strands against rubbing wear and corrosion and barrier or coating types the may penetrate initially but form a protective film om the exterior surface sealing the rope and protecting against abrasion, moisture, etc. Stationary or structural WR's typically use protective coatings that are more rust preventive that lubricant.

Angus Macdonald Experienced sales consultant for lubricants industry

Dear Masoud, some excellent useful information already in the thread. Peter and Arupanjan have listed the appropriate additional application data that is required in terms of the type of the wire rope, LETS (Load Environment Temperature Speed) The following technical white paper covers the whole subject of wire rope lubrication and will hopefully be of interest to you.
http://www.lelubricants.com/lit/news/White%20Papers/wireropes.pdf
in summary though there are 'penetrating' types of wire rope lubricants and 'coating' types of wire rope lubricants - the best recommendation depends on the method of lubrication and the type of application.
As per Andrew's comment there are a number of wire rope lubricators on the market and one brand that is increasingly popular & successful in a number of industries including ports, offshore, shipping & mines is the VIPER Wire Rope Lubricator www.VIPERWRL.com