



Spectrum

Winter 2024 | Issue 112

The fundamentals of
grease
– All you need to know!

**Grease
is the word!**

– A greasy tale of tired bearings

Correct shaft alignment

+
Conference'24

A full photo montage





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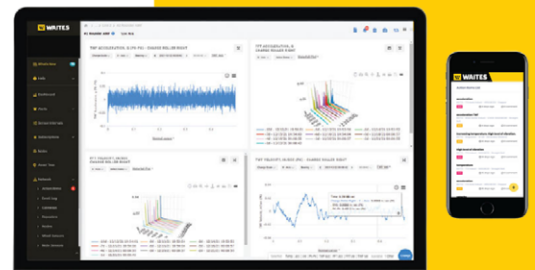
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Spectrum

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The magazine is designed to cover all aspects of the Vibration, Condition Monitoring, Reliability and the wider Predictive Asset Management field and distributed to all VANZ members, including corporate members.

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VIBRATIONS ASSOCIATION of NEW ZEALAND

> Website: www.vanz.org.nz

Conference paper submissions

> secretary@vanz.org.nz

Contributions to Spectrum are welcome.

Email material to:

> spectrumeditor@vanz.org.nz

Address all VANZ correspondence to:

PO Box 308093
Manly, Auckland 0952,
New Zealand

Editor: Angie Delfino

> spectrumeditor@vanz.org.nz

President: Tim Murdoch

> Timothy.Murdoch@ballance.co.nz

Treasurer: Graeme Finch

> g.finchnz@gmail.com

Design: Eddie van den Broek

Flashpoint Design and Marketing

> info@flashpoint.design

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PRESIDENTS' REPORT

By Tim Murdoch | VANZ President



Winter is here! Whether you're hitting the slopes or staying cozy indoors, I hope you're keeping healthy and warm. As a committee we are thrilled to report that the VANZ 2024 Conference, held from 21st-23rd May at the Plymouth International Hotel in New Plymouth, was a resounding success. Our exhibitors transformed the conference venue into a vibrant hub of ideas, products and solutions and their innovative displays and engaging interactions enriched the overall experience. Many thanks to our VANZ 2024 Platinum sponsor GVS Reliability Products for all your support and contributions. Thank you to Allan Rienstra, our keynote speaker from SDT Ultrasound Solutions, he captivated the audience with his insightful presentations.

To the other conference speakers, I want to express our sincere gratitude for your contemplative and engaging presentations, the expertise, passion, dedication and willingness to share was a major part of the conference. Your contributions made a significant impact and we appreciate the effort that was put into preparing and delivering the valuable content of your papers.

Thank you to our delegates for attending VANZ 2024 and being the heartbeat of this conference. Your active participation, thought-provoking discussions and networking efforts created an atmosphere of collaboration and growth, we appreciate your presence and contributions. Mike Davis conducted another successful Motors Masterclass, sharing his knowledge with those that attended. VANZ also has a new life member, Bruce Shepherd. Thank you, Bruce for all of your

contributions to the organisation over the years, this is well deserved.

The AGM was held during the conference and some new, additional committee members have been appointed: Daré Petreski, Matthew Jones, Chris Unsworth and Cole Stanton, it's great to have you all on the team.

The venue for our conference this year was the Plymouth International Hotel, their impeccable service, attention to detail and seamless co-ordination ensured that every aspect of the conference ran smoothly. Their team did an amazing job! We are pleased to announce that we will be returning to the Plymouth International Hotel

for the conference next year and would like to give a warm welcome to our new VANZ 2025 Platinum sponsor ABD Group. Mark your calendars for 20th-22nd May 2025 and include it in your training budgets now!

As we reflect on the success of VANZ 2024, we eagerly anticipate the conference next year. Do you have a case study to share? Would you like to present a paper, be a sponsor or an exhibitor? Or just come along for the experience, networking and learning? Get in touch with us at secretary@vanz.org.nz or visit our website www.vanz.org.nz for any queries.

Stay connected with VANZ! Follow us on our social media accounts (Facebook and LinkedIn) for updates and stay tuned for exciting announcements about our next conference! ■

“ Thank you to our delegates for attending VANZ 2024 and being the heartbeat of this conference. ”

ABD Group is proud to be platinum sponsor for the VANZ 2025 Conference in New Plymouth.

For more information about ABD Group, visit our website: www.abdgroup.co.nz



SCHAEFFLER

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Condition Monitoring

Schaeffler's OPTIME Ecosystem is a revolutionary condition monitoring system, designed to transform the landscape of industrial maintenance.

Pri-arily targeting rotating machinery, it is adept at functioning across a diverse range of speeds, from 120 to 5000 rpm, and is also suitable for hazardous environments. The system's foundation lies in its wireless, battery-operated sensors that are remarkably easy to install. After the installation, the data collected by wireless OPTIME sensors is transmitted to a digital service via a gateway. This setup enables continuous monitoring and early detection of potential machine issues, thereby preventing costly unplanned downtimes.

A distinguishing feature of the OPTIME Ecosystem is its usercentric design, making it accessible to a wide range of users, from beginners to experts in the field of maintenance. Its affordability further enhances its appeal, breaking traditional cost barriers associated with advanced monitoring systems. The system's design excellence has not gone unnoticed, garnering it prestigious awards such as the Red Dot Design Award 2021 and the Industry 4.0 Innovation Award 2020.

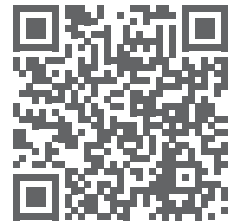
The 24/7 monitoring capability of OPTIME offers real-time data and analysis and allows maintenance technicians to tackle emerging issues promptly. This is a key factor in saving time and resources.

An integral component of the system is the OPTIME ExpertViewer digital service. This service is compatible with OPTIME and "OPTIME-ready" data, including data from Schaeffler SmartCheck and Schaeffler ProLink. ProLink, like SmartCheck, is part of Schaeffler's range of innovative monitoring tools, designed to work seamlessly with OPTIME. This compatibility ensures a comprehensive approach to condition monitoring, allowing users to leverage the strengths of different Schaeffler products in a unified manner. Additionally, the OPTIME C1 wireless automatic lubricator and the integrated digital lubrication management ensure optimal machine performance by continuously monitoring lubricator devices, alerting maintenance teams to critical lubricant levels and enabling remote adjustments, further enhancing operational efficiency.

Furthermore, OPTIME forms a key part of Schaeffler's broader Lifetime Solutions suite, offering an extensive approach to machine lifecycle management. This suite combines monitoring, analysis, and maintenance support into a cohesive package,

addressing various industrial maintenance needs.

Schaeffler's OPTIME is a groundbreaking development in condition-based monitoring. Its amalgamation of cutting-edge technology, ease of use, cost-effectiveness, and integration with a broader suite of tools, including ProLink, positions it as an indispensable asset in modern industrial maintenance. By implementing OPTIME, industries are poised to significantly improve their maintenance processes, resulting in enhanced efficiency, minimised downtime, and substantial cost savings. The OPTIME Ecosystem exemplifies Schaeffler's commitment to driving innovation and excellence in industrial maintenance solutions.



In it for life...

VANZ would like to extend our congratulations to new life member; **Bruce Shepherd**, who was presented with his awards at the recent conference in New Plymouth in recognition of his unwavering service and support to the association over the years. Bruce is very well respected in the industry and known for his hard work ethic. From all of us at VANZ - well done, and THANK YOU! ■



EDITORS' CORNER

By Angie Delfino | Spectrum Editor

As we recover from the hustle and bustle of the conference, we take stock of how everything has come together this year, the new ideas that worked well, the things we can improve on and the good old standard ideas that come through each year.

We'd like to thank our platinum sponsor GVS Reliability Solutions for the continued support, it is much appreciated and we hope all the attendees enjoyed their time with VANZ over the conference week, it was so good to see some new faces and also catch up with our regular supporters. Many thanks go to the organising team that helped push everything into place and to the various sponsors, many of which had a trade stand at the conference and have also placed an ad with us for this issue.

Be sure to check out Tim Murdoch's Presidents report, squeeze a bit of the old grey matter with Carl's quiz and see what sort of deals our post-conference advertisers have to offer. Our articles for this issue come from two of our conference speakers, we have Mike Wharry from Allied Petroleum with his take on Grease Fundamentals, and "Using Your Eyes and Ears." from Ian Van Der Sar – Micah Technologies Ltd.

As we continue on with the year our newly elected committee members are already ploughing into organising the conference for next year so we can continue to make it better and better for all involved.

Stay warm during these winter months. Happy reading! ■



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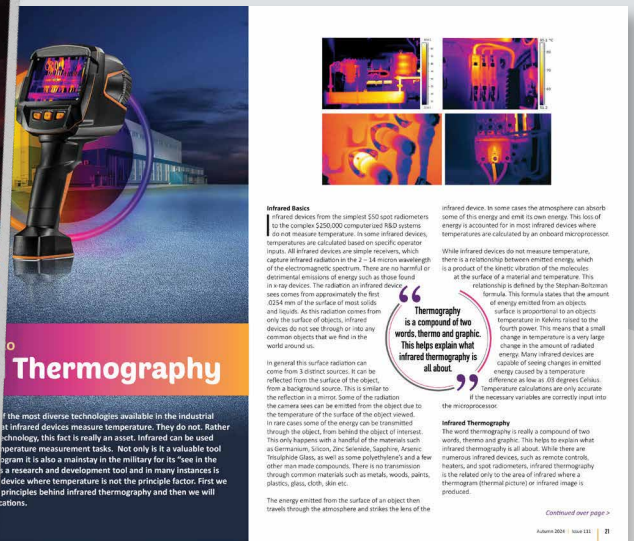
VANZ would like to take this opportunity to thank our platinum sponsor GVS Reliability Products., as well as all advertisers, exhibitors, speakers and attendees at this year's conference contributing to the overall success that it was. In no particular order, photos from the three-day conference event and Friday morning site tour to the Ballance Kapuni fertiliser site are showcased over the next few pages...



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Correct shaft alignment

Why precision alignment?

- Shaft alignment is performed whenever rotating components are coupled together.
- Accurate alignment is necessary to achieve the maximum possible life out of the components.
- Poor alignment will result in high vibration, stresses on the components, rapid wear of couplings, and early failure of the coupled equipment.
- Components that provide position feedback or speed feedback, such as tacho generators, also require accurate
- Alignment in order to provide a steady signal.

Before you start an alignment:

- Make sure that jacking screws are in place. You cannot do the job properly without them. You should have 2 on each side of the motor for horizontal adjustment, and 2 at the front of the motor for axial gap adjustment.
- Make sure that pre-cut stainless steel shims are available. Pre-cut plastics shims are an acceptable

alternative. Do not cut your own.

- Check that the coupling has no torsional play, as this will upset the alignment process. If torsional play is present, first of all check the condition of the coupling elements and replace them if worn. On some couplings, such as cone ring couplings, torsional play can be eliminated by wrapping tape around the periphery of the coupling faces.

Procedure for an alignment:

- Perform a soft foot check first! Do not be tempted to skip this step. Do not be like me and learn the hard way. Soft foot will make the alignment process difficult as it will not respond as expected to the corrections that you make. See separate flyers on soft foot.
- Correct the vertical alignment before you correct the horizontal alignment.
- ALWAYS tighten the hold down bolts in the same criss-cross sequence. This will ensure that you get the expected corrections.



- Tighten the hold down bolts with a tension wrench. Again, this will ensure that you get the expected corrections.
- When placing shims, always lift with jacks or chain blocks. Do not use a crane hoist! You run a very real risk of lifting too far and seriously damaging the equipment.

Common Problems

Insufficient room to mount the chain brackets. This can often be solved by using slimline brackets, or compact magnetic brackets. The slimline brackets are only 8mm thick and mount directly to the shaft. Because of their slenderness, it is necessary to take the average of a number of readings. The compact magnetic brackets are also thin, and must be mounted onto fixed hubs. They must not be mounted onto moveable components such as the outer part of a gearflex coupling.



One or both shafts cannot be rotated. In this situation it is often possible to use a magnetic sliding bracket in conjunction with 2 inclinometers. This bracket can slide around a machined corner of a fixed hub. It must not be mounted onto moveable components such as the outer part of a gearflex coupling and cannot be used if the faces of the hub are bruised or damaged in any way.

Shaft Alignment Tolerances

Use the following tolerances unless the manufacturer

specifies a tighter tolerance.

Soft Foot: 0.10mm maximum. On the Optalign display this is shown as "0010".

Short Couplings: (such as elastomeric, metallic grid, pin and bush) Use the following table.

Shaft Speed (rpm)	Maximum parallel misalignment or angular gap (mm)
Less than 600	0.20
601 – 800	0.15
801 – 1,100	0.11
1,101 – 1,500	0.08
1,501 – 2,200	0.05
2,201 – 3,000	0.04
3,001 – 6,000	0.02

Spacer Couplings: (such as gear couplings, diaphragm couplings, jack shafts)

Because these couplings have 2 flex planes that have some distance between them, the alignment tolerances are typically a little more generous. For these couplings we use the following values:

$$\text{Maximum offset at power planes} = \frac{\text{short coupling tolerance} * \text{distance between the power planes}}{\text{coupling pitch diameter.}}$$

Note that there is only an offset tolerance for each plane. Use the Optalign F7 function to measure these values.

Note also that for gear couplings where the distance between the power planes is short, it is acceptable to work to the tighter tolerances given for short couplings. ■



Grease is the word!

We know the rap sheet for failed bearings is 80% predominated by lubrication issues so how can we mitigate the premature death rate?

The old adage guns don't kill people... 'it is the one who is pulling the trigger at fault'. It is the same for grease guns with multiple inaccurate shots killing the very bearing you want to keep alive so that your asset runs smoothly for an extended time. I cannot say I have heard of a bearing dying of old age, but it is possible.

While lubricating a bearing on a regular basis seems practical, it's actually causing your bearings more harm than good. Grease is needed in bearings for one reason and that is to prevent and reduce friction by keeping the bearing cool in its operating temperature range. If the lubricant is doing its job well, you don't need to continue to change it or add more.

Grease Dynamics

By its very nature grease gets tired. A ball race for example, in a three phase four pole electric motor running at 1450 rpm passes through the loaded zone twenty-four times a

second and the grease contained therein must maintain a film thickness separation from anywhere between one micron to a tenth of a micron. The excess cannot go through this ball or roller pathway loaded region and in fact, a reverse flow occurs inside the lube churning the additive fibres creating more heat. Therefore, regular greasing is counter intuitive, contributing to the ultimate death of the bearing and downtime for the asset.

“With more machinery guarding in place these days, it is becoming more difficult for grease nipple access and monitoring.”

Who Pulled the Trigger?

An uneducated lube technician on a regular greasing route is tantamount to slowly euthanising the plant asset, by administering excess lubricant. Perhaps the bearing is doing just fine and does not need any grease at all. It is possible to measure the friction levels in a bearing to feed the precise amount of grease required. Grease fed pillow block and flange bearings can easily blow out their seals in the confined





internal cavity by over greasing. It pays to have the shaft rotating to avoid this whilst greasing.

Ultrasound for Best Results

You can monitor, measure, and trend friction levels with ultrasound instead of re-lubricating a bearing on a schedule, so you know exactly the right time to grease. Higher friction levels above a baseline will also indicate a bearing fault requiring future predictive maintenance. A measured approach is needed to administer the medication with the correct prescription and exact amount of grease in grams. With ultrasound you can connect directly to the grease gun chuck and listen in on the friction level while injecting the lube to the precise level the bearing needs one shot at a time.

Grease Chuck Delivery

Every grease gun differs in what each shot of grease weighs, even with identical grease guns. It would be good policy to weigh 10 shots of grease onto some scales to average what each shot of grease weighs in grams. Then write on the side of the grease gun exactly what a shot of grease weighs for that particular gun. Cordless powered grease guns can be fitted with a meter to establish the quantity also. In combination using ultrasound with grease shots administered, an accurate grease replenishment regime can be quickly established to prolong the life of the bearing and improve the overall health of the asset. More often than not, less grease is required to adequately lubricate the bearing.

Bearing manufacturers and suppliers can indicate approximate relubrication intervals, the exact type of lubricant and quantity required for each machine application, however a time-based regreasing schedule is no longer considered best practice. Further, lubricants have a lower percentage capacity of the bearing catalogue limited bearing speed. Some are as low as 40%, most of the average branded grease formulas are 70% and more expensive lubricants up to 100% operating capacity of the bearing catalogue limited speed.

Careful selection for the right type of grease is required if

you have a bearing running at or near the catalogue limited speed with a high operating temperature. Immediately you will have lubrication issues causing adhesive wear, skidding and smearing of the raceways if the lubricant is unable to cope with these conditions.

With more machinery guarding in place these days, it is becoming more difficult for grease nipple access and monitoring, however remote automated greasing systems are becoming more readily available for critical plant assessment direct to a mobile phone app to administer relubrication safely.

Conclusion

Ultrasound opens a whole new realm for precise grease lubrication and measuring friction levels in the plant assets. Immediate cost savings are realised with less lubricant required and predicted bearing failure can be anticipated well in advance as the decibel level increases long before vibration analysis can pick up any inner or outer ring defect.

For NZ industrial plant and assets this is an advance step toward a cleaner greener operation and an improvement in production and machine asset longevity reducing the potential for breakdown and fewer bearing death certificates issued. ■

References

1. ABD Group NZ Ltd
2. NSK CAT. No. E1103 2016 C-10 Lubrication 11.3 A237-241
3. SDT Ultrasound Solutions HearMore@sdtultrasound.com



The fundamentals of grease

Engineers understand that effective lubrication is a fundamental requirement for equipment reliability and increased mean time between component failures.

Surprisingly, there is often little or no formal lubrication training provided to engineering & maintenance staff that are responsible for maintaining equipment.

Approximately 80% of bearings are lubricated by grease and sometimes the OEM's grease recommendations are inadequate to select an appropriate grease and may even recommend an unsuitable grease for the application. e.g. it is not uncommon to see an OEM grease recommendation for an EP 2 grease, with no recommendation for base oil viscosity.

This article discusses the fundamentals of grease & considerations for selection of a suitable grease for individual applications.

Continued over page >





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Functions of a Grease

- The main function of a grease is to lubricate the moving components of machinery in order to minimise friction and wear.
- In addition to lubrication, grease has properties that reduce leakage and help protect machinery from:
- Rust and corrosion.
- Water, dirt and other contaminant ingress.

Where is Lubricating Grease Used?

Grease is a vital lubricant used virtually everywhere, in every sector.

- Industrial Sectors
 - Mining
 - Forestry & Paper
 - Primary Metals
 - Energy
 - Processing & Manufacturing
- Marine
- Aviation
- Passenger Vehicles
- Commercial Vehicles.

Why Use Grease?

Approximately 80% of all bearings are lubricated with grease... although oils are theoretically a more efficient lubricant.

Oil

- Additional cooling
- Allows higher speeds
- Easy removal of contaminants
- Filtering is possible
- Machine & lubricant condition monitoring through periodic oil analysis
- Efficient lubrication of seals.

Grease

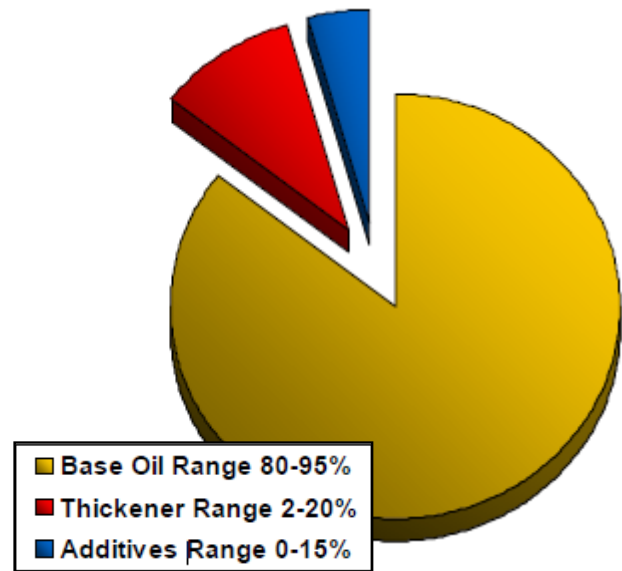
- Seals against dust and moisture
- Remains in place
- Low leakage
- Can be fortified with solids to provide very high load capacity.

Grease outperforms oil when:

- Effective sealing is needed for environmental or safety concerns (grease can act as a seal, eliminating the need for more expensive mechanical or elastomer seals).
- Leakage / Housekeeping is an issue.
- Water or other contaminants are present in the operating environment.
- Equipment / Budget constraints exist, not allowing the installation of oil circulation systems.

Typical Grease Composition

The wide variety of applications for lubricating greases



call for an equally diverse range of compositions. Actual compositions will vary, depending on the individual application.

Grease = Base Oil + Thickener + Additives

- **Base Oil:** Lubricates with mineral, synthetic or natural oils (may include combinations).
- **Thickener:** Provides body and structure with soap or non soap components.
- **Additives:** Enhance lubricant performance with oil soluble components to control extreme pressure, wear, rust, corrosion, oxidation and adhesion. Solid components may also aid performance.

Base Oil Viscosity is the most important characteristic of a grease.

Base Oil

- Base oil makes up 80 to 95% of a typical grease.
- Oil must bleed from the thickener to lubricate – a grease cannot be any better than its base oil, the thickener provides little or no lubrication.
- Base oil types range from mineral to synthetic or a blend of both.

Base oil viscosity is the most important factor for:

- Preventing bearing wear.
- Obtaining optimal EHL film thickness benefits.
- Selecting the best grease based on an application's load, speed, temperature and other environmental conditions.

Typical low base oil viscosity conditions are high speed, low load and low temperature. Typical high base oil viscosity conditions are low speed, high load and high temperature.

Additives

Additives make up 0 to 15% of a typical grease

- Additives enhance lubricant performance.
- Extreme pressure, wear, rust, corrosion, water

resistance and adhesion.

- There are two general categories of additives:
 - Oil soluble (most additives)
 - Solids (molybdenum disulfide, graphite, polymers and others).

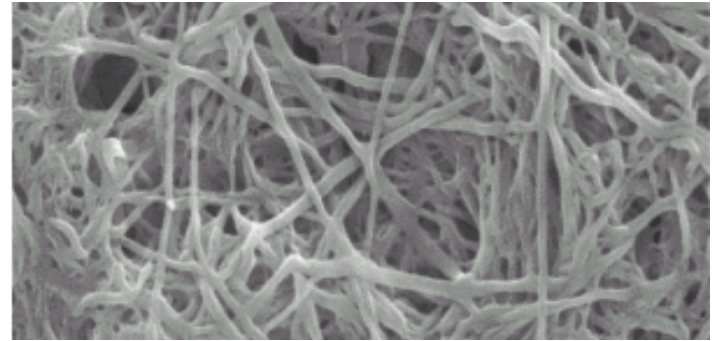


Thickener

Thickeners make up 2 to 20% of a typical grease

Properties of good grease thickener materials are:

- A three-dimensional network of fibres or particles filled with oil, no air
- Uniformly dispersed
- Large surface area
- Provides the structure.



NLGI Consistency Grade

The more thickener added, the higher the consistency (stiffer) the grease becomes. A typical multipurpose grease is an NLGI 2 grade. *See below.*

Continued over page >

Lithium soap with oil removed: looks like a sponge.

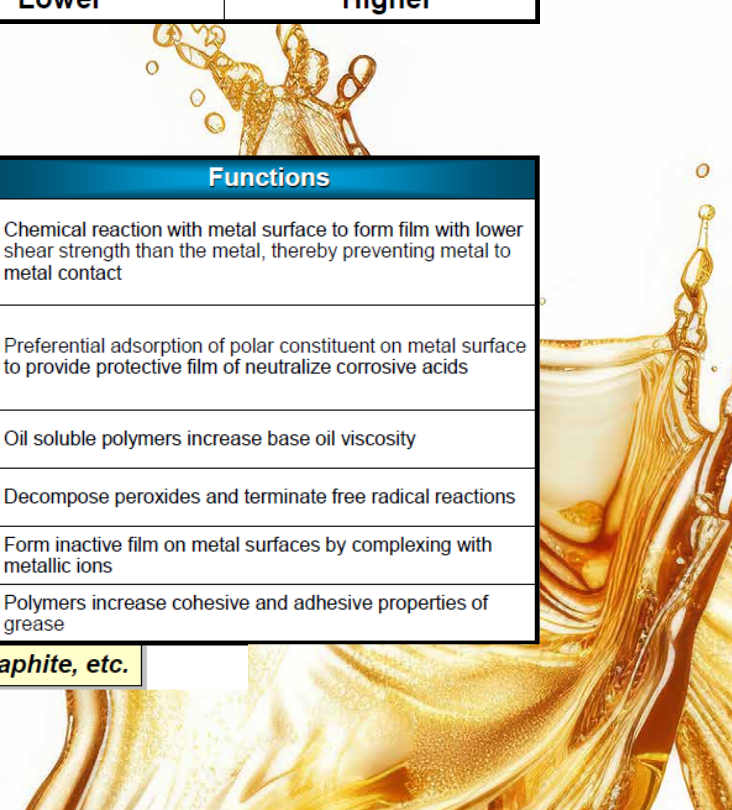
NLGI consistency guide

NLGI Grade	Consistency	Thickener Content	Oil Content
6	Hard ↓	Higher ↑	Lower ↓
5			
4			
3	Soft ↓	↑	↓
2			
1			
0	Semi - Fluid ↓	Lower ↑	Higher ↓
00			
000			

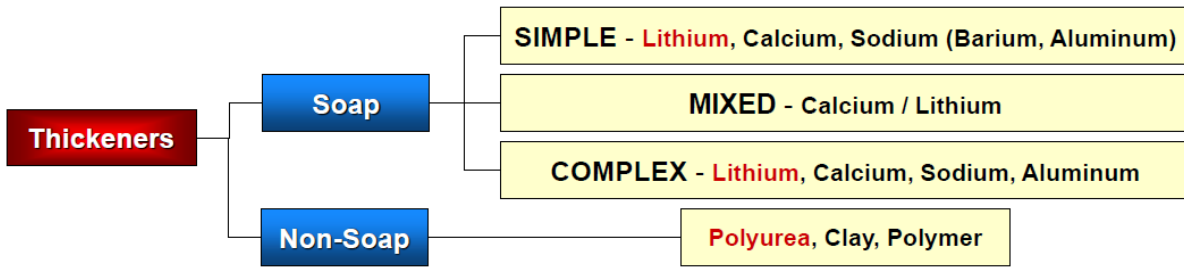
Additive types and functions

Additive Type	Purpose	Functions
Antiwear and EP Agent	Reduce friction and wear Prevent scoring and seizure	Chemical reaction with metal surface to form film with lower shear strength than the metal, thereby preventing metal to metal contact
Corrosion and Rust Inhibitor	Prevent corrosion and rusting of metal parts in contact with the grease	Preferential adsorption of polar constituent on metal surface to provide protective film of neutralize corrosive acids
Viscosity Modifier	Increase base oil viscosity	Oil soluble polymers increase base oil viscosity
Antioxidant	Retard oxidative de-composition	Decompose peroxides and terminate free radical reactions
Metal Deactivator	Reduce catalytic effects of metals on oxidation rate	Form inactive film on metal surfaces by complexing with metallic ions
Structure Modifier	Increase adhesion, water resistance	Polymers increase cohesive and adhesive properties of grease

Plus solid additives: Moly, Graphite, etc.



Grease Thickener Technologies



Selecting the right Thickener Technology for your application

Type	High Temp.	Water Resistance	Mechanical Stability	Pumpability	Oxidation Stability	Principal Uses
Lithium*	—	+	+			Multipurpose auto & ind
Lithium Complex*	+	+	+	+	+	Multipurpose auto & ind
Polyurea*	++	+		+	++	Multipurpose auto & ind
Clay	++		—		+	High temp industrial
Aluminum Complex		+	+	—		Multipurpose industrial
Sodium	—	—	—	—	—	Roller bearings
Calcium Sulfonate*	++	++	+	—	+	Wet applications
Calcium Complex	+	++	—	—	—	Multipurpose auto & ind

Each thickener technology has its pros & cons. Lithium has been the most common thickener technology for some time but Lithium complex technology is increasingly used in industry as it provides an “all round” performance and it is suitable for many applications.

If an application has special requirements, other thickener

technologies may provide improved performance. An example could be the use of Clay or Calcium Sulfonate in elevated temperatures.

Continued over page >

Interested in joining

VANZ

Anyone with an interest in the area of mechanical and electrical machine condition monitoring, to facilitate predictive asset management is eligible to join VANZ.

In-house technicians, consulting engineers, suppliers and distributors of specialised equipment, engineering students can all contribute and gain from membership.

For more information about membership please contact the VANZ secretary at: secretary@vanz.org.nz



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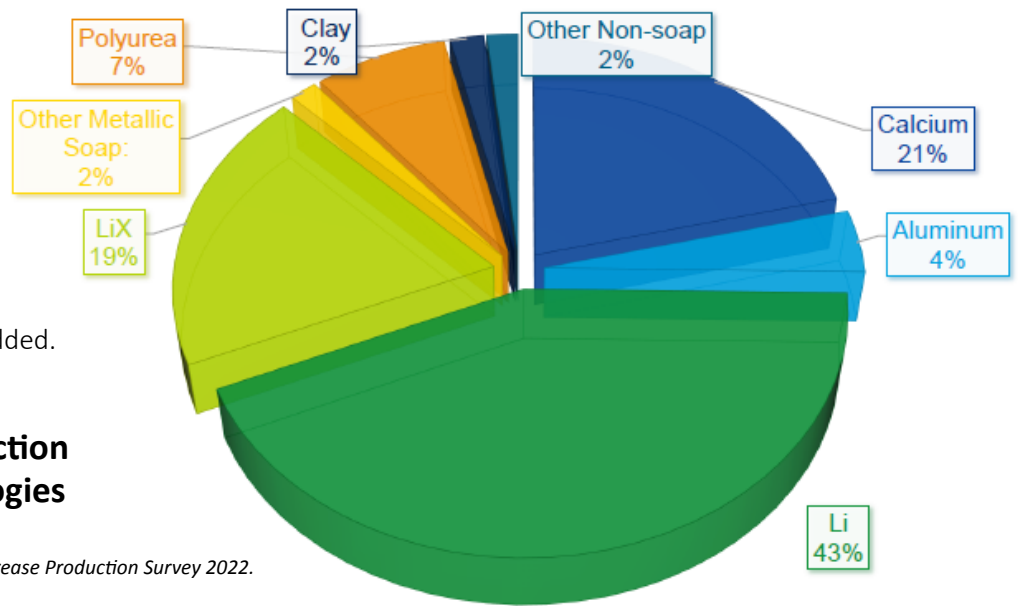
Grease Compatibility

The most common cause of lubricant failure after mixing greases is incompatibility of the thickener technologies, as well as ensuring the thickeners are compatible the base oil compatibility should also be checked.

The table below is a guide only and if unsure about compatibility of the greases to be mixed, it is worthwhile consulting the grease supplier to confirm compatibility. If unsure of grease compatibility, it is best practice to entirely remove (or thoroughly purge) the old grease before new grease is added.

In Summary

If you are unsure about what grease to select or you are experiencing a short mean time between failures of a component, consult your lubricant supplier to check if you have the appropriate grease for the application in question. ■



Global grease Production – Thickener Technologies

Source: NLGI Grease Production Survey 2022.

C: Compatible
M: Moderately Compatible
I: Incompatible

Grease Thickener generic compatibility chart

	Aluminum Complex	Calcium Complex	Calcium Sulfonate	Lithium 12-Hydroxy	Lithium Complex	Polyurea	Clay
Aluminum Complex	C	I	M	I	I	M	I
Calcium Complex	I	C	M	I	M	C	I
Calcium Sulfonate	M	M	C	M	C	I	I
Lithium 12-Hydroxy	I	I	M	C	C	M	I
Lithium Complex	I	M	C	C	C	M	I
Polyurea (shear stable)	M	C	I	M	M	C	M
Clay	I	I	I	I	I	M	C

LENZ has a full range of grease line fittings & hose for your Centralized Grease Systems & remote grease lines.



Centralized grease systems provide a safer work environment for maintenance personnel by simplifying the process of accessing remote grease points, especially in confined spaces, when equipment is in operation.

By protecting your equipment with continuous application of small amounts of grease will result in improved equipment life, due to the uniform supply of grease. Hand application is typically performed infrequently and may result in uneven amounts of grease being applied, or the incorrect grease which can damage seals and elevate bearing temperatures.



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TEST YOUR KNOWLEDGE - PART 76 OF A SERIES

1. The measurement points in a vibration database for routine data collection were set up with a nominal transducer sensitivity of 100 mV/g entered. For many years a transducer was used that had a true sensitivity of 97 mV/g. However, that sensor became damaged and a new sensor with a true sensitivity of 101 mV/g was used. How might the readings be affected with the change to the new transducer?
 - A. The new acceleration readings would be no different because the database is still set to 100 mV/g
 - B. The new acceleration readings will be 4% higher than the old readings
 - C. The new acceleration readings will be 4% lower than the old readings
 - D. The percentage change between the old and new acceleration readings will depend on the frequency
2. A fan shaft is supported by two spherical roller bearings, both of which have 20 rollers. Vibration has arisen at a frequency of 11.3 x running speed and harmonics. What bearing fault is likely to be present?
 - A. Cage defect
 - B. Roller defect
 - C. Outer race defect
 - D. Inner race defect
3. A belt-driven fan is run gradually up to speed via a VSD. You notice that its 1 x velocity levels more than double when going from 90% to 100 % speed. What might be the most-likely cause for this rapid increase in vibration? *Note that the vast majority of the vibration is at 1 x fan frequency.*
 - A. The fan might be entering into a resonant condition
 - B. The vibration might be related to misalignment of the belt pulleys
 - C. The fan impeller (and/or pulley) are badly unbalanced
 - D. The motor pulley is unbalanced
4. What multiplication factor would you apply to the rms value of a sinusoidal waveform if you want to arrive at its peak value?
 - A. 1.414
 - B. 2.828
 - C. 1.732
 - D. 2
5. A rigid rotor is balanced in 2 planes to grade G2.5. If that rotor was run in free space at its service speed, what would the amplitude of its vibration be?
 - A. 2.5 mm/s rms
 - B. 2.5 mm/s 0-pk
 - C. 2.5 mm/s pk-pk
 - D. 5 mm/s pk
6. During your work as a vibration analyst, in which of the following are you most-likely to encounter the term eddy-current?
 - A. The measurement of the displacement of shafts supported by journal bearings
 - B. Vibrations in DC motors
 - C. Vibrations in AC motors
 - D. Vibrations in AC motors connected to a VSD
7. Which of the following is most-likely to be a switching frequency of a VSD?
 - A. 4 Hz
 - B. 40 Hz
 - C. 400 Hz
 - D. 4000 Hz
8. When collecting your vibration data, you notice some "ski-slope" effects showing in some of the velocity spectra. What should you do?
 - A. Check the condition of your transducer cable
 - B. Allow more settling time after placing the accelerometer on each point
 - C. Compare different points to see if the effects only occur on points where the acceleration levels are very high
 - D. Any or all of the above could be useful measures to assist in understanding the problem
9. You use a stroboscope to determine the speed of a shaft which is otherwise unknown. Which is valid?
 - A. Start firing the stroboscope at a very high flash rate, and decrease it until you get a still image
 - B. Start firing the stroboscope at a very low flash rate, and increase it until you get a still image
 - C. Choose option A if the shaft is rotating clockwise
 - D. Choose option B if the shaft is rotating counter-clockwise
10. You use the cross-channel phase function of your dual-channel analyser to check for coupling misalignment in a motor-driven pump. The axial "across the coupling" readings are taken with the accelerometers facing in opposite directions. If you obtain a cross-channel phase measurement of 180 degrees, which is likely to be true?
 - A. The coupling is properly aligned
 - B. The coupling is misaligned
 - C. Your sensors are not working as it is impossible to obtain a reading of 180 degrees
 - D. The coupling has excellent parallel alignment, but poor angular alignment.

Check your answers on page 32 >



TEST YOUR KNOWLEDGE

Further enquiries can be directed to: Carl Townsend at Carlton Technology Ltd.

Phone: 64-6-759 1134 | Email: ctownsend@xtra.co.nz | Address: P.O. Box 18046 Merrilands, New Plymouth 4360, NZ

Do you...

have an interest in the area of mechanical and electrical machine condition monitoring, to facilitate predictive asset management?

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Whether your business or place of employment is large or small; In-house technicians, consulting engineers, suppliers and distributors of specialised equipment, engineering students can all contribute and benefit from a VANZ membership.

Find out more...

Email us at secretary@vanz.org.nz



Anyone with an interest in the area of mechanical and electrical machine condition monitoring, to facilitate predictive asset management is eligible to join VANZ. Asset managers, reliability engineers, technicians, consulting engineers, suppliers and distributors of specialised equipment, engineering students and apprentices can all contribute and gain immensely from membership and our annual conferences.

Technology, materials and manufacturing processes are continually developing. And so too has the engineer skills and knowledge developed. Today the engineering role has evolved to where the analyst, by diligent use of multiple Condition Monitoring tools and principles, can empower Predictive Asset Management. But it is a challenging role! So much is at stake with the high cost of downtime, equipment replacement costs, and the potential safety risks. The future of the business can hinge on the Predictive Asset Management achieved by this special group of people. Yet detecting, diagnosing, and preventing these faults takes training, knowledge, skill and experience. That is why VANZ exists, and why VANZ constantly evolves!

VANZ recognises that the engineers who apply the technology are one half of the equation. Equally important are the industries and businesses served by it, with their varied experiences and evolving requirements. The size of the operation and the machinery it runs are not an issue either.

For Analysts and Predictive Asset Management specialists
VANZ is a volunteer-run, not-for-profit, membership group of like-minded people from New Zealand and Australia. VANZ as an organisation evolved from a Workshop Conference held in New Plymouth in 1989.

From this Workshop Conference the Vibrations Association of New Zealand was registered and the first annual technical conference was held. From this beginning VANZ has continually developed to provide a platform for people to discuss their challenges with their fellow analysts and learn from their peers and industry experts.

Annual conference for networking and learning

The core function of VANZ is the annual conference. Like a family reunion, over 100 people gather in a friendly environment to participate in technical presentations, round-table discussions, and at times debate. Keynote speakers from around the globe have, and continue to present technical papers at conference. And importantly local presenters add a New Zealand context.

Our most recent conference in August, heralded a return to our grassroots, being held in New Plymouth.

VANZ is quite a unique society and has withstood the 'test-of-time' – and has, for many years, run an awareness day training for apprentices and trainees alongside an asset management stream for technicians, supervisors and management. It is a well respected 'track-record' which VANZ has consistently promoted for the New Zealand and Australian industry. ■

DID YOU KNOW?

VANZ membership is FREE if you attend the annual conference.

WORD BUILDER

How many words of **three or more** letters can you make using the six letters below? You can only use each letter once. Plurals are allowed, but no foreign words or words beginning with a capital.

Word scores expected...

25 - Good | 35 - Very Good | 40+ - Excellent

T	G	T	R	A	E
---	---	---	---	---	---

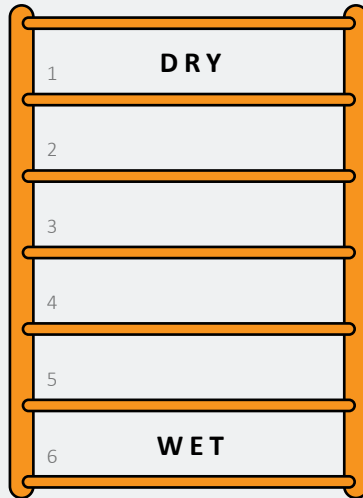
There is one 6 letter word in this puzzle.

There's 48 possible three or more letter words to find.

WORD LADDER

A Word Ladder has two words in the ladder, one at the top and one at the bottom. You must form a sequence of words going down. On every step of the ladder (1-6), you must unscramble and create a new word that only differs by one letter from the word above it until you reach the destination word on line 6.

Dry to Wet...



SUDOKU

To solve, each number from 1 to 9 must appear once in:

- Each of the nine vertical columns
- Each of the nine horizontal rows
- Each of the nine 3 x 3 boxes

No number can be repeated twice in a box, row or column. **We've started it off for you...**

Puzzle difficulty: **Hard**

53.3% of puzzlers can solve this. Can you?

3		4				9	8	
		2	7			4	5	
1		5	2	4	9			
			8	9		6		
	4	9		2				
8			1		3			
			3		2			
2	1	8						6
			9		6			4

Missed an issue of Spectrum?

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Head on-line to www.vanz.org.nz to find back issues of the magazine you can catch up on.

Or, simply scan the QR code below to link your device directly to the VANZ website. There you will find back issues of Spectrum available to view*.

* A QR code reading app will need to be installed on your device first.



FEATURE

The chaos theory of maintenance management

The fact that you have read past the title suggests that a nerve is already twitching when maintenance and chaos is used in the same sentence. Let's just leave it out there that perhaps the non-performance (in actual management or political terms) of your maintenance department had irked you at some time.

Simple humans.

Even more than that, maintenance engineering humans. We will come back to this later.

Things like and companies health maintenance fortunate to be involved in success stories they are satisfied. But I have also seen efforts to be reduced by changes in management.

Some of them looked internationally that did not processes and the speed 3 letter acronym, high demand, have been high value getting.

catch the surface of the job 2.2 years later, are not have a impact to the maintenance team, and the answer is a recurring 100.

Continued next page



Spectrum



The official journal of the Vibrations Association of New Zealand (VANZ)



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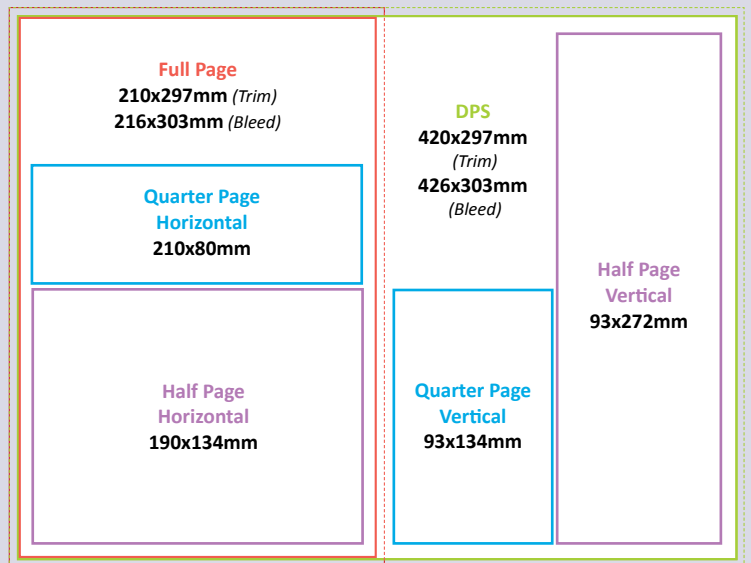
Publishing:

Each SPECTRUM will be distributed as an epub document and available for download and printing by VANZ members. Previous issues will become available on the public domain.

Article submissions:

Articles for upcoming issues of Spectrum are welcomed by the editor. Copy to be supplied preferably in Microsoft Word, but PDF file format is also acceptable.

Please email spectrumentitor@vanz.org.nz with your submission or should you require further information.



Word Ladder: 1. dry 2. day 3. bay 4. bat 5. bet 6. wet
Word Builder: target
Carlton Technology Quiz 76: 1B, 2D, 3A, 4A, 5B, 6A, 7D, 8D, 9A, 10A



CALL FOR PAPERS

The VANZ conference is a place for learning and sharing

- Have you ever had an experience that you think others would benefit from?
 - Something that went right or wrong?

We can all learn from our own experience, but we can avoid a lot of problems if we learn from other people too! That is what VANZ is all about. If you could talk for just 15 minutes (or longer if you like), please write to **secretary@vanz.org.nz**



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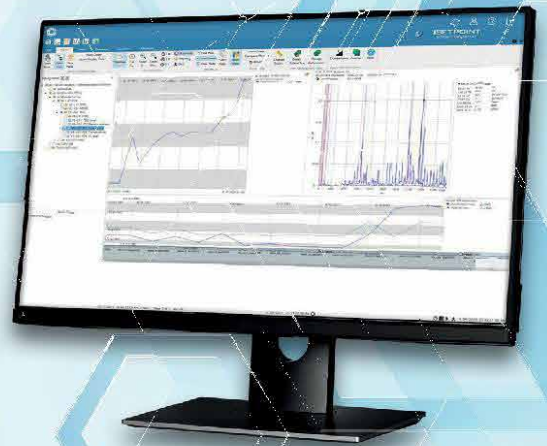
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