January - February 2025

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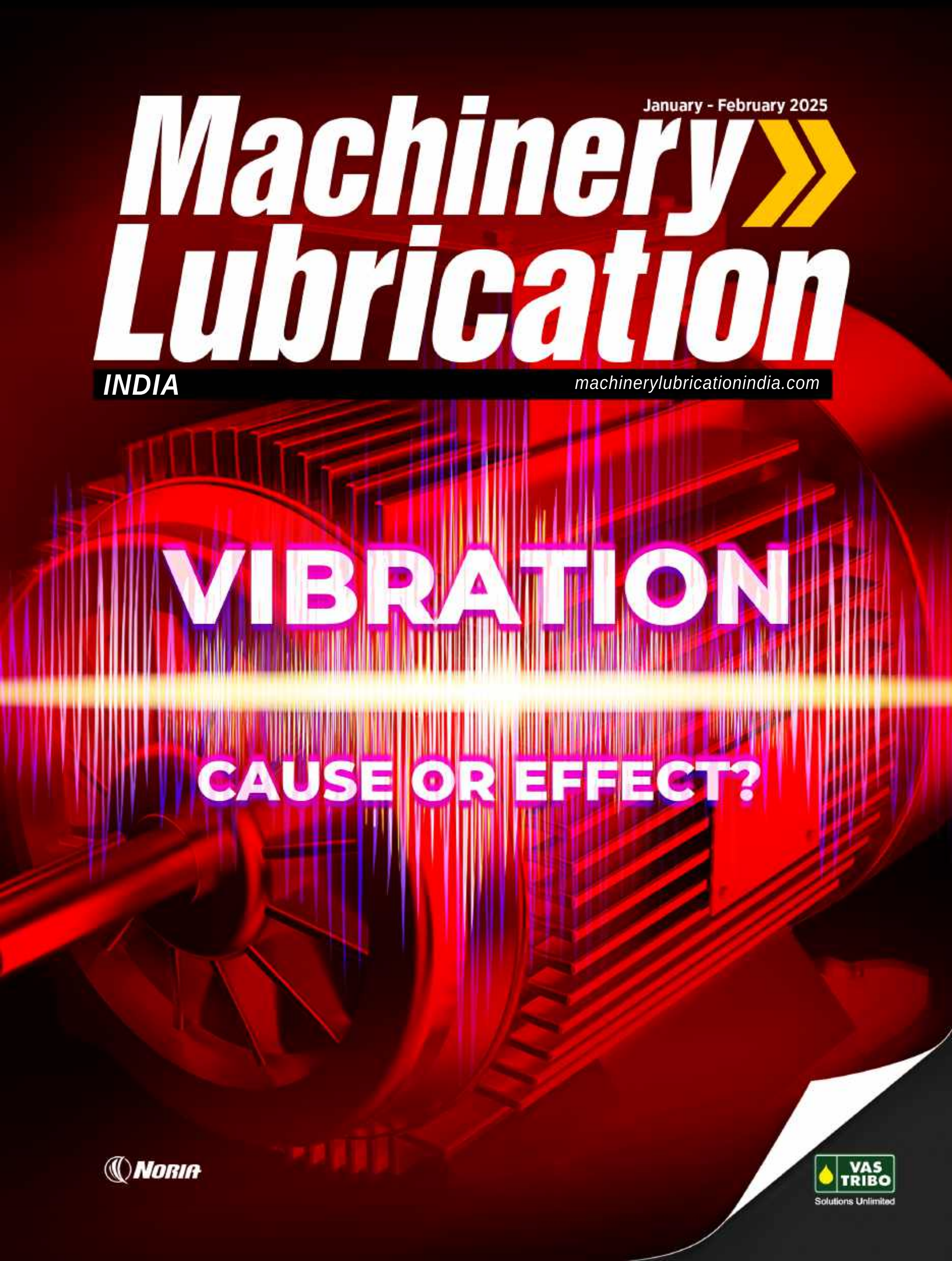


## AS I SEE IT

The Perils of Ignoring Low or Fluctuating Oil Levels



## COVER STORY

Vibration Cause or Effect?




## EDITORIAL FEATURES





# Publisher's Note

In the ever-evolving world of industrial operations, machinery reliability remains the cornerstone of success. It is not just about keeping machines running but about ensuring that every moving part contributes to seamless productivity, operational safety, and long-term sustainability. As we navigate an era of unprecedented technological advancements, one must ask: Are we truly leveraging the tools and practices available to enhance machinery reliability to its fullest potential?

The key to answering this question lies in adopting a proactive mindset. For far too long, our industry has been governed by a reactive approach, addressing issues only after they disrupt operations. In today's fast-paced industrial landscape, this approach is no longer viable. Proactive maintenance, coupled with advanced lubrication practices, has become indispensable—not just to meet industry demands but to redefine how we maintain and optimize machinery.

Proactive maintenance is not merely about fixing problems but about anticipating them. It is a philosophy rooted in preparation, foresight, and precision. With technologies like vibration analysis, ultrasound, and IoT-enabled systems, we can now predict and prevent failures before they occur. These tools reveal hidden inefficiencies and early warning signs of wear, enabling us to implement timely solutions that extend the life of equipment. By adopting this forward-thinking approach, we can reduce downtime, optimize performance, and significantly cut costs.

Lubrication, often seen as a routine maintenance activity, has evolved into a sophisticated science that plays a pivotal role in machinery reliability. Today, it is about much more than reducing friction; it is about optimizing performance and efficiency while addressing environmental concerns. Advances in lubricant formulations, including bio-based and synthetic options, are enabling industries to achieve higher efficiency and sustainability. Proper application and monitoring of lubricants can drastically reduce operational and maintenance costs, while simultaneously improving machinery performance. Mastering these fundamentals is crucial for achieving their full potential.

As professionals in the field of lubrication and reliability, we hold the responsibility of fostering a culture of excellence. This involves embracing continuous learning, staying updated with technological breakthroughs, and encouraging collaboration across teams. The integration of human expertise and technological innovation has the potential to redefine industry standards. By adopting a proactive mindset and leveraging advanced tools, we can build a resilient, efficient, and sustainable industrial future.

This 75th edition of Machinery Lubrication India marks a significant milestone for all of us. Over the years, this magazine has been a trusted companion to lubrication and reliability professionals across India and Asia, bridging the gap between emerging technologies and practical applications. Each edition is crafted with the aim of equipping you with actionable insights and solutions to address real-world challenges.

In this issue, you'll find thought-provoking articles that dive deep into the critical role of tribology in enhancing machinery performance, explore the latest advancements in lubrication science, and discuss innovative practices that are shaping the future of our industry. It is our mission to ensure that every page adds value to your professional journey, inspiring you to embrace proactive strategies and innovative solutions.

As we step into a new year filled with opportunities, I urge you to reflect on how we, as a community, can drive the adoption of proactive practices and advanced tools. Together, we can transform today's challenges into opportunities and set new benchmarks for reliability and efficiency. On a personal note, I would like to wish all our readers a very Happy New Year. May this year bring growth, innovation, and success to you and your teams.

Here's to celebrating 75 editions of empowering knowledge and industry transformation. Remember, we're here to help you solve your lubrication challenges, one article at a time.

**Warm regards,**
**Udey Dhir**

# THE PERILS OF IGNORING LOW OR FLUCTUATING OIL LEVELS

I've seen people shrug off the importance of fluctuating oil levels when they inspect sight-glasses. After giving a lot of thought to this phenomenon plus plenty of research, I've concluded that it's a very bad practice for many reasons. Those reasons are the subject of my article. My hope is that I can open your eyes to the need to investigate what's behind oil level changes and of course take corrective action when warranted (most of the time).

A sight glass is an information portal with a purpose. Through it, the oil and the machine can telegraph critical messages related to changing operating conditions. These messages, when seen and understood, offer forewarnings of adverse future events including catastrophic machine failure.

To you, the inspector or operator, these messages present an opportunity to impede the progress of failure. Too often people instead opt to postpone or dismiss the need for action including troubleshooting and fixing the off ending condition. True, you may not be facing a sudden death concern but how do you really know? There are consequences to deferred maintenance.

Why allow ignorance and inaction rob your oil and machine components of thousands of hours of service life? Proactive maintenance means fixing the roof when the sun is shining. Not rushing around looking for drip buckets to put under leaks during the deluge of a rainstorm.

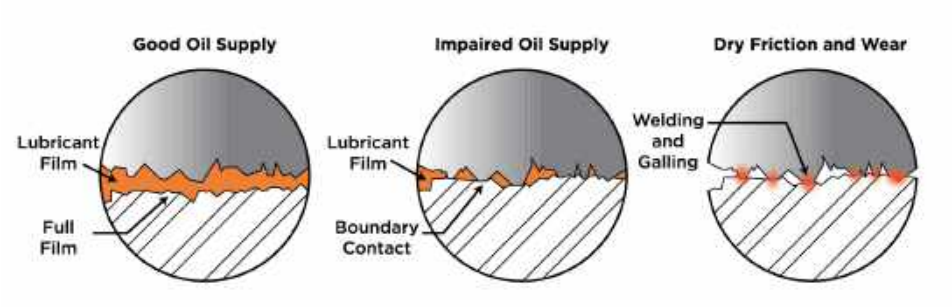

*A quick glance at this sight glass might be interpreted as nothing of concern. If the aeration and foam was allowed to dissipate and release out of the oil, the actual oil level would be well below the crosshairs of the gauge. Air and foam can significantly distort reality to produce an apparent oil level that is well above the actual level. Many machines that are lubricated by slingers, flingers, oil rings, collars, oil dip, and similar devices can be significantly affected by minor changes in oil level. An astute inspector will understand this and top up the sump before moderate to severe starvation occurs.*

## Where Is the Risk the Highest?

Many accelerated life tests (ALT) have been conducted by researchers on the effects impaired lubrication conditions have on machine service life, especially bearings and gears. Ultrasound, bearing metal tempera-

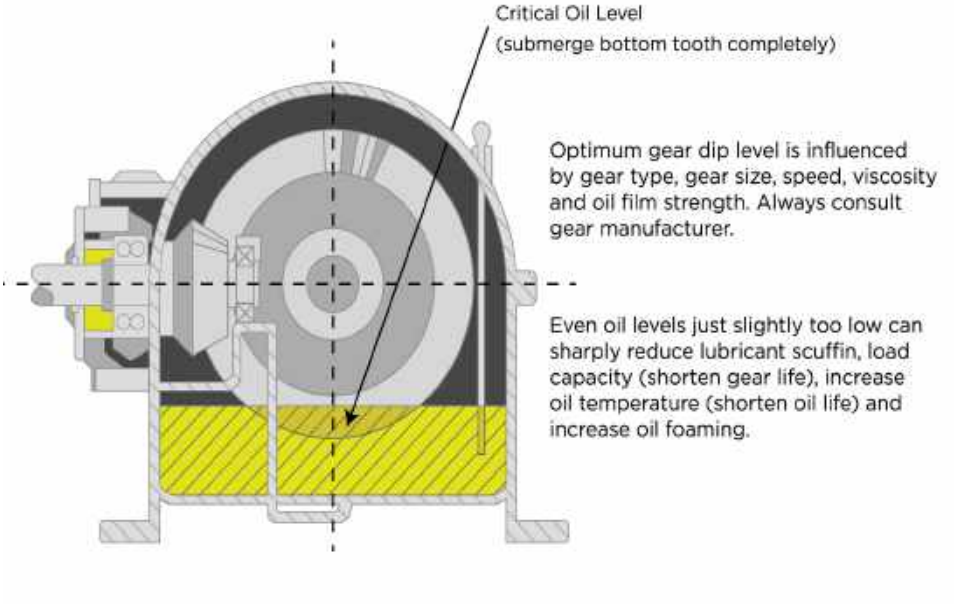
ture and wear debris analysis have been used to track and gauge the onsetof partial or full starvation conditions. Your ears alone can pick up that distinct metallic sound from mechanical friction that is transmitted when oil levels go down.

The image below illustrates how impaired oil film thickness from partial oil starvation causes mechanical two-body abrasion and adhesion. The same thing occurs due to misalignment, low oil viscosity, starts and stops. When surfaces rub and asperities collide, material is excavated, and particles are released to the oil (wear debris). A bearing for instance, will only allow so much wear debris to be released before a changeout is required. The same is true for gears, hydraulic pumps, pistons, and cams. The more friction, the more wear the shorter the bearing life — similar to the tread on your tires.




## Harm Done to Gearing

Splash lubricated gearing requires deeper gear tooth immersion depths for higher speeds and-loads. This translates to greater friction and wear penalty when oil levels drift down due to misting and leakage. This will show up as radial-direction scuffing/scoring marks on the addendum and dedendum surfaces of the gear teeth.




Many of the shaft bearings on these gearboxes are fed oil by splash and/or slinger action. Some use paddles gears. Oil travels down grooves or troughs to the bearing cavities. The oil flow rate depends on the splash depth of the gears and slingers. Meaning, when the oil level is low so is the splash feed rate. Both the frictional surfaces of the gears and the bearings can be sharply affected.


Machinery Lubrication

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**Advertisement Sales (US/Canada)**
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**Marketing Office**
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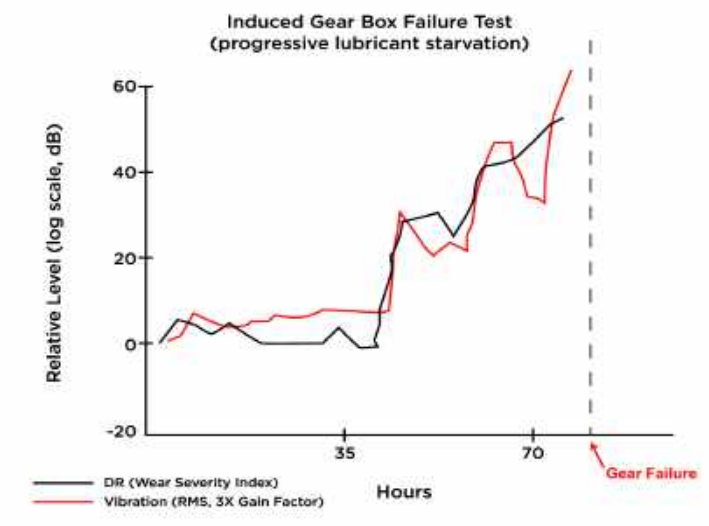
Sector 44, Gurgaon-122003, Haryana
National Capital Region, India

**Machinery Lubrication India** Volume 75 - Issue 1, January-February 2025 is published bi-monthly by VAS Tribology Solutions Pvt. Ltd. Operation Office:213, Ashiana Centre, Adityapur, Jamshedpur-831013, India.

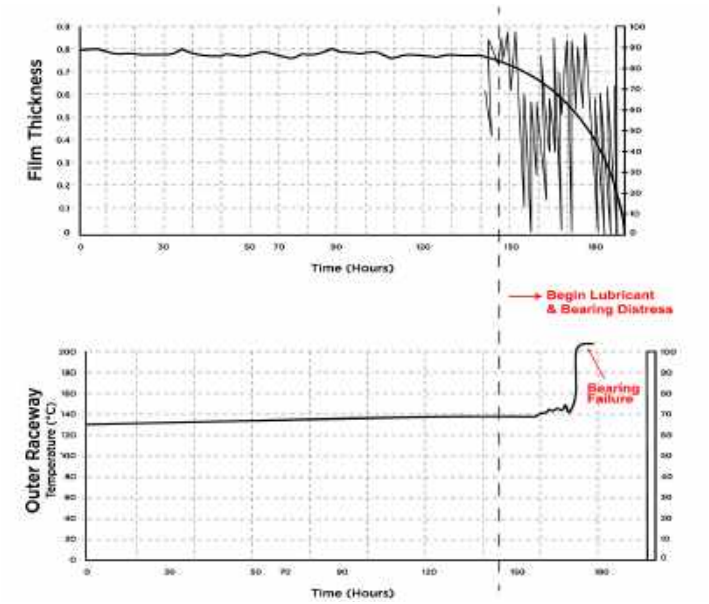
SUBSCRIBER SERVICES: The publisher reserves the right to accept or reject any subscription. Send subscription orders, change of address and all related correspondence to: VAS Tribology Solutions Pvt. Ltd. Operation Office:213, Ashiana Centre, Adityapur, Jamshedpur-831013, India Or : support@machinerylubricationindia.com




## Harm Done to Bearings

In rolling element bearings, partial starvation can reduce oil film thickness by 50% or more. This means the oil feed rate to the load zone is slowed or restricted. The bearings run hotter due to resulting friction and lack of heat transfer to the oil. The mechanical rubbing and friction pushes antiwear and anti-scuff additives into action, assuming they are in the lubricant's formulation. These additives are sacrificial, meaning they die as they try to suppress abrasive and adhesive wear. The more pronounced the starvation condition the faster they are consumed.

It's all about film thickness. If there is clearance between surfaces in relative motion, anti-scuff additives aren't consumed by the process. Heat generation is diminished and the heat that does occur is washed out by the healthy supply of oil flowing through the bearing. We all know that heat can rapidly reduce the life of our oil's additives and basestock. The impact that film thickness has on bearing wear and service life is shown in the data plot of the figure below.

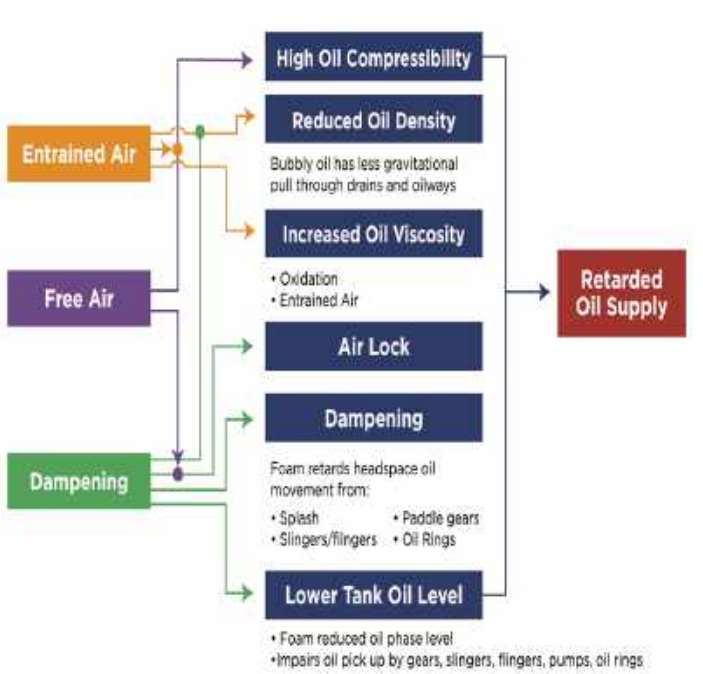



## Churning of Reservoirs and Sumps

High flow rate hydraulic and circulating oil systems require large reservoirs to dampen and diffuse the oil movement from tank returns. This prevents excessive aeration caused by vortex oil movement and lapping. Lapping refers to air being tucked into the body of the oil due to turbid oil surface conditions.

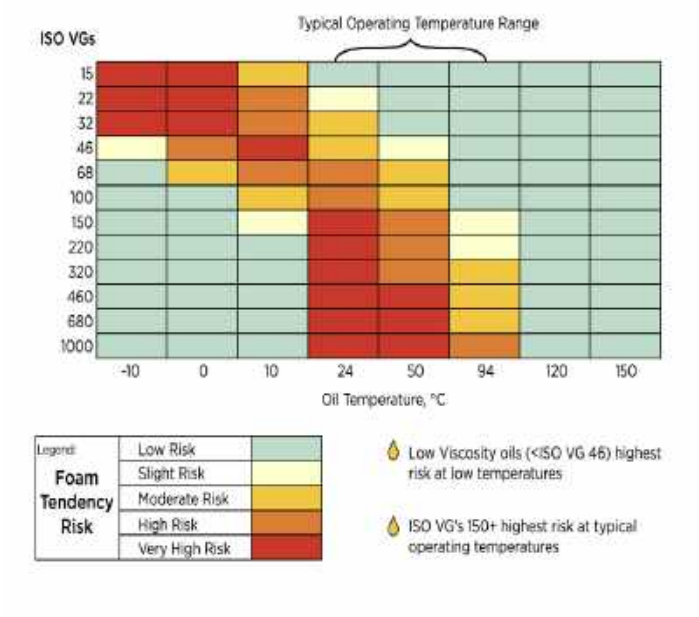
Low tank oil levels increase the churning and lapping that leads to entrained air. Correct oil levels reduce air entrainment and enables buoyant air bubbles to rise to the surface and dissipate from the oil. Conversely, air that remains entrained due to churning low oil levels can sharply reduce the oxidative life of the oil and its additives.

This aeration can compound starvation conditions further (see the diagram below). Further, aerated oil can induce cavitation in pumps and bearings as well as varnish from microdieseling, etc.




Similar issues occur in smaller wet-sump bearings and gears. Low oil levels not only churn air into the oil but also concentrate the heat in the remaining smaller volume. The air acts like an insulator impairing the dissipation of heat outward to the walls of the machine, oil reservoir or cooler. The amount of heat transfer is a function of the flow rate. Starvation slows flow and heat transfer. This increases thermal stress on the oil and the machine.

The condition goes viral as the elevated heat spurs aeration and foam of the oil. See the chart in the following figure that shows the relationship between rising temperature (induced by low oil level) and foam tendency.




## Oil Level and Energy Consumption

Anything that increases oil and bearing temperature will, by default, increase energy consumption. It is that simple. This includes too much oil as well as too much viscosity, both lead to churning energy losses.

As previously mentioned, too little oil level can reduce film thickness causing mechanical friction, heat and energy consumption. Getting the target oil level right and maintaining good oil level control is a smart strategy to reduce energy consumption. The benefit is instant.

## Low Oil Level Increases Oil Consumption

You may wonder why oil level has anything to do with oil consumption. It's a good question. There are several reasons.

- Low oil level causes more turbulence and more oil mist. Mist in gear boxes and bearings is a major cause of unnecessary oil consumption. Oil is lost to the ambient air.
- Low oil level concentrates heat, catalytic metal particles and other contaminants. These conditions put stress on critical oil additives like oxidation inhibitors, leading to premature base oil oxidation. These same conditions (particles, heat, oxidized oil) will distress and shorten the life of seals and packings, leading to oil leakage.
- Low oil level means low additive reserve needed to suppress oil degradation. This leads to shorter oil life. Conversely, when oil tops ups are routinely performed, additives become refreshed and contaminants become diluted. It's like a booster shot.

Don't make light of all the other costs associated with frequent oil changes. Some studies have stated that the real cost of an oil change can exceed 40 times of the cost of the oil itself. Compounding this are the disturbance risk from oil changes including the fishbowl effect.

## Distortions of True Oil Level

Bullseye sight glasses can play tricks on you. Pay close attention to ensure that you are viewing the true oil level. It is not uncommon for sight glasses to become stained or fouled, thus giving an illusion of oil at the correct level.

This is especially true if you are too far from the sight glass with poor lighting. Such a false reading can be catastrophic.

In the case of a columnar level gauge, remove the clear tube and clean it using an appropriate cleaner. If the stain is persistent, replace it. Plugged vents in columnar sight glasses can also lead to faulty oil level readings.

## What do Changes in Oil Level Mean?

A sudden change in oil level, either up or down, is a telegraphed alert that something is wrong. And, this "something" could potentially be serious. The frequent examination of quality oil level sight glasses by trained inspectors is a sound condition monitoring practice. Perhaps the most important of all lubrication-related inspections.

### Oil Too High:

When oil levels rise above the acceptable range usually something new has been added. But here are other options too:

- Too much makeup fluid. Adding makeup fluid without carefully watching sight glasses can cause over-lubrication.
- Oil drain back. If fluid is topped off while the machine is running, the oil level can climb when it stops and oil drains back from gears, bearings, oil galleries and distant zones or oilways.
- Aeration and foam. Such conditions can double or triple the apparent oil level.
- Internal leakage. Various sources of internal leakage can cause other nearby fluids to invade the sump. These include coolant, washdown fluids, fuel, heat transfer fluid, hydraulicfluid, grease and process fluids. Oil analysis can identify these invading fluids.

### Oil Too Low:

This is usually caused by leakage, but there are other reasons. Here's a short list.

- Out-leakage. This is an alert to examine the machine for any visual sign of oil leakage to external surfaces (oil exiting the machine).
- Internal leakage. If no out-leakage is observed, are there other internal pathways and compartments where the oil might have gone? Look for rising fluid levels in these zones and compartments.
- Gear climbing. Oil lifters, including paddle gears, slingers/fling-

ers and the rotation of moving parts (gearing in particular) all draw oil out of sumps and reservoirs and lower the apparent oil level during machine operation.

- Oil pump out. After startup, oil reservoirs can go down as the pump fills system lines and cavities such as gear cases, bearings, oil galleries and distant oil ways.
- Bleed purge. Hydraulic and circulating systems often have bleed valves that when opened allow trapped pockets of air to purge and become replaced by oil. This draws the oil level down the reservoir.
- Aeration and foam. Foam, in particular, lowers the liquid portion of level gauges, sometimes substantially. When the foam collapses (e.g., when the machine is at rest) the correct level should return unless foam was pushed out of vents and other headspace openings.
- Excessive misting and volatilization. This is a form of out-leakage from various causes, such as the wrong oil (e.g., wrong viscosity), high temperature, excessive agitation, headspace vacuum, atomization/sprays or aeration.

## Oil Too High or Too Low:

The following conditions can cause the oil level to appear to be too high or too low.

- Air currents. Strong air currents moving across vents and headspace openings can alter the oil level in the gauges. When the air currents stop the oil level returns to normal.
- Mechanical agitation. High speed mechanical agitation, including rotation, can push oil towards or away from the level gauge ports.
- Temperature. Hot oil and machine temperatures cause thermal expansion of lines, reservoirs and galleries. Extreme cold conditions do just the opposite.
- Cylinder actuation. Both single-acting and double-acting hydraulic cylinders change the oil level in the tank up or down depending the direction of actuation.
- Reservoir pressure. Some reservoirs have positive headspace pressure (nitrogen or instrument air for instance) and others have negative pressure (extraction fans for instance). This can move the oil level slightly.
- Sump or machine level. If the sump or the machine is off level, perhaps on a slope, this will affect the apparent oil level of the sight glass. This is common with mobile equipment.

Can this level gauge see foam? Emulsified water? Oxidized oil? Correct oil level? Any concerns about the installation hardware? Ventilation? Sediment build-up between the elbow and the sump? Correct oil level?

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- 3rd-5th November — Online

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- 15th-17th Sept. — Face to Face Mumbai

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VIBRATION
CAUSE OR EFFECT?

The understanding of machinery vibration analysis often leads to confusion regarding whether vibration is the cause of a problem, the result of a problem, or both. This confusion can lead to significant errors in data analysis. Let us take a moment to clarify this matter.

## Vibration as the Cause

Excessive vibration within machinery can instigate a cascade of problems. It can lead to fatigue failures in various components such as shafts, couplings, bearings, seals, pipes, and foundations. Additionally, it can induce quality issues in manufactured products. Consider the scenario of an HVAC fan vibrating near a computer chip printing machine: the vibration, traveling through the floor, can adversely affect the precision of the chip manufacturing process.

Furthermore, excessive vibration poses potential risks to human safety and comfort, even when direct harm is not directly inflicted. Think of the annoyance caused by an unbalanced ceiling fan going "whop, whop, whop!" while you're trying to sleep. Talk about annoying.

A helpful analogy to help wrap your head around this is to envision driving a car at high speeds over rough terrain. Continuously subjecting the vehicle to such conditions will inevitably lead to damage due to excess vibration.

During my audits of companies' vibration programs and data-analysis procedures, I often encounter a common misconception. Many tend to assess vibration levels solely based on graphs, identifying the highest peaks and assuming that as long as the vibration remains within acceptable limits, the machinery is functioning adequately. Alternatively, some rely on ISO RMS alarm charts for comparison. However, such approaches can overlook critical issues, as well.

In addition, it's important to consider the role of lubrication in relation to vibration as a potential cause of machine failure. Effective lubrication not only reduces friction between moving parts but also helps dampen vibration by forming a protective layer. Conversely, insufficient or degraded lubrication can exacerbate vibration problems and lead to accelerated wear or eventual failure of machine components. Therefore, proper lubrication practices are essential for mitigating vibration-related issues and ensuring the smooth operation and longevity of machinery.

## Vibration as an Effect

In a condition-based maintenance (CBM) approach, we often interpret vibration as an effect rather than a cause. Analogous to the car scenario, imagine driving your vehicle to work routinely and suddenly noticing a new noise. Your immediate inference is that something must be wrong with the car.

However, it's crucial to recognize that this new noise merely signifies an effect or consequence of an underlying issue. Moreover, the magnitude of this noise may not correlate directly with the severity of the damage.

Consider a defect on the outer race of a rolling element bearing in a piece of rotating equipment.As the balls or rollers traverse this defect, they generate a repetitive clicking sound. Despite the relatively minor amplitude of the resulting vibration compared to other sources, such as water flow through a pump or shaft rotation, the bearing is indeed damaged. Merely assessing vibration levels in terms of absolute amplitudes can lead to overlooking critical faults.

## Effect and Cause

In certain scenarios, vibration serves as both an effect and a cause. For instance, if a rotor is out of balance, the vibration amplitude will escalate at the shaft rate frequency (1x), indicating imbalance.

Why is imbalance concerning? Among many reasons, one major issue is that the heightened vibration that results from imbalance can inflict damage upon the machine.

Thus, this represents a scenario where vibration acts as both an effect and a cause simultaneously.

Expanding further, it's essential to recognize that vibration analysis is a nuanced field. Beyond the simple dichotomy of cause and effect, there are intricate relationships between various factors influencing machinery behavior.

For instance, environmental conditions, operational parameters, and material properties can all interact to modulate vibration characteristics. Therefore, a holistic approach to vibration analysisis imperative — encompassing not only the identification of causal factors but also the understanding of their interplay within the broader machinery context.

Moreover, the interpretation of vibration data requires a sophisticated understanding of signal processing techniques and diagnostic methodologies. Merely assessing vibration levels without contextualizing them within the operational environment can lead to erroneous conclusions.

Therefore, practitioners must integrate theoretical knowledge with practical experience to derive meaningful insights from vibration data.

Furthermore, advancements in technology have revolutionized vibration analysis, enabling predictive maintenance strategies that leverage machine-learning algorithms and IoT (Internet of Things) sensors. These technologies facilitate real-time monitoring of machine health, allowing for proactive intervention to prevent catastrophic failures. However, their effective implementation necessitates not only technical expertise but also organizational readiness to embrace data-driven decision-making paradigms.

## Vibration and Lubrication: A Symbiotic Relationship

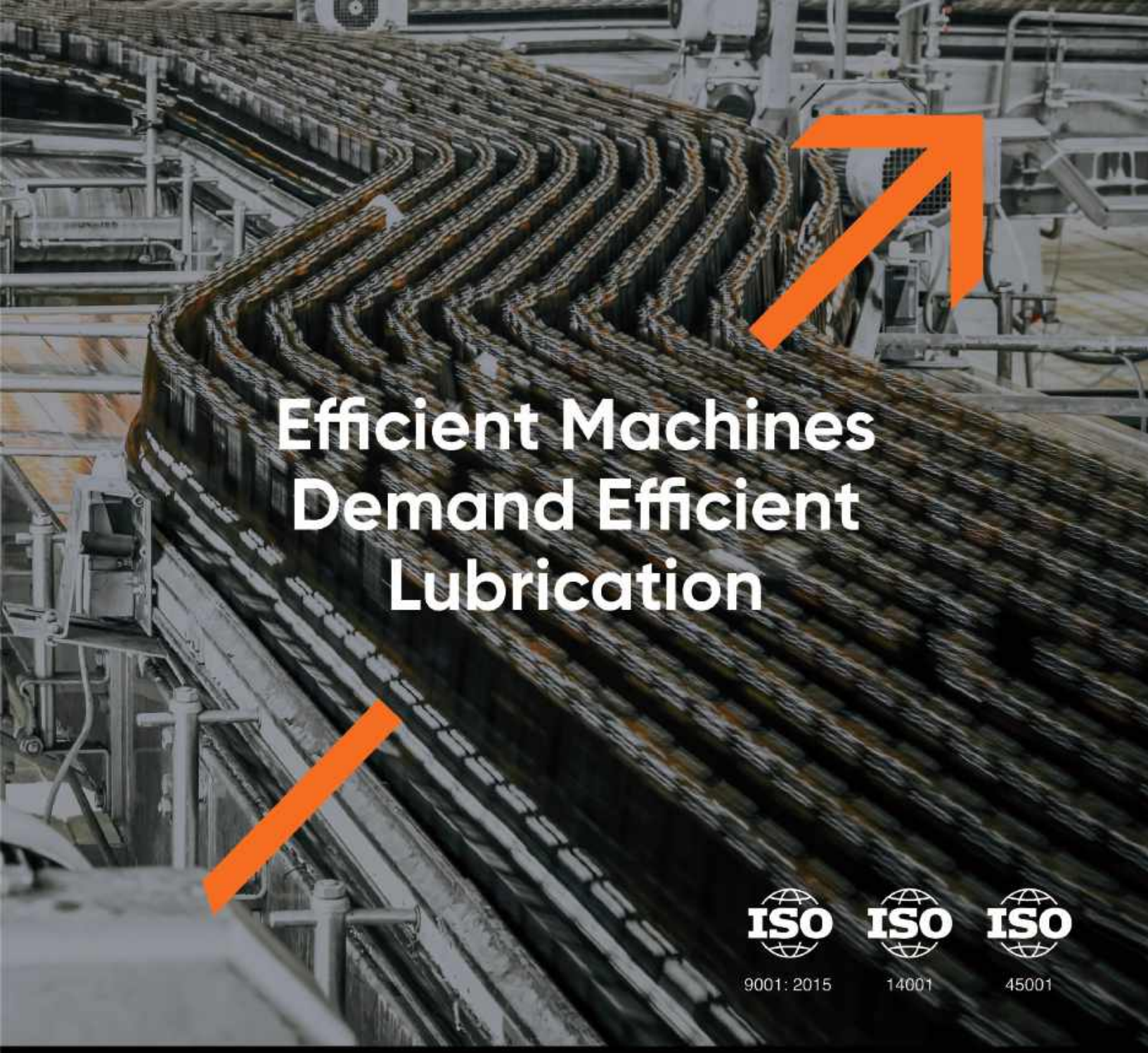
The connection between vibration and lubrication in machinery maintenance is deeply intertwined, with each factor significantly influencing the other. Lubrication serves as a critical element in minimizing vibration-induced wear and reducing friction within mechanical systems. By forming a protective fi lm between moving parts, effective lubrication minimizes surface-to-surface contact and dampens the propagation of vibration.

Conversely, the vibration patterns observed in machinery can offer valuable insights into the efficacy of lubrication practices. Anomalies in vibration, such as heightened amplitudes or shifts in frequency, often signal lubrication deficiencies, such as inadequate film thickness or contamination. Monitoring vibration signatures enables maintenance professionals to detect lubrication-related issues early, facilitating timely interventions to prevent equipment degradation and failure.

Moreover, the interaction between vibration and lubrication extends beyond mere problem detection to the optimization of maintenance strategies. Advanced predictive-maintenance approaches utilize vibration analysis alongside lubrication monitoring to develop customized maintenance schedules based on real-time equipment condition. By correlating vibration data with lubricant characteristics and performance metrics, organizations can optimize lubrication intervals, ensuring peak machinery performance while minimizing maintenance costs and downtime.

## Making It Make Sense

Vibration analysis is a multifaceted discipline that requires a nuanced understanding of the dynamic interactions between machinery, operational conditions, and environmental factors. The symbiotic relationship between vibration and lubrication underscores the importance of holistic maintenance approaches that integrate various predictive technologies and methodologies. By recognizing the interconnectedness of these factors and leveraging synergies between vibration analysis and lubrication management, organizations can enhance equipment reliability, extend asset lifespan, and maximize operational efficiency in today's dynamic industrial landscape.

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# REVOLUTIONIZING ELECTRICAL ENERGY CONSERVATION AND SAFETY WITH ULTRASOUND

Electrical safety and energy conservation are significant concerns in industrial manufacturing. Common issues like partial discharge and compressed air leaks are known to threaten employee safety and machine health; however, traditional methods of identifying these hazards can be time-consuming and inefficient. Ultrasound technology offers a reliable and cost-effective solution for detecting potential hazards early, reducing the risk of equipment failure and worker injury.

## What is Partial Discharge?

Partial discharge (PD) is a serious phenomenon that can damage critical machinery and threaten employee safety. PD occurs when a small insulation area in a high-voltage environment can't handle the electrical stress and begins breaking down. It's referred to as "partial" because it doesn't span the whole distance between two insulated electrodes.

This causes the insulation to deteriorate over time, resulting in total failure. If you don't identify the problem promptly, insulation failure can result in loss of power supply and serious physical harm to employees.

## Types of Partial Discharge

There are three distinct types of partial discharge:

1. Corona – This common form of PD occurs when discharge emits from the conductor's surface directly into the air. The electric field at a conductor is greatest where the curvature is sharpest, meaning that corona discharge will first occur at sharp points, corners, and edges.
2. Tracking – Surface tracking can be one of the most destructive types of PD and occurs when discharge travels along the surface of the insulation. Contamination and insulator surface weathering are the two most common causes of tracking.
3. Arcing – Arcing discharge is a prolonged electrical discharge produced by the electrical breakdown of a gas. When this current flows through the air or any other normally non-conductive medium, it forms plasma.

## Dangers of Partial Discharge

The effects of partial discharge can be highly detrimental; when PD occurs, it effectively changes the nature of the insulation medium. Left unchecked, the insulation cannot withstand the stress from the high voltage,

and a complete failure occurs. This final breakdown is catastrophic, causing large-scale damage to equipment and a danger to personnel.

**Damaging partial discharge can cause:**

- Unplanned downtime
- Facility fires
- Insulator degradation
- Grid overload

The thing to remember is that these dangers are completely avoidable with the right inspection tools. Advancements in ultrasound technology have allowed us to detect partial discharge before a threat is posed, protecting machine health, employee safety, facility productivity, and profitability.

## Improving Workplace Safety with Ultrasound

A reliable solution for preventing the dangers of PD is ultrasound technology. With an acoustic imaging camera, you can protect the invaluable safety of your personnel and efficiently detect issues such as corona, tracking, and arcing before severe damage occurs. These partial discharge emissions produce high-frequency sounds, which ultrasound equipment can detect and translate into audible ranges. These ranges can then be heard through headphones and recorded to determine the threat's severity.

One of the largest misconceptions surrounding ultrasound technology is that it's diffi cult to operate or requires extensive training. In reality, these solutions can be as simple as pointing a camera at an electrical asset and reading the screen, revealing the location of the partial discharge. The camera can even distinguish a PD from other ultrasound sources, reducing false positives and allowing you to maximize your maintenance schedule and budget.

### Energy Conservation Made Easy

Aside from ensuring electrical safety, an acoustic imaging camera can also help conserve energy by detecting air leaks, a signifi cant problem that affects most industrial facilities. If your compressors are having a hard time keeping up with the demand being placed on them, air leaks are the most likely culprit. 1 kW of compressed air is eight times more expensive than 1 kW of electricity, and about 30% of all compressed air is lost to leaks. Rising energy prices can quickly make compressed air your facility's most expensive utility.

Acoustic imaging cameras provide an easy way to find compressed air leaks (or any other compressed gas). Simply switch on the camera and watch the leak locations show up on the screen. These cameras will show you the decibel level, rate, and estimated leak cost for each compressed air leak.

**Not only do compressed air leaks cost money, but they also:**

- Reduce equipment running hours.
- Add unnecessary wear and tear to your equipment.
- Potentially present a safety risk to employees.

Utilizing simple point-and-scan technology to locate and fix compressed air leaks will reduce the effects of rising energy costs, create a safer working environment for all employees, and ensure your facility is running at optimal efficiency.

# THE RISING VALUE OF CALCIUM SULFONATE COMPLEX GREASE IN MACHINERY RELIABILITY

Lubricant choice has a large impact on machinery reliability. Maintnance engineers have many options when selecting the proper grease for their machinery. This choice can largely be driven by OEM specifications or by past experience with a type of grease in an application.

Grease formulated with lithium-based thickeners account for about 70 percent of the industrial grease market. Lithium-based grease has been prevalent for a long time because it was cost effective, reliable and readily available. Two of those attributes are no longer as true. The rise of lithium batteries used in electric vehicles (EVs) has caused a huge surge in lithium demand, which has greatly impacted the ability of grease manufacturers to reliably and cost effectively supply lithium-based grease.

## Understanding Supply Constraints

Before delving into the advantages of alternatives, it's crucial to understand the supply constraints affecting the lithium market. The exponential growth of the EV industry coupled with increasing demand for lithium-ion batteries in other applications has led to a significant imbalance between lithium supply and demand. Grease formulators and blenders are struggling to compete with the battery market for the lithium needed to produce this ubiquitous grease technology, severely limiting the supply of this once common commodity. As a result of lithium prices skyrocketing, operators are finding it challenging to secure stable supplies of lithium-based grease that are essential for machinery lubrication.

## Grease Formulation 101

Grease is made up of three basic components: base oil, additives and thickener. The base oil performs the vast majority of lubrication tasks and makes up 70 to 95 percent of grease volume.Grease performance can be modified with additives that improve extreme-pressure performanceor act as corrosion inhibitors, among other enhancements. Additives may add as much as 10 percent to total grease volume. Finally, the grease contains a thickening agent that provides between three to 30 percent of the volume of a grease.

The thickener is what makes a grease different from an oil, acting as a "sponge" that soaks up the base oil and additives and holds

it in a semi-fluid state so the grease stays in place. When pressure is applied, the thickener releases the base oil and additives providing lubrication. When pressure is released, the thickener soaks the components back up, holding them in place until they are needed again.

## The Rise of Calcium Sulfonate Complex Grease

Calcium sulfonate complex grease thickeners have been around for at least 50 years. However, they have not been a practical option for many general applications because historically the performance gained by using calcium sulfonate grease did not add value due to its increased cost. These costs have been declining over time due to improved refining methods.

Lithium-based thickeners hold the base oil and additives in place, but they don't add much tribological benefit to a grease formulation. Lithium-based thickeners create a lattice structure with voids that contain the vital base oil and additives.

Calcium sulfonate complex thickeners have distinct advantages over lithium-based thickeners, bringing tribological benefits that enhance grease performance. They provide a planar structure with calcite particles forming shear planes between metallic surfaces that boost extreme pressure wear protection. The vastly improved extreme pressure performance stems from multiple response points that absorb and disperse loads.

## Enhanced Performance in Extreme Conditions

Calcium sulfonate complex thickeners provide the additional benefit of a long-chain structure, forming a thickening arrangement with high molecular weight to improve wear resistance. This increased extreme pressure wear protection is especially beneficial in heavily loaded and slower moving bearings. Calcium sulfonate complex thickeners provide excellent mechanical stability and oxidation and water resistance for consistent wear protection and performance over the entire service length of a grease charge. Calcium sulfonate complex also excels at providing exceptional fretting wear protection, vital for equipment that sees multiple stop-start cycles or short-period oscillations.

## Extended Equipment Life

Another proven benefit of calcium sulfonate complex grease is its ability to maintain mechanical stability over long periods of time. A field trial was performed on large, slow moving wind turbine main bearings that operate under variable and heavy transient loading. In testing, a calcium sulfonate complex grease maintained the maximum loading of 1200N/1200N through 12 months of continuous use in the SRV Step Load EP test (ASTM D5706). This level of consistent extreme-pressure protection was verified through vibration analysis and visual inspection of the bearing rollers and races. A control lithium complex grease was unable to match this performance, dropping to 500N/500N after only three months in service under the same conditions.

## Environmental and Regulatory Compliance

In today's environmentally conscious world, operators are under increasing pressure to adopt sustainable practices and comply with stringent regulations. Calcium sulfonate-based grease aligns well with these goals as they are more environmentally friendly. Lithium-based grease may raise environmental concerns due to the amount of water and energy needed during the mining process and the potential for water supply contamination. Calcium is also readily available worldwide and is much easier and less resource intensive to extract and process.

## Cost-Effectiveness and Supply Stability

Perhaps the most compelling advantage of calcium sulfonate complex thickened grease in the current landscape is their cost-effectiveness and supply stability. With lithium prices soaring and supply constraints becoming more pronounced, operators are seeking alternatives that offer reliable performance and are readily available when they need it, while not breaking the budget. Calcium sulfonate grease presents a practical solution, as it is often more cost-effective than lithium grease and less susceptible to supply chain disruptions. By diversifying lubricant options and reducing reliance on lithium-based products, businesses can mitigate the impact of fluctuating market conditions and ensure uninterrupted operations.

## Embracing Innovation for Machinery Reliability

In the ever-evolving landscape of machinery reliability, adaptation is key to success. As industries face supply constraints in the lithium market, the spotlight is increasingly shifting toward alternative lubrication technologies, with calcium sulfonate complex grease emerging as a frontrunner. Pivoting to calcium sulfonate complex grease technology is an easy decision because it is highly compatible with lithium-based grease and better performing, with a reliable supply and a competitive price.

Offering superior performance, extended equipment life, environmental compliance and cost-effectiveness, calcium sulfonate complex grease presents a compelling proposition for operators looking to enhance machinery reliability while navigating challenging market conditions. By embracing innovation and diversifying lubricant strategies, businesses can safeguard their operations against disruptions and secure their path to sustainable growth.

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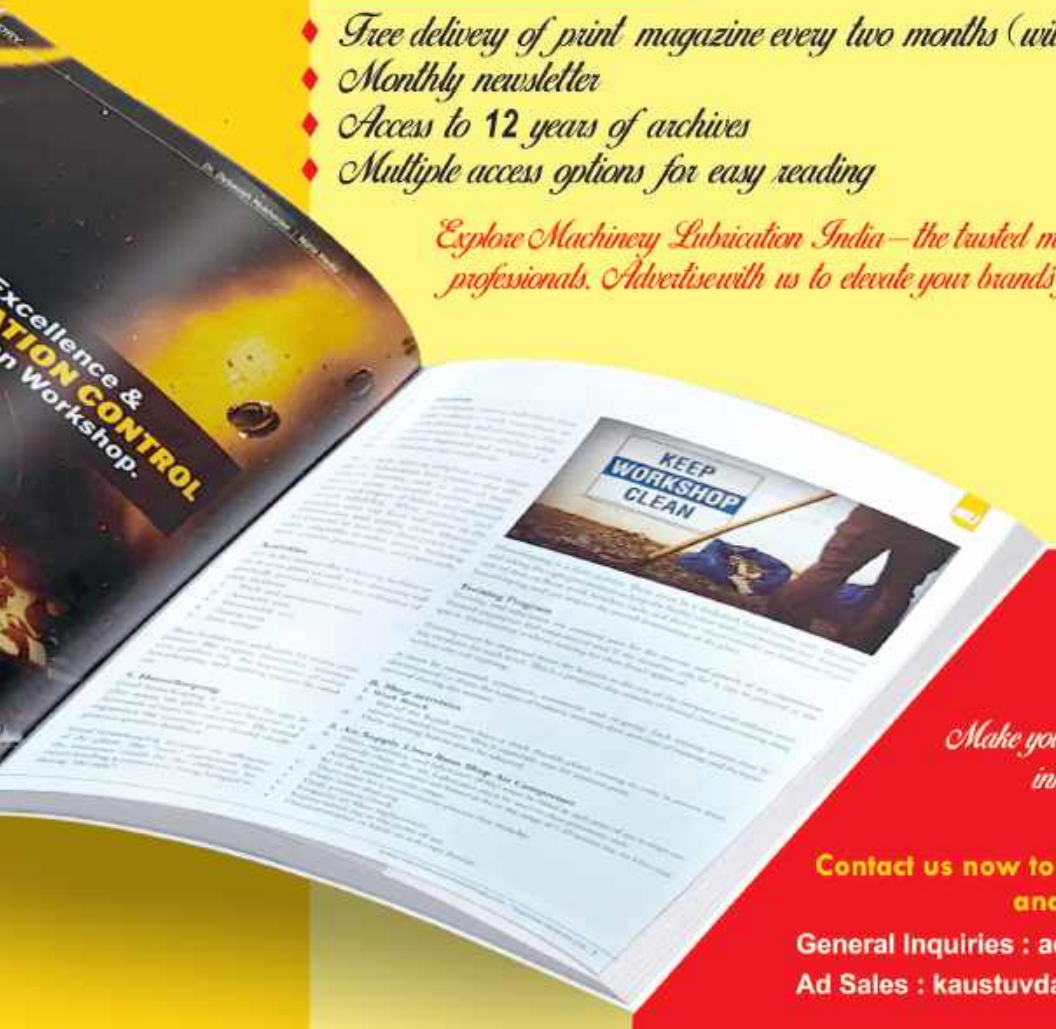


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# DECODING THE MIX: A GUIDE TO LUBRICANT COMPATIBILITY

Lubricants play a vital role in the intricate world of machinery. In the industry, we often refer to them as the lifeblood of a mechanical system, tasked with minimizing friction and wear to ensure smooth operation. But what happens when you decide to change the type of lubricant used or need to mix different lubricants?

Can they coexist harmoniously, or will they clash, causing performance issues and potential damage? This article delves into the fascinating world of lubricant compatibility, equipping you with the knowledge to make better, more informed decisions for the overall health of your equipment.

## Understanding the Reasons: Why Change?

Operators often choose to change the type of lubricant in their machinery for various reasons.These include the pursuit of enhanced performance tailored to specific operating conditions, such as reducing friction, minimizing wear, or extending equipment lifespan (Rudnick, 2016).Environmental concerns also drive this decision, with a growing emphasis on eco-friendly lubricants to align with sustainability goals and regulations (Rudnick, 2016).

Compatibility issues between the current lubricant and other machinery components may necessitate a switch to a more compatible option to prevent damage. Cost savings, driven by factors like lower maintenance requirements or extended service intervals, can also prompt a change. Advancements in lubricant technology continually introduce formulations with improved properties, enticing operators to upgrade for better lubricity or resistance to extreme conditions (Mang, 2018).

Additionally, equipment upgrades or modifi cations may require adjustments in lubricant selection to match updated specifications. Ultimately, the decision to change lubricants is multifaceted, influenced by performance needs, environmental considerations, compatibility requirements, cost factors, technological advancements, and specific equipment considerations. The question-remains: what are the risks associated with such change?

## Understanding the Players: Oils and Greases

The symphony of machinery will play in harmony when every instrument hits all the right notes.The choice between oil and

grease for lubricating equipment comes down to its design, operating parameters, and environment. Each has its strengths: oil excels at reducing friction and heat,while grease excels at staying put and sealing out contaminants.

Base oils form the foundation of lubricants, dictating their viscosity, thermal stability, and lubricity. Common base oils include mineral oils, synthetic oils, and vegetable oils (Rudnick, 2016). Mineral oils, derived from petroleum, are widely used due to their affordability and compatibility with arange of materials.

Synthetic oils, such as polyalphaolefins (PAO) and esters, offer superior thermal stability andoxidation resistance, making them suitable for high-temperature applications. Vegetable oils,while environmentally friendly, may exhibit poor oxidative stability compared to mineral orsynthetic oils (Rudnick, 2016).

Greases are lubricants that incorporate thickeners to enhance their consistency and adhesion properties. Thickeners, such as lithium, calcium, and polyurea, are chosen based on their compatibility with the intended application and other lubricants (Mang, 2018).

Lithium thickened, mineral oil-based greases are versatile and compatible with most materials, making them a popular choice for general-purpose lubrication. Calcium-based greases offer improved water resistance but may react unfavorably with certain additives. Polyurea thickeners provide excellent high-temperature performance but require careful consideration of compatibility with other greases (Mang, 2018).

## Considerations When Mixing Lubricants

Mixing lubricants can lead to unpredictable results if compatibility issues are not addressed. Some key considerations include base oil and thickener compatibilities as well as additive interactions.

Different base oils may not mix well, leading to phase separation or reduced performance. It's essential to ensure compatibility between base oils when blending lubricants.

Greases with different thickeners may exhibit chemical incompatibility, resulting in softening, hardening, or loss of lubricating properties. Compatibility testing is crucial before mixing greases with different thickener types.

Most lubricants contain additives to enhance their performance characteristics. However, additives from different lubricants may interact adversely, causing degradation or loss of functionality. Compatibility testing should assess the compatibility of additives when blending lubricants (Bell, 2017).

Verifying Compatibility Industry-available charts for both base oil and thickener compatibilities can serve as a first step inverifying how likely an undesirable reaction can occur when changing lubricants of differentchemistries. Both compatibility for the base oil and for the thickener should be looked at independently. Below are a couple of examples of such charts you can refer to when consideringa decision to change.

### Miscibility of Base Oils

| | Mineral | PAO | Ester | PAG | Silicon | PFPE |
|---|---|---|---|---|---|---|
| Mineral | | + | + | - | - | - |
| PAO | + | | + | - | - | - |
| Ester | + | + | | + | - | - |
| PAG | - | - | + | | - | - |
| Silicon | - | - | - | - | | - |
| PFPE | - | - | - | - | - | |

### Miscibility of Thickeners

| | Mineral Oil | Synthetic Hydrocarbon | Ester | Polyglycol | Silicone | PFPE |
|---|---|---|---|---|---|---|
| Elastomers | | | | | | |
| NBR | + | +* | +/- | +/- | + | + |
| HNBR | + | + | +/- | +/- | + | + |
| FPM/FKM | + | + | + | + | + | + |
| EPDM | - | - | - | + | + | + |
| ACM | + | + | +/- | +/- | + | + |
| AU | + | +/- | +/- | +/- | + | + |
| Synthetic Material | | | | | | |
| POM | + | + | + | + | + | + |
| PA | + | + | + | ++ | + | + |
| PE | +/- | +/- | +/- | + | + | + |
| PC | +** | + | - | - | + | + |
| ABS | + | + | - | +/- | + | + |
| PTFE | + | + | + | + | + | + |

*) mostly slight downswing **) white oil

*Source: Klüber Lubrication*

In addition, it is important to consider the materials present in the equipment. Lubricants may influence sealing materials, causing them to swell, shrink, or become brittle. Certain chemistries are not compatible with paints and primers that may have been used on the internals to initially prevent corrosion.

### Miscibility of Thickeners

| | Soaps | | | | Complex Soaps | | | | | Non-Soaps | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Al | Ca | Li | Na | Al C | Ba C | Ca C | Li C | Na C | Bentonite | Polyurea | PTFE |
| Al | | +/- | + | +/- | + | + | + | + | +/- | + | + | + |
| Ca | +/- | | + | + | + | + | + | +/- | + | + | + | + |
| Li | + | + | | - | + | + | + | + | - | +/- | +/- | + |
| Na | +/- | + | - | | + | + | +/- | +/- | + | - | + | + |
| Al C | + | + | + | + | | + | +/- | + | +/- | - | - | + |
| Ba C | +/- | + | + | + | + | | +/- | +/- | + | + | +/- | + |
| Ca C | + | + | + | +/- | +/- | +/- | | + | + | +/- | | + |
| Li C | + | +/- | + | +/- | + | +/- | + | | +/- | + | +/- | + |
| Na C | +/- | + | - | + | +/- | + | + | +/- | | - | + | + |
| Bentonite | + | + | +/- | - | +/- | + | +/- | + | - | | + | + |
| Polyurea | + | + | +/- | + | +/- | +/- | + | +/- | + | + | | + |
| PTFE | + | + | + | + | + | + | + | + | + | + | + | |

*Source: Klüber Lubrication*

An operator can also perform quick in-field checks, considered as spot tests, where small quantities of lubricants are mixed, ideally in a clean glass container, and observed for separation, thickening, or oil bleeding. Similarly, oils can be mixed at different ratios to observe for separation, cloudiness, or any other readily observable reactions like forming of gelatinous substances. Such tests are not meant to be scientific and definitive but can be used in times of desperate need for a quick check.

Though these charts or spot checks are a good start, it is recommended that laboratory compatibility testing is carried out to help minimize the effects of lubricant mixing, especially in critical applications where an unplanned shutdown needs to be prevented above all costs. There are several methods that can assess lubricant compatibility and identify potential issues, such as:

**Solubility Testing:** Solubility tests involve mixing lubricants at elevated temperatures and observing phase separation or cloudiness, indicating poor compatibility. Usually, three sets of mixes are considered: 90:10, 50:50, and 10:90 (ASTM International, 2020).

**Foaming Characteristics of Lubricating Oils:** This test method evaluates the foaming tendency and stability of lubricating oils under specified conditions. (ASTM International, 2020)

**Four-Ball Wear Testing:** Four-ball wear tests evaluate the friction and wear properties of lubricant blends, helping to assess their performance under load conditions (Bell, 2017). This is a quick and inexpensive way to check for basic wear resistance performance of mixed lubricants.

**Fourier Transform Infrared Spectroscopy (FTIR):** FTIR analyzes the chemical composition of lubricant blends, detecting any changes or reactions that may occur upon mixing (Bell, 2017).

In addition, for greases, typical tests include Dropping Point and Worked Penetration testing to establish compatibility.

Lubricant compatibility is a critical aspect of maintenance and reliability engineering, ensuring optimal equipment performance and longevity. Understanding the properties of base oils, thickeners in greases, and additives is essential for selecting compatible lubricants and avoiding detrimental effects on machinery.

By incorporating compatibility testing methods into lubricant management practices, industries can mitigate risks associated with lubricant mixing and maintain efficient operations. As a final word of caution, anytime you are considering a change, a proper flush and drain can help mitigate issues down the road and ensure you are getting the most out of the new lubricant you decide to use.

# OPTIMIZE YOUR MAINTENANCE SUCCESS-JOURNEY WITH QUICK WINS

This article is a crossover from Machinery Lubrication's sister publication, Reliable Plant.

"A body remains at rest, or in motion at a constant speed in a straight line, unless acted upon by a force."
-Newton's First Law of Motion

## Who Needs a Vision?

A business is much like a physical body. It has a life of its own with a trajectory and speed determined by its current state. The leader's job is to change the trajectory and speed of the organization to meet the demands of the modern world's ever-changing business environment.

Creating a vision of the future marks the beginning of making change happen. It is the tool the leader uses to convey a clear message about where the organization is headed so that a good strategic plan can be developed. It creates pressure for change.

## What Makes a Good Vision Statement?

Effective vision statements have ten common traits. They are:

1. **Future Focused –** The vision should be focused five to ten years in the future. It is a forward look at what the leader wants the organization to be in the future.

2. **Directional –** The vision should provide direction for the organization. It is all about where the organization needs to be in the future and the path it will take to get there.
3. **Clear –** The vision needs to be clear and easy to understand at all levels of the organization.
4. **Relevant –** A good vision is connected with the organization's past, its current reality, and where it needs to be in the future.
5. **Purpose Driven –** A good vision will clearly articulate the purpose of the organization. It lets everyone in the organization understand why the organization exists.
6. **Values-Based –** A good vision is well connected to the core values of the organization. The values drive how members of the organization will interact with each other, and others outside the organization such as suppliers, customers, regulators, and the general public.
7. **Challenging –** The vision should present a challenge or stretch goal for the organization that will help create innovation and drive for the members of the organization.

8. **Unique –** The vision should stress what is unique about the organization. It should say what makes the organization different from others.
9. **Vivid –** A well-crafted vision statement will paint a clear picture of what the organization will look like in the future.
10. **Inspiring –** A well-conveyed vision will inspire members of the organization to use their energies to make the vision a reality. It should create impetus for action.


*Figure 1: Forces for Business Change*

**There are several benefits of effective vision statements, including:**

- Vision provides direction and helps the organization prepare for the future.
- Vision guides decision-making.
- Vision shapes the organization's strategy.
- Vision guides the types of people you hire and promote.
- Vision defines what you will and what you will not do.
- Vision helps set priorities and guides planning.
- Vision aligns people and activities across the organization.
- Vision provides the purpose and a source of inspiration.
- Vision reflects an organization's core values and beliefs.
- Vision empowers people and helps focus their efforts.
- Vision brings change and hope for the future.

## The Role of the Strategic Plan

The leader can now work with a core team to create a strategic plan. The strategic plan is typically a three-to-five-year plan consisting of annual goals or targets that act as guides to drive the activities of the major parts of the organization. Each organization within the overall organization will develop annual goals congruent with the goals of the overall organization.

## What are OKRs?

Objectives and Key Results (OKRs) are a good way to achieve short-term wins for the organization as it moves toward achieving the vision. You can think of the vision as the long-term three to five-year objective for the organization. Each department in the organization would set up annual OKRs to achieve the vision, and each team within the departments would set up monthly to quarterly OKRs to support the department's OKRs. Your organization could implement personal OKRs once it gains experience with the higher-level OKRs.

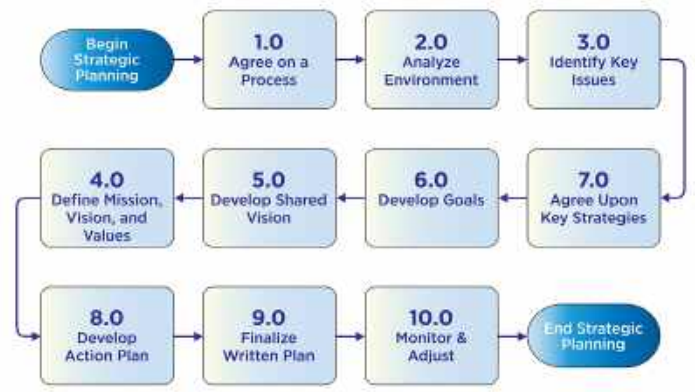



*Figure 2: The Strategic Planning Process*

## Objectives

Objectives for OKRs should be:

- A single sentence that is qualitative and inspirational — should not contain any quantitative measure such as "double", "triple", "100%"
- Time-bound — monthly, quarterly, annually
- Independently accessible and actionable by the team


*Figure 3: OKRs Drive the Organization*

| Good Objective Statements | Poor Objective Statements |
|---|---|
| • Be the go-to supplier for industrial control products in the Southeast U.S. | • Double the sales of industrial control products in the Southeast U.S. |
| • Provide an awesome presentation at this year's Reliable Plant conference | • Present at this year's Reliable Plant conference |
| • Provide best in-class levels of uptime for our production equipment | • Uptime of 90% |

## Key Results

Key results are the quantifiable evidence of meeting the objective. There are typically three, but there could be only one or up to as many as five.

| Objective | Key Results |
|---|---|
| Be the go-to supplier for industrial control products in the Southeast U.S. | 1. Place in the top five of presentation rankings.<br>2. Receive congratulatory letters from 20% of presentation attendees.<br>3. Be invited back to next year's conference as the keynote speaker. |

Notice that the key results are not in the form of outputs, but actual visible outcomes of the work. Focusing on outcomes means you are focusing on the short-term wins. The Key Result list should be rank-ordered from most to least important.

Key Results should be stretch goals. They shouldn't be achievable in the time frame of the OKR by doing what you have always done. The Key Results should require a step up in organizational performance.

### Some Considerations

1. Do we have a baseline? You may have to measure something for a month or two before you are comfortable setting Key Results.
2. How easy is it to measure?
3. Is it a strong signal or a weak signal? How confident will you feel if this number is met?

Beware of using the completion of some project or other as a Key Result. The outcome of the project could be desirable or undesirable. What we are after is measures of outcomes. You will need to provide mentoring and coaching to your team members to get them focused on writing Key Results that are focused on outcome thinking rather than output thinking.

## Managing OKRs

**Things to keep in mind:**

1. OKRs are not for managing the day-to-day work of the organization. They are intended to drive change and innovation to achieve the vision for the future.
2. Writing OKRs is not a silver bullet. It is important to remember that there will be hard work to be accomplished.
3. There must be a constant focus on the OKRs. Accomplishing OKRs requires weekly goal setting and weekly review of the week's results.
4. The Key Results need to be stretch goals that can only be achieved by changing the way work is done.
5. Completion of a project is not a Key Result. Projects should be designed to move the organization toward achieving the Key Results.
6. Have a Friday Wins Session. Stretch goals mean that some of them won't be met. Let the team members have a chance to brag a little about their wins. Do it late during the regular work day and provide snacks, etc. Don't keep them overtime. They will have had plenty of opportunities for that during the week.

Take some time to get familiar with the tips outlined in this article for a boost to your maintenance and reliability success journey. Adopting a strategy that incorporates Objectives and Key Result scan really help your organization achieve the quick wins aligned with your strategic goals while keeping stakeholders engaged.

# GREASING THE WHEELS OF SUCCESS: A ROADMAP TO LUBRICATION EXCELLENCE

Yup, it's 2025 already! And it goes without saying that maintaining machinery at peakperformance is not just a goal but a necessity. A well-structured lubrication program stands as the linchpin for ensuring smooth, efficient, and cost-effective machinery functioning. To achieve this, organizations can follow a strategic approach, encapsulated in a four-step framework presented below:


## 1: The Program Foundation - Building a SolidGroundwork for Success

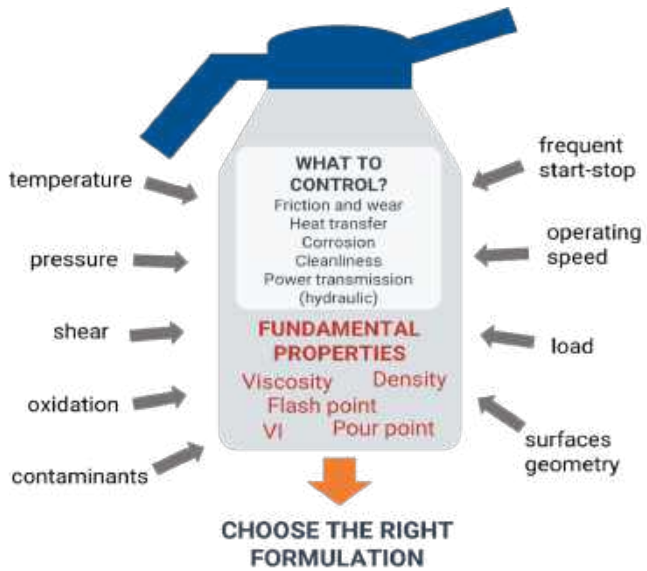
To embark on a journey towards an exemplary lubrication program, industries need a sturdy foundation. This involves understanding the intricacies of the machinery, identifying lubrication requirements, and establishing clear protocols. A comprehensive assessment of current practices and potential gaps may lay the ground work for the subsequent steps, creating a roadmap for success.

**Key elements include the following:**

- **Precision Lubrication Quantities and Frequencies:** Ensure that lubricant quantities and application frequencies are meticulously calculated to meet the specific needs of each machine, promoting optimal performance and longevity.
- **Strategic Lubricant Selection:** Optimize lubricant selection based on the unique requirements of individual machines. Tailor your choices to enhance efficiency and minimize wear and friction:
- **Lubrication Champion and Training:** Designate a Lubrication Champion who is not only well-versed in lubrication best practices but has undergone specialized training. This individual will be instrumental in driving the success of the lubrication program.
- **Comprehensive Training Matrix:** Establish a thorough training matrix covering all personnel involved in lubrication activities. Equip your team with the knowledge and skills necessary for effective lubrication practices.
- **Documented Lubrication Policies:** Document clear and comprehensive lubrication policies for all activities. This ensures a standardized approach and serves as a reference for consistent implementation across the organization.

- **Key Performance Indicators (KPIs):** Document Key Performance Indicators for all lubrication-related activities. This enables the continuous monitoring and evaluation of the lubrication program's effectiveness, guiding improvements where necessary.
- **Guidelines for Equipment Modification:** Set clear guidelines for equipment modification to maintain compatibility with lubrication requirements. This ensures that any changes made to machinery align with the established lubrication standards.
- **Validation of Lubrication Tasks:** Validate lubrication tasks for each asset based on a thorough analysis of failure modes and criticality. Tailor lubrication activities to address specific risks and prioritize tasks accordingly.
- **Roles and Responsibilities Definition:** Clearly define roles and responsibilities within the lubrication program. Establishing accountability ensures that each team member understands their contribution to the overall success of the program.

Acknowledging that Program Foundation (Step 1) is a time-intensive process requiring at least 12 months is crucial for setting realistic expectations and ensuring a thorough and well-executed foundation.




## 2: Implementation: Executing Precision for Optimal Performance

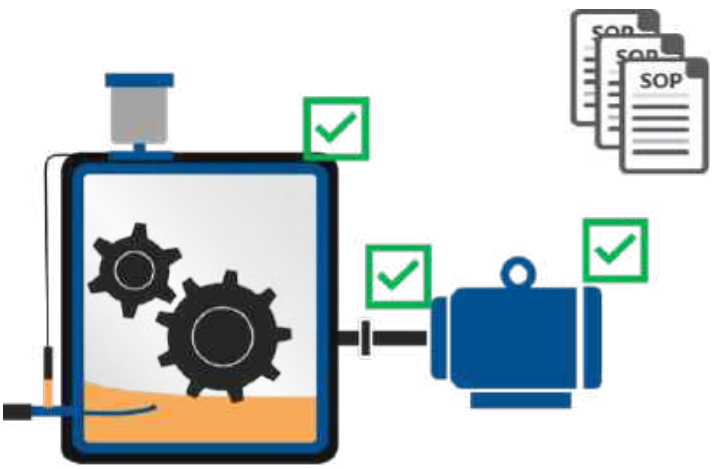
With a solid foundation in place, the next step is seamless implementation. This involves the precise execution of lubrication strategies developed in the foundation phase. Implementing best practices, utilizing state-of-the-art lubricants, and employing advanced technologies ensure that machinery operates at its full potential. Adequate training for personnel involved is paramount to guarantee consistency and reliability in the lubrication process:

- **Consolidation of Lubricants by Providers:** Streamline lubricant sourcing by consolidating providers. This ensures standardized quality and facilitates efficient inventory management.
- **Proper Tagging of Lubricated Points:** Implement a systematic tagging system for all lubricated points. Proper labeling ensures clarity and precision in identifying and servicing each lubrication point.
- **Tagging and Mapping of Oil Sampling Points:** Rigorously tag and map oil sampling points, linking them directly to the laboratory. This establishes a seamless process for sample collection, analysis, and interpretation.
- **Asset Modification for Lubrication Tasks:** Modify assets to optimize accessibility and facilitate all lubrication-related tasks. This includes ensuring that lubrication points are easily reachable for maintenance activities.
- **Filtration System Modification:** Update filtration systems to accommodate new lubricants inalignment with established policies. This ensures compatibility and effectiveness of the lubrication process.
- **Stakeholder Training Program:** Conduct a comprehensive training program for all stakeholders involved in lubrication activities. This includes personnel responsible for application, sampling, and analysis, ensuring a well-informed and skilled team.
- **Review of Oil Analysis Tests and Methods:** Regularly review and update oil analysis tests and methods in accordance with established policies. This ensures that testing protocols remain aligned with industry standards and technological advancements.

Acknowledging that the Implementation phase (Step 2) is a year-long process is essential formanaging expectations and ensuring a thorough and successful integration of the lubricationprogram.

## 3: Reinforcement: Sustaining Excellence Over Time

Organizations can fortify the foundation established in the previous steps by sampling incoming oils, building SOPs, and integrating oil analysis results with the CMMS to enhance their ability to respond swiftly and accurately to identified issues. Employee engagement and commitment playa crucial role during this phase, as they contribute to a culture of accountability and excellence.



- **Sample All New Incoming Oils:** Implement a rigorous sampling protocol for all new incoming oils. This ensures that each batch meets the required quality standards before integration into the lubrication system. Regular sampling helps maintain consistency andenhances overall lubricant quality.
- **Deployment of Standard Operating Procedures (SOPs):** Roll out comprehensive Standard Operating Procedures (SOPs) for all lubrication-related tasks. Clearly defined procedures establish a standardized approach, promoting consistency, efficiency, and adherence to best practices across the organization.
- **Integration of Oil Analysis Results with CMMS:** Enhance the management of corrective actions derived from oil analysis results by integrating this information with the Computerized Maintenance Management System (CMMS). This integration streamlines the process of implementing corrective measures based on real-time data and analysis outcomes.

At this point, 80% of the most important things are in place, and it is normal that step 3 can easily be implemented within 6 months.

## 4: Continuous Improvement: Adapting to the Future

The Continuous Improvement phase is aptly named because it is an ongoing, iterative process that has no set endpoint. Continuous Improvement is a philosophy that encourages organizations to consistently assess, adapt, and enhance their practices to achieve optimal efficiency, effectiveness, and sustainability.

In the context of a lubrication program, the commitment to continuous improvement is a recognition that technology, industry standards, and organizational needs are dynamic and subject to change. Therefore, the process of refining lubrication strategies, embracing new technologies, and adapting to evolving circumstances is perpetual:

- **Adaptability:** The ability to adapt to changing conditions, technologies, and industry best practices is fundamental to continuous improvement.
- **Feedback-Driven:** Regular feedback loops from stakeholders and ongoing assessment processes provide valuable insights for improvement.
- **Proactive Problem Solving:** Continuous Improvement involves identifying potential issues before they become major problems and implementing corrective actions proactively.
- **Employee Engagement:** Involving and engaging employees at all levels fosters a culture of innovation and improvement.
- **Benchmarking:** Regular benchmarking against industry standards and best practices helps identify are as where the organization can excel.
- **Incorporation of New Technologies:** Embracing emerging technologies that can enhance lubrication practices is a key aspect of continuous improvement.
- **Flexibility in Policies:** Policies and procedures are continually reviewed and adapted to align with changing needs and circumstances.

## Conclusion

In conclusion, achieving and maintaining a world-class lubrication program requires a strategic and disciplined approach. By establishing a robust foundation, executing precise implementation,consistently reinforcing best practices, and committing to continuous improvement, industries can not only enhance machinery performance but also pave the way for sustainable success in the ever-evolving industrial landscape. Embrace the journey towards operational excellence through the four pillars of a world-class lubrication program!

# KEY CONSIDERATIONS IN INDUSTRIAL LUBRICATION FOR ENHANCED WORK PLACE SAFETY

Insufficient attention to every day industrial lubrication tasks can compromise safety and lead to costly breakdowns. I have witnessed, first hand, the consequences of inadequate attention to lubrication in industrial settings, which include injuries, premature equipment wear, costly breakdowns, and lost productivity.

The efficient and safe operation of industrial machinery is only made possible with proper lubrication. Regular lubrication, especially when part of a comprehensive lubrication program, helps proactively prevent breakdowns and premature wear and tear.

Selecting the right lubricants is a major stage in a good lubrication program. Different machinery will require specific types of lubricants based on operating conditions, load, and temperature. And with so many different types of lubricants used in a wide range of industrial applications, the choices can sometimes be daunting. Furthermore, we can also recognize the importance of an optimized, consolidated list of lubricants to use throughout a plant to a selection of lubricants that helps avoid cross-contamination and among other benefits.

Choosing the right lubricants for the operations in your plant is typically guided by manufacturer recommendations and tested lubricant performance. Historically, many lubricants met a certain standard of industry use, and similar to most industries, these standards have changed over time.

For example, many lubricants on the market today are biodegradable and made from renewable resources. They're popular for industries that prioritize sustainability and reducing environmental impact.

While lubrication in a factory or plant requires more than just choosing the right lubricant, the connection between proper lubrication and machine reliability and plant safety cannot be overstated. Here are a few reasons why industrial lubrication is crucial for a truly safe and efficient working environment.

## The Fundamental Role of Industrial Lubrication in Workplace Safety

Industrial lubrication refers to the process of applying a lubricant to reduce friction between moving parts in machinery. The primary purpose is to minimize wear and tear, enhance performance, and promote longev-

ity. Friction and heat are two major factors that cause accidents in the workplace.

When moving parts rub against each other without proper lubrication, the friction can cause excessive heat buildup which can result in machinery suddenly seizing, breaking apart, exploding, or catching fire. Correctly applying lubricants reduces friction and heat generation, preventing accidents and ensuring the machinery can be operated safely.

Another safety consideration is workplace noise, which at high levels has been shown to damage hearing, increase the risk of cardiovascular health risks, and adversely affect concentration —potentially leading to user errors and an increased risk of accidents. Using proper lubrication can significantly reduce noise generated by machinery, contributing to a quieter and safer work environment. Continuous monitoring of noise reduction ratings and lubricant conditions plays a crucial role in ensuring that the levels of noise exposure remain within safe limits.

## Implementing Safe and Effective Lubrication Maintenance Schedules

While proper lubrication of equipment ensures the components function properly with minimal friction to reduce the risk of breakdowns or accidents, prevent premature failure, and avoid costly repairs, the implementation of an effective lubrication schedule is crucial for the long-term safety and effi cient operation of machinery.

Implementing proper maintenance schedules also reduces costs by extending the lifespan of equipment, which improves effi ciency and performance. Key components of an effective lubrication maintenance plan include choosing the right lubricant and equipment, determining specific lubrication requirements, considering operating conditions, following manufacturer recommendations, and regular equipment inspection and training to avoid mistakes such as under- or over-lubrication or using the incorrect lubricants.

- When choosing a lubricant, it is good to first consult the manufacturer's guidelines for the specification of lubricants to be used and the recommended lubrication intervals. Furthermore, calculations for the lubricant and lubrication intervals may need to be performed to best fir your unique operating and environmental circumstances.
- Consider the equipment usage; continuous or high-load usage may require shorter lubrication intervals.
- Monitor environmental factors such as temperature, humidity, and dust levels. These can all affect the appropriate lubrication schedule, so adjust accordingly. For example, check out the regrease interval and volume calculator to observe how these factors can influence the relubrication needs.
- Regularly inspect sight glasses for proper oil level and oil conditions, as well as overall equipment conditions for any signs of wear or leaks.
- Carry out a lubricant analysis at regular intervals for early detection of potential-problems before they lead to expensive wear or equipment failure.
- Train employees in correct lubrication techniques and follow best practice procedures.
- Keep detailed records of all lubrication maintenance carried out and any problems identified.

## Health and Safety: The Impact of Lubrication on Machinery

Lubrication can have a significant impact on machinery health and worker safety. Properlubrication will promote worker safety by reducing resistance, minimizing noise and vibrations, and preventing accidents. Inadequate lubrication can lead to worker safety hazards caused by machinery overheating, ultimately resulting in catastrophic failure and potentially serious or fatal injury to operators.

By implementing consistent, effective lubrication techniques, including selecting the appropriate lubricants, regular lubrication inspections, and implementing the proper maintenance schedules,worker and overall plant safety can be easily promoted and applied in any given industrial settings.

### Common Mistakes in Industrial Lubrication:

Lubrication mistakes with industrial machinery can be costly and dangerous.

- Probably the most common mistakes are insufficient contamination control,-degraded lubricant, wrong lubricant or mixing of lubricants, which can lead to total equipment failure. It's important to ensure contamination is taken seriously with headspaces management and good filtration as well as ensure the correct lubricant isused based on the manufacturer's recommendations, the environmental conditions and the operating conditions.
- In expensive machinery with safety implications, simply using the correct oil is not enough. Regular monitoring of the lubricant condition is crucial, as this can identify issues with wear and heat buildup before they become too serious or dangerous.
- Another common mistake is the failure to establish or stick to a regular lubrication schedule, or Lube PM's. Using the right Lubrication PM software is usually recommended.

*Avoiding these common mistakes helps to ensure smooth operations and maximum efficiency with minimum costs.*

## Industrial Lubrication Regulatory Standards and Compliance

Complying with regulatory standards helps to create a safer working environment and protects against legal penalties. Having regulated industry standards means all businesses operate on a level playing field, particularly with environmental regulations such as the

Clean Air Act and the Clean Water Act, which have provisions to reduce pollution caused by lubricants. Companies today need to regularly review their lubrication procedures to ensure compliance, which will help avoid penalties and lead to better plant safety and improved operational efficiency.

Upon considering the factors discussed here, along with the history and large-scale implications of industrial machinery, the commitment to proper and consistent machine lubrication and contamination control stands as a linchpin for workplace safety and operational efficiency. Proper lubrication not only mitigates friction-related accidents but also extends equipment lifespan and reduces maintenance costs.

Implementation of effective lubrication maintenance schedules, including adherence to manufacturer guidelines, regular inspections, and employee training, is vital to most industrial settings. By prioritizing compliance with regulatory standards and avoiding common lubrication mistakes, businesses can ensure a safer, more efficient working environment while minimizing environmental impact and legal liabilities.

# 2ND ROSEFIELD CONFERENCE FOR LUBRICANTS AND FUELS: A MILESTONE IN INNOVATION AND COLLABORATION

The 2nd Rosefield Conference for Lubricants and Fuels was a resounding success, attracting over 400 global delegates for two days of insightful discussions and networking. With 34 exhibition stalls and over 35 expert speakers, the event reinforced its position as a key platform for industry innovation.

Building on the success of the inaugural edition, this year's conference expanded its scope to include thought leaders from a wide range of sectors, such as specialty chemicals, additives, packaging, and lab services. The exhibition hall buzzed with activity as industry professionals exchanged ideas and explored new technologies.

A key highlight was the introduction of expanded award categories, which acknowledged industry leaders for their contributions. Networking sessions allowed attendees to delve into the latest industry trends, including the transition to sustainable energy and the growing demand for alternative fuels. Mr. Ali Alsadi from ADNOC kicked off the conference with a compelling keynote on ADNOC's leadership in sustainable energy and its commitment to India's burgeoning $7 billion lubricant market.

The session on "Emerging Fuel Technologies" was particularly well-received, with panelists from IOCL, HPCL, and BPCL discussing India's evolving fuel landscape. These experts emphasized the role of ethanol, biodiesel, and hydrogen as alternatives in meeting future energy needs.

The "Automotive Lubricants" session also stood out, with speakers from Gulf Oil, Lubrizol, and Valvoline addressing the impact


of emerging fuel technologies on lubricant formulations. The session highlighted the increasing need for versatile, fuel-agnostic lubricants that can meet the demands of modern engines.

In the "Industrial Lubricants" session, participants from Veedol, Quaker Houghton, and VAS Tribology Solutions shared insights on high-performance lubricants, which are essential in industries such as aerospace, automotive manufacturing, and heavy equipment. Sustainability and technological innovation were recurring themes, with a focus on developing lubricants that minimize environmental impact.

The "E-Fluids" session provided an in-depth look at the electric vehicle (EV) market, where experts from Shell, Veedol, and Afton Chemicals discussed the challenges of designing fluids that meet the thermal and performance needs of EVs.

The Rosefield Awards 2024 recognized excellence in the lubricants and fuels sector, honoring outstanding achievements across multiple categories.

On Day 2, the "Global Base Oil Demand" session, featuring speakers from HPCL, Ergon International, and BPCL, explored trends in base oil production and distribution. The session on "India-Middle East Trade and Opportunities" focused on the potential for collaboration between Indian and global players like ADNOC, highlighting opportunities in both lubricants and fuels.

The conference concluded with a roundtable discussion, where leaders from across the industry came together to talk about the challenges ahead. They emphasized the importance of collaboration, innovation, and digitization in shaping the future of the lubricants and fuels market.

Looking ahead, the Rosefield Conference will return in May 2025, focusing on the Circular Economy in Used Oil. Additionally, the November 2025 edition will expand on the impact of emerging technologies and market dynamics, setting the stage for further industry growth and collaboration.

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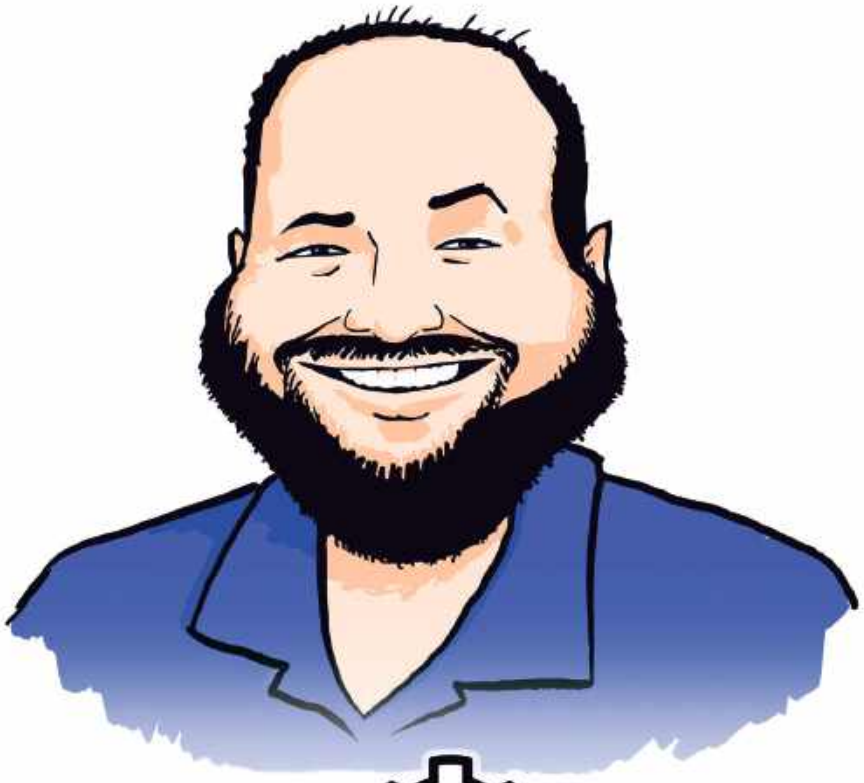

GEAR TALK

WITH **WES CASH**

In this episode of Gear Talk, Wes sits down with Jeremie Edwards, an associate technical consultant with Noria, to discuss operator-driven reliability. When it comes to this topic, many people try to implement operator-driven reliability but they may not know how to do this or even where to start.

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# FROM SILK ROADS TO SMART LUBRICANTS: THE EVOLUTION OF MACHINERY MAINTENANCE IN ASIA

Asia, a continent of resilience and innovation, has evolved remarkably from its ancient Silk Road days to modern industrial hubs. Amid the bustling trade and technological advances, a quieter story unfolds—the evolution of machinery maintenance, particularly in lubrication. This article reflects Asia's ingenuity, shaped by its geography, culture, and industrial needs.

## A Journey Through History: The Silk Road and Early Trade

Imagine a bustling Silk Road caravan laden with goods like silk, spices, and gold. As they traverse arid deserts and treacherous mountains, the wheels of their carts groan under the strain. Traders knew the journey's success depended not just on goods but also on the durability of their tools. Early lubricants like camel fat and olive oil were applied to reduce axle friction, ensuring smooth passage.

For instance, traders in Central Asia relied on camel fat, which was effective in harsh climates. Similarly, in Southeast Asia, palm oil—a local resource—served as a dual-purpose commodity for cooking and machinery maintenance.

Figure 1. From Ancient Ingenuity to Smart Solutions: Tracing Asia's Journey in Machinery Maintenance

## Insight: A Parallel for Marketers

Just as traders adapted lubrication solutions to their environments, marketing managers must craft region-specific strategies. For example, humid regions like Southeast Asia demand corrosion-resistant lubricants, while cold climates like Siberia require products with stable viscosity at sub-zero temperatures.

## Geography Shapes Demand: Diverse Terrain, Diverse Solutions

Asia's vast geography, from Himalayan peaks to coastal plains, presents diverse challenges for machinery maintenance. Take India's Gujarat coast, where salty air accelerates machinery corrosion, demanding anti-rust lubricants. In contrast, Japan's seismic terrain drove the development of synthetic lubri-

cants for precision machinery, ensuring performance in robotics and manufacturing.

**Case Study:**
In 2022, a coastal power plant in Vietnam reduced equipment downtime by 30% after adopting high-performance lubricants tailored to resist corrosion. Such success stories highlight how tailored solutions drive results.

**Insight for Marketers**
Customized messaging is key. Emphasize features like "anti-rust for coastal industries" or "cold-resistant formulas for extreme climates." This approach resonates more than generic claims.

**The Industrial Revolution in Asia: The Rise of Machinery**
With the Industrial Revolution came a surge in machinery use, from textile mills in India to shipbuilding in Japan. However, inefficiencies in maintenance often lead to costly downtime. Mineral oils emerged as a game-changer, offering superior performance.

**Real Impact:**
In India's textile sector, switching from traditional oils to synthetic lubricants in high-speed looms increased uptime by 40% and reduced maintenance costs by 20%. These numbers illustrate the transformative power of innovation.

**Marketing Tip:**
Position your product as a cost-saver. Highlight ROI through case studies and data, showing how adopting your lubricant extends machinery life and cuts expenses.

**Modern Challenges: The Sustainability Mandate**
Asia's rapid industrialization brought environmental challenges, pushing governments to tighten regulations. Bio-based and synthetic lubricants are gaining popularity, offering both performance and compliance.

Fact Check: According to a 2023 report, the global market for bio-based lubricants is projected to grow at a CAGR of 7.5%, with Asia leading the demand.

**Example:**
Malaysia's palm-oil-based lubricants balance eco-friendliness and high performance, addressing both regulatory requirements and industrial needs.

**Marketing Insight:**
Frame your product as "green and efficient." Use terms like "eco-friendly" and "energy-saving" to appeal to environmentally conscious industries.

**The Era of Smart Lubricants and IoT**
The digital revolution is redefining machinery maintenance. Smart lubricants equipped with IoT sensors now monitor performance in real-time, detect anomalies, and predict failures.

Figure 2. Driving Sustainability: Asia Leads the Global Growth of Bio-Based Lubricants

**Story:**
At Hyundai's South Korea facility, IoT-enabled lubrication systems saved the company $2 million annually by minimizing downtime and extending machinery life.

**Marketing Opportunity:**
Position your brand as a pioneer in Industry 4.0. Offer workshops or content on the benefits of smart lubricants, building trust and authority in this space.

**Marketing Managers' Takeaways**
1. Tailor to Regional Needs: Customize solutions for Asia's diverse climates and industries.
2. Emphasize ROI: Showcase cost savings and performance improvements through data.
3. Focus on Sustainability: Highlight eco-friendly solutions that comply with regulations.
4. Leverage Technology: Promote smart lubricants as the future of maintenance.
5. Tell Relatable Stories: Use examples and testimonials to create emotional connections.

# SHELL GROUP SEEKS CCI CLEARANCE FOR RAJ PETRO ACQUISITION

Shell Group, the global energy giant, has approached the Competition Commission of India (CCI) for approval to acquire a 100% stake in Raj Petro Specialities Private Limited. This strategic move aims to bolster Shell's operations in India's lubricant and petrochemical sector.

**Details of the Deal** The acquisition involves two Shell subsidiaries—Shell Deutschland GmbH and Shell Overseas Investments B.V.—which have submitted the required filings under CCI's combination regulations. The integration of Raj Petro into Shell's portfolio is expected to enhance customer offerings and operational efficiencies by leveraging Raj Petro's expertise in hydrocarbon-based specialty products.

**Key Players** Shell Group operates in over 70 countries and is renowned for its capabilities in oil and gas exploration, renewable energy, and manufacturing high-performance lubricants. In India, it serves sectors including automotive, energy, and industrial manufacturing.

Raj Petro Specialities, a prominent Indian player, manufactures a wide range of specialty products such as transformer oils, hydraulic oils, and industrial greases. These products cater to industries like pharmaceuticals, agriculture, and energy, serving both domestic and international markets.


Market Dynamics The deal highlights overlaps in the lubricant sector, covering segments like motor oils, industrial greases, and transformer oils. Shell and Raj Petro's combined operations could redefine market dynamics, given their presence in various lubricant categories. Additionally, a vertical integration aspect exists, as Shell's base oil production aligns with Raj Petro's blending operations.

The parties have proposed leaving the definition of relevant markets open, asserting that the acquisition will enhance market efficiencies without stifling competition. Alternate market definitions have been provided to the CCI for assessment, spanning broad categories like the overall lubricants market and narrower segments such as passenger car motor oils.

Implications and Next Steps Industry observers view the acquisition as a landmark development in India's petrochemical landscape. It signifies Shell's commitment to expanding its footprint in India while enhancing its product range for domestic consumers. The CCI's decision will be crucial in determining the trajectory of competition and collaboration in the sector.

Should the deal receive approval, it will likely enhance competitiveness in India's lubricant industry, setting a precedent for future global investments. The outcome will shape the evolving dynamics of the Indian petrochemical and energy markets.

**Disclaimer: Machinery Lubrication India was not involved in creating any of this content.**

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