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Basic Task or Strategic Decision
Selecting Lubricants



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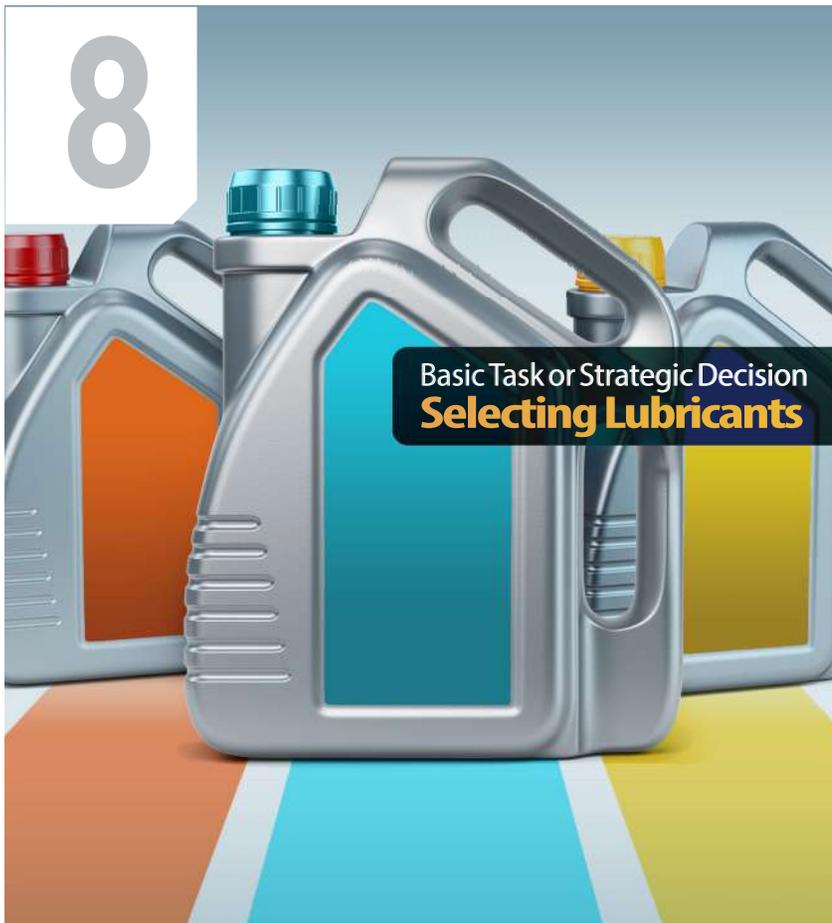
AS I SEE IT

How To Visually Inspect The Health And State Of Oil



COVER STORY

Basic Task or Strategic Decision Selecting Lubricants



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Publisher's Note



If India's growth story is being powered by advanced technology and a robust 8%-plus economy, the silent enabler inside every refinery, steel mill, and power plant is still a lubricating film only a few microns thick. As our industrial centers hum with the energy of "Make in India," the pressure on rotating assets has never been greater. Yet, a critical vulnerability persists: The industry continues to treat lubricants as a consumable commodity to be purchased, rather than a precision-engineered machine component to be specified. This month's cover story is designed to shatter that procurement myth.

In today's high-density operating environment, the idea of a "standard" lubricant has disappeared. Indian industry is moving toward continuous-duty cycles where equipment runs hotter and under more variable loads than ever before. This reality has rendered price-driven selection obsolete. When we view a lubricant as a "consumable," we look for the lowest cost per drum. When we view it as a primary machine component, we look for oxidation stability, shear strength, and additive chemistry that directly safeguard the bottom line. We must recognize that the lubricant is often the only thing standing between a high-value asset and catastrophic surface degradation; it is an investment in surface integrity, not a mere operational cost. The cost of a wrong choice is no longer just a shortened drain interval; it is a quiet erosion of profitability through varnish, sludge, and energy loss.

Modern best practice demands that we treat lubricant selection as a specialized subset of Reliability-Centered Maintenance (RCM). In practical terms, this means analyzing India's specific challenges—high ambient temperatures and humidity—against the lubricant's molecular architecture. Whether deciding between a mineral oil or a high-performance synthetic, the choice must be grounded in asset criticality and evidence-driven specifications rather than brand familiarity or a procurement spreadsheet. Modern lubricants are now formulated with molecular precision to serve as dynamic heat-transfer agents and chemical barriers; selecting them requires an engineer's eye, not just a buyer's pen. Furthermore, as sustainability becomes a non-negotiable metric, the right lubricant acts as a primary lever for reducing carbon footprints by lowering frictional energy consumption and extending oil life. If you wouldn't settle for a sub-standard bearing to save a few rupees, you cannot afford to settle for a sub-optimal fluid film.

This strategic shift is the central theme of our current cover story. The article provides a high-level roadmap to help you move beyond price sheets and toward a methodology that prioritizes asset safety and lifecycle cost. It bridges the gap between laboratory data and plant-floor reality, offering insights that help procurement leaders align with reliability engineers to achieve operational excellence. By redefining the selection process, we move from reactive replenishment to a Total Cost of Ownership (TCO) model that values

the "long-term health" of the asset over the "short-term savings" of the invoice.

As we step into 2026, it is worth pausing to recognize the resilience our community has demonstrated. The continued engagement of our readers—especially through the regional grit of our "From the Asian Desk" perspectives—keeps our mission grounded in real-world solutions. At Machinery Lubrication India, we believe that changing how you perceive the fluid in your machine is the most accessible lever for improving reliability and driving plant-wide efficiency. This issue serves as a call to action to align our technical choices with the same ambition that drives our national industrial goals.

As we celebrate the harvest season across our diverse nation, may this time of abundance bring renewed energy and prosperity to your professional and personal lives. On behalf of the entire team, I wish you a joyful festive season and a reliably operating New Year.

Let us keep precision at the heart of our operations. We advance together.

**Warm regards,
Udey Dhir**





HOW TO VISUALLY INSPECT THE HEALTH AND STATE OF OIL



The well-known KISS principle (keep it simple stupid) was first coined in the 1960s and began widespread use in the U.S. Navy shortly thereafter. While it started as a design principle for engineers, it has since been applied to any activity or creative endeavor that has had the propensity to become unnecessarily complicated.

What becomes overly complicated also becomes, by default, poorly understood and sparsely used. Conversely, the greater genius in design and engineering lies in achieving the design objective through simplicity and pureness of form.

This can be applied to the world of oil analysis in many ways. Increasingly, oil analysis has become engulfed by complex analytical chemistry and mathematical algorithms. This science is successful when it takes the complicated, such as an array of particles of varying shapes, sizes, textures, colors and compositions, and puts their formation into plain English (e.g., cutting wear on cylinder walls).

It is less successful when it does the opposite, i.e., over analyzes and over details. If someone asks you for the time, there is no need to give an explanation on how a watch works.



Don't get me wrong, I'm very proud of the technical progress of the oil analysis field and the tremendous value it has brought to the world of machinery reliability. That said, oil analysis should always be viewed in terms of its many forms. These are not competitive but rather should form a focused and unified activity, each with inherent strengths and weaknesses.

Collectively, they enable oil analysis to function at its best. Like all reliability initiatives, this should deliver reliability at the lowest possible cost. It optimizes reliability, not maximizes it. It's about making the right choices.

For instance, for a given machine, how fre-

quently should you conduct laboratory analysis? How frequently should you perform wear particle characterization? These are necessary questions needed to achieve the desired optimum reference state (ORS). The four principle forms of oil analysis are identified and described in Figure 1.

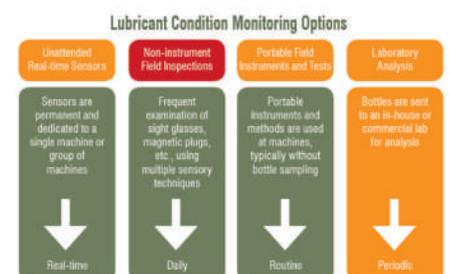


Figure 1. The four principle forms of oil analysis

In recent issues of Machinery Lubrication magazine, I've introduced Inspection 2.0 as an important reinvention of conventional inspection practices. I see so many low-hanging fruit opportunities for simple, daily, penetrating machine inspections that often go unnoticed and certainly unexploited.

It's far better to do 100 frequent "screening" inspections than one monthly or quarterly laboratory analysis. Laboratory analysis should still be performed, but it is not a substitute for frequent quality inspections. When this happens, reliability is marginalized and maintenance budgets are wasted.

As a review, Inspection 2.0 can be summarized by the following tenets:

- Culture of reliability by inspection (RBI)
- Advanced, tactical inspector skills
- Machine inspection readiness with inspection windows
- Advanced inspection tools and aids
- Inspection protocol that is aligned to failure modes
- Early fault and root cause emphasis
- Origin of more than 90% of unscheduled work orders

Tactical Inspections Are Purposeful Inspections

With the exception of taste, our four other senses can be effectively used, individually or collectively, for frequent tactical inspections. The concept of tactical inspections is inspection with a purpose. It is not just going through the motions down a checklist. For instance, you don't just look at oil but rather examine it for specific reasons. The inspectors must know the reasons.

This examination seeks to answer several questions about the health of the oil, the health of the machine and the state of the oil to protect the machine from premature failure. Inspectors should be hunting for something that often is inherently hard to find or notice. The machine, through the oil, will telegraph a signal. The strength of that signal increases as functional failure approaches. Early fault detection is the objective and is best achieved by tactical inspections. I'll talk about how this can be done visually.

There are no scientific instruments, sensors, algorithms or computers that can outperform the eyes and mind of a human inspector. To get the most out of your sense of sight, you need to know what you're looking for. Start by constructing a list of root causes and symptoms.

Inspection seeks to find critical states of the oil that cause failure (roots of failure) or reveals active failure in progress (symptoms). As an example, for a diesel engine oil this might be the oil level, soot dispersant, fuel dilution, coolant contamination and sludge. For an industrial gearbox, you might want to look for a wrong oil level, dirty oil, water contamination, excessive wear debris, aerated oil and an overextended oil drain.

By knowing the questions, you can work backward to define the tactical inspection protocol that provides the answers. This is a two-step process:

- **Causes and Symptoms (C&S)** - For every machine or system component, list what is important to find (ranked by importance).
- **Critical Occurrence States (COS)** - For each item on this list, create an inspection protocol that would reveal the state of occurrence (the earlier the better).

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A Well-trained Eye

Using the industrial gearbox example, let's rank the causes and symptoms guided by past experience and help from technical advisors. After each item on the following list are one or more ways to enable earlier alerts by visual inspection.

- **Wrong Oil Level :** Level gauge inspections.
- **Dirty Oil :** Exposed head space (vents, breather, hatch, etc.), filter in bypass, rapid rise in the filter pressure differential, entrained air problems, sediment in bottom sediment and water (BS&W) bowls, blotter test sediment.



The Esco OSG (oil sight glass), often referred to as a BS&W bowl or water separator, can be installed directly to a drain port located at the bottom of a reservoir or with an elbow for drain ports located on the side of the equipment.

- **Water Contamination:** Cloudy oil, free water in BS&W bowls, rust on the corrosion gauge, hydrated desiccant breather, entrained air problems, positive result from a crackle test.
- **Excessive Wear Debris:** Metallic sediment in BS&W bowls, laser pointer inspection, loaded magnetic plug, metallic debris on the filter's surface, magnet inspection of oil sample.
- **Aerated Oil (Entrained and/or Foam):** Sight glass inspection (cloudy or frothy oil), sudden rise in the oil level, hatch inspection, rise in the oil temperature,

emulsified water.

- **Overextended Oil Drain:** Sight glass inspection (dark, sludgy oil), dirty oil, excessive wear debris, soft insolubles on blotter, air-handling problems.

After each inspection (that passes), the inspector should have a high level of confidence that there are no active or abnormal C&S conditions related to the oil or machine. This is done by skillful inspection in search of the COS. If you engineered your inspection protocol properly, it would be extremely difficult for there to be an active C&S in progress without a positive alert from an inspection of each of the COS. These critical occurrence states are designed to effectively reveal C&S events.

Routine Inspections

A routine inspection consists of quick and frequent inspection events not generally requiring the use of tools, pulling a sample or special inspection aids. The following are examples of routine visual inspections related to lubricating oil:

- **Oil Level-** Visually inspect the dipstick, level gauge or sight glass.



View and maintain the level of oil in your equipment with the Esco LevelLock. The 3-D Viewport allows for immediate visual indication of lubricant level and when the lubrication falls below the desired oil level, the reserve reservoir bottle on top self-levels, refilling the reservoir to its appropriate level.

- **Oil Color and Clarity-** This involves a sight glass inspection aided by a strong light. Usually a comparator image is used.
- **Foam Presence and Stability-** This can be determined by some sight glasses or head space inspections, or both.
- **Entrained Air Presence and Stability-** Also generally assessed by sight glasses and head

space inspections.

- **Free Water-** Inspect water traps or BS&W bowls for a free water phase.
- **Emulsified Water-** Inspect sight glasses for turbidity.
- **Oil Sediment and Flocc-** Inspect sight glasses and BS&W bowls for stratified solids and soft insolubles.
- **Gauge and Sensor Inspections-** These inspections utilize various digital and analog gauges, including temperature, pressure and flow. Some machines have sensors that report oil properties, such as particle count, wear particle density, water contamination and viscosity.
- **Heat Gun Inspection-** This provides a quick, quantitative assessment of the oil temperature on critical machine surfaces.
- **Magnetic Oil Monitors-** This kit contains three durable magnetic strips that adhere directly to equipment, and provide real-time feedback on oil temperature, color, and clarity.



Esco Magnetic Oil Monitors

- **Head space Inspection-** Hinged hatch access aided by a strong light can enable observation of bathtub rings, varnish and foam.
- **Corrosion Gauge Inspection-** Similar to magnetic plugs, these gauges can be quickly inspected to reveal corrosive conditions associated with corrosion

agents, impaired rust inhibitors, etc.

- **Leakage Inspection-** Failed seals and radial shaft movement can cause leakage, but this can also be due to a sudden drop in oil viscosity, change in oil chemistry or ingress of certain liquid



contaminants.

Exception Inspections

Exception inspections are conducted either because of a reportable or questionable routine oil inspection or as the result of an abnormal operating condition. Most exception inspections require the extraction of an oil sample and a simple test that can be performed at the machine or on a bench top. The following are examples of visual exception inspections related to lubricating oil:

- **Blotter Spot Test-** This simple test can be extremely helpful for detecting a range of contaminant sand abnormal oil conditions.
- **Blender Test -** This test can be performed with a blender or graduated cylinder. It is useful for revealing certain contaminants, degraded oil chemistry, impaired air-handling ability and other abnormal conditions.
- **Inverted Test Tube-** This is an old method that uses the rate of rising air bubbles to roughly estimate oil viscosity. Graduated cylinders or sample bottles can be utilized as well.
- **Oil Drop on the Surface of Water-**

Certain additives and chemical contaminants influence the interfacial tension of lubricants. Placing a couple drops of oil on the surface of water can quickly exhibit this. Compare the results to that of new oil.

- **Cold Oil Turbidity-** Oil with trace amounts of water can be assessed by placing a sample of the oil in a refrigerator for an hour. Dissolved water will saturate in oil at cold temperatures and become visibly noticeable by a cloudy appearance.
- **Hot Oil Clarity-** The presence of soft oil insolubles (oxides, organic materials, dead additives, insoluble additives, varnish potential, etc.) and some emulsified water will often quickly dissolve in the oil when heated. This is visibly noticed by the oil becoming markedly clearer (less turbid).
- **Crackle Test-** This well-known test for water contamination can be performed with a hot plate or soldering iron.
- **Bottle and Magnet Test-** The presence of ferromagnetic wear debris particles can be separated and concentrated for quick inspection by placing a strong rare-earth magnet against the outside surface of an oil sample bottle and then agitating. For high-viscosity oils, dilute the oil first with kerosene or another solvent to lower the viscosity.
- **Laser Pointer Test-** Shining, reflective particles can be easily observed in many oils by passing a laser through the oil. The particles will scatter the light. It sometimes is best to allow the particles to settle to the bottom of the bottle first and then pass the laser light up from below.

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Basic Task or Strategic Decision
Selecting Lubricants



Proper lubricant selection is more than a simple maintenance task; it's at the heart of keeping industry moving. Contained within all moving machinery, lubricants are their very lifeblood, supporting and propelling industries worldwide.

Proper lubricant selection plays a pivotal role in achieving facility goals. By selecting the appropriate lubricant for each application, facilities can enhance overall equipment lifespan, reduce energy consumption, improve operational efficiency, and minimize the risk of unplanned downtime.

By understanding what goes into selecting a lubricant, facilities can choose the right one for the job, reap long-term business benefits, and enjoy healthier, more predictable operations.

Understanding Machine Needs

From a holistic viewpoint, few processes have as direct an impact on downtime rates, machine health, and the overall maintenance budget as lubricant selection. This is why experts consider this one of the most crucial decisions any maintenance program can make.

Every lubricated asset is precisely designed to accomplish a specific task, and choosing the correct lubricant for that asset is the best way to ensure its proper function and protect both the asset and the company's investment. A single mistake in the selection and management of lubricants can cause the wrong lubricant to be applied to critical equipment, causing premature failure of the machine and bringing a halt to the operations it supports.

While selecting a lubricant can seem deceptively simple, it's critical that selection decisions aren't made lightly. Small errors in lubricant selection can result in huge long-term consequences, often because these

mistakes go unnoticed until it's too late to fix them. Furthermore, factors like lubricant formulation and production constantly evolve as new data and technologies emerge. To properly select lubricants, a facility's selection process must keep up and not rely on outdated standards and recommendations.

But before a lubricant is chosen, a team must fully understand the needs of the equipment being lubricated. While Original Equipment Manufacturer (OEM) recommendations can be an adequate place to start, additional checks must be in place to ensure the recommended lubricant is a viable option. Many facilities find it necessary to make adjustments to their selection criteria based on their equipment's unique operating parameters, including:

- Speed
- Load
- Operating temperature
- Internal surface materials
- Environmental conditions
- Contamination potential
- Food-grade or environmental requirements

Each of these parameters must be considered and balanced against lubricant availability and overall price.

Many facilities looking to cut costs often consider purchasing cheaper lubricants. However, this is often ineffective from a profitability perspective and risky as a maintenance decision. On average, lubricant costs only make up approximately 1-3% of a facility's annual maintenance costs, and total maintenance budgets average 8-10% of total operating costs. This means that for every dollar spent by the company, lubricant purchasing would only make up 1/10th of a penny.

Obviously, when viewed from such a high level, lubricant selection does not demand a large portion of a company's annual budget. However, this doesn't mean that main-

tenance will automatically have access to the appropriate budget it needs. In these instances, decision-makers must make well-informed and appropriate decisions for their equipment while respecting pre-setspending limits.

Ultimately, the cost of the lubricant itself is a small fraction of the cost of the unscheduled downtime that could cripple production when machines fail. However, the lubricant is only the medium by which lubrication occurs; it's up to the maintenance team to incorporate it into an effective strategy that also considers things like proper contamination control and management of lubrication tasks.

The 3 Lubricant Categories

Once the asset's needs are fully addressed, the next criterion that should be considered is the lubricant's performance level. Most lubricants fall into three main categories: standard-performance, high-performance, and specialty-performance. Understanding their differences and appropriate applications is crucial to ensuring a facility is making the right selection.

Standard Performance

Often offered as bulk purchases that help minimize cost, standard performance lubricants are the most common type in use. They are broad solutions that perform the basic functions required to meet most OEM minimum operating requirements. It is estimated that approximately 80% of all mechanical components can be effectively lubricated with standard-performance products.

High Performance

High-performance lubricants are manufactured using specialized materials that offer enhanced capabilities. Some address specific performance needs, such as heavy load support, high wear resistance, or extended life cycle needs. Selecting a higher-performance lubricant is usually appropriate for 18-20%

of all mechanical components.

Specialty Performance

These products are specifically designed for extraordinary circumstances. For example, in nuclear power environments, extreme operating temperatures, operations in a vacuum or low-gravity, or in facilities regularly working with highly corrosive materials. Each specialty lubricant is designed with a specific environment or specification in mind and should be both chemically and physically stable in those situations.

However, certain disadvantages do exist. In many situations, these lubricants typically can't support a variety of valuable additives. Cost is also a factor – these lubricants can be cost-prohibitive, often 200 to 400 times more expensive than typical lubricants. That said, most

facilities won't ever have the need for these types of products (and if they do, the cost is usually justifiable). Specialty performance lubricants are only used in 1-2% of plant applications across all industries.

Conclusion

In an era of increasing operational complexity and steady competition, proper lubricant selection should not be considered as a mere maintenance task; it's a strategic investment that should be carefully considered. Cultivating this perspective as part of a well-informed and data-driven lubrication program, facilities can unlock significant operational advantages. By taking into account specific equipment needs, exploring lubricant categories, and balancing performance with price, facilities can optimize equipment lifespan, enhance efficiency, gain a competitive edge, and minimize operating costs.

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THE IMPORTANCE OF LUBRICANT FILM STRENGTH



Film strength is one of the most critical lubricant properties for protecting a machine's internal components from wear and degradation. It is heavily influenced by the lubricant's base stock and additives. This article will discuss the importance of a lubricant's film strength and what impacts its effectiveness.

Film Thickness

When you think of lubrication, what comes to mind? It might be the base oil creating a film thickness to separate two metal surfaces. After all, the primary intent is to avoid metal-on-metal surface contact. For the base oil to provide separation in this situation, there must be a balance of three contributing factors: the relative velocities, the base oil viscosity and the amount of load.

These three factors are also influenced by other elements such as temperature and contamination. When the film thickness is the result of a balance between these factors, it is called hydrodynamic lubrication.

In applications with rolling contact (and thus negligible relative sliding motion), film



thickness between the metal surfaces can still occur, even with greater localized pressure points. In fact, these pressure points play an important role.

The base oil's pressure-viscosity relationship allows the oil's viscosity to increase temporarily due to the higher pressures. This is called elastohydrodynamic lubrication. A full film separation remains, albeit a very thin one.

In practice, it is best to keep machine sur-

faces separated, with the film thickness providing the best opportunity for reduced friction and wear. But what happens if these film thickness conditions are not met, such as when there is insufficient relative velocity, inadequate viscosity or too much load?

Most machine designs and operating parameters will require instances when insufficient velocity exists, such as starts and stops or changes in directional motion. There may also be concerns when the temperature in-

creases too much, causing the viscosity to decrease, or excessive contamination contributes to abrasive contact in the film gap.

When the hydrodynamic or elastohydrodynamic lubrication prerequisites are not met, the base oil will require support during what is called boundary contact conditions. This support involves wear and friction-control additives.

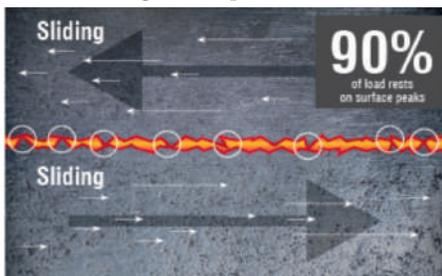
The base oil and additives are carefully blended together to produce the specific lubricant product (either oil or grease), which is formulated to mitigate the anticipated boundary conditions. The lubricant then possesses film strength and boundary lubrication properties.

Film Strength

Film strength can be described as the lubricant's ability to lessen the effects of friction and control wear by means other than the film thickness. As mentioned, the viscosity is the primary contributor to film thickness during hydrodynamic and elastohydrodynamic lubrication.

When the base oil viscosity is insufficient to overcome metal-to-metal surface contact, the base oil and additive chemistry work together to create a surface protection mechanism. During these boundary conditions, boundary lubrication is also influenced by the chemical and physical properties of the mechanical surfaces and any contributing environmental factors.

Even when loads and temperatures are higher and relative surface velocities are lower, the film strength is improved.



Boundary lubrication

Unlubricated Surface Interactions

If you were to observe contacting mechanical surfaces on a molecular level, you would see that they can be relatively rough, even if they are machined to be very smooth and appear that way to the unaided eye. This could be compared to how the earth looks like a perfect sphere from the perspective of an astronaut in space but is brimming with mountains and valleys of all heights and depths when viewed by someone standing on the earth's surface.

This is relevant because when two unlubricated metal surfaces come in contact, the actual contact area will be substantially less than the apparent contact area. The surfaces will only come in contact where these "microscopic mountains" called asperities are the tallest and reach to the other surface, preventing lower asperities from making contact.

These asperity surfaces can then elastically deform based on the corresponding shear strength of the metals. Thus, the real contact area will increase proportionally with an increase in load because the initial contact points will elastically deform first and more contact points will connect.

Friction

Friction, the resistance to sliding motion of interacting surfaces, is subject to several influencing parameters or processes. Most people consider the roughness of the surface as the primary contributing parameter for friction.

However, when considering that the real contact area may be less than 1 percent that of the apparent contact area, the actual roughness becomes much less relevant. The significant process contributing to friction is a result of the adhesive bonds occurring at the atomic level of asperity contact.

Wear Generation

In conditions where there is inadequate lubricant film thickness between the metal surfaces, the asperity contact points can lead to cold welding, which is the prerequisite for adhesive wear. The adhesion at these asperity points undergoes a work-hardening process, which strengthens the material.

Thus, the shear point happens at layers below the asperity contact point where the metal has not been strengthened. As the metal shears, the asperity tip is then either transferred to the other surface or broken off as an abrasive particle.

Adhesion is often seen as the initial form of mechanical wear, but as abrasive particles present themselves (either from wear or from an external source), abrasive wear can become more destructive. This form of abrasion is called three-body abrasion, whereas two-body abrasion is caused by cutting or gouging of sharp surface contact points.

During rolling contact, surface fatigue can occur. Fatigue mechanisms stem from cracks propagated at the surfaces or up from layers under the surface that contain inclusions or other impurities. The high stresses from rolling conditions at these surfaces will lead to fatigue wear.

Mitigating Surface Interactions

Friction and wear-control additives are formulated in small quantities within the base oil and have polar properties that foster metal surface attraction. These attractions are then further encouraged to chemically react with the surface as a result of the interacting conditions, which are inversely associated to the conditions leading to sufficient film thickness: higher pressure and higher temperature.

When machine surfaces interact with higher pressures and temperatures, the additives mitigate the typical effects of metal-to-metal contact (wear) by creating initial molecular layers on the machine surface that are more ductile. These friction-control layers directly reduce the shear strength during contact and become sacrificial.

The initial layers can mitigate friction by allowing the lubricant's weaker molecular bonds to release with less force compared to that of the strong bonds that result from the metal-to-metal asperity boundary conditions. The formation of low-shear-strength films is also influenced by the base stock type and the metallurgy of the mechanical surfaces.

There are three types of lubricant additives that help reduce this friction and control wear formation: friction modifiers, anti-wear additives and extreme-pressure additives.

Friction Modifiers (Lubricity or Oiliness Agents)

Polar compounds, such as a fatty acid added to the base oil, decrease friction at low sliding speeds by forming a soap film. They typically are used in components that are sensitive to fuel economy to reduce friction and stick-slip at low speeds, such as in an engine or transmission.

They act like anti-wear additives but are more effective with lighter loads and do not require high temperatures. The resulting low-shear-strength soap breaks down at higher temperatures. However, when the surface metal is more reactive to the fatty acid, creating a metal soap, the breakdown temperature is higher.

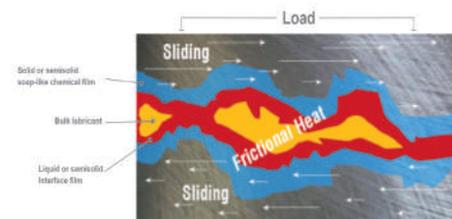
Anti-Wear Additives

These polar compounds are typically sulfur- or phosphorus-based, such as a zincdialkyldithiophosphate (ZDDP) type of additive. They are designed to chemically react with the metal surface only at boundary conditions.

However, anti-wear additives are more effective at higher temperatures, where they

become more activated and create a barrier film. ZDDP-type additives have been widely used for wear protection and are also beneficial as antioxidants in the oil.

Extreme-Pressure Additives (Anti-Scuff Additives)



Friction modifiers and even anti-wear additives become less useful and break down when surface temperatures get too high. Extreme-pressure additives, which are also sulfur- and phosphorus-based, are the best choice when high surface temperatures are expected.

These additives form a low-shear-strength, soap-like film with metal surface reactions and can withstand fairly high temperatures. While the reaction is beneficial for the film to be developed, it is important to take caution when the reaction has the potential to result in chemical corrosion of more reactive metals.

Physics and Chemistry

The physical molecular interactions of asperities at the actual contact pressure points

are the main concern when unlubricated or poorly lubricated machine surfaces come into sliding contact. At this molecular scale of the machine surfaces, boundary conditions are subject to numerous principles of physics and chemistry.

The role of oxidation, corrosion, chemisorption and other chemical reactions at the machine surfaces must be carefully balanced when additive compounds are selected for film strength protection.

These friction and wear-control additive films on the metal surfaces reduce the shear strength at the contact points. The low-shear-strength films are sacrificial during physical interactions and protect the surface from the effects of adhesive, abrasive and fatigue wear.

These sub micron films have a gradation of liquid to solid properties as they get closer to the metal surface. While the base oil is preferred to protect the machine surfaces with hydrodynamic and elastohydrodynamic lubrication, boundary conditions will exist.

Therefore, to protect against boundary conditions, a properly formulated lubricant with friction and wear-control additives should be used to provide a film strength that is proportional to the exhibiting mechanical interactions within reasonable limitations.



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THE IMPORTANCE OF OIL ANALYSIS AND PARTICLE COUNTING



In the world of machinery lubrication, ensuring the optimal performance and longevity of equipment is of the utmost importance. One critical aspect of achieving this goal is conducting regular oil analysis and particle counting.

In this article, we will explore the significance of these practices and shed light on how even small-sized particles can have a detrimental impact on machinery lubrication.

Understanding Oil Analysis

Oil analysis is a systematic approach to assess the condition and health of lubricating oil in machinery. It provides insight into a lubricant's effectiveness by evaluating various parameters such as:

- Viscosity
- Contaminants
- Wear debris
- Chemical properties

By monitoring and analyzing these characteristics, maintenance professionals can make informed decisions regarding equipment maintenance, oil change intervals, and potential issues that may arise.



Oil analysis is a critical aspect of machinery lubrication that allows for a deeper understanding of the health and performance of lubricants and the equipment they serve. By examining the physical and chemical properties of the oil, as well as the presence of contaminants, wear debris, and additive depletion, valuable insights can be gained regarding the machinery's condition.

Various techniques, such as spectrometry, viscosity measurement, and particle counting, are employed to analyze the oil and

detect potential issues early on. The results obtained from oil analysis can help identify abnormal wear patterns, lubricant degradation, and the presence of harmful contaminants that may lead to equipment failure or decreased efficiency.

Overall, understanding oil analysis plays a crucial role in the following:

- Proactive maintenance
- Practices
- Extending equipment life
- Optimizing lubricant usage

- Decreasing downtime
- Minimizing costly repairs



Source: Machinery Lubrication

The Significance of Particle Counting

One crucial aspect of oil analysis is particle counting. Particles can originate from several sources, including normal wear and tear, external contamination, and the breakdown of additives within the lubricating oil. Regardless of their origin, particles present in machinery lubrication can have severe consequences.

Did You Know?
The total amount of surface materials removed by a particle can easily be four to ten times the weight of the original offending particle.

When it comes to particle counting, size matters. While larger particles are easier to detect and remove, small-sized particles pose the greatest threat. These particles, often measured in microns, can cause substantial damage to machine components, leading to increased wear, reduced efficiency, and potential breakdowns.

The Detrimental Effects of Small-Sized Particles

Abrasive Wear

Even tiny particles in the lubricating oil can act as abrasive agents, causing accelerated wear of critical components such as bearings, gears, and pistons.

As these particles circulate within the machinery, they can embed themselves between moving surfaces, increasing friction and

causing surface damage. Over time, this abrasive wear can lead to premature component failure, necessitating costly repairs or replacements.

Viscosity Loss

Small particles can also impact the viscosity of the lubricating oil. Viscosity is a measure of the oil's resistance to flow and is crucial for maintaining proper lubrication.

When particles contaminate the oil, they can disrupt its molecular structure, resulting in viscosity loss. Reduced viscosity compromises the lubricant's ability to form a protective film between moving parts, leading to increased metal-to-metal contact and subsequent wear.

Clogging and Blockages

Particles can also accumulate in small crevices, filters, and fine clearances within machinery, causing clogging and blockages. These blockages restrict the flow of oil, reducing its effectiveness in reaching critical components. Insufficient lubrication due to blockages can result in overheating, increased friction, and, ultimately, equipment failure.

Importance of Particle Counting in Oil Analysis

Regular particle counting as part of oil analysis provides crucial insights into the health of lubricating oil. By measuring the concentration and size distribution of particles, maintenance professionals can determine the cleanliness level of the oil and identify potential issues utilizing the Renard series table.

The Renard Series Table, also known as ISO 4406:99, is a widely recognized standard used to classify the cleanliness of fluid systems, particularly hydraulic and lubricating fluids. It provides a comprehensive scale that categorizes the number and size of particles in each fluid sample, allowing for consistent and comparative analysis of contamination levels. This table aids in establishing cleanliness targets, evaluating filtration effectiveness, and main-

In this example, you can see how the particles measured at the given micron levels are assigned the specific code based on where that value falls in the table. For this example, the ISO code would be 20/17/13

	MORE THAN (p/ml)	UP TO AND INCLUDING (p/ml)	ISO CODE
	80,000	160,000	24
	40,000	80,000	23
	20,000	40,000	22
	10,000	20,000	21
	5,000	10,000	20
	2,500	5,000	19
	1,300	2,500	18
	640	1,300	17
	320	640	16
	160	320	15
	80	160	14
	40	80	13
	20	40	12
	10	20	11
	5	10	10
	2.5	5	9
	1.3	2.5	8

	PARTICLES/ML	ISO CODE
>4 microns	9,721	20
>6 microns	1,254	17
>10 microns	326	
>14 microns	73	13
>21 microns	12	
>38 microns	5	
>100 microns	0	

taining optimal fluid cleanliness for the efficient operation and longevity of equipment. Particle counting helps in establishing baseline data, detecting abnormal wear, and assessing the effectiveness of oil filtration systems.



Mitigating the Impact of Small-Sized Particles

Excluding and removing particles, among other contaminants, is the battle we fight every day in a plant. To mitigate the detrimental effects of small-sized particles in machinery lubrication, proactive measures can be taken, including having:

Effective Filtration Systems

Implementing effective oil filtration systems, both off line and in line filters, is crucial for removing contaminants and particles from the lubricating oil. High-efficiency filters can capture particles down to a specific size, preventing them from circulating within the machinery.

Effective filtration systems play a crucial role in industrial lubricating oils by removing contaminants and ensuring clean and high-quality lubricants. These systems help:

- Prevent wear and tear

- Reduce friction
- Extend the lifespan of critical components

By removing particles, dirt, and debris from the oil, filtration systems maintain the required viscosity and lubricity, enabling smooth and efficient equipment operation. They also aid in preventing the accumulation of harmful contaminants that can cause corrosion, blockages, or abrasive wear.

Effective filtration enhances overall system reliability, reduces maintenance costs, and minimizes unplanned downtime. It is an essential aspect of proactive maintenance practices, ensuring optimal performance and maximizing the longevity of industrial machinery.

Proper Maintenance Practices

It is the culmination of the little things that we do, day in and day out, that create big wins or big losses. Regular oil analysis and particle counting should be incorporated into maintenance routines.

By monitoring particle levels over time, maintenance professionals can detect abnormal trends and take appropriate action before significant damage occurs. This includes timely oil changes, filter replacements, and

investigating potential root causes of particle contamination.

Contamination Control

Controlling external sources of contamination, such as dust, dirt, and water, is essential for preventing particle ingress into the lubrication system. This can be achieved through:

- Proper sealing mechanisms
- Regular equipment cleaning
- Maintaining a clean operating environment

As I teach in all my MLT1 classes, the name of the game is *contaminant exclusion and contaminant removal*.

In the realm of machinery lubrication, the impact of small-sized particles cannot be underestimated. These particles, though often invisible to the naked eye, can wreak havoc on equipment performance, leading to increased wear, reduced efficiency, and costly repairs.

Conclusion

By incorporating oil analysis and particle counting into maintenance practices, proactive measures can be taken to mitigate the detrimental effects of solid particles, ensuring optimal machinery performance and longevity.

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CONDITIONS CASE STUDY: IDENTIFYING LUBRICANT DEGRADATION CAUSES IN DRAWING MACHINES

Situation

The client Proalco requested a visit from Compañía de Lubricantes to evaluate the reasons why one of the gearbox lubricants operating in the drawing section presented a degradation to the point that the oil solidified and jammed the reducer during a morning start-up.

Below is the lubricant condition found by Proalco's maintenance team; see image 1.



Image 1. State of lubricant found in worm gear reducer.



Lubrication Evaluation

Because it was not possible to extract enough volume to perform an oil analysis on the degraded lubricant, it was decided to perform the following actions:

1. Take a sample of lubricant in equipment with an hour meter similar to the one that presented the failure.
2. Perform thermographic analysis of the equipment that presented the failure.
3. Take a sample of the lubricant that the gearbox had on the day of the visit (new lubricant).

The results of the tests carried out will be presented below.

1. Take a Sample of Lubricant in Equipment with an Hour Meter Similar to the One that Presented the Failure

The oil analysis was performed on the equipment that experienced weather conditions similar to those that presented the failure. Due to its operating conditions, this equipment's lubrication is based on top-ups and does not have a set frequency for oil changes.

Due to extended changeover times, these

characteristics generate stronger operating environments, as lubricant fillers only mitigate the oil's natural degradation conditions but do not regenerate it.

These analyses are based on the SACODE criterion of health (SA-lud), Wear (DE sgaste), and Contamination (COntaminación).

Lubricante	Clasificación de Contaminación	Alerta
	Clasificación de Equipo	Alerta
	Clasificación del Aceite	Alerta
	Código de ISO diluido (4/6/14)	SEDIMENT
	Conteo de partículas (diluido) > 4um	S
	Conteo de partículas (diluido) > 6um	-
	Conteo de partículas (diluido) > 14um	-
	Índice PQ	408
	Visc@40C (cSt)	WET
	Oxidación (Ab/cm)	0
	Agua (% Vol)	0.930

Image 2. Lubricant Health Results

Contaminantes (ppm)	K (Potasio)	8
	Na (Sodio)	80
	Si (Silicio)	47
Aditivo (ppm)	B (Boro)	15
	Ba (Bario)	0
	Ca (Calcio)	3160
	Mg (Magnesio)	40
	P (Fósforo)	18
	Zn (Zinc)	80

Image 3. Lubricant Contamination Results

Desgaste (ppm)	Al (Aluminio)	6
	Cr (Cromo)	9
	Cu (Cobre)	253
	Fe (Hierro)	2874
	Mo (Molibdeno)	0
	Ni (Níquel)	4
	Pb (Plomo)	6
	Sn (Estaño)	15

Image 4. Equipment Wear Results

Image 2 shows how health, contamination, and wear results are on alert.

Regarding the health of the lubricant, it is evident that the viscosity could not be measured due to the high water content in the lubricant. The water and other solid contaminants cause the lubricant to present oxides and much more aggressive compounds that cause accelerated degradation.

The contamination results, see Image 3, show that not only is the lubricant contaminated with water, but it also presents contamination with silicon. This may be due to dirt entering the reducer due aluminum evidence as dirt contains silicon and alumina at a ratio of about 4:1, and the remaining concentration of silicon may be due to seals detaching or seizing.

The oil analysis finds calcium at more than 3,100 ppm, indicating contamination in the oil from a calcium-based grease.

Contamination of an oil lubricant with calcium-based grease results in the uncontrolled formation of a semi-solid/ solid lubricant. Therefore, the formation of semi-solid/ solid masses, as shown in Image 1, extracted from the affected reducer, is a product of a chemical reaction between the lubricant and mix of contaminants.

The chemical and physical reactions between the oil and the contaminants (including water, soil, and calcium thickener grease) generate an alteration in the lubricating film that works on the components of the reducer, resulting in metal-to-metal contact and a lack of surface protection, which can be seen in Image 4, where the presence of metals such as copper and tin represent the wear of the bronze crown. In contrast, the levels of iron (Fe) and the high ferrous density index (PQ Index) represent possible wear of the worm shaft and bearings.

It should be noted that in this type of gearbox, the presence of a high PQ provides information about the critically advanced wear of ferrous components in contact with the softer metals since these metals. Consequently, wear begins and is more advanced with these types of metals.

2. Perform Thermographic Analysis of the Equipment that Presented Failure

In the thermography carried out, the thermal conditions of the power transmission system were evaluated, specifically:

- Electric motor
- Electric Motor Shaft – Transmission pulleys
- Shaft Drive pulleys – Housing Internal worm shaft bearing
- Auger gearbox – Housing external worm shaft bearing

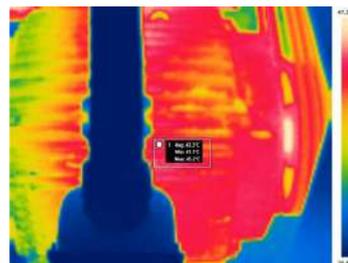


Image 5. Electric Motor Thermography: Drawing machine B.A.C.A. 11# 2



Image 6. Electric Motor Photograph: Drawing machine B.A.C.A. 11# 2

The operating conditions of the motor evaluated in the equipment housing show that, on average, the equipment is operating at 43.3°C, which is a normal and stable value for the motor. The axis at the motor outlet towards the pole is valued higher than 47.3°C, which will be shown in the following image.

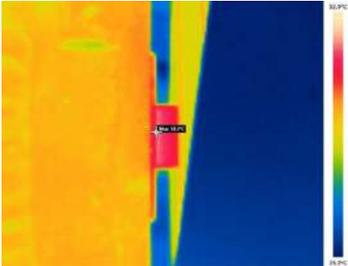


Image 7. Electric Motor Shaft Thermography: Wire Drawing Transmission pulleys B.A.C.A. 11 #2



Image 8. Photograph of Electric Motor : Wire Drawing Machine B.A.C.A. 11 #2

The electric motor shaft that reaches the transmission pulley has operating temperatures of 50.2°C, which is within normal values for electric motor output shafts. The temperature delta-between the housing and motor shaft does not exceed 10°C, which is a normal operating temperature delta.

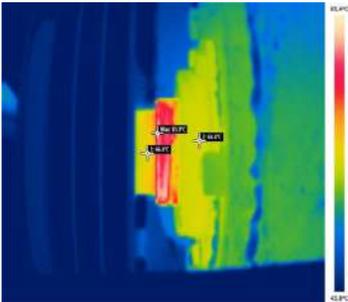


Image 9. Thermography of Transmission Pulley Shaft: Housing Internal Bearing Drawing Machine.



Image 10. Photograph of Transmission Pulley Shaft: Housing Internal Bearing Drawing Machine.

The temperature of the shaft entering the worm reducer is 66.4°C, and the temperature of the bearing house is 64.4°C. These values are within operating ranges for worm gear reducers, however, the bearing track outside the housing presents temperatures of 83°C. This is due to the mechanical installation, which can cause bearing alignment and lubrication problems.

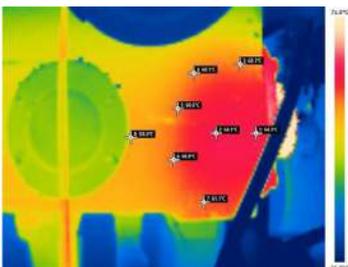


Image 11. Thermography of Worm Reducer: External worm shaft bearing housing wire drawing machine B.A.C.A. 11 #2



Image 12. Photograph of Worm Reducer: External worm shaft bearing housing wire drawing machine B.A.C.A. 11 #2

The thermography shows there is not expected thermal uniformity in the reducer; on the contrary, there is a temperature delta between the right and left ends of the reducer. This 6°C temperature different indicates an anomalous condition at the right end of the reducer. It can be seen how this housing condition is higher than 71°C, which will be reviewed in detail below.

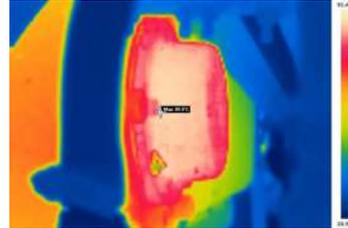


Image 13. Thermography of Housing External worm shaft bearing drawing machine B.A.C.A 11 #2



Image 14. Photograph of Housing External worm shaft bearing drawing machine B.A.C.A 11 #2

The thermography in Image 13 shows outer bearing housing temperatures of 89.9°C. Due to heat transfer, this indicates the bearing would be working between 90°C and 100°C. This is above the recommended operational value for compound mineral oils; after 75°C-80°C, these lubricants begin to exponentially degrade (every 10°C change in temperature represents a decrease in its useful life by 50%). The inspection was also carried out on additional outer bearing housings on the same line, and two more presented housing temperatures of 90°C-110°C.

3. Take a Sample of the Lubricant that the gearbox Had on the Day of the Visit (New Lubricant)

This analysis was carried out on the equipment that presented the failure due to the “hardening” of the lubricant seen in Image 1. Since extracting the minimum volume of oil to analyze this hardened lubricant was impossible, a sample was taken from the new oil (less than one month of use) currently in the gearbox. Below, in Images 15, 16, and 17, you will find the results.

Lubricante	Clasificación de Contaminación	Normal
	Clasificación de Equipo	Normal
	Clasificación del Aceite	PRECAUCIÓN
	Código de ISO diluido (4/6/14)	25/23/18
	Conteo de partículas (diluido) > 4um	170221
	Conteo de partículas (diluido) > 6um	41919
	Conteo de partículas (diluido) > 14um	1749
	Índice PQ	58
	Visc@40C (cSt)	479.7
	Oxidación (Ab/cm)	15
	Agua (% Vol)	0.006

Image 15. Lubricant Health Results

Contaminantes (ppm)	K (Potasio)	3
	Na (Sodio)	0
	Si (Silicio)	0
Aditivo (ppm)	B (Boro)	0
	Ba (Bario)	0
	Ca (Calcio)	20
	Mg (Magnesio)	0
	P (Fósforo)	0
	Zn (Zinc)	6

Image 16. Lubricant Contamination Results

Desgaste (ppm)	Al (Aluminio)	0
	Cr (Cromo)	0
	Cu (Cobre)	20
	Fe (Hierro)	29
	Mo (Molibdeno)	0
	Ni (Níquel)	0
	Pb (Plomo)	0
	Sn (Estaño)	0

Image 17. Equipment Wear Results

In Image 15, the lubricant has an oxidation level of 15 Ab/cm, which indicates an oxidation stage that has already started and is accelerated by the operating time. The reasons this oxidation occurs in such a short time are twofold.

First, operating conditions, such as bearing and reducer temperatures, exceed 80°C, which, as discussed above, exponentially reduces the lubricant’s useful life. Second, the conditions under which the new lubricant was applied may have been subjected to remnants of the previous lubricant, which catalyzes the degradation of the new oil. This equipment also presents values of calcium, although lower than those present in Images 2, 3, and 4. As explained in point 1, this contamination is due to the grease the facility used, which is cross contaminating the new lubricant. This will produce a physical and chemical degradation of the oil, turning it into a semi-solid/ solid that will not lubricate any of the reducer’s components.

Conclusions

1. The formation of the semi-solid/ solid paste found in the crown auger of the B.A.C.A 11 #2 drawing machine (Images 2, 3, and 4) is due to contamination by calcium soap from the lubricant used in the production process.
2. The gearbox bearings’ temperatures are above 90°C, accelerating the degradation of the lubricant and exponentially increasing the component’s wear rate.
3. A high level of water was found in the reducer of the B.A10 drawing machine (Images 2, 3, and 4). Calcium contamination and high operating temperatures solidify the lubricant, mechanically compromising the equipment.

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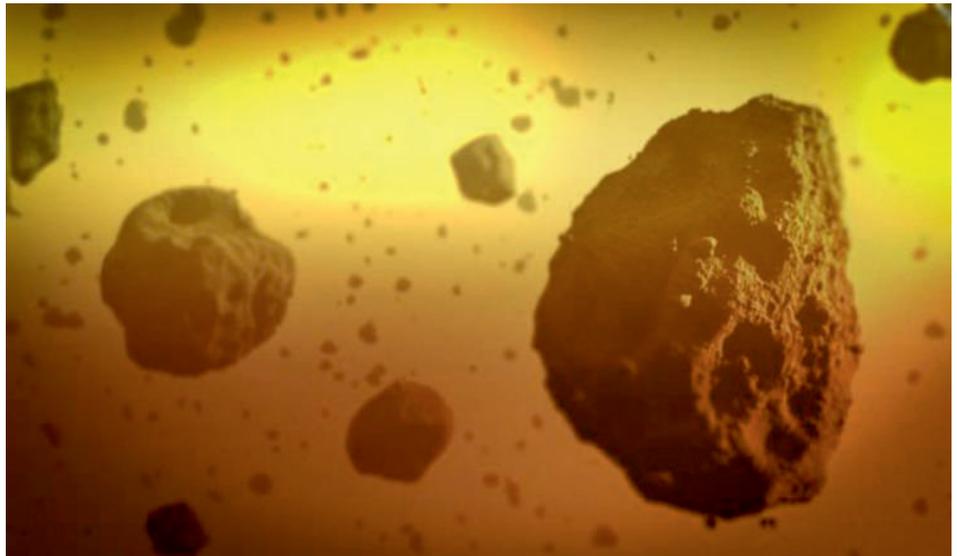
Extending the Life of Your Equipment Through Particle Counts



These are the words of an unnamed supervisor of a lubrication technician in my recent Oil Analysis Level II course. This technician knew that couldn't be right — as did I and just about everyone else in my class. It's a bit perplexing to hear a statement like that. How could he possibly think that? By the end of the week, not only was there a clear understanding of the importance of particle counts, but a very strong understanding as to why it might be the most important as pectin preventing equipment failure.

To understand this, let's start with why. Why do we analyze wear debris? Why do we analyze particle contamination?

Wear debris is a crucial early sign of machine failure. It's like a lit fuse to a catastrophic event, especially for critical machines. Most condition monitoring technologies and predictive maintenance strategies focus on discovering the signs of failure as soon as possible. After all, wear debris is a direct result of metal being removed from surfaces, usually from frictional interactions. The severity and urgency of wear debris issues should not be



“Only do something if wear metals show up on the oil analysis reports. Don't do anything with high particle counts.”

— Unnamed Supervisor

underestimated, and if discovered quickly and acted upon correctly, the progression of failure can be slowed down or delayed.

But why did the failure occur in the first place? What is the match that lit the fuse? While there could be many culprits, contamination is well-documented by machine OEMs and user group studies as the most common root cause of machine failure. And

of the forms of contamination responsible for machine failure, particle contamination is the most common. Thus, monitoring and controlling contamination in machines is how we prevent equipment failure — even before it begins. How is this possible? By tracking particle counts on oil analysis.

Here are some of the reasons why tracking particle counts bring you benefits across the life cycle of the lubricant, the life cycle of the

machine, and the many maintenance activities in between:

1. Particle counts help validate a lubricant's conditions before it's even in the machine

When lubricants are purchased, their cleanliness must be determined. Unfortunately, new oil doesn't always mean clean oil. New oil cleanliness is critical, not just for avoiding particle-induced wear in the machine, but also for avoiding damage to the lubricant during periods in storage containers. Particles can strip additives and promote oxidation. And if lubricants are transferred to the machines using dirty transfer equipment or dirty top-up containers, this will be picked up quickly with particle counts as well.

2. Particle counts help monitor the contamination control objectives on the machine

Firstly, particle counts are great for trending and confirming target cleanliness levels over time, allowing for the detection of compromises in contamination exclusion practices, which can include a loss in the performance of shaft seals, head space breathers and cylinder wiper seals. Similarly, particle counts can also monitor contamination removal effectiveness, such as impaired filter or centrifuge performance. The exclusion and removal practices must always be kept in balance for optimal proactive maintenance.

3. Particle counts help optimize the timing and urgency of maintenance activities

Simply knowing when to change a filter can be indicated by particle counts — often sooner than the differential pressure gauge on the filter. But similarly, if machine conditions change (including atmospheric contamination levels), particle counts can be validation that the filter choice is appropriate for the application. And for machines that do not have permanently installed filtration systems, particle counts can help determine the timing of filter cart usage.

4. Particle counts help optimize oil analysis activities

Monitoring for particle contamination is established as a routine oil analysis test for nearly all machines on oil analysis. High particle counts are simply a sign of an issue and a trigger for the technician to investigate the cause, which involves the analysis of data across several oil analysis tests, including the addition of exception tests. For example, analytical ferrography is too costly and unnecessary to perform routinely, but a series of rising particle counts, or one abnormal spike, can be the justification for such tests.

5. Particle counts help catch operating or maintenance human-induced errors

If repair work was performed or machines were recently installed with new parts, particle counts can monitor for botched work. This may include debris from machining or welding or airborne contaminants that entered the machine while work was being performed that were not properly filtered out before start-up. Particle counts can also monitor for abnormal break-in wear.

6. Particle counts help discover machine issues or early signs of machine wear

Monitoring the overall health of machine components such as pumps, bearings and gears can be linked directly to the trends of particle counts. This includes monitoring for contamination intrusion and wear debris. But similarly, particle counts will watch ancillary components for issues that can lead to collateral damage to the primary components, like ruptured filters, unexpected filter bypass, or other filter failures from unusual operating conditions, such as cold-start conditions.

7. Particle counts help alert to Lubricant issues

Various types of wear can occur when lubricants are not selected correctly or aren't performing as expected. Improper viscosity selection, additive depletion or impaired performance from other contaminants (such as air and water) can lead to gravitation wear, corrosive wear or oil film failure. This can be indicated by rising particle counts.

8. Particle counts help troubleshoot and solve problems

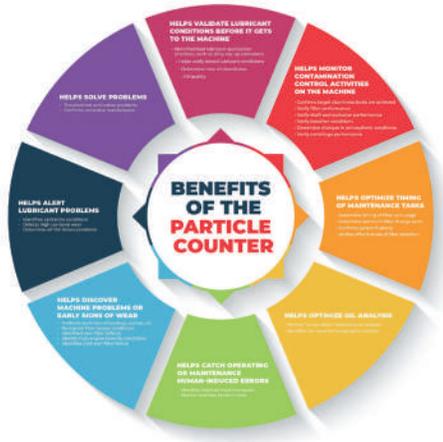
After problems are discovered, whether its high contamination, abnormal wear or even lubricant failure, particle counts can be a tool in the troubleshooting process. For example, analyzing the results of the particle counts after testing at different points in a circulating system can be a quick indicator of where the ingress source or wear generation source is located. Even after corrective actions are in place, the ongoing monitoring of particle counts can validate that the solution was successful.

The Right Test Slate

Particle counters have a multitude of uses and, when used correctly, can greatly improve equipment reliability. Considering that the particles being monitored by the trending data from a particle counter include both contamination (which causes wear) and wear debris (the effect of wear), the particle counts can be both a leading indicator and a lagging indicator of machine failure.

Where many fall short in reaching the real opportunity of particle counts is connecting the dots between cause and effect. Take, for example, monitoring for wear metals with elemental analysis or ferrous density: These are critical indicators for machine failure and must be on most oil analysis test slates. But if one is only looking for wear debris by itself, then the damage is already in progress and

may be too far developed to correct the problem without shutting the machine down.



looking at the concentration of particles at different specific sizes, with 4 microns as the smallest reported size. Thus, there are shortcomings when trying to identify contaminant type or monitor for contaminants at smaller micron sizes, which are both very important in oil analysis. Also, interference challenges can exist with certain types of particle counters, and even sampling practices can play a large role in creating false positives or false negatives. All of this can be remedied with the right awareness, training and implementation of best practices.

ement in nearly all oil analysis test slates. The value is even greater when considering a particle counter as an on site oil analysis instrument to allow for more frequent and immediate answers to particle contamination concerns. Staying focused on the root cause is the theme behind effective proactive maintenance. This includes establishing optimum cleanliness targets, taking specification to control contamination, and measuring contaminant levels frequently. This cannot be accomplished without vigilant practices using particle counts.

Particle counting isn't perfect. It's only

preventing failure, but it is an essential el-

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THE CHOLESTEROL TRAP : WHY ‘NORMAL’ OIL REPORTS CAN LEAD TO SYSTEM HEART ATTACKS



In the field of industrial maintenance, we often rely on laboratory reports as we often rely on laboratory reports as the definitive benchmark for lubricant health. We scan the results for “Red” or “Yellow” flags, and if everything looks “Green,” we assume the machine is safe. However, there is a critical discrepancy frequently observed in aging systems : a lubricant that has been in service for over a decade returns a “Normal” report, while the machine itself is on the verge of a catastrophic failure.

This situation is strikingly similar to a human medical check-up. Imagine a person who looks fit, has a normal body temperature, and a steady pulse. To a basic observer, they are healthy. But deep within their arteries, cholesterol is silently accumulating. Their “basic” vitals are fine, but their “lipid profile” indicates a latent critical risk.

In turbine systems, ignoring the “cholesterol” of the oil—varnish precursors — is significantly increases the risk of unpredicted failure

The Illusion of the “Clean” Report

Consider a common scenario: A turbine oil has been circulating for maybe 10 or 12 years. The maintenance team notices the oil has turned a dark, tea-like color. Suspicious, they send a sample to the lab. The results come back : Viscosity is stable, Total Acid Number (TAN) is normal, water content is normal, and Wear Metals are well within limits.

The report is “Green.” The team is told to “Continue Monitoring.” Yet, a few months later, a critical servo valve sticks, or a bearing temperature suddenly spikes. Upon opening the system, they find a thick, brown, lacquer-like coating on the metal surfaces. How can a ‘healthy’ report lead to such a catastrophic failure? The answer lies in the limitations of standard diagnostic “vitals.

Why Standard Tests Often Function as an Initial “Pulse Check”

Standard oil analysis packages are primarily effective for identifying acute changes in lubricant health. Much like a routine temperature or heart rate check, these tests are essential yet may not fully capture chronic, internal degradation such as the gradual

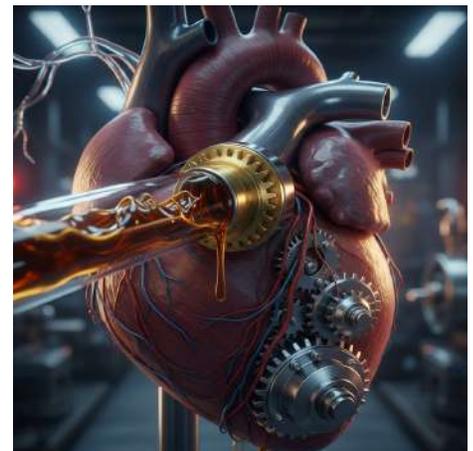


Figure 1: Diagnosing the Silent Killer — Identifying varnish precursors as industrial cholesterol to prevent catastrophic turbine failure

buildup of varnish precursors:

- **Viscosity and TAN :** These parameters are best understood as lagging indicators. Typically, by the time viscosity or acidity rises significantly, the lubricant may have already reached an advanced stage of degradation.
- **Elemental Analysis (ICP):** This test “sees” metallic particles. It is often ineffective at detecting organic “sludge” (varnish) that plates out on critical turbine components.



Human Medical Check-Up

Turbine Oil Monitoring

Standard Vital (Initial Check)	Measures body temperature, pulse, and body weight.	Tests Viscosity, TAN (Total Acid Number), water content, and wear metals.
Initial Impression	Body condition appears prime and is declared healthy in general. ✔	Parameters remain within normal limits despite slight changes. ✔
Comprehensive Check (In-depth)	Conducts laboratory tests for Cholesterol and Glucose levels.	Conducts specific tests for RPVOT/RULER (antioxidant health) and MPC (varnish potential).
Critical Findings	Found very high levels of cholesterol and glucose.	RPVOT/RULER values are below 25% (protection depleted) and MPC is above 50 (high deposit potential).
Final Risk	Danger: High risk of a sudden heart attack. ✘	Danger: Risk of catastrophic unit failure. ✘

Figure 2: The Diagnostic Parallel: Comparing Human Health Vitals with Turbine Oil Monitoring

The “Lipid Profile” for Turbines : The Critical Three

To truly understand the health of an aging turbine lubricant, you must look at the tests that measure the “unseen” risks. If your oil is more than five years old (or maybe faster for gas turbine), these three tests are essential components of your monitoring strategy :

1. MPC (Membrane Patch Colorimetry) – Measuring the Plaque

MPC (ASTM D7843) is the direct equivalent of a cholesterol test. It pulls a sample through a filter and measures the color intensity of the residue. This test captures the “soft” contaminants that standard tests ignore. A high MPC value means your oil is “saturated” and starting to dump “plaque” (varnish) onto your valves.

2. RULER (Remaining Useful Life Evaluation Routine) – The Immune System

In our bodies, certain factors help manage cholesterol. In oil, that role is played by antioxidants. RULER (ASTM D6971) quantifies the concentration of these additives. If your antioxidants are depleted, the oil has lost its “immune system.” Even if the oil looks “Normal” today, it has no defense against the heat of tomorrow.

3. RPVOT (Rotating Pressure Vessel Oxidation Test) – The Stress Test

RPVOT (ASTM D2272) is the “cardiovascular stress test” for your lubricant. It subjects the oil to extreme oxidation pressure to see how much “stamina” it has left. For an oil that has served for 10 years, RPVOT reveals whether the fluid is still capable of protecting the machine or if it is on the brink of total breakdown.

If your maintenance team reports varnish deposits or dark oil, but the lab report says “Normal,” the lab hasn’t failed—your testing suite has. Field observations (color, valve sluggishness) are the “symptoms.” Never ignore a symptom just because the “pulse check” (Viscosity/TAN) looks fine.

Conclusion

We would never accept a medical check-up that ignores cholesterol for a patient at risk. Why should we treat our multi-million dollar turbines any differently? For aging turbine lubricants, A ‘Normal’ status can create a false sense of security if not validated by complementary tests. By integrating MPC, RULER, and RPVOT into your monitoring regime, you transition from reactive witnessing to proactive reliability. Don’t wait for a “system heart attack” to realize your oil’s arteries were clogged all along.

About the Author



M.N. Ahab

A lubrication and reliability professional with nearly a decade of field experience across diverse heavy industries, including cement, mining, power generation, and marine sectors. As a Certified Machinery Lubrication Technician (MLT) II, he focuses on bridging the gap between technical theory and practical industrial application. He is dedicated to translating complex data into actionable maintenance strategies that enhance asset reliability and operational efficiency for field practitioners.

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***Disclaimer :** The insights shared in this article are based solely on the author’s personal field experience and professional observations. They do not necessarily reflect the official views or policies of any organization or entity with which the author is affiliated. As machine operating environments and site-specific conditions vary significantly, it is essential to consult with certified lubrication experts before implementing critical maintenance strategies*



HOW NMG 35 F BOOSTED EFFICIENCY IN ROTOMOULDING BEARINGS

Industry: Manufacturing | Application: Rotomoulding Bearings | Location: Saudi Arabia

Overview

A leading rotomoulding manufacturer in Saudi Arabia was grappling with persistent lubrication issues that hampered operational efficiency and increased downtime. Key problems included grease caking, leakage at high temperatures, and the need for frequent regreasing, leading to elevated maintenance costs and disruptions. The client partnered with us to find a reliable and sustainable lubrication solution.

Challenges

- Frequent formation of dry lumps and caked grease, impairing bearing performance
- Grease leakage under high-temperature conditions (up to 300°C)
- Short regreasing intervals (every 8–9 days), adding to labor and downtime
- Existing greases failed to withstand prolonged heat exposure
- Difficulty sourcing high-performance greases at cost-effective rates

Solution

We recommended **Molygraph NMG 35 F**, a high-performance grease formulated specifically for demanding applications like rotomoulding.

Key Benefits:

- Excellent high-temperature stability—suitable for operations up to 300°C



- Long-life lubrication reduces regreasing frequency and maintenance cycles
- Prevents overheating and premature bearing failure
- Ensures consistent film strength and performance under thermal stress

Product Specifications

NMG 35 F is a synthetic non-melt grease fortified with PTFE, NLGI # 2.

Results Achieved

- **Improved Performance:** NMG 35 F delivered consistent lubrication across all bearing sections of the rotomoulding unit.
- **Controlled Operating Temperatures:** Helped maintain ideal temperature range throughout the process.
- **Higher Efficiency:** Enhanced machine reliability and uptime without compromising on product quality.

- **Cost Efficiency:** Reduced lubricant consumption and extended maintenance intervals.

At Molygraph, our approach has always been solution driven. With more than five decades of experience, we've developed a wide portfolio of specialty lubricants tailored to industry specific challenges—from crusher bearings in sugar mills to continuous casters in steel plants and advanced greases for automotive applications. Our in-house R&D team works closely with OEMs and end-users to design formulations that meet stringent technical, environmental, and sustainability benchmarks. This combination of deep domain knowledge, technical expertise, and customization is what allows us to deliver results that generic lubricants cannot.

To know more about our products & offerings, visit - <https://www.molygraph.com/>



END-TO-END LUBRICATION SOLUTIONS FOR THE STEEL INDUSTRY



Steel production is not just the backbone of modern infrastructure; it's also one of the most demanding industrial processes, where every step involves high mechanical loads, extreme temperatures, contamination, and constant pressure to optimize output while minimizing downtime.

In such a high-stress environment, lubrication plays a critical role. It's not merely about keeping machines running; it's about protecting assets, improving safety, enhancing energy efficiency, and ultimately driving profitability. From the intense heat of rotary kilns in sponge iron units to the precise requirements of continuous casting machines and the high-speed demands of rolling mills, the choice of lubricant can influence everything from component longevity to operational stability.

The Role of Lubrication Across the Steel Value Chain

Each stage of steel manufacturing presents its own unique set of challenges. A one-size-fits-all approach doesn't work. The lubrication strategy needs to be nuanced, tailored, and responsive to both the application and its environment.

1. Sponge Iron & Parallelization



Rotary kilns and slip seal applications demand greases that can endure extreme temperatures and abrasive environments. Here, high-viscosity, wear-resistant greases are essential to prevent component degradation and gear failure. Advanced formulations provide robust protective films, reducing wear and extending re-lubrication intervals.

2. Sinter Plants & Blast Furnaces

Open gears, rotary mixers, and skip cars operate under intermittent loads and temperature shocks. In these areas, graphite-enriched greases and aluminum complex thickeners

offer the dual benefits of thermal stability and shock load resistance. Equipment like hydraulic mud guns and drill chains also benefits from high-load greases that remain pump able across varying ambient conditions.

3. Continuous Casting Machines (CCM)

Water ingress and high loads are the primary challenges here. The greases used must be water-resistant, shear-stable, and capable of maintaining consistency under constant stress. Bearings in withdrawal sections, tur-

rets, and roller tables require long-life EP (Extreme Pressure) greases with enhanced corrosion protection.

4. Hot & Cold Rolling Mills

The rolling stage demands precision and resilience. Work roll bearings, chokes, and drive shafts undergo continuous stress at high speeds and elevated temperatures. Calcium sulfate and polyurethane greases have become reliable solutions for these areas due to their mechanical stability, water washout resistance, and load-handling capabilities.

5. Auxiliary Systems and Finishing Lines

Beyond the core processes, support equipment such as cooling beds, cranes, fans, re-heating furnaces, and pickling lines requires greases suited to intermittent operation, chemical exposure, or fluctuating temperatures. Multipurpose greases that combine anti-wear, anti-corrosion, and thermal stability properties serve these needs well.

Lubricants for Real-World Demands

Today's lubricants must do more than reduce friction. They must reduce maintenance frequency, optimize energy consumption, resist contamination, and ensure machine availability even under unpredictable conditions. This demands an in-depth understanding of tribology, metallurgy, and plant operations.

Lubricant manufacturers working closely with steel plants are now offering:

- Tailored solutions based on component-level assessments
- Field-tested performance data under actual plant conditions
- Support for centralized lubrication systems and automated grease lines
- Problem-solving partnerships beyond the product — extending to training, audits, and monitoring

Lubrication and the Shift Towards Sustainable Steel making

As the global steel industry moves toward recarbonization and cleaner production, lubricants are also evolving. There is a growing shift toward biodegradable and low-toxicity formulations that meet performance standards without compromising environmental responsibility. Greases with longer service life not only reduce waste but also lower overall lubricant consumption, helping plants meet both economic and ESG goals.

Eco-conscious lubrication strategies now focus on:

- Minimizing lubricant leakage and runoff
- Using formulations with renewable or non-toxic base oils
- Enhancing energy efficiency through friction reduction
- Lowering emissions associated with frequent lubricant replacement

Lubrication technology providers have increasingly evolved from being mere suppliers to becoming technical partners for the steel industry. Modern lubrication solutions now encompass a wide range of applications, including open gears, slip seals, bearings, and high-performance spray systems.

Beyond product selection, effective lubrication management involves on-site collaboration with steel plants to optimize lubrication schedules, analysis root causes of equipment failures, and implement maintenance strategies aimed at reducing downtime and operational costs. This application-driven approach has helped establish certain lubricant technologies as benchmarks across multiple steel facilities. Although lubrication often operates in the background of steel man-



ufacturing, its influence on plant performance is substantial. It plays a critical role in equipment reliability, safety, energy efficiency, and sustainability. As steel plants continue to modernize and operate under increasing performance and environmental pressures, the adoption of intelligent, adaptable lubrication strategies is becoming an essential component of long-term operational excellence.

About the Author



Samarth Shah is a highly skilled individual with qualifications in Law and Business Management. However, his true passion lies in expanding the reach of Molygraph Lubricants on a global scale. He has played a pivotal role in leading international business teams and marketing teams and has successfully established a wide network of channel partners across the world. Contact Mr. Samarth Shah at samarth@molygraph.com.



WHY YOUR COOLANT FAILS

The Hidden impact of Water Quality

The Frustrating Reality of the Shop Floor

Anyone who has worked around CNC machines has seen the symptoms: the pungent 'Monday morning' odor, sticky residues on the ways, flash rust on parts, and foam overflowing the sumps. The immediate assumption is that the coolant oil is 'bad' or that the supplier has lowered their quality.

But the truth is often surprising. Most coolant failures are not caused by the oil, but by the water it is mixed with. Because coolant is 90–95% water, your water quality dictates your tool life and maintenance budget. If the water chemistry is wrong, your performance will be wrong, no matter how premium the oil is.

What is Your Water Carrying?



The Cost of Contamination: Visible emulsion failure caused by high mineral loads in source water

Water that looks crystal clear to the naked eye is often loaded with dissolved minerals. Your coolant system doesn't see 'water'; it sees a chemical load of ions picked up from soil, limestone, and deep underground rock formations.

The primary culprits are Calcium (Ca²⁺) and Magnesium (Mg²⁺), which define water

hardness. However, other 'hidden passengers' like Chlorides, Sulfates, and Silica act as aggressive agents that quietly disrupt coolant chemistry, shorten tool life, and drive up costs.

How Minerals Sabotage Your Results

Coolant concentrate is a finely balanced

chemical engine. When the mineral load in your water is too high, it triggers a chain reaction of shop-floor problems:

- **Emulsion Splitting:** Calcium and magnesium react with emulsifiers, causing the oil to separate and float. This robs the tool of lubrication, leading to poor surface finishes.
- **‘Calcium Soaps’:** Hardness ions react with fatty acids to form sticky white deposits that choke filters, pipes, and high-pressure nozzles.
- **The Corrosion Paradox:** Hardness neutralizes corrosion inhibitors. The result is ‘flash rust’ on machine beds and brown staining on finished components.
- **Bacterial Breeding:** Hard water weakens biocides and drops the pH, creating a playground for bacteria that cause foul odors and skin irritation.

The Hidden Cost of ‘Free’ Water

Ignoring water quality is an expensive mistake. Plants using uncontrolled hard water typically experience 30–50% higher coolant consumption due to premature emulsion breakdown. When you factor in machine downtime for cleaning and reduced tool life, “free” tap water becomes one of the most expensive raw materials in your plant.

The Shop-Floor Auditor: Quick Reference Guide

Use these benchmarks to diagnose your water and stabilize your process.

I. The ‘Green Zone’ Standards

Test your source water (RO or Tap) before mixing. Aim for these targets:

Parameter	The ‘Green Zone’	Impact if Too High
Hardness	80–150 ppm	Emulsion splitting, sticky scum
TDS	< 250 ppm	Rapid mineral buildup in sumps
Chlorides	< 50 ppm	Pitting and “Flash Rust” on beds
pH Level	6.5 – 7.5	Additive instability/ Biocide failure

II. Sump Troubleshooting: Action & Response

Symptom	Probable Cause	Practical Fix
Foul Odor	Low pH / Hard Water	Check pH; Top up with soft water + oil.
Floating Oil	Hardness >300 ppm	Drain 20%; top up with RO water.
Sticky Residue	Calcium Soap	Clean filters; switch to softer source.
Excessive Foam	Water ‘Too Pure’ (<30 ppm)	Blend 20% tap water into your RO water.

III. The Golden Rules of Mixing and Top-Ups

1. The Evaporation Trap

Evaporation concentrates minerals. As water evaporates, minerals stay behind; if you top up with hard water daily, the hardness levels will eventually double or triple.

The Fix: Always use RO or Softened water for daily top-ups to maintain a stable mineral balance.

2. The O-I-L Rule

Never add water to a container of oil concentrate. This creates an unstable ‘invert emulsion.’ To ensure a stable bond, always add Oil In Liquid. Slowly pour the concentrate into the water while stirring.

Conclusion: Control Your Water, Own Your Profits

The math is simple: You cannot have a stable emulsion with unstable water. In modern machining, coolant management is no longer a ‘janitorial’ task—it is a critical engineering process.

If you treat your water as a precision raw material rather than a basic utility, you stop being a ‘firefighter’ dealing with smells and rust. Understanding the minerals your water carries is the most important, yet most overlooked, part of shop-floor reliability. Stop fighting your coolant and start managing your water. Your tools, your machines, and your bottom line will thank you.

About the Author



Kunal is a Chemical Engineer and Lubrication Specialist with an MBA. He works at the intersection of lubrication management, oil analysis, and predictive maintenance, helping industries reduce failure rates, improve uptime, and future-proof their maintenance strategies through audits, consulting, and training.



INDUSTRY LEADERS CONVERGE AT THE 3RD ROSEFIELD CONFERENCE FOR LUBRICANTS AND FUELS 2025



The 3rd Rosefield Conference for Lubricants and Fuels was successfully held on 12th and 13th November 2025 at Nesco, Mumbai, marking the most expansive and influential edition of the platform to date. Organised by Rosefield Energy Tech, the two-day conference brought together over 640 delegates and featured 37 exhibition stalls, creating a comprehensive industry platform that brought together lubricant manufacturers, additive companies, base oil producers, OEMs, policymakers, researchers, sustainability leaders, and technology providers from India and overseas.

Centered on the theme “India at the Crossroads: Lubrication Strategies for Next Generation Fuels,” the conference served as a high-level forum to examine how evolving fuel pathways, regulatory transitions, and technological advancements are reshaping lubricant requirements across automotive and industrial applications.

The conference opened with a welcome address by Mr. Shailendra Gokhale, Founder and Director of Rosefield Energy Tech, who underscored the growing importance of col-



laboration as the industry navigates simultaneous transitions in fuels, emissions norms, and performance expectations. He highlighted the role of the Rosefield Conference as a neutral platform enabling informed dialogue and long-term alignment.

The keynote address was delivered by Mr. Keith Corkwell, Senior Vice President and President of Lubrizol Additives and The Lubrizol Corporation. Drawing on global experience, he spoke about the multi-pathway future of mobility and the continued

relevance of advanced lubricants across internal combustion engines, electrification, and alternative fuels, emphasizing the need for faster innovation cycles and deeper value chain collaboration.

A leadership insight address by Mr. Sandeep Kalia, Managing Director of Valvoline Cummins Pvt Ltd, focused on India's strong lubricant market fundamentals despite global slowdown, highlighting premiumisation, longer drain intervals, and rising demand for high performance formulations. The

Chief Guest address by Mr. Rajendra Petkar, President Emerging Mobility and Technology Strategy at Tata Motors Limited, offered an OEM perspective on the multi fuel future and the growing influence of software defined vehicles, electronics, and service led mobility models.

Across two days, the conference featured a comprehensive agenda covering future fuel mix, biofuels, hydrogen, base oils, automotive and industrial lubricants, metalworking fluids, artificial intelligence, EV and data centre cooling fluids, and sustainability. Sessions were led by senior experts from organisations including BPCL, HPCL, IOCL, Ashok Leyland, IIT Delhi, AM Green, ADNOC Distribution, Lubrizol, Infineum, Shell, Castrol, PETRONAS Lubricants International, Veedol, Gulf Oil, Lanxess, Savita

Oil Technologies, and Streamz AI.

The exhibition running alongside the conference featured 37 exhibition stalls showcasing lubricant manufacturers, additive suppliers, base oil producers, testing laboratories, packaging and equipment providers, and technology companies. The exhibition floor served as a vibrant networking hub, facilitating business discussions, technical interactions, and partnership exploration across the industry.

The evening of 12 November featured the prestigious Rosefield Awards 2025 ceremony, recognizing excellence across 9 categories- marketing, technology advancement, sustainability, manufacturing innovation, digital transformation, safety innovation, supply chain excellence, customer service,

and community development. The ceremony celebrated organisations and professionals driving progress through innovation and long-term value creation.

With strong participation, in depth technical discourse, and senior leadership engagement, the 3rd Rosefield Conference for Lubricants and Fuels reaffirmed its position as one of India's leading industry platforms, reflecting the sector's collective commitment to innovation, sustainability, and future readiness. Building on this momentum, the 4th Rosefield Conference for Lubricants and Fuels is scheduled to take place on 28th and 29th October 2026, continuing the platform's role in shaping strategic dialogue and industry collaboration.

5th Rosefield Conference on Circular Economy in Used Oil

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ERGONOMICS REDEFINED: HOW SMALL ADJUSTMENTS CAN PREVENT BIG PROBLEMS



In industrial workplaces, strength and precision often take center stage, but behind every well-maintained machine is a human body that deserves just as much care. Ergonomics, often dismissed as a “desk job concern,” is just as critical on the shop floor. The good news? Small adjustments can lead to big changes in how you feel and perform at work.

1. The Power of Posture

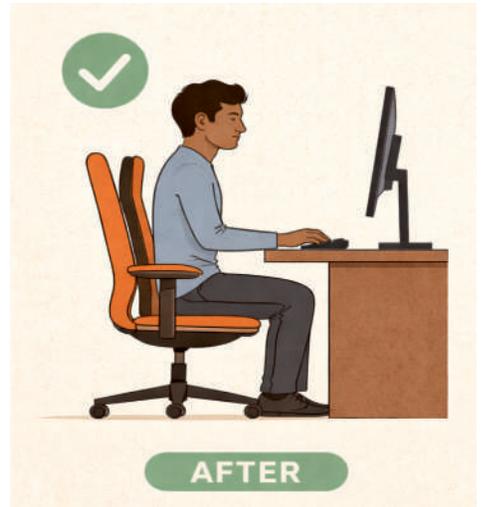
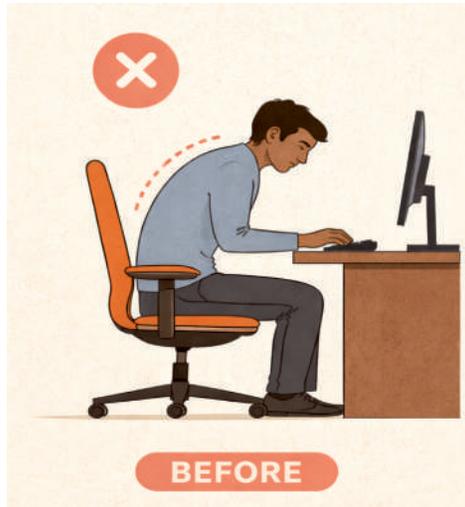
Posture is the foundation of ergonomic health. Whether you’re operating a lathe or monitoring machinery, maintaining a neutral spine, where your back’s natural curve is preserved, is key.

Tip: Keep your shoulders relaxed, elbows close to your body, and your head aligned with your spine. Even slight forward bending, when repeated for hours, can strain the neck and lower back. Incorporate short standing or stretching breaks every 45–60 minutes to reset your posture.

2. Smart Seating

Industrial professionals often spend part of their shift seated, during control room monitoring, maintenance planning, or quality checks. Unfortunately, many chairs don’t support the body’s natural alignment.

Tip: Choose a chair that supports your lower back’s curve, allows both feet to rest flat on



the floor, and lets knees stay level with hips. Add a small cushion or lumbar roll if needed.

3. Lighting

Poor lighting doesn’t just affect visibility, it affects posture and precision. Workers often lean forward to see better, leading to eye strain and neck discomfort.

Tip: Combine ambient lighting with task lighting at workstations. Use LED fixtures with neutral white light for better color accuracy and contrast. Regularly clean light covers and position sources to minimize glare or shadows on your workspace.

4. Movement is Maintenance

Staying static for long periods, even in an ideal posture isn’t ergonomic. Movement is essential for circulation and muscle balance.

Tip: Incorporate simple movement breaks: shoulder rolls, wrist circles, or calf raises every hour. These micro-movements prevent stiffness and promote long-term joint health. Redefining Ergonomics for the Modern Workforce Ergonomics isn’t about expensive equipment or fancy chairs; it’s about awareness and habit. By making small, intentional adjustments in posture, seating, lighting, and tool handling, industrial professionals can prevent injuries, enhance focus, and sustain performance for years to come.

After all, the best-maintained machine in your workplace should be you.





THE ‘RELIABILITY JUGAAD’

Why World-Class Lubrication is the Ultimate Maintenance Jugaad



In the bustling industrial hubs of India—from the coal belts of Dhanbad to the textile clusters of Tirupur—we have a shared superpower: Jugaad. We are masters of finding clever, low-cost ways to make things work.

But in a modern factory, there are ‘Bad Jugaad’ and ‘Smart Jugaad.’

Bad Jugaad is using a piece of wire to hold a sensor or using ‘any old grease’ to save a few rupees today, only to face a ₹ 20 Lakh breakdown tomorrow.

Smart Jugaad is Precision Lubrication. It’s the art of doing simple, common-sense things so well that your machines—the massive engines of your business—never have a reason to stop.

Whether you are in Steel, Cement, Mining, or Textiles, lubrication is the ‘secret sauce’ of your success.

Why Lubrication is the ‘Common Thread’ of Indian Industry

Every industry faces a ‘Villain,’ and the right lubricant is the ‘Hero’ that fights it:

- **Steel & Mining:** The villains are Heavy



Smart Lubrication: The heartbeat of Indian industry

Loads and Dust. In a Jharkhand mine, a 240-ton haul truck puts immense pressure on its joints. Without ‘Extreme Pressure’ additives, the metal would literally weld together.

- **Cement & Rubber:** The villain is Extreme Heat. In a kiln near Satna, temperatures reach levels that turn standard oil into black ‘kadai-carbon’ in minutes. You need synthetics that thrive in fire.

- **Textile & Paper:** The villain is Friction at High Speed. When spindles spin at thousands of RPM, the wrong oil causes the machine to ‘sweat’ heat and waste electricity. Here, the right oil is an energy saver.

Myths Busted: Understanding Lubrication Like a Pro

To a non-technical manager, oil might just

look like ‘slippery liquid.’ Let’s use everyday examples to understand the science behind ‘Smart Jugaad.’

1. The ‘Sand in the Eye’ Effect (Contamination)

You might think, ‘How can a speck of dust hurt a 50-ton steel crusher?’ Think of your eye. It’s small, but a single grain of sand makes it red, painful, and useless until it’s out. Inside a bearing, the gap between moving parts is thinner than a human hair. When Indian road dust gets in there, it acts like a diamond-tipped saw, scratching the smooth steel.

The Smart Jugaad: Wiping a grease nipple before use is like washing your hands before a meal. It keeps the ‘stomach’ of your machine clean.

2. The ‘Swimming Pool’ Problem (Over-Greasing)

In many Indian plants, we see grease ‘oozing’ out of machines. We think ‘more is safer,’ but we are actually suffocating the machine. Imagine running a race chest-deep in water. You have to push harder, you get tired faster, and your body heat shoots up. Over-greasing forces the machine to ‘plow’ through thick grease, resulting in internal friction and excessive heat.

The Smart Jugaad: Don’t grease until it leaks. Use a measured amount. A machine needs to move freely, not feel ‘stuffed’ like someone who overate at a wedding.

3. The ‘Desi Ghee’ Choice (Synthetics vs. Mineral)

Why pay 3x more for ‘Synthetic’ oil? Think of cooking. If you use Vanaspati to fry all day, it eventually turns black and sticky. Pure Ghee handles much higher heat without burning. In high heat industries, cheap oil turns into sludge (black gunk) that blocks your machine’s ‘veins.’

The Critical Layer: Viscosity Beyond the type of oil, you must consider Viscosity—the ‘thickness’ of the fluid. It is the single most important property of any lubricant. Using the wrong viscosity is like trying to breathe through a straw; it suffocates the machine’s moving parts. If the oil is too thin, it cannot support the load; if it is too thick, the machine wastes energy and overheats.

The Smart Jugaad: High-quality oil is ‘Premium Fuel.’ It lasts 4x longer and keeps your machine’s internals as clean as a new whistle.

Instead of this ‘Bad Jugaad’...	Do this ‘Smart Jugaad’...	Why?
Storing oil barrels in the rain/sun.	Storing barrels horizontally under a roof.	Prevents water and dust from ‘leaking’ in.
Using one dirty pump for all oils.	Using color-coded, labeled containers.	Prevents ‘wrong blood type’ reactions.
Topping up oil when it’s black.	Sending an oil sample for a ‘Blood Test.’	Detects internal ‘diseases’ by measuring wear metals in Parts Per Million (ppm) before a crash.
Ignoring a hot or vibrating gearbox.	Checking temperature and alignment early.	A ₹5,000 fix today saves a ₹5 Lakh repair later.

The ‘Smart Jugaad’ Guide – Better Habits for Higher Reliability

Real Success Stories in India

- **Cement Success:** A plant in Rajasthan was losing bearings every 3 months due to limestone dust. By simply installing Desiccant Breathers (which act like an N95 mask for the gearbox), bearing life jumped to 2 years.
- **Textile Win:** A mill in Tamil Nadu switched to a high-quality synthetic oil for their motors. They saw a 3% drop in electricity bills. In a 24/7 factory, that’s lakhs of rupees saved every year!

The Bottom Line

In the ‘New India,’ we are moving from making do to making world-class. Investing in the right lubricant and keeping it clean isn’t an expense—it’s an investment in your plant’s heart.

Remember: Oil is always cheaper than Steel.

About the author



Sangeeta Iyer, as Publications Manager, she combines 19+ years of expertise in technical writing and editing. She oversees the editorial direction of Machinery Lubrication India, translating complex lubrication and reliability concepts into relatable stories. Her passion lies in making technical knowledge accessible and actionable for industries.



BP SELLS 65% OF CASTROL TO STONEPEAK FOR \$6 BILLION – BIG CHANGE FOR LUBRICANTS MARKET!



In a landmark transaction announced on December 24, 2025, BP p.l.c. has agreed to sell a 65% majority stake in its iconic lubricants business, Castrol, to U.S.-based private equity firm Stonepeak for approximately \$6 billion in net proceeds. The deal values Castrol at an enterprise value of \$10.1 billion, marking BP's largest divestment yet in its ongoing \$20 billion asset sale program aimed at slashing net debt from \$26 billion to \$14-18 billion by 2027.

BP will retain a 35% minority interest in the new joint venture, subject to a two-year lock-up before potential full exit. The proceeds, including \$800 million in accelerated dividends, will bolster BP's balance sheet amid a strategic pivot to core oil and gas operations, following reviews of its "overly complex" portfolio. As of January 16, 2026, the deal awaits customary regulatory approvals and is slated for completion by year-end.

Castrol, with its 126-year legacy, stands as a global leader in high-performance lubricants, serving automotive, marine, industrial, and emerging sectors like electric vehicles and AI data center cooling. Operating 20 blending plants and over 100 facilities across 150 countries, Castrol's products power ev-



BP's Iconic Logo Stands Tall as Company Sells 65% Castrol Stake to Stonepeak for \$6B, Reshaping Global Lubricants Landscape.

erything from Concorde jets to space missions and racing teams. Stonepeak, managing \$80 billion in infrastructure assets, sees Castrol as a "mission-critical" player in the essential lubricants market.

Canada Pension Plan Investment Board (CPP Investments) commits up to \$1.05 billion, gaining an indirect stake. Stonepeak's Anthony Borreca praised Castrol's "iconic brand and differentiated products," while Castrol CEO Michelle Jou highlighted the partnership's potential for innovation. CPP's Bill Rogers noted its role in energy transition

applications.

For the Indian market, Stonepeak must launch a mandatory tender offer for 26% of Castrol India Ltd. shares post-closing, valued at ₹4,990 crore, per SEBI regulations.

Industry analysts like RBC question the sale of this "cash generative, low capital intensity" asset, citing risks to BP's long-term earnings quality. Yet, for machinery lubrication professionals in India, the shift promises sustained premium product availability amid growing industrial demand.

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