Machinery Lubrication

INDIA July-August 2017

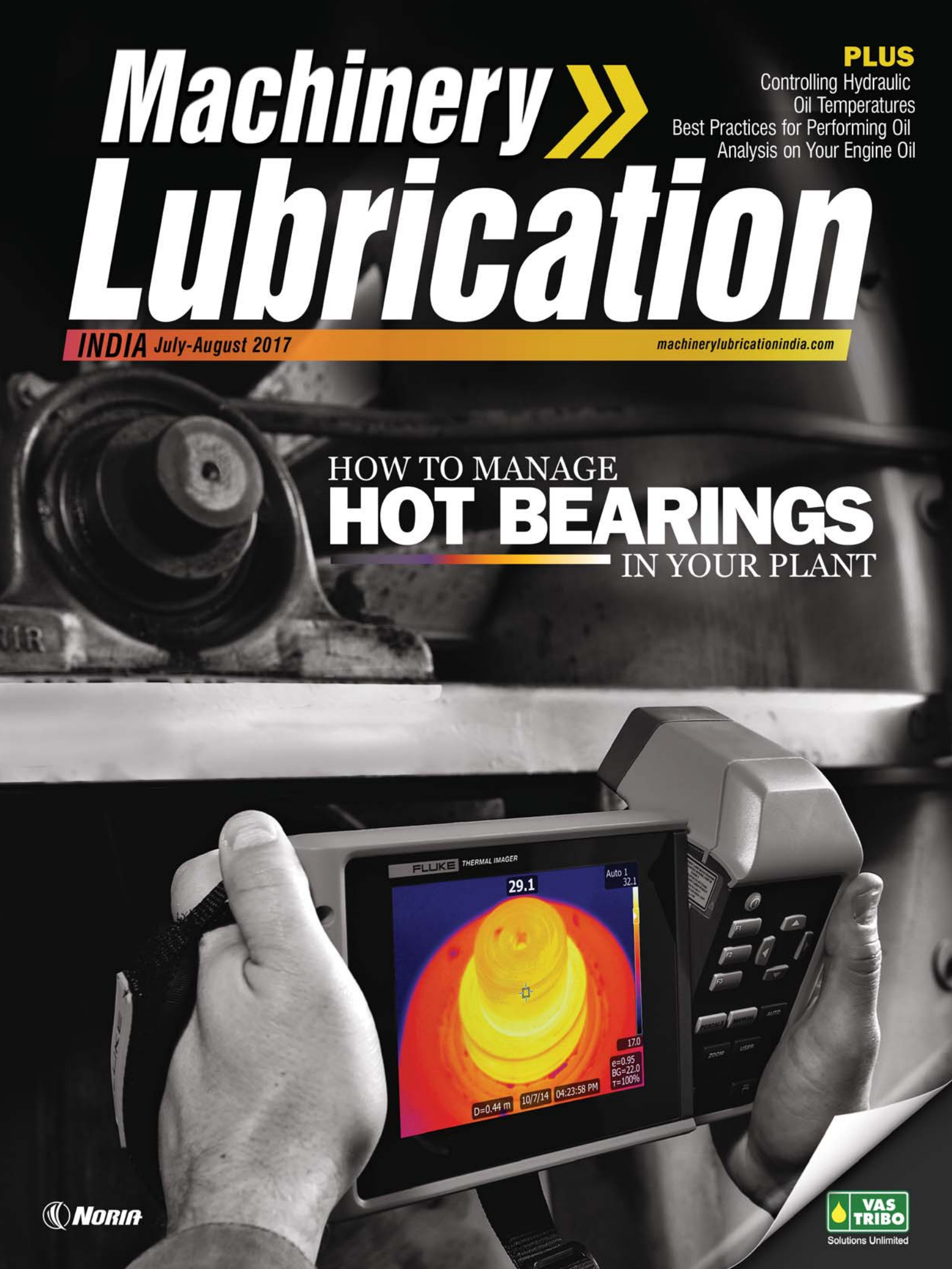
machinerylubricationindia.com

PLUS

Controlling Hydraulic Oil Temperatures

Best Practices for Performing Oil Analysis on Your Engine Oil

HOW TO MANAGE HOT BEARINGS IN YOUR PLANT



RPM isn't just revolutions per minute. It's also Rupees per minute.

In a machine shop, time is money. And downtime is no money.
To see how Mobil™ can enhance your profitability with its cutting-edge range of industrial lubricants,
visit **mobil.com/industrial**

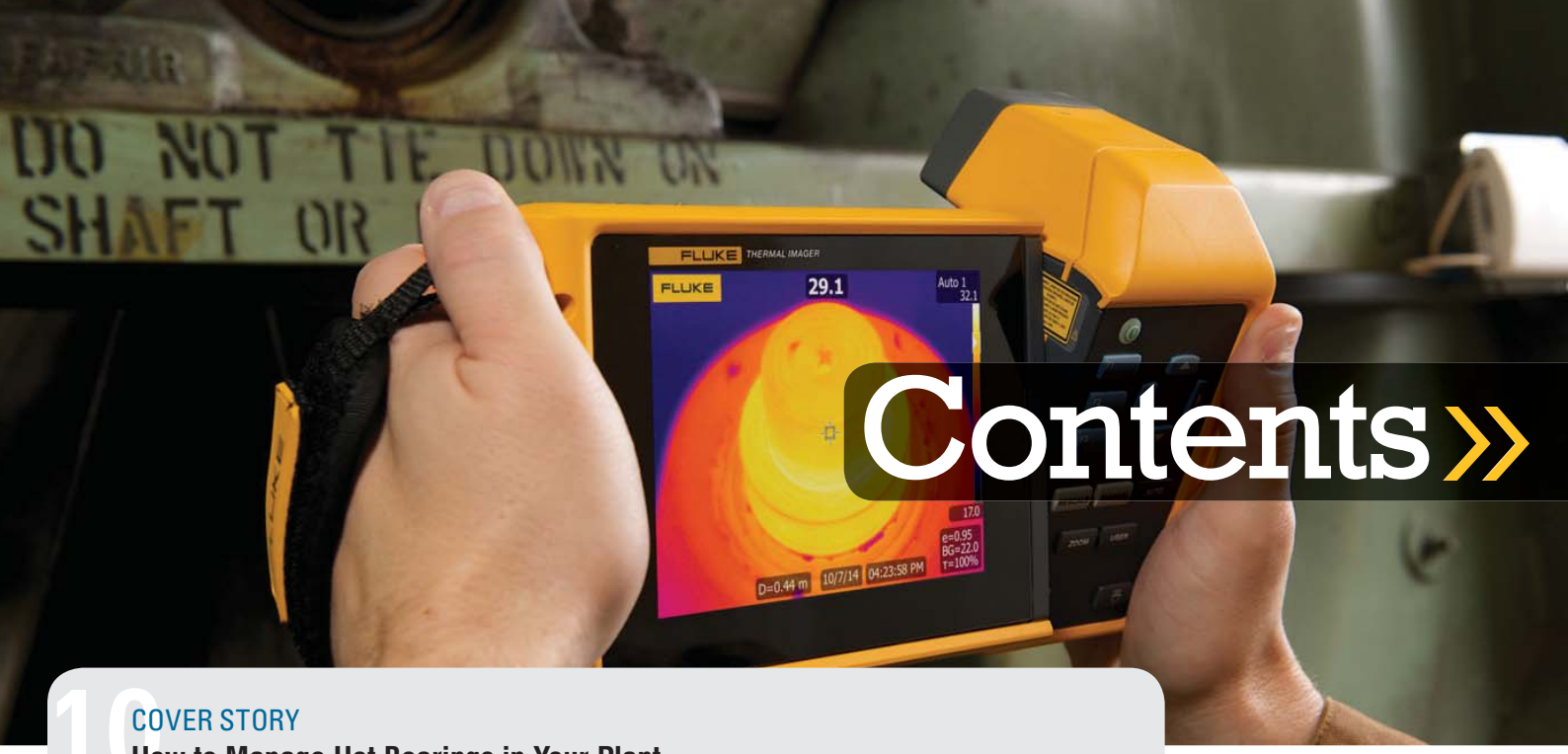
For any further query call our toll free no.: **000-800100-8401**
or e-mail at **ssindia@exxonmobil.com**

Mobil™

Industrial Lubricants

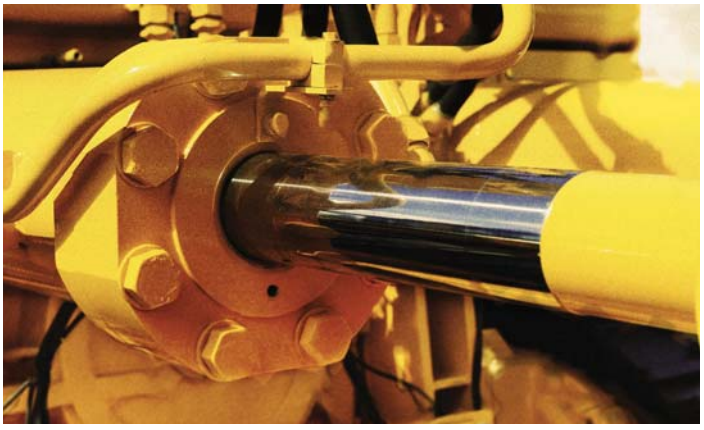
Advancing Productivity™

Energy lives here™



Contents

Machinery Lubrication India
July-August 2017



More

Editorial Features

Publisher's Note

Just last year we marked 25 years of liberalisation. In 1991, a liberalised investment and trade regime kick-started the economy bringing about a landmark change in our economy and strongly positioning India as an economic superpower.

The implementation of Goods & Services Tax (GST) is a similar landmark step, which will lubricate the gears of the Indian economy and ensure a virtuous growth cycle for Indian industries for the next several decades. This bold step towards unifying our tax architecture to bring it in line with the world's leading economies is also a critical step towards the government's vision of improving the "ease of doing business" in India. It is expected to have radical transformation from a complex, multi layered and cascading indirect tax system to a single and unified direct tax system that allows for tax set-off across the value chain, both for goods and services. This should help lower product costs and thereby make Indian goods competitive in comparison to imports, increasing profitability of companies. This efficiency and improvement should help achieve larger economies of scale leading to harnessing of inflation.

GST will also reduce the compliance scrutiny for inter-state movement of goods, which is currently a major source of concern and results in deadweight losses owing to transportation time. Removal of these barriers should help the supply chain of manufacturing industries to become much more efficient.

Previously, all decisions with respect to supply and distribution were guided by the need to minimise the impact of indirect taxes. With the advent of GST the supply chain decisions will be a function of economic factors such as costs, proximity to market rather than non-economic factors such as VAT rate differential between states. This should lead to efficient reallocation of resources in the economy.

A centralised and standardised GST registration would help in creation of an ecosystem conducive to start-ups, which can adhere to a centralised tax system. A unified system will also help reduce the compliance burden while allowing start-ups to compete on a level footing with established players. Also uniformity of tax systems across states can help all levels of production resulting in an improvement in the ease of doing business. The improvement in this ranking, which has been a key focus of the government, will also help attract more foreign direct investment and position India as a favourable and preferred investment destination.

Over the next 2-3 years, GST will have a cascading effect on the Indian economy and with structural enhancement, this can translate to a potential growth in GDP of 1-1.5%. GST should also help in the revival of an investment cycle which could bring in a disinflationary impact.

The Indian economy's wheels have been set in motion, and reforms such as the GST and the institutionalisation of the insolvency & bankruptcy code will act as lubricants to take this growth into the next gear!

Regarding the government's resolve to merge the oil companies, while a deal for ONGC's proposed takeover of HPCL is yet to be finalised, the centre has already embarked on its next ambitious project of combining Indian Oil Corporation Ltd and smaller oil exploration firm Oil India Ltd. The proposed merger of Indian Oil and Oil India is part of the government's plan to create mega oil PSUs of global scale, with vertically integrated functions across upstream and downstream. Vertically integrated oil companies would be better able to absorb the fluctuations in the global crude oil prices, as when the exploration unit will suffer from falling prices, the refining unit will benefit, and vice versa.

Season's greetings!

Warm regards,
Udey Dhir

JIM FITCH | NORIA CORPORATION

GETTING Machines to the Proper State of INSPECTION READINESS

I have written several articles on inspection recently, as I strongly believe it is foundational to condition monitoring, machine reliability and asset management. My last *Machinery Lubrication* column introduced the term "Inspection 2.0" to differentiate conventional inspection practices from the intense, probing and purposeful methods needed to optimize benefits. As common as inspection activities may be in any plant, Inspection 2.0 is largely untapped in my opinion. In fact, it is delusional to imagine world-class reliability without the coexistence of world-class inspection.

Inspection 2.0 borrows from many battle-tested philosophies, including the practice of autonomous maintenance advanced by total productive maintenance (TPM) doctrine. However, not detailed in these philosophies is the "how-to" to move an organization past the inspection status quo to the real game-changing opportunity that eludes their view. I plan to address these differences and the "how-to" tactics in several upcoming *Machinery Lubrication* articles.

This article introduces the concept of

machine readiness as a critical enabler to Inspection 2.0. An inspector who is eager to determine the state of machine health — good or bad — needs help from the machine. What hurts, where does it hurt and what are the symptoms of being hurt? Information exchange, like basic communication, is a two-way street. There is a need to enhance the quality of machine-transmitted conditions so the inspector gets a clear and complete picture of the state of the machine's health.

Now, assume that each and every machine in your plant is not yet Inspection 2.0 ready. That is very likely the case. Opportunity is knocking!

Work Backward

Start by compiling a list of machine faults and root causes you want your inspection program to reveal. This is generally a list of all the things that could go wrong that you definitely don't want to go wrong without adequate (early) warning. There is usually a need for some prioritization related to the list. Criticality analysis helps define the probability and consequences of failure. Failure mode ranking (e.g., failure modes and effects

There is a need to enhance the quality of machine-transmitted conditions so the inspector gets a clear and complete picture of the state of the machine's health.

analysis) delineates specific failure mode pathways, starting with root causes, that could possibly occur.

Next, take this prioritized list and construct an inspection gameplan that will reveal each of these alert conditions in real time. For instance, how might shaft misalignment be quickly recognized or aerated lube oil immediately detected? Is the machine currently able to reveal these inspection facts? If not, what modifications are necessary? Do the same with the other failure modes as you move down the list.

Smart Machine, Smart Inspections

Your machines can be smart, real-time communicators of the state of machine health. It is disappointing that very few original equipment manufacturers (OEMs) build machines to a suitable state of inspection readiness. This puts the burden on the asset owner to source needed parts and devices to be retrofitted on machines either at commissioning or during a scheduled shutdown.

Yes, there are often costs associated with retrofits and other machine modifications, and some of these changes can present risks related to human-agency failures from machine disturbances and defective parts/installations. However, if the modifications are properly engineered, sourced and installed, the benefits over the long term can be enormous. Don't pretend to save money by skipping this step. After all, inspection blindness is a far greater concern from the standpoint of machine reliability. You can't inspect and report what you can't see.

The following examples of machine-readiness practices, accessories, instruments and devices can substantially enhance and enable inspection readiness.

Good Housekeeping

Outside Dirt — This is always a good place to start. Keep your machines clean, inside and out. We all know that dirt is destructive to the machine's internal frictional surfaces, but it also masks many important inspection alerts, such as surface distress shown by cracked paint, tempered metal tints, chronic corrosion, runaway fretting, seal wear/damage and leakage points.

26%

of lubrication professionals say enabling inspections of their in-service oil and machinery would be the most likely reason for making machine modifications at their plant, based on a recent poll at Machinery-Lubrication.com

Machinery Lubrication India

Publisher
Udey Dhir - udeydhir@tribologysolutions.com

Creative Director
smassociates@gmail.com

Advertisement Sales (India)
ads@machinerylubricationindia.com

Advertisement Sales (US/Canada)
Tim Davidson - tdavidson@noria.com

Advertisement Sales
(All Other Countries)
ads@machinerylubricationindia.com
admin@machinerylubricationindia.com

CORRESPONDENCE
You may address articles, case studies, special requests and other correspondence to our

Operation office :

Editor
213, Ashiana Centre, Adityapur,
Jamshedpur-831013, India
email : editor@machinerylubricationindia.com
Tel: +91-657-2383238
Tel:(USA): +1-918-960-9738

Marketing Office
Rider House, 136,
Sector 44, Gurgaon-122003, Haryana
National Capital Region, India

Machinery Lubrication India Volume 29 - Issue 4, July-August 2017 is published bi-monthly by VAS Tribology Solutions Pvt. Ltd. Operation Office:213, Ashiana Centre, Adityapur, Jamshedpur-831013, India.

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

HP Lubricants

Trimofin, Trimol, Koolkut
Metal Cutting Fluids

At HPCL, we understand that our lubricants come in handy in every walk of life. Whether in automobiles, shipping or railways or in varied sectors like defence, mining and across industries, we believe in always keeping your life running smooth. Which is why, we take great pride in being an integral part of our nation's growth.

For details log on to: www.hindustanpetroleum.com | Email: lubescare@hpcl.in
Toll Free: 1800 120 4725 / 1800 121 4725 | Phone: 022 - 22637000
Follow us on : www.facebook.com/hplubricantsfromhindustanpetroleum

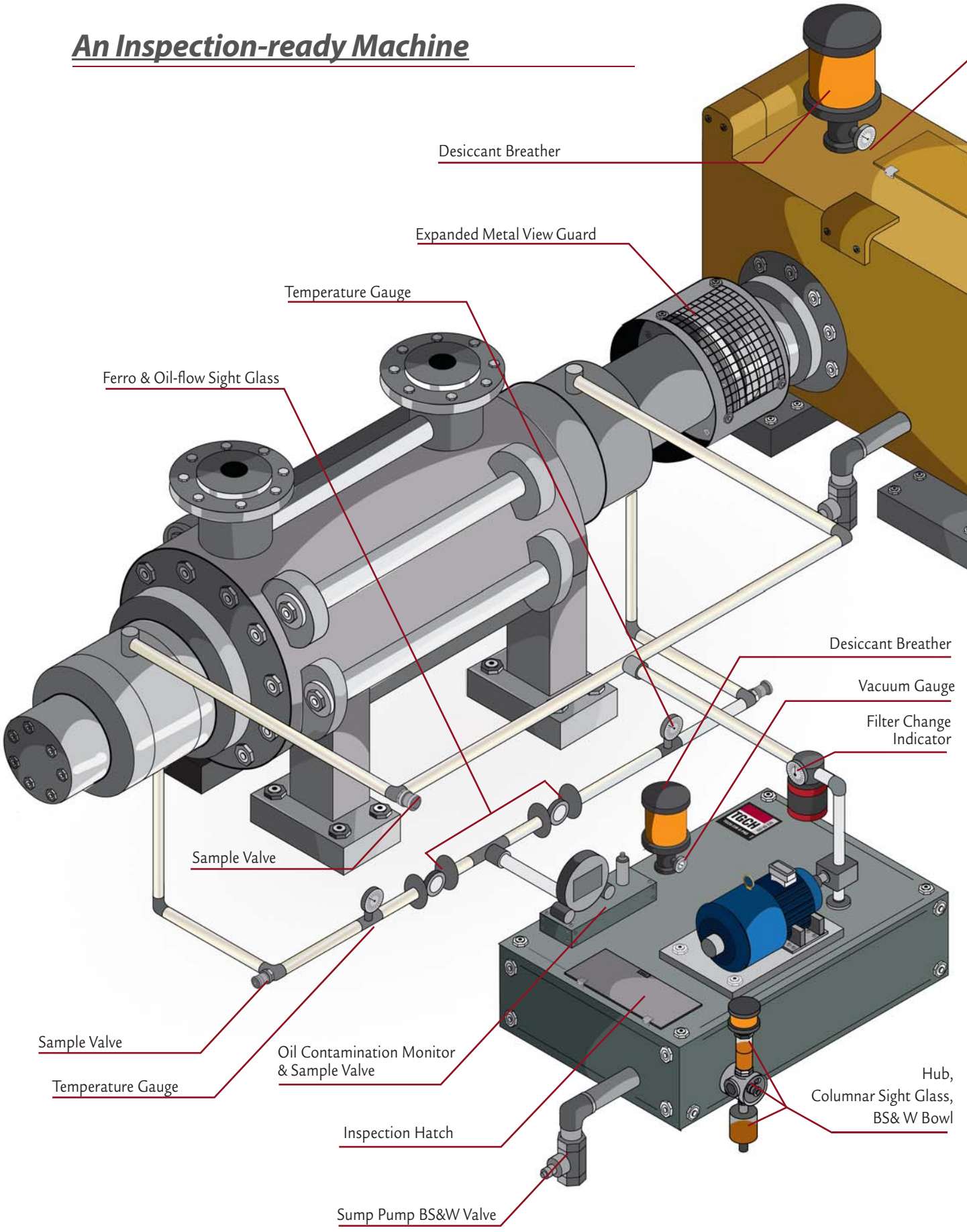
स्वच्छ भारत
एक कदम स्वच्छता की ओर

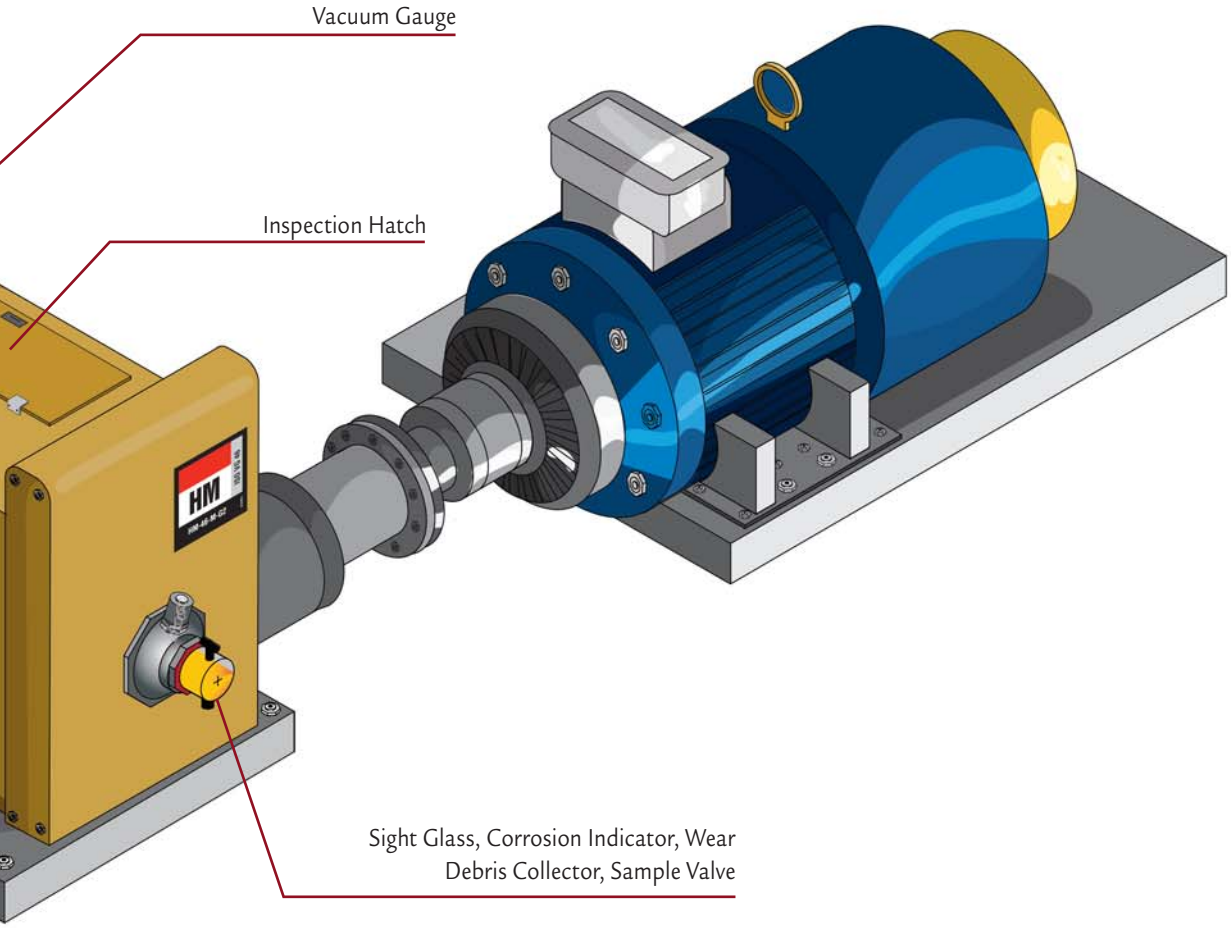
पहल

#GiveItUp
खुशियां बांटने की खुशी

उज्ज्वला

An Inspection-ready Machine





Inside Dirt and Fouling — Dirt and sludge can make oil so opaque that other oil properties become invisible. These might include water contamination, glycol, aeration, wear particle suspensions, etc. When oil is kept clear and bright, the slightest change in this state serves as an early sign of concern that should be reported for more detailed analysis. Additionally, sludge can stain sight glasses, preventing the oil level and other conditions from being easily determined.

Plates, Tags and Labels — Machine components should be properly labelled to avoid reporting errors. Other labels and markings are important, too, including filter and breather installation dates, lubricant type and gauge reading alerts.

Inspection Windows

An inspection window is effectively a portal used by the inspector to see within the machine. Many types of products can function as windows, such as the following:

Oil Level Gauges — These can be electronic, mechanical or a device that provides a visual indication of the oil level. Abnormal oil levels are often very meaningful and for many machines can lead to sudden-death failures. High oil levels might represent in-leaks (cross-contamination) of coolant, fuel or other lubricants. Low oil levels can be caused by high oil consumption or out-leaks. Oil level gauges should be marked to show the normal range for stopped machines as well as running machines, depending on the machine type. Level gauges should also be positioned for convenient viewing, especially by the person performing oil top-ups and changes.

Sight Glasses — Good sight glasses are far more than oil level gauges. They can communicate key transient conditions associated with localized areas of the machine. See my *Machinery Lubrication* article on zone inspections for a detailed narrative on the vast amount of information these inspection windows can provide. They include bottom sediment and water (BS&W) bowls, inline sight glasses (to confirm oil flow) and clear piping/hoses for fluid inspections.

Part-Movement Windows — Many machines need windows to verify proper movement of parts, such as oil rings, collar oilers, slingers and flingers. Certain belt, screw, chain and gear drives may need an inspector's line of sight.

Expanded Metal Guards — Couplings and other exposed rotating or reciprocating mechanisms are typically protected from accidental contact by the use of guards. These guards often

restrict visual observation of the movement mechanisms. However, they can be replaced with expanded metal so that both functions (safety and inspection) can be enabled.

Ferro Sites for Magnetic Particle Collection — These are magnets flooded in oil and placed behind inspection windows. Ferro sites are usually located on the return line where the ferromagnetic debris is the highest. The window can be periodically opened to clean the magnet.

Lubricant Sampling

Sump Drains with BS&W Valves — It's good to be paranoid about what might be sitting on the bottom of your sump or reservoir. It probably isn't anything your oil supplier sold you. BS&W bowls can provide a quick visual inspection. You can also pull a bottle sample if a simple ball valve is installed.

Sample Ports — These can be located in return lines, live zones or other strategic locations for quick sampling and at-machine inspections. In addition to visual inspections, you can perform a simple blotter spot test or a crackle test for the presence of free water.

Grease Purge Traps — What emerges out of a grease purge port during relubrication or during normal operation is an indication of lubricant health in the core of the bearing. Different traps and collection devices can be installed and used to inspect the discharged grease for hardness, oil content, particles, color, etc.

Inspection Devices

Numerous inspection devices are used to quickly assess solid debris concentrations and other types of lubricant contamination. These devices include magnetic plugs, debris traps, Y-strainers, last-chance filters and corrosion gauges.

Instrumentation

Today, there is a fairly wide selection of sensors and gauges that can provide effective real-time information on machine conditions. These include vacuum gauges, temperature gauges, proximity probes, flow meters, free-water alarms and load sensors. Most of these instruments can report digital or analog readings at the machine and are viewable by inspectors.

Additionally, oil analysis is no longer the exclusive domain of the laboratory. An assortment of instruments can be installed directly on the machine to assess viscosity changes, moisture readings, particle counts, wear debris concentrations and changes in oil chemistry. Vibration accelerometers can also be imbedded or affixed to operating machinery for periodic examination by inspectors.

Final Thoughts

As mentioned previously, there are costs and even a bit of risk associated with getting a machine to the proper state of inspection readiness. Reliability is always an investment. It's monetized later, usually in multiples. Most investments work this way.

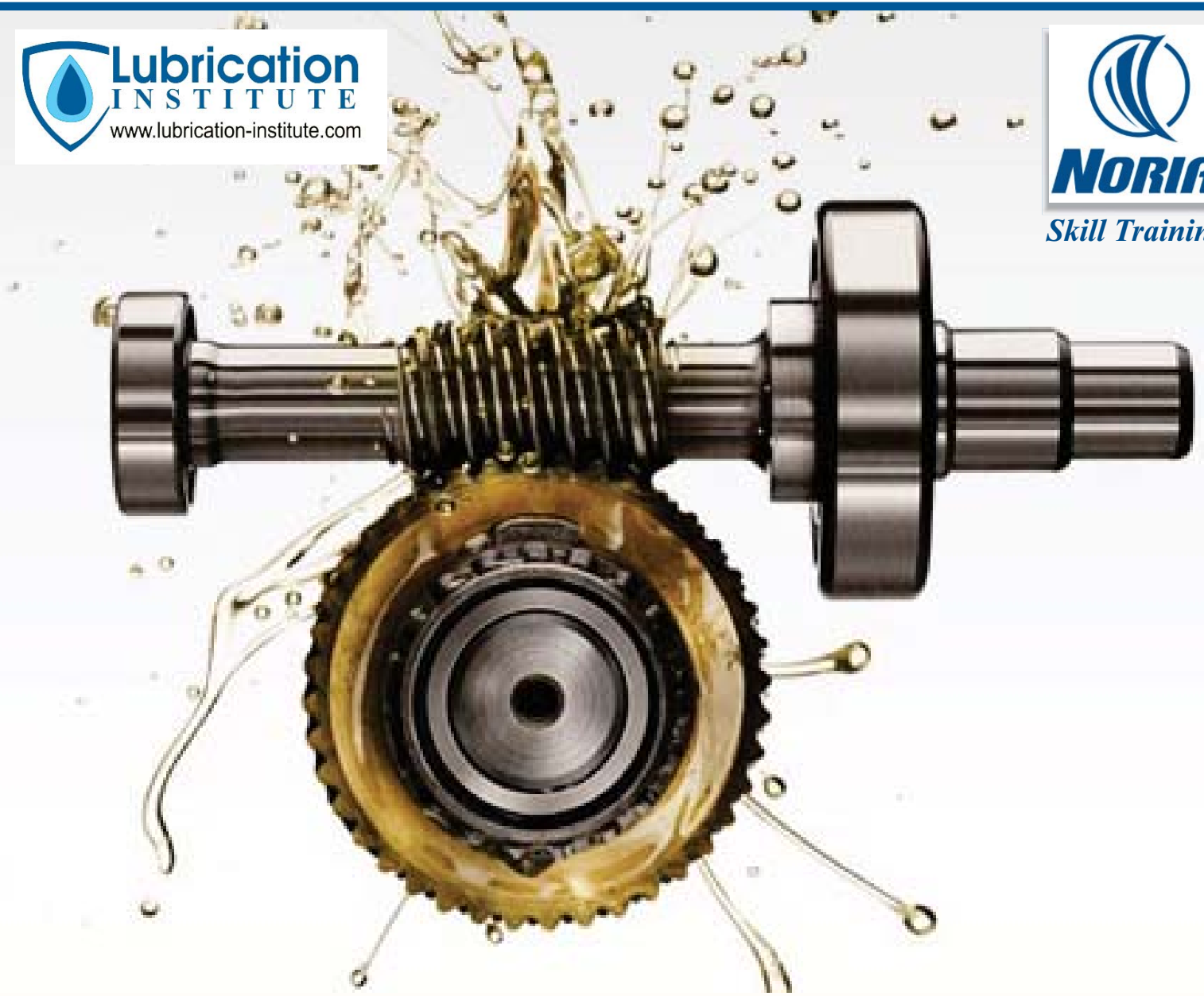
You are not trying to maximize inspection readiness but rather optimize it. You want to get it right, so make the right choices. Be penny wise, not pound foolish. It's false economy to try to save money by not investing wisely. It's like education. If you think it is expensive, try ignorance.

About the Author

Jim Fitch has a wealth of "in the trenches" experience in lubrication, oil analysis, tribology and machinery failure investigations. Over the past two decades, he has presented hundreds of courses on these subjects. Jim has published more than 200 technical articles, papers and publications. He serves as a U.S. delegate to the ISO tribology and oil analysis working group. Since 2002, he has been the director and a board member of the International Council for Machinery Lubrication. He is the CEO and a co-founder of Noria Corporation. Contact Jim at jfitch@noria.com.

Lubrication INSTITUTE
www.lubrication-institute.com

NORIA
Skill Training



TRAINING SCHEDULE

DHAKA (BD)	KOLKATA	MUMBAI	MUMBAI
20-22nd November	23-25th November	27-29th November	30-2nd December
Practical Oil Analysis	Essentials of Machinery Lubrication	Advanced Machinery Lubrication	Advanced Oil Analysis

To Register or For More Details Vist

www.lubrication-institute.com or CALL : +91-9431117604

Email : info@lubrication-institute.com

ICML

ICML Certification Testing is available after all the courses

On - Site (Private) Training

We deliver customized training programs to meet your unique requirement We'll provide expert instructors at a time and place most convenient for your group. Whether you have 5 or 500 people to train, We are the answer.

ASIA'S ONLY COMPREHENSIVE LUBRICATION SERVICE COMPANY

Online Training

Create your own flexible schedule to learn machinery lubrication and oil analysis best practices with self paced online training solution.

Get Access for

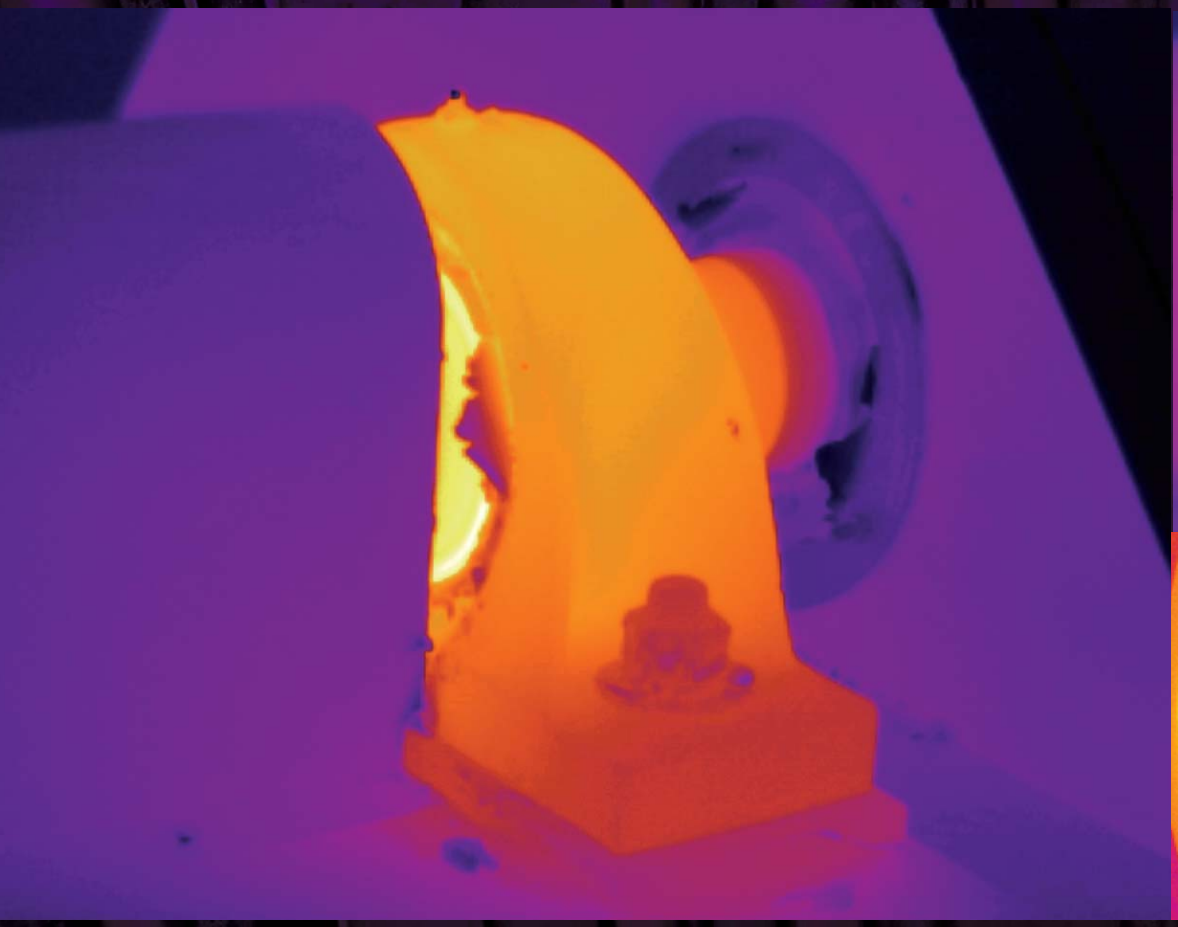
One Full year and login from any computer any time any where 24x7

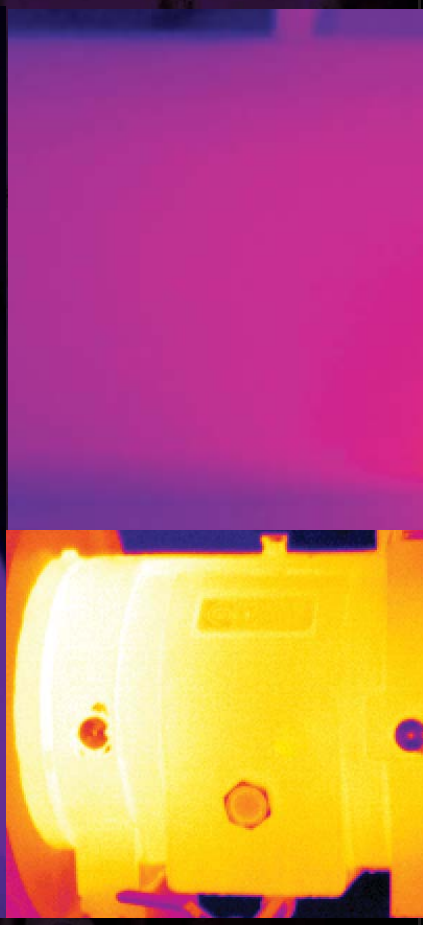
VAS TRIBO
Solution Unlimited

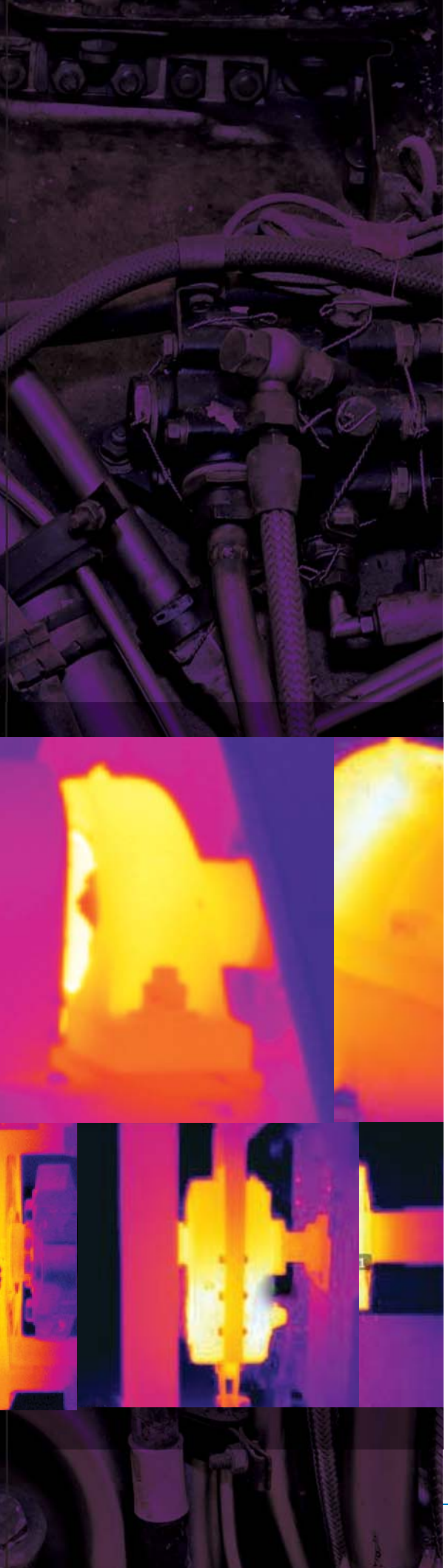
HOW TO MANAGE HOT BEARINGS IN YOUR PLANT

By Randy Riddell, SCA

After making his equipment-care rounds, a maintenance technician has discovered that several bearings are "running hot." These bearings are added to a list for some form of action. A work order may be written to change the bearings, or someone may put cooling water on the bearing housings. Even if the actual bearing temperatures are known, often times no one truly understands what actions are required at which temperatures.



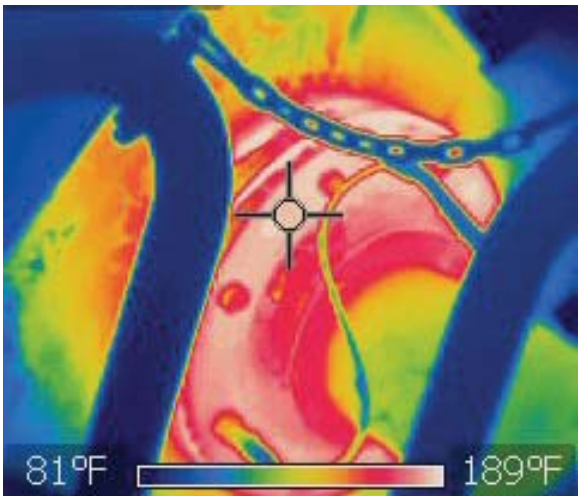




Measuring Bearing Temperatures

Before any action is taken, the question of how hot the bearing is should be answered. Hot to the touch might only be 130°F*, as 120°F is generally the threshold temperature where you can still hold your hand on the surface. While there may be gray areas for identifying the appropriate action at certain temperatures, some guidelines can provide consistency and help plant personnel make better decisions.

The first step should be to determine the actual temperature of the bearings being monitored. Keep in mind that the temperatures measured are only the skin temperatures of the bearing housings. The actual bearing temperatures will be 15-25°F hotter. Observe the surface condition and type when measuring temperature. Also, ensure the measuring device's emissivity is correct for the surface being measured. Most dark carbon-steel surfaces will have an emissivity setting around 0.95, while shiny stainless steel or aluminum will have a much lower setting. A typical infrared camera shot is shown below.



An infrared image of a bearing housing

Process buildup on bearing housings can result in lower measured temperatures when the actual bearing temperatures are much hotter. Buildup will insulate the bearing and not allow it to dissipate heat, which will in turn make the bearing run even hotter. Temperature checks should be performed in the same locations on the equipment and the bearings. Variations in bearing temperatures can be expected when different locations are measured due to load zones, ambient temperatures, lube levels, etc. Consistency is also important when different individuals are taking the measurements.

Bearing Temperature Conditions

Most precision installed and lubricated equipment will operate at less than 180°F. A bearing temperature that is less than 180°F is typically considered acceptable (see the chart below). Of course, there may be other consequences for operating in this "good" range. A higher operating temperature will cause the bearing lubricant to deteriorate at a faster rate. At more than 150°F, the lubricant life can be cut by 50 percent for every additional 18°F. A higher operating temperature also means a lower operating viscosity for the lubricant, which may hurt the overall reliability of the equipment.

<180°F Good	180-200°F Caution	200-250°F Alert	250-300°F Alarm	>300°F Trip/Shutdown

Bearing temperature condition chart

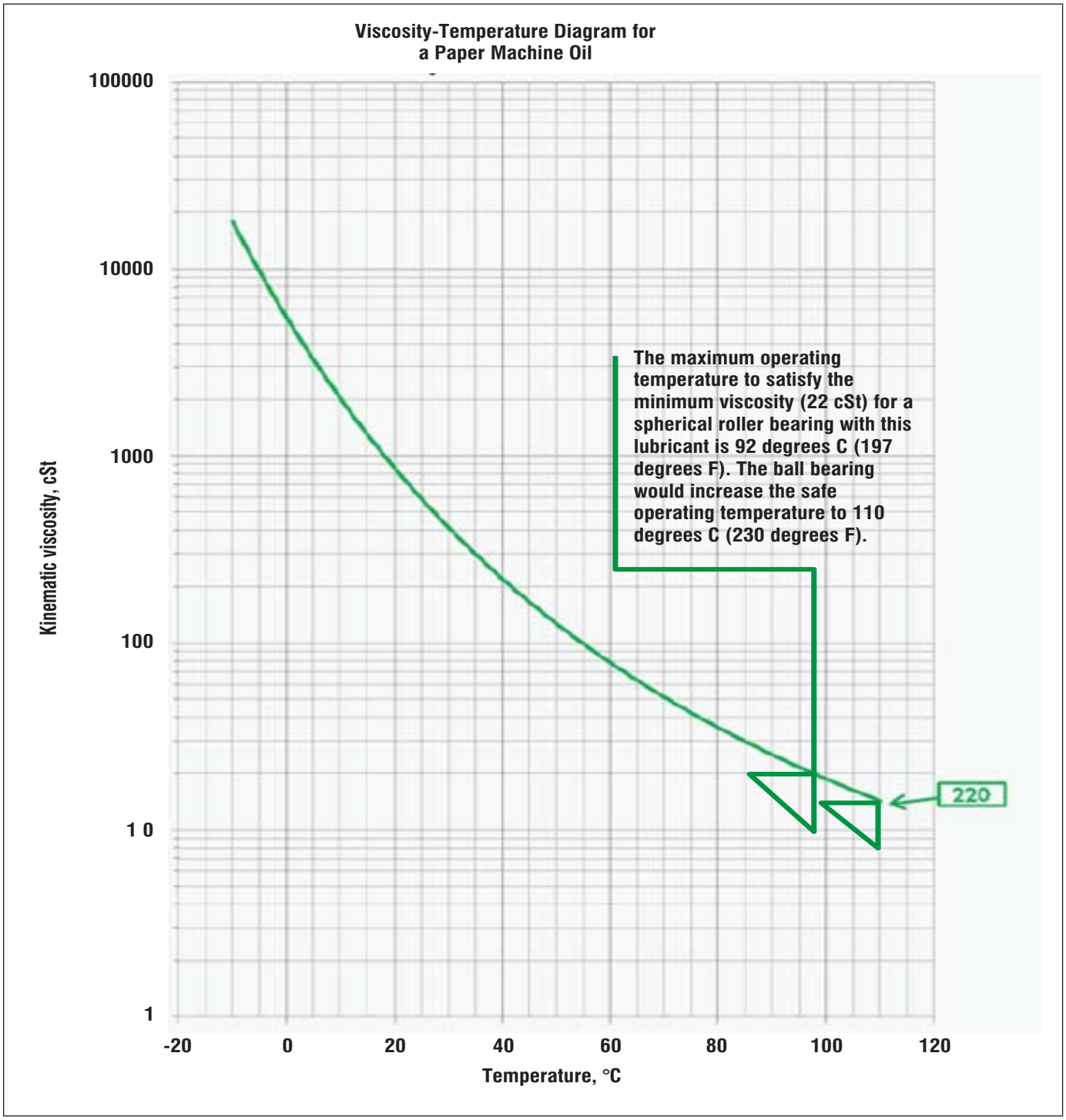
The chart on page 12 shows how the maximum temperature for a specific lubricant (viscosity index) and bearing type may limit the maximum operating temperatures.

Caution Conditions

In a caution condition, the bearing temperature may be between 180-200^{0}F. While this is slightly higher than desired, it may be a typical operating temperature for some equipment. Therefore, it is essential to have an operating temperature history for equipment in this range to determine if the temperature is normal.

For gearboxes, sump temperature limits are <200^{0}F, as defined by the American Gear Manufacturers Association (AGMA). A C3 clearance bearing is typically considered for this operating temperature. Continue regular monitoring and watch for any significant changes in temperature.

Another factor that is just as critical as the absolute bearing temperature is a change in temperature, which is an indication of a condition change. A temperature change of more than 50^{0}F is of concern no matter what condition range in which the absolute temperature



Lube viscosity-temperature curve (Ref. SKF)

FEED CONTAMINATION FREE OIL TO MACHINE

PARTICLE COUNTER

The **PARTICLE COUNTER** displays instant cleanliness readings for particulates in oil (ISO/NAS/SAE) suitable for Lubricants and Fuels

DUST FREE CONTAINER

A perfect container to avoid any kind of contamination in your oils.

FEED CONTAMINATION FREE OIL TO MACHINES

FT Filtertechnik UK

Your complete "SOLUTION" to keep Oils Dehydrated, Clean and Save on Mechanical Maintenance and Lubrication Costs.

Introducing 5th GENERATION Oil Filtration solutions from the world's best filtration company "Filtertechnik" with headquarters at Nottingham United Kingdom.

FILTRATION SYSTEM being available for removal of water / moisture , particulates or both , we have all solutions, remove moisture 100 % and clean oil to 1 Micron. Suitable for Hydraulic, Gear, Transmission oils (mineral & synthetic) and Fuels (mineral & Biofuel)

NDU-2 NX
Portable 5th Generation Oil Filtration Cart

Contamination causes 85% of Machine failures !!!

GUARANTEED WATER REMOVAL - below 50ppm

25% OIL CONSERVATION GUARANTEED

Oil Condition Monitoring Sensor
Fine and coarse particle contamination is a major cause of breakdowns in hydraulic and lubrication oil systems, continuous real-time oil debris monitoring plays a crucial role in developing a predictive maintenance strategy.

Bulk Oil Dispensing system helps to store the required quantity of various types of Lubricants.

OilSafe by Whitmore

OIL SAFE TRANSFER Containers to transfer lubricants from barrel to point of use. Ideal for all

MEMOLUB® Belgium

AUTO LUBRICATOR DECENTRALIZED LUBRICATION SYSTEM

EM / ONE / ECO / HPS / PLCD

SINGLE & MULTI-POINTS AUTOMATIC LUBRICATION SYSTEMS

Most reliable Greasing Technique

Distributors Enquiry solicited
+919892545299

UE Improve Reliability

URJA ENTERPRISES

B-234, Oshiwara Industrial Center, Opp.Goregaon Bus Depot, Off Link Road, Goregaon (W), Mumbai- 400 104, India
Tel: +91 022 2877 9776 I 2877 9832 I sales@urjaenterprises.com I www.urjaenterprises.com

OIL IN MACHINE IS LIKE BLOOD IN HUMAN BODY

falls. Increased monitoring and investigating should be required with this type of change.

Small temperature changes are generally of little concern. It may be normal for a recently greased bearing to increase in temperature 25-30^{0}F. Machine speeds and loads as well as ambient conditions (winter/summer) will also affect absolute temperatures. Other factors that can cause higher temperatures include increased bearing friction (poor lubrication, high load, high speed, etc.), excessive lubrication (grease overpressure), high oil level (oil churn) and misalignment.

Alert Conditions

In an alert condition, the bearing temperature may be between 200-250 ^{0}F. These elevated temperatures may be due to a heated application, a recently greased bearing, oil level issues, early stages of bearing failure, etc. Be sure to verify the process conditions, recent greasing cycle or oil level. You may also need to increase the frequency of monitoring the temperature changes. The safe operating temperature for grease is typically 75 percent of the dropping point. If the bearing is running in an application with heat through the journal, this elevated temperature range may be normal for operation. This would also call for a C4 clearance bearing.

Alarm Conditions

In an alarm condition, the bearing temperature may be between 250 - 300^{0}F). Bearings operating in this temperature range likely are in some stage of failure. The amount of life left can be highly variable. Employ other predictive technologies (vibration, infrared, ultrasonic testing, etc.) and increase the condition monitoring frequency until corrective action is taken. Also, minimize stress on the bearings by limiting startups/ shutdowns and reduce process speed/ load changes. Begin preparing a maintenance plan (order materials, define the job scope, etc.) for executing corrective action for either a planned event or unplanned failure. Use care when lubricating any bearing in an alarm condition, as lubricating (especially greasing) can elevate the operating temperature and even lead to failure.

Shutdown Conditions

In an equipment trip/shutdown condition, the bearing temperature may be more than 300^{0}F. Bearings at this temperature are likely in the final stages of failure. Depending on the equipment design, failure can be rapid and catastrophic. The time to react may only be hours, not days.

At this point, the bearing is gone, so your actions should be focused on minimizing a secondary failure of the remaining components (shaft, housing, etc.). An immediate equipment trip/ shutdown may be recommended to prevent catastrophic failure and additional damage.

The bearing integrity and geometry can be severely compromised at this temperature range, as the heat stabilization temperature for many bearings is between 300-400^{0}F). Do not attempt to grease a bearing in a shutdown/trip condition, since this is likely to result in an immediate failure.

Cooling Methods

If the bearing temperature is severely elevated, spraying with water could cause it to explode. Do not put water on the bearing or bearing housing. Water can migrate into the bearing and lead to a breakdown of the lubricant film. Corrosion can also occur.

Cooling the housing of a hot bearing can remove bearing clearances when the outer race cools, as the inner race will still be hot. The reduction in radial internal clearance will increase bearing friction and drastically reduce bearing life. The potential of catastrophic failure is also increased. Smaller bearings have a greater risk of this occurring due to their small radial internal clearances.

Using a fan on a bearing housing can be an acceptable cooling method for a bearing in an alert or alarm condition. If the bearing is on a circulating oil system, increasing the oil flow may also cool the bearing. However, too much oil flow can cause oil churn and increased friction inside the bearing.

Expert Help

If a bearing continually operates in an alert or alarm condition, you may need to consult an expert to evaluate the risk of continued operation and to identify possible changes for improvement. These bearings that persistently run at elevated temperatures have a chronic problem and require analysis to determine the root cause.

While bearing temperature monitoring can be relatively simple, the decisions that result will necessitate an evaluation by trained professionals to ensure the best course of action is taken to maximize equipment reliability. ■

About the Author

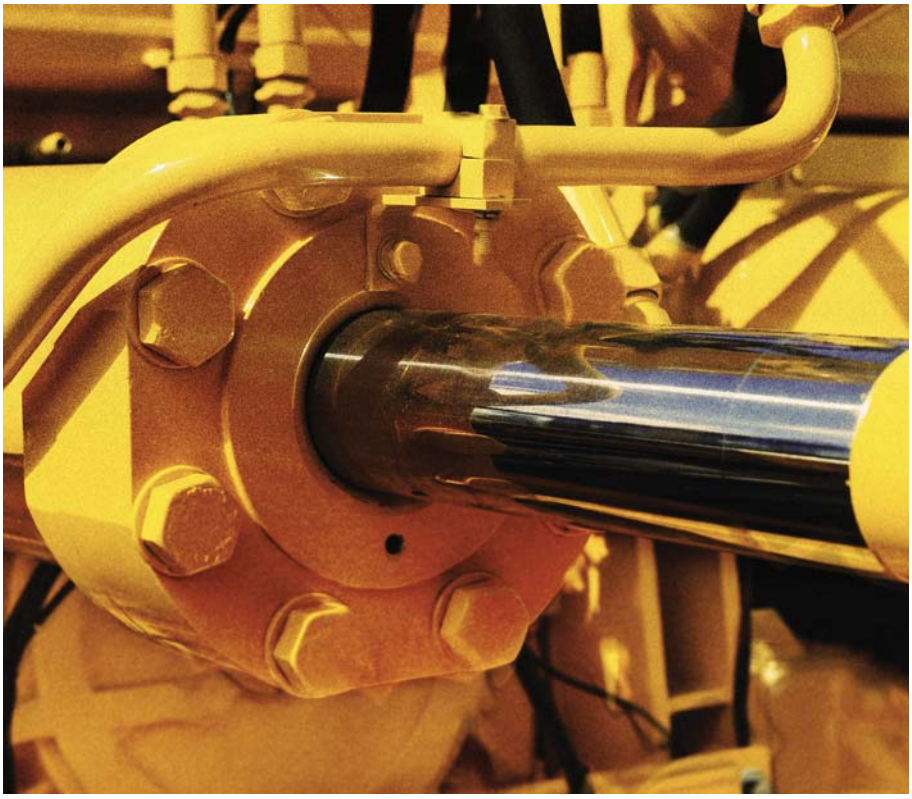
Randy Riddell is the reliability manager for SCA at the Barton Mill in Alabama. He has more than 25 years of industrial experience with a career focus on equipment reliability. Randy has a bachelor's degree in mechanical engineering from Mississippi State University and is a certified maintenance and reliability professional by the Society of Maintenance and Reliability Professionals. Contact Randy via email at Randy.Riddell@sca.com.

*(*Since the article has been contributed by an author from Alabama (USA), the temperature indicated are in degree F.)*

BY AL SMILEY, GPM HYDRAULIC CONSULTING

Controlling Hydraulic Oil Temperatures

With cooler weather on the way, you may not be too worried about rising oil temperatures, but the fact is, any industrial hydraulic system running higher than 140 degrees is too hot. Consider that for every 18-degree increase in temperature above 140 degrees, the life of the oil is cut in half. Systems that operate at high temperatures can produce sludge and varnish, which result in the sticking of valve spools. Pumps and hydraulic motors bypass more oil at high temperatures, causing the machine to operate at a slower speed. In some cases, high oil temperatures can waste electrical energy by making the pump drive motor pull more current to operate the system. O-rings also harden at higher temperatures, leading to more leaks in the system. So what checks and tests should you perform if the oil temperature is higher than 140 degrees?



Causes of Heat Generation

Every hydraulic system generates a certain amount of heat. Approximately 25 percent of the input electrical horsepower will be used to overcome heat losses in the system. Whenever oil is ported back to the reservoir and no useful work is done, heat will be generated.

The tolerances inside pumps and valves are normally in the ten-thousandths of an inch. These tolerances permit a small amount of oil to continuously bypass the internal components, causing the fluid temperature to rise. When oil is flowing through the lines, a series of resistances will be encountered. For example, flow controls, proportional valves and servo valves control the oil's flow rate by restricting flow. When oil flows through the valves, a "pressure drop" occurs. This means that a higher pressure will exist at the valve's inlet port than the outlet port. Anytime oil flows from a higher pressure to a lower pressure, heat is generated and absorbed in the oil.

When a system is initially designed, the reservoir and heat exchangers are sized to remove the generated heat. The reservoir allows some of the heat to dissipate through the walls to the atmosphere. If properly sized, heat exchangers should remove the balance of the heat, enabling the system to operate at approximately 120 degrees F.

Pressure-compensating Pumps

The most common type of pump is the pressure-compensating, piston-type

Figure 1. The tolerances between the pistons and barrel on a pressure-compensating, piston-type pump are approximately 0.0004 inch.

pump. The tolerances between the pistons and barrel are approximately 0.0004 inch (Figure 1). A small amount of oil at the pump outlet port will bypass through these tolerances and flow into the pump case. The oil is then ported back to the reservoir through the case drain line. This case drain flow does no useful work and is therefore converted into heat.

The normal flow rate out of the case drain line is 1 to 3 percent of the maximum pump volume. For example, a 30-gallon-per-minute (GPM) pump should have approximately 0.3 to 0.9 GPM of oil returning to the tank through the case drain. A severe increase in this flow rate will cause the oil temperature to rise considerably.

To check the flow, the line can be ported into a container of a known size and timed (Figure 2). Unless you have verified that the pressure in the hose is near 0 pounds per square inch (PSI), do not hold the line during this test. Instead, secure it to the container.

Figure 2. Check oil flow by porting the case drain line into a container of a known size and timing the flow rate.

A flow meter can also be permanently installed in the case drain line to monitor the flow rate. This visual check can be made regularly to determine the amount of bypassing. When the oil flow reaches 10 percent of the pump volume, the pump should be changed.

A typical variable-displacement, pressure-compensating pump is shown in Figure 3. During normal operation when the system pressure is below the compensator setting (1,200 PSI), the internal swashplate is held at the maximum angle by the spring. This enables the pistons to fully stroke in and out, permitting the pump to deliver the maximum volume. Flow from the pump's outlet port is blocked through the compensator spool.

Once the pressure builds to 1,200 PSI (Figure 4), the compensator spool shifts, directing oil to the internal cylinder. As the cylinder extends, the angle of the swashplate moves to a near vertical position. The pump will only deliver enough oil to maintain the 1,200 PSI spring setting. The only heat generated by the pump at this time is the oil that flows past the pistons and through the case drain line.

To determine the amount of heat the pump is generating when compensating, the following formula can be used: horsepower (HP) = GPM x PSI x 0.000583. Assuming the pump is bypassing 0.9 GPM and the compensator is set to 1,200 PSI, the amount of heat generation is: HP = 0.9 x 1,200 x 0.000583 or 0.6296.

As long as the system cooler and reservoir can remove at least 0.6296 horsepower of heat, the oil temperature should not increase. If the bypassing

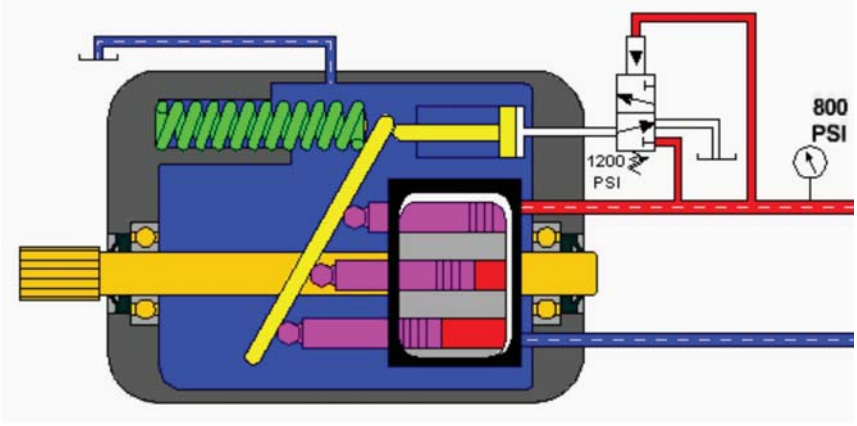


Figure 3. This illustration shows a variable-displacement, pressure-compensating pump in normal operation.

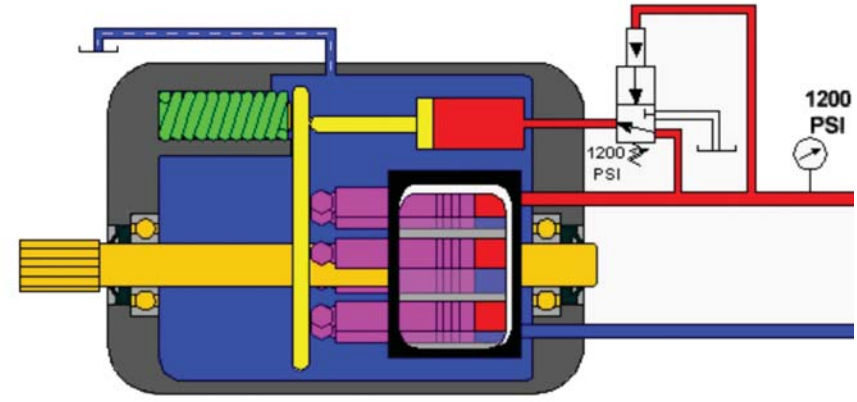


Figure 4. As pressure increases to 1,200 PSI, note the changes in the pump's compensator spool, internal cylinder and swashplate.

YELLOW PAGES

To advertise in this space contact admin@machinerylubricationindia.com

increases to 5 GPM, the heat load increases to 3.5 horsepower (HP = 5 x 1,200 x 0.000583 or 3.5). If the cooler and reservoir are not capable of removing at least 3.5 horsepower of heat, the oil temperature will increase.

Relief Valves

Many pressure-compensating pumps utilize a relief valve as a safety backup in case the compensator spool sticks in the closed position. The relief valve should be set 250 PSI above the pressure compensator's setting. If the relief valve's setting is above the compensator's setting, no oil should flow through the relief valve spool. Therefore, the valve's tank line should be at ambient temperature.

If the compensator were to stick in the position shown in Figure 3, the pump would deliver maximum volume at all times. The excess oil not used by the system would return to the tank through the relief valve. A significant amount of heat would be generated if this occurred.

Often the pressure in the system is randomly adjusted in an attempt to make the machine run better. If the local knob-turner sets the compensator pressure above the relief valve setting, excess oil will return to the tank through the relief, causing the oil temperature to rise 30 or 40 degrees. If the compensator fails to shift or is set above the relief valve setting, a tremendous amount of heat will be generated.

Assuming the maximum pump volume is 30 GPM and the relief valve is set to 1,450 PSI, the heat generation can be determined. If a 30-horsepower electric motor is used to drive this system (HP = 30 x 1,450 x 0.000583 or 25), then 25 horsepower will be converted to heat when in the idle mode. Since 746 watts equals 1 horsepower, 18,650 watts (746 x 25) or 18.65 kilowatts of electrical energy will be wasted.

Other valves used in the system such as accumulator dump valves and air bleed valves could also fail open and permit oil to bypass to the reservoir at high pressure. The tank lines of these valves should be at ambient temperature. Bypassing of the cylinder piston seals is another common cause of heat.

Heat Removal

The heat exchanger or cooler should be maintained to ensure excess heat is removed. If an air-type heat exchanger is used, the cooler fins should be cleaned on a regularly scheduled basis. A degreaser may be necessary to clean the fins. The temperature switch that turns on the cooler fan should be set at 115 degrees F. If a water cooler is used, a water-modulating valve should be installed in the water line to regulate flow through the cooler tubes to 25 percent of the oil flow.

The reservoir should be cleaned at least once per year. Otherwise, sludge and other contaminants not only can coat the bottom of the reservoir but also the sides as well. This would allow the reservoir to act as an incubator instead of dissipating the heat to the atmosphere.

I recently was at a plant where the oil temperature on a stacker was 350 degrees. It was discovered that the pressures were out of adjustment, the manual accumulator dump valve was partially open and oil was continually ported through a flow control that drove a hydraulic motor. The motor drove outfeed chains that only operated five to 10 times during an eight-hour shift. The pump compensator and relief valve were properly set, the manual valve was closed and the electrician de-energized the motor's directional valve, blocking flow through the flow control. When the unit was checked 24 hours later, the oil temperature had dropped to 132 degrees F. Of course, the oil had broken down, and the system had to be flushed to remove sludge and varnish. New oil also had to be added to the unit.

All of these issues were man-induced. The local knob-turner had set the compensator above the relief valve, enabling the pump volume to return to the tank at high pressure when nothing on the stacker was operating. Someone had also failed to fully close the manual valve, thereby permitting oil to bypass back to the tank at high pressure. In addition, the system had been improperly programmed to allow the chains to run continuously when they should have only been driven if a load was to be removed from the stacker.

The next time a heat problem occurs in one of your systems, look for oil that is flowing from a higher pressure to a lower pressure in the system. That's where you'll likely find your problem. ■

TEST your KNOWLEDGE

This month, *Machinery Lubrication India* continues its "Test Your Knowledge" section in which we focus on a group of questions from Noria's Practice Exam for Level I Machine Lubrication Technician and Machine Lubricant Analyst. The answers are located at the bottom of this page.

1. Acid number and base number determinations:

A) Are reported in the same units, mg of KOH/gram of oil
B) Are reported in pH units
C) Are reported in ml of HCL per gram of oil
D) Are reported in Abs/cm
E) Are reported as the same number because they are both neutralization numbers

2. Some additives are capable of:

A) Restoring themselves
B) Providing more than one function or benefit
C) Repairing metal surfaces
D) Regenerating/repairing the base oil
E) Improving the ISO cleanliness of the oil

3. NDm values:

A) Are a measure of greasing volume
B) Use rolling bearing RPM and pitch diameter to approximate bearing speed
C) Use journal bearing RPM and mean diameter to approximate bearing speed
D) Use gear RPM and diameter to determine gear velocity (speed)
E) Are a measure of bearing size sometimes called the pitch diameter

Answers

1. A

The acid number and base number are reported in milligrams (mg) of potassium hydroxide (KOH) per gram of oil. This can be confusing because in reality hydrochloric or perchloric acids are used to neutralize alkaline oil in order to measure the base number. The result is a derived value that represents the volume of KOH necessary to neutralize the volume of base number reagent acid required to neutralize the alkaline sample on which the base number is desired (i.e., one unit of base number neutralizes one unit of acid number).

2. B

Some additives are multi-functional, such as overbase detergents used in engine oils. These help to control deposits and neutralize harmful acids generated by combustion. Another example is zinc dialkyldithiophosphate (ZDDP), which works as an anti-wear additive and oxidation inhibitor.

3. B

NDm values are used to approximate the rolling bearing speed. NDm is calculated using the following formula: NDm = N x (Di + Do) / 2
Where: N = shaft speed in RPM, Di = bearing bore (inner) diameter in millimeters, and Do = bearing outer diameter in millimeters. So, the correct answer is B.

BENNETT FITCH | NORIA CORPORATION

Best Practices for Performing OIL ANALYSIS on Your ENGINE OIL

The benefits of oil analysis are enjoyed throughout all industries that operate mechanical equipment. Power plants track the changes in performance properties of thousands of gallons of turbine oil, as slight changes could lead to or indicate the onset of component failure. The main gearboxes in wind turbines are monitored regularly through oil analysis, since the cost of component replacement can be extremely expensive. Chemical plants perform routine oil analysis on the majority of their critical equipment to plan scheduled shutdowns more effectively. These are just a few examples of how oil analysis programs are implemented across various industries.

But what about the common machine most of us take for granted for its ability to get us from point "A" to "B" without fail? Yes, I'm talking about our personal passenger vehicles. Most of us would be frustrated and inconvenienced if our car suddenly ceased to provide its basic function. You likely have experienced this problem in the past for at least a day or so. As with most any other machine, our vehicles require routine maintenance.

Whether you perform the maintenance on your car or rely on a mechanic, there are several inspection points and areas of concentration throughout the vehicle. Historically, tire-related failures are the primary cause of breakdown. With most tire issues, the cost of repair and the length of downtime are low, especially if the remediation is simply a repaired flat. On the other hand, engine failure is far less common but can be very expensive and often results in downtime of several days or weeks, depending on the availability of spare parts.

Why Passenger Vehicle Oil Analysis Is Rare

There are many reasons oil analysis is not commonly performed on passenger vehicles. Car owners usually are not interested in extending their engine's life because they don't anticipate a significant failure during their ownership period. Most don't hold onto a new vehicle for more than five to 10 years. The majority of car owners also expect their insurance or warranty policy to cover any potential engine failure.

In addition, many people believe that simply changing the oil and oil filter routinely is sufficient to maintain their car's engine. They don't consider that the cost of oil analysis testing may be similar to that of an oil change. Some vehicles also have an onboard "oil life" indicator that provides real-time feedback to the driver about the engine oil's condition, which may give a false sense of security.

Even if you understand the benefits of oil analysis, collecting a sample on a passenger vehicle is inconvenient and ineffective. There generally is no good location to take a representative oil sample. Without an engine retrofit, the sample normally will be taken from the dipstick port via the drop-tube method or from the drain port during an oil change.

These are only a few of the reasons why there isn't much of a market for oil analysis of passenger vehicles. However, one of the most important aspects of oil analysis is often overlooked, which is the ability to provide information about the contamination and wear debris in the oil.

Why Passenger Vehicle Oil Analysis Should Be Performed

Oil analysis not only is effective in offering indicators of oil condition, but it can also identify various forms of contamination and wear debris as an engine condition monitoring indicator. This should be of even greater importance, since the longevity of the engine and the vehicle is the goal of any analysis performed, not just the quality and longevity of the oil.

The bulk of oil analysis performed in North America is on diesel engine oil. This is because the vast majority of these diesel engines are powering heavy-duty trucks for large transportation fleets or industries with off-road equipment. These fleet owners and owner-operators are reliant on the continuous operation of their trucks to produce revenue and income. This dependence can be risky, and thus oil analysis provides them with an added level of assurance toward improved reliability.

Oil analysis can be just as beneficial to most owners and drivers of passenger vehicles if the right information is obtained. Among the key questions to ask about the oil in your car include:

- Is the right oil being used?
- Are certain additives or base oil properties depleting or degrading too rapidly?
- Are there external contaminants in my oil that shouldn't be there?
- Are there internal contaminants like fuel, soot, coolant, etc.?
- Is there an indication that the engine is generating abnormal amounts of wear?
- Is the type of wear indicative of an incipient failure?
- Is the cause of the generated wear unique to a known type of failure?

Where and How Often to Perform Oil Analysis

With most oil analysis of industrial plant equipment, a sample is collected every "X" number of weeks or months and evaluated using a predetermined set of routine tests. This is practical when the cost of oil extraction and replenishment is reason enough to extend the drain interval until it has reached its condemning limit and when pulling a sample during operation is effortless because of an installed sample port. Even if it isn't costly to replenish the oil, it may be important to monitor machine conditions through oil analysis simply because the machine is critical.

75%

of lubrication professionals do not perform oil analysis on their car's engine oil, based on a recent survey at MachineryLubrication.com

The typical passenger vehicle is not equipped for proper oil sampling during operation. The ideal sampling location would be on the pressure line between the pump and filter on a wet-sump system. Since this is not feasible, it generally is better to opt for sampling at the drain port during a drain-and-fill or via the drop-tube vacuum sampling method. Keep in mind that there are best-practice procedures for these two sampling locations that should be considered before continuing with these approaches.

Sampling frequency is primarily based on the potential for oil analysis to offer an early indication of an unusual contamination issue, rapidly degrading oil or impending machine failure condition. Oil analysis is unique in that it can detect a possible concern long before other sensors or external symptoms are often triggered. Since oil drains normally are more frequent in passenger vehicles than other machinery,

the best sampling interval for the engine most likely would be right before the scheduled drain interval. As long as the sampling interval time is normalized relative to the previous oil change, the individual interpreting the data has an opportunity to effectively trend the data points. This strategy is beneficial because it not only will yield a variety of information about the engine's health but also help determine if the current drain interval is too long or short.

Which Tests to Use

Engine oils can be analyzed to obtain valuable information about their properties, contaminants or wear debris. The instruments in an oil analysis laboratory may focus on one specific piece of information or be designed to report multiple points of information. The following are some of the most common oil analysis tests for used engine oils.

Viscosity

This test measures a fluid's resistance to flow and shear. Viscosity is an oil's most important property. It provides the basic function for creating a film thickness between mechanical surfaces moving relative to one another. The engine oil in your vehicle is formulated to match a particular viscosity. If the viscosity changes, the oil may not be sufficient to protect the engine's surfaces. It can also mean that the oil has chemically degraded or been affected by a contaminant such as water, fuel or glycol. When this occurs, it will be necessary to further investigate the potential root causes with other oil analysis tests.

Base Number

Base number testing is used to measure the reserve alkalinity within the oil. This characteristic of engine oils is intended to neutralize the acidic compounds to which the oil may be exposed through blow-by contaminants. The base number will trend downward as the oil ages, but a rapid change could be an indicator of increased blow-by contaminants due to inefficiencies in the combustion zone, severe running conditions or using the wrong oil.

Particle Count

A particle count test identifies the level of general contamination in the form of three numbers representing the amount of contaminants greater than 4, 6 and 14 microns per milliliter of fluid. Contamination exposure to the engine oil can be detrimental, but it is expected during operation of the vehicle. Particle counting results can tell you several things, such as the potential ineffectiveness of the intake air filter or the oil filter. For example, if the oil filter has ruptured, it may not be removing contaminants sufficiently, allowing them to become continually ingressed into the engine oil.

Water

Water content is generally determined using the Karl Fischer test, which reports the amount of water present in oil in parts per million. An oil sample may also be screened first through a crackle test. Water in oil is particularly concerning because it can lead to rapid oil degradation and a corrosive reaction to iron and steel mechanical surfaces. The source of water must be investigated if abnormal amounts are found. These sources could include leaks from the oil cooler, high levels of moisture in the environment or inefficient running conditions.

Ferrous Density

This test focuses on increased levels of ferrous wear particles present in the oil sample. Once wear debris is observed at abnormal levels, remediation actions must be taken seriously, as the potential for engine failure is impending. Unlike solid contaminants and moisture, which are root causes that could lead to failure, increased levels of wear debris indicate that mechanical wear is already occurring in the engine. This may be a consequence of inaction to the contamination levels or poor lubrication due to changes in oil properties. It could also be a result of changes in operating conditions or mechanical inefficiencies.

Oil analysis can be beneficial to most owners and drivers of passenger vehicles if the right information is obtained.

Analytical Ferrography

If wear debris has been observed at abnormal levels, additional techniques can be used to examine it more closely to obtain clues as to its severity and root cause. This microscopic review of wear debris particles includes characterizing the general shape, size, color, reflectivity, edge details, markings and concentrations. The results can help establish from which components the wear particle originated and by which wear mode the particle was produced. These details can be useful in understanding how severe the problem is and if remediation actions are required.

The patch test is a similar method used to observe insoluble deposits on a porous membrane through which oil has been pulled. It offers a means of analyzing concentrated amounts of contaminants or oil degradation byproducts.

Fourier Transform Infrared (FTIR) Spectroscopy

This test provides information about not only the oil's health but also contaminants like soot, water, glycol

and fuel, as well as oil degradation byproducts such as oxides, nitrates and sulfates. It employs a unique technology that observes constituents within the sample at the molecular level. While the test excels in its capability to review a broad spectrum for analysis, its accuracy can be somewhat limited.

Elemental Spectroscopy

Elemental spectroscopy is similar to FTIR, but instead of observing constituents at the molecular level, it is able to report details about the oil at the elemental level. The results are most valuable after they have been trended with a reference sample or a history of samples from the same engine. As elemental concentrations increase or decrease, the trends can be correlated to specific wear patterns, contamination level increases or a depletion in additives formulated within the oil.

Other possible tests include flash point, fuel dilution, acid number, optical soot meters and blotter spot testing. The exact combination of tests to perform will depend on the types of questions you need answered.

Whether you are a hot-rod owner who can't bear the thought of an engine failure or a casual vehicle owner who doesn't want to be inconvenienced by a breakdown, there are good reasons to perform oil analysis. The oil in your engine is full of details, and it's just waiting to give you an update on how the engine is doing. So the next time you change your oil, consider taking a sample and having it tested. ■

Reference

Fitch, J.C. (2012). Analysis of In-Service Automotive Engine Oils. S.C. Tung & G.E. Totten (Eds.), *Automotive Lubricants and Testing*.

About the Author

Bennett Fitch is a senior technical consultant with Noria Corporation. He is a mechanical engineer who holds a Machine Lubricant Analyst (MLA) Level III certification and a Machine Lubrication Technician (MLT) Level II certification through the International Council for Machinery Lubrication (ICML). Contact Bennett at bfitch@noria.com.

BY LESLIE FISH, ICML

GAIN THE Confidence to Succeed with CERTIFICATION

Professional certification offers numerous benefits, which have been detailed numerous times in the pages of *Machinery Lubrication* magazine. However, certified individuals can often provide a unique perspective on how they continue to profit from their certifications.

Joe is one such individual. As the reliability manager in a Food Co. Joe has been certified for three years. He decided to obtain his certification because he needed to speak on lubrication best practices and wanted the necessary credentials to back it up. "Personally, it has helped me with job advancement as well as empowered me to drive our lubrication programs to a best-practice level," he said. Much has changed for Joe in the three years since obtaining his certification. "As I have grown in my knowledge, it has given me the confidence to walk into any situation and know that I can make it better," he noted.

Certified personnel can also benefit organizations, as employees gain an improved ability to ensure machine reliability and deliver quality assurance. In Joe's experience, this has resulted in reduced downtime, extended asset life and major cost savings on the bottom line. Gloria Gonzalez's company also saw the need to put more emphasis on training and certification.

"We wanted our staff to be more up to speed on current practices in the industry as well as with the body of knowledge," said Gonzalez, who works at a division of WearCheck, an oil analysis laboratory. "This also helps foster a healthy competition among employees to further increase their knowledge and attain more certifications." Gonzalez has been certified for 10 years but just recently achieved her Machine Lubricant Analyst (MLA) Level I and II certifications through the International Council for Machinery Lubrication (ICML). "This has given me more self-confidence in my field. I have now set my sights on ICML's MLA III."

"We are seeing an increase in vendors requesting that suppliers have certified personnel, so this definitely helps," she added. "Our employees also have more knowledge, so they begin to question processes, which leads to continuous improvements in the business."

Continuous improvement was also something the Mosaic Co. was looking to achieve. A leading producer of phosphate-based fertilizers, the organization was experiencing equipment failures that revealed the need for better lubrication practices. Training and certification would be required to help implement these improved practices.

As part of the training plan, a number of Mosaic team members became certified, including Charlie Fast, the senior reliability engineer. Having been certified now for 16 years, Fast has noticed that individuals with certifications are able to speak a common language. He has also seen how lubrication has been elevated at his

company from a low skill to the highest skilled position. More importantly, the organization's assets are lasting longer.

"More individuals are becoming certified as a measure of their training and qualification," Fast said. "Having to prepare and take the test allows these individuals to be recognized as having the knowledge to be qualified for these lubrication positions."

There are many benefits to earning a certification. Certified professionals not only are better able to evaluate their own strengths and weaknesses, but they also have a broader understanding of the skills and toolsets that can be effective. Are you ready for the next step in your career path? Get prepared and become certified today. ■

About the Author

Leslie Fish is the executive director of professional development and operations for the International Council for Machinery Lubrication, where she has worked since 2014.

ICML Certified Professional

Lubrication Institute
www.lubrication-institute.com

Recent Recipients Of ICML Certifications

Lubrication Institute (which conducts training programs in the areas of Oil Analysis & Machinery Lubrication in several countries of the Indian Subcontinent & Middle East) would like to congratulate professionals who have recently achieved certified status through ICML's certification program.

The following is a list of recently certified professional in various areas:

INDIA

Aditya Birla Management
Surendra Singh Solanki - MLT I

AIMIL Ltd.
K.N.V Subrahmanyam - MLA II, MLA I MLA III

Al-Hatimi Enterprises
Murtaza Taher Lokhandwala - MLT I, MLA I

Anand Engineers
Hitesh Madhukar More - MLT I

Aswartha Condition Monitoring Engineers
S. Ravi Kiran - MLA II

Balmer Lawrie & Company Ltd
Mukesh Agarwal - MLA I
Sujay Kumar - MLA I
BaisyaSharmila Barman - MLA I
Sandip Ranjan Das Gupta - MLA I
Somnath Dey - MLA I
Projjwal Ghorai - MLA I
Dipak Ghosh - MLA I
Mahesh Chandra Gupta - MLA I
Barunav Kundua. - MLA I
Mohan Kumar - MLA I
Krishnendu Mondal - MLA I
Mahendra Singh Negi - MLA I
Ramachandran Padmanaban - MLA I
Narbdeshwar Pandey - MLA I
Kedar Panse - MLA I
Chandrashekhar Yadaw Rade - MLA I
V. Ramanamurthy - MLA I
N. Ramesh - MLA I
Malay Kanti Saha - MLA I
Sanjay Sanfui - MLA I
Nilesh Mahadeorao Sapate - MLA I
Manoj Sardana - MLA I
Rajeshwar Singh - MLA I
Arijit Das Thakur - MLA I

Bharat Petroleum Corporation Ltd.
Sumeet Kumar Goswami - MLA I
Sujith Kumar - MLT I
Ashish Kumar Mishra - MLA I

Bunge
Upendrasinh Rajendrasinh Vala - MLT I

Capron Oil Management & Engineering Solutions
Chandra Sekhar Kartik - MLA I, MLA II MLA III

Chem-Tech Laboratories
Vedang Ghanashyam Bhagwat - MLA II, MLA III
Smita Subandh - MLA II

Cirra Consultants Pvt Ltd.
Charly George - MLA II

Croda Chemicals
Shantanu Das - MLT I, MLA I MLT II

EKS Filter Technik (I) Pvt. Ltd.
Nishil Bhatt - MLA II

Excell B Enterprises
Palanisamy Duraisaamy - MLT I, MLA I, MLA II MLT II, MLA III

FAG Bearings India
Jigarkumar Vinodbhai Patel - MLA II

General Mills
Ketan Mahendra Raut - MLT I
Nitin Ajwani - MLT I
Prajotkumar Nagapure - MLT I

Hindustan Petroleum Corporation Ltd
Vijay Kumar Ganta - MLA I
Marpina Naveen Kumar - MLT I

Indian Oil Corporation Ltd
Santosh Sudhakar Dhait - MLT I
Yavnish Garg - MLA I
Perumalla Sai Gopal - MLT I
Pratesh Jhari - MLT I
Abhinav Jogi - MLA I
Darshan Keshari - MLT I
Rajkumar Keshri - MLT I
Abinash Kumar - MLT I
Manjeet Kumar - MLT I
Nitish Mittal - MLA II
Pradeep P. - MLT I
Kuldeep Pradhan - MLT I, MLA II
Pramod Kumar Prasad - MLT I
Raben Chandra Roy - MLA II
Debdipta Roy - MLT I
Uday Shankar - MLA II
Pratyush Vikram Singh - MLT I
Prabhakar Sinha - MLT I
Ashwini Tripathi - MLT I
Kushal Tripathi - MLT I
Chaitanya Vvssgrk Tummala - MLT I
Mohomed Yassin S. - MLT I

Kinetics Commercial Company
Koustuv Mohanty - MLA I

Maersk Oil Trading Lubricants
Sandip R. Jarode - MLT I

One Stop Solutions
Samir Chandrakant Bhagwat - MLT I, MLA I

Onyx Dynamic Balancing Services
Vinay Sharma - MLA II

Orient Enterprise
Upendra Rungta - MLT I

Pall Corporation
Gonal Lakshmikanth - MLA II

Petronet LNG Ltd.
Pawan Kumar Chaturvedi - MLT I
Saurab Kumar Hasmukh bhai Patel - MLT I

Petronum Trading
M. Hussam Adeni - MLA I

Praxair
Kotresh Bullari Nevara - MLT I
Vikas Shivdekar - Praxair

Predict Technologies India CP Ltd
PSVV Dheeraj - MLT I, MLA II, MLA III

Pure Lubricants
D. Hemalatha - MLA II

Quest Global
Alv Avinash - MLA II, MLA III

Raj Petro Specialities Pvt. Ltd.
Tapas Chakraborty - MLT I

Tata Steel
Dipti Chaturvedi - MLA II
Vibhor - MLA II
Ajit Verma - MLT I

Tractors India Pvt Ltd
Saugata Roy - MLA II

Tribocare
Venkat Ramanan Ramadoss - MLA II

Valvoline Cummins
Manik Das - MLT I

VAS Tribology Solutions
Md Aatif - MLT I, MLA II
Praveen Kumar - MLT I
Preeti Prasad - MLT I
L. Viraraghavan - MLT I, MLA I, MLA II

Vestas Wind Systems
Pattabiraman Trichy Ramakrishnan - MLA II, MLA III

WearCheckPM
Ayub Pasha Shaik - MLA II

ICML Certification

- **MLA I**
  Machine Lubricant Analyst Level -I
- **MLA II**
  Machine Lubricant Analyst Level -II
- **MLA III**
  Machine Lubricant Analyst Level -III
- **MLT I**
  Machine Lubrication Technician Level -I
- **MLT II**
  Machine Lubrication Technician Level -II

ICML Certified Professional

BANGLADESH

Chevron
Mahbub B-Rabbani - MLA I
Md. Mahbub Hassan Mamun - MLA I
Taufiqul Islam - MLA I
Tanveer Raihan - MLA I

Lub-rref
Mohammad Mozammel Hossain - MLT I
Mizanur Rahman - MLT I

MH Energies & Distribution Co. (MEDCO)
Mosaddek Hossain - MLT I

Navana Petroleum
Md. Maruful Islam Raihan - MLT I

Standard Asiatic Oil Company
Md Abdullah Sefat - MLA I

UAE

Abu Dhabi Gas Industries, Ltd. (GASCO)
Lala Gulabrao Khunte - MLA I, MLA II, MLT I

ENOC Lubricants
Ali Yeslam Alsadi - MLT I
Lingesan Chinnamuni Mohanan - MLA I
Nitin Prabhakar Desai - MLA I, MLA II
Ranjan Guha - MLT I
Aarif Ahmed El Mardi Jubara - MLT I
Mardi Jubara - MLT
M. Rajasekaran Munirathinam - MLA II
Muhammad Owais - MLA I
Rejish Rajasekharan Pillai - MLT I
Mohamed Ahmed Saleh Hassan - MLT I, MLA II

EPPCO Lubricants
Yousef Hasan Mallouh - MLT I
Arun Kumar Mundani - MLT I
Porus Noshir - MLT I
Ammar Abdul Latif Mohd Said - MLT I
Yousef Hasan Mallouh - MLT I

FUCHS
Amjed Amin Abdelgalil Mustafa - MLA I
Fageer Abdalla Fageer Elnajeeb - MLA II
Abdelgadir Zienelabdin Glaleldin Gergawe - MLA I
Elamin Osman Elamin Mohammed - MLA I

Intertek
Sreekumar Puzhankara - MLA II
VivekVeliyamparambath - MLA II

Tribocare FZC
Murari Ravikumar - MLA II
Venkata Suresh Pedasingu - MLA II

Total Marketing Middle East
Amarnath Natarajan - MLT I

SAUDI ARABIA

Geo-Chem Middle East Inspection
Shathy Kannan Shaji - MLA II
Sunil Kumar Sukumaran - MLA II

Petromin Corporation
Emad Hamed Alahmadi - MLT I
Zeshan Ashraf - MLT I
Salman M Bajwa - MLT I
Ali Hyari - MLT I
Tariq Javed - MLT I
Bilal Samad Khan - MLT I
Mohammed Imran Khan - MLT I
Asif Ali Khan - MLT I
Muhammad Naeem - MLT I
Abdul Majid Osmani - MLT I
Syed Mahmood Quadri - MLT I
Essan M. Saleh - MLT I
Pir Shujahat Ali Shah - MLT I
Cherif Talibi - MLT I
Engr. Faisal Yasin - MLT I

Saudi Aramco
Hasanur Jamal Molla - MLA II

SABIC
Ranajit Dhar -

SRI LANKA

Loadstar (Pvt) Ltd.
Arambegoda Loku Gamage Yasith Chandrasiri - MLA I, MLTI
Prageeth Bandara Jayakody - MLT I, MLA I
Mayuri Shanika Sumanadasa - MLT I, MLA I

YEMEN

Yemen LNG Company Limited -
Venkatesan Narayanan - MLTI

Need to take an exam?

ICML regularly holds exam sessions throughout the Indian subcontinent and the world. Upcoming dates and locations for ICML exam can be found at www.lubecouncil.org.

Lubrication Institute (An associate of VAS Tribology Solutions, Asia's only comprehensive lubrication services company and partner of Noria Corporation, USA) is proud to announce Scholarships in the field of Machinery Lubrication & Oil Analysis.

Education and accredited certification are key to success, for those wanting to serve as lubrication engineers / technicians and chemists. We at Lubrication Institute will help them further their knowledge through these scholarships.

These scholarship awards are for professionals working in the field of reliability (lubrication) & oil analysis and for students currently pursuing education in the field of tribology/reliability/condition monitoring.

NORIA Skill Training

For further details please visit following web sites : www.lubrication-institute.com, www.machinerylubricationindia.com

PILOT (Practical Industrial Lubrication Orientation Training) conducted at HeroMoto Corp (L & D Centre) "GuruKul", Dharuhera (Haryana)

PILOT is a skill based lubrication training program specifically designed for lube technicians, operators and shop floor associates. Objective of this training program is to upgrade the skill of technicians who actually performs the lubrication and inspection tasks. To achieve this objective the program is conducted with the combination of classroom as well as onsite practical training (activity and accessory based).

PILOT is a unique program of its kind in which imparts training with the help of graphics, animations and videos along with practical training, in the local language. In classroom training it covers fundamental stuffs like lubricant, lubrication, onsite oil analysis, lubricant condition monitoring using five senses... etc.

Focus of the program is to train technicians to "how to" do various lubrication related tasks safely, effectively & efficiently. Under practical training session, trainer gives demonstration of various best practices using standard hardware. To ensure transfer of knowledge, after every demonstration, technicians are asked to perform the same activity and findings are shared with the participants. Emphasis is also given on handling, maintenance and best practices of various accessories like grease gun, oil level indicator, oils sampling valves, filtration machines, constant level oilers etc.

PILOT also acts as a myth buster as it uncovers various lubrication myths which technicians might have absorbed over a period of time.

Lubrication Institute (www.lubrication-institute) recently organised three public training programs on "Essentials of Machinery Lubrication " & "Practical Oil Analysis" in Mumbai, Chennai & Delhi (India). Multiple nominations from companies in India & Overseas were received. Participants from Bajaj Auto Ltd , Bunge Foods Ltd, Fuchs (UAE) , Intertek (UAE), Indian Oil Corporation Ltd , Indian Petro & Chemicals , Hindustan Petroleum Ltd,), Praxair (Bahrain) , Saint Gobain, , TVS Tyres, and a host of other companies took part in the trainings.

All the trainings were followed by ICML Certification Examination,in which most of the participants qualified for the certification.

ASK the EXPERTS

"Our gearbox, which leaks excessively, is close to the end of its life. It currently uses an ISO 680 EP oil, but we would prefer to use a lubricant that would stem some of the leakage and allow the gearbox to continue running until the next scheduled turnaround. What would you suggest?"

When it comes to leakage, the only real solution is to take down the machine and repair it in order to stop the leak. As oil continues to flow from the gearbox, there are obvious safety concerns involved with exposing people and the environment to the gear oil. This also doesn't take into consideration the cost of the oil that is leaking. Synthetic oils can be very costly, and having a component that leaks these fluids is similar to throwing money down the drain.

Provided that the component can be taken down and repaired in the near future, there are some options to "Band-Aid" the problem. Several manufacturers make compounds that can be added to the oil to help mitigate leakage. These compounds work along the same lines as radiator sealants that form deposits at the point of leakage. As with introducing any aftermarket product to your oil, this should only be done after careful consideration and testing to ensure there will be no ill effects on the oil or machine.

Other types of products that can be used are touted as seal enhancers. These fluids and pastes are manufactured with synthetic bases and will cause seal material to swell. As the seal swells, it slows the leakage. When the machine is able to be taken out of service, the seal should be replaced and the gearbox flushed to remove any traces of the seal compound that has been introduced.

Filling the gearbox with grease is another simple solution that has been used successfully. Grease has lower flow characteristics than oil and will not leak as fast. While grease will lubricate the gears effectively, more heat will be generated within the gearbox. Since grease does not dissipate heat as well as oil, the temperature should be monitored.

All of these solutions are not true fixes but simple patches that can help until the gearbox can be taken out of service and properly repaired. Keep in mind that after adding anything to a component other than the appropriate lubricant, it should be removed and the interior surfaces flushed to eliminate all risks of incompatibility. All seals should also be replaced to reduce future leakage.

"Over the past several months, we have noticed that one of our hydraulic cylinders speeds up by itself intermittently. Would you have any idea as to why this is happening and if this is a common problem?"

An increase in hydraulic cylinder speed is a rare occurrence. To better understand the problem, let's consider the much more prevalent case of decreasing speed and apply the opposite logic.

In terms of hydraulic systems, a reduction in performance is usually the first clue that a problem has manifested in the system. This is most often indicated by longer cycle times and slower operation. The root cause of these failure symptoms can frequently be traced back to fluid flow. The fluid flow in a hydraulic system determines actuator speed and quickness of response. Loss of flow will equate to loss of speed.

Applying this same logic to an increased cylinder speed would mean that more flow is occurring. What could happen in a hydraulic system that would cause an increase in flow over time?

Internal Leakage – If an internal leak becomes clogged, the flow would inherently increase.

Viscosity Change — If the viscosity were to decrease, the flow would increase (depending on the pump and system design).

Filter Collapse or Bypass Malfunction — If the filter was causing reduced flow and then burst, or there was a malfunction with the bypass that allowed flow to increase, both would result in an increased cylinder speed.

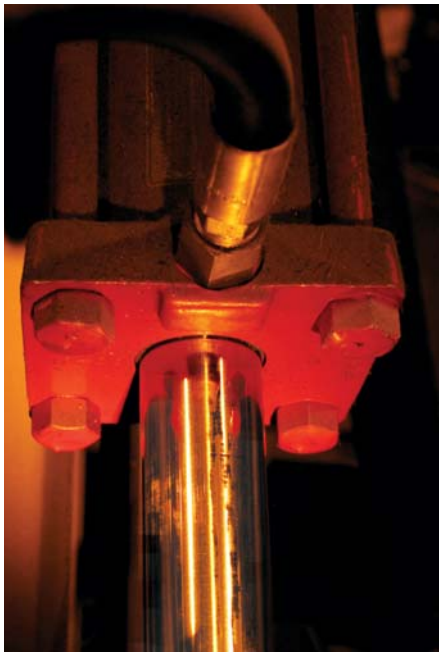
Air Entrainment — Air in the fluid will cause poor (slow) performance. If the air problem is corrected, the system will speed up.

Oil Line Cleared — If a restricted or blocked oil line becomes unrestricted/unblocked, the fluid flow will increase.

Change in Load — If the load on the cylinder is reduced, it may increase cylinder speed.

These are just a few things that may be plaguing the hydraulic system. In order to provide a more comprehensive diagnosis, more details would need to be known, such as the system design, seal health, filter type and age, contamination levels, cylinder position, etc.

Keep in mind that not all hydraulic cylinders are created equal. It is



estimated that up to 25 percent of mechanical equipment failures are design related. In regards to hydraulic cylinders, this suggests as many as one in four are not adequately designed for the application in which they are operating. So if the hydraulic cylinder suffers recurring failures, it is likely that design modifications will be required to break the cycle of failure and repair.

If you have a question for one of our experts, email it to editor@machinerylubricationindia.com

Lube-Tips™

THE "LUBE-TIPS" SECTION OF *MACHINERY LUBRICATION* MAGAZINE FEATURES INNOVATIVE ideas submitted by our readers. Additional tips can be found in our Lube-Tips email newsletter. If you have a tip to share, email it to admin@machinerylubricationindia.com. To receive the Lube-Tips newsletter, subscribe now at www.MachineryLubricationIndia.com/page/subscriptions.

Advice for Converting Gearboxes to Synthetics

When converting a gearbox from petroleum to synthetic oil, regardless of the synthetic base, it is advisable to thoroughly clean and then flush the gearbox with a charge of the new base material before putting the unit back in service. For some synthetics, such as with water-soluble polyalkylene glycol (PAG) oils, this is simply necessary. For others, such as polyalphaolefins (PAOs), it is just good practice.

The 10-percent Filtration Rule of Thumb

As a general guideline when periodically decontaminating a lubricant or hydraulic oil sump, the maximum pump displacement should be only 10 percent of the total volume of oil to be filtered. A 10-gallon reservoir requires no more than 1 gallon per minute for decontamination. Too much may cause a temperature increase, possible foaming and lubricant starvation. Too little pump displacement will require excessive filtration time.

Reasons for Fixing Oil Leaks

An oil leak of one drop per second amounts to approximately $1,000 of oil per year that must be replaced. If you estimate the cost of replacement, including purchasing, handling application, waste clean-up and disposal at three times the cost of the initial purchase, then each one-drop-per-second leak costs your company $2,956 (based on 14,000 drops per pint and $3.50 per gallon for oil).

Protecting New Bearings

Protect new bearings against contamination and condensation. New bearings should be kept in their original wrappings as long as possible and

stored away from moisture where the temperature can be kept reasonably constant. It is typically not a good practice to flush the original lubricant from a new bearing, as this could introduce contamination.

Check Grease Compatibility

If you use several greases at your facility, then it is important that all of your greases are compatible with one another. A safe first assumption is that they are not compatible unless proven otherwise. To confirm compatibility, have your supplier or an independent lab run a shear stability test on the greases individually and then repeat the test using a mixture of the products that you wish to cross-check. Ideally, you would like to see little to no change in the consistency of the greases either separately or after mixing.

How to Remove Acids from Used Oil

There are several suppliers of special adsorbents that can be used to remove acids from used oil. These powder-like materials have the ability to selectively strip acids from partially oxidized oils. For instance, a used turbine oil with an acid number of 0.6 can be brought back to a level below 0.1 (near the original, new oil level) using these materials. Commonly used adsorbents include fuller's earth and activated alumina. Ion exchange resins can also be used for this purpose. There are risks and disadvantages to reclaiming used oil in this way, including possible depletion of certain additives and the migrating of minerals from the adsorbent into the oil.

Why an Oil's Flash Point Decreases

The only way that the flash point of an oil can decrease over time is by the addition of a contaminant with a lower flash point. In a diesel engine, this is almost certainly a fuel leak. Since diesel fuel is chemically very similar to engine oil, it cannot be removed by filtration or any other means. The long-term solution to this problem is to find the source of the fuel leak and correct it. Then you must change the oil, since a fuel leak will decrease the viscosity and the oil's ability to form an adequate lube oil film.

Causes of Nitration in Engine Oil

Nitration is the degradation of oil in the presence of nitrogen compounds. It is a common mode of gas engine lubricant degradation and is a particular problem with higher-temperature four-cycle engines. Nitrogen oxides are typically formed during fuel combustion. These nitric oxides react with water to form nitric acid. The formation of nitric acids can lead to a corrosive environment for exposed engine surfaces. Nitration also results in the formation of deposits and sludge.

ExxonMobil

New Grease and Synthetic Lubricants Facilities

ExxonMobil recently announced the completion of its expansion project in Jurong (Singapore) to increase production of grease and synthetic lubricants, including Mobil 1™, the company's flagship synthetic engine oil. The expansion of the Jurong lubricant plant further strengthens the company's manufacturing capabilities and its ability to meet the growing demand for grease and synthetic lubricants products in the Asia Pacific region.

"These new grease and synthetic lubricants production facilities are strategically located close to key Asia Pacific markets, ensuring the reliable supply of these premium products to our customers. Our advanced lubricating oils and greases contribute to society's broader sustainability objectives by helping to increase equipment operating efficiency and engine fuel economy, which contribute to reduced energy and resource use, as well as lower emissions."

Teoh Song Ping
Asia Pacific Lubricant
Sales Director at ExxonMobil.

"**India's** economy continues to grow with significant opportunities across industries. One of the biggest market opportunities is within the automotive sector fueled by the growing middle class consumer segment who look for high quality lubricant solutions for their vehicles. Other industries such as general manufacturing also stand to benefit from increased product demand. The proximity of the new synthetic lubricants and grease plants in Singapore offer our customers in India an enhanced value chain with reliable supply and more efficient delivery."

Deepankar Banerjee
Chief Executive Officer, ExxonMobil Lubricants Pvt Ltd

SHELL LUBRICANTS

OPENS LEARNING CENTRE IN PARTERSHIP WITH BML UNIVERSITY

Shell Lubricants, the global market share leader in finished lubricants, recently inaugurated a Learning Centre in partnership with BML Munjal University(BMU), Haryana. Shell's collaboration with the varsity aims to provide real life hardware exposure and share practical knowledge in lubrication of automotive & industrial applications. The learning centre is aimed to provide industry experience to college students. The centre comprises of an Automotive Section and an Industrial Section.

"Shell has been focussing on improving energy efficiency for years through introduction of energy efficient lubricants. Lubricants will play a key role in reducing carbon footprint and enabling companies in addressing the larger energy challenge in near future. The centre gives us an opportunity to collaborate across industry and academia."

Ms. Mansi Tripathy
Country Head
Shell Lubricants India

"**We** believe as we move towards a more Sustainable and Energy efficient world, lubricants and tribology will play a major role in multiple other domains including aerospace, clean energy, medical instrumentation & implants, power transmission, food processing and packaging to contamination and environment protection. Thus we shall be educating the students on how the principles of lubricant and tribology can be used for not just new developments in automobile and industrial production process, but can be used for a wide range of applications mentioned above, leading to even new products, patents and cross disciplinary applications.

Dr. B.S. Satyanarayana
Vice Chancellor, BML Munjal University

"**One** of the unique things about this lab is that it will provide practical experience to our students and faculty through hands-on learning on various components and systems in different vehicles. We look forward to the centre bringing together Shell's expertise and BMU's talent"

Mr. Akshay Kant Munjal
President, BML Munjal University

GARRETT BAPP | NORIA CORPORATION

What You Should KNOW About BRAKE FLUID

Have you ever found yourself in a store isle looking at various brake fluids and wondering which one was right for your vehicle? Or maybe you just want the best performance from your braking or clutch system? Is your decision based on price or the fancy label on the bottle? There are many options and lots of information to decipher.

The Importance of Brake Fluid

Brake fluids are mainly used in the braking and clutch systems of on- and off-road vehicles. Typical applications include automobiles, motorcycles and light trucks. With roughly 253 million vehicles on American roadways daily, the braking system is vital for driver safety.

While vehicle owners may change their brake pads, rotors or drums based on a mechanic's recommendation or their car not stopping as soon as it once did, few people replace the brake fluid. Indeed, brake fluid may be a car's most neglected component.

35%

of MachineryLubrication.com visitors never replace the brake fluid in their vehicles

Reading your vehicle's owner manual will provide details on certain time-based or mileage-based service that should be performed, including oil, transmission, coolant and differential fluid changes. However, most American manuals offer no guidelines for when to service the brake fluid. The recommendations from fluid manufacturers and other countries typically range from one to two years for performing a flush of the braking system.

Contamination

Why should you change brake fluid if your vehicle's manufacturer doesn't give direction for doing so? Simply put, brake fluid is no different than the other fluids in your vehicle and should be replaced. It is subjected to contamination from deteriorating hoses and lines. When the master cylinder is opened up to inspect the fluid level, it is exposed to moisture contamination. If the brakes are not properly bled, air contamination will remain in the system. The high temperatures associated with braking can also cook the oil inside the caliper or wheel cylinder. This heat combined with any of the previously

mentioned contaminants can result in a poor-performing braking system.

Air

Air contamination within a braking system can occur in a variety of ways. The leading cause is poor bleeding of the system. Air may also enter the system due to worn seals and components. Over time, as the pistons move back and forth, the seals will break down, allowing air into the system. When worn or broken components are changed, pockets of air may also move into the system and be difficult to purge out.

The traditional bleeding method of having one person depress the brake pedal while another person bleeds the air at the wheel can be very time-consuming and often is not the most effective for removing 100 percent of the air. Vacuum and pressure systems offer better options for removing the air.

Moisture

By design, a brake fluid is formulated to absorb moisture. Otherwise, water molecules could rot the internal components and damage the braking system. Of course, this property comes at a price. As the brake fluid absorbs moisture, it lessens the fluid's performance. The high temperatures common with braking systems can result in this moisture vaporizing, which causes the fluid to become compressible and gives you that "spongy" feeling.

Brake fluid is no different than the other fluids in your vehicle and should be replaced.

Not all brake fluids have this property of absorbing moisture. Silicone fluids will only absorb so much moisture, leaving the rest to stay in free form and sink to low spots in the system. This can lead to corrosion.

So whether the contamination is from air, water, temperature or foreign materials, your brake fluid will need to be changed. I recently went through this with my car. While at the quarter-mile drag strip on a sunny day, I lost the functionality of my clutch. With a combination of hard launches and old fluid in my reservoir, my clutch pedal fell dead to the floor as I was trying to shift into third gear. After giving the car some time to cool down, I discovered that my clutch pedal came back to its normal firmness.

I sought a solution to this problem and found I was not the only one to experience this phenomenon. I set out to correct the issue by purchasing some components that didn't allow the supply line to the slave cylinder to be exposed to such intense heat. Another improvement was adding a remote bleeder to the system. With my new hardware and fluid, I'm now able to change out the fluid quickly without much hassle and haven't had a disappearing pedal since.

Classifications and Standards

Brake fluids are categorized into four main classifications by the U.S. Department of Transportation (DOT): DOT 3, DOT 4, DOT 5 and DOT 5.1. Most fluids fall into the DOT 3, DOT 4 or DOT 5.1 classification. These fluids are all hygroscopic, which means they absorb moisture from the air. DOT 5 fluids are not hygroscopic but are often used in vehicles that sit for long periods of time, such as collector cars or military vehicles.

The chemical composition of the fluids also changes with the different classifications. DOT 3 fluids are glycol ether based.DOT 4 fluids are a mixture of glycol ether with borate ester. DOT 5.1 fluids use borate ester with glycol ether blended in, while DOT 5 fluids are silicone based.

The Federal Motor Vehicle Safety Standards (FMVSS) No. 116 defines the properties that a brake fluid must have

	DRY BOILING POINT	WET BOILING POINT	VISCOSITY @ -40°C	VISCOSITY @ 100°C	CHEMICAL COMPOSITION
DOT 2	190°C/374°F	140°C/284°F	-	-	Castor Oil/ Alcohol
DOT 3	205°C/401°F	140°C/284°F	Max. 1,500 mm^2/s	Min. 1.5 mm^2/s	Glycol Ether
DOT 4	230°C/446°F	155°C/311°F	Max. 1,800 mm^2/s	Min. 1.5 mm^2/s	Glycol Ether/ Borate Ester
DOT 4+, SUPER DOT 4	300°C/572°F	180°C/356°F	Max. 750 mm^2/s	Min. 1.5 mm^2/s	Glycol Ether/ Borate Ester
DOT 5	260°C/500°F	180°C/356°F	Max. 900 mm^2/s	Min. 1.5 mm^2/s	Silicone
DOT 5.1	260°C/500°F	180°C/356°F	Max. 900 mm^2/s	Min. 1.5 mm^2/s	Borate Ester/ Glycol Ether
LHM+	249°C/480°F	249°C/480°F	1,000-1,200 mm^2/s	6-6.5 mm^2/s	Mineral Oil

DOT 4+ and Super DOT 4 fluids are not governed by FMVSS No. 116. The values shown are typical of DOT 4+ and Super DOT 4 fluids on the market. Most meet or exceed DOT 5.1 specifications for boiling points.

to be categorized into one of the DOT classifications. The table below shows some of the limits a fluid must meet to fit within this classification.

These properties affect how a brake fluid performs. Boiling point is one of the major indicators of how the braking or clutch system will react. During braking, wheel cylinders and brake calipers are subjected to very high temperatures due to the friction from the brake pads coming into contact with the drum or disk. During road course events and track days, it's not uncommon to experience caliper temperatures of 400 to 500 degrees F.

Even with these higher than normal temperatures, the brake fluid still must perform. A fluid that reaches its boiling point will vaporize inside the line. This causes the fluid to become compressible and provide inadequate hydraulic transfer of the braking force.

Boiling point can be broken into two categories: dry and wet. The dry boiling point applies to the fluid straight from the container. The wet boiling point is measured based on a 3.7-percent water absorption.

Another essential property of a brake fluid is its viscosity. Fluids must meet SAE specifications at minus 40 degrees C and 100 degrees C. For the different classifications, the minimum and maximum viscosity ranges will vary.

Testing Brake Fluids

The Federal Motor Vehicle Safety Standards (FMVSS) No. 116 stipulates the requirements for motor vehicle brake fluids. To be considered for one of the DOT classifications, a brake fluid must go through the following tests:

1. Equilibrium reflux boiling point (dry boiling point)
2. Wet equilibrium reflux boiling point (tested with 3.7 percent water)
3. Kinematic viscosities
4. pH value
5. Brake fluid stability (high-temperature and chemical stability)
6. Corrosion
7. Fluidity and appearance at low temperature
8. Reserved
9. Water tolerance (low temperature and at 60 degrees C)
10. Compatibility (low temperature and at 60 degrees C)
11. Resistance to oxidation
12. Effects on cups
13. Stroking properties
14. Fluid color

Packaging

The packaging in which a brake fluid is shipped and stored is also important. Before purchasing, always ensure the foil cap is intact. A damaged bottle or cap will expose the fluid to moisture contamination. According to FMVSS No. 116, there are standards for packaging and labeling by which all manufacturers must abide.

Purchase only the amount of brake fluid you need, as opposed to buying a larger bottle just because it is a better deal. Any leftover fluid should be disposed of once it has been opened, since any humidity will be sucked into the fluid, degrading the performance of the braking system when you perform a top-off or refill the system.

Final Thoughts

When deciding which brake fluid to purchase, the best advice is to stick with what's in your system. Just because a fluid falls within a certain classification doesn't mean it won't provide equal or better performance than a fluid with a higher classification. Depending on the composition, a DOT 3 fluid may have a better boiling point than a DOT 4 fluid. In addition, vehicles with an anti-lock braking system (ABS) are designed to work within the viscosity range of the specified classification.

Keep in mind that even though all fluids meeting DOT specifications must be compatible, mixing is not recommended. DOT 5 fluids should never be mixed with other classifications. The different boiling points and standards can result in decreased performance. A vehicle specified to use a DOT 3 fluid was designed and tested for the compatibility of the DOT 3 fluid's chemical composition. Changing classifications will alter the chemical composition, and the compatibility of components will be unknown. Therefore, when switching fluids, a full system cleanse should be performed.

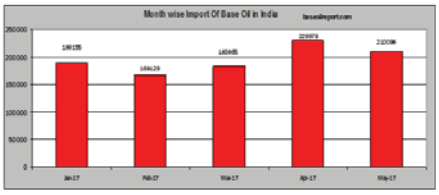
Unless you are a professional racecar driver, a change in brake fluid will likely be unnoticeable. When replacing your fluid, it's more important to properly bleed your system and seal everything. Also, don't use brake fluid that has been sitting around for an extended period of time. As mentioned previously, brake fluids are hygroscopic, so any humidity will end up inside the bottle. By changing your brake fluid every one to two years, you should enjoy many years of reliable braking. ■

About the Author

Garrett Bapp is a technical consultant with Noria Corporation, focusing on machinery lubrication and maintenance in support of Noria's Lubrication Program Development (LPD). He is a certified lubrication specialist through the Society of Tribologists and Lubrication Engineers (STLE) and holds a Machine Lubrication Technician (MLT) Level II certification through the International Council for Machinery Lubrication (ICML). Contact Garrett at gbapp@noria.com.

BASE OIL REPORT

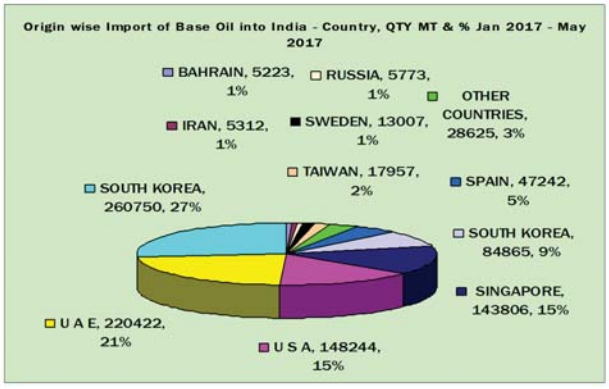
India, the world's third-largest oil importer, has sealed a first deal to import crude oil from the US and the shipment is expected to touch Indian shores in October.The deal, by state-owned Indian Oil Corp (IOC), comes within weeks of Prime Minister Narendra Modi's visit to the US when President Donald Trump talked of his country looking to export more energy products to India."We have bought 2 million barrels of crude oil from North America comprising 1.6 million barrels of US Mars crude and 400,000 barrels

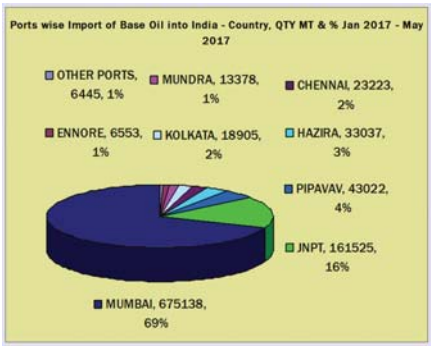


of Western Canadian Select," IOC Director (Finance) A K Sharma.US Mars is a heavy, high-sulphur grade which will be processed at IOC's newest refinery at Paradip in Odisha.

"Given the current international oil markets where the differential between Brent (the benchmark crude or marker crude that serves as a reference price for buyers in western world) and Dubai (which serves as a benchmark for countries in the east) has narrowed."Even after including the shipping cost, buying US crude proved to be very cost competitive to us." he said. Sharma said the company will buy more crude from the US if the market conditions remain favorable for such purchases.

Indian state-run refiner Bharat Petroleum Corp Ltd has also bought 1 million barrels of sour crude from the US for its 190,000 b/d Kochi refinery,





Dhiren Shah (Editor – In – Chief of Petrosil Group)

Dhiren Shah is a Chemical Engineer and Editor – In – Chief of Petrosil Group.

Base Oil Group I & Group II CFR India prices:-

Month	Group I - SN 500 Iran Origin Base Oil CFR India Prices	J-150 Singapore Origin Base Oil CFR India Prices	N- 70 South Korea Origin Base Oil CFR India Prices	Bright Stock-150
January 2017	USD 570 – 585 PMT	USD 585 - 600 PMT	USD 560 - 565 PMT	USD 975 - 985 PMT
February 2017	USD 620 – 630 PMT	USD 630 - 640 PMT	USD 610 - 625 PMT	USD 1000 - 1030 PMT
March 2017	USD 640 – 650 PMT	USD 650 - 660 PMT	USD 630 - 645 PMT	USD 1020 - 1050 PMT
April 2017	USD 645 – 655 PMT	USD 655 - 665 PMT	USD 635 - 650 PMT	USD 1025 - 1055 PMT
May 2017	USD 710 – 715 PMT	USD 685 - 695 PMT	USD 655 - 665 PMT	USD 1065 - 1085 PMT
June 2017	USD 700 – 705 PMT	USD 675 - 685 PMT	USD 645 - 655 PMT	USD 1055 - 1075 PMT
July 2017	USD 715 – 720 PMT	USD 690 - 700 PMT	USD 660 - 670 PMT	USD 1070 - 1090 PMT
	Since January 2017, prices have gone up by USD 140 PMT (24%) in July 2017.	Since January 2017, prices have firmed up by USD 100 PMT (17%) in July 2017.	Since January 2017, prices have shoot up by USD 100 PMT (18%) in July 2017.	Since January 2017, prices have hike up by USD 100 PMT (10%) in July 2017

Hungry for Training?

Satisfy your appetite.

Contact us today on www.lubrication-institute.com or call + 91 657 2383238

HIGH PERFORMANCE GREASES

Greases - Choicest range of greases for different applications

- GEM / GEM EP series - Lithium soap
- PLEX LC series - Lithium complex soap
- GREASE WR series - Lithium Calcium soap
- GEM SUPER HT / HTXX series - Calcium Sulfonate soap
- GEM TX / TXX series - Titanium complex soap
- GREASE CG series - Aluminum complex soap

SERVO® – India's first choice

SERVO® INDUSTRIAL OILS

100% PERFORMANCE. EVERYTIME.

Industrial Oils | Automotive Oils | Marine Oils | Greases

www.servo.in | www.facebook.com/IndianOilCorpLimited | twitter.com/IndianOilcl

GREY/MUM/06.17