March - April 2020

Machinery Lubrication

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OIL SAMPLING & FILTERING:

HOW TO SAVE MONEY AND REDUCE YOUR CARBON FOOTPRINT

INSIDE

Best Practices for Storing and Using Grease Guns

What if You Observe Water in Lubricant Container

NORIA

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Publisher's Note

Proper oil sampling is critical to an effective oil analysis program. Without a representative sample, further oil analysis endeavours are pointless.

There are two primary goals in obtaining a representative oil sample. The first goal is to maximize data density. The sample should be taken in a way that ensures there is as much information per millilitre of oil as possible. This information relates to such criteria as cleanliness and dryness of the oil, depletion of additives, and the presence of wear particles being generated by the machine.

The second goal is to minimize data disturbance. The sample should be extracted so that the concentration of information is uniform, consistent and representative. It is important to make sure that the sample does not become contaminated during the sampling process. This can distort and disturb the data, making it difficult to distinguish what was originally in the oil from what came into the oil during the sampling process.

To ensure good data density and minimum data disturbance in oil sampling, the sampling procedure, sampling device and sampling location should be considered. The procedure by which a sample is drawn is critical to the success of oil analysis. Sampling procedures should be documented and followed uniformly by all members of the oil analysis team. This ensures consistency in oil analysis data and helps to institutionalize oil analysis within the organization.

In establishing a filtration program, several factors must be considered, such as the type of filtration device, type of contaminant being filtered (water or particles), the viscosity of the lubricant, and the type and location of the machine.

A bulk storage tank and larger, more critical machines may use dedicated piping in their filtration systems, while smaller, less critical units may employ portable filtration. These portable systems can be easily transferred from one machine to another. However, to avoid cross-contamination, it is best to have a dedicated filter system for each lubricant viscosity.

A successful oil analysis program requires an investment of time and money to make sure the proper sampling hardware is fitted to the machinery. It is important to understand that not all locations in a machine will produce the same data.

We would like to thank our readers for the great response to our previous edition's cover story – "Extending Oil Change Intervals: How to manage the unintended consequences". Our current issue's cover story is "Oil Sampling and Filtering: How to Save Money and Reduce Your Carbon Footprint" which will help our readers to know about oil sampling program and the impact of improved filtration and sampling practices. You will find much more in this edition.

The threat of COVID-19 causing massive outbreaks that overwhelm health systems around the world is serious. This is a global issue but sooner or later we shall overcome this situation.

Read 'Machinery Lubrication India' during this home quarantine!!

Stay Safe.

As always, we welcome your feedback & suggestions.

Warm regards

Udey Dhir

Philosophies of **Transformational Change and ICML 55**

"The best strategies are those that affect **the behavior and activities of the most people.**"

I first met Ron Moore in the early 1990s. He is known as an icon in the reliability community and is the author of an excellent book entitled *What Tool? When?* This book tackles a delicate subject that is both difficult and controversial. Moore examines and contrasts the world's most notorious and respected philosophies in the field of maintenance and reliability. These include lean manufacturing, kaizen, total productive maintenance (TPM), Six Sigma, reliability-centered maintenance (RCM), root cause analysis (RCA), predictive maintenance (PdM) and others.

Which of these philosophies does a user organization really need? Is there a priority order or logical sequence to their use? Which produces the greater benefit or return for the lowest risk or investment? How sustainable are they? These are all great questions that require an answer, especially for those seeking a major transformation in their maintenance and reliability programs.

For those of you in the reliability field, this book is a must read. Lectures and interviews with Moore can also be found on YouTube and in the "Rooted in Reliability" podcasts for an abridged understanding of his main themes.

Moore in the Context of Lubrication

Lubrication is a vast subject and highly important to the reliability and management of physical mechanical assets. For those who have read the recently published ICML 55.1 standard, this fact could not have been more validated. This landmark standard

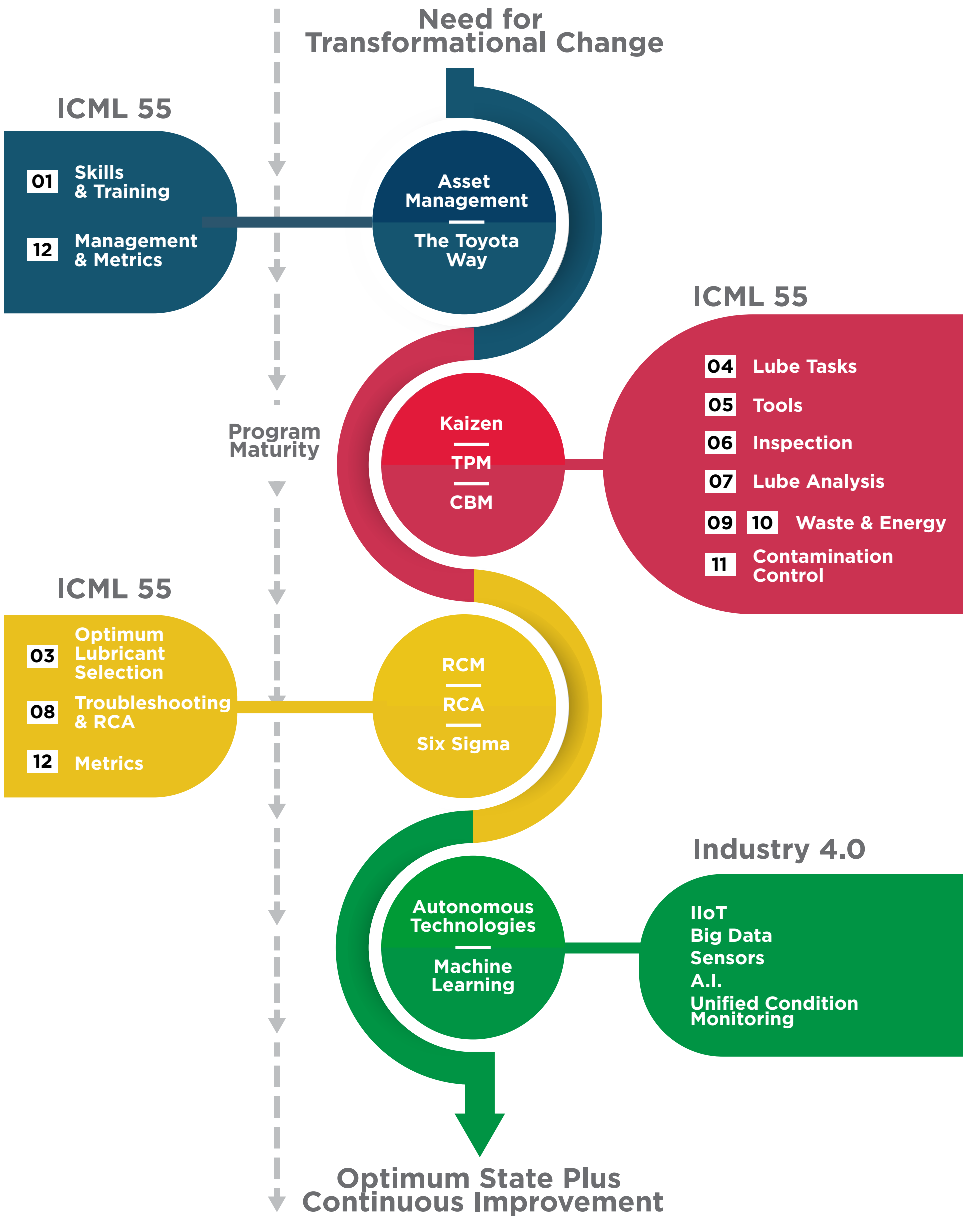

Figure 1: Transformational Change Chart

on the optimum management of lubricated mechanical assets lists 12 major categories that provide the foundation and framework for the lubrication field.

Do all 12 of these categories merit equal weight related to value and importance? Should all 12 categories be approached and implemented concurrently? Of course, the answer is no. Fortunately, we have learned greatly from the many documented case studies shared by organizations that have gone down these roads before. Their published experience not only helped construct the 12 categories but also provided guidance on how to rank them for a more efficient and beneficial implementation.

However, this column will be a bit different. I'll be cross-referencing the key points or lessons from Moore's book *What Tool? When?* against the 12 categories in the ICML 55 standard that was developed by 45 lubrication subject-matter experts. In the interest of

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brevity and keeping things simple, I've taken some liberties in the narrative that follows to condense the central points of both Moore's book and the ICML 55 elements (12 categories). I've also added a few of my own thoughts.

The order of the following sections is generally aligned with the main recommendations in Moore's book. In other words, while all philosophies he discusses have the potential for solid value, it may be wise to evolve a program (crawl-walk-run) through a series of rational steps. The first would likely produce some quick wins and low-hanging fruit.

As the transformation matures, more advanced and complex philosophies can be incorporated. In the final stage, I've added autonomous technologies, e.g., Industry 4.0 and other disruptive solutions. Although I've placed this stage at the end of the maturity timeline, its order for some may defy other precursory steps. Only history will know for sure what lies ahead. See the transformational change chart in Figure 1.

This exercise is far from an exact science, and many industry-specific or company-specific differences and special requirements must be considered. Furthermore, these philosophies are not mutually exclusive. The main themes overlap and are interrelated with the core principles of other philosophies. I see this as particularly true with Kaizen and TPM, for instance. A solid case can be made that they all relate to the lean manufacturing model as well. Drawing all of these connections will not be attempted.

Likewise, I will not try to reproduce the arguments behind Moore's conclusions or sequence. For that, I suggest you read his book. I will say that I in no way disagree. So, let's get started.

Asset Management

I've discussed asset management extensively in past columns. ICML 55.1 is an asset management standard that is structurally aligned to ISO 55000. Across any organization, ISO 55000 should be harmonized with ISO 9000 (quality), ISO 14000 (environment), ISO 45000 (health and safety) and ISO 31000 (risk management).

Moore talks about beginning with an overall philosophy and strategy patterned after The Toyota Way/Production System. He refers to long-term thinking, the importance of top-down leadership and the need to align reliability to the broader organizational objectives. Closely related are employee engagement (culture), action plans, metrics, compliance assessments, training, procedure-based work and much more. This all underpins the ideology and principles of asset management, and as such rightly deserves the top spot in the transformational change chart.

ICML 55 Elements: *Management (12), Skill (1)*

Kaizen, TPM & CBM

Many books and thousands of articles have been written on these subjects. They are the cornerstone of all modern concepts in maintenance and reliability.

45%

of lubrication professionals say their organization does not have a system to manage change in their lubrication program, based on a recent survey at MachineryLubrication.com

Moore points out that one of the main benefits of Kaizen and TPM is that they are not isolated thrusts but are instead broad-based. They can alter culture and affect the activity of people from the plant floor to the CEO. As such, you enable deep and widespread transformation, improvement and benefit.

The strategic and tactical elements that facilitate transformational change from these philosophies are numerous. These include:

- Standardization of work practice
- Visual systems and Inspection 2.0
- 5-S and autonomous maintenance
- Cleanliness and orderly work environment
- Operator asset care
- Overall equipment effectiveness (OEE)
- PM optimization
- Training and continuous learning
- Motivated staff involvement
- Continuous improvement

Moore refers to condition monitoring and predictive maintenance as "sophisticated inspection." This is exactly what is happening. Sensors and instruments serve as data collectors. Software and algorithms aid in problem detection, diagnosis and prognosis. As always, there should be a root cause emphasis (proactive maintenance) that is paired with predictive maintenance for early fault detection.

As condition-based maintenance (CBM) moves increasingly online and towards the industrial internet of things (IIoT), the human element fades or diminishes. Portable data collectors and human analysts are overtaken by real-time sensors, predictive analytics, etc. The velocity of these trends is real and unstoppable. While Industry 4.0 is the buzzword that keeps being mentioned, references are already being made to Industry 5.0.

ICML 55 Elements: *Lube Tasks (4), Tools (5), Inspection (6), Lubricant Analysis (7), Waste and Energy (9-10), Contamination Control (11)*

RCM, RCA & Six Sigma

Reliability-centered maintenance (RCM) is the core reliability platform for many organizations, and for good reason. It has produced powerful and prominent tactual methods, including failure modes and effects analysis (FMEA), criticality analysis (failure probability and consequences), the P-F interval and life expectancy.

However, as Moore explains, RCM should not preempt the foundational elements of the first two major steps (asset management, TPM, etc.). Some have viewed RCM as too technical and difficult to mainstream within an organization. Sustainability problems have been noted. Others have pointed to exceptional success.

Like RCM, Six Sigma is another great tool. It is recognized for DMAIC (define, measure, analyze, improve, control), process design and management, analysis of variance, balanced scorecards, and statistical process control. Yet Moore asserts there is a risk that Six Sigma can "consume considerable resources in applying … people often get so engrossed in the process they forget the goal is to get results." The risk of "paralysis by analysis" is mentioned. Instead, he suggests that it should be "selectively applied to complex problems that require a disciplined methodology."

That said, Six Sigma is lauded by many organizations around the world. Moore describes how General Electric has been very successful with Six Sigma because the leadership drove the process and demanded results. He also tells how Toyota has been very effective without Six Sigma, using simple tools, kaizen, 5-S, TPM and engaging the entire workforce in improvement. Again, the point here is to do the basics really well first (kaizen, TPM, etc.).

Root cause analysis (RCA) is yet one more stalwart tool of the reliability field. Its goal is to fix problems forever, regardless of whether they involve a machine failure, human issue, process problem or others. You likely have heard of the 5 Whys, fault trees, RCA logic charts and those famous fishbone diagrams. Failure is a great teacher.

ICML 55 Elements: *Optimum Lubricant Selection (3), Troubleshooting and RCA (8), Metrics (12)*

Wisdom in Execution

To some, the advice emphasized by Moore and summarized above may seem trivial and a little too pedestrian. It reminds me of the title of another one of his books, *Making Common Sense Common Practice*. Yes, sexy new technologies may possess the cool factor, but sometimes these cutting-edge ideas later lose their luster or die on the vine.

Moore suggests the best strategies are those that affect the behavior and activities of the most people. Get leadership right, get aptitude and attitude right, and then go on to pursue the rest. ***ML***

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 also 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.

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Advantages of Using **Real-Time, In-Line Oil Sensors**

"These devices can identify most, if not all, events and project the remaining useful life of the oil while the asset is in operation."

Oil analysis has been the backbone of reliability programs over the past century. From the earliest instruments used by laboratories to the more modern, miniaturized benchtop equipment, this technology has transformed the way and speed by which maintenance decisions are made. Among the latest advancements are in-line, real-time oil sensors, which promise to deliver true online monitoring capabilities.

Previous sensors generally were simple, single-point dielectric, conductivity or permittivity measurement devices used to detect oil oxidation but were not sensitive to other key parameters. The newest sensors are capable of not only detecting degradation of the overall oil quality but also estimating the percentage of soot, base number, relative humidity, additive depletion, etc. These devices can identify most, if not all, events and project the remaining useful life of the oil while the asset is in operation.

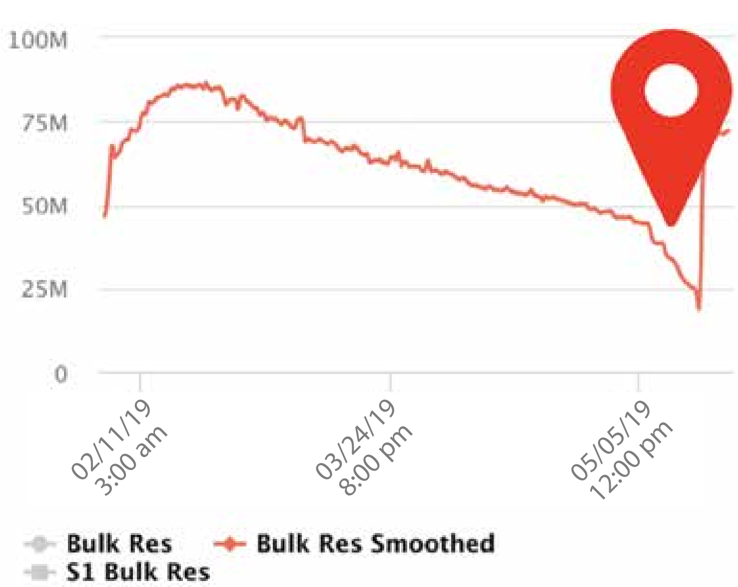


Figure 1. Oil-quality readings from an online sensor installed on a diesel engine

Figure 2. Readings from an oil-quality sensor used to monitor oil changes on a piece of mining equipment

Event Detection

Although these sensors cannot replace laboratory analysis results, they can provide the necessary insight to make preventive maintenance decisions before damage occurs. New sensor technologies utilize electrochemical impedance spectroscopy (EIS), which covers a broad spectrum of oil properties and enables sensitivity to most failure modes.

In Figure 1, an online oil-quality sensor was installed on a diesel engine operating in off-highway conditions. After an oil change, there was a break-in period, and the oil-quality reading peaked for that cycle. As the engine continued in operation, the sensor readings trended down as the oil quality degraded.

While in operation, the engine developed a coolant leak that would have gone undetected and severely damaged the equipment, forcing a full engine rebuild. Upon a significant break in the oil-quality trendline and an increase in relative humidity detected by the sensor, an investigation discovered the coolant leak. The equipment was repaired, and the oil was changed and put back into service with minimal downtime.

Oil Drain Optimization

Optimizing oil drains is another important benefit of oil-quality monitoring. Unlike previous generations, the newest sensors can track and trend most of the major indicators for condemning the oil. Figure 1 offers a good example of a normal trendline: The oil has a break-in period, peaks and then degrades over time. This degradation of the trendline lets you predict when condemning limits will be crossed, allowing the oil's remaining useful life to be forecasted. Being able to not only detect when oil changes are required but also to predict the oil's lifespan is a major enabler for oil drain optimization.

In Figure 2, an operator installed an oil-quality sensor on a piece of mining equipment to monitor oil changes. Upon review, it was found that the oil changes were occurring on average at around 25 percent of the total remaining useful life. This left approximately 75 percent of the oil's life unused. In most cases, the oil was changed before it had even been broken in.

By using the data provided by the online sensor, the operator was able to change the drain interval practices from being based on the number of in-service hours to being condition-based. This has led to a big savings per asset per year through decreased oil consumption while significantly reducing downtime and environmental waste in the process.

Additional Improvements

New sensing technology is just now starting to reveal all the ways that it can help reliability programs. As the use of these sensors increases, more improvements can be expected, from optimizing top-offs and bleed-and-feed methods to advanced filtration, additive replenishment systems, etc. For now, these early wins are driving adoption at a significant rate by changing the way best-in-class reliability programs operate. *ML*

GUYS WHO DO THE WORK (THE REAL HEROES)

OIL SAMPLING AND FILTERING:

HOW TO SAVE MONEY AND REDUCE YOUR CARBON FOOTPRINT

BY SCOTT BRINER, ADVANCED COMPOSITES

As the leading supplier of thermoplastic olefins (TPOs) and polypropylene compounds to the automotive industry, operates 24 hours a day, seven days a week. Its product line consists of proprietary formulations designed to meet specific original equipment manufacturer (OEM) applications, ranging from super-ductile materials required for interior-trim, side-air-bag (SAB) applications and highly engineered TPO compounds needed for scratch-resistant, mold-in-color instrument panels to compounds designed for exterior bumper-fascia and body-side moldings. At a facility that runs 24 hours a day, scheduling and completing proactive maintenance can be challenging. Work orders may be created to take a line down for oil filtering, but scheduling in most cases makes it difficult for this to happen in a timely manner.

Thankfully, Advanced Composites is an organization that fosters development and improvement. This has enabled the preventive maintenance (PM) program to be transformed into a proactive maintenance program. Through this shift, the company was able to increase savings and reduce its carbon footprint. This article will describe how the necessary changes were implemented to its maintenance and lubrication program, as well as provide a glance into where the program is heading in the future.

Photos by Harry Acosta

A Brief History

Before the current maintenance PM coordinator started working for Advanced Composites, the original maintenance and lubrication program consisted of only two semi-annual oil changes. The PM task team would change out the oil on their vital equipment during the July and December shutdowns as a preventive measure against breakdowns. For reference, vital equipment is defined as the equipment necessary to keep the facility running and making product. The current lubrication program is set to only sample equipment that has 100 or more litres of oil or is defined as "support vital equipment." This equipment has a direct impact on all production operations, such as laboratory test equipment or air compressors. Through semi-annual oil changes, Advanced Composites was disposing of about 5000 litres of oil per year on average from just 12 pieces of equipment. Changing out the oil semi-annually on these machines started to become a fruitless and very costly PM task.

Advanced Composites took a step in the right direction by beginning an oil sampling program. Unfortunately, the program was put in place with very little direction or knowledge of how to run it. Oil samples were scheduled to be drawn as a quarterly PM task. The team would go to the equipment, open it up through the breather port, and draw a sample with the vacuum pump and tubing. Sometimes additional contamination would fall into the gearbox through this sampling procedure. The reports would come back and be filed away.

When it came time to filter, personnel would go out to the oil shed/maintenance shop to get a plumbing fixture to attach the filter cart to the gearbox (or other equipment). This process could take up to 30 minutes. Sometimes the plugs and pipes were not wiped down, leading to additional contamination entering the system.

After almost two years in the evolution of Advanced Composites' early maintenance and lubrication program, Scott Briner was hired as the PM administrator. His responsibility was to lead and manage this lubrication program and the preventive maintenance program. Within the first few months, Briner started Noria's lubrication training and took the certification test to obtain his Level I Machinery Lubrication Technician (MLT I) certification through the International Council for Machinery Lubrication (ICML).

After receiving his certification, Briner implemented an "oil change/filtering worksheet." This worksheet helped him to better manage, schedule and then note when jobs were completed. It also provided a paper trail to file electronically for future reference as needed.

However, for the first six months of Briner's first year with Advanced Composites, the PM team was operating on the limited knowledge of how to use and understand their current oil analysis results. When the quarterly oil sample was sent out to be tested, it usually would take the laboratory more than 30 days to return the results. Waiting this long for sample results was not helpful, especially if there was a problem that required urgent attention. By the time it was determined based on the results that an action such as an oil change or filtration was needed, it was time for the next quarterly oil sample to be collected.

As Briner began looking at the results closely, questions about the reports sometimes would arise. He would reach out to his contact at the lab and often have to wait for days or weeks to receive an answer. Advanced Composites was just taking the word of its lab as to whether anything needed to be done on the equipment. This made personnel feel as if the lab was driving them. The company was not steering the wheel of its own lubrication program.

The Company was also struggling to find the right time to conduct oil changes and filter oil in a timely manner. With a production schedule that is seven days a week, 24 hours a day, the PM team would have to work closely with production management to find out when and how long the next line changeover was scheduled for the vital equipment that required lubrication attention. In most cases, by the time oil changes or filtering could be conducted, it was time to extract oil samples on the next scheduled quarterly PM task.

The facility was not even close to being preventative with its lubrication PM program, let alone proactive. Frustration was beginning to build, and Briner knew big changes would be necessary to create a world-class lubrication program.

Fostering Change

Briner met with the maintenance team and brought forth his concerns about the current state of the lubrication program. Right away, they gave him the go-ahead to seek a better laboratory to handle the oil samples. They also asked him to establish a set of goals to work toward, make changes and improve in a timely manner. There were many things he wanted to improve at this point, but Briner had to limit his list to the most important goals first. The initial goals were as follows:

1. Perform oil filtration on vital equipment in a timely manner by finding a way to filter the oil while the equipment is still in operation.
2. Obtain a better laboratory to handle the oil samples with a quicker turnaround time for the results.
3. Find training, possibly with the new laboratory, to gain the knowledge and understanding to read the oil sampling test results.
4. Improve the prevention and common practices relating to oil contamination within the lubrication program.
5. Continue to improve and reduce the lubrication carbon footprint.
6. Continue to improve the lubrication program's file history, including oil sample test results and work completed, possibly within a spreadsheet.

After this list of goals was submitted, Briner located a laboratory that promised to have oil test results back within 24 hours and at a savings of half the current cost per sample. Briner also decided to undergo the Oil Analysis training of Noria to read and understand the results to proactively tackle issues. Now he would know how good his oil was and whether it could last until the next scheduled quarterly oil sampling.

In addition, this lab could provide an online database with a history of the oil sampling as a bonus service. This database makes it easy to go back and look at baseline samples to see trends and spikes. For instance, Advanced Composites received a report indicating what was considered a high particle count. Previously, a filtration work order would have just been scheduled, but after examining the current report, some past reports, and the baseline report, the company determined that the particle count wasn't high at all. It was consistent across all the samples. There was no need to create a new work order. This saved a tremendous amount of man hours.

Personnel at the new lab were also very interested in visiting the Advanced Composites facility to get a better idea of the environment in which the equipment operates. This allowed them to recommend the best tests for the equipment. Briner now receives better results that are tailored to his type of production and equipment, and he is in a better position to advise the maintenance team on what to do. They can see when a problem is coming, and if something keeps recurring in the results, they can dig into it to determine if there is a larger issue. Partnering with this new lab effectively crossed two items off the to-do list.

Briner then started search for a company which could help with in-service filtration. He was able to locate one and they discussed installing "oil access assemblies" on a vital piece of equipment to see if they could filter while the equipment was in production. Then the assembly was installed on a trial basis and tested for about 30 days.

One piece of the assembly is installed into the drain port. This portion includes a quick connect and sampling tube. The tube goes directly into the gearbox and can be bent upward so the sample is taken away from the bottom and side sediment for a more representative sample. The quick coupling still permits draining, but it also allows a permanent connection to a filter cart. The other piece of the assembly is installed into the breather port. This piece includes an area where a desiccant breather and another quick connect can be installed for filling or connecting to a filter cart.

The mounts worked great. In-service filtration was able to be completed and with a much better method of extracting oil samples. Once the 30-day testing period was over, Briner obtained purchasing approvals from the maintenance team. By the end of the year, all the vital equipment had been fitted with these mounts.

The mounts and expedited oil analysis reports improved the success and completion of work orders. Because Briner was receiving reports faster and understood them better, he could create work orders for the PM task team to complete. Before the drain and breather mounts, they had to schedule work alongside the production schedule to determine when these vital pieces of equipment could be taken out of service for filtering. As mentioned, sometimes the work could not even be completed before the next oil sample. Now, because these mounts with quick couplings are already on the machines, the team can simply hook filter cart and come back in a couple of hours.

These mounts were the biggest game changer of all the improvements. With the first three major items on Briner's list crossed off, he began working on the other improvement items.

Reducing Contamination

Reducing oil contamination has been a continuous improvement process. Advanced Composites first had to educate and train its team on ways to prevent contamination. Briner introduced "maintenance touchpoints," which are handouts that are reviewed by all team members, discussed, signed and then filed away in the training folder. Within the maintenance touchpoint, Briner gave one word to remember: COPPER, which stands for contaminated oil, proactive practices, and effective results. The reason "COPPER" was chosen is because copper is a contaminant in the facility's oil. The goal is to remember that if personnel are proactive in preventing contamination, this will lead to more effective maintenance results.

To aid in better storage and handling practices, a set of rules was created to prevent oil mishandling and contamination. The current rules include the following:

1. Do not mix different types of oil. Verify which type of oil is needed for each application and then use the correct or provided handheld container in the oil storage shed.
2. When replacing oil, only drain into buckets and containers clearly marked

The drain mount (left) and breather mount (right) installed on a vital piece of equipment

The filter cart connection on one of the breather mounts

for "used oil." These are located in an area within the vacuum waste tote storage areas. No used oil should be stored in the oil storage shed at any time for any reason.

3. Do not use any provided handheld container for used oil if it is intended for new oil and located in the oil storage shed.
4. Only use the trash pump to pump used oil. Never use any other filter pump to assist in draining out used oil.
5. Always ensure the funnel, new oil container and area around the opening to each piece of equipment are clean and free of any foreign debris when refilling new oil.
6. Keep the tops of oil drums in the oil storage shed free and clear of any and all foreign debris. Ensure the drums are clean before and after extracting oil from them.

The equipment installed had a tremendous impact on preventing and reducing contamination. The drain and breather mounts have allowed Advanced Composites to engage in better filtering and sampling practices. Before, the facility was only filtering during shutdowns or changeovers. Personnel would have to install and connect to plugs and pipes, and filtering was performed on cold, uncirculated oil. Usually, the pipes and plugs were not wiped down, which would lead to more contamination entering the system. Now, they are able to complete in-service filtering while the equipment is making product. Most importantly, the oil is warm and agitated, so the filtration is better. The team has also installed desiccant breathers on their machines for moisture and particle prevention.

Currently, Briner is looking to fine-tune the time required for the equipment's quarterly oil filtering. This could potentially save man hours and workable filter cart conditions.

In addition to filtration, the drain and breather mounts have improved sampling practices. Previously, personnel had to open the system to the dusty environment to obtain a sample at the breather port. Now, they can collect an oil sample without opening the system to the outside environment. The sample is pulled directly into the bottle while the equipment is in full operation, providing a better representation of the oil's condition. Doing everything they can to minimize contamination during the sampling process ensures the results are reliable.

Carbon Footprint

One of Advanced Composites' goals as an organization is to reduce its carbon footprint. Within the lubrication program, the company strives to minimize oil waste by educating the PM task team on how to prevent oil contamination. This starts with properly filling equipment with new oil and continues through oil sampling and daily visual inspections of all seals and oil levels.

Back when Advanced Composites was performing semi-annual oil changes, it was leaving a big carbon footprint in terms of its disposed oil. As mentioned previously, the facility was disposing of about 5000 litres of oil per year. Through improved understanding of oil analysis results, better sampling and filtering, and contamination reduction strategies, unnecessary oil changes were eliminated.

Earlier, the company focused on putting all the necessary blocks in place so it could start gathering and reporting numbers. One of the biggest changes was to the work environment. The team had to be educated on the importance of providing these numbers, which could then be reported to upper management, allowing them to see the improvements being made.

Afterwards, within a year, 28 pieces of vital equipment were maintained. By filtering about 8000 litres of oil, the site retained 6000 litres in the machines and only had to change out 2000 litres. In 2018, 25 pieces of vital equipment were proactively maintained with the drain and breather mounts installed. The facility filtered 6500 litres of oil, retaining 6000 litres and changing out only 500 litres.

The Company was able to significantly increase the amount of oil it retained in its machines while decreasing the amount of changed oil over the course of one year. It also found cost savings in reducing the amount of disposed oil.

After that Briner was trying to find a better way to recycle used oil. He was exploring the possibility of having more control of what happens after it is collected.

The "used oil" storage and buckets are kept far from the new oil storage.

Advanced Composites
Attn: Scotty Briner
Customer ID#-6517

Plant-

Machine ID#-

Tests-

Oil Type-

Oil Hrs.-

Oil Change Date- Initials- SAB

Comments-

Example of an oil sample label used at Advanced Composites

Improved Record-Keeping

Since the year of such improvements, a much more accurate electronic filing account has been kept of Advanced Composites' oil analysis results, oil changes and filtration. The online database has helped Briner maintain an electronic history of oil sample results. He can add or remove equipment without affecting any historical information in the database. Instead of digging through files and papers for analysis history, he can simply pull up the information on his computer to instantly compare sample reports.

The oil change/filtering worksheet has changed the work environment as well. It is mandatory that this worksheet be filled out before and after any work is completed, and then returned to Briner for review and electronic filing.

A label maker was also purchased so oil sample labels wouldn't need to be handwritten. This has saved a lot of time. Briner's advice is to contact your oil analysis laboratory to find out what information is required on your printed labels. This may even speed up the turnaround time of your oil analysis results. Customizing your label on each sample helps the lab keep better records and makes the process easier when issues with the sample results arise.

Future Improvements

Many other improvements are being planned to increase savings and prevent oil contamination. The next big project is to enhance the oil storage area. Advanced Composites has already made changes to its handling practices to reduce contamination, but improvements to the storage area will further aid in decreasing contamination. Briner hopes to create a more user-friendly storage facility that will allow for lubricant inventories to be better controlled.

Within this revamp, a color-coding system is being considered with dedicated transfer hoses and oil containers. Briner would like to add drum mounts to aid in filtering, sampling and transferring new oil. These mounts will also provide a clean connection through the use of quick connects.

On a smaller scale, Briner is looking to improve his facility's grease gun management. By weighing the pumps of grease from each grease gun and labelling the guns with this information, the PM task team will know exactly how much grease per pump they are applying. This should prevent over greasing the bearings on vital equipment.

Reliable Support

Advanced Composites' lubrication program has grown and is continuing to grow because of the guidance and continued support from the maintenance team as well as outside contractors. Also, if it were not for the PM task team, the implementation of all the changes would never have happened. As the saying goes, "There is no 'I' in team." This successful journey required everyone working together to reach this point, and it will take everyone working together to continue to make improvements to the lubrication program at Advanced Composites. ***MLI***

Controlling the Speed of a Hydraulic System

"If speed control is important to your operation, switching to one of these flow controls may help."

The speed of a hydraulic system is determined by the amount of flow delivered. Normally, flow controls are used to accomplish this. While many people are aware that a flow control or orifice will limit the hydraulic flow in a system, they may not realize that orifice size isn't the only variable that will affect the flow and therefore the speed of a hydraulic actuator, such as a cylinder or hydraulic motor. There actually are three variables that affect flow: the orifice size, the pressure difference between the inlet and outlet of the orifice, and the oil temperature.

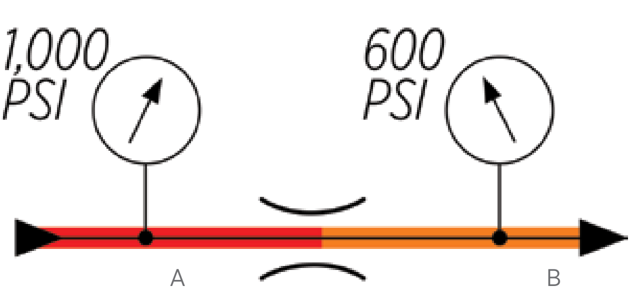
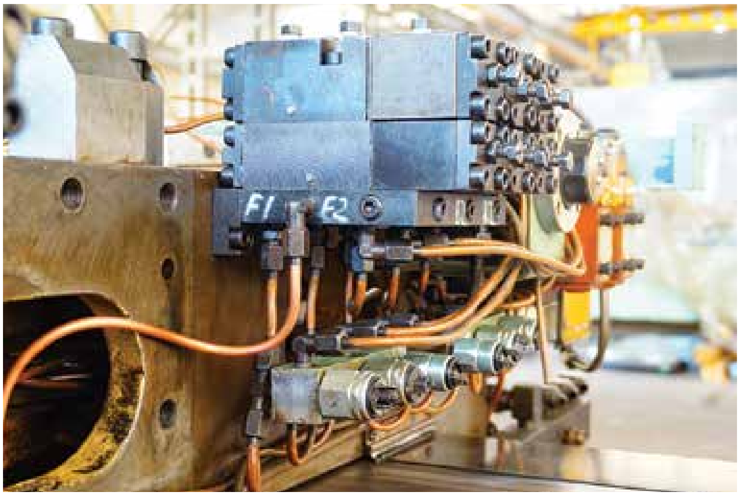


Figure 1. The higher the upstream pressure reading on gauge A (as compared to gauge B), the harder the flow is pushed through the orifice.



Orifice Size

The size of the orifice is fairly straightforward. The bigger the hole, the more flow will pass through it. Many flow controls have a variable orifice size, so turning the adjustment counterclockwise will increase flow, while turning it clockwise will close the valve, limiting the flow and slowing down the actuator.

Pressure Difference

Whenever a flow control is adjusted so that it limits flow, there will always be a pressure drop across the orifice. Any restriction of flow causes back pressure to build upstream of the valve. The greater the pressure drop, the more flow will pass through it. Figure 1 provides a good example of this.

Oil Temperature

You may notice some machines move more slowly at startup than they do once the oil gets up to temperature. This is to be expected, because the higher the oil temperature, the lower the oil

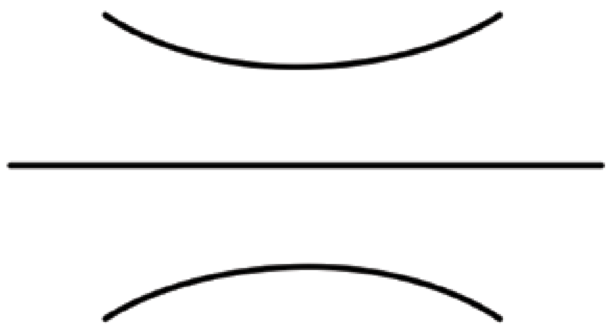


Figure 2. A fixed-orifice flow control symbol

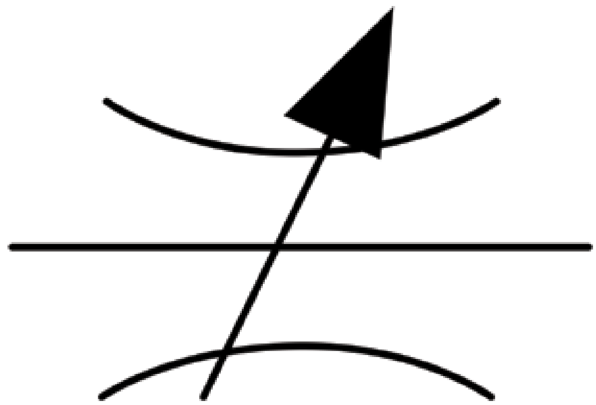


Figure 3. A variable-orifice flow control symbol

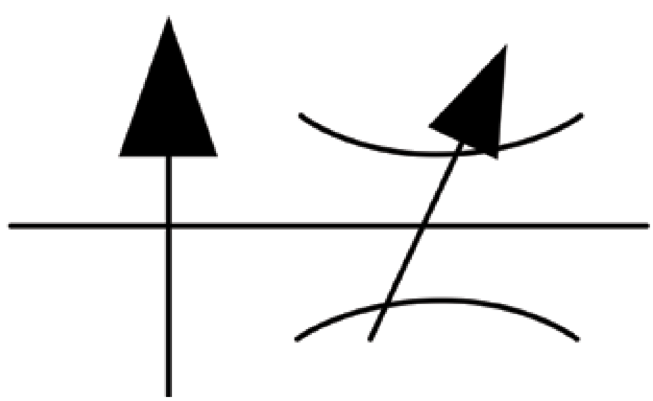


Figure 4. A flow control symbol with a bypass check valve

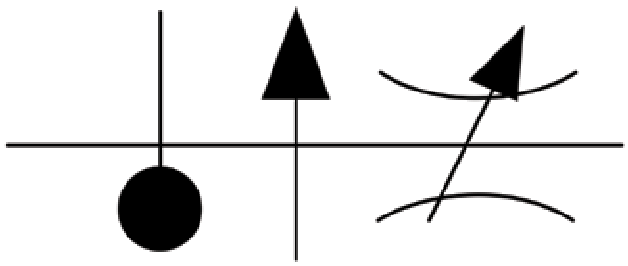


Figure 5. A pressure-compensating flow control symbol

viscosity will be. Thicker oil cannot move as rapidly through an orifice as thinner oil can.

Fixed Orifice

The fixed-orifice flow control (Figure 2) may or may not be a proper component in a machine. By definition, it is nothing more than a hole of a specific size that cannot be adjusted. It may be simply a drop in line size. Sometimes when a 50 mm hydraulic line is teed off to a 6 mm line, a draftsman may represent this as a fixed orifice. If you remove the valves from a manifold, you will find large holes and small holes drilled through it. The fixed-orifice flow control symbol may represent one of the smaller holes. It may also represent an orifice that can be removed from the manifold with an Allen wrench. Whatever form it takes, it should never be removed and replaced by a variable-orifice flow control. The designer had something specific in mind when calling for a fixed-orifice flow control. For whatever reason, the designer did not want it to be adjusted. Its purpose may be to synchronize flow to more than one actuator, or it may be for safety purposes to keep an actuator from moving too rapidly.

Variable Orifice

The variable-orifice flow control symbol in Figure 3 has a diagonal arrow to indicate that it can be adjusted. It often is called a needle valve because a common construction uses a conical needle that seats to close off the valve. The conical needle is called a vernier. The purpose of the vernier is to make the adjustment proportional to the number of turns made on the adjustment. A common number of turns between fully open and fully closed is five, so each full turn of the knob will change the orifice size by 20 percent.

Manual valves such as ball valves, gate valves and butterfly valves should never be used to control speed in a hydraulic system. These types of valves are meant to be open or closed. Keeping them partially open in a high-pressure hydraulic system will cause them to be unable to seat properly, and they will not close all the way. The vernier is specifically designed to adjust flow.

There are also cartridge-type flow controls that mount in a manifold or valve stack. While these are not true needle valves, they are engineered with a spool that is cut to limit flow.

It is not uncommon for either fixed- or variable-orifice flow controls to have a built-in bypass check valve (Figure 4). The flow control with a bypass will limit flow in one direction but will allow free flow in the opposite direction. The purpose of these controls is usually to enable independent forward and reverse speed control.

Pressure Compensating

The pressure-compensating flow control (Figure 5) is designed to maintain a constant flow regardless of the pressure drop across it. This control is used in systems where the load weight changes, but it is important to maintain a constant speed. Without the pressure-compensating feature, a heavier load will move more slowly than a lighter load. The pressure-compensating flow control is available as either a fixed- or variable-orifice type.

Temperature Compensating

If the ambient temperature varies enough to affect production, the answer may be a temperature-compensating flow control. The additional symbol looks a bit like a thermometer. This control can be expensive, so it is unlikely to be found unless it is truly needed. The temperature-compensating flow control will maintain a constant flow regardless of any changes in oil viscosity. It is available as either a fixed- or variable-orifice type, and can also be a pressure-compensating control if the load weight changes constantly.

When I am called to help diagnose problems in a system and the issue concerns a flow control, the most common problem I find is that an incorrect type of flow control has been installed. It may be that the flow control specified by the designer failed to take certain conditions into account, or that a flow control has been replaced with one of the wrong types. If speed control is important to your operation, switching to one of these flow controls may help. ***ML***

About the Author

Jack Weeks is a hydraulic instructor and consultant for GPM Hydraulic Consulting. Since 1997 he has trained thousands of electricians and mechanics in hydraulic troubleshooting methods. Jack has also taught radio-wave propagation for the U.S. Air Force and telecommunications equipment operation and repair for the Central Intelligence Agency at American embassies overseas.

Manoj Srivastava

You Observe Water in Lubricant Container

As lubricant professionals (whether manufacturer or a trader), we come across a very common complaint from our clients i.e. presence of water in oil packages.

Before going into analysis, let me share few of the visit reports in short. It is a mere coincidence that all these examples are for 200 litre drums.

Visit at customer-1 showed us that oil is dispensed from the drum into a mineral water bottle, this is then taken to point of lubrication. No one was willing to vouch for the bottle to be free of water before oil is transferred into it.

Visit at customer-2 showed the oil drum to be stacked in open. We noticed presence of cotton waste on top of drum and we saw rainbow diffraction pattern when sunlight was reflected from top surface. These were enough to hint presence of water on top of drum before being dispensed – must have been cleaned just before our visit.

Visit at customer-3, showed that oil drum was stored in a small warehouse. The drums (with open bungs and a

funnel in the bung hole) were lying adjacent to window, which had no panes. Being monsoon season, it was not too difficult to deduce that rain water must have entered the drum through funnel + bung hole.

Visit at customer-4, showed drums stored in open. The drum had few millimeters of water on top of drum. The drums were sealed that is to say that our company seal-cap was intact. But, interestingly, we noticed bubbles escaping from the larger bung from one of the drums. Obviously the water must have gone inside.

These examples seem to suggest that all mistakes happened only at customer's end due to their fault. However, this is not the whole story. Let us try to analyze the entire flow:

i) Upstream: before process happens
ii) Process: manufacturing and filling/ packing at factory
iii) Downstream: After the goods leave the factory premises.

We had come across an incident which falls under step i) – empty drum is a packaging material supplied by vendor to factory. While regular "incoming inspection" was being carried, water droplets were noticed inside some of the drum. Needless to say, it was rainy season and the drums were kept in open (uncovered) before being dispatched to our factory. After this incident, we had given instruction to the vendor:

- Bungs to be tightened on drums immediately after manufacturing at vendor's end.
- In case it is to be stored, the drums should either be stored in covered warehouse or covered by tarpaulin/ plastic sheet, if stored in open
- While transporting to our factory the drums should be kept upside down

Step ii) – probability of water entering the product in lube plant is zero. Here it is presumed that the factory is standard one of reputed brand. The usual manufacturing practice involves product being tested by QC before filling. And the filling/ packaging are done through pipeline and pumps etc. Barring unforeseeable circumstances, there is no chance of water entering the product. Also, the warehousing within the factories is usually covered so there is no chance of rainwater finding ingress into the product. We used to organize plant visits especially for big clients and also for clients who complained. They were taken around the plant so that they could be convinced that there was no chance water/ moisture entering into product at factory.

Step iii), the downstream end is the most susceptible. To start with is the stage of transportation from factory to branch warehouses. There is a possibility of rain water collecting on drum top and entering inside, if the drums are loaded and driven around uncovered. Dry seasons are comparatively safer but rainy season needs precaution.

Same reasoning applies to storage at branch warehouses or customer's warehouses. If the drums need to be stored in open, then they should be covered by tarpaulin or plastic sheets. If this is also not possible then they should be stored in horizontal position with both bungs in 3o'clock – 9o'clock position.

Last step is dispensing from the drums into point of lubrication. As mentioned earlier casual bottles should be avoided, since its being 'water-free' cannot be guaranteed. A customer visit had shown us that even 'tasla' was being used for dispensing, which is not a good practice.

There is another very important but often neglected route which we had come across - pilferage. Someone had taken out oil from drum and filled water. It is sad to say that pilferers have the expertise and tools to open the seal cap, remove oil, reseal them and hardly leave any evidence of tampering.

In conclusion, we come to the most important point – what is to be done in case water is noticed in lubricating oil? At customer's end, it is always advisable not to use such product.

Each manufacturing unit has its own standards or follows the global standard set by its parent company with instruction of disposal or reprocessing of such non-conforming products.

About the Author

Manoj Srivastava graduated as Chemical Technologist. He has 32 years rich experience in strategic planning, plant operations with proven abilities in enhancing production process operations, optimizing resources, capacity utilization, escalating productivity & operational efficiency while curtailing costs and expenses in various lubricant companies in India and Africa (Tanzania). He is experienced in carrying out lube surveys/ audits & lubrication training for end customers.
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How to Qualify Personnel to **Perform Lubrication Tasks**

> "When managers take the time to train their staff and ensure everyone has the necessary skills to perform the work, the results can be extraordinary."

Lubrication is a skilled trade that requires skilled personnel. Unfortunately, it often is regarded as menial work, which can lead to inconsistent practices and poor equipment reliability. When managers take the time to train their staff and ensure everyone has the necessary skills to perform the work, the results can be extraordinary. While developing an appropriate training plan and targeting it to your workforce can be challenging, a few key objectives will help make this possible.

Who's Responsible?

The first decision that must be made is determining which staff members will be responsible for specific activities within the lubrication program. Keep in mind that a single lube program can have activities that range from janitorial (cleaning the lube room) to scientific (diagnosing failures in oil analysis reports) and everything in between. Some facilities divide the tasks among different crafts or departments based on maintenance philosophies or manpower constraints. It is not uncommon to have as many as three to four different departments involved in varying degrees. Of course, this increases the risk of inconsistency in the work being performed.

Task Types

Next, identify the types of tasks that must be completed in the lubrication program. These tasks can be broken down into several categories, including inspections, routine relubrication, sampling, on-condition work and one-off tasks. Each of these categories will have important steps that must be followed but can and often are assigned to different craftspeople. This can be due to the nature of the work or the manpower in the various groups at the facility.

Inspections

The most common tasks associated with lubrication are inspections related to the lubricant level and quality, as well as equipment accessories such as breathers, filters, seals and other items installed to aid in the maintenance of the machine. These inspections tend to dominate the total number of tasks in a lube program. Operations personnel frequently perform some of these inspections. The idea is that operators will be around the equipment far more often than other departments, so these inspections can become part of a daily round or checklist that must be completed by the operators at the start of their shift. This further distributes the workload and allows for more departments to become involved in the lubrication program.

Regardless of who conducts the inspections, there is a tendency to overlook or "pencil-whip" the inspection round. When you do the same task every day, it's easy to become complacent and simply fill out the checklist or document as if everything is OK, rather than taking the time and being cognizant as to what is actually happening. To combat this, create metrics based on the inspection results or reward those who catch abnormalities during an inspection round. This keeps each member honest and can help make those performing the inspections more diligent.

On-Condition Tasks

On-condition work usually is associated with abnormal findings from an inspection or test. Depending on how severe the abnormality is, other departments may be called in to fix the issue. Among the most common on-condition task is the topping up of a reservoir with oil. In this case, the inspector has checked the sight glass and determined the oil level is too low for proper machine function. This in turn creates an on-condition task of topping up the reservoir to the optimum level. The inspector may be the one who adds the oil or may simply note this in the inspection checklist to generate a task for the lube team or department that handles the lubrication.

Top-ups must be performed in a manner that restricts the ingress of contamination, while certain devices must be in place to ensure the right lubricant is used. This is where the greatest risk of cross-contamination occurs, as it is very easy to grab the wrong oil container and fill the reservoir. Training and labeling can help to mitigate this from being an issue.

Other examples of on-condition work in a lubrication program include changing breathers and oil filters that have become saturated. An inspection can identify saturation by either a gauge reading or a color-change indicator. The inspector typically will change a breather since this is a minor task. However, a lube technician or maintenance person may need to change a filter, depending on how the system is set up and whether the filter is a simple spin-on version or a more complex drop-in style.

Another on-condition task is decontaminating a reservoir by utilizing a filter cart. The trigger for this task comes from an oil analysis test result. An oil sample has been extracted and sent to the lab, with the results indicating a high particle count. The lube tech now must take the filter cart to the system, attach it and filter the oil until the desired cleanliness level is achieved.

Using filter carts and attaching them to a system generally is regarded as a task best done by the lubrication or maintenance team. On the surface, this task may seem relatively easy, but there are complexities that require a high level of knowledge to ensure it is being performed properly. Without training on utilizing a filter cart and determining clean-up rates for the equipment, the task may not be completed with the desired level of accuracy.

Routine Work

The routine work of periodic relubrication is sometimes divided into different departments based on what is being relubricated. For instance, many plants rely on electricians to regrease electric motors, while others believe this is best done by the lube team. Some facilities prefer that operators carry out all regreasing tasks, with maintenance or lubrication personnel performing all the oil changes. These tasks can be distributed to different teams, but the best results often are when a single team owns the work. This allows more accountability to ensure the work is accomplished and makes it easier to train those who are involved.

For routine work, the simplest relubrication task is the lubrication of total-loss systems. These typically are chains or slideways which require a simple spray of oil or grease. Since the total charge of lubricant eventually is lost to the machine and these devices are completely exposed to the environment, cleanliness generally is not much of a concern, as it is not controllable.

These tasks may be sent to operations to perform as part of their daily rounds.

Regreasing can be highly technical depending on the component and how grease is applied. Utilizing a feedback technology such as ultrasound will help identify how much grease to add as well as how often to apply it. This technology requires training and experience, so it usually is left to the lube team. A condition monitoring team may also complete this work, as they will be charged with all types of predictive maintenance, including vibration, infrared, ultrasound and oil analysis.

The changing of oil in a system may demand a high degree of skill and for the machine to be removed from operation. These tasks normally are left in the hands of the lube team, as they will be able to take any samples needed during the change-out and can filter the incoming oil to ensure it is clean. Maintenance personnel may also be involved in this work depending on the number of oil changes required. During outages and turnarounds, it is common for multiple departments to help with oil changes.

Sampling

Extracting lubricant samples is highly specialized work that should be performed by trained individuals, such as the plant's lubrication or condition monitoring team. On the surface, collecting a lubricant sample may seem simple and straightforward, yet there are many intricacies that can taint the results. Previously, all lube samples were exclusively oil, but new technology has made grease sampling easier to aid in the diagnosis of grease-lubricated equipment failures.

Regardless of the lubricant being sampled, the work must be done consistently and in a manner that eliminates outside contaminants. Samples should be taken from an area that is representative of the lubricant in the system so the results can be analyzed for corrective action.
The diagnostic work related to lube sampling is even more specialized and frequently requires an individual becoming trained in this specific discipline. The work is often assigned to managers or engineers, with all test results coming across their desk for more detailed analysis. Without the proper training, this person may miss some of the incipient failures that can be clearly shown within the body of the reports. Simply relying on the comments from the testing lab will not be enough to get the most out of the lube sampling program.

One-off Tasks

Certain tasks in the lubrication program are performed only once. These generally include machine modifications or changing of a lubricant from one type to another. Once completed, these tasks are no longer valid and typically are not part of the computerized maintenance management system (CMMS) or lubrication software.

Machine modifications involve the installation of various inspection and contamination control hardware. Normally, these modifications are made during oil changes or turnarounds to allow for easier inspection of the lubricant as well as to improve the ability to add, drain or decontaminate lubricants while they are in service. It is common for maintenance personnel to carry out this work.

Changing a lubricant from one type to another may require the flushing of the cavity to ensure there is little risk of incompatibility. This often is performed by the lube team and is regarded as highly skilled work, especially when a large volume of oil in a complex machine is being changed. This task demands a clear plan and all the necessary materials for the changeover. Aside from changing oils, switching greases can be just as challenging.

Documented Procedures and Checklists

Documented procedures and checklists are essential to make certain that the individual performing the work has at least a basic understanding of the task that needs to be accomplished. Procedures and checklists can level the playing field in regard to experience. If someone has been doing the work for years, complacency frequently can set in, but a checklist helps to verify that he or she hits all the necessary points. For new hires, a detailed, step-by-step procedure ensures they treat the equipment with the same level of care as their more experienced counterparts. The importance of these documents cannot be overstated.

Education, Training and Certification

Understanding why each task must be completed in the specified manner will help your team be more engaged in their work. For example, knowledge of how simple sight-glass inspections may prevent catastrophic failures can drive home the need for these tasks to be performed with diligence and care every time.

The top organizations certify their lube team members in lubrication-specific disciplines. Certification adds credibility and creates ownership of the program. At least one person in the plant should own all the lubrication program and have a higher degree of knowledge and certification in lubrication. This individual should also be involved in the onboarding of new lube professionals at the facility.

By incorporating a hands-on component in the training of new lube technicians, you can further instill the practices you want to incorporate in the daily work. It often is best to explain, demonstrate and then coach individuals on how to complete a particular task before having them show you how to perform it. This simple process enables you to observe them accomplishing the task and verify that they are qualified to do the work. It also allows for coaching to be done more quickly without the risk of having an unqualified person working unsupervised.

As you can see, many tasks in a lubrication program require training and coaching to ensure they are done properly. Without emphasis on each element, it will be difficult to transition from the status quo to world class. If you haven't done so already, document who is responsible for each aspect of the lubrication program and start training your team based on the criticality of the work being performed. With consistent effort and focus, you can have a highly skilled lube team in a short amount of time. ***ML***

About the Author

Wes Cash is the director of technical services for Noria Corporation. He serves as a senior technical consultant for Lubrication Program Development projects and as a senior instructor for Noria's Oil Analysis II and Machinery Lubrication I and II training courses. Wes holds a Machine Lubrication Technician (MLT) Level II certification and a Machine Lubricant Analyst (MLA) Level III certification through the International Council for Machinery Lubrication (ICML). Contact Wes at wcash@noria.com to learn how Noria can help you develop an appropriate training plan for your lubrication program.

Best Practices for **Storing and Using Grease Guns**

> "Grease guns should be treated with care. **Although some may be inexpensive in comparison to other equipment, they are still precision instruments.**"

I recently moved across town. During the process of unpacking the truck, I quickly was reminded of the value of organization and how no two boxes are created equal. This also made me think about the importance of best practices as they relate to the storage, use and handling of grease guns.

Properly storing your grease and grease guns is vital to achieving longevity from your lubricant. It is also essential to keep all your lubricants clean, cool and dry, with cleanliness often the most difficult to accomplish. Have you ever tried to remove a solid particle from a tube of grease? It is almost impossible without introducing more contaminants.

How to Store Greases and Grease Guns

So, how do you keep your grease clean whether it is in a grease gun, keg or tube? The best way to maintain a clean grease gun is to hang it horizontally inside a

clean, fireproof cabinet with the plunger disengaged from the tube. Grease guns should be stored horizontally to avoid two potential problems. First, you don't want to overexert the spring and plunger, as this will cause the grease gun to wear quicker and change the amount of lubricant it exerts on each pump. Secondly, if there is a tube of grease inside the gun and the base oil begins to bleed out of the thickener, you would prefer that base oil be evenly distributed inside the tube. This will help prevent you from just pumping thickener into your machine.

Once a grease gun is no longer working properly or has become too dirty to clean, throw it away immediately. The longer it stays around the plant, the more likely it will be put back into service.

Taking pride in the cleanliness of your lubrication equipment is infectious and puts everyone on notice that you take your job seriously and are dedicated to doing it right.

If you purchase grease in kegs, it is critical to keep the lid on the keg at all times when not refilling a grease gun. Kegs should also be stored inside a clean cabinet. When you refill a grease gun, ensure the plunger and outside of the gun are clean. If they are not, you will be introducing more contaminants into the keg.

Finally, if you buy your grease in tubes, be sure to store them vertically with the removable seal on top and preferably inside the original box in which they were delivered. Having the seal on top helps to prevent oil leakage in the event the base oil separates from the thickener. Grease tubes should be stored inside a clean cabinet as well.

Now that you know how to keep grease clean, how can you make certain that it stays cool and dry while in storage? The simplest answer is to store your cabinets inside a climate-controlled room. It is not enough to simply maintain an air temperature of approximately 70 degrees. You also want to limit the amount of moisture in the room. Two of the top oxidation accelerators are water and heat. By controlling these two factors, you can significantly extend the life of your lubricants.

Just like my moving boxes, all greases are not created equal. It is important to mark the date when your greases were received and when they will expire. The expiration date will vary depending on the thickener. For example, lithium greases have a 12-month shelf life, while calcium-complex greases have a shelf life of just six months.

Some people may wonder whether they need to label their greases in storage, since the product names are already on the boxes. The answer is yes, you should. The goal of labeling lubricants in your plant is to have everything and everywhere a lubricant is stored, transported or applied be identified with a label that is unique to that specific lubricant. The label should at least include the product name or lubricant identification system (LIS) code, as well as a unique color and shape. As technology continues to advance, you may also add a barcode or radio-frequency identification (RFID) tag to prevent accidental cross-contamination.

While grease is in storage, the best way to identify it is to label the shelf where the grease or grease gun is to be stored. It also is a good idea to have a picture of what the contents of the cabinet should look like. This will help set the expectation for all personnel who open the cabinet.

How to Handle Grease Guns

Grease guns should be treated with care. Although some may be inexpensive in comparison to other equipment, they are still precision instruments. When calculating how much grease to apply, remember that the amount can be reported in either ounces or grams. The lubrication technician must convert the number of pumps into volume. Just as not all greases are created equal, the same can be said for grease guns. This goes beyond simply the model and manufacturer. Therefore, the volume per pump must be determined for each individual grease gun.

The best way to calibrate a grease gun is to slowly pump 10 strokes of grease onto a postal scale and then divide the total volume by 10. This will yield the average volume per pump of the grease gun. Each grease gun should also be dedicated to a single grease. This will significantly reduce the amount of cross-contamination. Be sure to place a label on the grease gun with the date it was calibrated and the average volume dispensed per pump. Grease guns should be calibrated before being placed into service and every 12 months after being put into service.

70%

of lubrication professionals most frequently use a manual grease gun, according to a recent survey at MachineryLubrication.com

There are many grease gun options on the market. Choose the ones that will work best for your plant and personnel. Regardless of the model you purchase, each grease gun should be labeled to indicate the lubricant to which it is dedicated. If possible, it also is recommended that the grease gun's barrel be clear. This will allow you to visually check whether the correct grease tube is in the gun before you apply lubricant to your equipment.

How to Properly Use a Grease Gun

Now that you know how to store and handle your grease guns, the real work begins. How do you get the grease from the grease gun into your equipment? This will require attention to detail. If you skip one step in the process, you risk introducing contaminants and overgreasing or undergreasing your equipment.

First, verify that you are at the correct lube point, have the correct grease and grease gun in hand, and that the equipment is in the proper operating state (running or shut down) to safely perform the procedure. Next, calculate the maximum number of pumps to apply by dividing the regreasing volume by the average volume per pump of the grease gun. After confirming that you are at the right place with the right lubricant and know the right amount, remove the grease fitting cap (if it exists) and clean the grease fitting with a lint-free cloth or towel. Then, inspect the fitting for damage or wear. You can do this by simply pressing down on the BB to ensure it depresses and springs back quickly. If it is damaged, replace the fitting immediately before proceeding.

After determining the lube point is in good working order and ready to be lubricated, remove the purge plug and connect the grease gun's coupling to the grease fitting. Do not hold the hose near the coupling due to the risk of injury. Manual grease guns can generate considerable pressure. If the hose fails, grease can penetrate most gloves and even your skin. High-pressure injection wounds are serious injuries. If left untreated or when treatment is delayed, they can result in extensive medical procedures. If the coupling does not attach securely, it must be replaced.

Once everything is connected, you are ready to apply the grease. Slowly pump grease into the bearing. Each pump should take three to five seconds. Continue pumping until you reach the maximum volume of the regreasing amount or feel abnormal back pressure. If you experience significant back pressure, the passageway may be blocked with caked thickener. Don't try to force the grease into the equipment. This likely will result in either the coupling disengaging from the fitting or blowing a seal in the equipment.

Keep in mind that manual grease guns can produce pressures up to 40 MPa and lip seals 4 MPa. If greasing an electric motor, you risk collapsing shields and getting grease into the windings. Any time you feel excessive back pressure, a corrective work order should be created and completed to resolve the issue before the equipment is regreased.

When using ultrasonic tools, listen to the machine before regreasing. If the equipment is within an acceptable decibel range, do not apply new grease. When adding grease, regrease until either the decibel level remains in range after applying small amounts of grease or you have applied the maximum amount of grease for a regreasing event. Stop when either of these two criteria have been met.

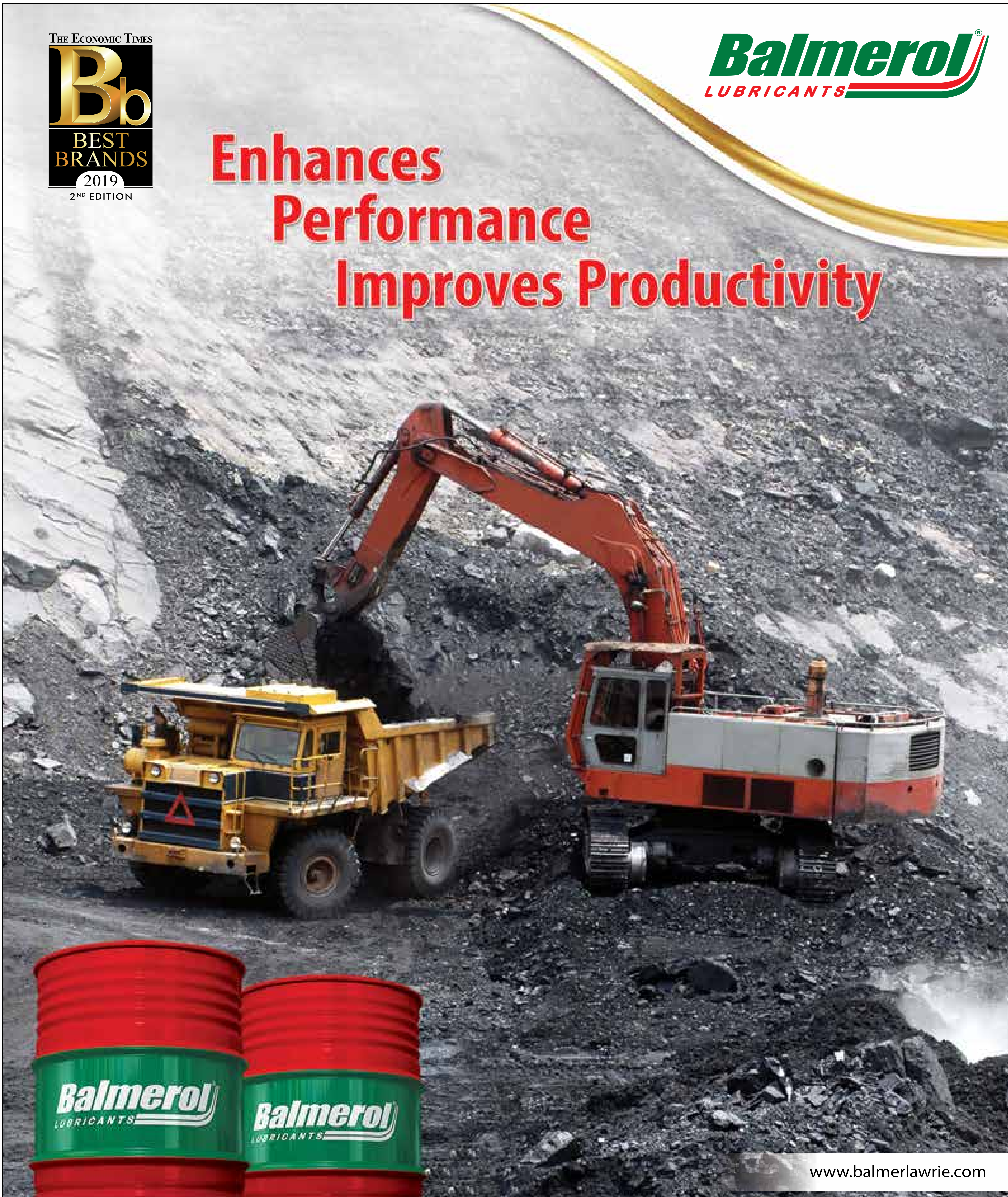
After the component has been properly regreased, disconnect the grease gun coupling from the equipment and clean the grease point. If the equipment has a grease cap, replace the cap on the grease fitting. If it doesn't have a cap, place a small dollop of grease on the fitting. The dollop should be big enough to cover the entire grease fitting but not too large that it becomes a hinderance to clean later.

Finally, after you have completed regreasing, wait approximately 10-30 minutes before putting the purge plug back into the equipment. This will allow any excess grease to leave the grease cavity. Don't worry if grease doesn't purge out when you have applied the maximum amount of lubricant.

The most important thing to remember when storing or using your grease guns and lubricants is to keep all your lubrication equipment clean, cool and dry. This will help to maximize the longevity of your grease. Also, don't forget to label everything, which is what I did when packing up my house. Your team shouldn't have to play hide-and-seek for the items they need, because they likely will just use whatever is readily available, and then you will be right back where you started. ***ML***

About the Author

Devin Jarrett is a success manager at Noria Corporation. He holds a Level II Machine Lubrication Technician (MLT) certification and a Level III Machine Lubricant Analyst (MLA) certification through the International Council for Machinery Lubrication (ICML). Contact Devin at djarrett@noria.com to learn how Noria can help ensure your grease guns are used and stored properly.



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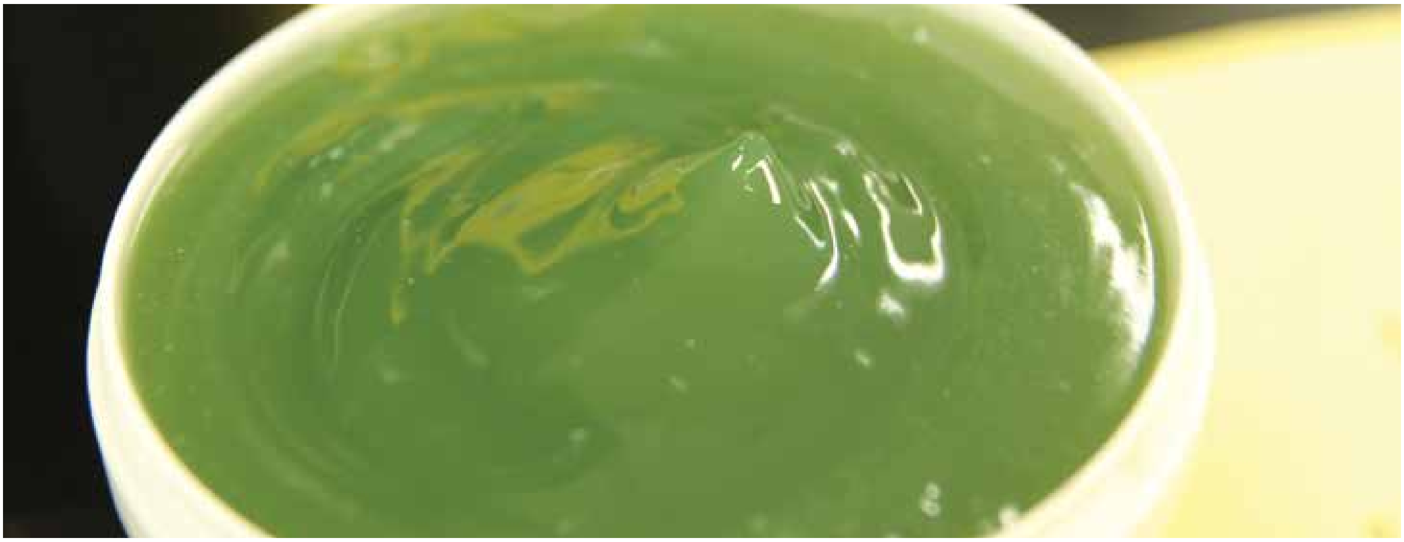
The "Lube-Tips" section of *Machinery Lubrication* magazine features innovative ideas submitted by our readers.



Smoothing Out Bulk Grease

After scooping out grease from a bulk container, ensure the top surface of the remaining grease in the container is level. Do not leave the grease surface with pockets or cavities. This will cause bleeding of the base oil from the grease thickener into these zones. In order to use the grease in such a case, the separated oil would need to be worked back by agitation. This should only be attempted if there is no risk of dirt entering the bulk grease during agitation (from the container, tools or grease surface).

No-Mess Filter Removal

This technique can help you avoid a mess when changing your vehicle's oil and filter. Horizontally cut a recycled 2-liter plastic soda-pop bottle in two pieces, about halfway up. Slide either half over the loosened filter and spin the filter until it is unthreaded and drops off. Hold the cupped filter in position for a minute or two to catch any leakage from the filter housing before removing. This can eliminate most of the mess, even on a nearly horizontally mounted filter.

Slight Vacuum Solves Problem

Have you ever threaded in a drain plug not quite right or had the drain plug washer not seat properly but didn't want to drain out all the new oil? For many small-sump machines (gearboxes, etc.), you can apply suction via a shop vac with a clean rag over the fill hole. This will create a vacuum, allowing you to momentarily remove the drain plug and reinsert a new one with hardly a drop lost.

Selecting the Right Piping

When retrofitting gearboxes for service and filtering, consider using stainless- steel piping instead of black iron piping. After a rather short period of time, the inside of the black piping begins crusting and flaking off into the gear oil, giving false testing results. This is more predominant in high humidity and frequent wash-down areas. ***ML***

Did You Know?

Additional tips can be found in our Lube-Tips email newsletter. To receive the Lube-Tips newsletter, subscribe now at machinerylubricationindia.com

Have Some Tips?

If you have a tip to share, email it to admin@machinerylubricationindia.com

TEST YOUR KNOWLEDGE

This month, *Machinery Lubrication* 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. The complete 126-question practice test with expanded answers is available at store.noria.com.

1. Oxidation stability is highest for which of the following groups?

A) Group I
B) Group II
C) Group III
D) Group IV
E) Fuel oil

2. Thermal breakdown of lubricants typically:

A) Occurs at very high temperatures due to heat alone with an absence of oxygen
B) Is monitored with acid number
C) May result in thermal cracking of the base oil and a decrease in viscosity
D) All of the above
E) Answers A and C

3. Overgreasing is a common problem with higher speed rolling bearings because:

A) It causes the temperature to rise
B) It causes the grease to mechanically shear down
C) It causes the grease to change color
D) It causes the temperature to decrease
E) It causes the bearings to elastically deform in shape

ANSWERS

1. D

Group IV is a PAO synthetic and has high oxidation stability.

2. E

Thermal degradation (breakdown) typically occurs at very high temperatures due to heat alone with or without oxygen present. Acid number and other oxidation stability tests will not help in monitoring the thermal breakdown of oil. Thermal breakdown may result in thermal cracking of the base oil, thus leading to a critical drop in viscosity and sometimes flash point.

3. A

This is because overgreasing creates high viscous friction, which leads to high temperature. The high temperature causes the oil within the grease to rapidly oxidize and in some cases leads to premature failure.

How Far is **India's EV Dream?**

India has boldly announced its intention to move towards 100 percent electric vehicles (EVs) by 2030, following the Paris Agreement 2015. The Paris Agreement is a landmark environmental accord that was adopted by nearly every nation to address climate change and its negative impacts. As per the data, India has a long way to go. For example, the number of electric cars grew by about 300 percent in the last decade. However, the absolute number is only around 4,000 electric cars on Indian roads, which is just about 0.1 percent of around 3.5 million cars sold in 2019.

India is a market that provides an incredible opportunity in the EV space—just like it does in petrol and diesel car segments. Recently, the GST Council reduced the taxes on EVs from 12% to 5%. Similarly, Phase 2 of the Faster Adoption and Manufacturing of Hybrid and Electric vehicles (FAME) scheme is now gathering momentum. The government is looking to tighten the Corporate Average Fuel Economy (CAFE) norms, in a bid to push automakers to increase production of electric vehicles. Even at this year's Auto Expo, electric vehicles were clearly the show-stoppers.

Though Government is doing commendable work in creating an empowering environment for EVs, most of the manufacturers are yet to establish a proper ecosystem for developing and manufacturing electric vehicles in India. Let's put some light on the challenges EVs are facing in India.

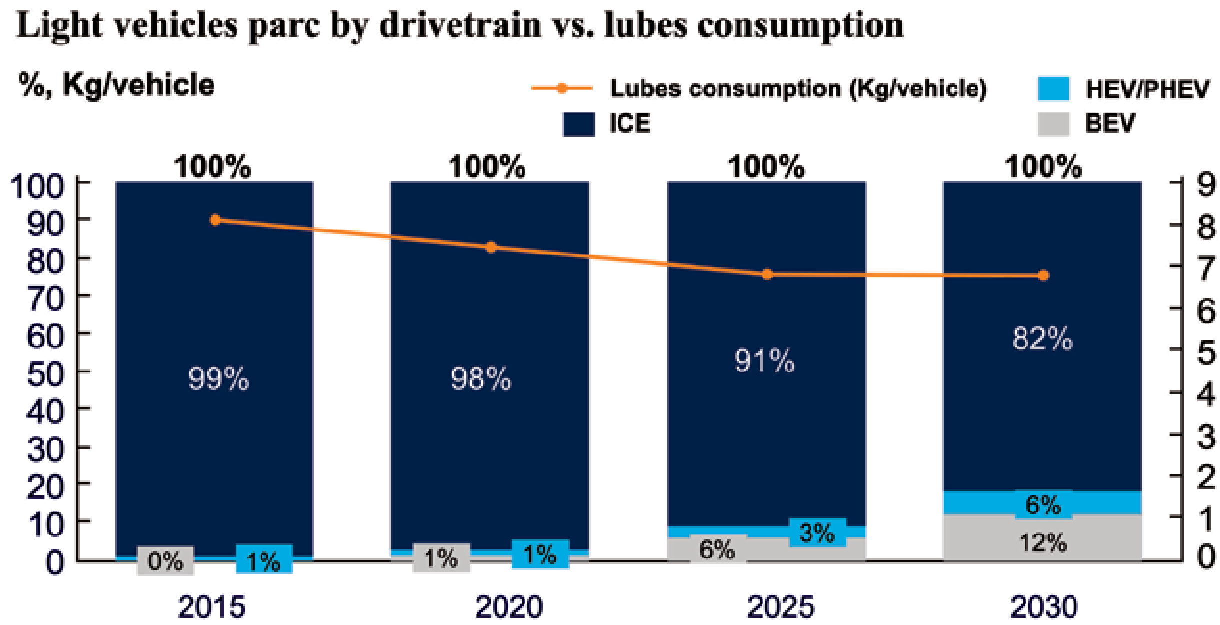
REQUIREMENTS OF EV CHARGING STATIONS

To meet the charging requirement for 20 Lakh electric cars, India needs about 4 Lakh charging stations installed by 2026. Currently, India is said to have around 300 public EV chargers compared to 57,000 petrol pumps. A joint venture under the ministry of power, the government of India, Energy Efficiency Service Limited (EESL) is a public service energy and infrastructure provider that focuses on implementing energy efficiency programmes for public projects and public-private partnerships.

LUBRICATION CHALLENGES

All the Original Equipment Manufacturer (OEM) companies are trying out different solutions. They themselves are in a learning phase when it comes to which concepts are reliable and suitable for the future. As the future demands completely electric vehicles, the development of engine oil must continue. When the development of

Lubricant Consumption for Internal Combustion Engines (ICE) Vehicles, Hybrid / Plug-in Hybrid and Battery Electric Vehicles



SOURCE: McKinsey Energy Insights

completely electric vehicles intensifies, other product groups will also be affected. Whole new demands will be placed on gear oils, coolants and greases, partly because they will be in contact with electric modules, sensors and circuits, and will be affected by electrical current and electromagnetic fields.

Moreover, motors in electric cars also emit a lot of heat, which will need to be led away from the electric module. Here, effective cooling concepts will be increasingly important. It is also likely that the electric motors will be driven at higher speeds in order to increase efficiency. Already brand new motors are being designed, and different lubrication and cooling concepts are being discussed. With high-speed electric motors, the Revolutions per minute (RPM) in the drivetrain will need to decrease. New reduction gears with less gear steps are therefore being implemented, with potentially higher input speeds. Since the reduction gears can be combined with electric modules, their gear oils too must work well with the chosen module materials. This transition is a major challenge for developers of lubricants, since it involves a considerable change in lubricant specifications.

There are two pressing issues which India should focus on. First, get prepared for the coming disruption in the automobile industry. Fully adopted EVs will kill most of the auto component firms. Survivors will have to move to an industry 4.0 format. India would also need to reskill a large number of motor mechanics. They cannot repair EVs because of the sophisticated electronics. Second, and, more important, India should use the next ten years frame to become a leader in next-generation battery technology. This is an honourable way to pursue EV dreams without being critically dependent on any country.

PRICE: THE BIGGEST CHALLENGE FOR EVs

According to BloombergNEF (BNEF), electric cars won't achieve price parity with gasoline-powered cars until the early 2030s. "Mass adoption of electric cars in India will not happen unless the gap in upfront prices of electric and ICE vehicles is brought down," said Shantanu Jaiswal, head of research for India at BloombergNEF.

"The Budget is not quite favourable for us. While the government is pushing manufacturing of EVs in India within set guidelines and urging everyone to go eco-friendly, a huge amount of taxes is being slapped on the import of batteries and other important components needed to assemble an EV. All this has delayed the aim of making EVs the future of our country", says Srinivas Reddy, director of a Pune-based start-up.

While the companies are ready to electrify the automotive market in India, we can say that EV ecosystem is yet to take shape. Though 100 percent electrification seems to be a far-fetched concept, 2020 will in all prospect be a turning point for the automobile market. Over to the EV manufacturers.

COVID-19 : Impact on Lubricant Market

Public sector oil companies like Indian Oil Corporation Ltd, Balmer Lawrie, HPCL & BPCL and major private sector players like Castrol India & Gulf Oil Lubricants India Ltd. temporarily closed its lubricant plants (fully or partially) as the government tries to stop the spread of the deadly coronavirus in the world's third-largest lubricant market. The partially operating plants are manufacturing lubricants for Defence & Essentials services.

The local authorities and various state governments in India issued directives around the week of March 2020 to shut down factories and offices as well as public transport for a few days to prevent the spread of the coronavirus, which has killed more than 47,245 globally as of 2nd April 2020 (10:01 am), according to the World Health Organization.

India, Asia's third-largest economy, has also been affected by the coronavirus, and the government has taken several measures to slow the pandemic. The retail market and institutional sales of lubricants is down by over 75%, which may adversely affect the books of most of the companies.

It is expected that even after the national lockdown is lifted some time in mid-April 2020, it may take at least a few quarters for the economy to come on track. Industry officials feel that the complete lockdown in the country will put further strain on businesses, including auto sector, which is already facing the heat due to change over from BS IV to BS VI, which was to be implemented from 1st April 2020. There is also subdued demand amid slowdown in the economy and weak consumer sentiment.

BASE OIL REPORT

Indian markets followed the global equities meltdown. While shares of most domestic oil marketing companies (OMCs) rose, oil and gas explorers saw a severe sell-off. The fall in crude oil prices has placed major consumers such as India at an advantage. India is the world's third-largest crude oil buyer and the fourth-largest liquefied natural gas importer. Brent fell to $31.02 a barrel, before recovering partially to trade at $35.36 per barrel, a far cry from the high of $147 a barrel in July 2008. The West Texas Intermediate (WTI) was at $31.79 per barrel.

The Indian domestic market Korean origin Group II plus N-60–70/150/500 prices at the current level is marginally up for lighter grades and heavier grades. As per conversation with domestic importers and traders prices for N – 70/ N- 150/ N - 500 grades and at the current level are quoted in the range of Rupees 42.95 – 43.10/43.70 – 43.85/48.60 – 48.75 per litre in bulk plus 18% GST as applicable. Discounts being offered for sizeable quantity. The above mentioned prices are offered by a manufacturer who also offers the grades in the domestic market, while another importer trader is offering the grades cheaper by Rs.0.30 – 0.35 per litre on basic prices. Light Liquid Paraffin (IP) is priced at Rs.44.25 – 44.40 per litre in bulk and Heavy Liquid paraffin (IP) is Rs.50.25 – 50.35 per litre in bulk respectively plus GST as applicable.

While in the month of January 2020, India imported 302773 MT of Base Oil, India imported the huge quantum in small shipments on different ports like 181877 MT (60%) into Mumbai, 23623 MT (8%) into Hazira, 22327 MT (7%) into JNPT, 20042 MT (7%) into Chennai, 19825 MT (7%) into Pipavav, 15463 MT (5%) into Mundra, 13473 MT (4%) into Kolkata, 3647 MT (1%) into Kandla and 2496 MT (1%) into Other Ports.

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(Editor – In – Chief of Petrosil Group)
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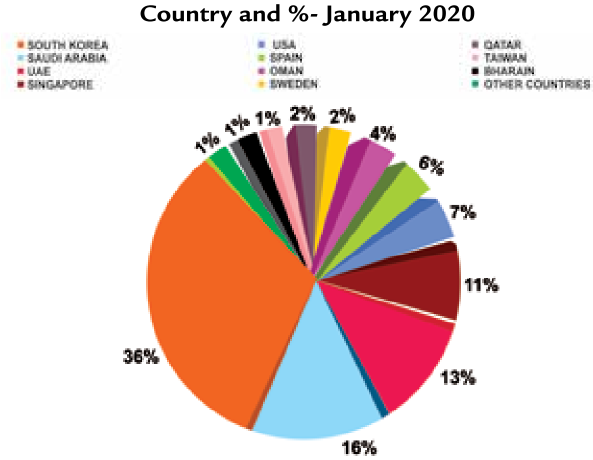
Month wise import of Base Oil in India

Origin wise Base Oil import to India, Country and %- January 2020



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

Month	Group I - SN 500 Iran Origin Base Oil CFR India Prices	Napthenic Base Oil HYGOLD L 500 US Origin CFR India Prices	N- 70 South Korea Origin Base Oil CFR India Prices	Bright Stock CFR India Prices
January 2020	USD 580 – 590 PMT	USD 635 – 645 PMT	USD 590 - 600 PMT	USD 800 – 810 PMT
February 2020	USD 560 – 570 PMT	USD 615 – 625 PMT	USD 570 - 580 PMT	USD 780 - 795 PMT
March 2020	USD 550 – 560 PMT	USD 605 - 615 PMT	USD 560 - 570 PMT	USD 770 - 785 PMT
	Since January 2020, prices have decreased by USD 30 PMT (5%) in March 2020.	Since January 2020, prices have fallen down by USD 30 PMT (5%) in March 2020.	Since January 2020, prices have decreased by USD 30 PMT (5%) in March 2020.	Since January 2020, prices have dipped down by USD 30 PMT (4%) in March 2020.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