8 Things to Know About Maximum Efficiency Hydraulic Fluids (MEHFs)

Introduction

The saying, 'No two snowflakes are alike,' is just as true for manufacturing plants. Maintenance managers and plant operators know this all too well. The production schedules you manage, the materials you use and the hours you operate under vary. You have different safety requirements to adhere to and quality standards to meet while keeping costs in check.

All of these variables affect how you run your hydraulic equipment, and that impacts the lubricants you use. When companies look to cut costs, it's not uncommon for the purchasing department to go straight for the lubricant program. Lubricants seem like a big piece of the budget because quality hydraulic fluids do cost more.

What may seem like a straightforward decision on paper can have a ripple effect in your equipment's performance. Hoses cracking and fluids leaking everywhere. Equipment running at a snail's pace. Cycle times increasing. Operating temperatures spiking. Your hydraulic equipment could be trying to tell you something.

1. Not all hydraulic fluids are alike

Price is always a concern, but maximum efficiency hydraulic fluids (MEHFs) can offset operating costs in your plant. It all comes down to keeping equipment running efficiently and maintaining output.

Consider LED lights; they use technology to allow the bulb to do more than just provide light. They last longer than traditional lights bulbs, and they emit less heat, which conserves energy. Has your plant replaced incandescent and halogen bulbs with the more expensive LED light bulbs because of the energy and cost savings potential? The same is possible with multi-grade MEHFs—they're designed to withstand and outperform in punishing environments without increasing energy usage.

Highly refined synthetic base stocks with shear-stable viscosity improvers provide a higher viscosity index, which is the fluid's ability to stay in grade over a wide range of operating temperatures. MEHF fluids stay in grade because of the superior base stocks as well as high-quality polymers that expand and contract in response to temperature changes.

Better stay-in-grade performance prolongs the service life of the hydraulic fluid, reduces operating temperatures, lowers energy consumption and provides consistent operation, all of which is possible from high-quality, multi-grade MEHFs.

Even the best petroleum-based fluids will not have as high a viscosity index as a synthetic fluid due to the molecular structure of the base stocks involved. What this means is that when the fluid overheats, it thins, which will cause sluggish hydraulic responsiveness. The pumps will have to work harder, which increases the likelihood of pump wear.

From an energy standpoint, the hydraulic system will require more energy to do the same amount of work. Also, when the fluid is too thick due to cold temperatures, you have poor mechanical efficiency. Instead of the pump moving the fluid to do the work, the pump is working drastically harder to move the fluid.

2. Product datasheets should be understood

You may have noticed how the amount of information listed on product datasheets (or technical datasheets) vary by lubricant brand. This can make it harder to decipher how competing products measure up.

With lubricants, more information is helpful. The following tests provide insight as to base oil quality, operating temperature range, viscosity stability and oxidation stability:

- **Pour Point (ASTM D97)** is the lowest temperature at which the oil will visibly move—this does not determine the lowest operating temperature; however, it provides a good comparison between oils.

- **Brookfield Viscosity (ASTM D2983)** determines the viscosity in centipoise (cP) of the hydraulic oil at a given temperature—typically below zero. The lower the number, the easier the fluid will move at cold temperatures.

- **Flash Point (ASTM D92)** provides the temperature at which vapors that are given off will cause a 'flash' when a flame is introduced to the surface of the sample. Flash point provides some insight as the base oil composition—heavier base oils and synthetic base oils have higher flash points.

- **Viscosity Index (ASTM D2270)** is the resistance of the viscosity of the fluid to change over a wide temperature range. Viscosity index depends not only on quality base oils, including synthetics, but also on shear stable viscosity improvers (which make multi-viscosity oils possible). The viscosity of an oil will typically decrease with a rise in temperature—the use of synthetic base oils and shear stable viscosity improvers enables the viscosity to actually maintain over wider temperature ranges.

- **Oxidation Stability Test (ASTM D943)** provides the number of operating hours until the acid number (AN) reaches 2. This test should only be used to compare new oils; in operation, the hydraulic oil may actually reach an AN of 2 sooner depending on the 'real world' working conditions.

3. Varnish is the enemy

Varnish is the death of the hydraulic system. That may sound like an exaggeration, but varnish clogs up the pumps, valves, cylinders, solenoids and filters, and it will gloss over temperature sensors.

Varnish is a by-product of increased oxidation and thermal degradation. In the early stages, varnish is soft and pliable; it's like butterscotch topping on ice cream. In this state, varnish tends to attract and hold onto wear metals and debris, which increases friction and generates pump wear.

Erratic operation of the hydraulic actuator is usually the first sign of varnish build-up. The cylinder will appear to be sticking, but it's actually the spool in the valve body that's not operating freely. This forces the hydraulic equipment to use more energy.

Varnish prevents the anti-wear additives in the fluid from doing their job, and thus increases friction between moving parts. As equipment is pushed to keep up with output, excessive wear occurs on pumps, which can lead to equipment failure. Over time, varnish will harden and create thick layers on metal surfaces; it starts to look like peanut brittle.

As if these problems weren't costly enough, varnish also shortens the service life of the hydraulic fluid. Savings gained by cutting costs in the lubricant program can show up as expenses somewhere else on the budget such as increases in lubricant usage, repair, downtime and maintenance.

The best way to protect equipment against future varnish build up is to use a multi-grade MEHF with high oxidation and thermal stability plus varnish dispersing capability and synthetic base oils.

4. Contaminants are attracted to hydraulic fluids

You cannot keep a hydraulic oil clean enough. Despite best attempts, whatever you're producing can get pulled into the hydraulic oil, whether it's cheese, dog food, plastic or rubber particles. These contaminants can cause the hydraulic fluid to thicken and change color. Oil analysis is helpful to identify if foreign contaminants are present in the fluid.

One of most common sources of contaminants, including dirt, moisture and production materials, is from the air intake system. If it's a compressor system, is it bringing clean air from outside or is it recycling air from inside your plant? Compressor systems are extremely sensitive, and they should be checked frequently for leaks and their filters should be changed diligently.

If you're drawing air from outside, be sure the air intake is positioned in a clean area outside your plant. Inside the plant, there's still the potential for contamination because the filters will not remove gases or small airborne particulates.

Contaminants can enter your system each time more fluid is added. Changing how you refill fluids (i.e., opening and filling one system at a time), will reduce the amount of time the system is open. Longer drain intervals that are possible with high-quality MEHFs also make a difference.

Multi-grade MEHFs with synthetic base oils are able to maintain performance and protection under severe service conditions longer. More hours between fluid applications decrease the number of times the system is opened.

Leaky hoses and weak seals also provide an entry point for contaminants. Reducing the number of hoses needing to be replaced reduces your hydraulic fluid's exposure to contaminants.

5. Leaky seals and hoses can be reduced

Lubricant quality and leaky seals and hoses go hand-in-hand with hydraulic fluids. Why put a high-quality MEHF in equipment when it's just going to leak out everywhere?

Hoses are used in parts that are capable of bending. A certain amount of flexibility is needed in the hose's material. When a hose is flexing continually while subjected to heat, the composite material can crystallize and eventually break causing leaks. Hoses may also break because of a mechanical bind or they could be pinched or excessively bent by adjoining parts. However, the majority of leaks can be attributed to high temperatures.

As we explained, multi-grade MEHFs do a better job of maintaining viscosity. The equipment doesn't have the kinds of excessive temperatures that occur with a lesser-quality fluid. Hotter fluids weaken seals and affect the integrity of the hose material, allowing the fluid to leak out. Higher temperatures can be avoided by maintaining correct volumetric pressure with use of the proper multi-viscosity MEHF.

An MEHF that's compatible with all types of seals and coatings will provide further protection against leaky seals and hoses. Varnish can weaken seals, so look for MEHFs with varnish dispersing technology.

6. Oil analysis is your best friend

Original equipment manufacturers' (OEM) drain intervals are based on performance gained in a controlled environment. The problem with this is that 'controlled environment' doesn't exist in the manufacturing world. Whether it's food, plastic or steel, the working conditions are going to differ. The age of the equipment and its maintenance impact drain intervals.

Without oil sampling, it's almost impossible to determine how long the fluid will last in your equipment operating in your plant. The OEM may recommend 4,000 hours on the fluid, but in your world, that fluid may only last 2,000 hours. With oil analysis, you may discover the fluid is being changed too soon or it's in use too long, allowing oxidation and varnish to form.

Say hello to your new best friend—oil analysis. It will help detect any abnormal wear patterns, viscosity changes, contamination or wrong fluids being used that may affect how equipment is operating.

Oil analysis should report viscosity, acid number, varnish potential and wear metals in your fluid. This data is based on the oil's performance in the equipment, so you will need to establish baseline numbers and monitor trends over several samples.

- **Viscosity alarms** are 10 percent up or down out of the ISO range based on the standard method for kinematic viscosity of transparent and opaque liquids (ASTM D445). For example, the range for an ISO 100 would be 80-120 (as the ISO range for new oil is 90-110).
- **Acid Number (AN)** is twice the AN of the new oil or an increase of one whole number (ASTM D664). This test indicates any changes in oil that occur in oxidizing conditions.
- For the **Varnish Potential Test**, 0-10 is acceptable, 10-25 is caution, and >25 is severe. A baseline of the new oil is needed to trend varnish potential. This data allows you to track the development of varnish in the fluid.
- **Wear metals and contaminants** should also be trended, and any significant changes noted and investigated.

7. Equipment performance should be documented

You rely on your equipment every day, but how well you really know how your equipment performs?

Documentation is vital; that data tells you what you need from hydraulic fluid. Equipment performance is tied to the hydraulic fluid's quality. As OEMs continue to push the limits of equipment design, hydraulic fluids must be able to withstand those demands.

Whether it's done monthly or quarterly, get into the habit of tracking equipment failures, unplanned downtime, costs related to failures, hoses breaking, and leaks. Keep track of how often you're refilling or topping off hydraulic fluid. The cost of lesser quality hydraulic fluids quickly adds up when shorter drain intervals and add oil are calculated.

Regarding the production side, look at the amount of work completed. With lesser quality fluids, cycle times increase, and the number of parts produced per hour decreases. Another point to calculate is the cost per hour to produce. Does that figure increase when equipment is forced to shut down or go offline maintenance and repairs are needed?

Electrical power is an expensive commodity, but it's possible to notice a decrease in power usage with high-quality MEHFs. Purchase a power meter and measure the electrical energy used to spin a pump. This area will be your first indication and your best data point. Information such as this can help you justify looking beyond price for a high-quality, multi-grade MEHF.

If you are comparing two hydraulic fluid brands, give the testing time to generate results. Establish a baseline with your current hydraulic fluid and give it a couple of months or even a quarter to see results. Then switch out and replace the fluid with the new brand and allow it to run the same amount of time to compare results.

Taking the time to gather data will provide the evidence you need to make an informed decision. There's a big difference in an anecdotal story and actual data.

8. A trained lubricant specialist can make a difference

Some lubricants only show up by a delivery truck with no one there to help set up your lubricant program. To help put the advice listed in this paper into action at your plant, consider working with a trained lubricant specialist. He or she can be an advocate for you and your plant's equipment.

A lubricant specialist can survey your plant and spend time reviewing OEM manuals to verify the right fluids are used in each piece of equipment. He or she can help you cross-check product usage, which can help consolidate the number of fluids you purchase and use.

Selling lubricants is only one aspect of the transaction. With the right lubricant specialist, you can depend on him or her to help organize and streamline your lubricant program. He or she can take the time to color code and label equipment and lubricants as well as train your staff on how to reduce lubricant contamination.

When you begin your oil analysis program, a lubricant specialist can be a tremendous asset. He or she can work with you to keep up with regular sampling and can interpret the results to create a plan of action. Part of a what makes oil analysis successful is documentation. A lubricant specialist can help you track results and review the lifetime performance of your equipment. This will not only keep you and your equipment happy, but it will also provide documentation to keep your purchasing agent at bay.

Conclusion

As manufacturing plants find new ways to keep their operation running efficiently, high-quality MEHFs can play a leading role in producing savings. What you put in your hydraulic systems has an impact on your bottom line. Hydraulic fluids designed with synthetic base oils can withstand severe working environments. They're able to provide longer fluid life, extended drain intervals and equipment life and reduced downtime—all of which saves you time and money. For more information on how a high-quality MEHF can maximize equipment productivity and offset costs, please visit **www.schaefferoil.com.**