Techni-Tips 35

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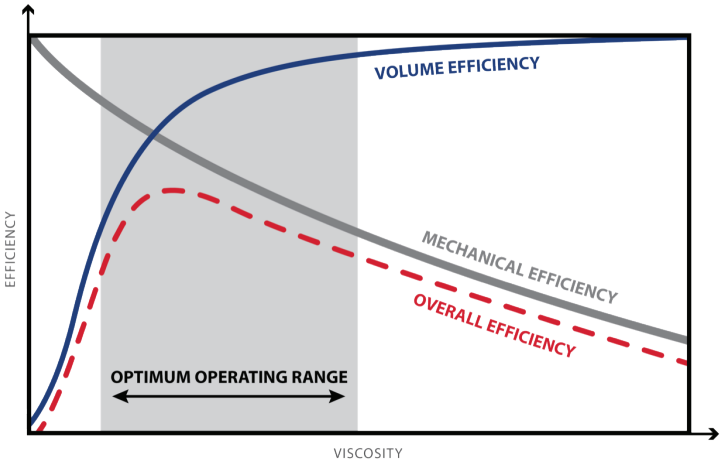
Hydraulic Oil Selection & Troubleshooting

Proper selection of hydraulic oils has become much more important in the past few years. Some years ago, almost any good quality hydraulic oil would give satisfactory service. Today, proper oil selection and maintenance are required by the OEM to maximize system performance and reliability.

As hydraulic systems have become more sophisticated, speed and pressure have increased tremendously. Years ago, hydraulic pressures of 500, 1,000 or even 1,500 psi were common. Today, pressures as high as 10,000 psi are seen in some systems. In addition, newer systems are designed with smaller oil reservoirs. The result is a potential increase in wear, higher bulk oil temperatures, increased oxidation rates of the oil, and the need for better anti-foam performance.

To formulate a high-quality hydraulic oil, base oils must be blended with a precise amount of selected additives to supplement and improve the qualities needed in the hydraulic oil, including oxidation resistance, wear protection, rust inhibition and air release.

Many modern hydraulic pumps have an optimum oil viscosity of 20-40 cSt at operating temperature. Proper selection of hydraulic oil viscosity is critical to ensure satisfactory system performance. Selecting an oil with viscosity that is too low can lead to volumetric losses – bypass of oil around seals, pistons, vanes and gears. Selecting an oil with viscosity that is too high can lead to mechanical losses – sluggish controls, increased bulk oil temperature and cavitation. Both volumetric and mechanical losses contribute to overall performance loss in a hydraulic system.



When high oil temperatures are encountered, an oil of higher viscosity and/or higher viscosity index is needed to ensure that volumetric losses do not occur. When low oil temperatures are encountered, an oil of lower viscosity and/or higher viscosity index is needed to ensure that mechanical losses do not occur. With extremely low oil temperatures, consideration must also be given to the allowable viscosity during cold startup. An oil of the appropriate viscosity grade with sufficiently high viscosity index is needed to ensure that both low-temperature fluidity and optimal viscosity at operating temperature are attained. (See chart.)

Evaluating Hydraulic Oil

Two good yardsticks for determining the suitability of any given oil are oil specifications and performance data.

- Oil specifications are used to pick the right oil with respect to:
  - o Viscosity
  - o Viscosity index (VI)
  - o Other technical data such as rust protection, wear protection, water separation and air release.
- Performance data should be used as a guide in making the ultimate choice of an oil that will provide:
  - o Efficient power transmission
  - o Proper lubrication
  - o Long oil life
  - o Wear protection

5 Keys to Hydraulic Oil Selection

In addition to considering specific equipment requirements or environmental or operating conditions, five primary keys to selecting the right hydraulic oil are:

1. Viscosity. For proper efficiency, oil must have the right viscosity at the operating temperature. Recommendations are available from the OEM.

2. Viscosity index. For optimal performance in applications where the temperature varies widely, oil must possess low viscosity at low temperatures and high viscosity at high temperatures. Also, for applications with typical operating temperatures, a higher VI can lead to less volumetric loss, which enhances overall system efficiency.

3. Oxidation. This problem occurs in any hydraulic system and can be controlled. Oxidation rates increase with temperature and percentage of contaminants. The greater the oxidation resistance of the oil, the better the protection.

4. Rust. Oil must have the ability to prevent rust under existing conditions, as rust can cause serious damage to any hydraulic system. Oil properly inhibited against rust has a greater ability to prevent rust under existing conditions and a greater ability to form a protective film on metal surfaces.

5. Air release. Entrained air and foam can be detrimental to hydraulic system function and to oil life. Both can cause cavitation, elevated operating temperatures, spongy or sluggish response, and potential housekeeping issues.

High-quality hydraulic oil will more than pay for itself in the long run. Such oils will always have the proper viscosity, VI, pour point, oxidation stability, rust prevention, foam resistance, water separation characteristics and anti-wear properties. Use of the right oil results in reduced wear, downtime and labor – more than enough to offset the initially higher cost.

Preventive Maintenance

Keep Oil Clean

After selecting a premium hydraulic oil, the best insurance for long oil and equipment life is cleanliness. Several guidelines regarding hydraulic oils should be included in any preventive maintenance program, including the following:

- Store oil drums inside, but at least sheltered if outside.
- Store drums on their sides.
- Carefully clean top of drum before opening so no dirt can enter. Install desiccant breathers on drums after they are opened.
- Clean containers or hoses before using.
- Filter oil when filling or adding to hydraulic system. Filtration to 5 microns or lower is frequently recommended.
- Keep dirt off sump, motors, pumps, valves, cylinders, piston rods, etc. Ensure desiccant breathers or at the very least dust filters are installed on system breather ports.

Perform Frequent Inspections

Preventive maintenance should begin when a new machine is installed. Most hydraulic maintenance problems can be prevented by taking measures at the beginning. Regular and frequent inspections will help prevent breakdowns.

- Leaks, oil levels and condition of oil can be determined by visual inspection. Installation of proper sight glasses improves the ease and reliability of these inspections.
- Pump wear is evidenced by increase in cycle time.
- Filters should be fitted with differential pressure gauges to eliminate filter plugging.
- High oil temperatures should be investigated.
- Equipment will generally give a warning before breakdown occurs, and someone must heed the warnings and do something.
- Daily checks:
  - Oil level in reservoir – Check sight glasses
  - External leakage (with machine running and not running)
  - Unusual noises
  - Proper cycle operation
  - Temperature of oil

Other Suggestions

- Use only trained maintenance specialists who are thoroughly familiar with the specific equipment. Use OEM's training facilities.
- Clean or replace filter elements as indicated during system inspections.
- Maintain adequate spare units and parts inventory.
- Use high-performance hydraulic oils.
- Perform oil analysis to evaluate equipment condition and optimize oil life.
- Choose a lubricant supplier that can:
  - Recommend the proper oil
  - Help with lubricant inventory consolidation
  - Provide storage and transfer options
  - Offer lubrication-related training

Hydraulic Equipment Troubleshooting Tips

Trouble	Cause	Action
Noisy Pump	1. Restricted intake 2. Worn pump 3. Pump picking up air a. Around shaft or head packing b. At loose or broken intake pipe 4. Cavitation at pump inlet 5. Excessive speed 6. Excessive pressure	1. Clean intake strainer. Check intake piping for obstruction. 2. Disassemble pump, inspect internal parts for wear. 3. Replace packings, grease pump fitting. a-b. Repair or replace pipe. 4. Oil viscosity too high or partially restricted 5. Check prime mover speed and operate pump within recommended limits. 6. Check relief valve setting and for line restriction (clogged or undersized lines).
No Pressure Fluctuating Pressure	1. Broken pump shaft 2. Worn pump 3. Vanes stuck in rotor (vane pump) 4. Relief valve a. Large piston stuck open b. Small hole in large piston plugged* c. Piston or valve seat in cover damaged d. Dirt between piston and seat in relief valve control head*	1-3. Disassemble, inspect pump parts. 4. Disassemble valve, clean, replace damaged parts.
Relief Valve Chatter	1. Piston or valve seat in cover damaged 2. Dirt between piston and seat in relief valve control head*	1-2. Disassemble valve, clean; replace damaged parts.
Four-Way Valves Not Shifting	1. Electrical trouble (solenoid operated valves) 2. Main valve spool sticking 3. Pilot pressure too low (pilot pressure operated valves)	1. Shift solenoid by hand; if valve operates, call electrician to check circuit. 2. Disassemble valve, clean spool and bore with crocus cloth. 3. Should be 50 psi minimum
Machine Feed Slowed Down	1. Slot in throttle valve dirty* 2. Weak or broken hydrostatic spring	1. Remove throttle, clean out valve slot. 2. Replace spring.
Chatter in Feed	1. Sticky hydrostatic valve 2. Machine ways lack lubrication or are out of line	1. Disassemble and clean hydrostatic valve. 2. Check and correct.

*Wherever difficulties have been caused by dirt in the system, check oil supply and oil filter; change if necessary. Oil must be kept free of water and foreign material. Continuing problems may indicate a dirty new oil supply.

LE Hydraulic Oils Offer Performance, Specs To Meet Your Needs

LE manufactures a variety of oils suited for hydraulic systems, offering a range of features and performance benefits to suit different applications and operating environments. Many are rust and oxidation inhibited, nonfoaming hydraulic oils designed for long life and superior lubrication; they help reduce deposits and stand up under considerably higher operating temperatures than most hydraulic oils.

LE's Equipower™ Ultra HVI Hydraulic Oil

Long-lasting, nonfoaming oil designed to extend life of hydraulic systems. Outperforms other commercial hydraulic oils in thermal, oxidative and hydrolytic stability. High viscosity index formulation contains Monolec®, LE's proprietary wear-reducing additive. Recommended for hydraulic applications with widely fluctuating operating temperatures.

- 6522 – ISO 22
- 6532 – ISO 32
- 6546 – ISO 46

Equipower Ultra Hydraulic Oil

Long-lasting, nonfoaming oil designed to protect the life of hydraulic systems. Outperforms other commercial hydraulic oils in thermal, oxidative and hydrolytic stability. Contains Monolec.

- 6132 – ISO 32
- 6146 – ISO 46
- 6168 – ISO 68

Equipower Hydraulic Oil

Anti-wear hydraulic oil formulated with select base oils for oxidation resistance and an additive package that offers anti-wear properties, rust protection and thermal stability. Recommended for hydraulic systems operating in highly contaminated environments or where high lubricant consumption is a concern.

- 4932 – ISO 32
- 4933 – ISO 46
- 4934 – ISO 68

Multilec® Industrial Oil

Multifunctional, heavy-duty, nonfoaming industrial oil designed to provide long-term anti-wear and rust and oxidation protection in a variety of industrial applications, including hydraulics. Contains Monolec.

- 6801 – ISO 32
- 6802 – ISO 46
- 6803 – ISO 68
- 6804 – ISO 100
- 6805 – ISO 150
- 6806 – ISO 220
- 6807 – ISO 320

Low Tox® Hydraulic Oil

Exhibits very low toxicity as compared to conventional and biodegradable hydraulic oils. There is no worry of premature oxidation or failure of the lubricant as there is with most vegetable oil-based products. Recommended for use where low toxicity and minimal environmental impact is desirable.

- 6603 – ISO 68

H1 Quinplex® Synthetic Food Grade Oil

Nonfoaming food grade lubricant is registered NSF H1 and certified Kosher Pareve and Halal. Recommended for use in food processing and other sensitive environments where anti-wear, rust-resistant and oxidation-resistant properties are required. Featuring 100% synthetic base oil, it has excellent load-carrying abilities and can be used in low-temperature applications. Contains Quinplex, LE's proprietary impact-resistant additive.

4032 – ISO 32
4046 – ISO 46
4068 – ISO 68

H1 Quinplex White Oil

Food grade lubricant is registered NSF H1 and certified Kosher Pareve and Halal. Recommended for use in food processing and other sensitive environments where superior anti-wear, rust-resistant and oxidation-resistant properties are required. Contains Quinplex.

- 4010 – ISO 46
- 4020 – ISO 68
- 4030 – ISO 100
- 4040 – ISO 150

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