Lube Q&A

Question:
Name five functions of a lubricant.
Answer:
Reduce wear, reduce friction, prevent corrosion, control contamination and control heat.

Question:
Where in the refinery process do lubricant raw materials come from?
Answer:
Vacuum distillation tower.

Question:
What are some of the refinery steps employed to produce finished lubricant base stocks?
Answer:
Vacuum distillation, propane deasphalting, furfural extraction, solvent extraction, dewaxing, hydroprocessing.

Question:
What is "hydroprocessing" in lubricating oil terms?
Answer:
Reacting the base oil with hydrogen and catalysts to remove/convert less desirable compounds of crude.

Question:
What are the four maintenance strategies generally seen in industry?
Answer:
Breakdown (PRV: reactive), preventive, predictive and proactive.

Question:
Can you name an oil analysis test used for proactive maintenance?
Answer:
Particle counting and viscosity analysis, among others.

Question:
What type of hydraulic component is sensitive to failure by silt lock?
Answer:
Electrohydraulic valves (for example, servo valves).

Question:
Silt-size particles are typically in what size range?
Answer:
1 to 10 microns.

Question:
Do large particles always cause more wear than small particles?
Answer:
No.

Question:
What is a common cause of seal swell or seal shrinkage?
Answer:
Incompatibility with base oils and/or additives.

Question:
Where on a gear tooth might you see pitting?
Answer:
On the pitch line or other rolling contact zones.

Question:
Can you name two possible causes of noisy open gear operation?
Answer:
Misalignment, compacted lubricant in tooth root area and excessive tooth wear.

Question:
What would be best practice when purchasing lubricants?
Answer:
Purchase on quality and performance specification, not on price.

Question:
What would be a reason for changing the oil type?
Answer:
Marked change in ambient or operating temperature, if oil deteriorates rapidly, excessive wear or risk of fire.

Question:
What is the effect of water contamination on rolling-element bearing life?
Answer:
Bearings can lose 75 percent of their expected service life due to water at less than 0.1 percent, or before it becomes cloudy.

Question:
How would you recognize a symptom of incompatibility of different greases?
Answer:
Incompatibility commonly occurs when a mixture of two greases has a consistency markedly softer than either of the original greases.

Question:
What might happen when two incompatible greases are mixed?
Answer:
Reduction or increase in consistency (typically reduction).

Question:
Can you name two symptoms of incompatibility in greases?
Answer:
Lower heat resistance, decrease in shear stability or a change in consistency.

Question:
How is the consistency or penetration of grease defined?
Answer:
It is the depth (in tenths of a millimetre) to which a standard cone sinks into the grease sample under prescribed conditions (ASTM D217).

Question:
Grease penetration is commonly measured under two different conditions. What are they?
Answer:
Worked and unworked. Worked penetration is more significant to service behaviour than unworked penetration.

Question:
How would the consistency of grease change with a change in temperature?
Answer:
The penetration test is done at 25 degrees C (77 degrees F). If temperature is reduced to 0 degrees C (32 degrees F), grease will be firmer by one to two NLGI numbers.

Question:
What does “bleed” mean with respect to grease?
Answer:
When oil drains out of the thickener by gravity or centrifugal forces.

Question:
Is oil separation or "bleeding" in a grease reason to condemn it as unfit for service?
Answer:
No. A small amount of visible separated oil is normal and part of the lubrication mechanism.

Question:
How long should grease be stored on-site?
Answer:
A common rule is any grease more than a year old should be inspected before it is used. Sensitive greases should be inspected after six months.

Question:
Can you name a common effect of storage on grease?
Answer:
Hardening. This is not a permanent condition, and simple stirring could soften the grease back into range.

Question:
Name four common soap-based thickeners used in greases.
Answer:
Lithium, calcium, sodium and aluminium.

Question:
What are the principal thickeners used in grease manufacturing?
Answer:
Soaps of lithium, sodium, calcium, barium and aluminum are the principal thickeners. Organo-clay is used in some high-temperature, non-melting greases. Polyurea is often used in motor-bearing applications.

Question:
Which grease types provide the best water resistance?
Answer:
Barium and aluminium complex.

Question:
Can you name two problems associated with grease contaminated or exposed to water?
Answer:
Water washing and water absorption.

Question:
Can you name three factors affecting the amount of grease to be applied to a bearing?
Answer:
Is the bearing subjected to: shock loading, heat, water, speed or external contamination?

Question:
Many equipment manufacturers specify re-lubrication as "x shots of grease." How much is a shot of grease?
Answer:
A shot is generally accepted to mean one stroke of a grease gun. However, grease guns deliver widely varying amounts of grease (typically 0.1 ounce or 2 to 3 grams). Always calibrate your grease guns.

Question:
How much pressure can a grease gun generate?
Answer:
15,000 to 20,000 psi.

Question:
When would you consider using grease instead of oil as a lubricant?
Answer:
To decrease the frequency of lubrication, to seal out contaminants, for intermittent operation, to suspend solid lubricants, for shock loading and for low speeds/high loads.

Question:
What factors would you consider when offered a "cheaper" oil?
Answer:
Is it cheaper through lower supply and transport costs? Is it less highly refined? Does it contain less effective additives? Are the additives compatible with those currently in use?

Question:
What can reduce three-body abrasion in a machine?
Answer:
Reducing the contamination level, reducing the bearing load and/or increasing the oil viscosity.

Question:
Can you name two disadvantages of manual oiling and greasing?
Answer:
There is usually an oversupply and excessive leakage or throw-off occurs. Also, the machine often has to be stopped, resulting in lost production.

Question:
Positive oil supply systems provide a number of benefits in machinery lubrication. Can you name three?
Answer:
Replacement of used oil by fresh oil, removal of contaminants possible by filtration, and more effective cooling as hot oil is removed and replaced by cool oil.

Question:
Can you identify three root causes of failure?
Answer:
Wear, fluid contamination, fluid temperature, fluid physical stability, fluid chemical stability and material distortion/alignment.

Question:
Name two disadvantages of using synthetic lubricants.
Answer:
Cost (typically four to 10 times more expensive) and compatibility with seals, hoses, coatings and other lubricants.

Question:
Meshing gears can be difficult to lubricate effectively. Why?
Answer:
The combination of rolling and sliding friction at meshing plus high loads and low speeds mean they may need special additives to reduce wear.

Question:
How is "stick-slip" overcome in machine tools?
Answer:
Use a lubricant containing special friction modifiers as typically found in way oils.

Question:
Viscosity can be measured in a number of different ways. Name three of them.
Answer:
Kinematic viscosity, dynamic viscosity, Redwood viscosity, Saybolt viscosity and Engler viscosity.

Question:
Can you name two possible causes of viscosity loss?
Answer:
Fuel dilution in engine oils, top-up with lighter oil or permanent shear of viscosity index improver.

Question:
If high pressure were applied to a lubricant, what would be its effect on viscosity?
Answer:
The viscosity would increase.

Question:
List three potential advantages of synthetic engine oils over mineral oils.
Answer:
High-temperature stability, low-temperature fluidity, high viscosity index and low volatility.

Question:
Theoretically, high viscosity index oils are needed only under what conditions?
Answer:
High VI oils are generally required where machines are likely to operate over a wide range of temperatures, such as outdoors.

Question:
How does a viscosity index improver work?
Answer:
In cold oil, the viscosity index improver (VII) molecules adopt a coiled shape and have little effect on viscosity. In hot oil, the VII molecules uncoil and have a thickening effect.

Question:
What properties of oil are used to calculate viscosity index?
Answer:
Viscosity index is calculated from an oil's kinematic viscosity at both 40 and 100 degrees C.

Question:
Hypoid gears usually require special lubricants meeting the American Petroleum Institute's GL-5 standards. Why?
Answer:
In addition to the usual rolling action, hypoid gears have a combination of radial and sideways sliding action in the boundary lubrication regime, similar to those found in worm gears.

Question:
What inspection needs to be performed when draining oil from a sump or reservoir?
Answer:
The presence of bottom sediment and sludge.

Question:
In plain bearings, there are several mechanical factors affecting lubrication. Can you name three?
Answer:
Ratio of bearing length to diameter, clearance, surface finish, grooving and bearing material.

Question:
Name two properties of plain bearing material.
Answer:
Scoring resistance and conformability.

Question:
Provide examples of the three lubricant film types.
Answer:
A shaft rotating at full speed (hydrodynamic), a roller or ball bearing (elastohydrodynamic), and load has squeezed lubricant out and metal-to-metal contact has occurred (boundary).

Question:
On a diesel engine, where would the best sample point be?
Answer:
On the pressure line before the filter.

Question:
Why is drop-tube sampling not recommended for engines?
Answer:
The machine has to be shut down, the tube’s final point is difficult to control, and the tube may pick up contaminants on the way in.

Question:
Name a major factor in determining the correct oil viscosity for a rolling-element bearing.
Answer:
Bearing speed factor (also known as DN factor) where rotational speed (RPM) is multiplied by pitch diameter in millimetres.

Question:
If rust suddenly appears on oil-wetted machine surfaces, which tests should be performed on the oil?
Answer:
Water test, acid number and rust-inhibiting test (ASTM D665).

Question:
A base number will typically increase or decrease as the oil ages?
Answer:
Decrease.

Question:
What are the main types of solid contaminants possible in an oil system?
Answer:
Wear debris, oil breakdown products, combustion products (soot in an engine) and external dust and dirt.

Question:
Name the three classes of machinery failure.
Answer:
Early (or infant) failure, random failure (during normal service life) and time-dependent failure (at expected end-of-life).

Question:
Can you list the five failure classifications of a mechanical system?
Answer:
Catastrophic failure, precipitous failure, impending failure, incipient failure and conditional failure.

Question:
Name two additives commonly found in turbine oil.
Answer:
Antioxidants and rust inhibitors as well as demulsifying agents and foam inhibitors.

Question:
Can you name three types of polar additives?
Answer:
Dispersants, detergents, anti-wear additives, EP additives and rust inhibitors.

Question:
What type of additive is known to polish gear teeth?
Answer:
Sulfur-phosphorus EP additives.

Question:
Can you name a common EP additive that is soluble in oil?
Answer:
Sulfur phosphorus.

Question:
What properties are provided by the additive zinc dialkyldithiophosphate (ZDDP)?
Answer:
Anti-wear and anti-oxidation.

Question:
Can you name four common causes of loss of dispersancy in motor oil?
Answer:
Coolant contamination, overextended oil drain, water contamination, high blow-by, long idling, high elevation and exhaust gas recirculation.

Question:
What are the consequences of a loss of dispersancy?
Answer:
Engine deposits, sludge, impaired lubrication and oil flow.

Question:
What would be some of the reasons for replacing mineral oils?
Answer:
Temperature too high for mineral oil, temperature too low for mineral oil, lower flammability required for hazardous conditions, compatibility problems and contamination problems.

Question:
Why is manual lubrication sometimes not effective?
Answer:
It is dependent on the operator/lube tech for success. Unless one is very careful, it is easy to miss lubrication points.

Question:
If oil drums must be stored outside, what is the best way to do this?
Answer:
At the very least, drums should be stored on their sides with the bungs in the 9 and 3 o'clock positions.

Question:
How are users of lubricants containing potentially hazardous components notified of any danger?
Answer:
Hazard information must be communicated to customers and employees by means of container labeling, other forms of warning, MSDS and employee training. This requirement is law in many countries.

Question:
Name a common lubricant that uses a detergent additive.
Answer:
Motor oils as well as some compressor oils, paper machine oils and gas engine oils.

Question:
When would you consider adjusting oil sampling frequency?
Answer:
Sampling should be adjusted to consider machine criticality, environment severity, machine age and oil age.

Question:
The term "demulsibility" is often used. In terms of lubricants, what does it mean?
Answer:
An oil's ability to separate from water.

Question:
What sampling methods could be considered for pressurized oil lines?
Answer:
Portable high-pressure tap, ball-valve sampling point and Minimess tap sampling.

Question:
What problems can occur when a bearing is lubricated with too much oil or grease?
Answer:
Higher energy consumption, short lubricant life and thinning oil film thickness.

Question:
What are two ways a seal may change when in contact with an incompatible oil?
Answer:
Swell or shrink

Question:
There are three methods used to determine elemental constituents in an oil. What are they?
Answer:
Atomic emission spectroscopy, atomic absorption spectroscopy and X-ray fluorescence spectroscopy.

Question:
Apart from chemical breakdown, why might oils deteriorate in service?
Answer:
Through contamination from external sources. Possible contaminants include water, unburnt fuel in an engine, wear debris, atmospheric dust, soot from poor combustion, corrosion products, process materials and additive breakdown products.

Question:
Can you describe three common ways the mass of an additive can be lost from oil during service?
Answer:
Adsorption, water washing, filtration, gravity separation, evaporation and particle stripping.

Question:
How do contaminants enter fluid systems?
Answer:
Through introduction via dirty components, assemblies and fluid and/or through environmental ingression and surface degradation in an active system.

Question:
Name four impurities of mineral oils that are removed in the refining process.
Answer:
Salt, wax, aromatics, sulphur compounds, nitrogen compounds, solids and water.

Question:
What types of contaminants might a vacuum dehydrator remove?
Answer:
Water, entrained air, refrigerant and entrained gases.

Question:
Provide examples of the three lubricant film types.
Answer:
A shaft rotating at full speed (hydrodynamic), a roller or ball bearing (elastohydrodynamic), and load has squeezed lubricant out and metal-to-metal contact has occurred (boundary).

Question:
Is it good practice to use funnels for topping up machines?
Answer:
Funnels are a source of contamination and should be avoided. If they must be used, then clean them well and store in a large zip-lock plastic bag.

Question:
What is the best flushing oil to use?
Answer:
Generally, the same oil that is to be used in the system, unless adherent surface deposits have formed, requiring the use of solvent or detergents.

Question:
How damaging is fuel dilution in an engine?
Answer:
Fuel dilution can lead to much increased wear, component seizure, increased oxidation and the potential for fire. Ten percent fuel contamination can remove 27 percent of piston ring metal in 100 hours of operation.

Question:
What often happens if air is trapped in oil, and what would be the result?
Answer:
Foam. Oxidation increases. Loss of bulk modulus. [Petr: IS THAT ALL?]

Question:
What causes darkening of oil in non-engine applications?
Answer:
Thermal or oxidative degradation causes discolouration and change in viscosity. Photocatalytic reaction from sunlight can cause darkening as well.

Question:
How does thermal stability of a lubricant compare with oxidation?
Answer:
Thermal stability is the ability of oil to resist degradation under high-temperature conditions with minimal oxygen present.

Question:
What is the effect of glycol contamination in engine oil?
Answer:
Glycol reacts with the lubricant base stock and additives to cause oil thickening and accelerate oil oxidation and sludge formation.

Question:
How is oxidation affected by wear metal particles?
Answer:
Wear metals act as a catalyst and increase the speed of reaction.

Question:
How does oxidized oil affect machine reliability?
Answer:
It causes corrosive wear, oil flow is hampered by varnish and sludge, filters plug, and increased viscosity results in heat build-up and oil flow problems.

Question:
Can you name four products of oxidation?
Answer:
Acids, gums, varnish and sludge.

Question:
What are common indications of oil oxidation that are observed with the human senses?
Answer:
Sludge/varnish formation, oil darkening, acidic and putrid oil odour.

Question:
Copper lubricant delivery lines are easy to install. Are there any problems associated with them?
Answer:
Copper lines are easy to crimp, work-harden and have a catalytic effect on the lubricant oxidation. Steel piping is preferred.

Question:
Ferrous density analysis is a useful monitoring tool. What information can it provide?
Answer:
It tells about the population of ferromagnetic (iron and steel) particles greater than 5 microns in the oil and can serve as a warning of impending failure.

Question:
What are the two wear metal detection methods employed in oil analysis?
Answer:
Ferrography (ferrous density analysis) and emission spectrometry.

Question:
What questions can be answered by analytical ferrography?
Answer:
Where in the machine has the wear originated, what caused it, how severe is it and can it be arrested?

Question:
What information should accompany the oil sample to the laboratory?
Answer:
Machine ID, sample point, date sampled, running conditions, hours (or distance) since last sample, last fluid change, amount of top-up, last filter change, last major service or repair.

Question:
What would be the best oil sample location on a return line?
Answer:
At a turbulent zone such as a bend or elbow.

Question:
What external factors can influence the accuracy of oil sample analysis?
Answer:
Cleanliness of sample container, dirty sampling hardware, machine not operating prior to sampling, variable sample locations, insufficient flushing, sampling after oil change, inconsistent sampling procedures, etc.

Question:
Name two types of wear commonly associated with sliding contact.
Answer:
Abrasive and adhesive wear.

Question:
Can you name a common rolling contact wear mode?
Answer:
Contact fatigue, surface fatigue.

Question:
What type of wear in gears and bearings is controlled by using extreme-pressure (anti-scuff) additives?
Answer:
Adhesive wear.

Question:
In splash-lubricated gearing, what is the generally recommended oil level?
Answer:
Oil should completely cover the lowest gear tooth.

Question:
In oil bath lubricated rolling-element bearings, what is the generally recommended oil level?
Answer:
Halfway up the lowest roller or ball.

Question:
Name three examples of total-loss lubricant delivery methods.
Answer:
Oil mist, drop, wick feed, grease gun, spray, airborne oilers, hand lubrication

Question:
Where on a gear tooth might you see pitting?
Answer:
On the pitch line or other rolling contact zones.

Question:
What is the recommended sampling interval for a steam turbine?
Answer:
500 operating hours

Question:
What are the most common wear modes in machinery?
Answer:
Abrasion (22 to 50 percent), surface fatigue (10 to 20 percent), adhesion (7 to 15 percent), corrosion (5 to 13 percent), fretting (5 to 13 percent) and erosion (4 to 8 percent).

Question:
Hypoid gears usually require special lubricants meeting the American Petroleum Institute's GL-5 standards. Why?
Answer:
In addition to the usual rolling action, hypoid gears have a combination of radial and sideways sliding action in the boundary lubrication regime, similar to those found in worm gears.

Question:
The specific gravity and API gravity relate to the density of oils. For water, what are the specific gravity and API gravity?
Answer:
1 and 10

Question:
What three particle size ranges are used with the ISO code?
Answer:
4, 6 and 14 microns.

Question:
What inspection needs to be performed when draining oil from a sump or reservoir?
Answer:
The presence of bottom sediment and sludge.

Question:
Can you define how the beta rating is calculated?
Answer:
The number of particles larger than a given size before the filter divided by the number of particles larger than the same size downstream of the filter.

Question:
Can you name some of the health hazards associated with lubricants?
Answer:
Some toxicity, dermatitis, skin cancer, infection from microbial contamination.

Question:
How do you diagnose a leaky system?
Answer:
When diagnosing a leaky system, first look for things that may cause the leak. Leaks are often triggered by pressure build-up. Check for plugged vents, overfilling and elevated heat levels. Stress from too much torque can result in gasket failures that lead to leaks.