What is behind the MPC test?

The long-term use of turbine oils can lead to deposits like sludge and varnish. Varnish constitutes a massive risk to the oil system. Oil pipes and bores can become clogged, valves and filters can be blocked, sealing problems can occur. The MPC value is the only procedure worldwide that can be used to quantify an oil's potential to form varnish.

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A high degree of efficacy, short start-up periods and flexibility under changing operating conditions – today, turbines must meet a variety of requirements. Increasingly, they depend on their turbine oils to operate safely. These must cope with:

- very long oil change intervals;
- Increased oil circulation temperatures;
- more compact oil circulation system structures with shorter circulation times.

Although the standard specifications for turbine oils are constantly being tightened, they often do not sufficiently cover individual strain scenarios. Accordingly, the focus is increasingly on practical performance tests as a prerequisite for the recommending of oils by the OEM.

The long-term use of turbine oils is influenced by several factors.

- Oxidation: accelerated by the oil's reaction with atmospheric oxygen in connection with increased oil circulation temperatures of over 60°C.
- Thermal disintegration of base oil and additive package: through localized extreme temperatures during electrostatic discharges or local spontaneous combustion of compressed, undissolved air bubbles.
- Contaminants: water, dust, wear particles and mixtures with other oils.

There are various consequences for the turbine oil: significant consumption of antioxidants, potential filtering of anti-foaming additives, deterioration of air output behavior, decomposition of the wear protection package, reaction products in the form of undissolved oil components, deposits (sludge), varnish formation, dark coloration and/or oil turbidity.

As well as the deterioration of lubricant performance, the deposits constitute a risk for the system above all. The solubility of the additives in the base oil play a key role in their formation. Today, the manufacturers of turbine oils are increasingly using base oils in groups II (hydro-treated), III (hydrocrack) and IV PAO (poly-alpha olefins). These oil types boast an improved relationship between viscosity and temperature and are more stable in the face of oil ageing and oxidation, for instance. Yet decomposed additive components and reaction products of base oil are less easily dissolved by these base oils. The ageing products can deposit more as a result. They also have a high polarity and mostly form deposits on metallic components, such as slide bearings, oil coolers, tanks or gears. In addition, ageing products form increasingly large molecules. They 'agglomerate', stay in filters and/or valves in greater numbers and can block them.

During cooling, such as during downtime as a result of a turbine inspection, the oil is even less soluble. The process of precipitation and deposits in the system is thereby reinforced. Soft sludge and/or varnish is produced as a result. Calm areas with very low oil circulation and/or flow velocity are under particular strain. While sludge can still be wiped away, varnish often cannot be removed, even with solvents. It constitutes a massive risk to the system. Oil pipes and bores can become clogged, valves and filters can be blocked, sealing problems can occur. The oil circulation quantity reduced as a result affects the lubrication of bearings, the function of oil coolers and heat exchangers.

Oil monitoring is more important than ever before

Oils are still supposed to reach lifespans of several years, despite an annual 8,500 hours of strain, particularly in large oil circulation systems with capacities well over 1,000 liters. Due to increasingly demanding operating conditions, turbine oils are being developed, but how they prove themselves only becomes clear in practice. Regular monitoring with oil analyses is therefore crucial.

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However, modern turbine oils also require constant adjustment of the values detected in lubricant analyses. OELCHECK offers 10 different all-inclusive analysis kits for turbine oils. The scope of the analysis is adapted for a wide range of turbine oils and operating conditions. In the analysis, oxidation, modification of additives, any wear or contaminants in the fine and/or finest range are the focus, among others. The values detected are assessed OELCHECK tribologists as parts of a whole. If formation of sludge and/or varnish is suspected, an additional MPC test (Membrane Patch Colorimetry) is recommended.

The MPC value is included as standard in analysis kit 10 (standard for turbine inspection). The higher the MPC index is, the more undissolved particles are present in the oil.

A practical tip

Turbine oils should be monitored through oil analyses every 2,500 to 4,000 operating hours. This is the only way to guarantee maximum operating safety. However, if unusual temperatures, shortened filter lifespans and/or discolorations of the oil nevertheless occur during operation, these are often the first indicators that deposits or even varnish are being formed. In that case, only an immediate analysis of the turbine oil including an MPC test will provide certainty.