

Gas Engine Oil Analysis



Growing energy demand and concerns over the environmental impact of coal-fired power generation has led many countries worldwide to explore the use of alternative energy sources both renewable and non-renewable. One of the alternative technologies identified is the utilisation of natural and biogas for power generation.

The search for inexpensive and reliable energy has prompted interest in natural gas which, in turn, has increased the popularity of stationary gas engines. It has also led to the growing use of alternative gases, such as landfill gas and biogas for power generation. While providing some of the same benefits as natural gas, these alternate gases contain contaminants that present challenges to the efficient running of these engines and their lubricants.

Gas engine lubricants need to withstand the various levels of oil degradation caused by the higher operating temperatures, as well as the combustion process of gas fuels that contain varying impurities depending on the source and quality of the gas fuel. As a result of these higher operating temperatures, oil degradation modes like oxidation and nitration need to be monitored closely.

One of the most effective and least expensive condition monitoring techniques available to gas engine operators and OEMs is oil analysis, as it provides a wealth of information about the lubricant's condition, contaminants and the mechanical wear taking place. When oil analysis results are trended over a period of time, potential problems can be identified and this, in turn, helps machine-operators schedule the appropriate maintenance and avoid costly repairs and reduce machine downtime.



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Reasons to analyse gas engine oil

- Improve plant reliability and reduce maintenance costs.
- Optimal oil drain interval can be established with oil analysis.
- Oil analysis is recommended by OEMs and lubricants suppliers.

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Gas Engine Oil Test Profile

Viscosity @100°C and @40°C ASTM D7279

Viscosity is the most important physical property of a lubricant, and is defined as a fluid's resistance to flow. This in turn determines the thickness of the oil film that prevents contact between metal surfaces. Trending of viscosity data is important as deviations from the norm may indicate base oil degradation, additive depletion or the use of an incorrect lubricant.

Viscosity Index (VI) ASTM D2270

The viscosity index characterises the effect of temperature on an oil's viscosity and is of particular importance in applications where ambient operating temperatures vary significantly.

Total Base Number (TBN) ASTM D2896

The TBN is a measure of the oil's alkaline reserve and a decrease in the TBN would be an indication of additive depletion. The TBN is also an essential element in establishing the optimal oil drain intervals since it indicates whether the additives are still capable of providing sufficient engine protection.

Total Acid Number (TAN) ASTM D664

The total acid number is a quantitative measure of acidic compounds in the oil that are generated as a result of oxidation and the formation of acidic degradation by-products.

Initial pH (IpH) ASTM D7946

The IpH value is considered an important parameter along with the TAN and TBN value, particularly for the evaluation of engine oils in biogas and landfill gas applications as it represents the strong acids in the oil which directly cause corrosion of engine components. This method can even be used to detect minor quantities of strong corrosive acids in oil, even if the TAN has not yet increased significantly.

Particle Quantifier (PQ) Index OEM supplied method

The PQ gives a measure of the total ferrous content of the oil sample and from this measurement the total amount of ferrous (iron) debris can be determined irrespective of the size of the particles.

Fourier Transform Infrared (FTIR) oxidation ASTM D7414 and nitration ASTM D7624 (spectral subtraction method)

The FTIR produces an IR spectrum that is often referred to as the 'fingerprint' of the oil as it contains specific features of the chemical composition of the oil. The IR spectrum can be used to identify types of additives, trend oxidation and nitration by-products that could form as a result of high operating temperatures and thermal degradation.

ICP spectroscopy (wear, contaminants and additive concentrations) ASTM D5185

The spectrometer measures the concentration of wear metals such as iron, oil additives like calcium and contaminants such as silicon in the oil.

Microscopic Particle Examination (MPE) In-house method

An MPE is performed by filtering the oil through a membrane patch of a known micron rating and any debris present is examined under a microscope. The membrane patch is examined for wear, contamination and colour. An MPE can provide clues to the source of the debris and the potential severity of a problem that may be causing it.

% Water ASTM D6304

Water is one of the most destructive contaminants in a lubricant and can cause a wide range of operational problems and significantly affect engine reliability and longevity. It causes additive depletion, base oil oxidation and impairs the oil's film strength. Water contamination also sharply increases the corrosive potential of acids found in gas engine oils.



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