GAS ENGINE OIL **ANALYSIS**

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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.

Gas Engine Oil Test Profiles

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 and ASTM D4739

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 values, 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. It 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.

Contact Details

South African Offices & Laboratories

Head Office
Unit 4, The Terrace, Westway Office Park,
Westville, KwaZulu-Natal
t : +27 31 700 5460
e : support@wearcheck.co.za

Bloemfontein
Unit B, 4 Milner Road
Waverley
t : +27 51 101 0930
e : support@wearcheck.co.za

Eastern Cape
8 Van Wyk Road,
Westering
t : +27 82 290 6684
e : support@wearcheck.co.za

Gauteng
55 Angus Crescent, Longmeadow
Business Estate ext.1, Edenvale
t : +27 11 392 6322
e : support@wearcheck.co.za

Klerksdorp
Unit 19 Buffelspark office complex, 48
Buffeldoorn road
t : +27 83 281 6896
e : support@wearcheck.co.za

Middelburg & Witbank
Unit 7a Nungu Industrial Park
13 Mandela Drive, Middelburg
t : +27 13 246 2966
e : support@wearcheck.co.za

Northern Cape
4 Arrows premises, Bestwood Estate,
Kathu, 8446
t : +27 66 474 8628
e : support@wearcheck.co.za

Rustenburg
F&F Office Park, Block D1, 219 Beyers
Naude Drive, Rustenburg, 0300
t : +27 83 938 1410
e : support@wearcheck.co.za

Western Cape
Unit 25, Reserve 3, cnr Kruispad &
Capricorn Way, Brackenfell, 7561
t : +27 21 001 2100
e : support@wearcheck.co.za

International Offices & Laboratories:

DRC
Kibali Mine
Kibali
t: +260 977 622 287
e: boniface@wearcheck.co.zm

Ghana
Adjacent PanAfrican (Zen Yard),
Akyempin Road, Tarkwa
t: +233 54 431 6512
e: supportgh@wearcheck.com.gh

India
#16-B Kamokoti Nagar Main Road, Palli Karanai,
Chennai, 600 100, Tamilnadu
t : +91 44 4557 5039
e : nissar@wearcheck.co.in

Mozambique
Esquina da EN4 and Mozal Road, Talhão no. 11/15,
Bairro Mussumbuluco, Municipio da Matola
t : + 258 85 792 7933
e : supportmz@wearcheck.co.mz

Namibia
Unit 14, Lafrenz Industrial Park – Erf R/E 26 W,
Rendsburger Street, Windhoek
t: +264 81 141 7205
e: supportna@wearcheck.co.na

UAE – Dubai
Plot 271, Sector 18
AlJarf Area, Ajman
t : +971 6 740 1700
e : operations@wearcheckpm.com

Zambia
Plot 3717, Prescott Road
Light Industrial Area, Kitwe
t : +260 212 210 161
e : supportzm@wearcheck.co.zm

Zimbabwe
23 Amby Drive, Amby,
Harare
t : +263 24 244 6369
e : supportzw@wearcheck.co.zw

CONTACT US