

## White Paper

# Preventing Equipment Failures with Real Time Oil Condition Monitoring

### Abstract

*"It is essential that both suppliers and operators of industrial equipment which relies on oil for lubrication and/or operation, ensure that the oil is correctly specified and maintained in the optimal condition for reliable and cost effective operation. Commercial expectations are also placing greater pressure on OEM's to supply extended warranties whilst operators are constantly looking for effective sustainable cost savings. Real time oil condition monitoring tools such as the Tan Delta Oil Quality Sensor can make this a reality."*

### Introduction

Emergency and standby power generation is a critical part of the UK's energy production strategy and it has recently been in the media spotlight for a whole multitude of reasons. With the commitment and investment by the Government in renewable energy and the continuing changes to the energy mix actually produced due to tighter controls and legislation, flexible and reliable peak capacity has never played a more critical role in ensuring that the lights quite literally "do not go out".

### Real Time Oil Monitoring

The life blood of any engine is the hydrocarbon or synthetic based oils which provides the essential lubrication to ensure trouble free operation. As over 80% of all equipment failures are due in some form to lubrication issues and the use of more diverse fuel types such as Methane is further putting pressure on all operators to regularly monitor and maintain this fluid to ensure efficient running and reduce the significant risk of engine failure. That is why the measurement and monitoring of the quality of the oil for ongoing performance and reliability is paramount.

It is essential that both suppliers and operators of industrial equipment which relies on oil for lubrication and/or operation, ensure that the oil is correctly specified and maintained in the optimal condition for reliable and cost effective operation. Commercial expectations are also placing greater pressure on OEM's to supply extended warranties whilst operators are constantly looking for effective sustainable cost savings.

Traditional offline oil sampling techniques are widely used within industry for the purpose of oil monitoring, there is the risk that the condition of the machine and/or lubricant could become seriously contaminated or otherwise affected at a point just after or at least between sampling times. To reduce this problem a risk assessment programme is usually carried out to establish the ideal frequency of monitoring any given equipment. However, this ideal frequency of monitoring could prove difficult to justify both financially and practically in cases where safety of sampling is an issue or the equipment is in remote locations, such as isolated pumping stations, a wind turbine or landfill sites.

To overcome this problem and reduce the risk further it follows that an accurate real time oil monitoring solution would deliver significant advantages in such cases. Historically the challenge has been that the available technology has been proven to be unreliable and insensitive to the key changes in the oil condition and has therefore failed to deliver a commercial base on which to

deploy such technology. However with the advent of the patented Tan Delta Oil Quality Sensor, a revolutionary broad spectrum sensor which accurately and reliably monitors all of the key factors within the oil in real time, the ability to realise a significant return on investment has now become a reality.

The Tan Delta Oil Quality Sensor is based on a variant of the dielectric properties of the oil, the sensor uses patented technology based on dielectric loss factor (Tan Delta), which is a far more sensitive indicator of oil condition than Permittivity alone (often known as dielectric constant). For most oils, the loss factor will vary from perhaps 0.005 (fresh oil) to 0.1 when contaminated, a dynamic range of 20:1. This is compared with just 0.8:1 for dielectric constant (which changes typically from 2.3 to 2.9), and therefore it is evident that Tan Delta is many times more sensitive than the traditionally understood and used dielectric constant.

Fig 1 shows the data produced in the laboratory from oil samples taken from a Gas Engine running on Methane fitted with the Tan Delta Oil Quality Sensor. Clearly there are direct relationships with the oil sensor readings and the typically measured oil condition monitoring laboratory data.

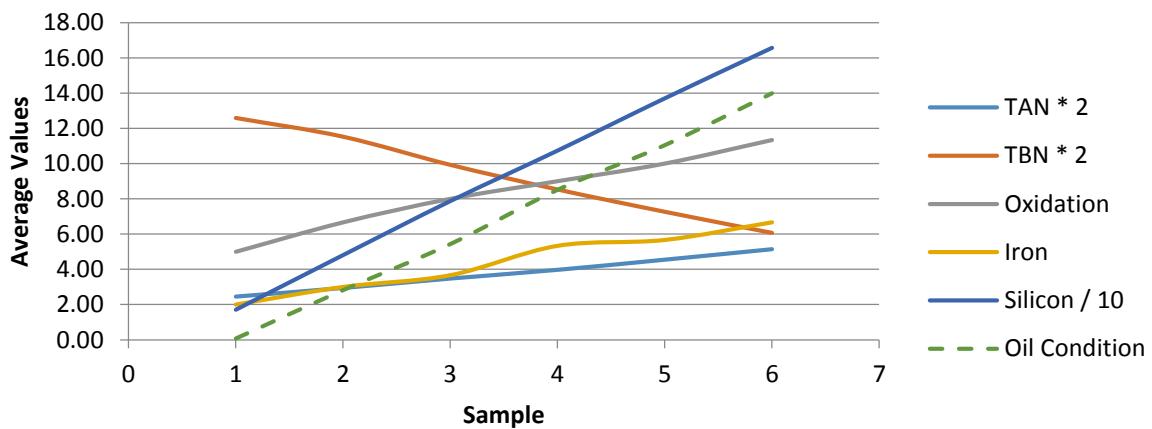


Fig 1.

Table 2 shows the above results in detail. The analyses show a fall in TBN, a rise in TAN and a rise in oxidation resulting in the laboratory recommending a caution value where appropriate. The data shown in Table 2 confirms that the oil sensor reliably tracked the oil condition.

Table 2

| Sample | TAN  | TBN | Oxidation | Iron | Silicon | ~ Hours Run | Oil Condition |
|--------|------|-----|-----------|------|---------|-------------|---------------|
| 1      | 1.12 | 6.2 | 5         | 2    | 16      | 0           | 0.0           |
| 2      | 1.32 | 5.6 | 6         | 2    | 46      | 168         | 3.5           |
| 3      | 1.55 | 4.7 | 8         | 2    | 77      | 336         | 6.4           |
| 4      | 1.84 | 3.9 | 9         | 3    | 106     | 504         | 8.4           |
| 5      | 2.06 | 3.2 | 10        | 3    | 138     | 672         | 10.3          |
| 6      | 2.37 | 2.3 | 12        | 4    | 167     | 840         | 13.5          |

## Sensor Technology

The Tan Delta Oil Quality Sensor uses patented technology to accurately monitor the various changes which take place as oil ages and degrades. Every single oil which is available on the market today has a unique chemical makeup, this is as a result of the different base oil and the individual additive package which has been utilised. The Tan Delta Oil Quality Sensor can easily be configured for the specific oil which is being used, the sensor then knows what this oil looks like when it is clean and can therefore accurately report any changes which take place.

The sensor works by introducing a very high frequency AC voltage into the fluid to precisely measure the oil's ability to store energy (Capacitance) and the oil's ability to conduct current (Conductance).

As an oil ages and/or get contaminated the amount of polar molecules with the oil increase dramatically and by combining the measurement factors (patented method) we can assess the amount of change (damage) which has occurred.

Tan Delta's Technical Support Manager commented, *"Ensuring that your oil is in optimum condition is essential if you are serious about maintaining your equipment's efficiency. Knowing that your oil is starting to degrade and being able to schedule any maintenance actually based on the condition of the equipment, as opposed to just following a pre-defined maintenance schedule brings a number of significant benefits, such as reducing the amount of maintenance required and increasing equipment availability. We work very closely with existing and potential clients to understand how these benefits will deliver significant cost savings. With our comprehensive range of solutions and our dedicated support team we are in the privileged position of being able to develop and grow with our customers"*

## About Tan Delta

Working in collaboration with a number of OEMs and using knowledge from a history of expertise in oil analysis and condition based monitoring, Tan Delta Systems have developed a complete range of solutions for real time monitoring of oil condition at the heart of which is the patented Tan Delta Oil Quality Sensor, a revolutionary broad spectrum sensor which accurately and reliably monitors all of the key factors within the oil in real time. This sensor can be easily integrated into just about any existing industrial controller as well as Tan Delta's own range of display products.

Formed in 2007, Tan Delta's continuous technology and product development program, coupled with comprehensive support ensures that our customers will continue to enjoy the significant financial and operational benefits delivered by Tan Delta Performance oil condition monitoring. At the heart of Tan Delta is a knowledge and technology base which has been accumulated over many years through relentless and research and development. The sophistication and quality engineering of our products reflect this unique knowledge base and ensures solutions that deliver unmatched reliability and performance, and ultimately significant and sustained financial and operational benefits. Receive an average reduction in annual operating costs of 30% through Tan Delta oil condition monitoring and management.

Contact Us

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