



## Case Study

### Oil Analysis prevents Major Engine Failure on the YWAM Medical Ship

The YWAM PNG is a modern ship manned by a volunteer ship's crew and medical staff from all over the world. The YWAM PNG provides free dental and optical care to the people of PNG, who are located in remote coastal villages. Dunlop – PNG donates lubricants, oil analysis services and specialist technical advice to the YWAM Medical Ships.



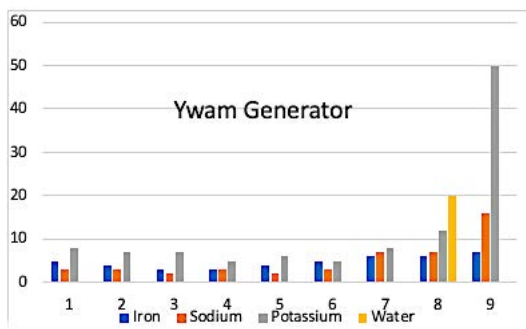
As part of this support, Oil Laboratories – PNG, carries out routine oil analysis on the main engines, port and starboard generators, gearboxes and hydraulic systems.

Oil Laboratories - PNG have been carrying out routine oil analysis and diagnostics on machinery onboard the YWAM PNG for the past 8 months. During the first 5 months the samples reported results within normal operating limits. During this period, we took the opportunity to establish the safe running hours for the main engine oil by monitoring the key properties of the oil, Viscosity, Oxidation Soot and TBN. As the operating hours of the oil increase the additives in the oil are depleted and the values of the key properties change. The viscosity starts to increase along with soot and oxidation levels, at the same time the TBN slowly decreases. This work allowed us to establish that under normal operating condition the oil currently used in the main engine has a safe working life of 700 hours and should be changed before 800 hours.



Establishing the engine oil safe working life was just incidental to this case study. Seven months into the sampling program we noticed a small increase in Iron, Sodium and Potassium in the Starboard generator. At that time, it was not significant enough to warrant any comment.

However, the eight-month sample reported a slight increase in iron but a significant jump in sodium



and potassium, plus water was present in the oil this was enough evidence to warrant raising a caution warning. With a request for the engineers to inspect the engine for an internal coolant leak. *Sodium and Potassium are elements found in the cooling water anti-corrosion additives, when found in the engine oil they indicate there could be a coolant leak into the engine. But at the level we found these elements it would be weep rather than a leak.*



As this was the first indication of a leak, the engine was operating without a problem and inspecting for a leak is a rather large and onerous task, the engineers decided to keep operating the engine but monitor it closely.

However, on the nine-month sample water was not detected in the sample but the Sodium and Potassium in the oil raced past the critical level indicating the leak was accelerating. The laboratory staff immediately contacted the staff on the YWAM recommending an immediate inspection of the engine.



*A point of interest, it is not unusual for water not to be detected in the oil of an engine with a slow coolant leak. As most of the water will evaporate from the hot engine oil, the remainder will dissolve into the oil. Only the more sophisticated analysis techniques will identify dissolved water in oil, and these are not usually carried out routinely as these analyses are time consuming and expensive.*

The YWAM engineers stopped the starboard generator drained the oil and removed the sump. They then pressurised the cooling circuit monitoring the system for a slow pressure drop while inspecting the lower lip of the cylinder liners. Sure enough, number 3 cylinder showed a drip of water indicating a slow leak.

They then removed the head and piston and found that the circlip retaining the gudgeon pin had broken and dropped out working its way past the piston down the liner into the sump. During the transit it had scoured the skirt of the piston and cracked the liner, but the engine remained operational. However, water was now weeping through the cracked liner into the oil.



If this problem had not been picked up by oil analysis and if the YWAM engineers had not acted so promptly, there is a distinct possibility that cylinder 3, may have hydrolocked. Subsequently bending the connecting rod, and either bending or breaking the crankshaft, putting the vital generator out of action necessitating major repairs or engine replacement

In this instance the repairs were relatively simple: a replacement piston, rings, circlips and liner plus associate gaskets engine fluids and labour then the engine will be operational once more.

Needless to say, the staff and operators of the YWAM PNG are extremely happy that they have an oil analysis program in place and that their engineers acted promptly on the Laboratory recommendation.

If you would like further information on Oil Analysis or our service, we can be contacted on +675 472 0711 [enquires@oillabspng.com.pg](mailto:enquires@oillabspng.com.pg) [www.oillabspng.com.pg](http://www.oillabspng.com.pg) - January 2020.

More information about YWAM Medical Ships is at: <https://ywamships.org>