



WDA No 005 T1 MPVP

Client Company

Company Details
 Attention of Client Name
 Contact Details

Objective. Turbine 1 Oil Sample from 1/07/2015. Complete Laboratory analysis on sample, information found used to establish machine condition and future maintenance requirements.

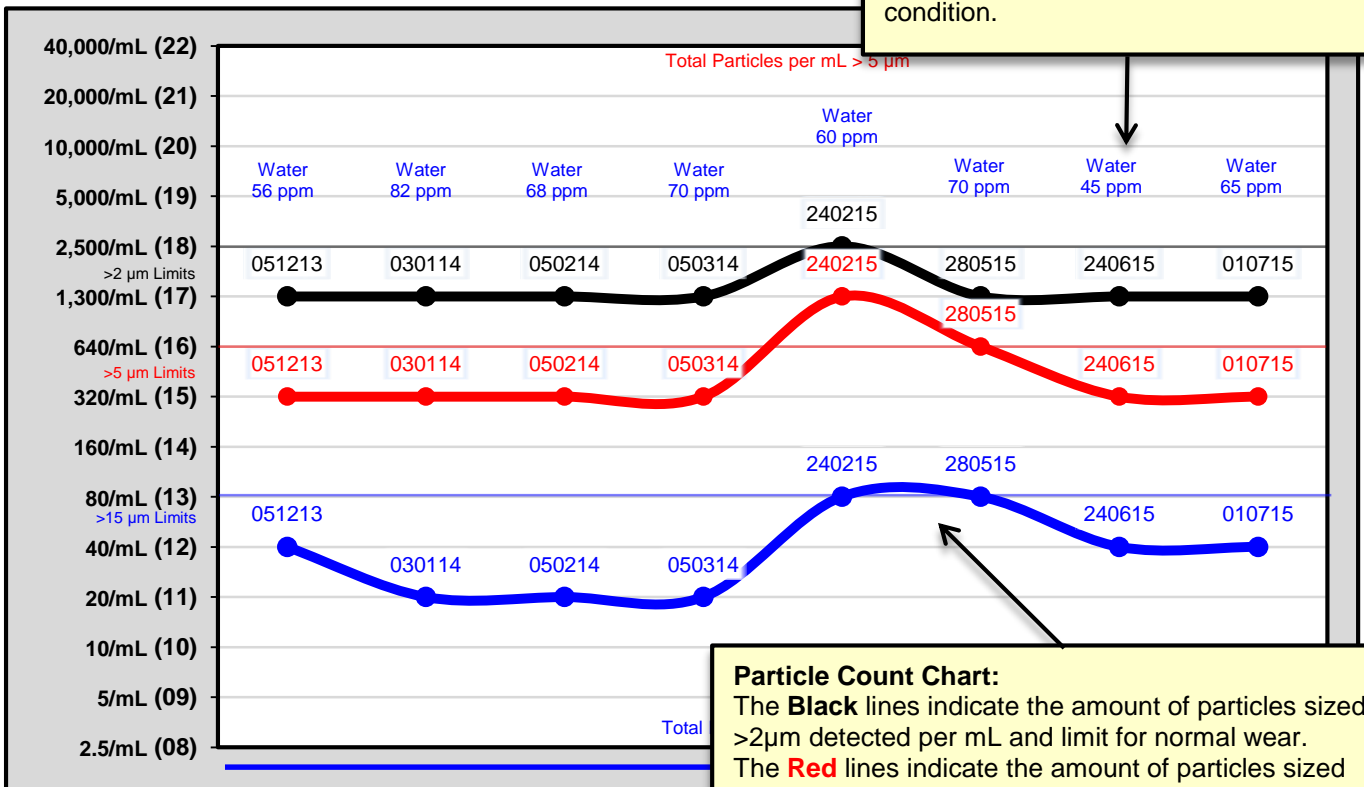
Method. Sample approx 200 mL received, Sample preparation in accordance with Procedure No. 22. One sample processed 1 mL in volume, therefore the amount seen in the video pictures is relatable to the debris concentration per mL of oil.



Turbine 1

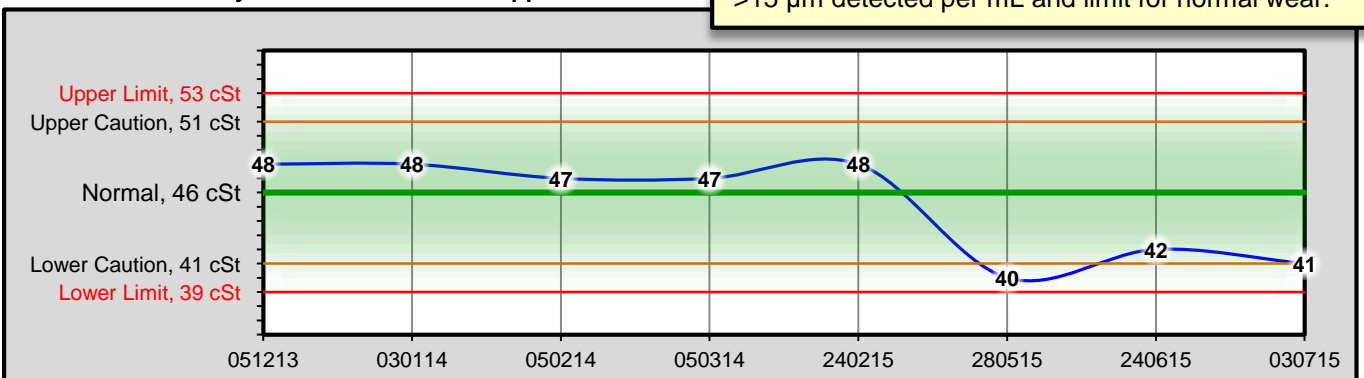
ISO 4406 Cleanness Code for Wear Debris Analysis No 00

Water:
 Water ingress is detrimental to the oil condition.



Particle Count Chart:
 The **Black** lines indicate the amount of particles sized >2µm detected per mL and limit for normal wear.
 The **Red** lines indicate the amount of particles sized >5µm detected per mL and limit for normal wear.
 The **Blue** lines indicate the amount of particles sized >15 µm detected per mL and limit for normal wear.

Conoco Ecoterra Hydraulic Fluid ISO 46 - Upper & Lower limits



3 µm Membrane Filter



These images at 100X/500X indicates the average wear debris and contamination deposited on the analysis filter from 1 CC of the sample being forced through the 3-µm Membrane Analysis Filter.

The brightness of microscope's bottom Green/Blue light shining up through the sample provides an indication of the level of wear debris and contamination per CC of sample.

100/20 µm



3 µm Membrane Filter



**Fine Metallic Wear Particle & Silica Type Crystal
@ 500X Sized 0.5-50 µm**

There was a few of these fine contaminates found in the sample.

20 µm



010715 Results Conclusions and Recommendations

The Turbine 1 Oil Sample indicates the system is wearing in a normal wear mode at a low rate of wear with a few fine metallic particles deposited upon the analysis filter.

Resample in 800 operating hours to check the machine trends.

240615 Results Conclusions and Recommendations

The Turbine 1 Oil Sample indicates the system has continued to run in a normal wear mode at a low rate of wear with a few fine metallic particles deposited upon the analysis filter.

Check the reservoirs breather filters are in good condition.

Resample in 800 operating hours to check the machine trends.

280515 Results Conclusions and Recommendations

The Turbine 1 Oil Sample indicates the system has continued to run in a normal wear mode at a low rate of wear with a few fine metallic particles deposited upon the analysis filter.

Check the reservoirs breather filters are in good condition.

Resample in 800 operating hours to check the machine trends.

240215 Results Conclusions and Recommendations

The Turbine 1 Oil Sample indicates the system has continued to run in a normal wear mode at a low rate of wear with a few fine metallic particles deposited upon the analysis filter.

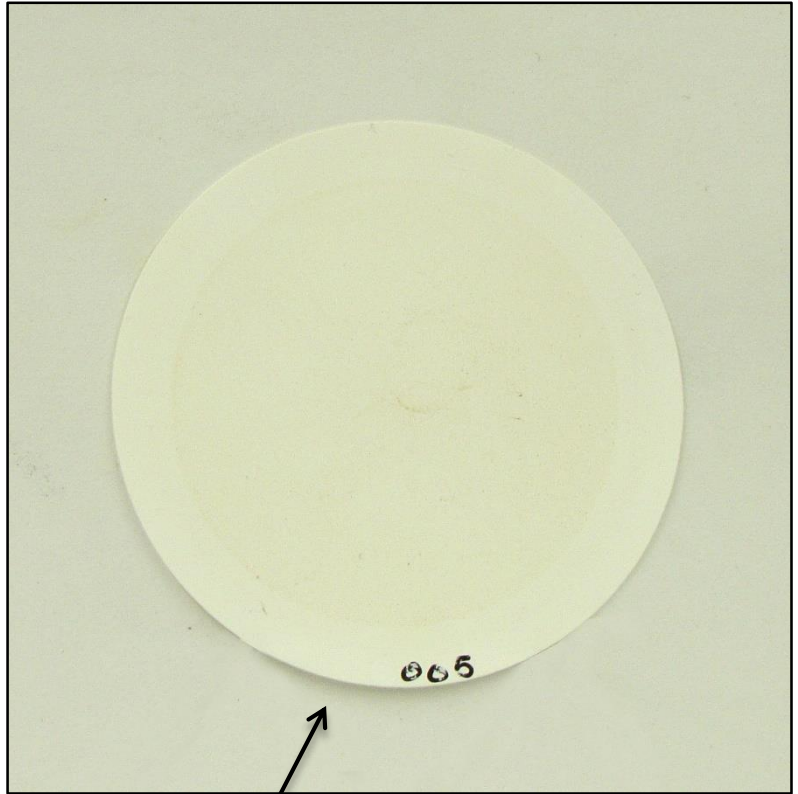
Check the reservoirs breather filters are in good condition.

Resample in 800 operating hours to check the machine trends.

Rob Simmonds
Reliability Manager

005 Turbine 1 MPV @ 0.45 µm Processed @ Ambient Temperature

The MPVP (Membrane Patch Varnish Potential) part of this analysis checks for damage to the fluid being analysed, this analysis uses a 50X larger volume of sample and filters down to a 1/6th of the size of the filter used for the WDA analysis.



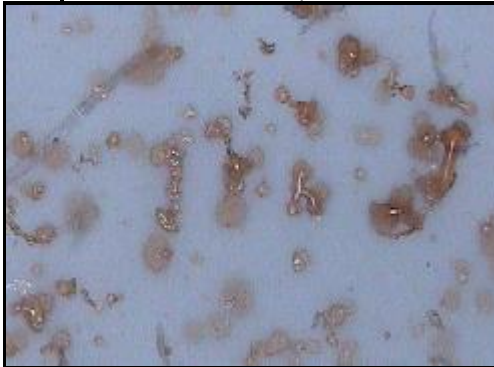
The Membrane Patch Filter was gravimetrically analyzed and weighed. Next the patch was inspected and analysed upon the Membrane Patch Varnish Potential

Membrane Patch Varnish Potential:

In order to calculate and show varnish and other wear we do a higher volume pass on a large area filter. Using our microscope imaging techniques we can physically show varnish and other wear occurring in the item. The patch is shown with the oil to show correlation between visual oil condition and patch.

ed and weighed. minates deposited

Turbine 1 MPV @ 0.45 µm Processed @ Ambient Temperature



100X Brightfield

500X Darkfield

Synthetic Fibres

100 µm



Turbine 1 MPV @ 0.45 µm Processed @ Ambient Temperature



Hard Particle Damaged Metallic Wear Debris.
@ 500X Sized 0.2-55 µm
Brightfield

This sample has a few to light amount of fine metallic wear debris present.

20 µm



Turbine 1 MPV @ 0.45 μm Processed @ Ambient Temperature



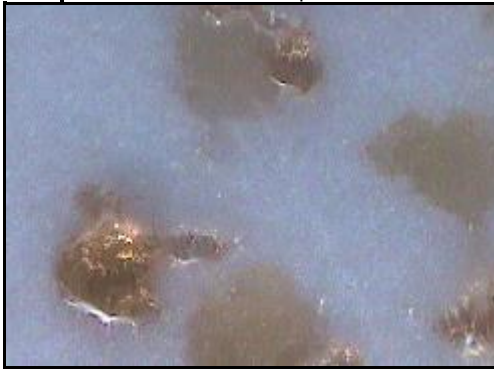
**Hard Particle Damaged
Metallic Wear Debris.
@ 500X Sized 0.2-10 μm**
Brightfield

This sample has a few to light amount of fine metallic wear debris present.

20 μm



Turbine 1 MPV @ 0.45 μm Processed @ Ambient Temperature



**Gelled Lubricant
@ 500X Sized 0.2-75 μm**
Darkfield

These shaped deposits of gelled lubricant are a result of the increase in solubility of the lubricant reabsorbing gelled lubricant deposits from throughout the system.

20 μm



Turbine 1 MPV @ 0.45 μm Processed @ Ambient Temperature



**Gelled Lubricant
@ 500X Sized 0.2-75 μm**
Darkfield

These shaped deposits of gelled lubricant are a result of the increase in solubility of the lubricant reabsorbing gelled lubricant deposits from throughout the system.

20 μm



Turbine 1 MPV @ 0.45 μm Processed @ Ambient Temperature



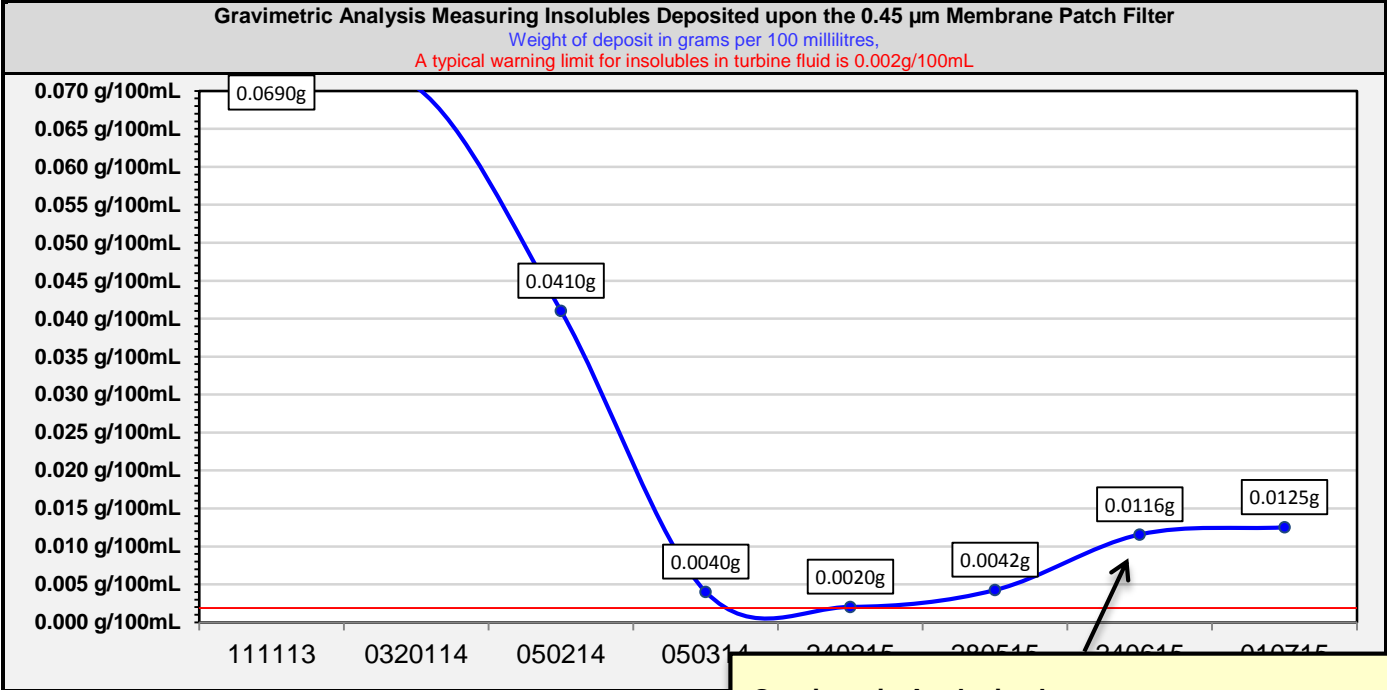
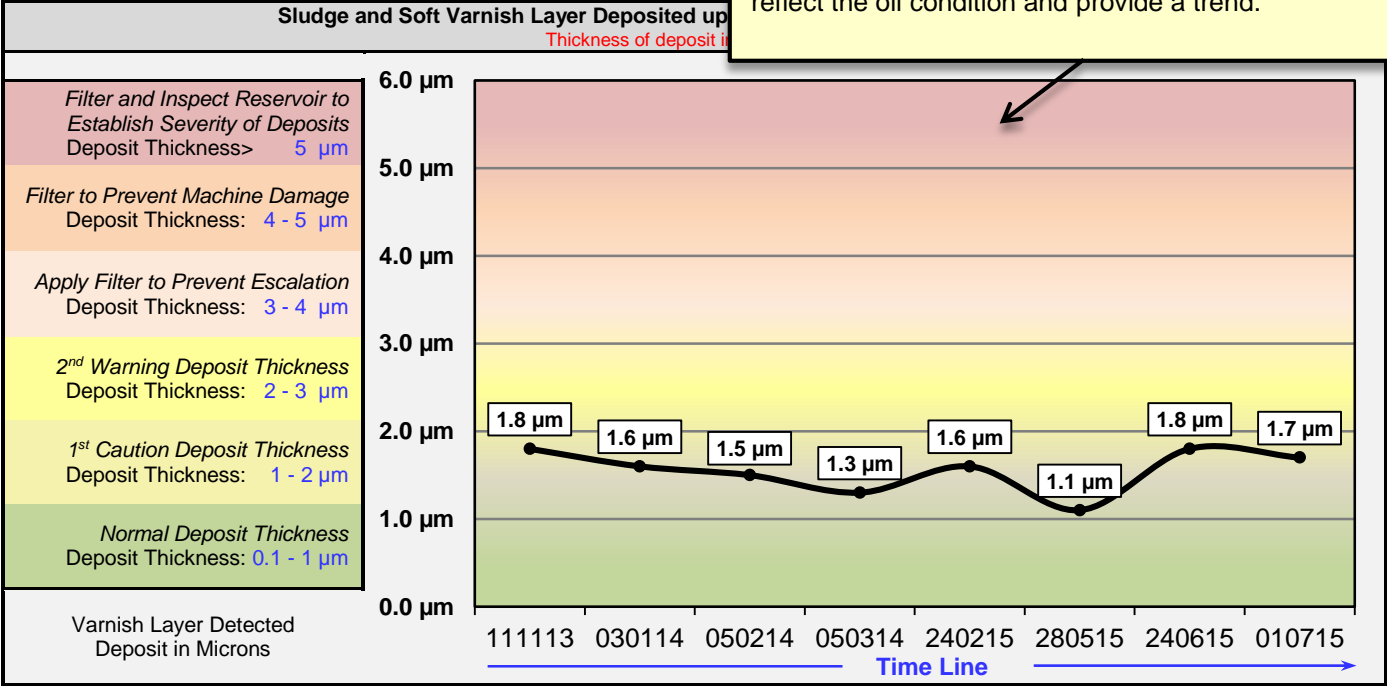
**Gelled Lubricant
@ 500X Sized 0.2-15 μm**
Darkfield

These shaped deposits of gelled lubricant are a result of the increase in solubility of the lubricant reabsorbing gelled lubricant deposits from throughout the system.

20 μm



Sludge and Soft Varnish layer detected Chart:
 We are able to measure the amount of varnish deposited upon the varnish potential patch. This can reflect the oil condition and provide a trend.



Gravimetric Analysis chart:
 Weighing the deposition of varnish and other wear upon the filter helps us trend the condition of the item.

010715 Results Conclusions and Recommendations

The Turbine 1 Oil Sample Membrane Patch Filter analysis indicates the system has continued to clean the degraded lubricant from out of the system with these large globules of resolubilised gelled lubricant removed from the sample. The rate of wear is low with only a few fine metallic particle found in the analysis filters.

The increase in the resolubilised globules of gelled lubricant deposited across the filter has continued indicating the cleaned lubricants continues to reabsorb gelled deposited from throughout the system.

The resolubilised globules of gelled lubricant deposited increased the gravimetric analysis insoluble weight with 0.01250 g of insoluble debris per 100 mL of turbine fluid sample deposited upon the Membrane Patch Filter.

The viscosity remains lower with the removal of the heavier ends of damaged lubricant and if this trend continues the system could have a small volume refresh with an ISO 68 Fluid to restore specification back to an ISO 46 but at present viscosity remains in the normal range. Resample in 800 hour to monitor the systems trends.

240615 Results Conclusions and Recommendations

The Turbine 1 Oil Sample Membrane Patch Filter analysis indicates the system has continued to clean the degraded lubricant from out of the system with these large globules of resolubilised gelled lubricant removed from the sample. The rate of wear is low with only a few fine metallic particle found in the analysis filters.

The increase in the resolubilised globules of gelled lubricant deposited across the filter has continued indicating the cleaned lubricants continues to reabsorb gelled deposited from throughout the system.

The resolubilised globules of gelled lubricant deposited increased the gravimetric analysis insoluble weight with 0.01156 g of insoluble debris per 100 mL of turbine fluid sample deposited upon the Membrane Patch Filter.

The viscosity remains lower with the removal of the heavier ends of damaged lubricant and if this trend continues the system could have a small volume refresh with an ISO 68 Fluid to restore specification back to an ISO 46 but at present viscosity remains in the normal range. Resample in 800 hour to monitor the systems trends.

280515 Results Conclusions and Recommendations

The Turbine 1 Oil Sample Membrane Patch Filter analysis indicates the system is slowly cleaning it's self with the smooth layer of damaged lubricant deposited reducing back to 1.1 μm of layered gelled lubricant.

The increase in the resolubilised globules of gelled lubricant deposited across the filter has continued indicating the cleaned lubricants continues to reabsorb gelled deposited from throughout the system.

The metallic wear debris and resolubilised globules of gelled lubricant deposited increased the gravimetric analysis insoluble weight with 0.00424 g of insoluble debris per 100 mL of turbine fluid sample deposited upon the Membrane Patch Filter.

The viscosity has drifted lower with the removal of the heavier ends of damaged lubricant and if this trend continues the system could have a small volume refresh with an ISO 68 Fluid to restore specification back to an ISO 46.

Resample in 800 hour to monitor the systems trends.

240215 Results Conclusions and Recommendations

The Turbine 1 Oil Sample Membrane Patch Filter analysis for any detected layer of varnish damaged lubricant and general dirt and debris indicates there was a light increase to 1.6 μm of layered varnished gelled lubricant and a light to moderate increase in the globules of damaged gelled lubricant deposited across the filter. The metallic wear debris detected in previous sample reduced in amount to a few to light amount with the gravimetric analysis insoluble weight indicating there was 0.00202 g of insoluble debris per 100 mL of turbine fluid sample deposited upon the Membrane Patch Filter. The presence of the moth scales and larger debris indicate the Reservoir/Lubrication System Breather Filters appear to be allowing large air borne particle into the Hydraulic Fluid. There appears to be a light amount of wear damage occurring in the system and to root cause the reason for the fluid damage and fine metallic wear debris analyse the contents of a Lubrication System Filter to root cause the reason for the heat damaged lubricant and fine metallic wear debris found in the sample.



Rob Simmonds
Reliability Manager

The analysis provided is indicative of conditions based upon sample information received and quality of sample processed. Recommendations are provided as a guide only. Any decisions relating to repair of components or changes to procedures are entirely at the discretion of the customer.