Oil Analysis Identifies Source of Water in Dozer Power Shift Transmission

OVERVIEW

Client: **Heavy Duty Equipment Distributor**

Industry: **Construction/Excavation**

Oil Analysis Cost: **$8 per sample**

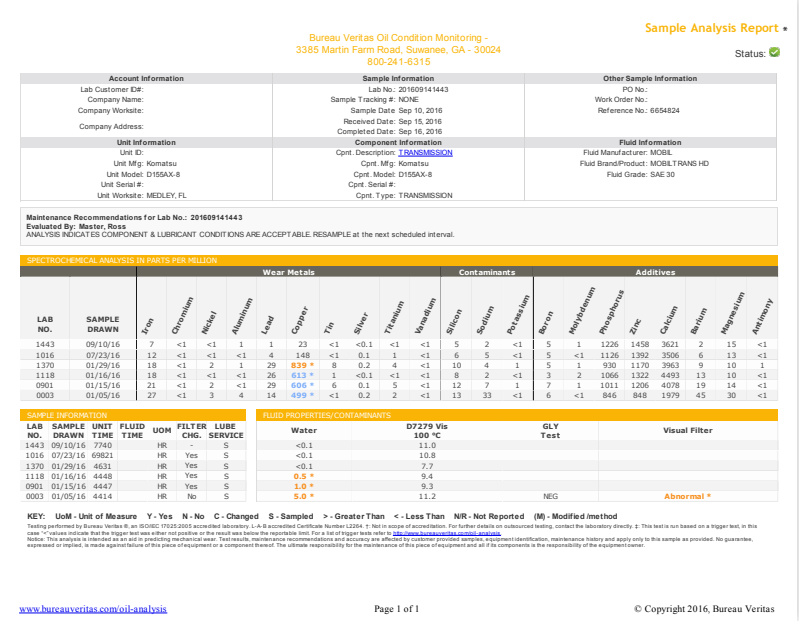
Estimated Savings: **$50,000**

SYNOPSIS

This case study illustrates how oil analysis determined the most likely source of excessive water contamination in a crawler dozer power transmission to be the result of improper storage and handling of the new lubricant supply.

BACKGROUND

During a scheduled preventive maintenance inspection (PM) of a Komatsu D155AX-8 Power Shift Transmission with 4,414 total hours since new, the maintenance technician observed several abnormal conditions. Among them, the technician reported that the machine required the addition of approximately one quart of coolant per week and the power shift transmission oil appeared to have water contamination.



Sample Analysis Report *

Bureau Veritas Oil Condition Monitoring -
3385 Martin Farm Road, Suwanee, GA - 30024
800-241-6315

Status:

Account Information	Sample Information	Other Sample Information
Lab Customer ID#:	Lab No.: 201609141443	PO No.:
Company Name:	Sample Tracking #: NONE	Work Order No.:
Company Worksite:	Sample Date Sep 10, 2016	Reference No.: 6654824
	Received Date: Sep 15, 2016	
Company Address:	Completed Date: Sep 16, 2016	
Unit Information	**Component Information**	**Fluid Information**
Unit ID:	Cpnt. Description: TRANSMISSION	Fluid Manufacturer: MOBIL
Unit Mfg: Komatsu	Cpnt. Mfg: Komatsu	Fluid Brand/Product: MOBILTRANS HD
Unit Model: D155AX-8	Cpnt. Model: D155AX-8	Fluid Grade: SAE 30
Unit Serial #:	Cpnt. Serial #:	
Unit Worksite: MEDLEY, FL	Cpnt. Type: TRANSMISSION	

Maintenance Recommendations for Lab No.: 201609141443
Evaluated By: Master, Ross
ANALYSIS INDICATES COMPONENT & LUBRICANT CONDITIONS ARE ACCEPTABLE. RESAMPLE at the next scheduled interval.

SPECTROCHEMICAL ANALYSIS IN PARTS PER MILLION

		Wear Metals										Contaminants			Additives								
LAB NO.	SAMPLE DRAWN	Iron	Chromium	Nickel	Aluminum	Lead	Copper	Tin	Silver	Titanium	Vanadium	Silicon	Sodium	Potassium	Boron	Molybdenum	Phosphorus	Zinc	Calcium	Barium	Magnesium	Antimony
1443	09/10/16	7	<1	<1	1	1	23	<1	<0.1	<1	<1	5	2	<1	5	1	1226	1458	3621	2	15	<1
1016	07/23/16	12	<1	<1	<1	4	148	<1	0.1	1	<1	6	5	<1	5	<1	1126	1392	3506	6	13	<1
1370	01/29/16	18	<1	2	1	29	839 *	8	0.2	4	<1	10	4	1	5	1	930	1170	3963	9	10	1
1118	01/16/16	18	<1	<1	<1	26	613 *	1	<0.1	<1	<1	8	2	<1	3	2	1066	1322	4493	13	10	<1
0901	01/15/16	21	<1	2	<1	29	606 *	6	0.1	5	<1	12	7	1	7	1	1011	1206	4078	19	14	<1
0003	01/05/16	27	<1	3	4	14	499 *	<1	0.2	2	<1	13	33	<1	6	<1	846	848	1979	45	30	<1

SAMPLE INFORMATION

LAB NO.	SAMPLE DRAWN	UNIT TIME	FLUID TIME	UOM	FILTER CHG.	LUBE SERVICE
1443	09/10/16	7740		HR	-	S
1016	07/23/16	69821		HR	Yes	S
1370	01/29/16	4631		HR	Yes	S
1118	01/16/16	4448		HR	Yes	S
0901	01/15/16	4447		HR	Yes	S
0003	01/05/16	4414		HR	No	S

FLUID PROPERTIES/CONTAMINANTS

Water	D7279 Vis 100 °C	GLY Test	Visual Filter
<0.1	11.0		
<0.1	10.8		
<0.1	7.7		
0.5 *	9.4		
1.0 *	9.3		
5.0 *	11.2	NEG	Abnormal *

KEY: UoM - Unit of Measure Y - Yes N - No C - Changed S - Sampled > - Greater Than < - Less Than N/R - Not Reported (M) - Modified /method

Testing performed by Bureau Veritas ®, an ISO/IEC 17025:2005 accredited laboratory. L-A-B accredited Certificate Number L2264. †: Not in scope of accreditation. For further details on outsourced testing, contact the laboratory directly. ‡: This test is run based on a trigger test, in this case "*" values indicate that the trigger test was either not positive or the result was below the reportable limit. For a list of trigger tests refer to http://www.bureauveritas.com/oil-analysis
Notice: This analysis is intended as an aid in predicting mechanical wear. Test results, maintenance recommendations and accuracy are affected by customer provided samples, equipment identification, maintenance history and apply only to this sample as provided. No guarantee, expressed or implied, is made against failure of this piece of equipment or a component thereof. The ultimate responsibility for the maintenance of this piece of equipment and all if its components is the responsibility of the equipment owner.

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***Note: For the purposes of this case study, customer- and equipment-specific information has been removed from this testing and analysis report with respect to customer data confidentiality.**

CASE STUDY

Based on information provided by the customer and further observation, additional inspections were performed. An oil sample from the transmission was taken and submitted to the laboratory for testing and analysis while the equipment distributor continued investigations to determine the source of the water contamination.

Since the customer was adding at least a quart of coolant to the cooling system on a weekly basis, the assumption was that the transmission had an oil cooler leak inside the main radiator. The radiator was removed from the machine and the oil cooler removed from the radiator for a full inspection.

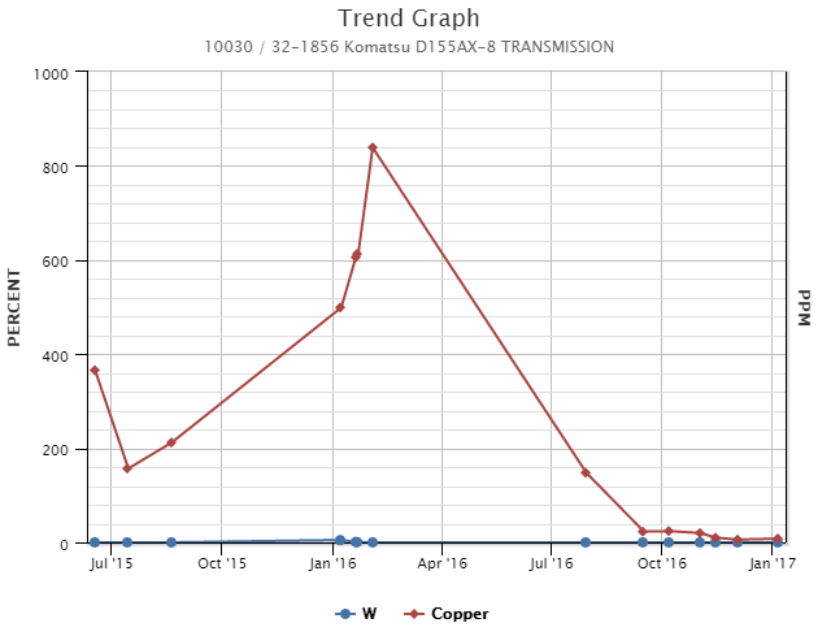

Figure 1

The oil analysis report confirmed that the sample was emulsified – water content was at 5% by volume. Copper was elevated but there were no coolant additives present and testing for glycol was negative – clear indications that the source of the water contamination was not from the cooling system.

The elevated water content will act as a catalyst for the formation of copper oxidizes from any copper alloy component, including the copper oil cooler. Elevated copper alone is usually from oil cooler oxides. All other wear metals were within acceptable limits. Having normal wear levels with high water content indicates the water contamination was occurring for a short period of time.

After inspection and testing, it was determined that the transmission's oil cooler was reported to be in satisfactory condition and no repairs were required. The oil cooler was reinstalled in the radiator and the radiator reinstalled in the machine. While an oil cooler leak had been eliminated as the source of the water ingression, the question remained – where was it coming from?

Further discussion and investigation also ruled out rain water, operating the machine in high water and high pressure water spray from cleaning as possible reasons for the contamination. It was determined that machine design would make rain water entry unlikely. The machine was then inspected for water marks that would indicate it was being used in water high enough to enter the transmission – none were noted – and the machine had not been cleaned with water at high pressure.

The only other typical explanation would be the improper handling and/or storage of a new oil supply. The new oil could have been delivered via a contaminated oil tote, lube truck tank or drum. Improper storage and handling of the new lubricant supply after delivery may have also resulted in contamination from the environment.

KEY FINDINGS

After reassembly of the radiator, and the transmission oil and oil filters were changed, another oil sample was taken within 33 operating hours. The water content had decreased to 1% by volume. The oil and filters were changed again and allowed to accumulate 1 hour of operation before sampling again. The water content was reduced to 0.5% by volume. The oil and filters were changed once again and allowed to run in service for 183 hours before sampling again. The third oil change water result was less than 0.1% by volume.

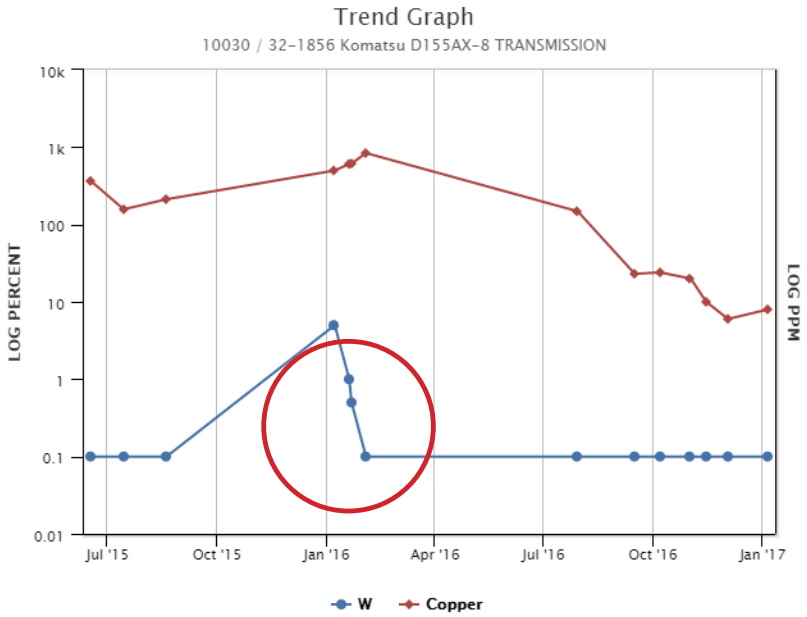

Figure 2

CONCLUSION

Even sealed drums that are allowed to stand upright and collect water on top will become contaminated. Condensation is a common source of contamination as is improperly installed or a lack of desiccant filters on totes or oil supply tanks. The overall condition of all new oil supply sources could not be inspected and may not be fully known by the owner of the machine. One contaminated drum of lubricant could be, and is the most likely, source of the contamination.

Water is one of the most common machine contaminants and when allowed to enter any mechanical component, elevated wear and reduction of service life will occur. This confirms the need for daily inspections by machine operators. Due to the excessive level of water in the transmission, premature wear or even failure would have occurred if not found and corrected in a timely manner.

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