



February 14, 2019

TD 19007-01

Dear Mr. Chin,

Laboratory analysis has been completed on the unknown solid particles taken from a filter canister servicing a mixer gearbox, submitted on behalf of Yii-kei trading Co. LTD and your customer, Formosa Chemicals & Fibre Corporation. The purpose of our analysis was to identify the unknown particles taken from the filter housing. Our results are attached for your review.

Results

Infrared analysis of this sample was inconclusive, and we were unable to identify the composition of the particles. Elemental analysis was not able to identify the source or make-up of these chips as they were not soluble and are larger than five microns. Elemental can only detect particles smaller than five microns in size. Elemental analysis was done on the limited amount of oil that coated these particles and the container. Elemental analysis shows elevated levels of aluminum, chromium, copper, iron, lead, manganese, nickel, and titanium. Levels of barium, calcium, magnesium, zinc, silicon, and sodium were also identified. Aluminum, iron and lead are common elements found in paint and may point to the origination of the particles. Note that when an insufficient amount of lubricant is analyzed, results can be suspect. For this reason, we suggest submitting a representative sample of oil for analysis to determine oil condition and identify potential contaminants. When examined under a microscope at 20X magnification, the unknown particles appear to be paint chips from an unknown source, see **Figure 1** below. It is not uncommon for the inside of some gearboxes to be painted as an additional barrier for rust and corrosion.

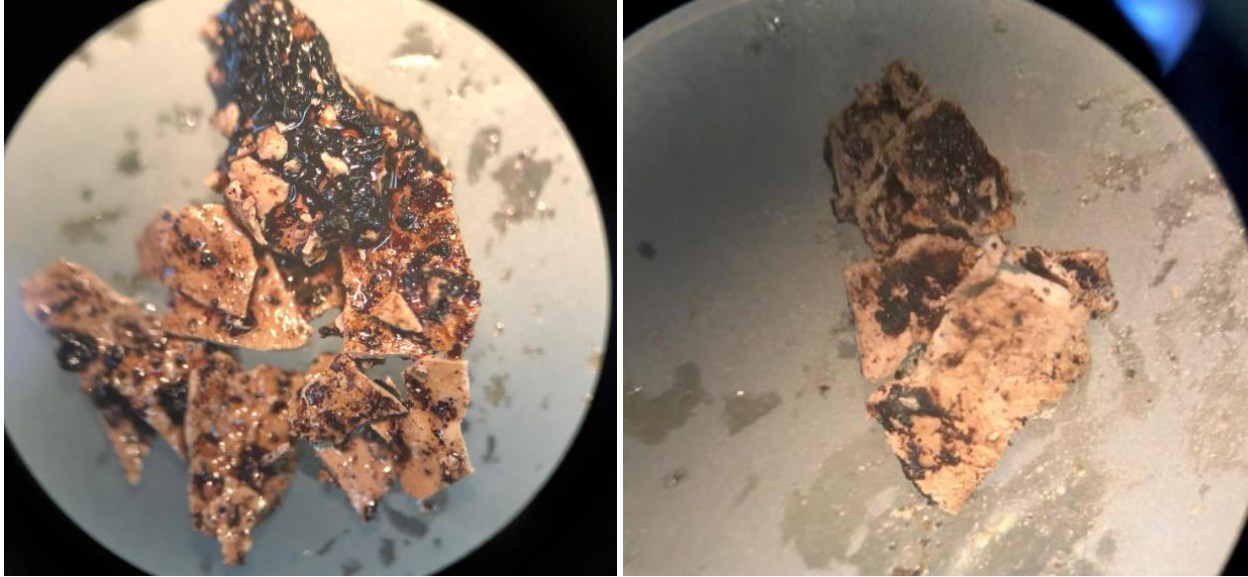


Figure 1: Unknown particles seen at 20X magnification

Conclusions and Recommendations

While we were not able to identify the origin, or the composition of the particles delivered for analysis, these particles under 20X magnification appear to be from a protective coating on the inside of the gearbox. The source of the particles should be identified and eliminated. We inspected all available retains for LE 1606 and were able to verify that these particulates were not present. The inside of the gearbox should be inspected for foreign debris and to determine if there is an internal coating that is wearing. We recommend draining, flushing, and refilling this unit and confirming that LE 1606 meets the OEM lubricant requirements. We recommend submitting a representative sample of oil to determine the condition of the oil and identify any potential contaminants.

We hope this information is useful to you in working with Yii-kei trading Co. LTD and your customer, Formosa Chemicals & Fibre Corporation. If you have any questions or need further assistance, please do not hesitate to let us know.

Sincerely,

Patrick Loe, CLS
Technical Services Engineer
/bf

LABORATORY ANALYSIS

LOCATION: Yii-Kei Trading Co.

UNIT ID: Gearbox M301

OIL TYPE: LE1606

SAMPLE ID: TD 19007-01

UNIT TYPE, MFG, MODEL: Mixer Gearbox M301

DATE		-	-	January 2019	
LAB NUMBER		-	-	TD 19007-01	
OIL SERVICE TIME		-	-	UNKNOWN	
TEST		UNITS	Typical LE1606 VPGL	Typical LE1606 IGO	
ELEMENTAL ANALYSIS - ASTM D5185		Used Sample			
Wear Metals	Aluminum/Al	ppm	0	0	67
	Antimony/Sb	ppm	0	0	0
	Cadmium/Cd	ppm	0	0	0
	Chromium/Cr	ppm	0	0	22
	Copper/Cu	ppm	0	0	543
	Iron/Fe	ppm	0	0	6335
	Lead/Pb	ppm	0	0	16
	Manganese/Mn	ppm	0	0	49
	Nickel/Ni	ppm	0	0	8
	Silver/Ag	ppm	0	0	0
	Tin/Sn	ppm	0	0	0
	Titanium/Ti	ppm	0	0	476
Vanadium/V	ppm	0	0	2	
Additives	Barium/Ba	ppm	0	0	348
	Calcium/Ca	ppm	0	0	200
	Magnesium/Mg	ppm	0	0	14
	Molybdenum/Mo	ppm	0	0	0
	Phosphorus/P	ppm	1000-1230	403-491	3525
	Zinc/Zn	ppm	0	0	54
Contam.	Boron/B	ppm	60-120	28-40	335
	Potassium/K	ppm	0	0	0
	Silicon/Si	ppm	0	0	106
	Sodium/Na	ppm	0	0	17