TESTOIL
INDUSTRIAL ANALYSIS

Machine Condition: MARGINAL
Lubricant Condition: NORMAL

Machine Name: Engine - Main Propulsion
Machine ID: 4005AAC28003

Analysis Report

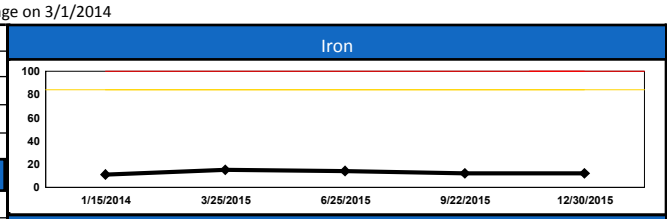
Component Information			Sample Information		Customer Information	
Machine Type:	Low Speed Diesel	Sump Size: 5,320	Received:	12/15/2015	R-5 - Ship A-201	
Lubricant:	MOBIL/Mobilgard 300		Report:	12/15/2015	Port Example	
Machine MFG:	SULZER		Sample No.:	2695 - 2 - 1 - 17	Baltimore, MD	
Machine MOD:	6RND90		Data Analyst:	DR	Contact:	Jack Boilerman

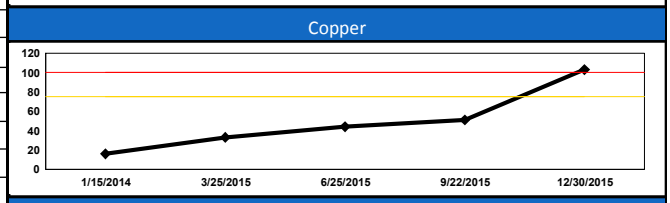
PROBLEMS
HIGH COPPER.
Low VISCOSITY 100C
EXCESSIVE FUEL DILUTION

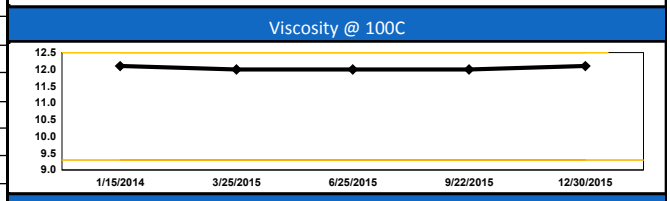
COMMENTS Elevated wear metals may indicate accelerated machine wear. Inspect unit for abnormal noise, vibration and high temperature.
The viscosity is out of range due to excessive fuel contamination in the fluid. Fuel dilution level is above acceptable limits. Locate source of fuel leakage or possible cause of contamination prior to changing oil.

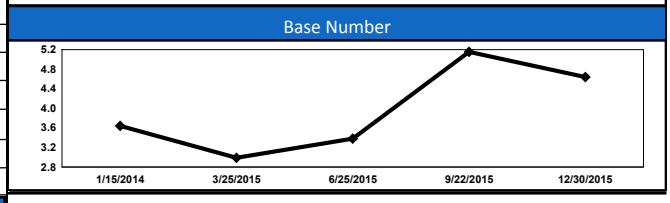
CUSTOMER NOTES Mach Hours: 86617 * Last oil change on 3/1/2014

			NEW OIL	12/15/2015	9/22/2015	6/25/2015	3/25/2015	1/15/2014
	Date Sampled							
	Lab No			1616750	1551194	1494456	1441548	1405210
	Machine / Lube Cond.			M / N	N / N	N / N	N / N	N / N
	Lube Hours			2755	2755	2999	4	2753
	Machine Hours			86617	86617	86615	86373	86369
ELEMENTAL SPECTROSCOPY (ppm) ASTM D5185 Mod (-) indicates below detection limit								
Wear Metals	Iron			12	12	14	15	11
	Copper			103	51	44	33	16
	Lead			-	-	-	5	-
	Aluminum			2	-	-	-	-
	Tin			-	-	-	-	-
	Nickel			-	-	-	-	-
	Chromium			-	-	-	-	-
	Titanium			-	-	-	-	-
	Vanadium			7	8	7	8	6
	Silver			-	-	-	-	-
Additives	Calcium			1733	1790	1697	1996	1631
	Magnesium			10	11	12	13	12
	Phosphorus			173	167	170	217	157
	Zinc			226	234	232	287	203
	Barium			-	-	-	-	-
	Molybdenum			-	-	-	-	-
Contaminants	Silicon			4	5	4	6	5
	Boron			8	41	10	11	8
	Lithium			-	-	-	-	-
	Sodium			50	38	43	60	41
	Potassium			-	-	-	-	-
FTIR SPECTROSCOPY (Indexing Numbers) ASTM E2412								
	Oxidation			3	2	2	2	2
	Glycol			0	0	0	0	0
	Soot			3	3	4	3	3
	Nitration			5	5	5	5	5
VISCOSITY (centistokes) ASTM D445								
	Viscosity@100°C			11.1	12.0	12.0	12.0	12.1
BASE NUMBER (mg KOH/g) † - ASTM D4739 ‡ - IWI-390								
	Base Number			4.64 ‡	5.16 ‡	3.38 ‡	2.99 ‡	3.64 ‡
WATER (%) a-ASTM D6304A b-IWI-133 c-ASTM D6304C d-IWI-134* e-IWI-135* f-IWI-136* g-Crackle h-IWI-370*								
	Water			NEG (g)	NEG (g)	NEG (g)	NEG (g)	NEG (g)
FUEL DILUTION BY GC (%)								
	Fuel Dilution			1.4	0	0.0	0.0	0.0









Date	Customer Corrective Actions
1/13/13	re-sample; Possibility of switched sample warrants resampling.

TestOil - 20338 Progress Drive - Strongsville, OH 44149 216-251-2510 www.testoil.com

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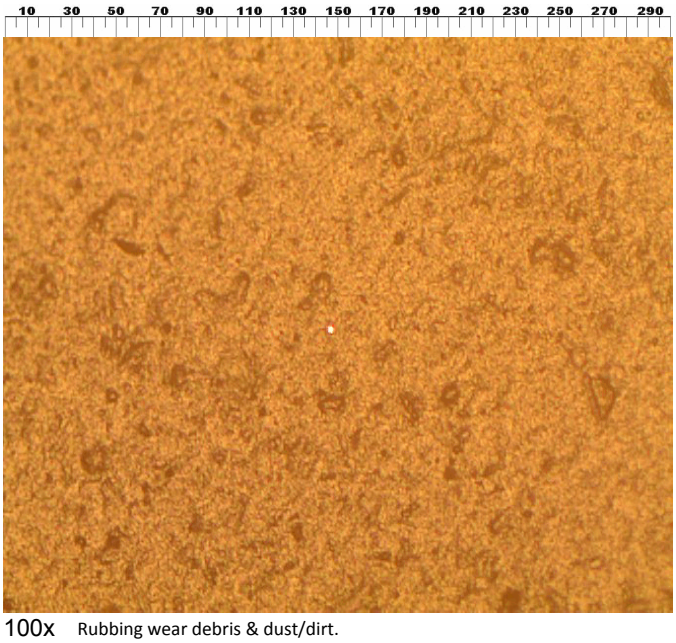
Wear Particle Analysis Report

	Trace	Light	Moderate	Heavy	Max. Size	Particle Composition
Rubbing Wear					5-15	Copper Alloy,White Non-Ferrous
Rolling Contact						
Sliding Wear						
Rolling/Sliding Wear						
Cutting Wear						
Chunks						
Spheres						
Corrosion						
Dark Metallic Oxides						
Red Oxides						
Dust/Dirt						
Other Contaminants						
Oxidation By-Products						

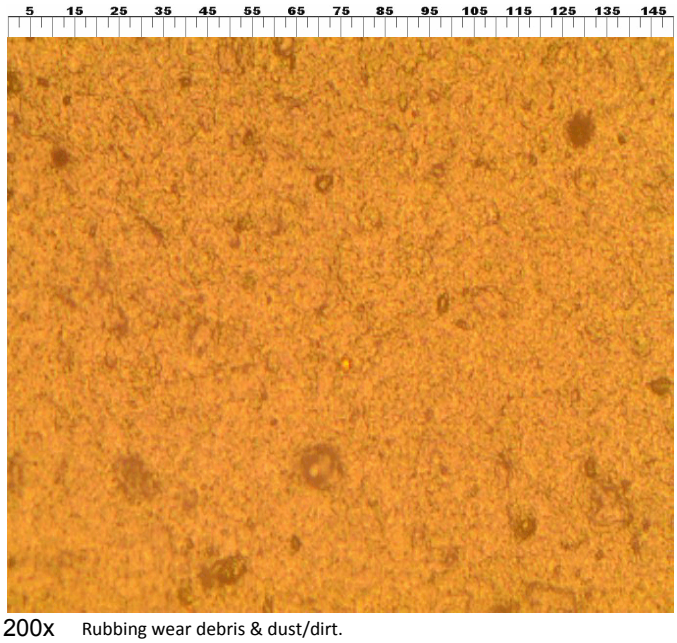
Observations:Analytical microscopy has discovered the following abnormalities. High levels of dust and dirt. Excessive dust and dirt particles are the result of external contamination. These are usually airborne and the result of open hatches, failed seals, poor filtration and inadequate breathers.

Microns



100x Rubbing wear debris & dust/dirt.

Microns



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