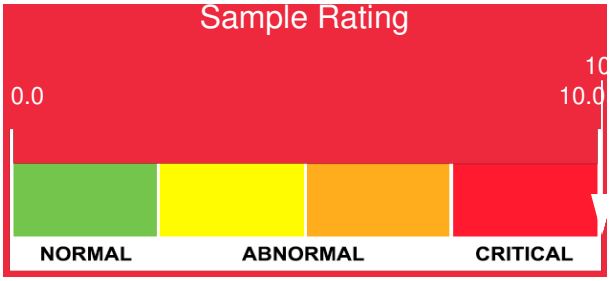
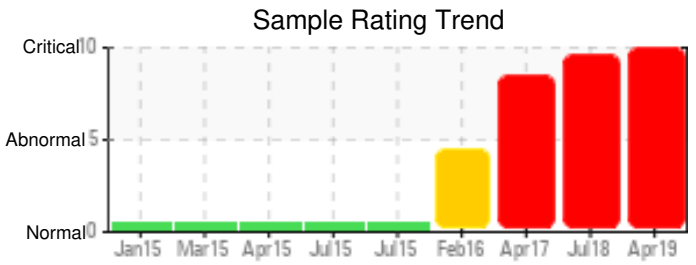




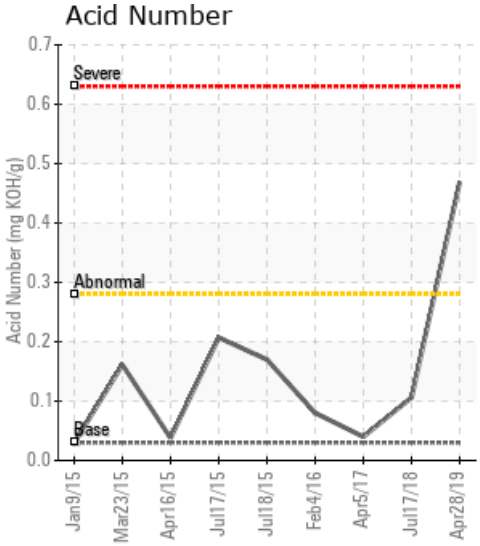
[DE-ETHENIZER OIL HEARTER / 13-24-80-15W6] H5040 Reboiler

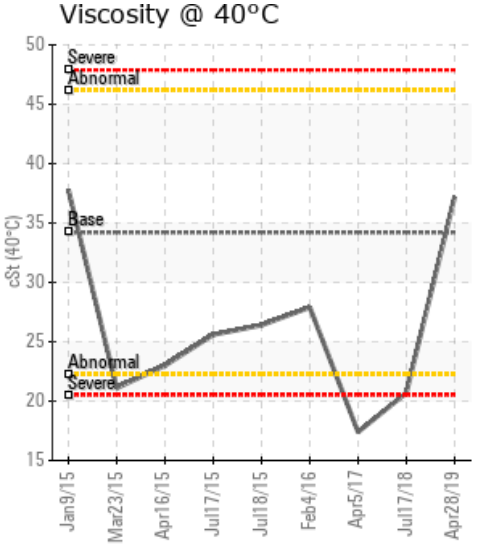
Customer: PTRHTF20151	System Information	Sample Information
LEUCROTTA EXPLORATION 13-24-80-15W6M DAWSON CREEK, BC Canada Attn: Lee Robinson Tel: (780)712-6561 E-Mail: lrobinson@leucrotta.ca	System Volume: 19000 ltr Bulk Operating Temp: 617F / 325C Heating Source: Blanket: Fluid: PETRO CANADA PETRO-THERM Make: ALCO	Lab No: 02283660 Analyst: Clinton Buhler Sample Date: 04/28/19 Received Date: 05/07/19 Completed: 07/18/19

Recommendation: Please note that sample result distribution was delayed on this analysis as Petro-Canada Lubricants was awaiting responses to questions pertaining to these results.GCD %<335C value of 15.03, reduced flash point and low 10% distillation value indicates either/or a combination of thermal degradation, too high of blanket gas pressure or contamination with a process fluid. There is excessive water contamination (>4%) which is a safety concern as there could be boil over at high temperatures. Sodium is also high which may be related to the water contamination.The fluid's Acid number has increased from 0.106 to 0.469. This indicates oxidation degradation and can also be expedited due to the high water content.Solids content is at 2.53%. This is high and can be associated to thermal degradation. Solids content can indicate risk of heavy deposit build-up on burner tubes, piping and heat exchangers.It is recommended to perform a cleaning on system including cleaning runs, flush and a final fill with fresh Petro-Therm. Please contact Petro-Canada Technical Services for further discussion and assistance

Comments: Water contamination levels are severely high. Water contamination levels are severely high.. ppm Water contamination levels are severely high. Pentane Insolubles levels are severely high. Sodium ppm levels are severely high. (GCD) 10% Distillation Point is severely low. COC Flash Point is severely low. (GCD) % < 335°C is abnormally high. Acid Number (AN) is abnormally high.

Sample Date	Received Date	Fluid Age	Sample Location	Flash Point (COC)	Water (KF)	Viscosity (40°C)	Acid Number	Solids	GCD 10%	GCD 50%	GCD 90%	GCD % < 335°C
	mm/dd/yy			°F/°C	ppm	cSt	mg/KOH/g	%wt	°F/°C	°F/°C	°F/°C	%
04/28/19	05/07/19	2y	MIDDLE OF HEAT RADIU	284 / 140	48932.2	37.2	0.469	2.53	585 / 307	776 / 413	897 / 481	15.03
07/17/18	07/30/18	0y		313 / 156	34.6	20.7	0.106	1.20	572 / 300	764 / 407	900 / 482	18.16
04/05/17	04/17/17	0y	SITE GLASS	270 / 132	39.0	17.4	0.04	0.351	525 / 274	772 / 411	918 / 492	20.53
02/04/16	02/16/16	0y	SITE GLASS	367 / 186	327.5	27.9	0.08	0.521	645 / 341	796 / 424	911 / 488	8.74
07/18/15	07/22/15	2y	HEATER BOTTOMS	374 / 190	3.1	26.4	0.170	0.142	644 / 340	803 / 428	920 / 493	8.90
07/17/15	07/22/15	2y	MID POINT HEATER	370 / 188	112.4	25.6	0.207	0.115	584 / 307	783 / 417	931 / 500	13.30
Baseline Data				433 / 223		34.2	0.03		720 / 382	817 / 436	900 / 482	1.00





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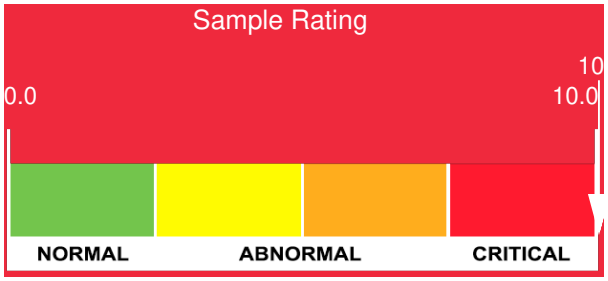
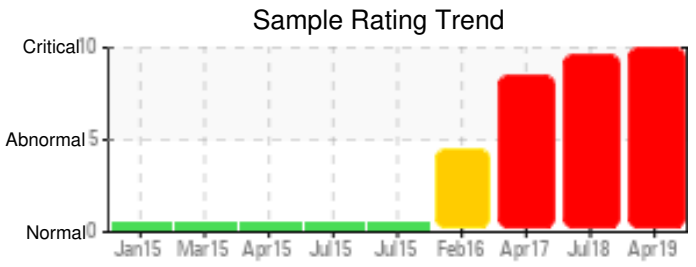
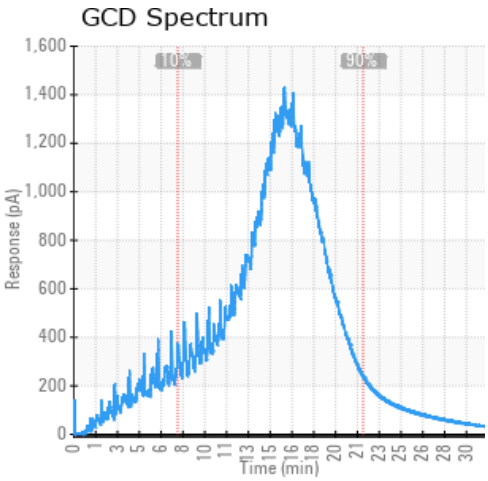
PETRO-CANADA LUBRICANTS

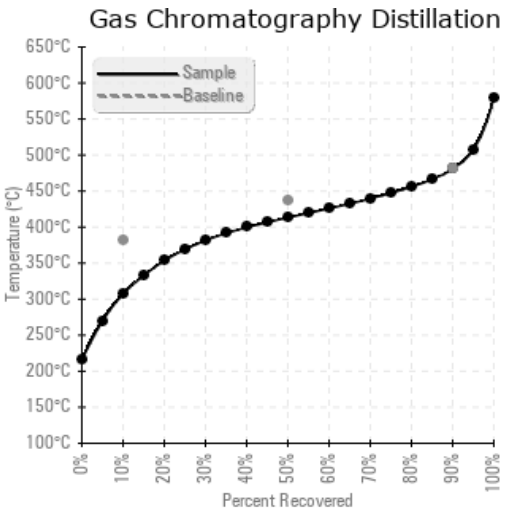


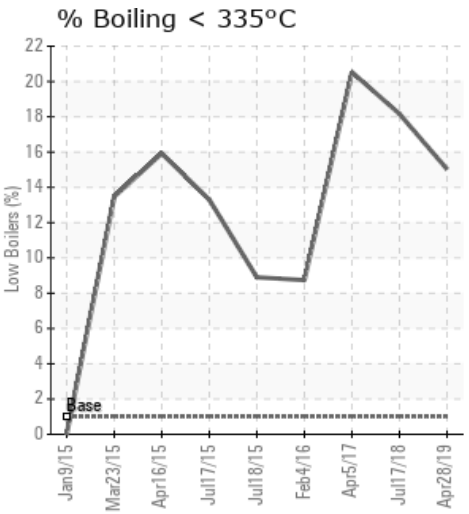


Sample Date	Iron	Chromium	Nickel	Aluminum	Copper	Lead	Tin	Cadmium	Silver	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Antimony	Manganese	Lithium	Boron	Magnesium	Calcium	Barium	Phosphorus	Zinc
04/28/19	2	0	0	0	0	0	0	0	0	0	0	52	0	0	0	0	0	0	0	0	0	0	0	0
07/17/18	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04/05/17	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02/04/16	76	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	2	0	0	0	0	0
07/18/15	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
07/17/15	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Baseline Data			0	0						0			0	0					0				0	

Elemental anaysis results (above) in parts per million (ppm). [10,000 ppm = 1.0%]







Historical Comments

07/17/18	Sample results indicate that the heat transfer fluid is not suitable for continued service.Fluid requires replacement and the system requires cleaning due to severe thermal degradation as evidenced by low viscosity, 18.16% boil off, flash point and 1.2 % insoluble (solids). Severe thermal degradation can be caused by too high of heat flux and lack of turbulent flow around the burner tubes.Once system is cleaned and filled with fresh fluid, please obtain an initial fluid sample before start-up followed by a second sample after approx. 24 hours of service to establish a baseline. It is of utmost importance to ensure all water is thoroughly cleaned from system before initial fill.A slow, gradual start-up procedure will be very beneficial to fluid life.Please contact Petro-Canada Lubricants Technical Services for further assistance (GCD) % < 335°C is severely high. (GCD) 10% Distillation Point is severely low. COC Flash Point is severely low. Visc @ 40°C is abnormally low.
04/05/17	Please note comments below: a high GCD %<335C, a low 10% GCD and low flash point are indications of severe thermal degradation. Please note that the flash point of 132C can be a safety concern. Aside from thermal degradation, the reduced viscosity of 17.4 cSt can also indicate contamination with a different process fluid. Check for possible process leaks (exchangers, etc). Please also ensure that blanket gas pressure is between 2-3 psi as excess pressure can dilute the HTF. Please perform a thorough venting regiment of the expansion tank to release the low boiling vapors. Re-sample within the next 2-3 months after thorough venting has been completed. Please contact your technical services advisor with any questions.Please include oil service life and type of blanket gas on the sample registration card for all future samples. (GCD) % < 335°C is severely high. (GCD) 10% Distillation Point is severely low. COC Flash Point is severely low. Visc @ 40°C is severely low.
02/04/16	Pentane insolubles are marginally high as is the GCC @10% indicating possible some contamination. continue to operate and resample in 9 - 12 months. Pentane Insolubles levels are abnormally high. (GCD) 10% Distillation Point is abnormally low. (GCD) % < 335°C is marginally high. COC Flash Point is marginally low.
07/18/15	As the comments below state the GCD at 10% and 90% are marginally high but this oil has greatly improved. Resample in 6 months. (GCD) 10% Distillation Point is abnormally low. (GCD) % < 335°C is marginally high. (GCD) 90% Distillation Point is marginally high. COC Flash Point is marginally low.
07/17/15	As comments below state, the GCD at 10% is low nut has greatly improved since last tested. Continue to operate and resample in 6 months. (GCD) 10% Distillation Point is severely low. (GCD) % < 335°C is abnormally high. (GCD) 90% Distillation Point is abnormally high. COC Flash Point is marginally low.

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