

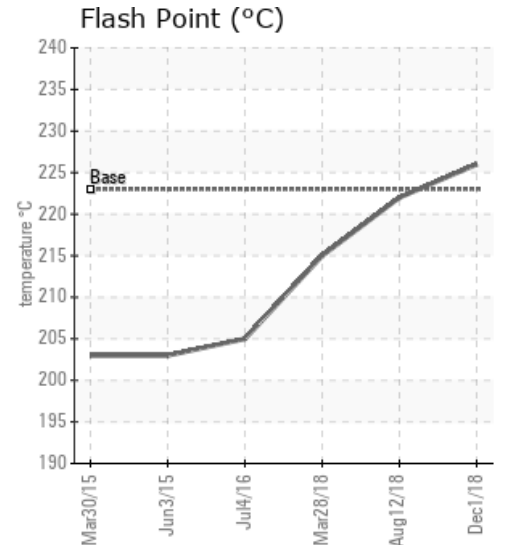
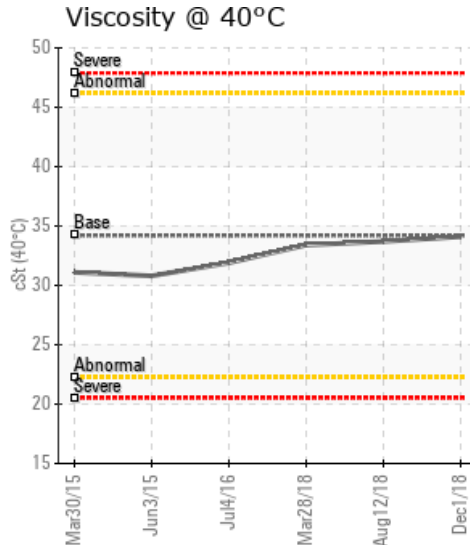
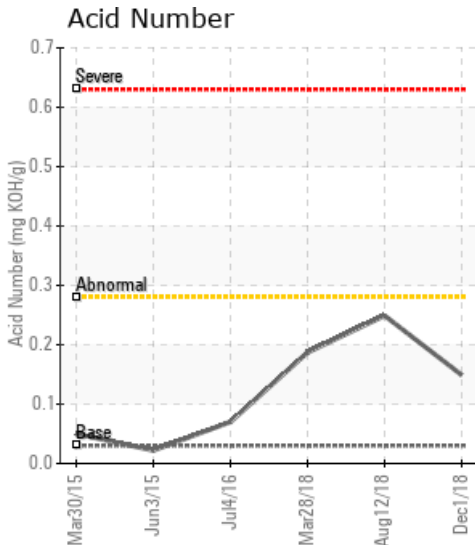
## TRAIN #2 HEAT MEDIUM

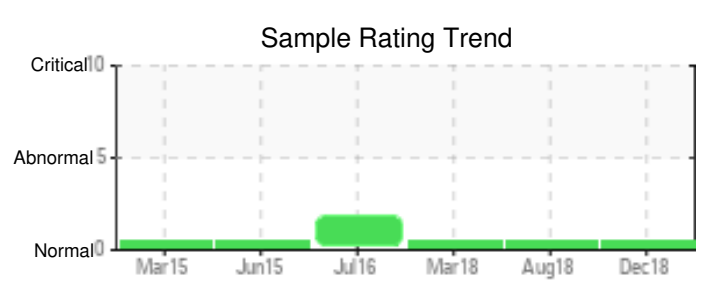
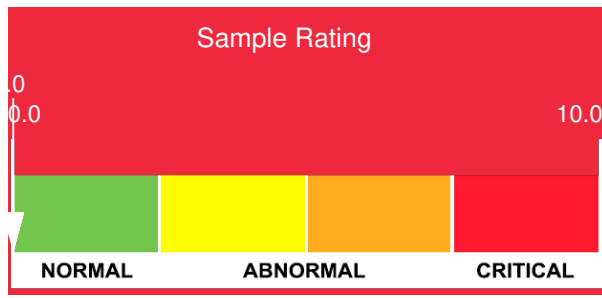
Customer: PTRHTF20156	System Information	Sample Information
TOURMALINE OIL 13-25-80-16W6 9920 98a Ave FORT ST. JOHN, BC V1J 1S2 Canada Attn: Brandon Braun Tel: (250)262-5420 E-Mail:	System Volume: 55000 ltr Bulk Operating Temp: 464F / 240C Heating Source: Blanket: Fluid: PETRO CANADA PETRO-THERM Make: PROPAK	Lab No: 02258129 Analyst: Peter Hartevelde Sample Date: 12/01/18 Received Date: 12/18/18 Completed: 12/21/18

Recommendation: The fluid is in good condition and suitable for further use. Please re-sample in 6 months. List fluid service life on analysis request form.

Comments:

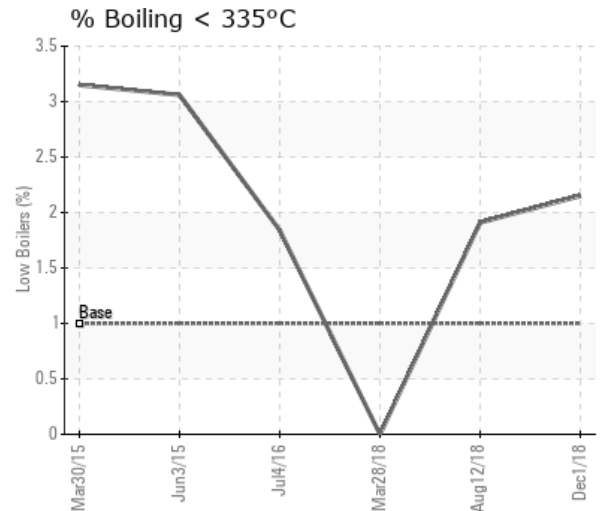
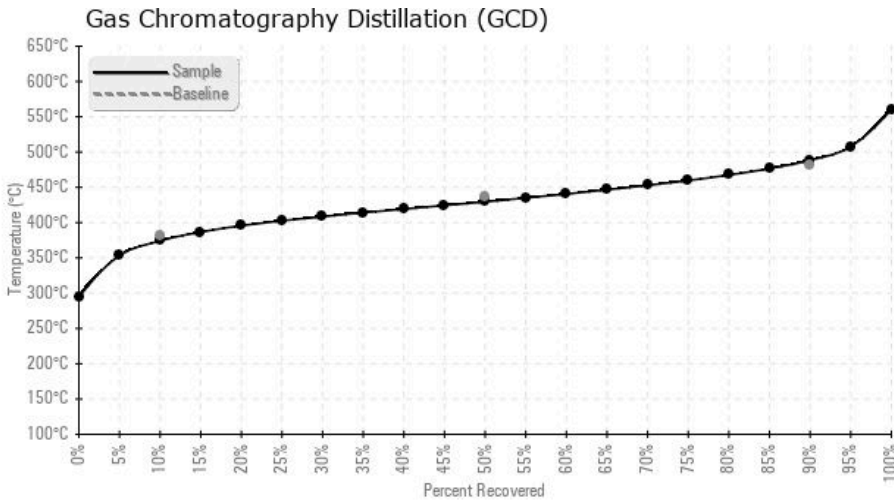
Sample Date	Received Date	Fluid Age	Sample Location	Flash Point (COC)	Water (KF)	Viscosity (40°C)	Acid Number	Solids	GCD 10%	GCD 50%	GCD 90%	GCD % < 335°C
	mm/dd/yy			°F/°C	ppm	cSt	mg/KOH/g	%wt	°F/°C	°F/°C	°F/°C	%
12/01/18	12/18/18	0m		439 / 226	17.4	34.1	0.149	0.311	705 / 374	805 / 430	911 / 488	2.15
08/12/18	08/31/18	48m	PUMP SUCTION	432 / 222	12.1	33.7	0.249	0.255	708 / 375	806 / 430	910 / 488	1.91
03/28/18	04/06/18	48m		419 / 215	7.8	33.4	0.187	0.046	707 / 375	795 / 424	907 / 486	0.00
07/04/16	07/15/16	24m	PUMP SUCTION	401 / 205	0.00	31.9	0.07	0.103	699 / 371	799 / 426	904 / 485	1.84
06/03/15	06/09/15	0m		397 / 203	17.8	30.8	0.022	0.038	700 / 371	812 / 434	921 / 494	3.06
03/30/15	04/17/15	0m	PUMP SUCTION	397 / 203	15.6	31.1	0.050	0.025	698 / 370	810 / 432	918 / 492	3.15
Baseline Data				433 / 223		34.2	0.03		720 / 382	817 / 436	900 / 482	1.00





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
12/01/18	12	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	8	0
08/12/18	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	8	0
03/28/18	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0
07/04/16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0
06/03/15	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0
03/30/15	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13	0
<b>Baseline Data</b>			0	0						0			0	0					0				0	

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



Historical Comments	
08/12/18	Sample results indicate the fluid is suitable for continued service. Please note that acidity of the fluid (TAN) continues to increase; from 0.187 in March 2018 to 0.249. An increase in TAN is generally related to oxidation of the fluid. Ensuring that blanket gas is operational is critical to reducing oxidation. At the same time, there is some evidence of thermal degradation: 1.91% boil-off can be an indication of this. Please also note the increase in solids; from 0.046% to 0.255%. This can also be related to fluid degradation, contamination or corrosion. It is recommended practice to regularly vent off expansion tank of low boiling vapors if safe to do so. During venting, blanket gas needs to be disabled to allow vapors to escape. Enable blanket gas in between venting periods. re-sample fluid in 12 months
03/28/18	Sample results indicate that the thermal fluid is suitable for continued service. Acid Number has increased since the last sample, which can be an indication of oxidation. Ensure blanket gas is properly being applied to the expansion tank. Re-sample in 12 months
07/04/16	The fluid is in good condition but shows indications of thermal degradation in an early stage. This is not a problem at this moment. It is recommended to vent off low boiler vapors to atmosphere on a regular basis. Please re-sample in 6 months.
06/03/15	Sample indicates that fluid is suitable for continued use. Resample in 6 months. (GCD) 90% Distillation Point is marginally high.
03/30/15	Note the flash point is below the system operating temperature. Ensure that this is a closed system and that there is a N2 blanket in the headspace. Also note the dark colour of the product and the reduced initial boiling point of the GCD distillation indicating that the oil may be beginning to thermally crack. Resample at the next interval and continue to monitor. (GCD) 90% Distillation Point is marginally high.

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