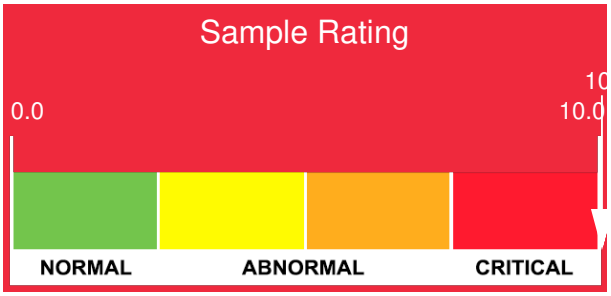
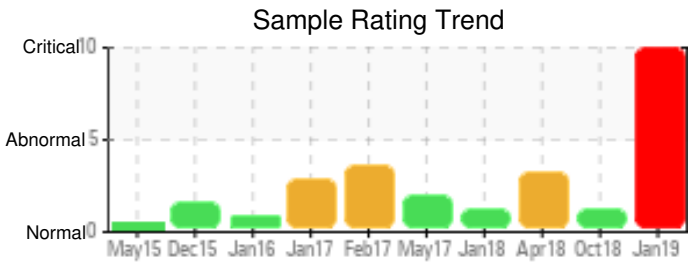




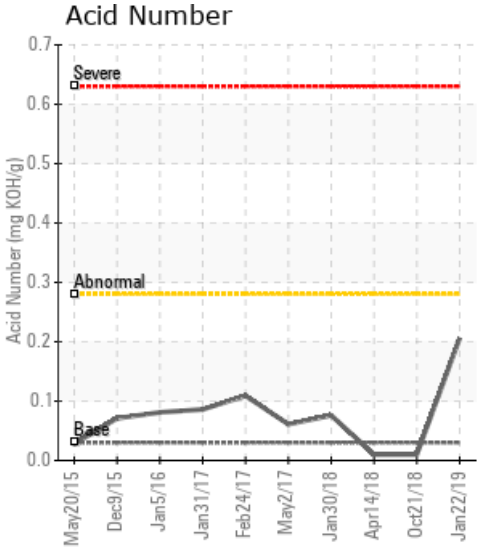
NUVISTA ENERGY BILBO 03-36-65-06W6 CL1804-0348-01

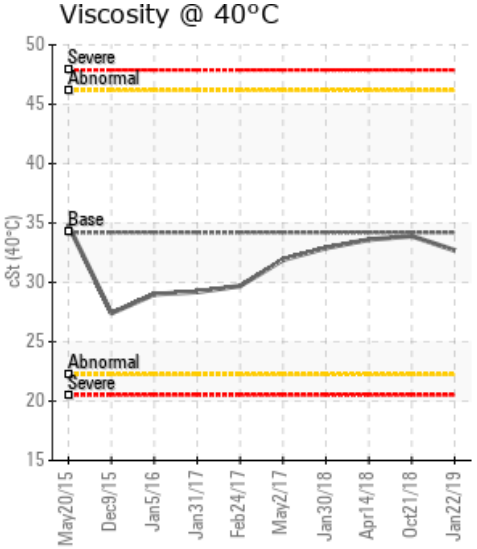
Customer: PTRHTF20039	System Information	Sample Information
BRENNTAG CANADA INC 3124-54TH AVENUE SE CALGARY, AB T2A 0A8 CANADA Attn: Toader Georgiana Tel: E-Mail: gtoader@brenntag.ca	System Volume: 40000 ltr Bulk Operating Temp: 446F / 230C Heating Source: Blanket: Fluid: PETRO CANADA PETRO-THERM Make: ALCOE	Lab No: 02265952 Analyst: Clinton Buhler Sample Date: 01/22/19 Received Date: 02/04/19 Completed: 02/20/19

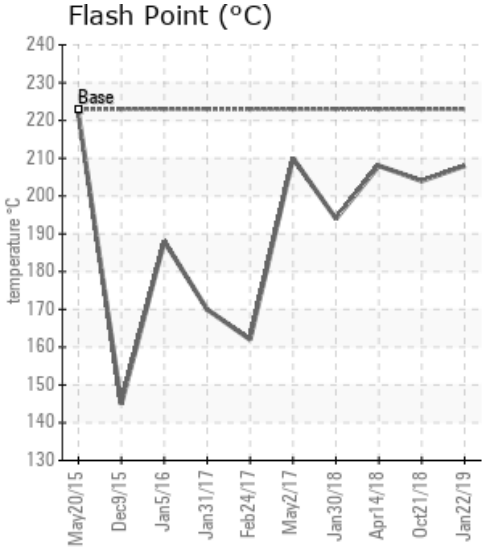
Recommendation: Sample results are of concern. Iron has increased to 198ppm from 10. This, along with significant increase in Acid Number may indicate ongoing corrosion.Sodium, Potassium and Calcium have all increased along with an alarming increase in water- water at 5,425 ppm. This is a risk for fluid boil-over.Water needs to be removed from system. Venting, if safe to do so will help remove excess water. This water content may have also influenced the increase in % boil-off, now at 5.33. The excess water contamination likely has contributed to the increased AN and Iron levels.Please safely remove water from system and re-sample once venting is completed. Please ensure that sample port is near pump discharge and that a very thorough purge of the valve and related piping occurs before collecting the sample in the sample container.Please include time on oil with next sample

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	%
01/22/19	02/04/19	0y	BOTTOM OF VESSEL	406 / 208	5425.7	32.7	0.206	0.465	676 / 358	786 / 419	899 / 481	5.33
10/21/18	11/05/18	5y		399 / 204	137.8	33.9	0.01	0.289	713 / 379	809 / 432	914 / 490	1.42
04/14/18	04/24/18	0y		406 / 208	19.5	33.6	0.01	0.283	713 / 379	821 / 438	951 / 511	2.85
01/30/18	02/28/18	36y		381 / 194	6.9	32.9	0.076	0.173	700 / 371	805 / 429	915 / 490	3.80
05/02/17	05/26/17	0y		410 / 210	113.8	31.9	0.061	0.198	703 / 373	813 / 434	924 / 496	3.56
02/24/17	03/10/17	0y		324 / 162	208.1	29.7	0.109	0.127	700 / 371	809 / 432	937 / 503	4.06
Baseline Data				433 / 223		34.2	0.03		720 / 382	817 / 436	900 / 482	1.00







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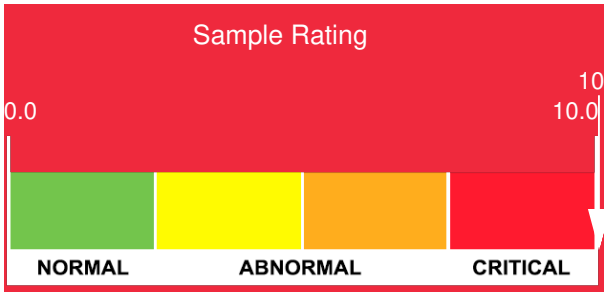
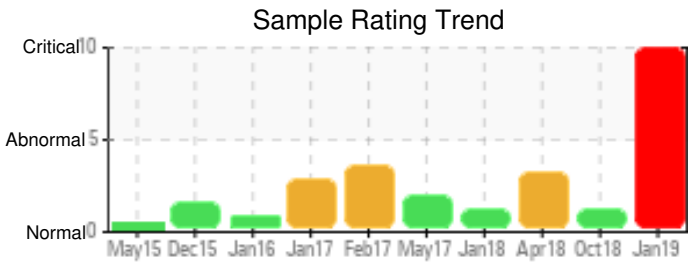
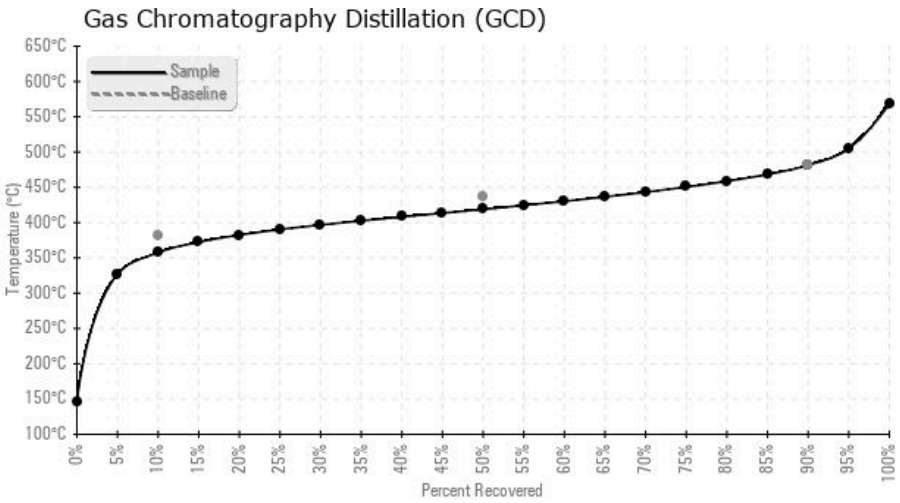
PETRO-CANADA LUBRICANTS

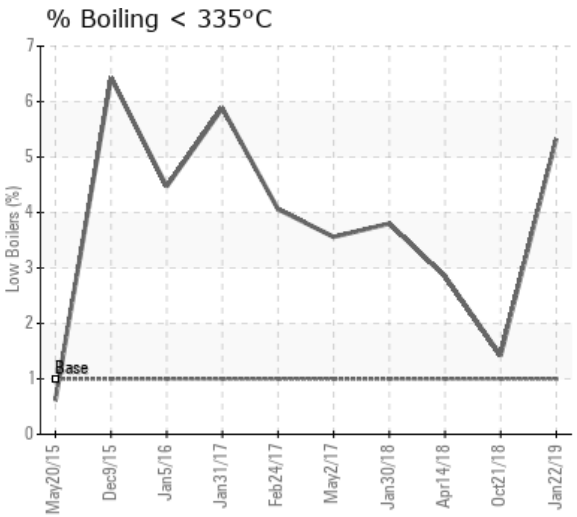




Sample Date	Iron	Chromium	Nickel	Aluminum	Copper	Lead	Tin	Cadmium	Silver	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Antimony	Manganese	Lithium	Boron	Magnesium	Calcium	Barium	Phosphorus	Zinc
01/22/19	198	0	0	0	0	0	0	0	0	0	3	68	144	0	0	0	3	0	0	5	34	0	1	1
10/21/18	10	0	0	0	0	0	1	0	0	0	0	9	28	0	0	0	0	0	0	1	4	0	0	0
04/14/18	14	0	0	0	0	0	0	0	0	0	1	12	30	0	0	0	0	0	0	0	4	0	0	0
01/30/18	14	0	0	0	0	0	3	0	0	0	1	10	29	0	0	0	0	0	0	0	3	0	0	0
05/02/17	31	0	0	0	0	0	0	0	0	0	0	3	26	0	0	0	0	0	0	0	2	0	0	0
02/24/17	7	0	0	0	0	0	0	0	0	0	0	2	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

10/21/18	Sample results indicate that the fluid is suitable for continued service.Please note Potassium which is a contaminant in this case, however it remains fairly steady over multiple samples so ongoing contamination doesn't seem to be occurring. Please re-sample in 12 months Potassium ppm levels are abnormally high.
04/14/18	Sample results indicate that the thermal fluid is suitable for continued service.increased 90% distillation point can be an indication of fluid oxidation. Ensure blanket gas is operational.(GCD) % < 335°C value of 2.85% indicates thermal degradation of the fluid. Pentane Insolubles has increased supporting the that thermal degradation has been ongoing. Please perform regular venting of thermal expansion tank to release low boiling vapors. Note that Potassium and Sodium are contaminants. Investigate source.It is understood that this sample was drawn after a re-boiler failure. Please call Petro-Canada Lubricants Technical Services to discuss next re-sample interval. Potassium ppm levels are abnormally high. (GCD) 90% Distillation Point is severely high.
01/30/18	Sample results indicate fluid is suitable for continued service. GCD % < 335C value of 3.8 indicates low boiling vapors in the fluid. This can be an indication of thermal degradation or possible cross contamination with another fluid. Continue venting of system to release low boiling vapors after which time, ensure that blanket as is in operation. Sodium and Potassium indicates possible contamination with glycol or similar product. Investigate and resolve source of ingression.Re-sample in 12 months Potassium ppm levels are abnormally high.
05/02/17	Please include system volume, bulk temperature and fluid service time with sample registration.90% distillation point level can indicate oxidation of the fluid. Please ensure blanket gas is operational in expansion tank.GCD %<335°C and 10% distillation point can indicate thermal degradation (cracking), which means low boiling vapors are present. Continue periodic yet thorough venting of expansion tank to release the low boilers.26 ppm of Potassium may indicate contamination with outside sources. Please investigate possible sources of contamination (water/glycol, etc.).Re-sample fluid in 6 months. Potassium ppm levels are abnormally high. (GCD) 90% Distillation Point is marginally high.
02/24/17	Please list system volume, bulk oil temperature and fluid service life on the sample label. The blank areas are there for a reason !Low Flash Point, decreased viscosity and elevated low boiler vapor content (% boil-off below 335C.) are indications of thermal degradation. At the same time oxidation is taking place. (90% GCD temp is high). Please vent off low boiler vapors to atmosphere but make sure that the fluid is not exposed to outside air (oxygen) for too long when the fluid temp is high. After venting please ensure that blanket gas is applied. (GCD) 90% Distillation Point is severely high. COC Flash Point is severely low.

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