

[7-27-51-19W5 / Ansel Gas Plant] HEAT MEDIUM

Customer: PTRHTF20103
 CANADIAN NATURAL RESOURCES (CNRL)
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 EDSON, AB T7E 1L5 CA
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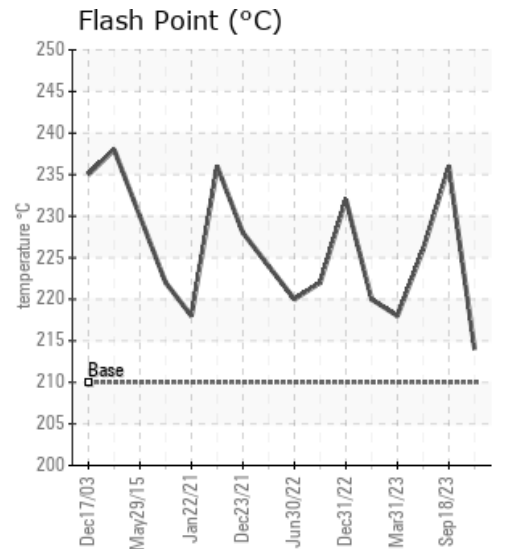
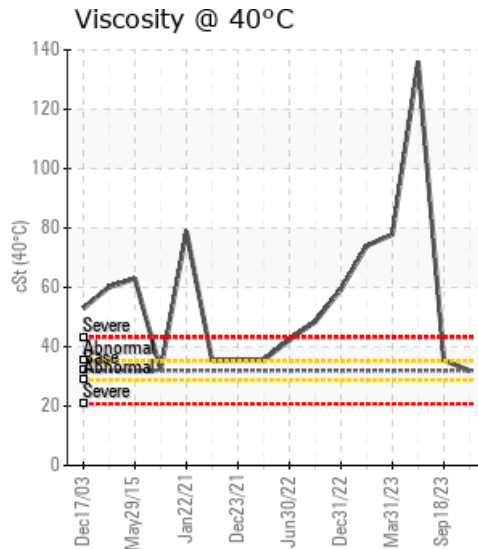
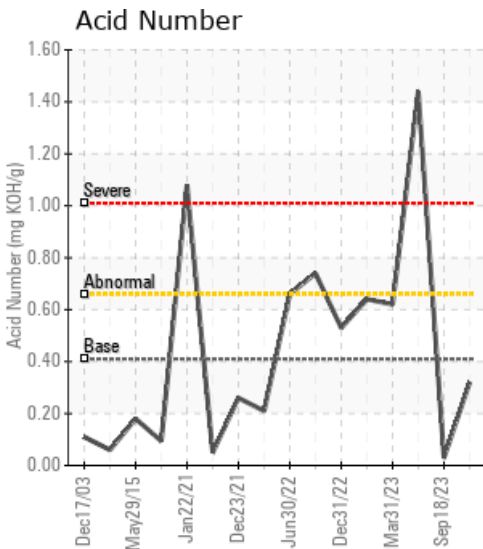
System Information
 System Volume: 14200 ltr
 Bulk Operating Temp: 446F / 230C
 Heating Source:
 Blanket:
 Fluid: HEAT TRANSFER FLUID ISO 32
 Make: PRESSON

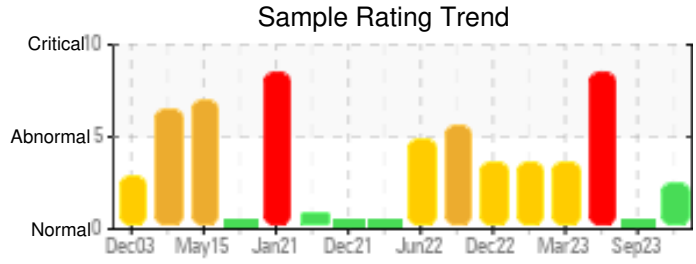
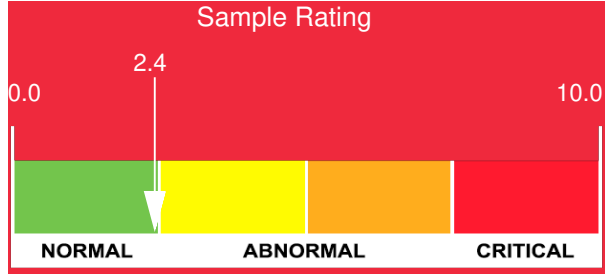
Sample Information
 Lab No: 02603353
 Analyst: Clinton Buhler
 Sample Date: 12/13/23
 Received Date: 12/14/23
 Completed: 01/02/24
 Clinton Buhler
 Clinton.Buhler@HFSinclair.com

Recommendation: Sample results indicate the fluid is in suitable condition for continued service. Fluid viscosity has reduced slightly to 31.9 from 35.5. This may be due to cross contamination with lighter process fluid(?). Acid Number is up to 0.32 compared to 0.03 from the last sample. Please ensure blanket gas (sweet- no h2s, no CO2- and dry) is at least 1 psi (2-3psi ideal) and ensure that fluid level is at least 70% in the expansion tank site glass when at operating temperature. Please re-sample in 3 months; please make sure to thoroughly purge sample valve before taking the sample.

Comments:

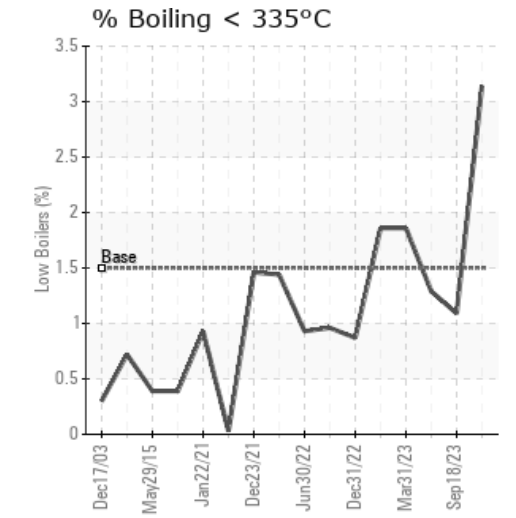
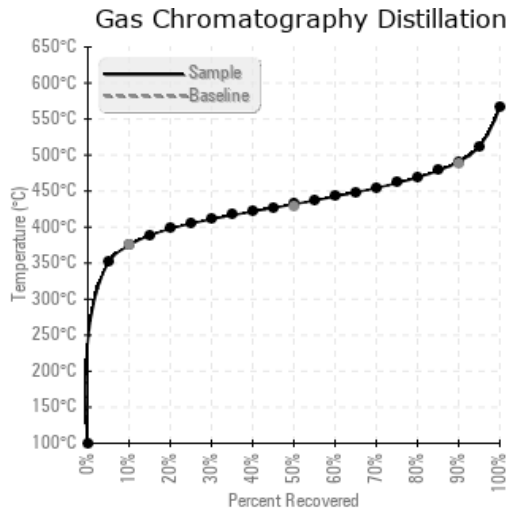
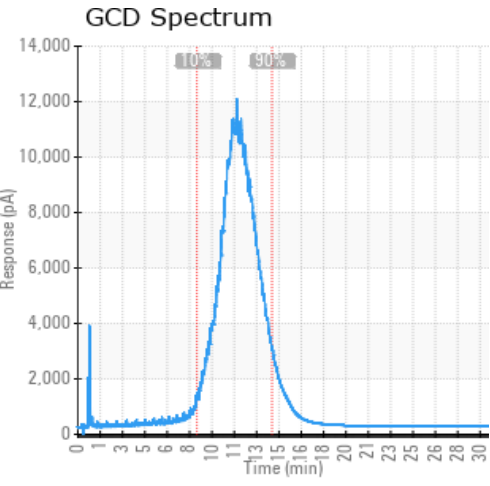
Sample Date	Received Date	Fluid Age	Sample Location	Flash Point (COC)	Water (KF)	Viscosity (40°C)	Acid Number	Solids	GCD 10%	GCD 50%	GCD 90%	GCD % < 335°C
	mm/dd/yy			°F/°C	ppm	cSt	mg/KOH/g	%wt	°F/°C	°F/°C	°F/°C	%
12/13/23	12/14/23	0.0m		417 / 214	27	31.9	0.32	0.169	706 / 375	809 / 432	915 / 491	3.14
09/18/23	09/21/23	0.0m		457 / 236	41.7	35.5	0.03	0.064	707 / 375	794 / 424	911 / 488	1.09
06/09/23	06/23/23	0.0m		439 / 226	92.0	136	1.44	3.35	735 / 391	818 / 437	903 / 484	1.29
03/31/23	04/04/23	24.0m	H800	424 / 218	34.5	77.8	0.62	2.34	730 / 388	816 / 436	903 / 484	1.86
03/31/23	04/04/23	24.0m	H800	428 / 220	36.6	74.0	0.64	2.55	730 / 388	817 / 436	904 / 484	1.86
Baseline Data				410 / 210		32	0.41		707 / 375	802 / 428	910 / 488	1.5





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	
12/13/23	6	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
09/18/23	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3
06/09/23	252	0	0	0	0	0	1	0	0	0	0	3	0	0	0	0	2	0	0	0	0	0	0	0	1
03/31/23	160	0	0	0	0	0	1	0	0	0	0	3	0	0	0	0	2	0	0	0	0	0	0	0	0
03/31/23	157	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0
Baseline Data			0	0						0			0	0					5					250	

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



Historical Comments	
09/18/23	This is the first sample taken after the system was put back online following being cleaned, flushed and re-filled with fresh Petro-Therm. The sample results show that the cleaning was effective: note solids content down to 0.064% from 3.35%. 10 ppm of Fe likely associated with the process of replacing the corroded expansion tank. Please re-sample in 3 months to begin building a trend of fluid condition going forward.
06/09/23	Sample results indicate severe fluid degradation. Fluid Acid Number has more than doubled and fluid viscosity has gone from 77.8 to 136 cSt (fresh Petro-Therm is 34 cSt) in ~2.5 months. Both of these parameters are indicative of fluid oxidation. The increased acid concentration would also be contributing to corrosion: note increase in iron from 160 ppm to 252 ppm. Solids content is nearly 7x the warning limit of 0.5%, currently sitting at 3.35%, up from 2.34%. Assistant foreman Robin Hallock found a hole in the expansion tank outlet on June 22, 2023. It is advised to perform a thorough system clean, flush and refill with fresh Petro-Therm. Please contact Petro-Canada Lubricants technical services for further assistance. PQ levels are abnormal. Iron ppm levels are abnormal. Pentane Insolubles levels are severely high. Acid Number (AN) is severely high. Visc @ 40°C is severely high.
03/31/23	Fluid degradation continues to progress. Fluid viscosity, Acid Number, solids and iron content all have increased since the sample taken on December 31, 2022. The system requires cleaning, flushing and refill with fresh heat transfer fluid. Pentane Insolubles levels are severely high. Visc @ 40°C is severely high. Acid Number (AN) is abnormally high.
03/31/23	Fluid degradation continues to progress. Fluid viscosity, Acid Number, solids and iron content all have increased since the sample taken on December 31, 2022. The system requires cleaning, flushing and refill with fresh heat transfer fluid.

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