

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

**Customer: PTRHTF20103**  
 CANADIAN NATURAL RESOURCES (CNRL)  
 P.O. BOX 6808  
 EDSON, AB T7E 1L5 CA  
 Attn: Rod Bailer  
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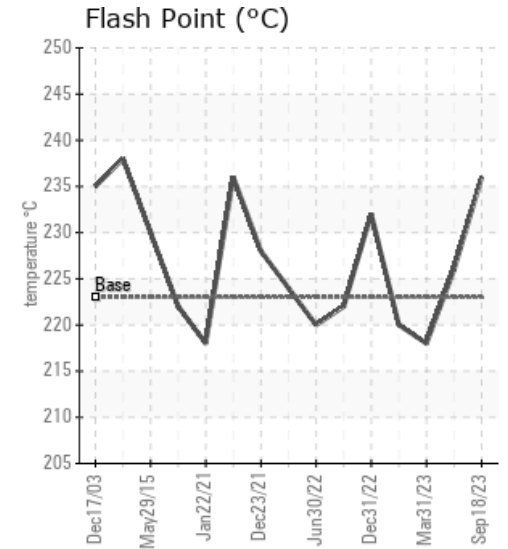
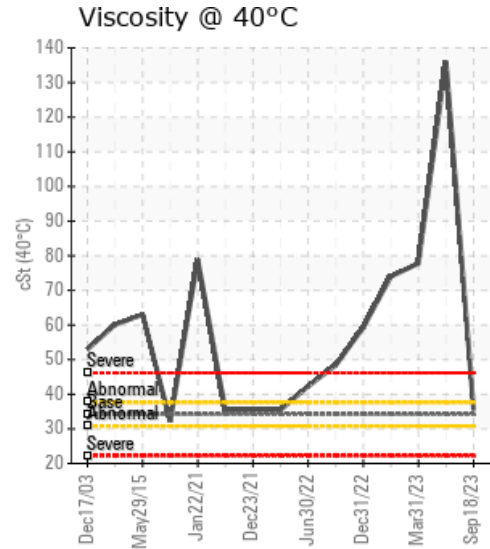
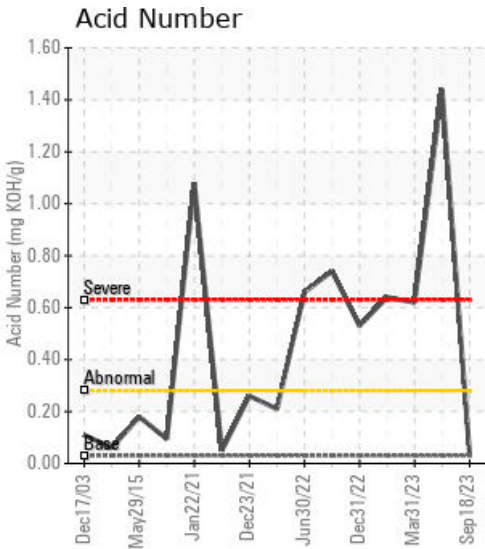
**System Information**  
 System Volume: 14200 ltr  
 Bulk Operating Temp: 446F / 230C  
 Heating Source:  
 Blanket:  
 Fluid: PETRO CANADA PETRO-THERM  
 Make: PRESSON

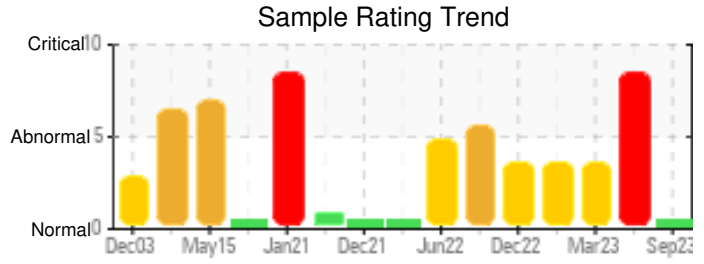
**Sample Information**  
 Lab No: 02584574  
 Analyst: Clinton Buhler  
 Sample Date: 09/18/23  
 Received Date: 09/21/23  
 Completed: 09/26/23  
 Clinton Buhler  
 Clinton.Buhler@HFSinclair.com

Recommendation: 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.

Comments:

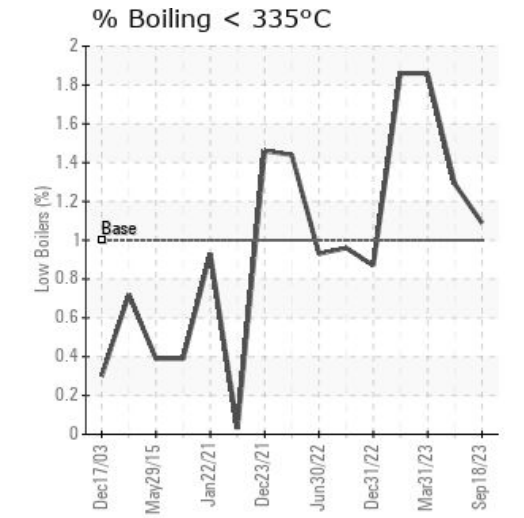
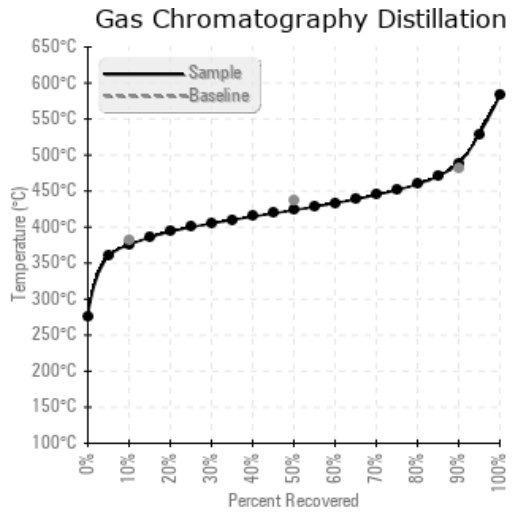
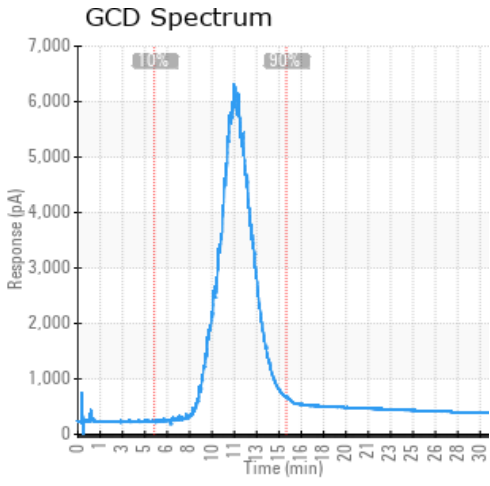
Sample Date	Received Date	Fluid Age	Sample Location	Flash Point (COC)	Water (KF)	Viscosity (40°C)	Acid Number	Solids	GCD 10%	GCD 50%	GCD 90%	GCD % < 335°C
	mm/dd/yy			°F/°C	ppm	cSt	mg/KOH/g	%wt	°F/°C	°F/°C	°F/°C	%
09/18/23	09/21/23	0.0m		457 / 236	41.7	35.5	0.03	0.064	707 / 375	794 / 424	911 / 488	1.09
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
12/31/22	01/05/23	22.0m	HOT OIL PUMP DISCHAR	450 / 232	31.6	59.3	0.53	1.72	742 / 395	822 / 439	907 / 486	0.87
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	
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
12/31/22	122	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0
Baseline Data			0	0						0		0	0					0					0		

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



Historical Comments	
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.
12/31/22	Sample results indicate that fluid degradation (oxidation) continues to progress as evidenced by elevated AN and ever increasing fluid viscosity. Last sample the fluid had thickened to 48.4 cSt and now it has increased to 59.3 cSt. Iron content has climbed from 45 ppm to 93 ppm to 122 ppm, likely from corrosion. Solids content has nearly doubled from the last sample. It is advised to make plans for replacement of the fluid along with system cleaning to un-foul the system. Petro-Canada Lubricants technical services can assist with cleaning procedures. Please ensure blanket gas is operational in the expansion tank as this will help reduce the rate of oxidation.

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