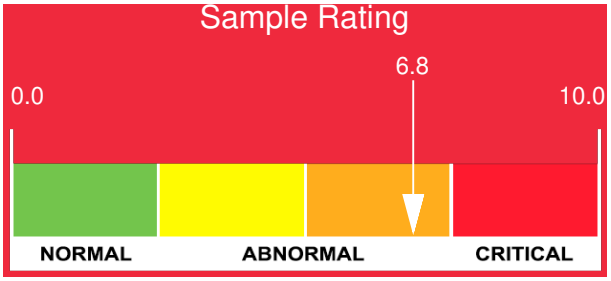
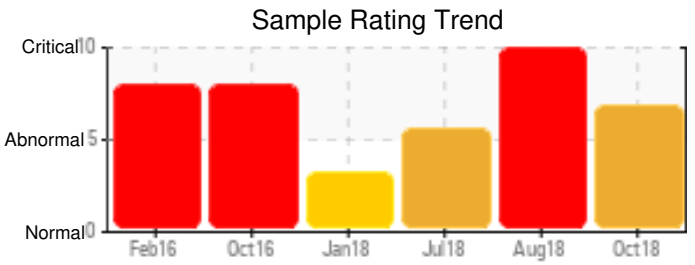




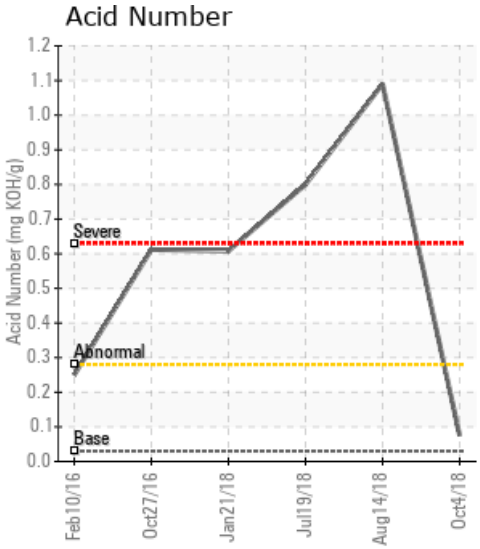
[14-17-55-21W5M / Oldman] H-802

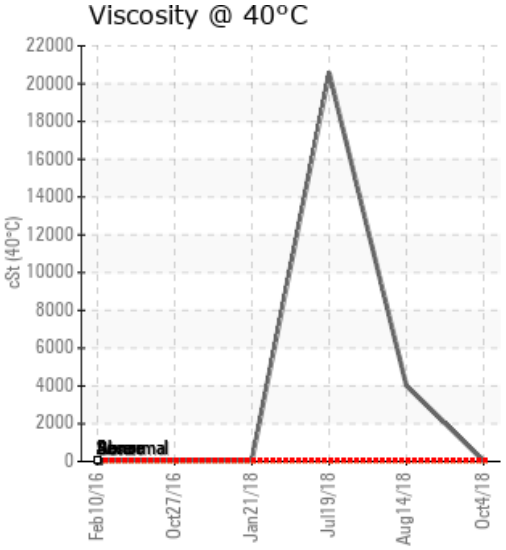
Customer: PTRHTF20124	System Information	Sample Information
PEYTO EXPLORATION BOX 7198 EDSON, AB T7E 1V4 Canada Attn: Cory Pambrub Tel: (780)712-0217 E-Mail: cpambrun@peyto.com	System Volume: 33400 ltr Bulk Operating Temp: 401F / 205C Heating Source: Blanket: Fluid: PETRO CANADA PETRO-THERM Make: ALCO	Lab No: 02253037 Analyst: Peter Harteveld Sample Date: 10/04/18 Received Date: 11/22/18 Completed: 11/28/18

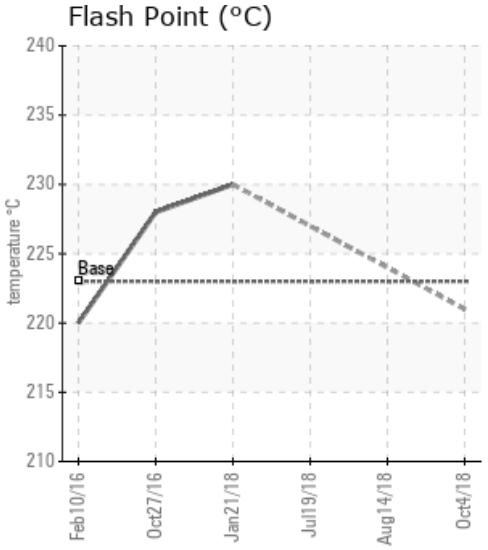
Recommendation: This is the baseline reference sample that was taken on Oct.4, 2018, 2.5 hours after start-up of the pumps at a fluid temperature of 40 degrees C. The sample was taken from the discharge of the heat medium pump. The water content of the fluid is high. This is most likely water remaining from cleaning the heater vessel. Since the fluid has not seen heat, the water has not been boiled off yet. The distillation curve of the fluid is not representative for Petro-Therm but could be influenced by the high water content. To find this fluid condition right after start-up is not uncommon. The next sample will provide more accurate information about the condition of the fluid. With respect to system/fluid cleanliness, the Pentane Insoluble (solids) content is low which indicates the cleaning/flushing has been effective.

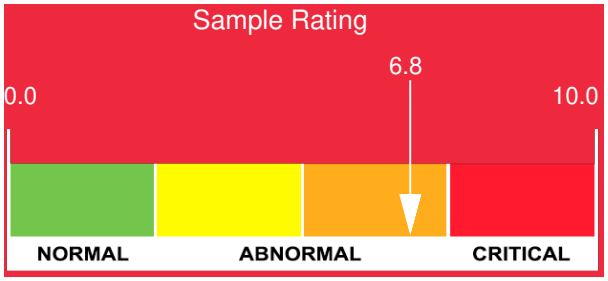
Comments: Water contamination levels are severely high. Water contamination levels are severely high.. ppm Water contamination levels are severely high. (GCD) 90% Distillation Point is severely low. (GCD) 10% Distillation Point is marginally low. (GCD) 50% Distillation Point is marginally low.

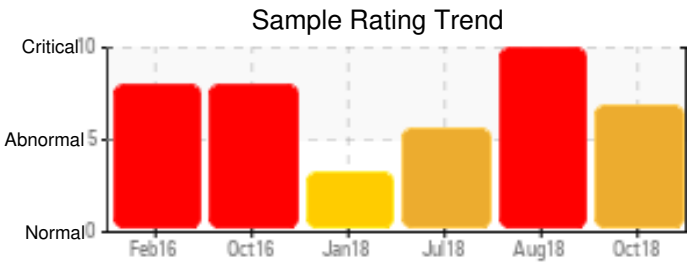
Sample Date	Received Date	Fluid Age	Sample Location	Flash Point (COC)	Water (KF)	Viscosity (40°C)	Acid Number	Solids	GCD 10%	GCD 50%	GCD 90%	GCD % < 335°C
	mm/dd/yy			°F/°C	ppm	cSt	mg/KOH/g	%wt	°F/°C	°F/°C	°F/°C	%
10/04/18	11/22/18	0y	PUMP DISCHARGE	430 / 221	1109.3	34.5	0.075	0.076	654 / 346	747 / 397	848 / 454	5.41
08/14/18	08/21/18	5y	PUMP DISCHARGE		25.8	4018	1.09	4.84	707 / 375	808 / 431	911 / 488	2.68
07/19/18	08/08/18	4y	BOTTOM DRAIN LINE		107.5	20577	0.80	2.21	717 / 381	816 / 435	916 / 491	2.00
01/21/18	01/24/18	0y		446 / 230	6.6	57.5	0.608	1.39	731 / 389	801 / 427	884 / 474	0.00
10/27/16	11/01/16	0y	PUMP DISCHARGE	442 / 228	22.1	58.9	0.612	0.922	742 / 395	841 / 449	929 / 498	0.27
02/10/16	02/18/16	0y	DISCHARGE OF PUMP	428 / 220	9.5	61.4	0.25	1.47	739 / 393	839 / 448	904 / 484	0.70
Baseline Data				433 / 223		34.2	0.03		720 / 382	817 / 436	900 / 482	1.00







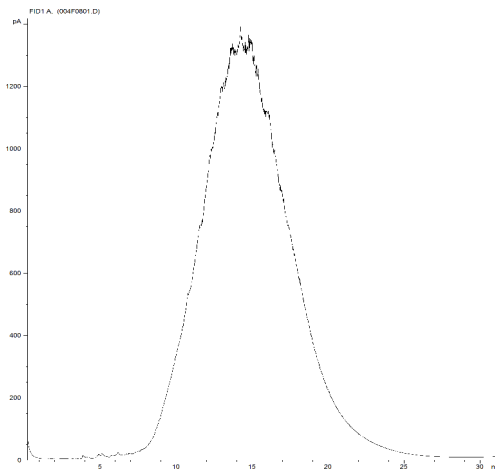




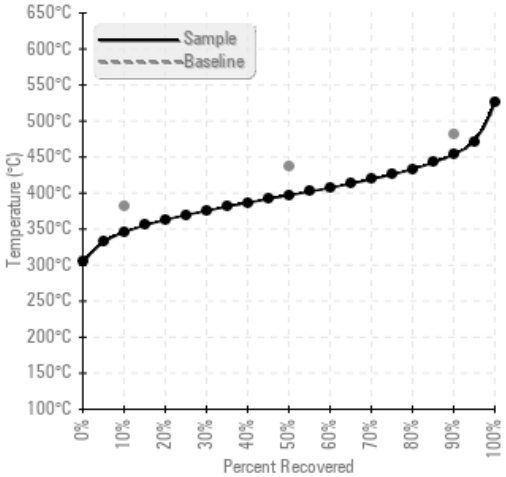
Sample Date	Iron	Chromium	Nickel	Aluminum	Copper	Lead	Tin	Cadmium	Silver	Vanadium	Silicon	Sodium	Potassium	Titanium	Molybdenum	Antimony	Manganese	Lithium	Boron	Magnesium	Calcium	Barium	Phosphorus	Zinc
10/04/18	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	1
08/14/18	903	0	0	2	0	0	0	0	0	0	3	10	0	0	0	0	12	0	0	0	2	0	4	0
07/19/18	129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
01/21/18	66	0	0	0	0	0	0	0	0	0	2	4	0	0	0	0	0	0	0	0	0	0	0	0
10/27/16	56	0	0	0	0	0	0	0	0	0	1	4	0	0	0	0	0	0	0	0	0	0	0	0
02/10/16	47	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%]

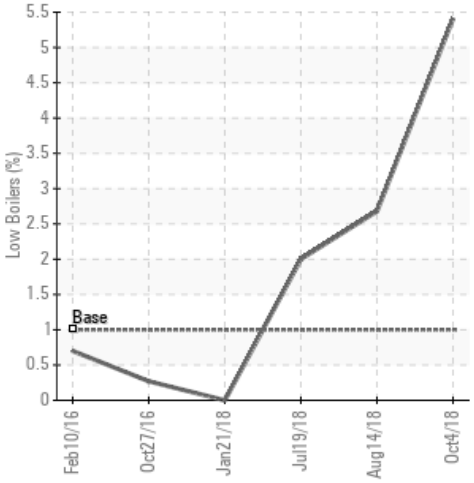
GCD Spectrum



Gas Chromatography Distillation



% Boiling < 335°C



Historical Comments

08/14/18	The fluid is in a poor condition and not suitable for further use. TAN has exceeded the limit of 1. The oil has become acidic and corrosion is taking place. (Fe = 903 ppm.) The viscosity is excessively high due to fluid degradation. The Pentane Insoluble (solids) content is very high with 4.84% (more than 9x the reportable limit). It is recommended to replace the current fill of Petro-Therm. Prior to that the system has to be cleaned and flushed. A plan has been made to start this job on October 1st. Petro-Canada reps will be on site to assist. A request has been made for Petro-Canada to go on site on August 30th for a preparation visit.Iron ppm levels are severe. PQ levels are severe. Pentane Insolubles levels are severely high. Acid Number (AN) is severely high. Visc @ 40°C is severely high.
07/19/18	If this sample was not taken from a low drain point and it can be assumed that it is representative for the condition of the fill, the fluid is severely degraded and no longer suitable for use. The Fe content is high which is the result of corrosion. TAN is high and viscosity very high (this is unlikely and therefore a re-run will be requested). The Pentane Insoluble (solids) content (2.21%) has exceeded the reportable limit 4x. It is recommended to replace the fluid after a system cleaning and flushing. Please consult your Petro-Canada Tech Service Advisor. Pentane Insolubles levels are severely high. Acid Number (AN) is severely high. Visc @ 40°C is severely high.
01/21/18	The fluid shows signs of degradation. TAN is high which has led to an increase in Fe as a result of corrosion. The viscosity is high which results in a decrease of heat transfer efficiency. The Pentane Insoluble (solids) content is high. Filtration of the fluid is recommended. If there are indications of system problems like plugging of heat exchanger bundles, leaking of mechanical seals on heat medium pumps or not being able to produce sufficient heat for the process it might be time to start planning a system cleaning/flushing. If the latter is the case, please contact your Petro-Canada Technical Service Advisor for support. Please re-sample in 6 months. Pentane Insolubles levels are severely high. Acid Number (AN) is abnormally high. Visc @ 40°C is abnormally high.
10/27/16	Compared to the previous sample the condition of the fluid is similar with exception of TAN which has increased significantly. Judging from the 90% GCD temperature, oxidation is the cause of this. The pentane insoluble (solids) content has decreased but is still appr. twice the warning limit. As advised for the previous sample, filtration is still recommended. In order to prevent the fluid from becoming too acidic which will result in system corrosion, partial (25%) sweetening of the fill is recommended in addition to filtration. Pentane Insolubles levels are severely high. Acid Number (AN) is abnormally high. (GCD) 90% Distillation Point is abnormally high. Visc @ 40°C is abnormally high.
02/10/16	NOTE: Viscosity test run twice, 61.4 cSt and 61.8 cSt.The viscosity of the fluid is high. TAN is elevated. The Pentane Insoluble (solids) content is high. If the system fill is 100% Petro-Therm and no other higher viscosity fluids are present, the condition of the fluid indicates degradation. It is recommended to lower the solids content of the fluid by filtration. Please re-sample after filtration and indicate the service life of the fluid at the next sample. Pentane Insolubles levels are severely high. Visc @ 40°C is abnormally high.