

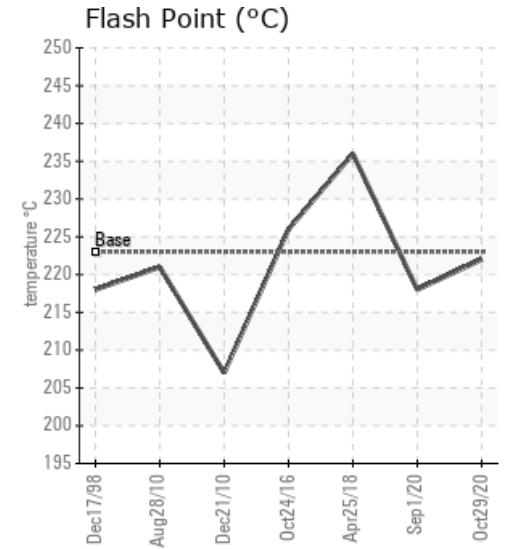
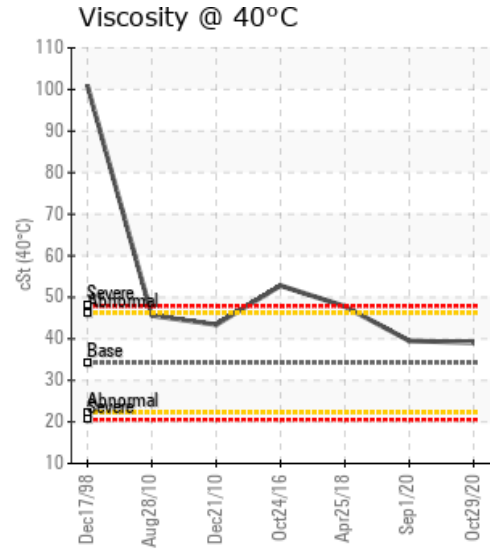
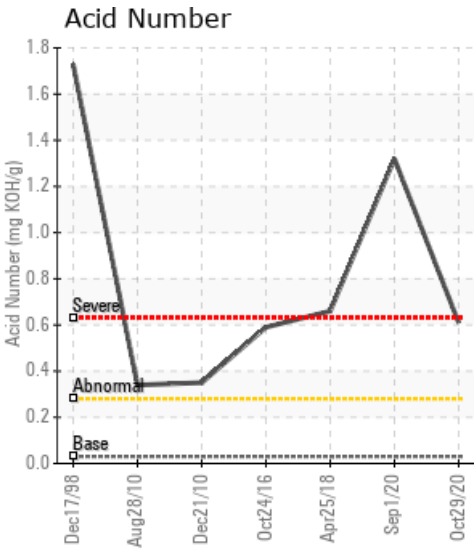
KONUS #1, 2 & 3

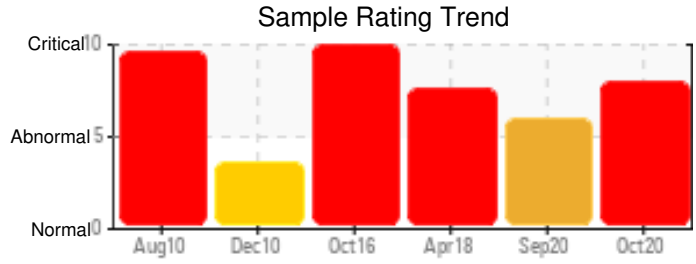
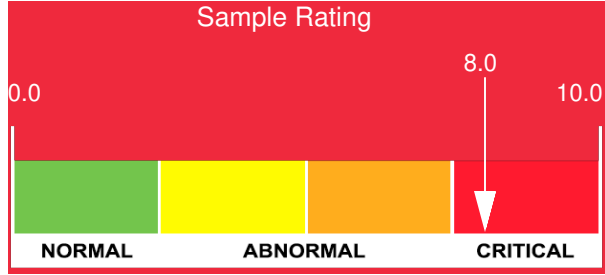
Customer: PTRHTF20179	System Information	Sample Information
Canfor - Polar 36654 Hart Highway General Delivery Bear Lake, BC V0J 3G0 Canada Attn: Kevin Meise Tel: (250)552-5028 E-Mail: kevin.meise@canfor.com	System Volume: 170000 ltr Bulk Operating Temp: 446F / 230C Heating Source: Blanket: Fluid: PETRO CANADA PETRO-THERM Make: KONUS	Lab No: 02385539 Analyst: Ray Rolston Sample Date: 10/29/20 Received Date: 11/05/20 Completed: 11/13/20 Ray Rolston Ray.Rolston@petrocanadalsp.com

Recommendation: Acid Number value on latest sample is 0.61 mg KOH/g which is more in line with previous trend, still above our condemning guideline. Note that Sep 1 2020 AN value reported as 1.32 was re-tested at 0.69 mg KOH/g (see lab comment below). Latest sample AN testing was run in triplicate to enhance accuracy. Pentane Insolubles (solids) value of 1.92 continues to be above the condemning limit (see lab comment below). These factors affirm Petro-Canada's position that the heat transfer system should be cleaned, flushed and refilled with fresh fluid when conditions are favourable. Additional sampling over the coming months is recommended, but sweetening the system should not be required at this point.

Comments: Pentane Insolubles levels are severely high (results 1.89 and 1.94 averaged to 1.92). Acid Number (AN) is severely high. Acid Number result from 09/01/2020 was retested and result was more in-line with trend (0.69 mg KOH/g). (GCD) 90% Distillation Point is marginally high.

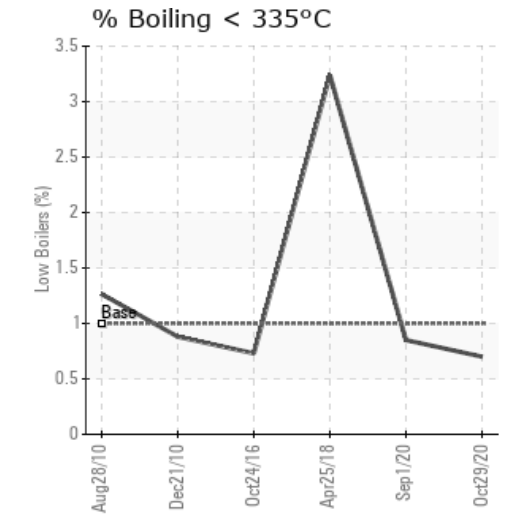
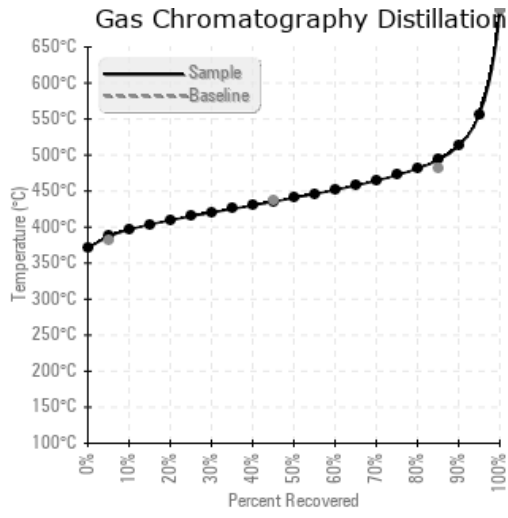
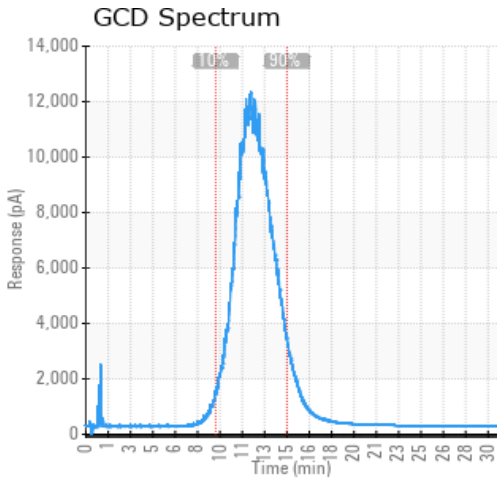
Sample Date	Received Date	Fluid Age	Sample Location	Flash Point (COC)	Water (KF)	Viscosity (40°C)	Acid Number	Solids	GCD 10%	GCD 50%	GCD 90%	GCD % < 335°C
	mm/dd/yy			°F/°C	ppm	cSt	mg/KOH/g	%wt	°F/°C	°F/°C	°F/°C	%
10/29/20	11/05/20	0y	Pump Gauge	432 / 222	341.9	39.1	0.61	1.92	728 / 387	816 / 435	920 / 493	0.70
09/01/20	09/10/20	0y	Pump 1	424 / 218	107.8	39.5	1.32	2.49	727 / 386	815 / 435	919 / 493	0.85
04/25/18	05/02/18	0y		457 / 236	315.9	47.8	0.66	4.88	695 / 368	800 / 427	915 / 490	3.24
10/24/16	11/11/16	8y		439 / 226	979.7	52.8	0.59	5.99	721 / 383	819 / 437	934 / 501	0.73
12/21/10	12/23/10			405 / 207	80	43.4	0.35	1.359	719 / 381	810 / 432	907 / 486	0.88
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
10/29/20	62	0	0	0	0	0	0	0	0	0	1	12	0	0	0	0	2	0	0	0	22	0	2	4
09/01/20	62	0	0	0	0	0	0	0	0	0	0	13	0	0	0	0	2	0	2	0	25	0	2	6
04/25/18	57	0	0	0	0	0	0	0	0	0	1	33	0	0	0	0	1	0	0	0	65	0	6	9
10/24/16	57	0	0	0	0	0	0	0	0	0	0	47	2	0	0	0	1	0	2	0	99	0	9	11
12/21/10	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	7	1
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	
09/01/20	Sep 1, 2020 sample has 62 ppm iron wear; last 2 samples were 57 ppm. This may be a result of pump wear or corrosion. Initial Boiling Point of 288 deg C is low suggesting that some thermal cracking has occurred, though balance of distillation range is okay. Acid Number (AN) has doubled from 0.66 in Apr 2018 to 1.32 mgKOH/g which is beyond our condemning guideline of 0.6. Pentane Insolubles (solids) value of 2.49% also exceeds our condemning guideline of 0.5%.Based on the high AN and solids content, Petro-Canada recommends that the system be drained, flushed, cleaned and recharged with fresh fluid. Pentane Insolubles levels are severely high. Acid Number (AN) is severely high. Calcium ppm levels are abnormally high. (GCD) 90% Distillation Point is marginally high.
04/25/18	Iron wear has remained at 57 ppm, while other wear metals are at low levels. The presence of additive metals sodium and calcium are unexpected, but their concentration has dropped since the last sample in October 2016. The oil's viscosity and Gas Chromatography Distillation (GCD) results have also improved since the last sample.The Total Acid Number (TAN) has increased to 0.66 mg KOH/g, above the condemning limit of 0.60, and Pentane Insolubles value of 4.88 (previously 5.99) suggests that the oil has oxidized and a significant volume of sediment is present.Petro-Canada Lubricants recommends that the Petro-Therm heat transfer fluid be drained, flushed and replaced as soon as practical. Pentane Insolubles levels are severely high. Acid Number (AN) is severely high. Calcium ppm levels are severely high. Sodium ppm levels are abnormally high. Visc @ 40°C is abnormally high.
10/24/16	The sample shows a high level of acids through high Acid Number, a high amount of water as well as high concentrations of sodium and calcium. If this is truly a representative sample of what is flowing through this system this is extremely concerning. However, experience shows it might come from a sampling valve that was improperly flushed. Either way, we recommend to re-sample after making sure a good 4L (1 gal.) of oils drained out before collecting the sample. Pentane Insolubles levels are severely high. ppm Water contamination levels are abnormally high. Water contamination levels are abnormally high. Sodium ppm levels are severely high. Calcium ppm levels are severely high. Visc @ 40°C is severely high. Acid Number (AN) is abnormally high. (GCD) 90% Distillation Point is abnormally high.
12/21/10	The addition of oil improved the properties slightly but the insoluble solid material floating in the oil remains excessively high. The Acid Number also remained high which means there is still a fair amount of oxidation by-products in the system. Viscosity is still much higher than fresh Petro-Therm but still suitable for further use. We recommend to re-sample in 6 months to monitor fluid condition. Next time a major work is planned to be performed on the system pls consult with Terry Veenstra to discuss this so that we can suggest actions that would create the most bang for your buck.

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