

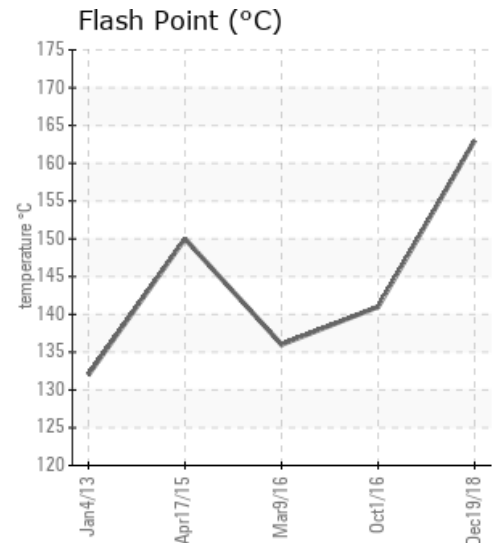
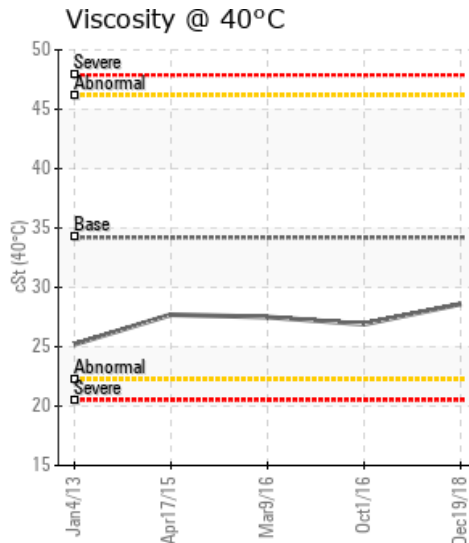
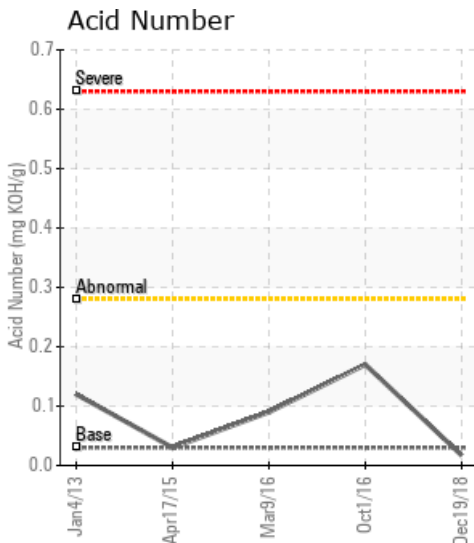
HOT OIL

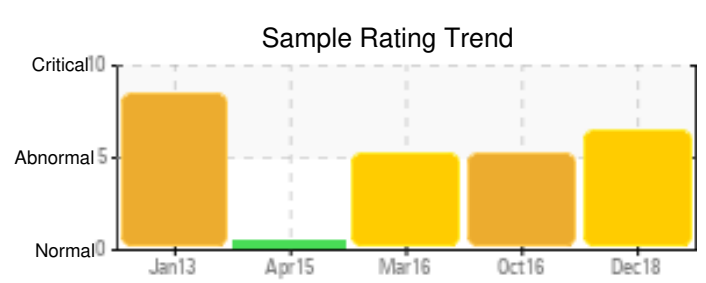
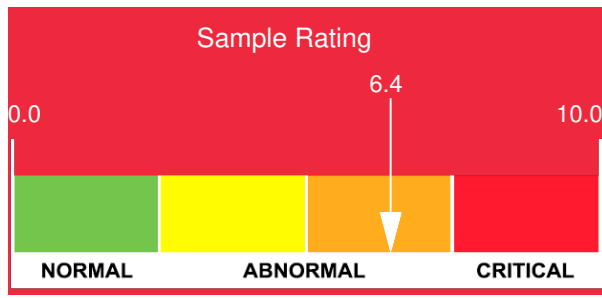
| Customer: PTRHTF10123 | System Information | Sample Information |
|---------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| AKZONOBEL 300 SPROWL RD HURON, OH 44839 USA Attn: Rick Sindelar Tel: (419)433-9153 E-Mail: rick.sindelar@akzonobel.com | System Volume: 1250 gal Bulk Operating Temp: 550F / 288C Heating Source: Blanket: Fluid: PETRO CANADA PETRO-THERM Make: FULTON | Lab No: 02263395 Analyst: Yvette Trzcinski Sample Date: 12/19/18 Received Date: 01/21/19 Completed: 02/01/19 |

Recommendation: It looks like some oil replacement was done since the last sample in 2016 the viscosity has increased about 6% as well as the flash point now at 325 F, though it is still low. There is still thermal cracking happening in the system that is causing thermal degradation of the fluid. I recommend venting the low boilers from the system and then resampling the system to see if venting helped, or if some oil replacement is required

Comments:

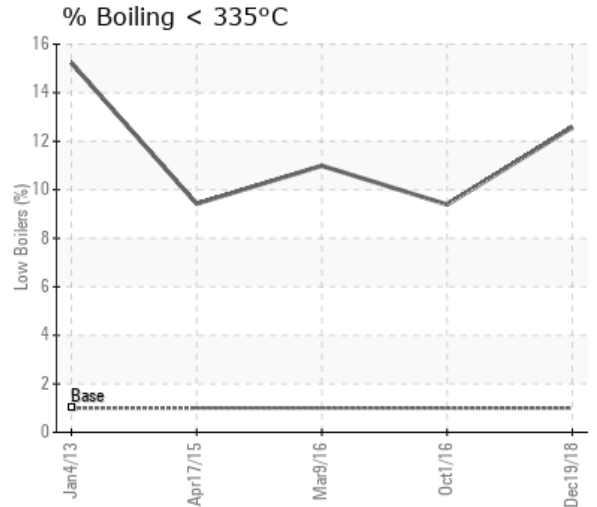
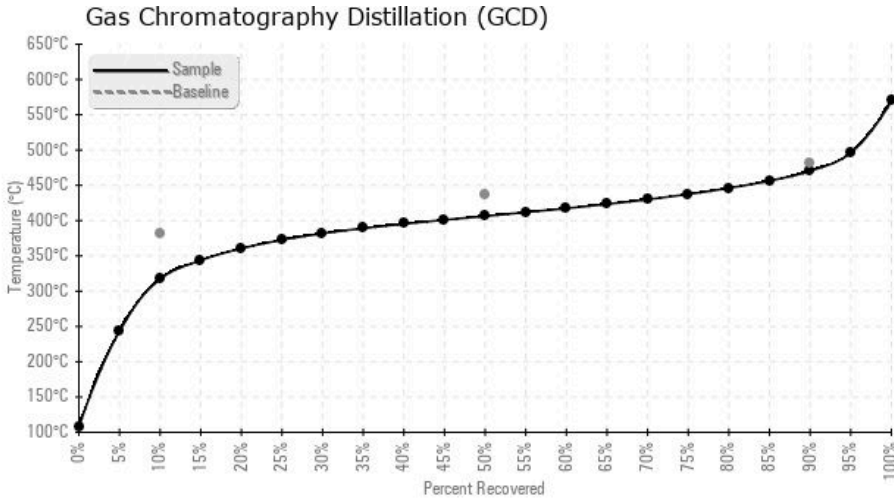
| Sample Date | Received Date | Fluid Age | Sample Location | Flash Point (COC) | Water (KF) | Viscosity (40°C) | Acid Number | Solids | GCD 10% | GCD 50% | GCD 90% | GCD % < 335°C |
|---------------|---------------|-----------|-----------------|-------------------|------------|------------------|-------------|--------|-----------|-----------|-----------|---------------|
| | mm/dd/yy | | | °F/°C | ppm | cSt | mg/KOH/g | %wt | °F/°C | °F/°C | °F/°C | % |
| 12/19/18 | 01/21/19 | 2h | | 325 / 163 | 8.5 | 28.6 | 0.017 | 0.040 | 603 / 317 | 763 / 406 | 879 / 470 | 12.57 |
| 10/01/16 | 10/11/16 | 0h | INLET TO PUMP | 286 / 141 | 22.0 | 26.9 | 0.17 | 0.094 | 635 / 335 | 788 / 420 | 910 / 488 | 9.39 |
| 03/09/16 | 04/05/16 | 0h | | 277 / 136 | 14.5 | 27.5 | 0.090 | 0.048 | 631 / 333 | 785 / 418 | 920 / 493 | 10.99 |
| 04/17/15 | 04/29/15 | 0h | | 302 / 150 | 18.5 | 27.7 | 0.03 | 0.044 | 635 / 335 | 790 / 421 | 931 / 500 | 9.42 |
| 01/04/13 | 01/24/13 | 0h | | 270 / 132 | 13.9 | 25.2 | 0.12 | 0.059 | 607 / 320 | 739 / 393 | 898 / 481 | 15.23 |
| 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 | |
|----------------------|------|----------|--------|----------|--------|------|-----|---------|--------|----------|---------|--------|-----------|----------|------------|----------|-----------|---------|-------|-----------|---------|--------|------------|------|---|
| 12/19/18 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | |
| 10/01/16 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| 03/09/16 | 76 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 04/17/15 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 01/04/13 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 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 | |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 10/01/16 | The situation is not as dire as when the first sample was taken 3 years ago but the flash point remains low at 286F. We suggest to vent the low boiling hydrocarbons (present at 9.4%) out of the system via the expansion tank while keeping the nitrogen blanketing on, then replace the losses by adding fresh oil. Lastly, a day after this operation is performed we suggest to take another sample to measure the effectiveness of the operation. This will tell us if the fluid flash point can be restored this way or if a more aggressive approach like 50% or complete replacement will be needed. COC Flash Point is severely low. (GCD) 10% Distillation Point is abnormally low. (GCD) % < 335°C is marginally high. |
| 03/09/16 | This fluid is experiencing thermal degradation which is causing the flashpoint of the fluid to be come extremely low. Please vent the system of light ends in order to try and increase the flashpoint. Once the system has been vented of the light ends, please re-submit a sample for testing. COC Flash Point is severely low. (GCD) 10% Distillation Point is abnormally low. (GCD) % < 335°C is marginally high. (GCD) 90% Distillation Point is marginally high. |
| 04/17/15 | There has been a very slight improvement of the oil condition, as if some new oil was added to the system. The flash point rose from 270F to 302F, viscosity increased a couple centiStokes (~10%) closer to fresh oil, insoluble solids went down slightly, the amount of low boilers decreased from 15% to 9%. If this fluid is planned to be used for the next few years to come, we suggest to do another partial oil replacement by at least as much as what was just performed and keep monitoring the oil condition every 9 months or so. The condition improved slightly but not enough to give full confidence that the flash point and other properties is strong enough for mid term use. COC Flash Point is severely low. (GCD) 90% Distillation Point is abnormally high. (GCD) 10% Distillation Point is abnormally low. (GCD) % < 335°C is marginally high. |
| 01/04/13 | The Petro-Therm has a much lower viscosity and flash point. either because it was mixed with a lighter oil at some point, or either because it has degraded thermally. The best and fastest way to restore the properties towards safer values is partial oil replacement combined with a venting strategy. Please consult Gaston Arseneault to discuss these results. (GCD) 10% Distillation Point is severely low. COC Flash Point is severely low. (GCD) % < 335°C is abnormally high. (GCD) 50% Distillation Point is marginally low. |

Petro-Canada makes no representation or warranty of any kind, either express or implied, as to the accuracy or completeness of the analysis and assumes no responsibility and shall have no liability whatsoever with respect to such analysis, or a party's use of it. Petro-Canada is a division of HollyFrontier Corporation.