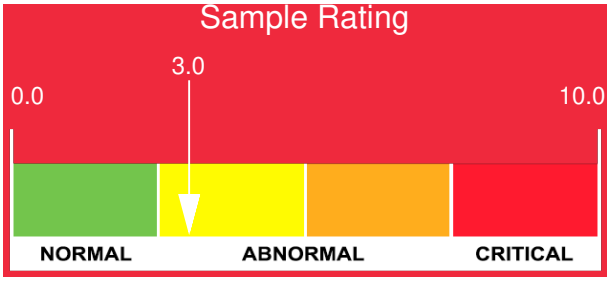
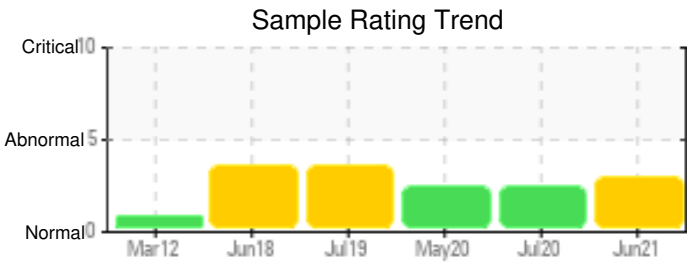


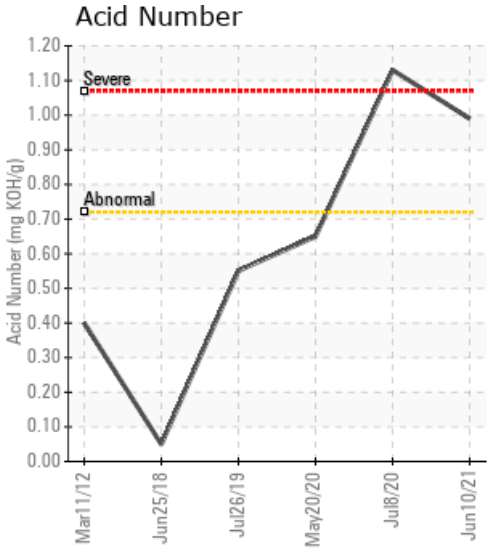

# [LSD: 03-14-12] HEAT TRANSFER SYSTEM

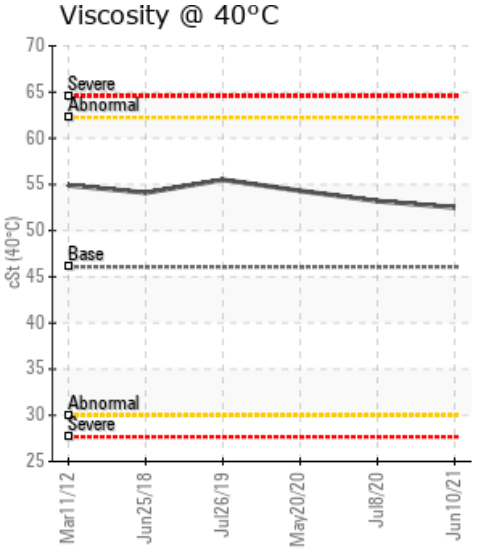
| Customer: PTRHTF20097 | System Information | Sample Information |
|---|---|---|
| FOOTHILLS FOREST PRODUCTS<br>HWY 40 SOUTH MILLSITE<br>GRANDE CACHE, AB T0E 0Y0<br>CANADA<br>Attn: Collins Elms<br>Tel: (780)827-2225<br>E-Mail: celms@dunkleylumber.com | System Volume: 27231 ltr<br>Bulk Operating Temp: 450F / 232C<br>Heating Source:<br>Blanket:<br>Fluid: ESSO THERMOIL 46<br>Make: SALTON/WELLONS | Lab No: 02428404<br>Analyst: Yutong Gao<br>Sample Date: 06/10/21<br>Received Date: 06/21/21<br>Completed: 06/23/21<br>Yutong Gao<br>yutong.gao@hollyfrontier.com |

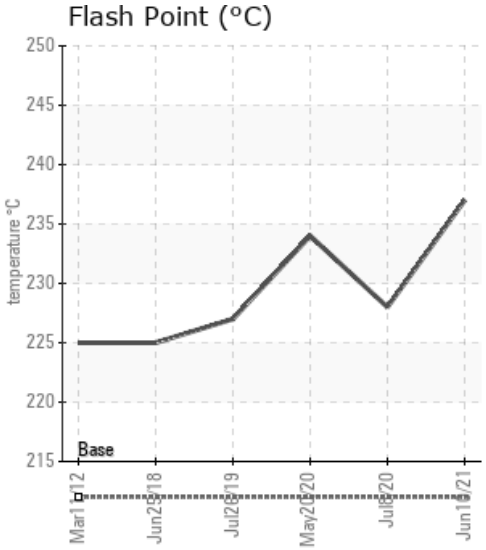
Recommendation: Based on the recent technical interface meeting, we were informed that 12 drums of fresh Petro-Therm had been filled in the system since Aug 2020. The 9% of the system sweetening helped to reduce the Acid Number and the Solid Contents. The fluid viscosity is also trending down to the normal reading. There is minimum water or dirt contamination. The contaminant of iron element remains consistent in the past 9 years. The current fluid age shall be 13 years old instead of the reported 6 years. In conclusion, the current fluid is suitable for further operation. The 12 drums of fresh Petro-Therm annual top-up definitely helps to bring this large system towards to normal, so please keep doing this good practice. Take one sample in 12 months to monitor the conditions.

Comments: Solid levels are abnormally high. Acid Number (AN) is abnormally 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 | % |
| 06/10/21 | 06/21/21 | 6.0y | Heater Inlet | 459 / 237 | 83.7 | 52.5 | 0.99 | 0.413 | 705 / 374 | 820 / 438 | 924 / 495 | 3.44 |
| 07/08/20 | 07/14/20 | 12.0y | | 442 / 228 | 85.4 | 53.2 | 1.13 | 0.603 | 738 / 392 | 845 / 452 | 934 / 501 | 1.54 |
| 05/20/20 | 05/28/20 | 12.0y | HEATER INLET | 453 / 234 | 229.0 | 54.3 | 0.65 | 0.739 | 730 / 388 | 844 / 451 | 933 / 500 | 2.03 |
| 07/26/19 | 08/07/19 | 12.0y | | 441 / 227 | 80.6 | 55.5 | 0.551 | 1.14 | 688 / 365 | 809 / 432 | 910 / 488 | 3.63 |
| 06/25/18 | 07/12/18 | 5.0y | MAIN HEADER INLET | 437 / 225 | 49.5 | 54.1 | 0.05 | 0.937 | 736 / 391 | 818 / 437 | 911 / 488 | 0.00 |
| | | | | | | | | | | | | |
| Baseline Data | | | | 414 / 212 | | 46.07 | | | 709 / 376 | | 961 / 516 | |

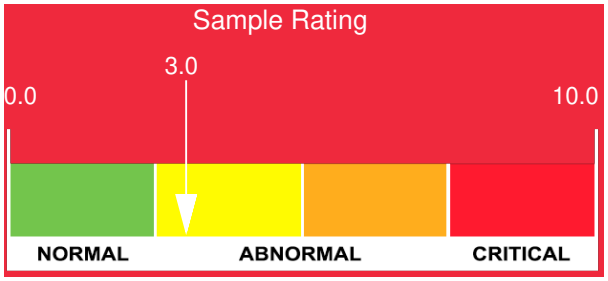


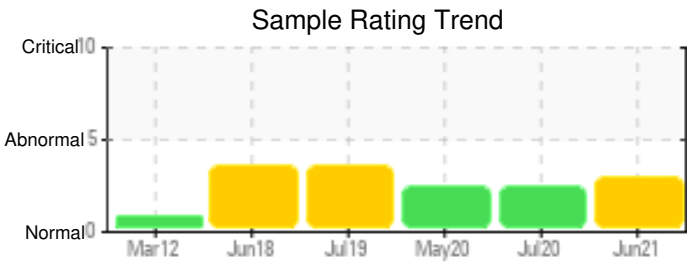



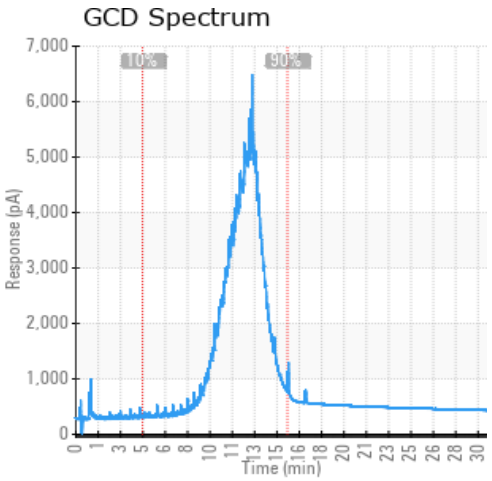
PETRO-CANADA LUBRICANTS

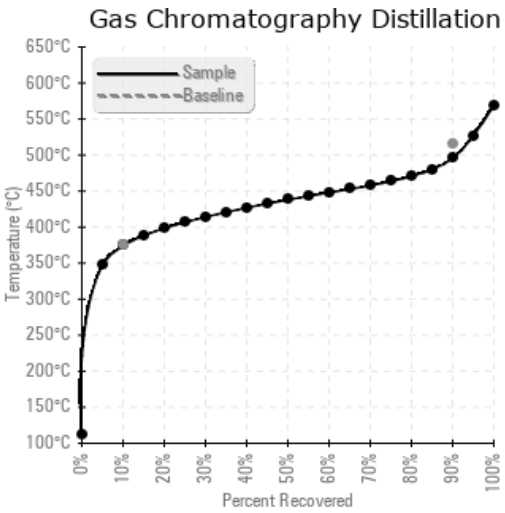


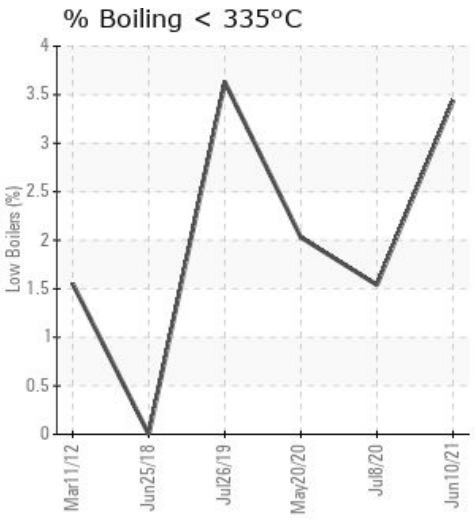




| Sample Date | Iron | Chromium | Nickel | Aluminum | Copper | Lead | Tin | Cadmium | Silver | Vanadium | Silicon | Sodium | Potassium | Titanium | Molybdenum | Antimony | Manganese | Lithium | Boron | Magnesium | Calcium | Barium | Phosphorus | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 06/10/21 | 31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 2 |
| 07/08/20 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 2 |
| 05/20/20 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 2 | 2 |
| 07/26/19 | 58 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 3 | 0 | 2 | 3 |
| 06/25/18 | 44 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 2 | 2 |
| | | | | | | | | | | | | | | | | | | | | | | | | |
| Baseline Data | | | | | | | | | | | | | 0 | | | | | | 0 | | | | 0 | |

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




## Historical Comments

| | |
|---|---|
| 07/08/20 | The 6 drums of fresh Petro-Therm sweetening helps to reduce the solid contents. The fluid has low water contaminant, and normal flash point. However, the mixed fluid still has relatively high viscosity and moderate oxidation. Please keep running the fluid and take one sample in 6 months to monitor the conditions. Pentane Insolubles level is high. Acid number is high. |
| 05/20/20 | The current fluid has a similar condition as the last sample in July 2019. However, the elevated Acid Number means there are more fluid oxidation in the past 9 months. The water contamination is also a concern. Solid levels are severely high. (GCD) 90% Distillation Point is abnormally low. |
| 07/26/19 | Based on the analysis results, it appears that the oil may have experienced some thermal degradation. This may be due in part to the length of service on the oil (12 of years indicated). The FBP Increase indicates that high boilers are present and normally associated with carbonaceous deposits in the system that can foul heat exchanger surfaces or plug small lines. Low values in the GCD, indicates that low boilers are present. This result can be associated with thermal degradation. Pentane In-solubles are above normal and determine the amount of contaminants in used heat transfer oils. It is to determine the amount of insoluble materials such as oxidation by products, dirt, carbonaceous material, and system wear components. These contaminants as a group are called pentane in-solubles.Although the following conditions are within normal guidelines, they did increase since the last sample. Iron, Water, Acid number and an increase in the percentage less than 335C (3.63%) Pentane Insolubles levels are severely high. (GCD) 90% Distillation Point is severely low. |
| 06/25/18 | Based on the analysis results, it appears that the oil may have experienced some contamination or possibly some thermal degradation. This may be due in part to the length of service on the oil (5 years indicated). Thermal degradation results, In the presence of excess heat, the hydrocarbon molecules reach the breaking point of normally stable C-C covalent bonds and crack into lighter hydrocarbons chains. As the oil thermally degrades it may deposit heavy carbonaceous material by baking it on the tubes and then act as an insulation layer. These carbonaceous layers can flake away and produce hot spots on the tubes possibly resulting in a tube rupture. The carbon residues that get carried away can settle downstream and obstruct the flow in small lines and are typically indicted in higher than normal Pentane Insolubles. The Pentane Insolubles analysis is used for the determination of contaminants in used heat transfer oils, and determines the amount of insoluble materials such as oxidation by products, dirt, carbonaceous material, and system wear components. These contaminants as a group are called pentane Insolubles. Most pumps can handle some 'slurries', however, warning limits should be below <.5%. Improved filtration can help. Pentane Insolubles levels are severely high. (GCD) 90% Distillation Point is severely low. |
| | |