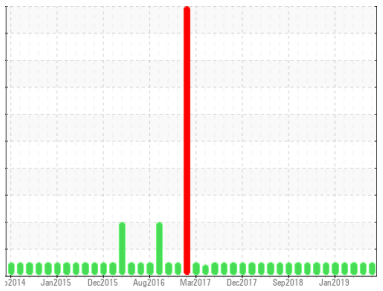
# OIL ANALYSIS REPORT

Sample Rating Trend



NORMAL

Area
## Main Power Generation [01978195]
Machine Id
## Generator - MPG (Port) Lube Oil System (S/N Sample Tag XX-80201-S1)
Component
**Turbine**
Fluid
**PETRO CANADA TURBOFLO 32 (8300 LTR)**

## DIAGNOSIS

**Recommendation**
Resample at the next service interval to monitor.

**Wear**
All component wear rates are normal. The direct-reading & analytical ferrographic results are normal indicating no abnormal wear in the system.

**Contaminants**
MPC (Membrane Patch Colorimetry) test indicates acceptable levels of varnish present. The system cleanliness is acceptable for your target ISO 4406 cleanliness code. The water content is negligible. Water Separability results (ASTM D1401) indicate good water shedding properties. The system and fluid cleanliness is acceptable.

**Oil Condition**
The Air Release Value (ASTM D3427) indicates that the oil has good deaeration properties. Foaming Tendency and Stability (ASTM D892) results all within normal range. Linear Sweep Voltammetry (RULER – ASTM D6971) testing indicates normal levels of anti-oxidants present in the oil. The Rotating Pressure Vessel Oxidation Test (RPVOT – ASTM D2272) result indicates suitable amounts of anti-oxidant(s) present in the oil. The AN level is acceptable for this fluid. The condition of the oil is suitable for further service.

| SAMPLE INFORMATION | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Sample Number | | Client Info | | **PC** | PC | PC |
| Sample Date | | Client Info | | **10 Jun 2019** | 02 Apr 2019 | 20 Mar 2019 |
| Machine Age | hrs | Client Info | | **0** | 0 | 0 |
| Oil Age | hrs | Client Info | | **0** | 0 | 0 |
| Oil Changed | | Client Info | | **N/A** | N/A | N/A |
| Sample Status | | | | **NORMAL** | NORMAL | NORMAL |

| WEAR METALS | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| PQ | | ASTM D8184* | | **10** | 18 | 7 |
| Iron | ppm | ASTM D5185(m) | >15 | **<1** | <1 | <1 |
| Chromium | ppm | ASTM D5185(m) | >4 | **0** | 0 | 0 |
| Nickel | ppm | ASTM D5185(m) | >2 | **0** | 0 | 0 |
| Titanium | ppm | ASTM D5185(m) | | **0** | 0 | 0 |
| Silver | ppm | ASTM D5185(m) | | **0** | 0 | 0 |
| Aluminum | ppm | ASTM D5185(m) | >10 | **0** | 0 | 0 |
| Lead | ppm | ASTM D5185(m) | | **<1** | <1 | 0 |
| Copper | ppm | ASTM D5185(m) | >5 | **<1** | <1 | <1 |
| Tin | ppm | ASTM D5185(m) | >5 | **0** | 0 | 0 |
| Antimony | ppm | ASTM D5185(m) | | **<1** | 0 | 0 |
| Vanadium | ppm | ASTM D5185(m) | | **0** | 0 | 0 |
| Beryllium | ppm | ASTM D5185(m) | | **0** | 0 | 0 |
| Cadmium | ppm | ASTM D5185(m) | | **0** | 0 | <1 |

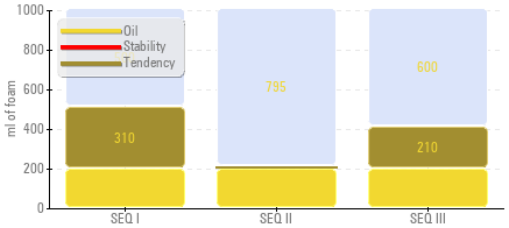
| ADDITIVES | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Boron | ppm | ASTM D5185(m) | 0 | **0** | <1 | 0 |
| Barium | ppm | ASTM D5185(m) | 0 | **0** | 0 | 0 |
| Molybdenum | ppm | ASTM D5185(m) | 0 | **0** | 0 | 0 |
| Manganese | ppm | ASTM D5185(m) | | **0** | 0 | 0 |
| Magnesium | ppm | ASTM D5185(m) | 0 | **<1** | <1 | <1 |
| Calcium | ppm | ASTM D5185(m) | 0 | **<1** | <1 | <1 |
| Phosphorus | ppm | ASTM D5185(m) | 120 | **255** | 246 | 247 |
| Zinc | ppm | ASTM D5185(m) | 0.0 | **1** | <1 | <1 |
| Sulfur | ppm | ASTM D5185(m) | 0 | **522** | 499 | 504 |
| Lithium | ppm | ASTM D5185(m) | | **0** | 0 | 0 |

| CONTAMINANTS | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Silicon | ppm | ASTM D5185(m) | >15 | **<1** | <1 | <1 |
| Sodium | ppm | ASTM D5185(m) | | **0** | 0 | <1 |
| Potassium | ppm | ASTM D5185(m) | >20 | **0** | 0 | <1 |
| Water | % | ASTM D6304* | >0.03 | **0.001** | 0.001 | 0.001 |
| ppm Water | ppm | ASTM D6304* | >300 | **13.6** | 14.0 | 11.5 |

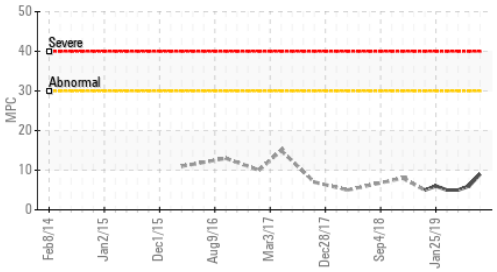
| INFRA-RED | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Soot % | % | ASTM D7844* | | **0** | 0 | 0 |
| Nitration | Abs/cm | ASTM D7624* | | **2.1** | 2.1 | 2.0 |
| Sulfation | Abs/.1mm | ASTM D7415* | | **13.6** | 13.3 | 13.1 |

# OIL ANALYSIS REPORT

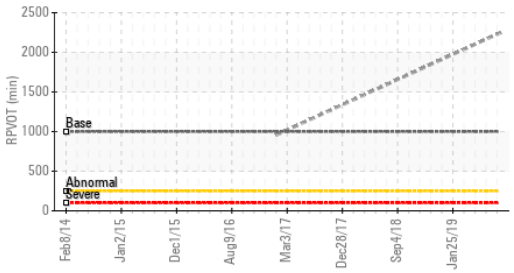
Foaming SEQ I/II/III



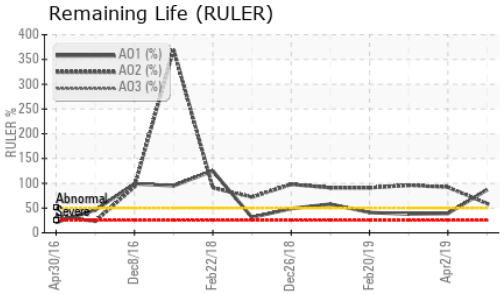

Varnish Potential



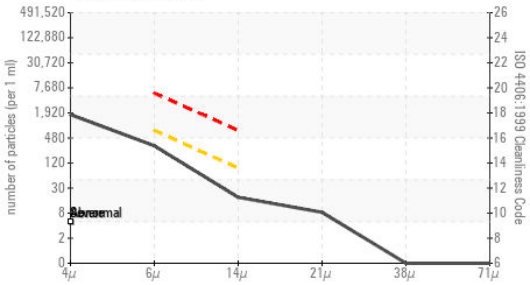

RPVOT




Remaining Life (RULER)




Particle Count



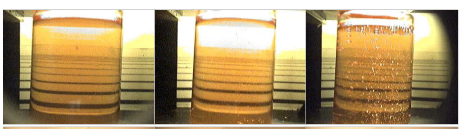

| FLUID CLEANLINESS | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|
| Particles >4µm | ASTM D7647 | | **1529** | 3411 | 298 |
| Particles >6µm | ASTM D7647 | >640 | **275** | 640 | 59 |
| Particles >14µm | ASTM D7647 | >80 | **16** | 35 | 6 |
| Particles >21µm | ASTM D7647 | >20 | **7** | 11 | 2 |
| Particles >38µm | ASTM D7647 | >4 | **0** | 0 | 0 |
| Particles >71µm | ASTM D7647 | >3 | **0** | 0 | 0 |
| Oil Cleanliness | ISO 4406 (c) | >--/16/13 | **18/15/11** | 19/16/12 | 15/13/10 |

| FLUID DEGRADATION | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Oxidation | Abs/.1mm | ASTM D7414* | | **3.8** | 3.9 | 3.9 |
| Acid Number (AN) | mg KOH/g | ASTM D974* | 0.04 | **0.058** | 0.077 | 0.075 |
| Anti-Oxidant 1 | % | ASTM D6971* | <25 | **87** | 39 | 38 |
| Anti-Oxidant 2 | % | ASTM D6971* | <25 | **59** | 92 | 96 |
| MPC Varnish Potential | Scale | ASTM D7843(m)* | >15 | **9** | 6 | 5 |

| VISUAL | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| White Metal | scalar | Visual* | NONE | **NONE** | NONE | NONE |
| Yellow Metal | scalar | Visual* | NONE | **NONE** | NONE | NONE |
| Precipitate | scalar | Visual* | NONE | **NONE** | NONE | NONE |
| Silt | scalar | Visual* | NONE | **NONE** | NONE | NONE |
| Debris | scalar | Visual* | NONE | **NONE** | NONE | NONE |
| Sand/Dirt | scalar | Visual* | NONE | **NONE** | NONE | NONE |
| Appearance | scalar | Visual* | NORML | **NORML** | NORML | NORML |
| Odor | scalar | Visual* | NORML | **NORML** | NORML | NORML |
| Emulsified Water | scalar | Visual* | >0.03 | **NEG** | NEG | NEG |
| Free Water | scalar | Visual* | | **NEG** | NEG | NEG |

| FLUID PROPERTIES | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Visc @ 40°C | cSt | ASTM D7279(m) | 34.0 | **33.7** | 33.5 | 33.6 |
| Visc @ 100°C | cSt | ASTM D7279(m) | 5.59 | **5.6** | 5.6 | 5.5 |
| Viscosity Index (VI) | Scale | ASTM D2270* | 110 | **103** | 104 | 98 |
| Separability | oil/h2o/em | ASTM D1401* | 40/40/0 | **38/40/2 (15)** | --- | --- |
| Air Release Time | min | ASTM D3427* | 2 | **4.26** | --- | --- |
| Foam Tendency | I/II/III | ASTM D892* | 5 | **310/15/210** | --- | --- |
| Foam Stability | I/II/III | ASTM D892* | 0 | **0/0/0** | --- | --- |
| ASTM Color | scalar | ASTM D1500* | 0.5 | **3.0** | 3.0 | --- |
| Rust Prevention | PASS/FAIL | ASTM D665* | | **PASS** | --- | --- |
| Oxidation Test (RPVOT) | minutes | ASTM D2272* | 1000 | **2229** | --- | --- |

| SEDIMENT | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Pentane Insolubles | % | ASTM D893(m)* | | **0.030** | --- | --- |
| Toluene Insolubles | % | ASTM D893(m)* | | **0.023** | --- | --- |

| SAMPLE IMAGES | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|
| Color | | |  | | |
| Bottom | | |  | | |
| MPC | | |  | | |

CALA
ISO 17025:2017 Accredited Laboratory

**Laboratory**
**Sample No.**
**Lab Number**
**Unique Number**
**Test Package**

*To discuss this sample report, cc*
*Test denoted (*) outside scope o*
*Validity of results and interpretation are based on the sample and information as supplied.*

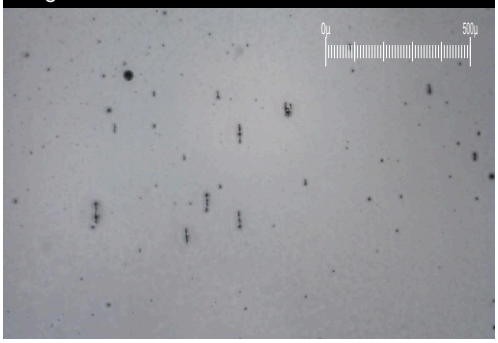
F: (709)724-2835

# FERROGRAPHY REPORT

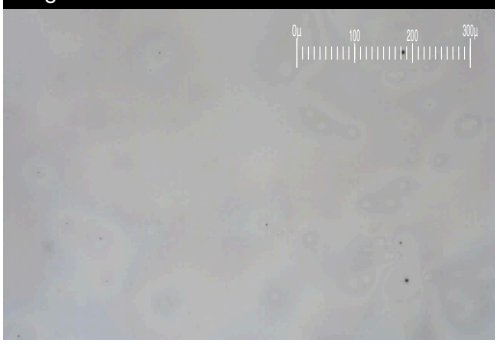
Area
## Main Power Generation [01978195]
Machine Id
## Generator - MPG (Port) Lube Oil System (S/N Sample Tag XX-80201-S1)
Component
**Turbine**
Fluid
**PETRO CANADA TURBOFLO 32 (8300 LTR)**

Magn: 200x Illum: BC

Magn: 50x Illum: RW



Magn: 100x Illum: RW

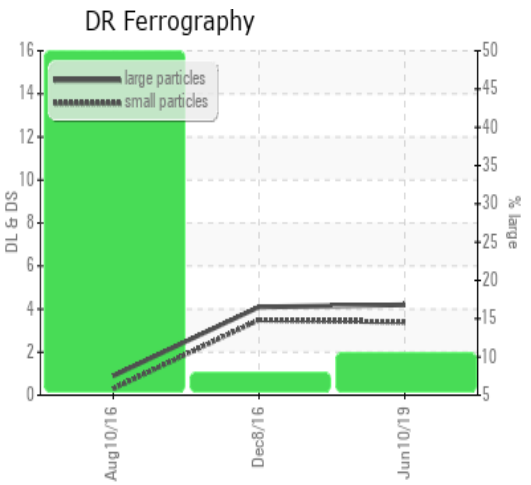


| DR-FERROGRAPHY | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Large Particles | | DR-Ferr* | | **4.2** | --- | --- |
| Small Particles | | DR-Ferr* | | **3.4** | --- | --- |
| Total Particles | | DR-Ferr* | >--- | **7.6** | --- | --- |
| Large Particles Percentage | % | DR-Ferr* | | **10.5** | --- | --- |
| Severity Index | | DR-Ferr* | | **3.4** | --- | --- |

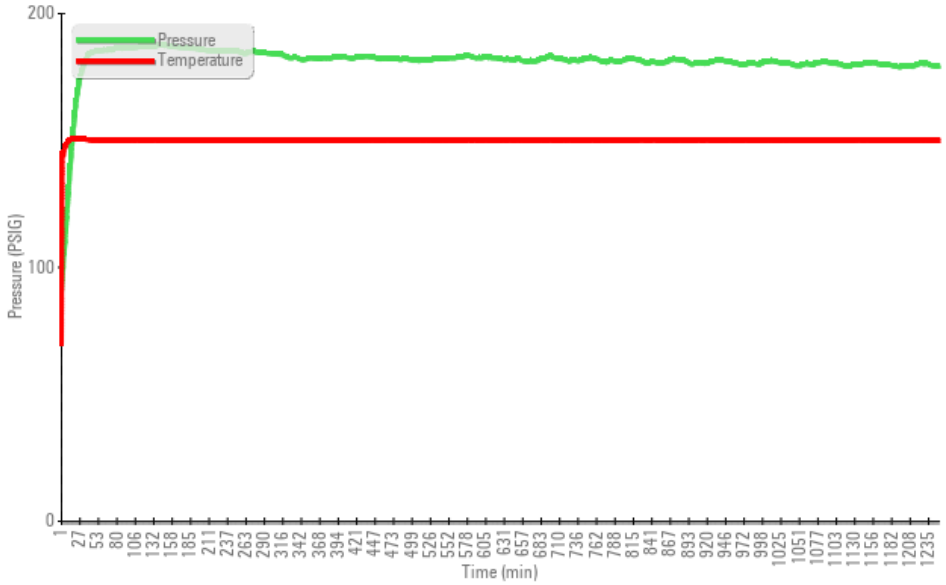
| FERROGRAPHY | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Ferrous Rubbing | Scale 0-10 | ASTM D7684* | | **1** | | |
| Ferrous Sliding | Scale 0-10 | ASTM D7684* | | | | |
| Ferrous Cutting | Scale 0-10 | ASTM D7684* | | | | |
| Ferrous Rolling | Scale 0-10 | ASTM D7684* | | **1** | | |
| Ferrous Break-in | Scale 0-10 | ASTM D7684* | | | | |
| Ferrous Spheres | Scale 0-10 | ASTM D7684* | | | | |
| Ferrous Black Oxides | Scale 0-10 | ASTM D7684* | | | | |
| Ferrous Red Oxides | Scale 0-10 | ASTM D7684* | | | | |
| Ferrous Corrosive | Scale 0-10 | ASTM D7684* | | | | |
| Ferrous Other | Scale 0-10 | ASTM D7684* | | | | |
| Nonferrous Rubbing | Scale 0-10 | ASTM D7684* | | | | |
| Nonferrous Sliding | Scale 0-10 | ASTM D7684* | | | | |
| Nonferrous Cutting | Scale 0-10 | ASTM D7684* | | | | |
| Nonferrous Rolling | Scale 0-10 | ASTM D7684* | | | | |
| Nonferrous Other | Scale 0-10 | ASTM D7684* | | | | |
| Carbonaceous Material | Scale 0-10 | ASTM D7684* | | | | |
| Lubricant Degradation | Scale 0-10 | ASTM D7684* | | | | |
| Sand/Dirt | Scale 0-10 | ASTM D7684* | | **1** | | |
| Fibres | Scale 0-10 | ASTM D7684* | | | | |
| Spheres | Scale 0-10 | ASTM D7684* | | | | |
| Other | Scale 0-10 | ASTM D7684* | | **1** | | |

## WEAR

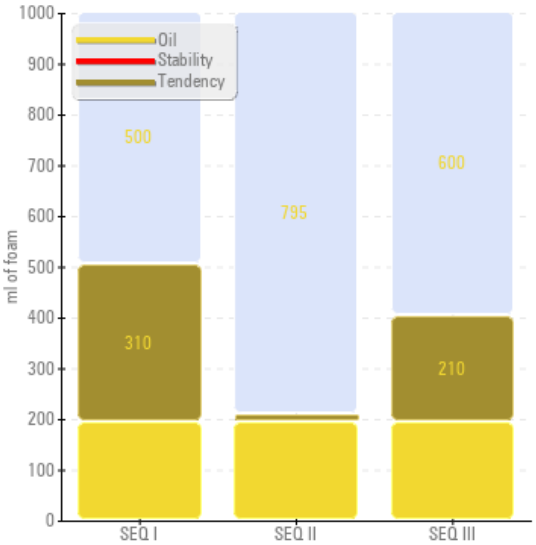
All component wear rates are normal. The direct-reading & analytical ferrographic results are normal indicating no abnormal wear in the system.



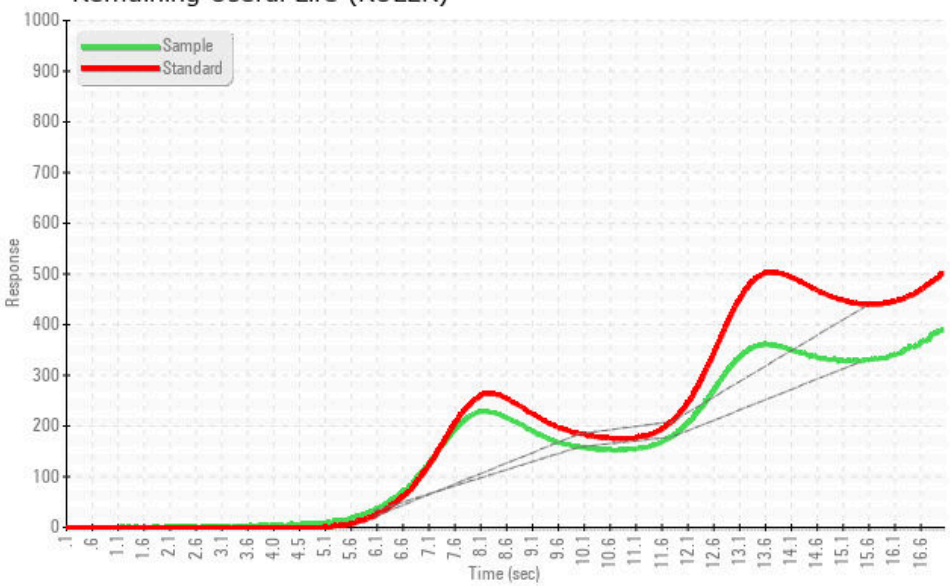
## Rotating Pressure Vessel Oxidation Test



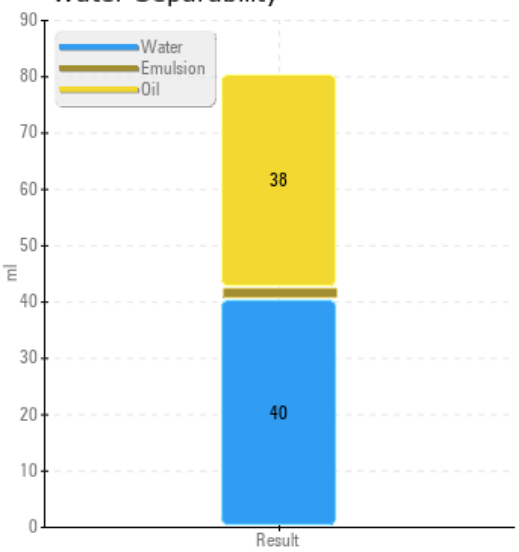

## Foaming SEQ I/II/III




## Remaining Useful Life (RULER)




## Water Separability




## MPC (Varnish Test)


## Sample Color & Clarity