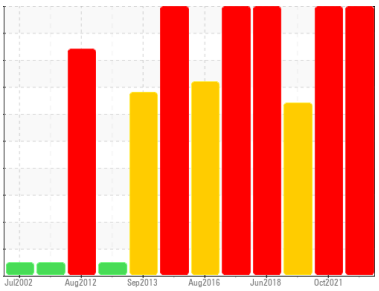
PROBLEM SUMMARY

Sample Rating Trend

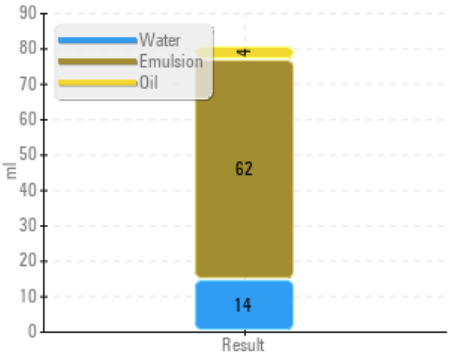


CONTAMINANT

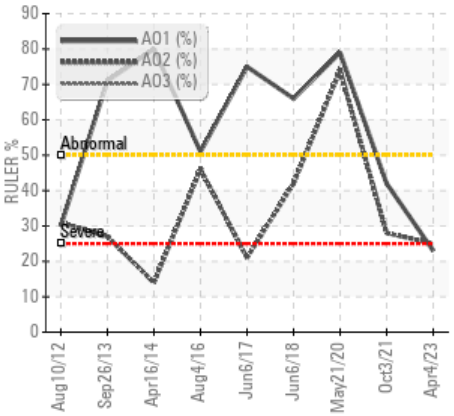
Machine Id
A7 - Thrust Bearing
Component
Thrust Bearing
Fluid
PETRO CANADA TURBOFLO R&O 46 (5705 LTR)

COMPONENT CONDITION SUMMARY

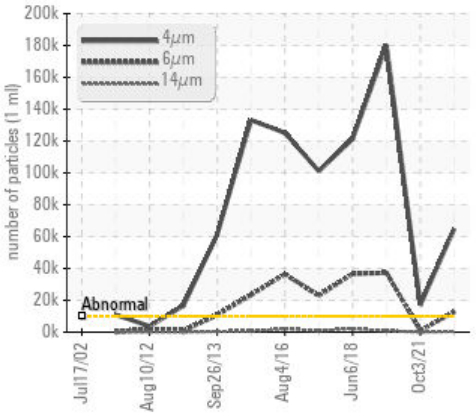
Water Separability



Remaining Life (RULER)



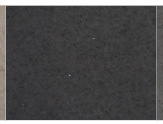
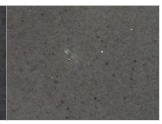
Particle Trend



RECOMMENDATION

We recommend that you perform vacuum distillation and/or air drying to attempt to remove any residual water and/or entrained gases from this oil that may be contributing to abnormal foaming and/or poor water separability. We advise that you check for the source of water entry. Check seals and/or filters for points of contaminant entry. We recommend that you sweeten the oil by draining off a portion of the system oil (25%) and replacing with new oil. The air breather requires service. If unrated, we recommend that you replace with a suitable micron rated and/or desiccant air breather. If rated, we recommend that you service/replace the breather. We advise that you use off-line filtration with water adsorbent filters to attempt to remove the water from this oil. We advise that you perform a filter service, and use off-line filtration to improve the cleanliness of the system fluid. We recommend an early resample to monitor this condition.

PROBLEMATIC TEST RESULTS

Sample Status				**SEVERE**	SEVERE	SEVERE
Particles >4µm		ASTM D7647	>10000	▲ **64881**	▲ 17142	⬢ 180130
Particles >6µm		ASTM D7647	>2500	▲ **12700**	1041	⬢ 37244
Particles >14µm		ASTM D7647	>160	▲ **438**	13	▲ 768
Particles >21µm		ASTM D7647	>40	▲ **84**	3	▲ 130
Oil Cleanliness		ISO 4406 (c)	>20/18/14	▲ **23/21/16**	▲ 21/17/11	⬢ 25/22/17
Anti-Oxidant 1	%	ASTM D6971*	<25	▲ **23**	42	79
Anti-Oxidant 2	%	ASTM D6971*	<25	▲ **25**	28	74
Free Water	scalar	Visual*		▲ **5%**	NEG	NEG
Separability	oil/h2o/em	ASTM D1401*	41/39/0	⬢ **4/14/62 (30)**	⬢ 2/2/76 (30)	41/39/0 (25)
Foam Tendency	I/II/III	ASTM D892*	10	▲ **450/20/405**	420/40/270	390/10/110
PrtFilter						

Customer Id: CHUCHU
Sample No.: WC
Lab Number: 02580006
Test Package: AOM 3

To manage this report scan the QR code

To discuss the diagnosis or test data:
Bill Quesnel CLS,OMA II,MLA-III,LLA-I +1 (289)291-4641 x4641
Bill.Quesnel@wearcheck.com

To change component or sample information:
Gloria Gonzalez +1 (289)291-4643 x4643
gloria.gonzalez@wearcheck.com

RECOMMENDED ACTIONS

Action	Status	Date	Done By	Description
Change Filter	---	---	?	We advise that you perform a filter service, and use off-line filtration to improve the cleanliness of the system fluid.
Resample	---	---	?	We recommend an early resample to monitor this condition.
Check Breathers	---	---	?	The air breather requires service. If unrated, we recommend that you replace with a suitable micron rated and/or desiccant air breather. If rated, we recommend that you service/replace the breather.
Check Water Access	---	---	?	We advise that you check for the source of water entry.
Check Seals	---	---	?	Check seals and/or filters for points of contaminant entry.
Filter Fluid	---	---	?	We advise that you perform a filter service, and use off-line filtration to improve the cleanliness of the system fluid.
Partial Drain	---	---	?	We recommend that you sweeten the oil by draining off a portion of the system oil (25%) and replacing with new oil.

HISTORICAL DIAGNOSIS

CONTAMINANT

03 Oct 2021 Diag: Bill Quesnel

We recommend that you perform vacuum distillation and/or air drying to attempt to remove any residual water and/or entrained gases from this oil that may be contributing to abnormal foaming and/or poor water separability. We recommend you service the filters on this component. Confirm the source of the lubricant being utilized for top-up/fill. We recommend an early resample to monitor this condition.All component wear rates are normal. The direct-reading & analytical ferrographic results are normal indicating no abnormal wear in the system. There is a light amount of silt (particulates < 14 microns in size) present in the oil. MPC (Membrane Patch Colorimetry) test indicates acceptable levels of varnish present. Water Separability results (ASTM D1401) are poor and indicate that the oil will form emulsions with water. The water content is negligible. Additive levels indicate the addition of a different brand, or type of oil. 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.

view report

ISO

21 May 2020 Diag: Bill Quesnel

We advise that you check all areas where contaminants can enter the system. We advise that you perform a filter service, and use off-line filtration to improve the cleanliness of the system fluid. The air breather requires service. If unrated, we recommend that you replace with a suitable micron rated and/or desiccant air breather. If rated, we recommend that you service/replace the breather. We recommend that you use electrostatic filtration to remove insolubles from the oil and to reduce the levels of varnish in the system. Alternatively draining a percentage of the oil and topping up with fresh oil (sweetening the oil) may provide a reduction in the varnish potential level. Resample in 30-45 days to monitor this situation. Diagnostician's Comments: It appears as if you did a sweetening of the oil (or used some type of resin filtration), and this has restored some properties of the oil, however, it has also liberated more varnish (probably older varnish that was lining piping). Advise that you look at purchasing some type of varnish removal filtration system.All component wear rates are normal. The direct-reading & analytical ferrographic results are normal indicating no abnormal wear in the system. Particles >6µm are severely high. MPC Varnish Potential contamination levels are severely high. Particles >4µm are severely high. Particles >4µm are severely high.. Particles >14µm are abnormally high. Particles >21µm are abnormally high. MPC (Membrane Patch Colorimetry) test indicates a high concentration of varnish present. The water content is negligible. Water Separability results (ASTM D1401) indicate good water shedding properties. 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 oil is still serviceable provided that the contaminant(s) can be reduced to acceptable levels.

view report

OFF SPEC

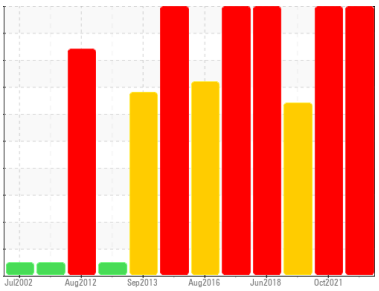
06 Jun 2018 Diag: Bill Quesnel

We recommend that you perform vacuum distillation and/or air drying to attempt to remove any residual water and/or entrained gases from this oil that may be contributing to abnormal foaming and/or poor water separability. We advise that you check all areas where contaminants can enter the system. We recommend that you investigate the system for introduction of a surfactant to the reservoir. Some potential surfactants include incorrect oil make-up with an oil containing emulsifying agents (engine oil, compressor oil, gear oil), or soaps entering the system after wash down. We advise that you perform a filter service, and use off-line filtration to improve the cleanliness of the system fluid. The air breather requires service. If unrated, we recommend that you replace with a suitable micron rated and/or desiccant air breather. If rated, we recommend that you service/replace the breather. We recommend that you use electrostatic filtration to remove insolubles from the oil and to reduce the levels of varnish in the system. Alternatively draining a percentage of the oil and topping up with fresh oil (sweetening the oil) may provide a reduction in the varnish potential level. Resample in 30-45 days to monitor this situation.Wear particle analysis indicates that the nonferrous rolling particles are abnormal. Particles >14µm are severely high. Particles >21µm are severely high. Particles >6µm are severely high. Particles >4µm are severely high. MPC Varnish Potential contamination levels are abnormally high. Particles >38µm are abnormally high. MPC (Membrane Patch Calorimetery) test indicates a moderate concentration of varnish present. The water content is negligible. Water Separability results (ASTM D1401) indicate good water shedding properties. The Air Release Value (ASTM D3427) indicates the oil has poor deaeration properties. Foaming Stability stage I (ASTM D892) result is abnormal indicating an oil foaming problem that could lead to erratic operation. 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 oil is no longer serviceable as a result of the abnormal and/or severe wear.

view report

OIL ANALYSIS REPORT

Sample Rating Trend



CONTAMINANT

Machine Id
A7 - Thrust Bearing
Component
Thrust Bearing
Fluid
PETRO CANADA TURBOFLO R&O 46 (5705 LTR)

DIAGNOSIS

Recommendation

We recommend that you perform vacuum distillation and/or air drying to attempt to remove any residual water and/or entrained gases from this oil that may be contributing to abnormal foaming and/or poor water separability. We advise that you check for the source of water entry. Check seals and/or filters for points of contaminant entry. We recommend that you sweeten the oil by draining off a portion of the system oil (25%) and replacing with new oil. The air breather requires service. If unrated, we recommend that you replace with a suitable micron rated and/or desiccant air breather. If rated, we recommend that you service/replace the breather. We advise that you use off-line filtration with water adsorbent filters to attempt to remove the water from this oil. We advise that you perform a filter service, and use off-line filtration to improve the cleanliness of the system fluid. We recommend an early resample to monitor this condition.

Wear

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

Contaminants

There is a moderate amount of particulates (2 to 100 microns in size) present in the oil. Water Separability results (ASTM D1401) are poor and indicate that the oil will form emulsions with water. There is a moderate concentration of water present in the oil. Free water present.

Oil Condition

Foaming Tendency stage I (ASTM D892) result is abnormal indicating a tendency for oil foaming. Linear Sweep Voltammetry (RULER– ASTM D6971) testing indicates a low amount of both anti-oxidants present in the oil. Rust Prevention test (ASTM D665) indicates the oil retains good anti-corrosion properties. The AN level is acceptable for this fluid. The oil is still serviceable provided that the

Particle Filter (Magn: 200 x)

SAMPLE INFORMATION		method	limit/base	current	history1	history2
Sample Number		Client Info		**WC**	WC0308164	WC944663
Sample Date		Client Info		**04 Apr 2023**	03 Oct 2021	21 May 2020
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				**SEVERE**	SEVERE	SEVERE

WEAR METALS		method	limit/base	current	history1	history2
PQ		ASTM D8184*		**0**	0	0
Iron	ppm	ASTM D5185(m)	>85	**2**	1	3
Chromium	ppm	ASTM D5185(m)	>20	**0**	0	0
Nickel	ppm	ASTM D5185(m)	>20	**<1**	0	0
Titanium	ppm	ASTM D5185(m)		**0**	0	0
Silver	ppm	ASTM D5185(m)		**0**	0	<1
Aluminum	ppm	ASTM D5185(m)	>40	**<1**	<1	<1
Lead	ppm	ASTM D5185(m)	>60	**2**	13	9
Copper	ppm	ASTM D5185(m)	>7	**<1**	<1	<1
Tin	ppm	ASTM D5185(m)	>40	**0**	0	0
Antimony	ppm	ASTM D5185(m)		**0**	0	<1
Vanadium	ppm	ASTM D5185(m)		**0**	0	0
Beryllium	ppm	ASTM D5185(m)		**0**	0	0
Cadmium	ppm	ASTM D5185(m)		**0**	0	0

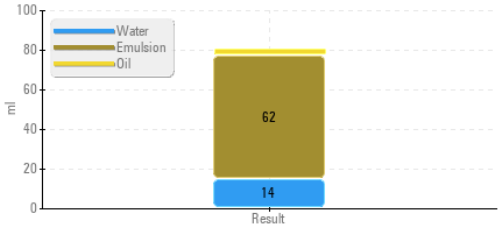
ADDITIVES		method	limit/base	current	history1	history2
Boron	ppm	ASTM D5185(m)		**0**	<1	0
Barium	ppm	ASTM D5185(m)		**0**	0	0
Molybdenum	ppm	ASTM D5185(m)		**0**	0	0
Manganese	ppm	ASTM D5185(m)		**0**	0	0
Magnesium	ppm	ASTM D5185(m)		**0**	<1	0
Calcium	ppm	ASTM D5185(m)	0	**<1**	<1	<1
Phosphorus	ppm	ASTM D5185(m)	3	**3**	▲ 5	4
Zinc	ppm	ASTM D5185(m)	0	**2**	2	2
Sulfur	ppm	ASTM D5185(m)		**141**	128	141
Lithium	ppm	ASTM D5185(m)		**<1**	<1	<1

CONTAMINANTS		method	limit/base	current	history1	history2
Silicon	ppm	ASTM D5185(m)	>20	**<1**	0	0
Sodium	ppm	ASTM D5185(m)		**0**	0	0
Potassium	ppm	ASTM D5185(m)	>20	**<1**	<1	<1
Water	%	ASTM D6304*	>2	**0.348**	0.002	0.006
ppm Water	ppm	ASTM D6304*		**3485.2**	21.1	62.9

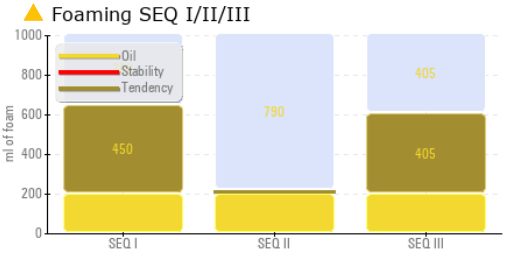
INFRA-RED		method	limit/base	current	history1	history2
Soot %	%	ASTM D7844*		**0**	0	0
Nitration	Abs/cm	ASTM D7624*		**0.9**	1.6	2.8
Sulfation	Abs/.1mm	ASTM D7415*		**4.5**	11.5	15.5

OIL ANALYSIS REPORT

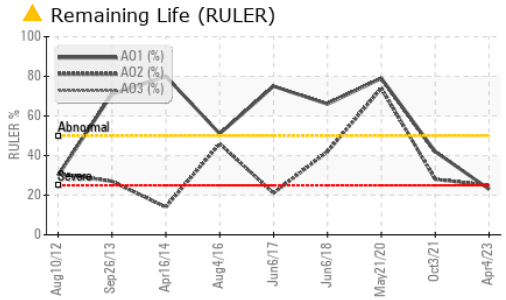
Water Separability



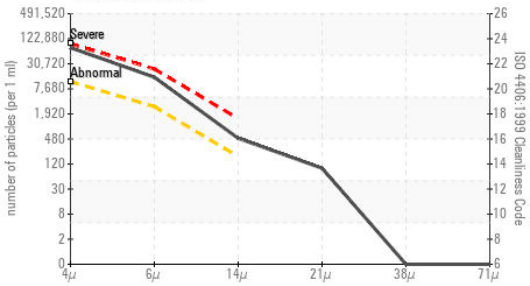
Foaming SEQ I/II/III



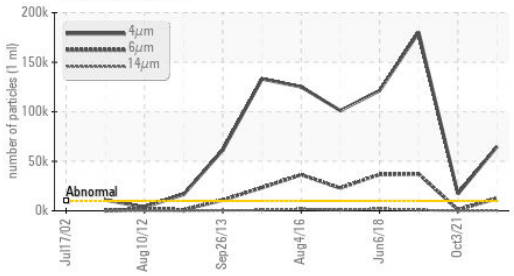
Remaining Life (RULER)



Particle Count



Particle Trend



FLUID CLEANLINESS		method	limit/base	current	history1	history2
Particles >4µm		ASTM D7647	>10000	▲ **64881**	▲ 17142	⬢ 180130
Particles >6µm		ASTM D7647	>2500	▲ **12700**	1041	⬢ 37244
Particles >14µm		ASTM D7647	>160	▲ **438**	13	▲ 768
Particles >21µm		ASTM D7647	>40	▲ **84**	3	▲ 130
Particles >38µm		ASTM D7647	>10	**0**	0	1
Particles >71µm		ASTM D7647	>3	**0**	0	0
Oil Cleanliness		ISO 4406 (c)	>20/18/14	▲ **23/21/16**	▲ 21/17/11	⬢ 25/22/17

FLUID DEGRADATION		method	limit/base	current	history1	history2
Oxidation	Abs/.1mm	ASTM D7414*		**1.0**	2.5	2.5
Acid Number (AN)	mg KOH/g	ASTM D974*	0.12	**0.07**	0.07	0.08
Anti-Oxidant 1	%	ASTM D6971*	<25	▲ **23**	42	79
Anti-Oxidant 2	%	ASTM D6971*	<25	▲ **25**	28	74
MPC Varnish Potential	Scale	ASTM D7843(m)*	>15	**10**	14	⬢ 52

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	**VLITE**	NONE	NONE
Debris	scalar	Visual*	NONE	**VLITE**	NONE	VLITE
Sand/Dirt	scalar	Visual*	NONE	**NONE**	NONE	NONE
Appearance	scalar	Visual*	NORML	**WGOIL**	NORML	▲ HAZY
Odor	scalar	Visual*	NORML	**NORML**	NORML	NORML
Emulsified Water	scalar	Visual*	>2	**.5%**	NEG	.2%
Free Water	scalar	Visual*		▲ **5%**	NEG	NEG

FLUID PROPERTIES		method	limit/base	current	history1	history2
Visc @ 40°C	cSt	ASTM D7279(m)	44.4	**44.8**	44.5	44.3
Visc @ 100°C	cSt	ASTM D7279(m)	6.72	**6.7**	6.8	6.7
Viscosity Index (VI)	Scale	ASTM D2270*	104	**102**	107	103
Separability	oil/h2o/em	ASTM D1401*	41/39/0	⬢ **4/14/62 (30)**	⬢ 2/2/76 (30)	41/39/0 (25)
Air Release Time	min	ASTM D3427*	3.5	**4.00**	5.30	3.40
Foam Tendency	I/II/III	ASTM D892*	10	▲ **450/20/405**	420/40/270	390/10/110
Foam Stability	I/II/III	ASTM D892*	0	**0/0/0**	0/0/0	0/0/0
ASTM Color	scalar	ASTM D1500*	0.5	**L0.5**	<1.0	<1.0
Rust Prevention	PASS/FAIL	ASTM D665*	PASS	**PASS**	PASS	PASS
Oxidation Test (RPVOT)	minutes	ASTM D2272*	400	**846**	625	744

SEDIMENT		method	limit/base	current	history1	history2
Pentane Insolubles	%	ASTM D893(m)*		**0.031**	0.110	0.101
Toluene Insolubles	%	ASTM D893(m)*		**0.014**	0.055	0.040

CALA Testing Accreditation No. 1005078
ISO 17025:2017 Accredited Laboratory

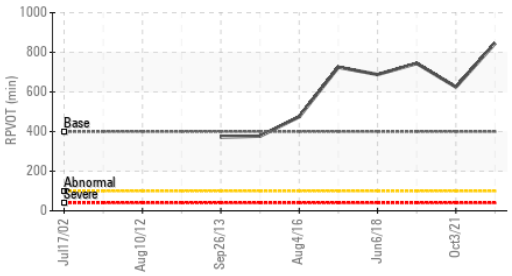
Laboratory : WearCheck - C8-1175 Appleby Line, Burlington, ON L7L 5H9
Sample No. : WC **Received** : 01 Sep 2023
Lab Number : 02580006 **Diagnosed** : 19 Sep 2023
Unique Number : 5633066 **Diagnostician** : Bill Quesnel
Test Package : AOM 3 (Additional Tests: BottomAnalysis, FilterPatch, PrtFilter, TolInsol)

To discuss this sample report, contact Customer Service at 1-800-268-2131.
Test denoted (*) outside scope of accreditation, (m) method modified, (e) tested at external lab.
Validity of results and interpretation are based on the sample and information as supplied.

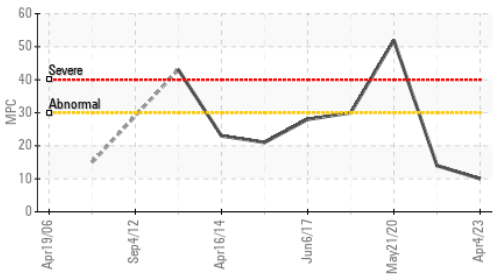
Nalcor Energy - Churchill Falls
PO Box 310
Churchill Falls, NL
CA A0R 1A0
Contact: Robert Noel
robertnoel@nlh.nl.ca
T: (709)925-8294
F: (709)925-8220

OIL ANALYSIS REPORT

RPVOT

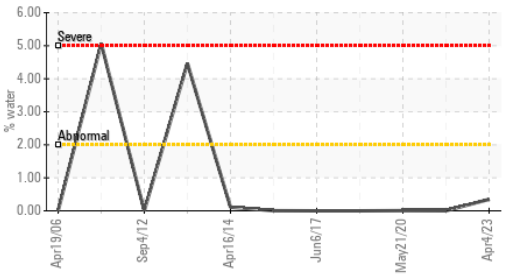


Varnish Potential



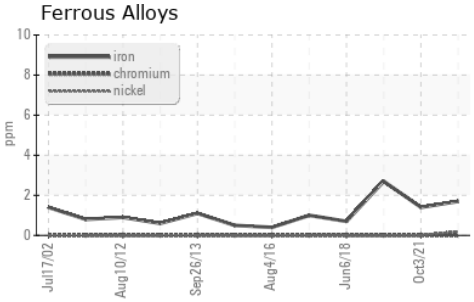
SAMPLE IMAGES	method	limit/base	current	history1	history2
Color					
Bottom					
PrtFilter					
MPC					

Water

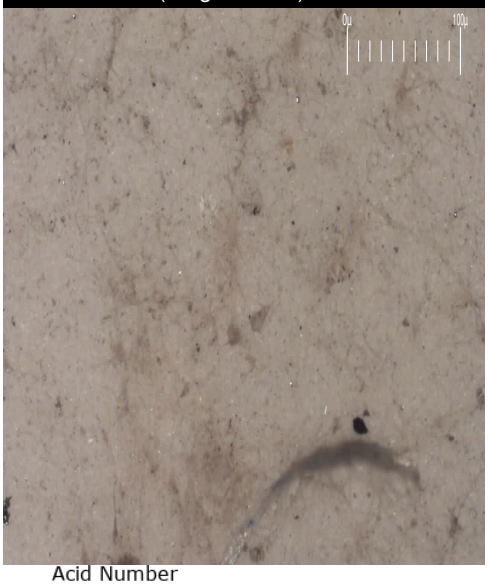


GRAPHS

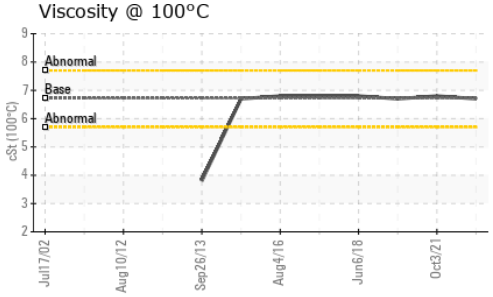
Ferrous Alloys



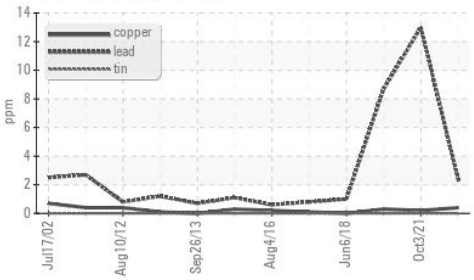
Particle Filter (Magn: 200 x)



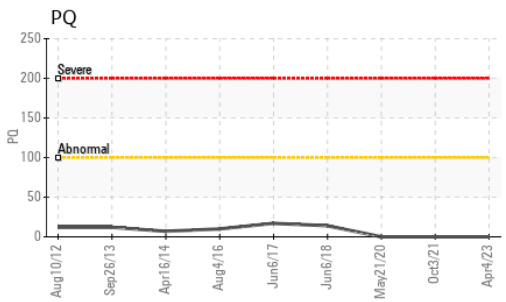
Viscosity @ 100°C



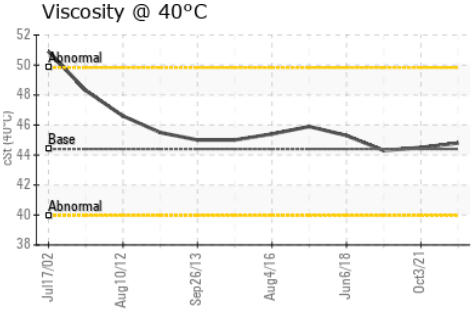
Non-ferrous Metals



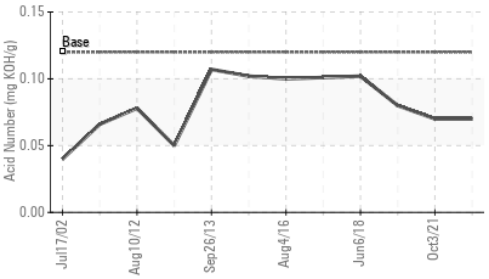
PQ



Viscosity @ 40°C



Acid Number



ISO 17025:2017 Accredited Laboratory

Laboratory	: WearCheck - C8-1175 Appleby Line, Burlington, ON L7L 5H9		
Sample No.	: WC	**Received**	: 01 Sep 2023
Lab Number	: 02580006	**Diagnosed**	: 19 Sep 2023
Unique Number	: 5633066	**Diagnostician**	: Bill Quesnel
Test Package	: AOM 3 (Additional Tests: BottomAnalysis, FilterPatch, PrtFilter, TolInsol)		

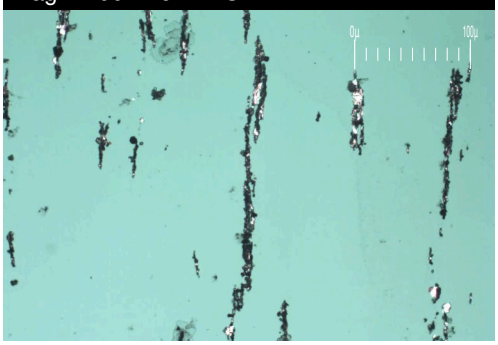
To discuss this sample report, contact Customer Service at 1-800-268-2131.
Test denoted (*) outside scope of accreditation, (m) method modified, (e) tested at external lab.
Validity of results and interpretation are based on the sample and information as supplied.

Nalcor Energy - Churchill Falls
PO Box 310
Churchill Falls, NL
CA A0R 1A0
Contact: Robert Noel
robertnoel@nlh.nl.ca
T: (709)925-8294
F: (709)925-8220

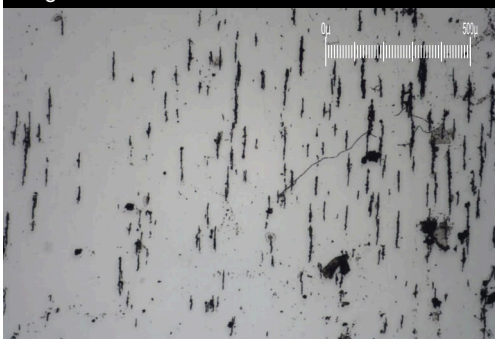
FERROGRAPHY REPORT

Machine Id
A7 - Thrust Bearing
Component
Thrust Bearing
Fluid
PETRO CANADA TURBOFLO R&O 46 (5705 LTR)

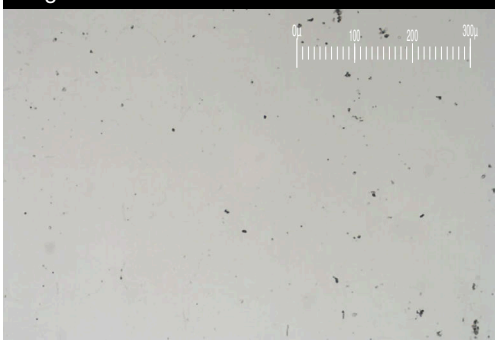
Magn: 200x Illum: BC



Magn: 50x Illum: RW



Magn: 100x Illum: RW

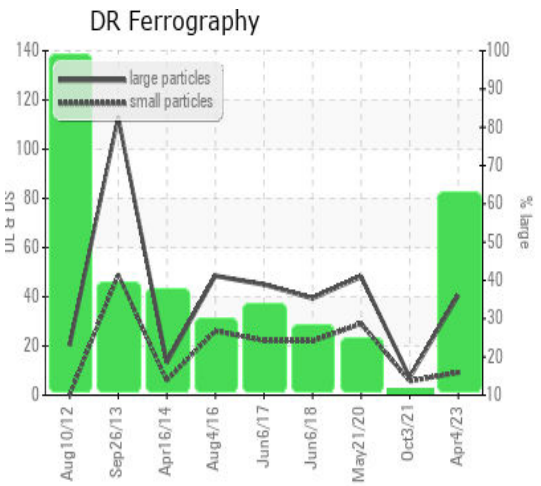


DR-FERROGRAPHY		method	limit/base	current	history1	history2
Large Particles		DR-Ferr*		**40.5**	7.2	48.2
Small Particles		DR-Ferr*		**9.2**	5.7	29.1
Total Particles		DR-Ferr*	>---	**49.7**	12.9	77.3
Large Particles Percentage	%	DR-Ferr*		**63**	11.6	24.7
Severity Index		DR-Ferr*		**1268**	10.8	921

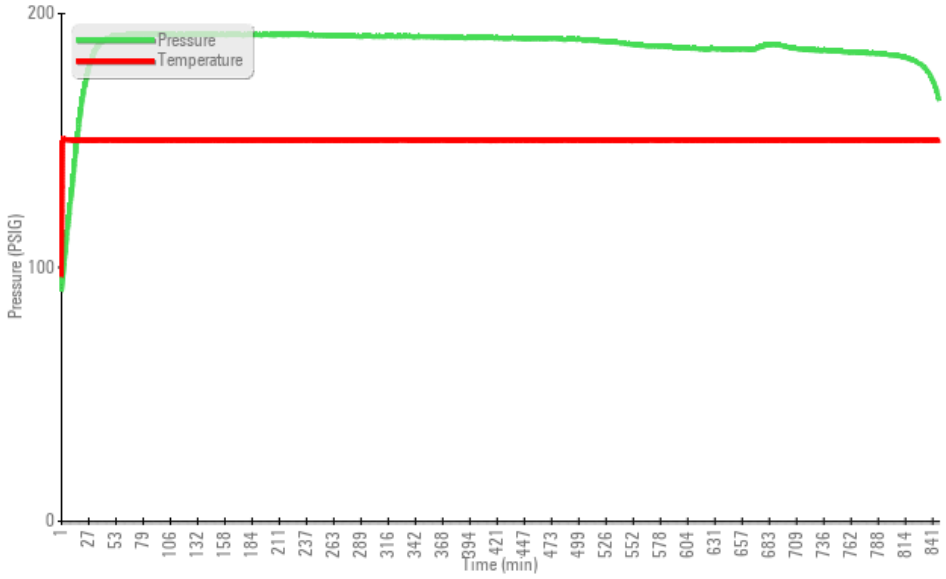
FERROGRAPHY		method	limit/base	current	history1	history2
Ferrous Rubbing	Scale 0-10	ASTM D7684*		**4**	2	3
Ferrous Sliding	Scale 0-10	ASTM D7684*				
Ferrous Cutting	Scale 0-10	ASTM D7684*				
Ferrous Rolling	Scale 0-10	ASTM D7684*		**2**	1	1
Ferrous Break-in	Scale 0-10	ASTM D7684*				
Ferrous Spheres	Scale 0-10	ASTM D7684*				
Ferrous Black Oxides	Scale 0-10	ASTM D7684*		**1**		
Ferrous Red Oxides	Scale 0-10	ASTM D7684*				
Ferrous Corrosive	Scale 0-10	ASTM D7684*				1
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*			1	3
Sand/Dirt	Scale 0-10	ASTM D7684*		**1**	1	1
Fibres	Scale 0-10	ASTM D7684*				
Spheres	Scale 0-10	ASTM D7684*				
Other	Scale 0-10	ASTM D7684*		**2**	2	2

WEAR

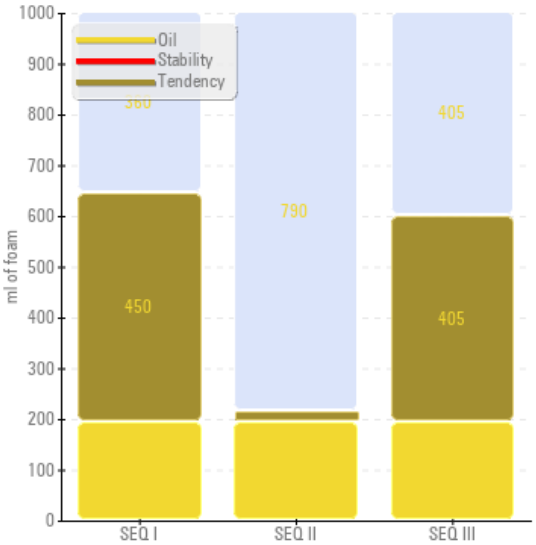
All component wear rates are normal. The direct-reading & analytical ferrographic results are normal indicating no abnormal wear in the system.



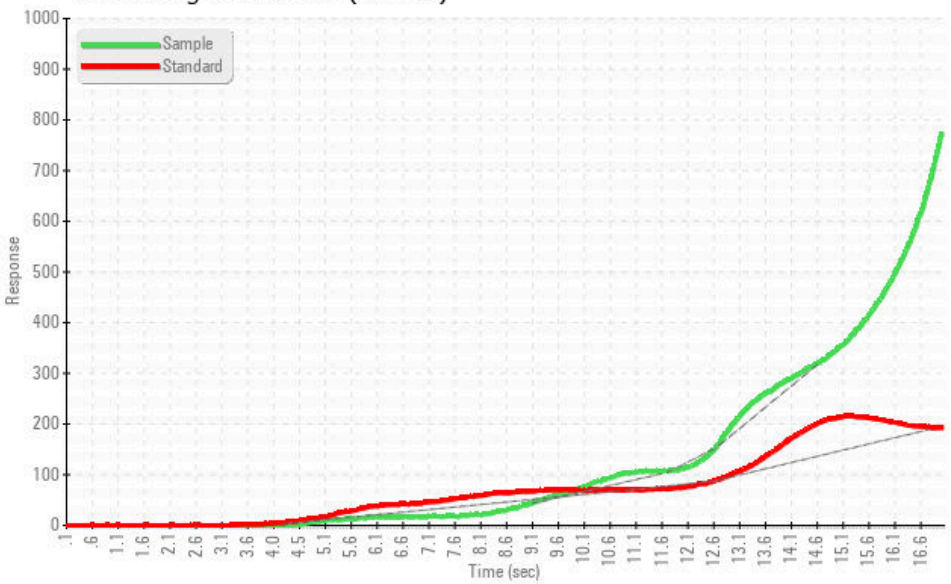
Rotating Pressure Vessel Oxidation Test



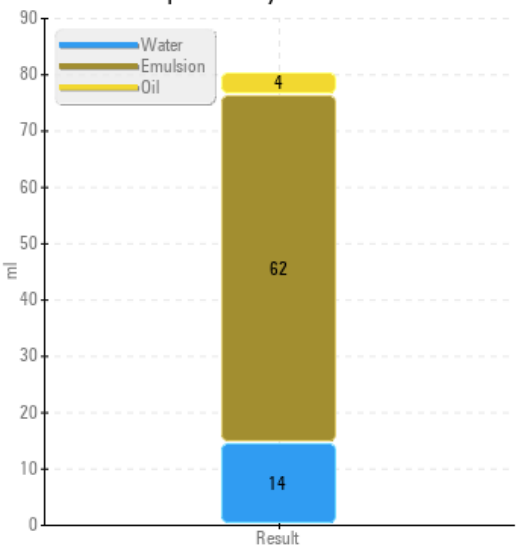
Foaming SEQ I/II/III



Remaining Useful Life (RULER)



Water Separability



MPC (Varnish Test)

Sample Color & Clarity

This page left intentionally blank