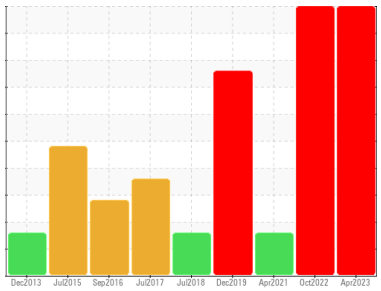
PROBLEM SUMMARY

Sample Rating Trend

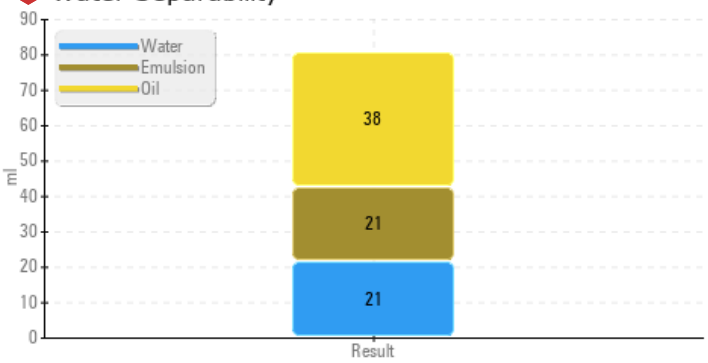


OFF SPEC

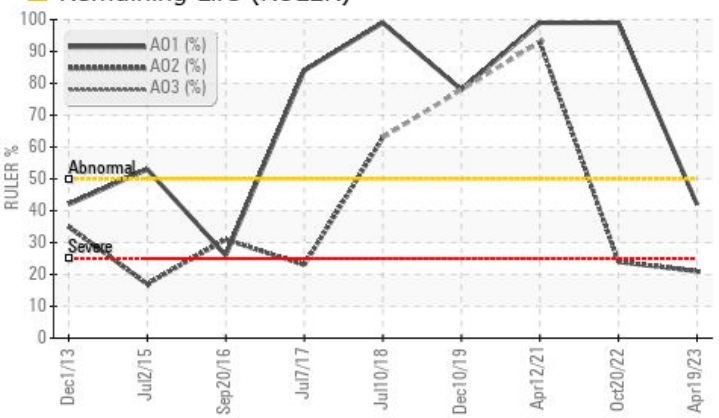
Area
[02437560]
Machine Id
A-6 THRUST BEARING
Component
Thrust Bearing
Fluid
PETRO CANADA TURBOFLO R&O 46 (5705 LTR)

COMPONENT CONDITION SUMMARY

Water Separability



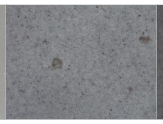
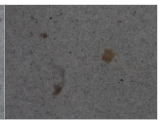
Remaining Life (RULER)



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 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 recommend an early resample to monitor this condition.

PROBLEMATIC TEST RESULTS

Sample Status				**SEVERE**	SEVERE	ABNORMAL
Anti-Oxidant 2	%	ASTM D6971*	<25	▲ **21**	▲ 24	93
Separability	oil/h2o/em	ASTM D1401*	41/39/0	⬢ **38/21/21 (30)**	41/39/0 (25)	41/39/0 (25)
Foam Tendency	I/II/III	ASTM D892*	10	▲ **560/120/530**	▲ 570/100/500	▲ 490/40/490
Foam Stability	I/II/III	ASTM D892*	0	⬢ **190/0/160**	⬢ 160/0/60	0/0/0
PrtFilter						

Customer Id: CHUCHU
Sample No.: WC
Lab Number: 02579998
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
Resample	---	---	?	We recommend an early resample to monitor this condition.
Filter Fluid	---	---	?	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.

HISTORICAL DIAGNOSIS

OFF SPEC

20 Oct 2022 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 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 recommend that you sweeten the oil by draining off a portion of the system oil (25%) and replacing with new oil (this could have a positive effect on reducing the oil foaming). 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. The system cleanliness is acceptable for your target ISO 4406 cleanliness code. The water content is negligible. The system and fluid cleanliness is acceptable. Foaming Stability (ASTM D892) results are abnormal indicating an oil foaming problem that could lead to erratic operation. Linear Sweep Voltammetry (RULER– ASTM D6971) testing indicates a low amount of one of the anti-oxidants present in the oil, however, the other anti-oxidant(s) are still performing adequately. The AN level is acceptable for this fluid.

view report

OFF SPEC

12 Apr 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 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. 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. Foaming Tendency (ASTM D892) results are abnormal indicating a tendency for oil foaming. The Air Release Value (ASTM D3427) indicates that the oil has good deaeration properties. 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

DEGRADATION

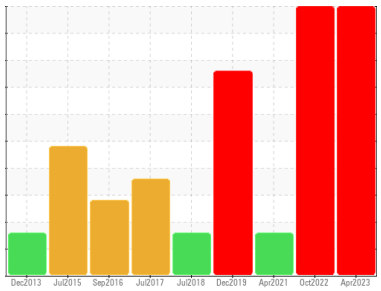
10 Dec 2019 Diag: Bill Quesnel

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 that you sweeten the oil by draining off half the system oil (50%) and replacing with new oil. 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. 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. Foaming Tendency (ASTM D892) results are abnormal indicating a tendency for oil foaming. Linear Sweep Voltammetry (RULER– ASTM D6971) testing indicates one of the anti-oxidants present in the oil will soon be depleted. The Air Release Value (ASTM D3427) indicates that the oil has good deaeration properties. 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

OIL ANALYSIS REPORT

Sample Rating Trend



OFF SPEC

Area
[02437560]
Machine Id
A-6 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 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 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.

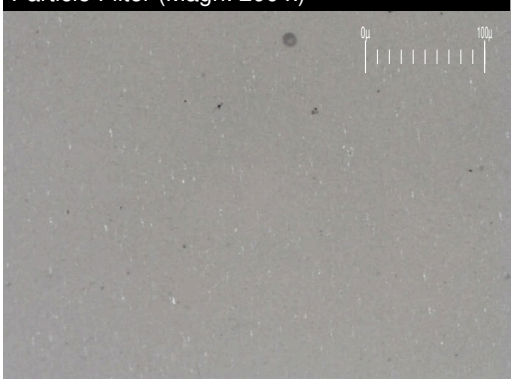
Contaminants

Water Separability results (ASTM D1401) are poor and indicate that the oil will form emulsions with water. The system cleanliness is acceptable for your target ISO 4406 cleanliness code. The water content is negligible.

Oil Condition

Foaming Stability (ASTM D892) results are abnormal indicating an oil foaming problem that could lead to erratic operation. Linear Sweep Voltammetry (RULER– ASTM D6971) testing indicates a low amount of one of the anti-oxidants present in the oil, however, the other anti-oxidant(s) are still performing adequately. Rust Prevention test (ASTM D665) indicates the oil retains good anti-corrosion properties. The AN level is acceptable for this fluid.

Particle Filter (Magn: 200 x)



SAMPLE INFORMATION		method	limit/base	current	history1	history2
Sample Number		Client Info		**WC**	WC0679965	WC
Sample Date		Client Info		**19 Apr 2023**	20 Oct 2022	12 Apr 2021
Machine Age	days	Client Info		**0**	0	0
Oil Age	days	Client Info		**0**	0	0
Oil Changed		Client Info		**N/A**	N/A	N/A
Sample Status				**SEVERE**	SEVERE	ABNORMAL

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

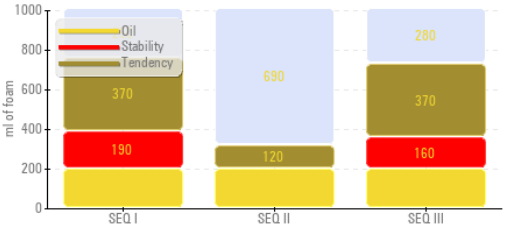
ADDITIVES		method	limit/base	current	history1	history2
Boron	ppm	ASTM D5185(m)		**<1**	<1	<1
Barium	ppm	ASTM D5185(m)		**0**	<1	0
Molybdenum	ppm	ASTM D5185(m)		**0**	0	0
Manganese	ppm	ASTM D5185(m)		**0**	0	0
Magnesium	ppm	ASTM D5185(m)		**<1**	<1	<1
Calcium	ppm	ASTM D5185(m)	0	**<1**	0	<1
Phosphorus	ppm	ASTM D5185(m)	3	**2**	1	2
Zinc	ppm	ASTM D5185(m)	0	**1**	<1	<1
Sulfur	ppm	ASTM D5185(m)		**142**	150	145
Lithium	ppm	ASTM D5185(m)		**<1**	<1	<1

CONTAMINANTS		method	limit/base	current	history1	history2
Silicon	ppm	ASTM D5185(m)	>20	**3**	3	<1
Sodium	ppm	ASTM D5185(m)		**<1**	<1	<1
Potassium	ppm	ASTM D5185(m)	>20	**<1**	0	0
Water	%	ASTM D6304*	>2	**0.001**	0.001	0.001
ppm Water	ppm	ASTM D6304*		**8.4**	2.5	2.1

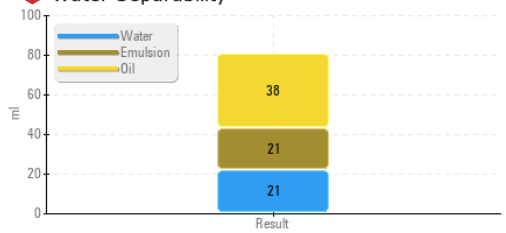
INFRA-RED		method	limit/base	current	history1	history2
Soot %	%	ASTM D7844*		**0**	0	0
Nitration	Abs/cm	ASTM D7624*		**1.9**	1.8	1.7
Sulfation	Abs/.1mm	ASTM D7415*		**12.4**	11.8	11.7

OIL ANALYSIS REPORT

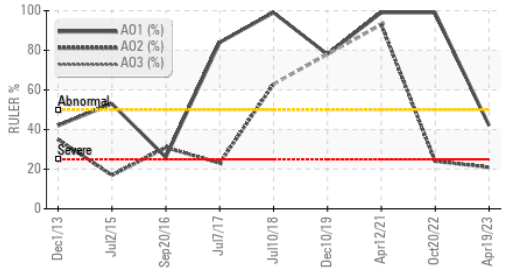
Foaming SEQ I/II/III



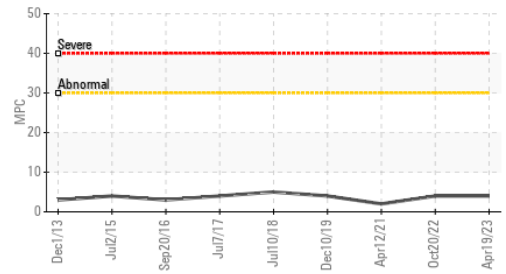
Water Separability



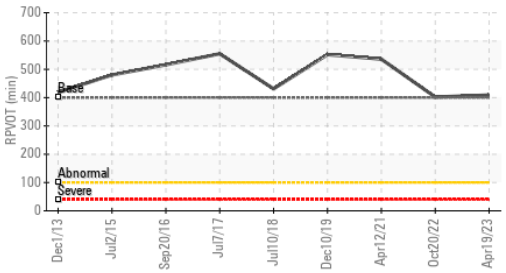
Remaining Life (RULER)



Varnish Potential



RPVOT



FLUID CLEANLINESS	method	limit/base	current	history1	history2
Particles >4µm	ASTM D7647	>10000	**838**	1850	5387
Particles >6µm	ASTM D7647	>2500	**187**	632	1383
Particles >14µm	ASTM D7647	>160	**14**	73	118
Particles >21µm	ASTM D7647	>40	**4**	27	36
Particles >38µm	ASTM D7647	>10	**1**	3	3
Particles >71µm	ASTM D7647	>3	**0**	0	0
Oil Cleanliness	ISO 4406 (c)	>20/18/14	**17/15/11**	18/16/13	20/18/14

FLUID DEGRADATION		method	limit/base	current	history1	history2
Oxidation	Abs/.1mm	ASTM D7414*		**2.5**	2.9	2.3
Acid Number (AN)	mg KOH/g	ASTM D974*	0.12	**0.05**	0.07	0.06
Anti-Oxidant 1	%	ASTM D6971*	<25	**42**	99	99
Anti-Oxidant 2	%	ASTM D6971*	<25	▲ **21**	▲ 24	93
MPC Varnish Potential	Scale	ASTM D7843(m)*	>15	**4**	4	2

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	VLITE
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*	>2	**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)	44.4	**45.1**	44.9	45.1
Visc @ 100°C	cSt	ASTM D7279(m)	6.72	**6.8**	6.8	6.7
Viscosity Index (VI)	Scale	ASTM D2270*	104	**104**	105	100
Separability	oil/h2o/em	ASTM D1401*	41/39/0	⬢ **38/21/21 (30)**	41/39/0 (25)	41/39/0 (25)
Air Release Time	min	ASTM D3427*	3.5	**6.90**	8.00	6.80
Foam Tendency	I/II/III	ASTM D892*	10	▲ **560/120/530**	▲ 570/100/500	▲ 490/40/490
Foam Stability	I/II/III	ASTM D892*	0	⬢ **190/0/160**	⬢ 160/0/60	0/0/0
ASTM Color	scalar	ASTM D1500*	0.5	**L1.5**	L1.5	1.5
Rust Prevention	PASS/FAIL	ASTM D665*	PASS	**PASS**	PASS	PASS
Oxidation Test (RPVOT)	minutes	ASTM D2272*	400	**409**	402	536

SEDIMENT		method	limit/base	current	history1	history2
Pentane Insolubles	%	ASTM D893(m)*		**0.025**	0.097	0.347
Toluene Insolubles	%	ASTM D893(m)*		**0.012**	0.033	0.116

ISO 17025:2017 Accredited Laboratory

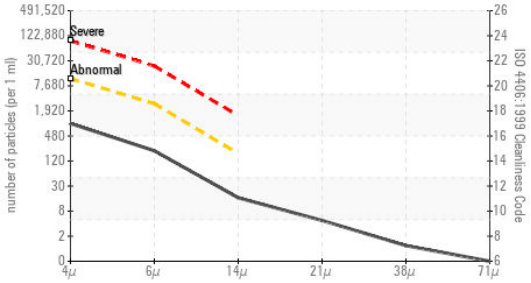
Laboratory : WearCheck - C8-1175 Appleby Line, Burlington, ON L7L 5H9
Sample No. : WC **Received** : 01 Sep 2023
Lab Number : 02579998 **Diagnosed** : 18 Sep 2023
Unique Number : 5633058 **Diagnostician** : Bill Quesnel
Test Package : AOM 3 (Additional Tests: BottomAnalysis, FilterPatch, PrtFilter, TolInsol)

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.

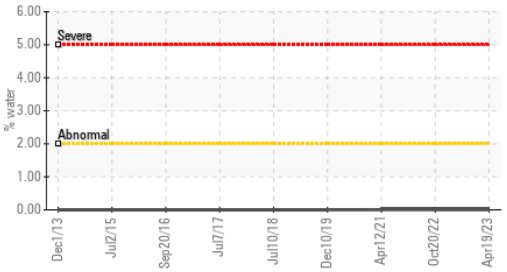
Nalcor Energy - Churchill Falls
PO Box 310
Churchill Falls, NL
CA A0R 1A0
Contact: Robert Noel
robertnoel@nlh.nl.ca
T: (709)925-8294
F: (709)925-8220

OIL ANALYSIS REPORT

Particle Count



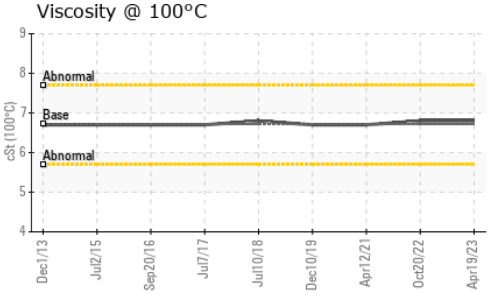
Water



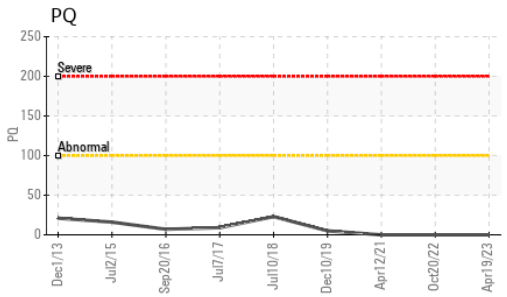
SAMPLE IMAGES

	method	limit/base	current	history1	history2
Color					
Bottom					
PrtFilter					
MPC					

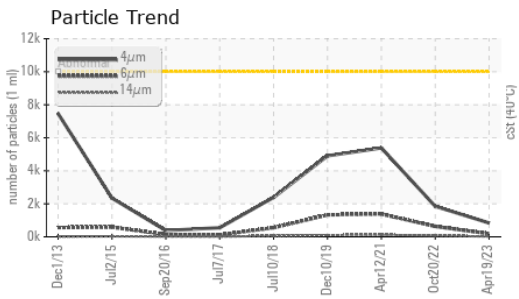
Viscosity @ 100°C



PQ

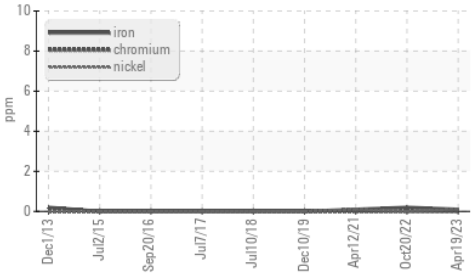


Particle Trend

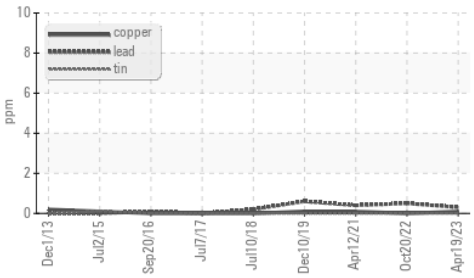


GRAPHS

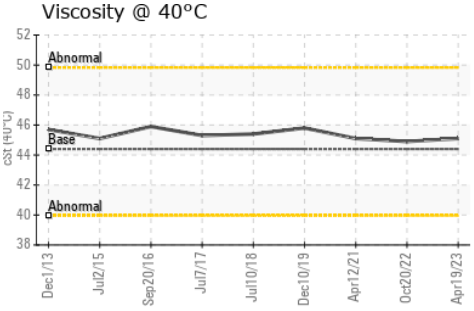
Ferrous Alloys



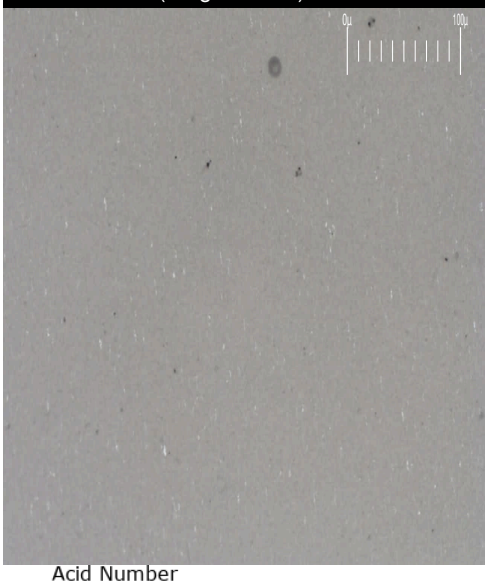
Non-ferrous Metals



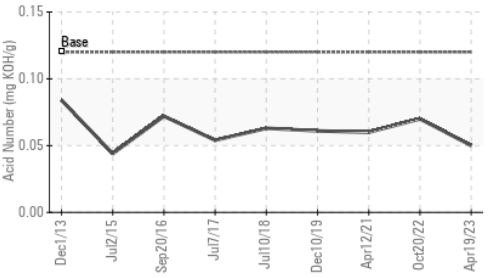
Viscosity @ 40°C



Particle Filter (Magn: 200 x)



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	: 02579998	**Diagnosed**	: 18 Sep 2023
Unique Number	: 5633058	**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.
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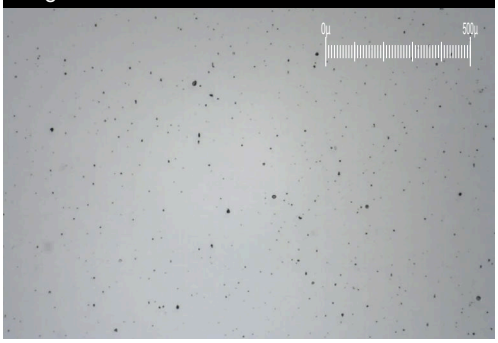
Nalcor Energy - Churchill Falls
PO Box 310
Churchill Falls, NL
CA A0R 1A0
Contact: Robert Noel
robertnoel@nlh.nl.ca
T: (709)925-8294
F: (709)925-8220

FERROGRAPHY REPORT

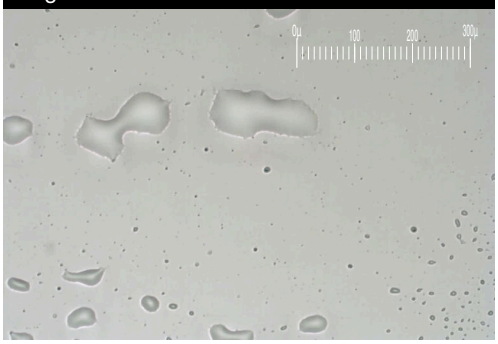
Area
[02437560]
Machine Id
A-6 THRUST BEARING
Component
Thrust Bearing
Fluid
PETRO CANADA TURBOFLO R&O 46 (5705 LTR)

Magn: 200x Illum: BC

Magn: 50x Illum: RW



Magn: 100x Illum: RW

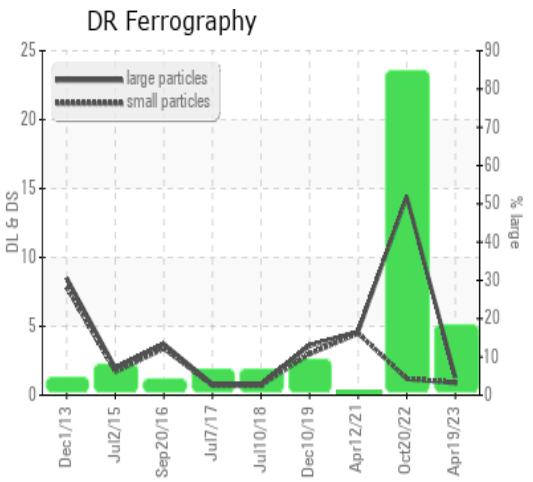


DR-FERROGRAPHY		method	limit/base	current	history1	history2
Large Particles		DR-Ferr*		**1.3**	14.4	4.6
Small Particles		DR-Ferr*		**0.9**	1.2	4.5
Total Particles		DR-Ferr*	>---	**2.2**	15.6	9.1
Large Particles Percentage	%	DR-Ferr*		**18.2**	84.6	1.1
Severity Index		DR-Ferr*		**1**	190	0.5

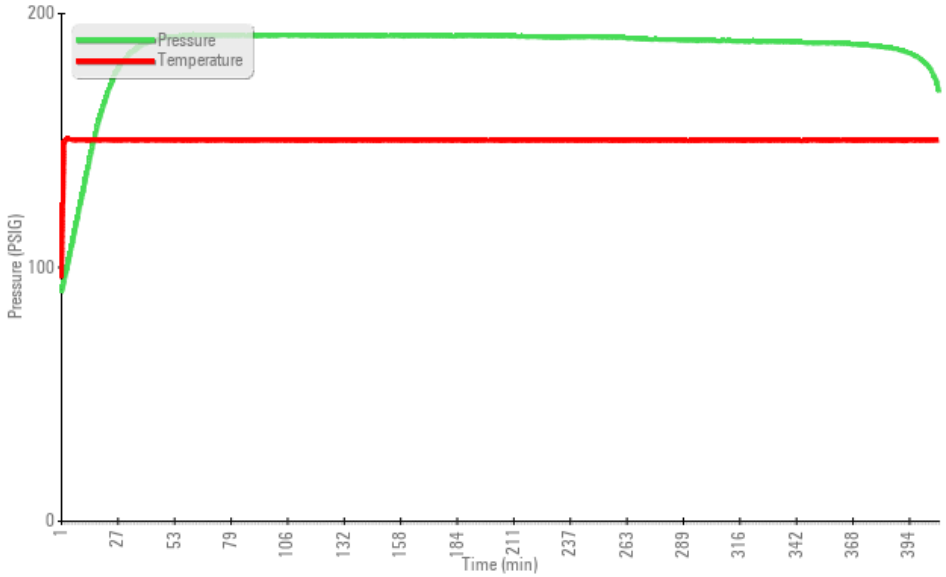
FERROGRAPHY		method	limit/base	current	history1	history2
Ferrous Rubbing	Scale 0-10	ASTM D7684*		**1**	1	1
Ferrous Sliding	Scale 0-10	ASTM D7684*				
Ferrous Cutting	Scale 0-10	ASTM D7684*				
Ferrous Rolling	Scale 0-10	ASTM D7684*		**1**		
Ferrous Break-in	Scale 0-10	ASTM D7684*				
Ferrous Spheres	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**	1	
Fibres	Scale 0-10	ASTM D7684*				
Spheres	Scale 0-10	ASTM D7684*				
Other	Scale 0-10	ASTM D7684*		**1**	2	1

WEAR

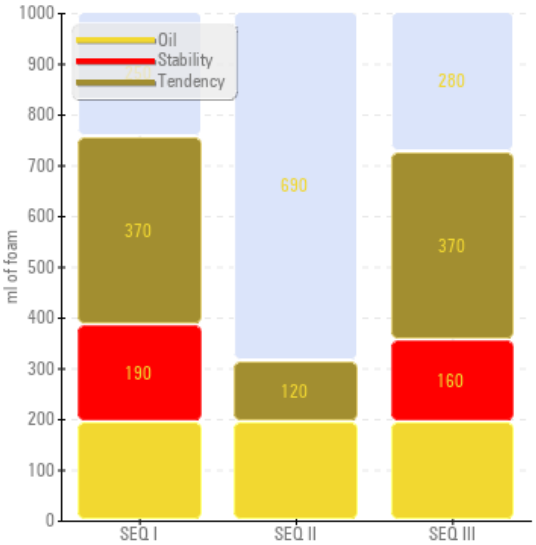
All component wear rates are normal. The direct-reading & analytical ferrographic results are normal indicating no abnormal wear in the system.



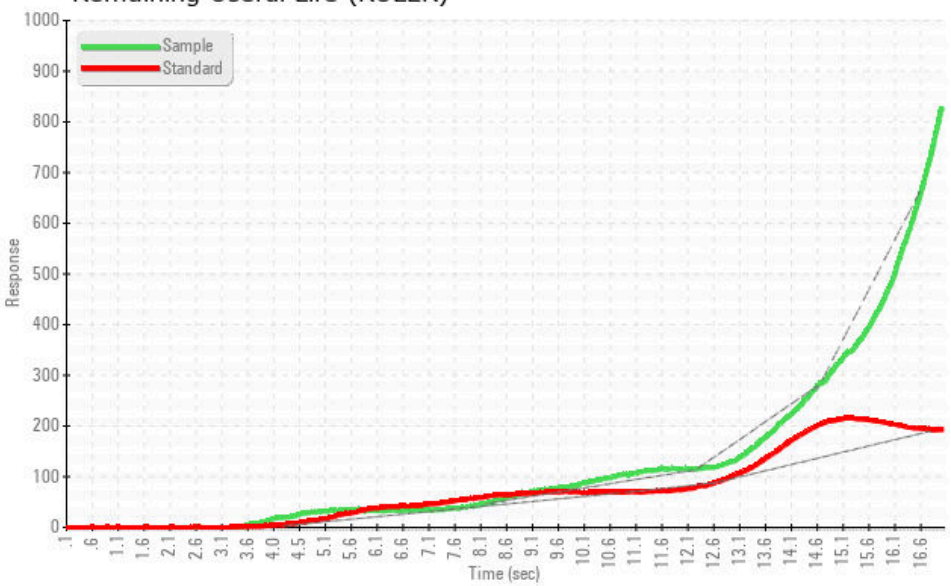
Rotating Pressure Vessel Oxidation Test



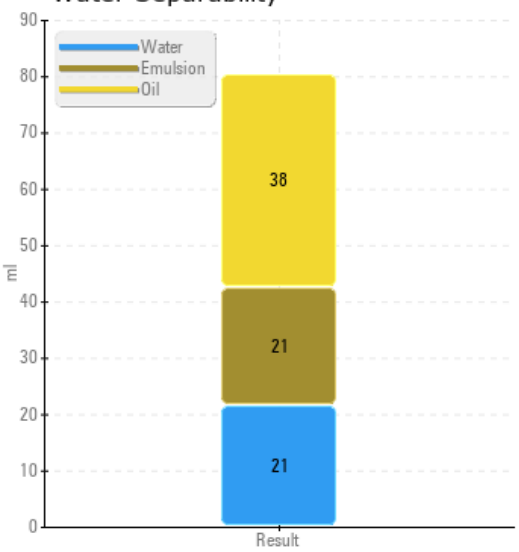
Foaming SEQ I/II/III



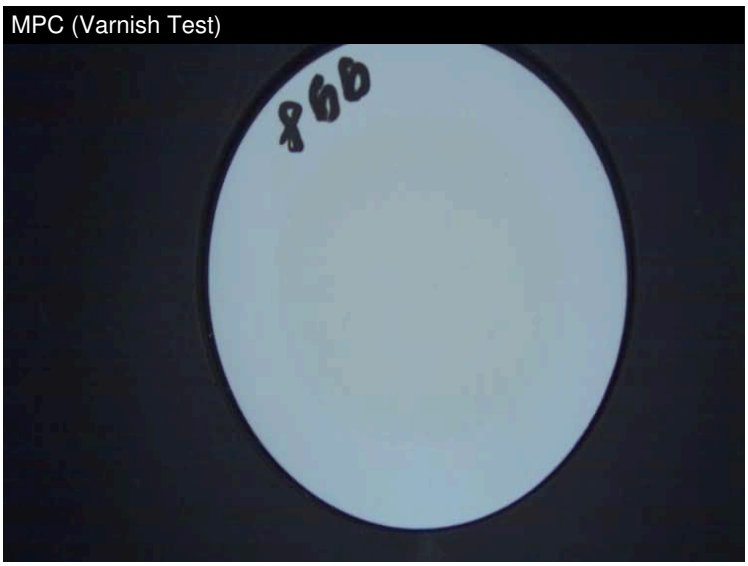
Remaining Useful Life (RULER)



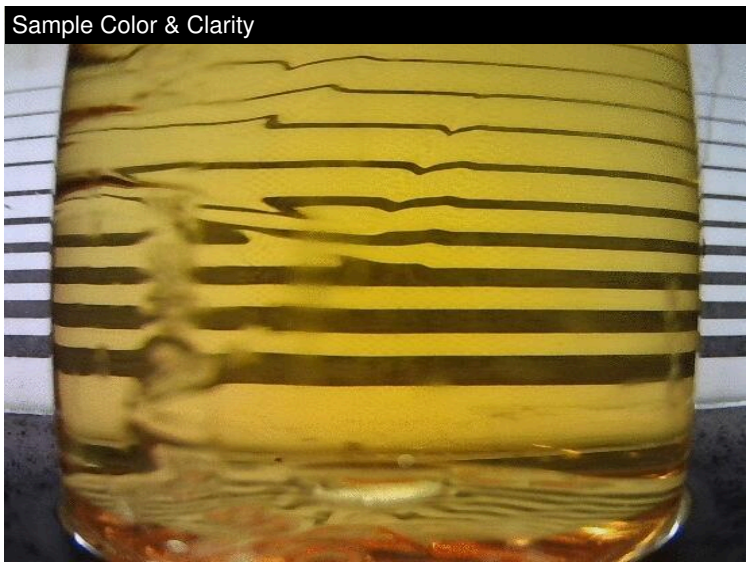
Water Separability



MPC (Varnish Test)



Sample Color & Clarity



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