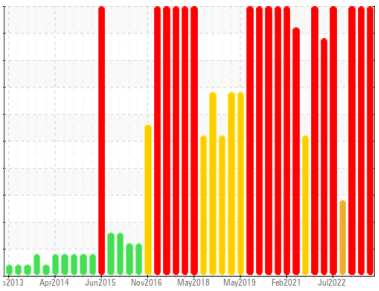
PROBLEM SUMMARY

Sample Rating Trend

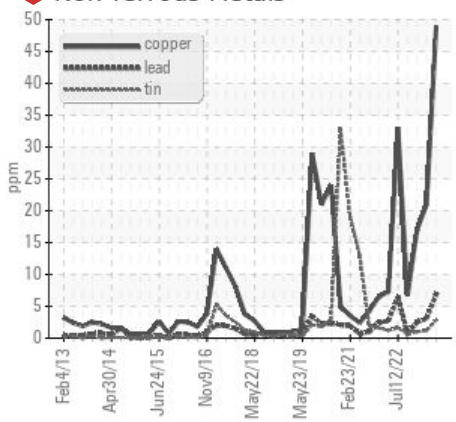


WEAR

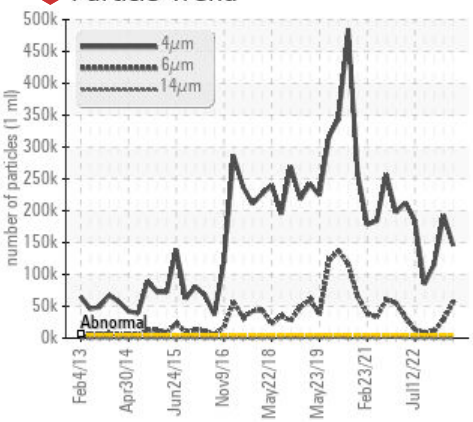
Area
BRUCE B/5/43230
Machine Id
5-43230-P4-P OB Brg Drn
Component
Outboard Bearing
Fluid
ESSO NUTO H ISO 46 (--- GAL)

COMPONENT CONDITION SUMMARY

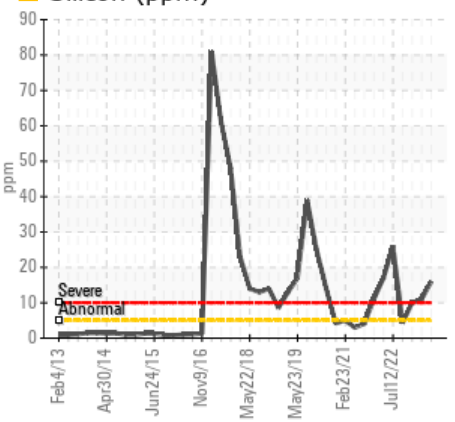
Non-ferrous Metals



Particle Trend



Silicon (ppm)



RECOMMENDATION

Check seals and/or filters for points of contaminant entry. We advise that you check all areas where dirt can enter the system. 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 either performing an oil change or oil filtration. We cannot recommend specific action as we have limited information with regards to reservoir capacity and/or lubricant type. Resample in 30-45 days to monitor this situation. NOTE: Please provide information regarding reservoir capacity, filter type and micron rating with next sample.

PROBLEMATIC TEST RESULTS

Sample Status				**SEVERE**	SEVERE	SEVERE
Lead	ppm	ASTM D5185(m)	>5	▲ **7**	3	2
Copper	ppm	ASTM D5185(m)	>5	⬢ **49**	⬢ 21	⬢ 17
Silicon	ppm	ASTM D5185(m)	>5	▲ **16**	▲ 11	▲ 10
Particles >4µm		ASTM D7647	>5000	⬢ **145640**	⬢ 192904	⬢ 115573
Particles >6µm		ASTM D7647	>1300	⬢ **56692**	⬢ 29098	⬢ 10339
Oil Cleanliness		ISO 4406 (c)	>19/17/15	⬢ **24/23/15**	⬢ 25/22/15	⬢ 24/21/14

Customer Id: BRUTIV
Sample No.: WC0744592
Lab Number: 02602853
Test Package: IND 2

To manage this report scan the QR code

To discuss the diagnosis or test data:
Kevin Marson +1 (289)291-4644 x4644
Kevin.Marson@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	---	---	?	Resample in 30-45 days to monitor this situation.
Information Required	---	---	?	NOTE: Please provide information regarding reservoir capacity, filter type and micron rating with next sample.
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 Dirt Access	---	---	?	We advise that you check all areas where dirt can enter the system.
Check Seals	---	---	?	Check seals and/or filters for points of contaminant entry.
Filter Fluid	---	---	?	We recommend either performing an oil change or oil filtration. We cannot recommend specific action as we have limited information with regards to reservoir capacity and/or lubricant type.

HISTORICAL DIAGNOSIS

WEAR

08 Aug 2023 Diag: Kevin Marson

Check seals and/or filters for points of contaminant entry. Check seals and/or filters for points of contaminant entry. 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 perform a filter service, and use off-line filtration to improve the cleanliness of the system fluid. Resample in 30-45 days to monitor this situation. NOTE: Please provide information regarding reservoir capacity, filter type and micron rating with next sample.Copper ppm levels are severe. Wear particle analysis indicates that the ferrous cutting particles are abnormal. Bearing wear is indicated. Cutting wear particles are caused by either hard protuberances (mis-aligned components, etc.), or abrasives entering the system and embedding themselves in softer materials (sand, etc.), and gouging out mating surfaces. There is a high amount of silt (particulates < 14 microns in size) present in the oil. Elemental level of silicon (Si) above normal indicating ingress of seal material. The water content is negligible. The system cleanliness code is much higher than the acceptable limit for the target ISO 4406 cleanliness code. 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

WEAR

18 May 2023 Diag: Kevin Marson

Check seals and/or filters for points of contaminant entry. 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 perform a filter service, and use off-line filtration to improve the cleanliness of the system fluid. Resample in 30-45 days to monitor this situation. NOTE: Please provide information regarding reservoir capacity, filter type and micron rating with next sample.Copper ppm levels are severe. Bearing wear is indicated. There is a high amount of silt (particulates < 14 microns in size) present in the oil. Elemental level of silicon (Si) above normal indicating ingress of seal material. The water content is negligible. The system cleanliness code is much higher than the acceptable limit for the target ISO 4406 cleanliness code. 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

WEAR

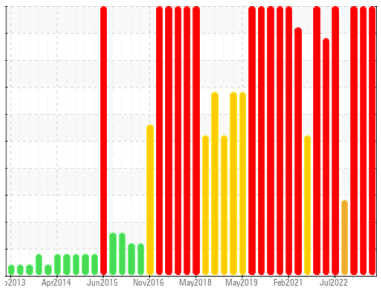
01 Nov 2022 Diag: Kevin Marson

Check seals and/or filters for points of contaminant entry. 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 you service the filters on this component. Resample in 30-45 days to monitor this situation. NOTE: Please provide information regarding reservoir capacity, filter type and micron rating with next sample.Copper ppm levels are abnormal. Bearing wear is indicated. The direct-reading & analytical ferrographic results are normal indicating no abnormal wear in the system. Particles >4µm and oil cleanliness are severely high. Particles >6µm are abnormally high. The water content is negligible. The system cleanliness code is much higher than the acceptable limit for the target ISO 4406 cleanliness code. 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



WEAR

Area
BRUCE B/5/43230
Machine Id
5-43230-P4-P OB Brg Drn
Component
Outboard Bearing
Fluid
ESSO NUTO H ISO 46 (--- GAL)

DIAGNOSIS

Recommendation

Check seals and/or filters for points of contaminant entry. We advise that you check all areas where dirt can enter the system. 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 either performing an oil change or oil filtration. We cannot recommend specific action as we have limited information with regards to reservoir capacity and/or lubricant type. Resample in 30-45 days to monitor this situation. NOTE: Please provide information regarding reservoir capacity, filter type and micron rating with next sample.

Wear

Copper ppm levels are severe. Lead ppm levels are abnormal. Bearing wear is indicated. The ferrography results are normal indicating no abnormal wear in the system.

Contaminants

There is a high amount of silt (particulates < 14 microns in size) present in the oil. Elemental level of silicon (Si) above normal indicating ingress of seal material and/or dirt. The water content is negligible. The system cleanliness code is much higher than the acceptable limit for the target ISO 4406 cleanliness code.

Oil Condition

The AN level is acceptable for this fluid. The oil is no longer serviceable as a result of the abnormal and/or severe wear.

SAMPLE INFORMATION		method	limit/base	current	history1	history2
Sample Number		Client Info		**WC0744592**	WC0791595	WC0744587
Sample Date		Client Info		**28 Nov 2023**	08 Aug 2023	18 May 2023
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
Iron	ppm	ASTM D5185(m)	>10	**8**	6	4
Chromium	ppm	ASTM D5185(m)	>5	**<1**	<1	0
Nickel	ppm	ASTM D5185(m)	>5	**<1**	<1	<1
Titanium	ppm	ASTM D5185(m)	>5	**0**	0	0
Silver	ppm	ASTM D5185(m)		**<1**	0	0
Aluminum	ppm	ASTM D5185(m)	>5	**<1**	<1	0
Lead	ppm	ASTM D5185(m)	>5	▲ **7**	3	2
Copper	ppm	ASTM D5185(m)	>5	● **49**	● 21	● 17
Tin	ppm	ASTM D5185(m)	>5	**3**	1	1
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

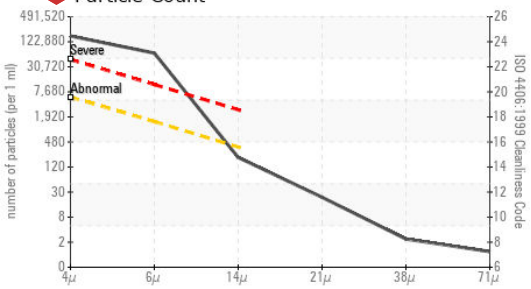
ADDITIVES		method	limit/base	current	history1	history2
Boron	ppm	ASTM D5185(m)	0	**<1**	0	<1
Barium	ppm	ASTM D5185(m)	0	**<1**	0	0
Molybdenum	ppm	ASTM D5185(m)	0	**0**	0	0
Manganese	ppm	ASTM D5185(m)		**0**	0	0
Magnesium	ppm	ASTM D5185(m)	5	**0**	<1	<1
Calcium	ppm	ASTM D5185(m)	50	**53**	54	53
Phosphorus	ppm	ASTM D5185(m)	330	**346**	383	373
Zinc	ppm	ASTM D5185(m)	410	**442**	449	426
Sulfur	ppm	ASTM D5185(m)	2700	**5662**	5872	5725
Lithium	ppm	ASTM D5185(m)		**<1**	<1	<1

CONTAMINANTS		method	limit/base	current	history1	history2
Silicon	ppm	ASTM D5185(m)	>5	▲ **16**	▲ 11	▲ 10
Sodium	ppm	ASTM D5185(m)	>5	**<1**	0	0
Potassium	ppm	ASTM D5185(m)	>20	**0**	0	<1
Water	%	ASTM D6304*	>0.005	**0.001**	0.00	0.002
ppm Water	ppm	ASTM D6304*	>50	**13**	0.00	15.1

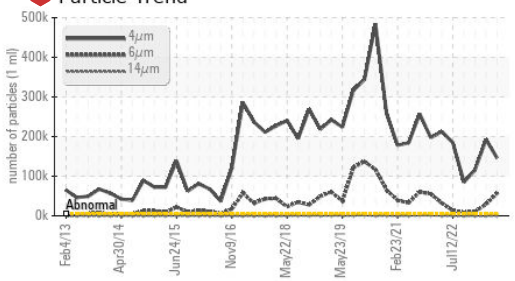
FLUID CLEANLINESS		method	limit/base	current	history1	history2
Particles >4µm		ASTM D7647	>5000	● **145640**	● 192904	● 115573
Particles >6µm		ASTM D7647	>1300	● **56692**	● 29098	● 10339
Particles >14µm		ASTM D7647	>320	**180**	237	106
Particles >21µm		ASTM D7647	>80	**20**	32	20
Particles >38µm		ASTM D7647	>20	**2**	2	1
Particles >71µm		ASTM D7647	>4	**1**	0	0
Oil Cleanliness		ISO 4406 (c)	>19/17/15	● **24/23/15**	● 25/22/15	● 24/21/14

OIL ANALYSIS REPORT

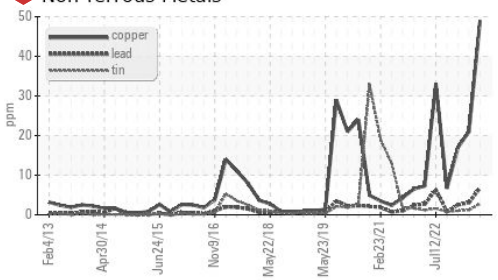
Particle Count



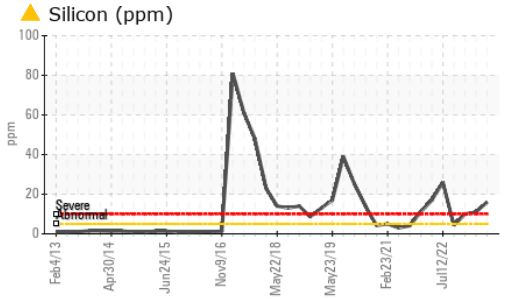
Particle Trend



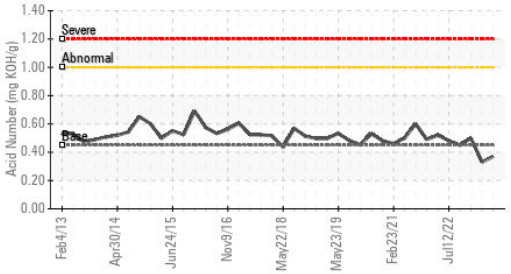
Non-ferrous Metals



Silicon (ppm)



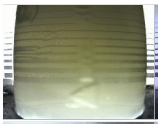
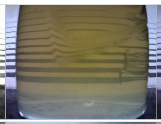
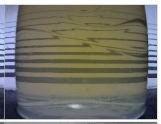
Acid Number



FLUID DEGRADATION		method	limit/base	current	history1	history2
Acid Number (AN)	mg KOH/g	ASTM D974*	0.45	**0.37**	0.33	0.50

VISUAL		method	limit/base	current	history1	history2
White Metal	scalar	Visual*	NONE	**NONE**	VLITE	NONE
Yellow Metal	scalar	Visual*	NONE	**NONE**	NONE	NONE
Precipitate	scalar	Visual*	NONE	**NONE**	NONE	NONE
Silt	scalar	Visual*	NONE	**NONE**	VLITE	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*	>0.005	**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)	46	**43.6**	43.3	43.4

SAMPLE IMAGES	method	limit/base	current	history1	history2
Color					
Bottom					
PrtFilter			*no image*	*no image*	*no image*

ISO 17025:2017 Accredited Laboratory

Laboratory : WearCheck - C8-1175 Appleby Line, Burlington, ON L7L 5H9
Sample No. : WC0744592 **Recieved** : 13 Dec 2023
Lab Number : 02602853 **Diagnosed** : 18 Dec 2023
Unique Number : 5695938 **Diagnostician** : Kevin Marson
Test Package : IND 2 (Additional Tests: A-FERR, DR-FERR, FILTERPATCH)

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.

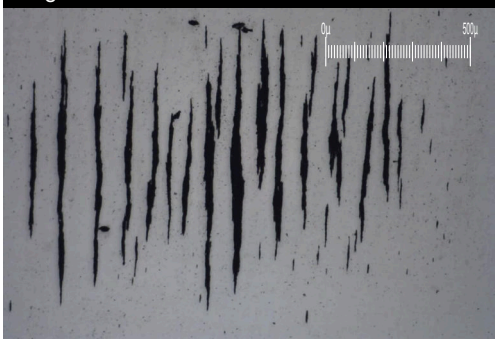
Bruce Power - Bruce A PdM
P.O.Box 1540, 177 Tie Road,, RM-222 U2 Column 2N11 615`
Tiverton, ON
CA N0G 2T0
Contact: Andrew Roffey
andrew.roffey@brucepower.com
T: (519)361-2673 x:17186
F:

FERROGRAPHY REPORT

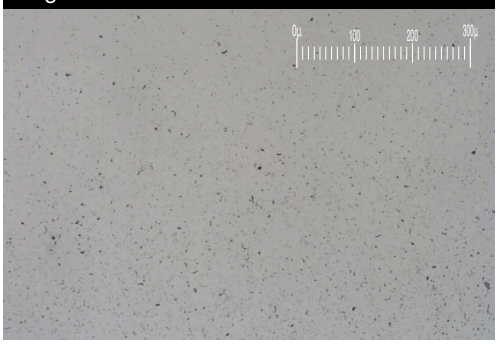
Area
BRUCE B/5/43230
Machine Id
5-43230-P4-P OB Brg Drn
Component
Outboard Bearing
Fluid
ESSO NUTO H ISO 46 (--- GAL)

Magn: 200x Illum: BC

Magn: 50x Illum: RW



Magn: 100x Illum: RW

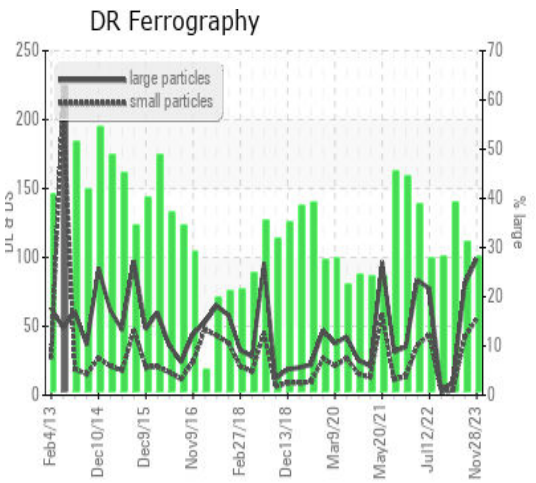


DR-FERROGRAPHY		method	limit/base	current	history1	history2
Large Particles		DR-Ferr*		**98.8**	80.6	8.5
Small Particles		DR-Ferr*		**55.3**	42.2	3.7
Total Particles		DR-Ferr*	>---	**154.1**	122.8	12.2
Large Particles Percentage	%	DR-Ferr*		**28.2**	31.3	39.3
Severity Index		DR-Ferr*		**4298**	3095	41

FERROGRAPHY		method	limit/base	current	history1	history2
Ferrous Rubbing	Scale 0-10	ASTM D7684*		**5**	4	
Ferrous Sliding	Scale 0-10	ASTM D7684*				
Ferrous Cutting	Scale 0-10	ASTM D7684*			1	
Ferrous Rolling	Scale 0-10	ASTM D7684*		**2**	2	
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**	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*				
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*		**2**	2	

WEAR

Copper ppm levels are severe. Lead ppm levels are abnormal. Bearing wear is indicated. The ferrography results are normal indicating no abnormal wear in the system.



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