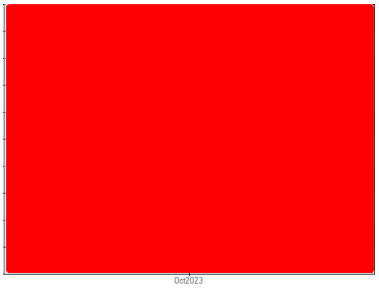
LIEBHERR

PROBLEM SUMMARY

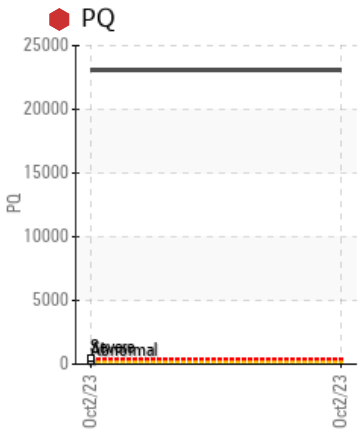
Sample Rating Trend

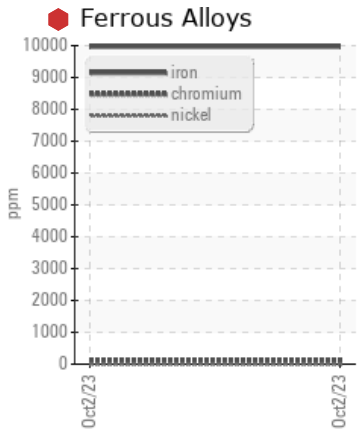


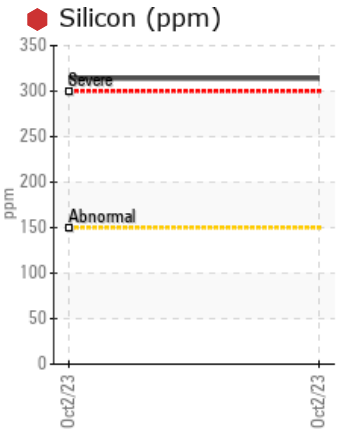
WEAR

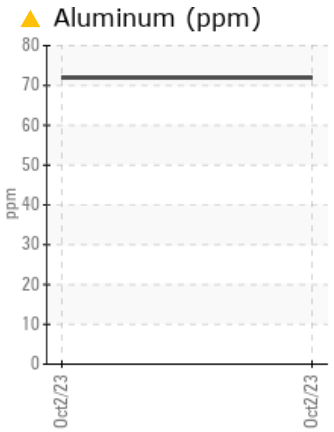
Machine Id
RAT M ROLLER
Component
Upper Grease
Fluid
NOT GIVEN (--- GAL)

COMPONENT CONDITION SUMMARY









RECOMMENDATION

We advise that you check all areas where dirt can enter the system. We recommend that you re-grease the component if this has not already been done. We advise that you purge the component thoroughly with grease. We recommend an early resample to monitor this condition. Analytical Ferrography: Results suggest excessive debris contamination has caused significant amounts of wear. Dark wear debris and some thermal discoloration suggest there may be overheating occurring, suggest checking with thermography after grease purge has been completed to ensure proper working order. Suggest checking for tolerance/clearance issues - the amount of ferrous debris present (visual, PQ, and metals analysis) suggests there may have been enough wear to create tolerance gaps that require inspection and repairs.

PROBLEMATIC TEST RESULTS

Sample Status				SEVERE	---	---
PQ		ASTM D8184	>200	23095	---	---
Iron	ppm	ASTM D5185m	>250	9970	---	---
Chromium	ppm	ASTM D5185m	>10	102	---	---
Ferrous Rubbing	Scale 0-10	*ASTM D7684		5		
Ferrous Sliding	Scale 0-10	*ASTM D7684		7		
Ferrous Black Oxides	Scale 0-10	*ASTM D7684		4		
Other	Scale 0-10	*ASTM D7684		7		
Aluminum	ppm	ASTM D5185m		72	---	---
Silicon	ppm	ASTM D5185m	>150	314	---	---

Customer Id: LIEGIL
Sample No.: LH05968191
Lab Number: 05968191
Test Package: GRS 3

To manage this report scan the QR code

To discuss the diagnosis or test data:
Aaron Black +1
aaron.black@wearcheck.com

To change component or sample information:
Customer Service +1 1-800-237-1369
customerservice@wearcheck.com

RECOMMENDED ACTIONS

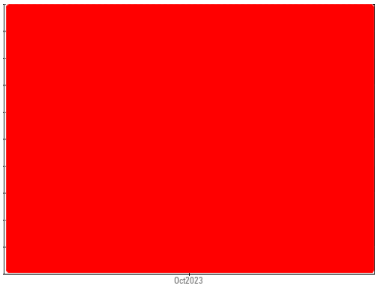
Action	Status	Date	Done By	Description
Flush System	---	---	?	We advise that you flush the component thoroughly before re-filling with grease.
Resample	---	---	?	We recommend an early resample to monitor this condition.
Check Dirt Access	---	---	?	We advise that you check all areas where dirt can enter the system.

HISTORICAL DIAGNOSIS

LIEBHERR

GREASE ANALYSIS

Sample Rating Trend



WEAR

Machine Id
RAT M ROLLER
Component
Upper Grease
Fluid
NOT GIVEN (--- GAL)

DIAGNOSIS

Recommendation

We advise that you check all areas where dirt can enter the system. We recommend that you re-grease the component if this has not already been done. We advise that you purge the component thoroughly with grease. We recommend an early resample to monitor this condition. Analytical Ferrography: Results suggest excessive debris contamination has caused significant amounts of wear. Dark wear debris and some thermal discoloration suggest there may be overheating occurring, suggest checking with thermography after grease purge has been completed to ensure proper working order. Suggest checking for tolerance/clearance issues - the amount of ferrous debris present (visual, PQ, and metals analysis) suggests there may have been enough wear to create tolerance gaps that require inspection and repairs.

Wear

Chromium and iron ppm levels are severe. Wear particle analysis indicates that the ferrous sliding particles are severe. PQ levels are severe. Wear particle analysis indicates that the ferrous black oxides particles are abnormal. Aluminum ppm levels are abnormal. Wear particle analysis indicates that the ferrous rubbing particles are abnormal. The very high ferrous density (PQ) index indicates that severe wear is occurring.

Grease Condition

The grease is no longer serviceable due to the presence of contaminants.

Contaminants

High concentration of dirt present in the grease. High amount of ingressed dirt has caused abrasive wear to the component.

SAMPLE INFORMATION		method	limit/base	current	history1	history2
Sample Number		Client Info		**LH05968191**	---	---
Sample Date		Client Info		**02 Oct 2023**	---	---
Machine Age	hrs	Client Info		**0**	---	---
Grease Age	hrs	Client Info		**0**	---	---
Grease Serviced		Client Info		**N/A**	---	---
Sample Status				**SEVERE**	---	---

WEAR METALS		method	limit/base	current	history1	history2
PQ		ASTM D8184	>200	**23095**	---	---
Iron	ppm	ASTM D5185m	>250	**9970**	---	---
Chromium	ppm	ASTM D5185m	>10	**102**	---	---
Nickel	ppm	ASTM D5185m	>5	**0**	---	---
Cadmium	ppm	ASTM D5185m		**0**	---	---
Titanium	ppm	ASTM D5185m		**6**	---	---
Vanadium	ppm	ASTM D5185m		**2**	---	---
Lead	ppm	ASTM D5185m	>25	**4**	---	---
Copper	ppm	ASTM D5185m	>75	**30**	---	---
Tin	ppm	ASTM D5185m	>5	**0**	---	---
Silver	ppm	ASTM D5185m	>5	**<1**	---	---

ADDITIVES		method	limit/base	current	history1	history2
Boron	ppm	ASTM D5185m		**894**	---	---
Magnesium	ppm	ASTM D5185m		**66**	---	---
Manganese	ppm	ASTM D5185m		**112**	---	---
Molybdenum	ppm	ASTM D5185m		**10124**	---	---
Phosphorus	ppm	ASTM D5185m		**182**	---	---
Zinc	ppm	ASTM D5185m		**300**	---	---

THICKENER/SOAP		method	limit/base	current	history1	history2
Aluminum	ppm	ASTM D5185m		**72**	---	---
Barium	ppm	ASTM D5185m		**32**	---	---
Calcium	ppm	ASTM D5185m		**10710**	---	---
Sodium	ppm	ASTM D5185m		**98**	---	---
Lithium	ppm	ASTM D5185m		**872**	---	---
Sulfur	ppm	ASTM D5185m		**26000**	---	---

CONTAMINANTS		method	limit/base	current	history1	history2
Silicon	ppm	ASTM D5185m	>150	**314**	---	---
Potassium	ppm	ASTM D5185m		**36**	---	---
Water	%	ASTM D6304	>0.1	**0.295**	---	---
ppm Water	ppm	ASTM D6304	>1000	**2959.1**	---	---

GREASE CONDITION		method	limit/base	current	history1	history2
Grease Color		*Visual		**Grey**	---	---
Texture		*In-house		**Short fiber**	---	---
NLGI Consistency	NLGI Scale	*SKF Method		**1-2**	---	---

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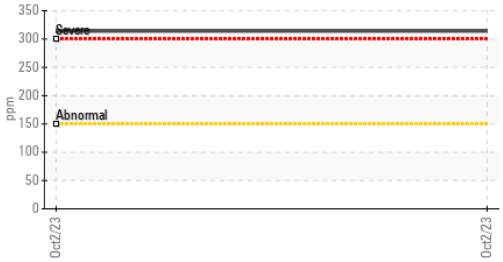
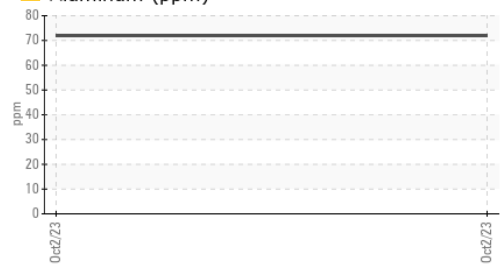
GREASE ANALYSIS

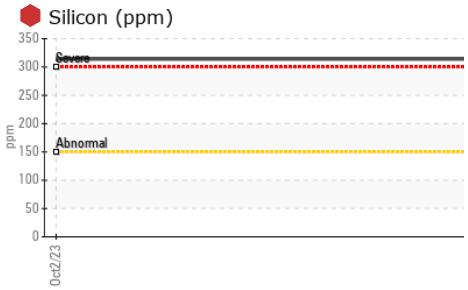
Silicon (ppm)



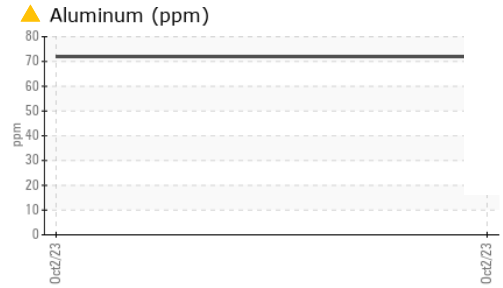
Aluminum (ppm)



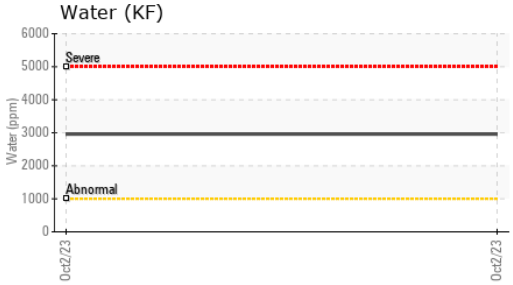
Silicon (ppm)



Aluminum (ppm)



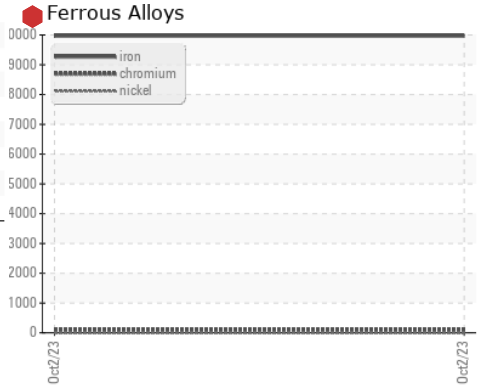
Water (KF)



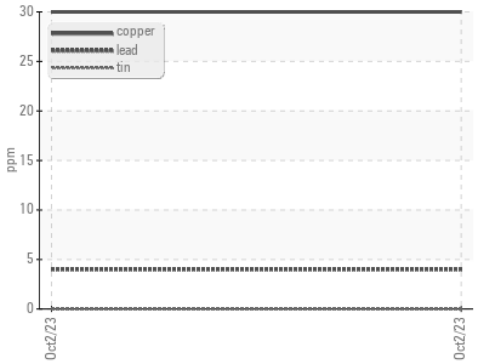
SAMPLE IMAGES	method	limit/base	current	history1	history2
Color				*no image*	*no image*
Bottom				*no image*	*no image*

GRAPHS

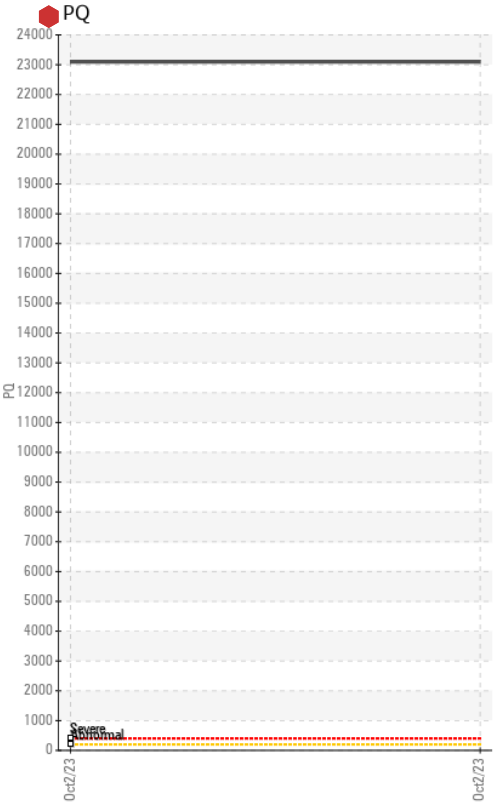
Ferrous Alloys



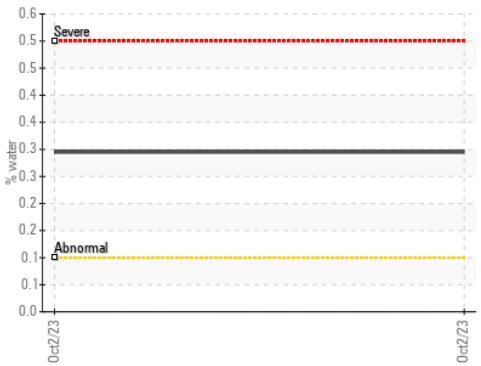
Non-ferrous Metals



PQ



Water



Certificate L2367

Laboratory : WearCheck USA - 501 Madison Ave., Cary, NC 27513
Sample No. : LH05968191 **Received** : 03 Oct 2023
Lab Number : 05968191 **Diagnosed** : 23 Oct 2023
Unique Number : 10674742 **Diagnostician** : Aaron Black
Test Package : GRS 3 (Additional Tests: SCREEN)

To discuss this sample report, contact Customer Service at 1-800-237-1369.
** - Denotes test methods that are outside of the ISO 17025 scope of accreditation.*
Statements of conformity to specifications are based on the simple acceptance decision rule (JCGM 106:2012)

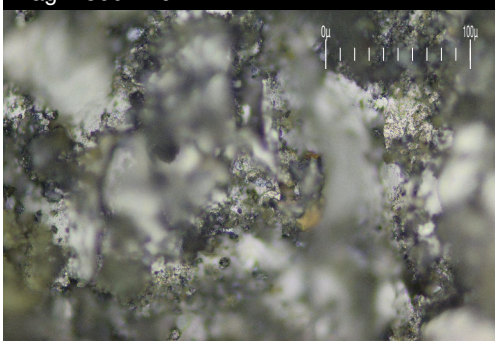
LIEBHERR MINING EQUIPMENT CO
5800 S DOUGLAS HWY
GILLETTE, WY
US 82718
Contact: DUSTIN HARDEN
DUSTIN.HARDEN@LIEBHERR.COM
T: (307)660-8763
F:

LIEBHERR

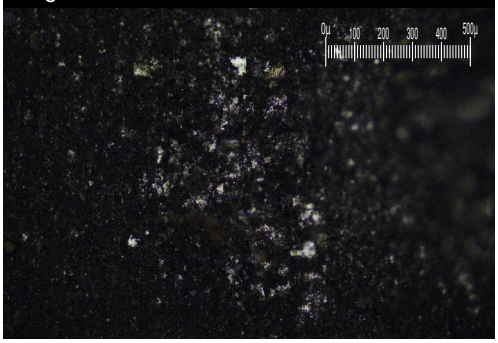
FERROGRAPHY REPORT

Machine Id
RAT M ROLLER
Component
Upper Grease
Fluid
NOT GIVEN (--- GAL)

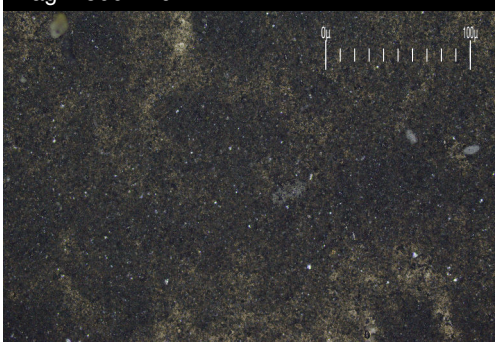
Magn: 500x Illum: RW



Magn: 100x Illum: RW



Magn: 500x Illum: RW



Magn: 500x Illum: RW

FERROGRAPHY		method	limit/base	current	history1	history2
Ferrous Rubbing	Scale 0-10	*ASTM D7684		5		
Ferrous Sliding	Scale 0-10	*ASTM D7684		7		
Ferrous Cutting	Scale 0-10	*ASTM D7684				
Ferrous Rolling	Scale 0-10	*ASTM D7684				
Ferrous Break-in	Scale 0-10	*ASTM D7684				
Ferrous Spheres	Scale 0-10	*ASTM D7684				
Ferrous Black Oxides	Scale 0-10	*ASTM D7684		4		
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				
Fibres	Scale 0-10	*ASTM D7684				
Spheres	Scale 0-10	*ASTM D7684				
Other	Scale 0-10	*ASTM D7684		7		

WEAR

Chromium and iron ppm levels are severe. Wear particle analysis indicates that the ferrous sliding particles are severe. PQ levels are severe. Wear particle analysis indicates that the ferrous black oxides particles are abnormal. Aluminum ppm levels are abnormal. Wear particle analysis indicates that the ferrous rubbing particles are abnormal. The very high ferrous density (PQ) index indicates that severe wear is occurring.

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