

## **OIL ANALYSIS REPORT**

#### Sample Rating Trend



# FREIGHTLINER 2-138

Component

**Diesel Engine** 

**DIESEL ENGINE OIL SAE 15W40 (46 QTS)** 

#### DIAGNOSIS

#### Recommendation

We advise that you check for possible coolant leak. Check for low coolant level. Oil and filter change at the time of sampling has been noted. We recommend an early resample to monitor this condition.

#### Wear

The copper level is abnormal. In the absence of other significant wear metals, suspect copper due to sources other than wear (i.e. cooling core).

#### Contamination

Sodium and/or potassium levels are high.

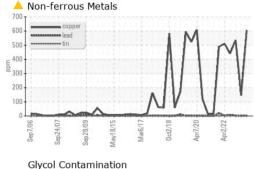
#### Fluid Condition

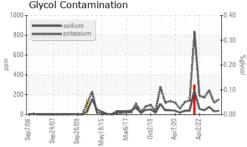
The BN result indicates that there is suitable alkalinity remaining in the oil.

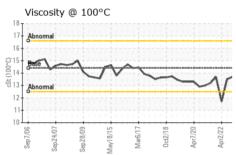
SAMPLE INFORMATION   method   limit/base   current   history1   history2			52006 Sep20	07 Sep2009 May2015	Mar2017 Oct2018 Apr2020	Apr2022	
Sample Date         Client Info         20 Dec 2022         21 Oct 2022         28 Aug 2022           Machine Age         hrs         Client Info         39132         38721         38333           Oil Age         hrs         Client Info         809         378         763           Oil Changed         Client Info         Changed         Changed         Changed         Changed         ABNORMAL         ABNORMAL <t< th=""><th>SAMPLE INFORT</th><th>MATION</th><th>method</th><th>limit/base</th><th>current</th><th>history1</th><th>history2</th></t<>	SAMPLE INFORT	MATION	method	limit/base	current	history1	history2
Machine Age         hrs         Client Info         39132         38721         38333           Oil Age         hrs         Client Info         809         378         763           Oil Changed         Client Info         Changed         Changed         Changed         Changed         Changed         Changed         Changed         ABNORMAL         ABNORMAL<	Sample Number		Client Info		WC0337176	WC0723809	WC0337182
Oil Age         hrs         Client Info         809         378         763           Oil Changed         Changed <td>Sample Date</td> <td></td> <td>Client Info</td> <td></td> <th>20 Dec 2022</th> <td>21 Oct 2022</td> <td>28 Aug 2022</td>	Sample Date		Client Info		20 Dec 2022	21 Oct 2022	28 Aug 2022
Oil Changed Sample Status         Client Info         Changed ABNORMAL ABNORMA	Machine Age	hrs	Client Info		39132	38721	38333
Sample Status	Oil Age	hrs	Client Info		809	378	763
CONTAMINATION         method         limit/base         current         history1         history2           Fuel         WC Method         >5         <1.0	Oil Changed		Client Info		Changed	Changed	Changed
Fuel	Sample Status				ABNORMAL	ABNORMAL	ABNORMAL
Water         WC Method         >0.2         NEG         NEG         NEG           WEAR METALS         method         limit/base         current         history1         history2           Iron         ppm         ASTM D5186m         >100         16         10         13           Chromium         ppm         ASTM D5186m         >20         <1	CONTAMINATIO	N	method	limit/base	current	history1	history2
WEAR METALS         method         limit/base         current         history1         history2           Iron         ppm         ASTM D5185m         >100         16         10         13           Chromium         ppm         ASTM D5185m         >20         <1	Fuel		WC Method	>5	<1.0	<1.0	<1.0
Iron	Water		WC Method	>0.2	NEG	NEG	NEG
Chromium         ppm         ASTM D5185m         >20         <1	WEAR METALS		method	limit/base	current	history1	history2
Nickel         ppm         ASTM D5185m         >2         <1         0         <1           Titanium         ppm         ASTM D5185m         >2         <1	Iron	ppm	ASTM D5185m	>100	16	10	13
Titanium         ppm         ASTM D5185m         >2         <1         <1         <1           Silver         ppm         ASTM D5185m         >2         <1	Chromium	ppm	ASTM D5185m	>20	<1	<1	<1
Silver         ppm         ASTM D5185m         >2         <1         0         0           Aluminum         ppm         ASTM D5185m         >25         1         1         <1           Lead         ppm         ASTM D5185m         >40         2         <1         8           Copper         ppm         ASTM D5185m         >330         605         146         442           Tin         ppm         ASTM D5185m         >15         <1         <1         1           Vanadium         ppm         ASTM D5185m         >15         <1         <1         <1           Cadmium         ppm         ASTM D5185m         0         0         0         0           ADDITIVES         method         limit/base         current         history1         history2           Boron         ppm         ASTM D5185m         250         15         26         23           Barium         ppm         ASTM D5185m         10         0         <1         0           Molybdenum         ppm         ASTM D5185m         10         0         47         37         43           Mangaesium         ppm         ASTM D5185m         100 <th< td=""><td>Nickel</td><td>ppm</td><td>ASTM D5185m</td><td>&gt;2</td><th>&lt;1</th><td>0</td><td>&lt;1</td></th<>	Nickel	ppm	ASTM D5185m	>2	<1	0	<1
Aluminum         ppm         ASTM D5185m         >25         1         1         <1           Lead         ppm         ASTM D5185m         >40         2         <1	Titanium	ppm	ASTM D5185m	>2	<1	<1	<1
Lead         ppm         ASTM D5185m         >40         2         <1         8           Copper         ppm         ASTM D5185m         >330         ▲ 605         146         ▲ 442           Tin         ppm         ASTM D5185m         >15         <1         <1         1           Vanadium         ppm         ASTM D5185m         >15         <1         <1         <1           Cadmium         ppm         ASTM D5185m         0         0         0         0           ADDITIVES         method         limit/base         current         history1         history2           Boron         ppm         ASTM D5185m         250         15         26         23           Barium         ppm         ASTM D5185m         10         0         <1         0           Molybdenum         ppm         ASTM D5185m         100         47         37         43           Manganese         ppm         ASTM D5185m         100         47         37         43           Manganesium         ppm         ASTM D5185m         300         894         795         858           Calcium         ppm         ASTM D5185m         150         88	Silver	ppm	ASTM D5185m	>2	<1	0	0
Copper         ppm         ASTM D5185m         >330         ▲ 605         146         ▲ 442           Tin         ppm         ASTM D5185m         >15         <1	Aluminum	ppm	ASTM D5185m	>25	1	1	<1
Tin ppm ASTM D5185m > 15 <1 <1 <1 <1 <1 Cadmium ppm ASTM D5185m	Lead	ppm	ASTM D5185m	>40	2	<1	8
Vanadium         ppm         ASTM D5185m         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1         <1 <td>Copper</td> <td>ppm</td> <td>ASTM D5185m</td> <td>&gt;330</td> <th><b>605</b></th> <td>146</td> <td><u>442</u></td>	Copper	ppm	ASTM D5185m	>330	<b>605</b>	146	<u>442</u>
Cadmium         ppm         ASTM D5185m         0         0         0           ADDITIVES         method         limit/base         current         history1         history2           Boron         ppm         ASTM D5185m         250         15         26         23           Barium         ppm         ASTM D5185m         10         0         <1	Tin	ppm	ASTM D5185m	>15	<1	<1	1
ADDITIVES         method         limit/base         current         history1         history2           Boron         ppm         ASTM D5185m         250         15         26         23           Barium         ppm         ASTM D5185m         10         0         <1	Vanadium	ppm	ASTM D5185m		<1	<1	<1
Boron         ppm         ASTM D5185m         250         15         26         23           Barium         ppm         ASTM D5185m         10         0         <1         0           Molybdenum         ppm         ASTM D5185m         100         47         37         43           Manganese         ppm         ASTM D5185m         100         47         37         43           Magnesium         ppm         ASTM D5185m         450         894         795         858           Calcium         ppm         ASTM D5185m         3000         998         1097         1119           Phosphorus         ppm         ASTM D5185m         1150         886         831         964           Zinc         ppm         ASTM D5185m         1350         1081         992         1068           Sulfur         ppm         ASTM D5185m         2250         3787         3215         3535           CONTAMINANTS         method         limit/base         current         history1         history2           Solium         ppm         ASTM D5185m         >25         3         4         5           Sodium         ppm         ASTM D5185m <t< td=""><td>Cadmium</td><td>ppm</td><td>ASTM D5185m</td><td></td><th>0</th><td>0</td><td>0</td></t<>	Cadmium	ppm	ASTM D5185m		0	0	0
Barium         ppm         ASTM D5185m         10         0         <1	ADDITIVES		method	limit/base	current	history1	history2
Molybdenum         ppm         ASTM D5185m         100         47         37         43           Manganese         ppm         ASTM D5185m         450         894         795         858           Calcium         ppm         ASTM D5185m         3000         998         1097         1119           Phosphorus         ppm         ASTM D5185m         3000         998         1097         1119           Phosphorus         ppm         ASTM D5185m         1150         886         831         964           Zinc         ppm         ASTM D5185m         1350         1081         992         1068           Sulfur         ppm         ASTM D5185m         4250         3787         3215         3535           CONTAMINANTS         method         limit/base         current         history1         history2           Silicon         ppm         ASTM D5185m         >25         3         4         5           Sodium         ppm         ASTM D5185m         >25         38         32         44           Potassium         ppm         ASTM D5185m         >20         154         119         173           Glycol         "ASTM D5185m	Boron	ppm	ASTM D5185m	250	15	26	23
Manganese         ppm         ASTM D5185m         <1         <1         <1           Magnesium         ppm         ASTM D5185m         450         894         795         858           Calcium         ppm         ASTM D5185m         3000         998         1097         1119           Phosphorus         ppm         ASTM D5185m         1150         886         831         964           Zinc         ppm         ASTM D5185m         1350         1081         992         1068           Sulfur         ppm         ASTM D5185m         4250         3787         3215         3535           CONTAMINANTS         method         limit/base         current         history1         history2           Silicon          ppm         ASTM D5185m         >25         3         4         5           Sodium         ppm         ASTM D5185m         >158         38         32         44           Potassium         ppm         ASTM D5185m         >20         154         119         173           Glycol         *ASTM D5185m         >20         NEG         NEG         NEG           INFRA-RED         method         limit/base         current         <	Barium	ppm	ASTM D5185m	10	0	<1	0
Magnesium         ppm         ASTM D5185m         450         894         795         858           Calcium         ppm         ASTM D5185m         3000         998         1097         1119           Phosphorus         ppm         ASTM D5185m         1150         886         831         964           Zinc         ppm         ASTM D5185m         1350         1081         992         1068           Sulfur         ppm         ASTM D5185m         4250         3787         3215         3535           CONTAMINANTS         method         limit/base         current         history1         history2           Silicon         ppm         ASTM D5185m         >25         3         4         5           Sodium         ppm         ASTM D5185m         >158         38         32         44           Potassium         ppm         ASTM D5185m         >20         154         119         173           Glycol         %         *ASTM D5185m         >20         NEG         NEG         NEG           INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7624	Molybdenum	ppm	ASTM D5185m	100	47	37	43
Calcium         ppm         ASTM D5185m         3000         998         1097         1119           Phosphorus         ppm         ASTM D5185m         1150         886         831         964           Zinc         ppm         ASTM D5185m         1350         1081         992         1068           Sulfur         ppm         ASTM D5185m         4250         3787         3215         3535           CONTAMINANTS         method         limit/base         current         history1         history2           Silicon         ppm         ASTM D5185m         >25         3         4         5           Sodium         ppm         ASTM D5185m         >158         38         32         44           Potassium         ppm         ASTM D5185m         >20         154         119         173           Glycol         %         *ASTM D2982         NEG         NEG         NEG           INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         >3         0.2         0.1         0.1           Nitration         Abs/cm         *ASTM D7415	•	ppm	ASTM D5185m		<1	<1	<1
Phosphorus         ppm         ASTM D5185m         1150         886         831         964           Zinc         ppm         ASTM D5185m         1350         1081         992         1068           Sulfur         ppm         ASTM D5185m         4250         3787         3215         3535           CONTAMINANTS         method         limit/base         current         history1         history2           Silicon         ppm         ASTM D5185m         >25         3         4         5           Sodium         ppm         ASTM D5185m         >25         38         32         44           Potassium         ppm         ASTM D5185m         >20         ▲ 154         ▲ 119         ▲ 173           Glycol         %         *ASTM D2982         NEG         NEG         NEG           INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         >3         0.2         0.1         0.1           Nitration         Abs/cm         *ASTM D7624         >20         10.8         9.7         11.0           Sulfation         Abs/.1mm         *ASTM D7415	Magnesium	ppm	ASTM D5185m	450	894	795	858
Zinc         ppm         ASTM D5185m         1350         1081         992         1068           Sulfur         ppm         ASTM D5185m         4250         3787         3215         3535           CONTAMINANTS         method         limit/base         current         history1         history2           Silicon         ppm         ASTM D5185m         >25         3         4         5           Sodium         ppm         ASTM D5185m         >158         38         32         44           Potassium         ppm         ASTM D5185m         >20         154         119         173           Glycol         %         *ASTM D5185m         >20         NEG         NEG         NEG           INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         >3         0.2         0.1         0.1           Nitration         Abs/cm         *ASTM D7624         >20         10.8         9.7         11.0           Sulfation         Abs/.1mm         *ASTM D7415         >30         19.9         20.8         21.4           FLUID DEGRADATION         method	Calcium	ppm	ASTM D5185m	3000	998	1097	1119
Sulfur         ppm         ASTM D5185m         4250         3787         3215         3535           CONTAMINANTS         method         limit/base         current         history1         history2           Silicon         ppm         ASTM D5185m         >25         3         4         5           Sodium         ppm         ASTM D5185m         >158         38         32         44           Potassium         ppm         ASTM D5185m         >20         154         119         173           Glycol         %         *ASTM D2982         NEG         NEG         NEG           INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         >3         0.2         0.1         0.1           Nitration         Abs/cm         *ASTM D7624         >20         10.8         9.7         11.0           Sulfation         Abs/.1mm         *ASTM D7415         >30         19.9         20.8         21.4           FLUID DEGRADATION         method         limit/base         current         history1         history2           Oxidation         Abs/.1mm         *ASTM D7414	Phosphorus	ppm	ASTM D5185m	1150	886	831	964
CONTAMINANTS         method         limit/base         current         history1         history2           Silicon         ppm         ASTM D5185m         >25         3         4         5           Sodium         ppm         ASTM D5185m         >158         38         32         44           Potassium         ppm         ASTM D5185m         >20         154         119         173           Glycol         %         *ASTM D2982         NEG         NEG         NEG           INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         >3         0.2         0.1         0.1           Nitration         Abs/cm         *ASTM D7624         >20         10.8         9.7         11.0           Sulfation         Abs/.1mm         *ASTM D7415         >30         19.9         20.8         21.4           FLUID DEGRADATION         method         limit/base         current         history1         history2           Oxidation         Abs/.1mm         *ASTM D7414         >25         18.3         16.2         17.6	Zinc	ppm	ASTM D5185m	1350	1081	992	1068
Silicon         ppm         ASTM D5185m         >25         3         4         5           Sodium         ppm         ASTM D5185m         >158         38         32         44           Potassium         ppm         ASTM D5185m         >20         154         119         173           Glycol         %         *ASTM D2982         NEG         NEG         NEG           INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         >3         0.2         0.1         0.1           Nitration         Abs/cm         *ASTM D7624         >20         10.8         9.7         11.0           Sulfation         Abs/.1mm         *ASTM D7415         >30         19.9         20.8         21.4           FLUID DEGRADATION         method         limit/base         current         history1         history2           Oxidation         Abs/.1mm         *ASTM D7414         >25         18.3         16.2         17.6	Sulfur	ppm	ASTM D5185m	4250	3787	3215	3535
Sodium         ppm         ASTM D5185m         >158         38         32         44           Potassium         ppm         ASTM D5185m         >20         ▲ 154         ▲ 119         ▲ 173           Glycol         %         *ASTM D2982         NEG         NEG         NEG           INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         >3         0.2         0.1         0.1           Nitration         Abs/cm         *ASTM D7624         >20         10.8         9.7         11.0           Sulfation         Abs/.1mm         *ASTM D7415         >30         19.9         20.8         21.4           FLUID DEGRADATION         method         limit/base         current         history1         history2           Oxidation         Abs/.1mm         *ASTM D7414         >25         18.3         16.2         17.6	CONTAMINANTS	3	method	limit/base	current	history1	history2
Potassium         ppm         ASTM D5185m         >20         ▲ 154         ▲ 119         ▲ 173           Glycol         %         *ASTM D2982         NEG         NEG         NEG           INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         >3         0.2         0.1         0.1           Nitration         Abs/cm         *ASTM D7624         >20         10.8         9.7         11.0           Sulfation         Abs/.1mm         *ASTM D7415         >30         19.9         20.8         21.4           FLUID DEGRADATION         method         limit/base         current         history1         history2           Oxidation         Abs/.1mm         *ASTM D7414         >25         18.3         16.2         17.6	Silicon	ppm	ASTM D5185m	>25	3	4	5
NEG   NEG	Sodium	ppm	ASTM D5185m	>158	38	32	44
INFRA-RED	Potassium	ppm	ASTM D5185m	>20	<u> </u>	<u> </u>	<u></u> 173
Soot %         %         *ASTM D7844 >3         0.2         0.1         0.1           Nitration         Abs/cm         *ASTM D7624 >20         10.8         9.7         11.0           Sulfation         Abs/.1mm         *ASTM D7415 >30         19.9         20.8         21.4           FLUID DEGRADATION method limit/base current history1         history2           Oxidation         Abs/.1mm         *ASTM D7414 >25         18.3         16.2         17.6	Glycol	%	*ASTM D2982		NEG	NEG	NEG
Nitration         Abs/cm         *ASTM D7624         >20         10.8         9.7         11.0           Sulfation         Abs/.1mm         *ASTM D7415         >30         19.9         20.8         21.4           FLUID DEGRADATION         method         limit/base         current         history1         history2           Oxidation         Abs/.1mm         *ASTM D7414         >25         18.3         16.2         17.6	INFRA-RED		method	limit/base	current	history1	history2
Sulfation         Abs/.1mm         *ASTM D7415         >30         19.9         20.8         21.4           FLUID DEGRADATION         method         limit/base         current         history1         history2           Oxidation         Abs/.1mm         *ASTM D7414         >25         18.3         16.2         17.6	Soot %	%	*ASTM D7844	>3	0.2	0.1	0.1
Sulfation         Abs/.1mm         *ASTM D7415         >30         19.9         20.8         21.4           FLUID DEGRADATION         method         limit/base         current         history1         history2           Oxidation         Abs/.1mm         *ASTM D7414         >25         18.3         16.2         17.6	Nitration	Abs/cm	*ASTM D7624	>20	10.8	9.7	11.0
Oxidation Abs/.1mm *ASTM D7414 >25 <b>18.3</b> 16.2 17.6	Sulfation	Abs/.1mm	*ASTM D7415	>30			
	FLUID DEGRADA	ATION	method	limit/base	current	history1	history2
	Oxidation	Abs/.1mm	*ASTM D7414	>25	18.3	16.2	17.6
	Base Number (BN)	mg KOH/g	ASTM D2896	8.5	7.6	10.6	9.6

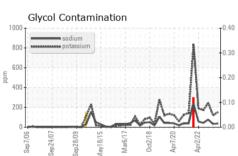


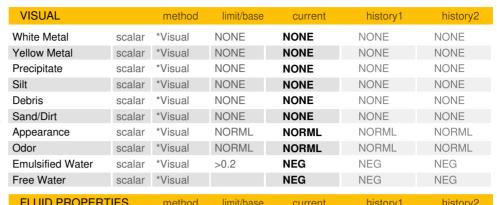
### **OIL ANALYSIS REPORT**







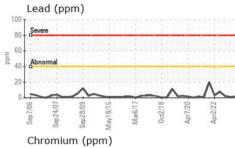


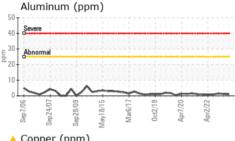


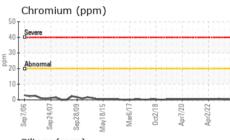
1 LOID I HOI LIH		motriod	IIIIII Daoo	Odiront	Thotoly I	motory
Visc @ 100°C	cSt	ASTM D445	14.4	13.7	14.0	13.7

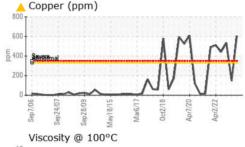
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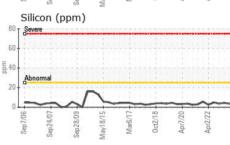
**GRAPHS** 

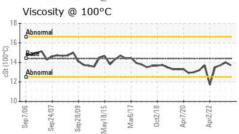


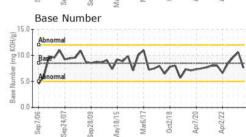
















Certificate L2367

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

: WC0337176 : 05746000 : 10305604

: WearCheck USA - 501 Madison Ave., Cary, NC 27513 Received Diagnosed

: 23 Jan 2023 : 24 Jan 2023 : Jonathan Hester

Diagnostician Test Package : MOB 1 ( Additional Tests: Glycol, TBN ) 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) **ALASKA WEST EXPRESS** 

1095 SANDURI STREET FAIRBANKS, AK US 99701

Contact: TOM DOUTHIT tdouthit@lynden.com T: (907)452-4355 F: (907)328-1956

Report Id: ALAFAI [WUSCAR] 05746000 (Generated: 11/29/2023 13:27:41) Rev: 1

Contact/Location: TOM DOUTHIT - ALAFAI