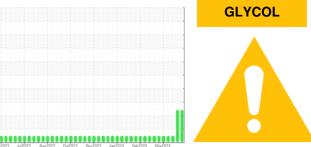


OIL ANALYSIS REPORT

Sample Rating Trend



Machine Id

E-2 (S/N 1144675)

Biogas Engine

MAHLER Q8 Mahler G8 SAE 40 (--- GAL)

DIAGNOSIS

Recommendation

We advise that you check for possible coolant leak. Check for low coolant level. We recommend an early resample to monitor this condition.

All component wear rates are normal.

Contamination

Sodium and/or potassium levels remain high.

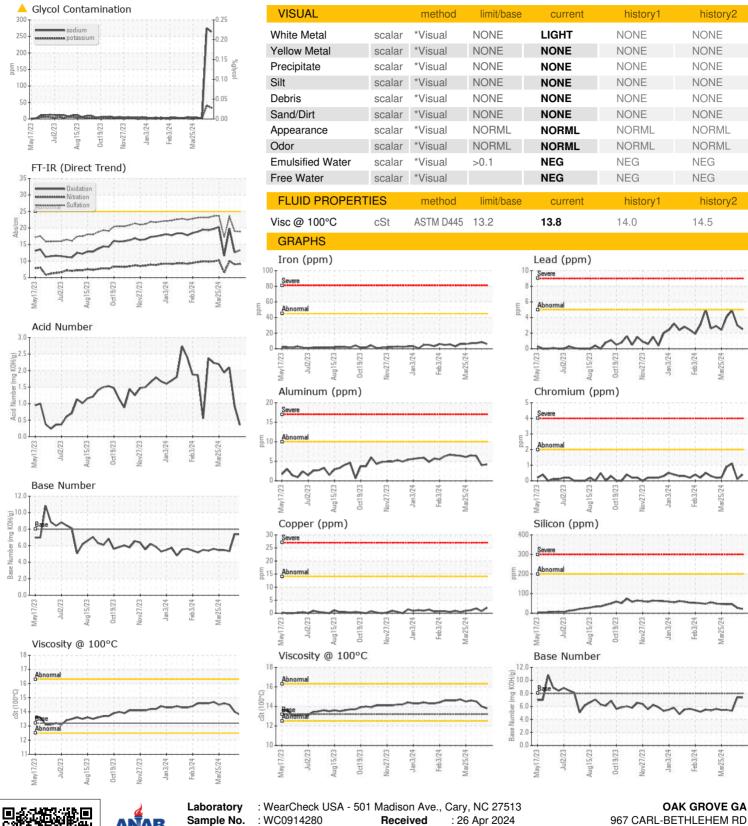
Fluid Condition

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

Sample Number Client Info WC0914280 WC0914283 WC0914276 Sample Date Client Info 22 Apr 2024 17 Apr 2024 08 Apr 2024 09 Apr 2024 08 Apr 2024 09 Apr 2024 08 Apr 2024 08 Apr 2024 09 Apr 2024 09 Apr 2024 09 ABNORMAL AbnORMAL	n/2023 Jul2023 Aug/2023 Oct2023 Nov2022 Jan/2024 Feb/2024 Mn/2024							
Sample Date	SAMPLE INFORM	MATION	method	limit/base	current	history1	history2	
Machine Age hrs Client Info 0 12464 12404 5688 5688 ABNORIMAL ABNORIM	Sample Number		Client Info		WC0914280	WC0914283	WC0914276	
Oil Age hrs Client Info 0 34 5668 Oil Changed Sample Status Client Info Not Changed ABNORMAL Changed ABNORMAL Not Changed ABNORMAL ABNORMAL Not Changed ABNORMAL ABN	Sample Date		Client Info		22 Apr 2024	17 Apr 2024	08 Apr 2024	
Oil Changed Sample Status	Machine Age	hrs	Client Info		0	12464	12404	
ABNORMAL ABNORMAL ABNORMAL CONTAMINATION method limit/base current history1 history2	Oil Age	hrs	Client Info		0	34	5668	
Fuel	Oil Changed		Client Info		Not Changd	Changed	Not Changd	
Fuel	Sample Status				ABNORMAL	ABNORMAL	NORMAL	
Water WC Method >0.1 NEG NEG NEG Glycol WC Method NEG NEG NEG WEAR METALS method limit/base current history1 history2 Iron ppm ASTM DS185m >45 6 8 7 Chromium ppm ASTM DS185m >2 -1 -1 1 Nickel ppm ASTM DS185m >2 0 0 1 Titanium ppm ASTM DS185m >2 0 0 -1 Silver ppm ASTM DS185m >10 4 4 6 Copper ppm ASTM DS185m >10 4 4 6 Copper ppm ASTM DS185m >13 2 4 6 Vanadium ppm ASTM DS185m 0 0 -1 -1 ADDITIVES method limit/base current history1 history2 Boron	CONTAMINATION	١	method	limit/base	current	history1	history2	
Glycol WC Method NEG NEG NEG WEAR METALS method limit/base current history1 history2 Iron ppm ASTM D5185m >45 6 8 7 Chromium ppm ASTM D5185m >2 41 <1 1 Nickel ppm ASTM D5185m >2 0 0 1 Silver ppm ASTM D5185m >5 0 0 0 Aluminum ppm ASTM D5185m >5 0 0 0 Aluminum ppm ASTM D5185m >5 2 3 5 Copper ppm ASTM D5185m >13 2 4 6 Copper ppm ASTM D5185m 0 0 <1 <1 Vanadium ppm ASTM D5185m 0 0 <1 <1 ADDITIVES method limit/base current history1 history2	Fuel		WC Method	>4.0	<1.0	<1.0	<1.0	
WEAR METALS method limit/base current history1 history2 Iron ppm ASTM D5185m >45 6 8 7 Chromium ppm ASTM D5185m >2 <1	Water		WC Method	>0.1	NEG	NEG	NEG	
Iron	Glycol		WC Method		NEG	NEG	NEG	
Chromium ppm ASTM D5185m >2 -1 <1	WEAR METALS		method	limit/base	current	history1	history2	
Nickel	Iron	ppm	ASTM D5185m	>45	6	8	7	
Titanium ppm ASTM D5185m <1 0 <1 Silver ppm ASTM D5185m >5 0 0 0 Aluminum ppm ASTM D5185m >10 4 4 6 Lead ppm ASTM D5185m >5 2 3 5 Copper ppm ASTM D5185m >13 2 4 6 Vanadium ppm ASTM D5185m 0 0 <1	Chromium	ppm	ASTM D5185m	>2	<1	<1	1	
Silver	Nickel	ppm	ASTM D5185m	>2	0	0	1	
Aluminum ppm ASTM D5185m >10 4 4 6 Lead ppm ASTM D5185m >5 2 3 5 Copper ppm ASTM D5185m >14 2 <1	Titanium	ppm	ASTM D5185m		<1	0	<1	
Lead ppm ASTM D5185m >5 2 3 5 Copper ppm ASTM D5185m >14 2 <1 2 Tin ppm ASTM D5185m >13 2 4 6 Vanadium ppm ASTM D5185m 0 0 <1 <1 ADDITIVES method limit/base current history1 history2 Boron ppm ASTM D5185m 0 3 0 Barium ppm ASTM D5185m 0 2 0 Barium ppm ASTM D5185m 2 2 2 2 Magnesium ppm ASTM D5185m -1 -1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Silver	ppm	ASTM D5185m	>5	0	0	0	
Copper ppm ASTM D5185m >14 2 <1 2 Tin ppm ASTM D5185m >13 2 4 6 Vanadium ppm ASTM D5185m 0 0 <1	Aluminum	ppm	ASTM D5185m	>10	4	4	6	
Tin ppm ASTM D5185m >13	Lead	ppm	ASTM D5185m	>5	2	3	5	
Vanadium ppm ASTM D5185m 0 0 <1 Cadmium ppm ASTM D5185m 0 <1 <1 ADDITIVES method limit/base current history1 history2 Boron ppm ASTM D5185m 0 3 0 Barium ppm ASTM D5185m 0 2 0 Molybdenum ppm ASTM D5185m 2 2 2 Manganese ppm ASTM D5185m 7 10 10 Calcium ppm ASTM D5185m 2354 2421 2725 Phosphorus ppm ASTM D5185m 2464 517 567 Sulfur ppm ASTM D5185m 2795 2902 3282 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >200 22 27 46 Sodium ppm ASTM D5185m >20 34 </td <td>Copper</td> <td>ppm</td> <td>ASTM D5185m</td> <td>>14</td> <th>2</th> <td><1</td> <td>2</td>	Copper	ppm	ASTM D5185m	>14	2	<1	2	
Cadmium ppm ASTM D5185m 0 <1 <1 ADDITIVES method limit/base current history1 history2 Boron ppm ASTM D5185m 0 3 0 Barium ppm ASTM D5185m 0 2 0 Molybdenum ppm ASTM D5185m 2 2 2 2 Manganese ppm ASTM D5185m 7 10 <td>Tin</td> <td>ppm</td> <td>ASTM D5185m</td> <td>>13</td> <th>2</th> <td>4</td> <td>6</td>	Tin	ppm	ASTM D5185m	>13	2	4	6	
ADDITIVES	Vanadium	ppm	ASTM D5185m		0	0	<1	
Boron	Cadmium	ppm	ASTM D5185m		0	<1	<1	
Barium ppm ASTM D5185m 0 2 0 Molybdenum ppm ASTM D5185m 2 2 2 Manganese ppm ASTM D5185m 7 10 10 Calcium ppm ASTM D5185m 7 10 10 Calcium ppm ASTM D5185m 2354 2421 2725 Phosphorus ppm ASTM D5185m 417 430 503 Zinc ppm ASTM D5185m 464 517 567 Sulfur ppm ASTM D5185m 2795 2902 3282 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >200 22 27 46 Sodium ppm ASTM D5185m >20 34 41 3 INFRA-RED method limit/base current history1 history2 Soot % *ASTM D7844 0 0 </th <th>ADDITIVES</th> <th></th> <th>method</th> <th>limit/base</th> <th>current</th> <th>history1</th> <th>history2</th>	ADDITIVES		method	limit/base	current	history1	history2	
Molybdenum ppm ASTM D5185m 2 2 2 Manganese ppm ASTM D5185m <1 <1 1 Magnesium ppm ASTM D5185m 7 10 10 Calcium ppm ASTM D5185m 2354 2421 2725 Phosphorus ppm ASTM D5185m 417 430 503 Zinc ppm ASTM D5185m 464 517 567 Sulfur ppm ASTM D5185m 2795 2902 3282 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >200 22 27 46 Sodium ppm ASTM D5185m >200 22 27 46 Sodium ppm ASTM D5185m >20 34 41 3 INFRA-RED method limit/base current history1 history2 Soot % % *ASTM	Boron	ppm	ASTM D5185m		0	3	0	
Manganese ppm ASTM D5185m <1 <1 1 Magnesium ppm ASTM D5185m 7 10 10 Calcium ppm ASTM D5185m 2354 2421 2725 Phosphorus ppm ASTM D5185m 417 430 503 Zinc ppm ASTM D5185m 464 517 567 Sulfur ppm ASTM D5185m 2795 2902 3282 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >200 22 27 46 Sodium ppm ASTM D5185m >20 264 275 2 Potassium ppm ASTM D5185m >20 34 41 3 INFRA-RED method limit/base current history1 history2 Soot % * ASTM D7624 >20 9.1 9.0 10.0 Sulfation Abs/:nm	Barium	ppm	ASTM D5185m		0	2	0	
Magnesium ppm ASTM D5185m 7 10 10 Calcium ppm ASTM D5185m 2354 2421 2725 Phosphorus ppm ASTM D5185m 417 430 503 Zinc ppm ASTM D5185m 464 517 567 Sulfur ppm ASTM D5185m 2795 2902 3282 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >200 22 27 46 Sodium ppm ASTM D5185m >20 264 ≥275 2 Potassium ppm ASTM D5185m >20 34 41 3 INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0 0 0 Nitration Abs/:1mm *ASTM D7624 >20 9.1 9.0 10.0 Sulfati	Molybdenum	ppm	ASTM D5185m		2	2	2	
Calcium ppm ASTM D5185m 2354 2421 2725 Phosphorus ppm ASTM D5185m 417 430 503 Zinc ppm ASTM D5185m 464 517 567 Sulfur ppm ASTM D5185m 2795 2902 3282 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >200 22 27 46 Sodium ppm ASTM D5185m >20 264 ≥75 2 Potassium ppm ASTM D5185m >20 34 41 3 INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0 0 0 Nitration Abs/.mm *ASTM D7415 >30 18.9 19.0 10.0 Sulfation Abs/.1mm *ASTM D7414 >25 13.3 12.6 19.8 <tr< td=""><td>Manganese</td><td>ppm</td><td>ASTM D5185m</td><td></td><th><1</th><td><1</td><td>1</td></tr<>	Manganese	ppm	ASTM D5185m		<1	<1	1	
Phosphorus ppm ASTM D5185m 417 430 503 Zinc ppm ASTM D5185m 464 517 567 Sulfur ppm ASTM D5185m 2795 2902 3282 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >200 22 27 46 Sodium ppm ASTM D5185m >20 264 275 2 Potassium ppm ASTM D5185m >20 34 41 3 INFRA-RED method limit/base current history1 history2 Soot % "ASTM D7844 0 0 0 Nitration Abs/cm "ASTM D7624 >20 9.1 9.0 10.0 Sulfation Abs/.1mm "ASTM D7415 >30 18.9 19.0 23.4 FLUID DEGRADATION method limit/base current history1 history2	Magnesium	ppm	ASTM D5185m		7	10	10	
Phosphorus ppm ASTM D5185m 417 430 503 Zinc ppm ASTM D5185m 464 517 567 Sulfur ppm ASTM D5185m 2795 2902 3282 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >200 22 27 46 Sodium ppm ASTM D5185m ≥20 264 ≥75 2 Potassium ppm ASTM D5185m >20 34 41 3 INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0 0 0 Nitration Abs/cm *ASTM D7624 >20 9.1 9.0 10.0 Sulfation Abs/.1mm *ASTM D7415 >30 18.9 19.0 23.4 FLUID DEGRADATION method limit/base current history1 history2 <td>Calcium</td> <td>ppm</td> <td>ASTM D5185m</td> <td></td> <th>2354</th> <td>2421</td> <td>2725</td>	Calcium	ppm	ASTM D5185m		2354	2421	2725	
Zinc ppm ASTM D5185m 464 517 567 Sulfur ppm ASTM D5185m 2795 2902 3282 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >200 22 27 46 Sodium ppm ASTM D5185m ≥20 264 ≥75 2 Potassium ppm ASTM D5185m >20 34 41 3 INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0 0 0 Nitration Abs/cm *ASTM D7624 >20 9.1 9.0 10.0 Sulfation Abs/.1mm *ASTM D7415 >30 18.9 19.0 23.4 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 13.3 1	Phosphorus		ASTM D5185m		417	430	503	
CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >200 22 27 46 Sodium ppm ASTM D5185m ▲ 264 ▲ 275 2 Potassium ppm ASTM D5185m >20 ▲ 34 ▲ 41 3 INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0 0 0 Nitration Abs/cm *ASTM D7624 >20 9.1 9.0 10.0 Sulfation Abs/.1mm *ASTM D7415 >30 18.9 19.0 23.4 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 13.3 12.6 19.8 Acid Number (AN) mg KOH/g ASTM D8045 0.35 0.92 2.09			ASTM D5185m		464	517	567	
Silicon ppm ASTM D5185m >200 22 27 46 Sodium ppm ASTM D5185m ▲ 264 ▲ 275 2 Potassium ppm ASTM D5185m >20 ▲ 34 ▲ 41 3 INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0 0 0 Nitration Abs/cm *ASTM D7624 >20 9.1 9.0 10.0 Sulfation Abs/.1mm *ASTM D7415 >30 18.9 19.0 23.4 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 13.3 12.6 19.8 Acid Number (AN) mg KOH/g ASTM D8045 0.35 0.92 2.09	Sulfur	ppm	ASTM D5185m		2795	2902	3282	
Sodium ppm ASTM D5185m ▲ 264 ▲ 275 2 Potassium ppm ASTM D5185m >20 ▲ 34 ▲ 41 3 INFRA-RED method limit/base current history1 history2 Soot % *ASTM D7844 0 0 0 Nitration Abs/cm *ASTM D7624 >20 9.1 9.0 10.0 Sulfation Abs/.1mm *ASTM D7415 >30 18.9 19.0 23.4 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 13.3 12.6 19.8 Acid Number (AN) mg KOH/g ASTM D8045 0.35 0.92 2.09	CONTAMINANTS		method	limit/base	current	history1	history2	
Sodium ppm ASTM D5185m ▲ 264 ▲ 275 2 Potassium ppm ASTM D5185m >20 ▲ 34 ▲ 41 3 INFRA-RED method limit/base current history1 history2 Soot % *ASTM D7844 0 0 0 Nitration Abs/cm *ASTM D7624 >20 9.1 9.0 10.0 Sulfation Abs/.1mm *ASTM D7415 >30 18.9 19.0 23.4 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 13.3 12.6 19.8 Acid Number (AN) mg KOH/g ASTM D8045 0.35 0.92 2.09	Silicon	ppm	ASTM D5185m	>200	22	27	46	
Potassium ppm ASTM D5185m >20 ▲ 34 ▲ 41 3 INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0 0 0 Nitration Abs/cm *ASTM D7624 >20 9.1 9.0 10.0 Sulfation Abs/.1mm *ASTM D7415 >30 18.9 19.0 23.4 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 13.3 12.6 19.8 Acid Number (AN) mg KOH/g ASTM D8045 0.35 0.92 2.09	Sodium		ASTM D5185m		<u>^</u> 264	<u>^</u> 275	2	
Soot % *ASTM D7844 0 0 0 Nitration Abs/cm *ASTM D7624 >20 9.1 9.0 10.0 Sulfation Abs/.1mm *ASTM D7415 >30 18.9 19.0 23.4 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 13.3 12.6 19.8 Acid Number (AN) mg KOH/g ASTM D8045 0.35 0.92 2.09	Potassium	ppm	ASTM D5185m	>20	△ 34	▲ 41	3	
Nitration Abs/cm *ASTM D7624 >20 9.1 9.0 10.0 Sulfation Abs/.1mm *ASTM D7415 >30 18.9 19.0 23.4 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 13.3 12.6 19.8 Acid Number (AN) mg KOH/g ASTM D8045 0.35 0.92 2.09	INFRA-RED		method	limit/base	current	history1	history2	
Nitration Abs/cm *ASTM D7624 >20 9.1 9.0 10.0 Sulfation Abs/.1mm *ASTM D7415 >30 18.9 19.0 23.4 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 13.3 12.6 19.8 Acid Number (AN) mg KOH/g ASTM D8045 0.35 0.92 2.09	Soot %	%	*ASTM D7844		0	0	0	
Sulfation Abs/.1mm *ASTM D7415 >30 18.9 19.0 23.4 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 13.3 12.6 19.8 Acid Number (AN) mg KOH/g ASTM D8045 0.35 0.92 2.09				>20				
Oxidation Abs/.1mm *ASTM D7414 >25 13.3 12.6 19.8 Acid Number (AN) mg KOH/g ASTM D8045 0.35 0.92 2.09								
Acid Number (AN) mg KOH/g ASTM D8045 0.35 0.92 2.09	FLUID DEGRADA	TION	method	limit/base	current	history1	history2	
Acid Number (AN) mg KOH/g ASTM D8045 0.35 0.92 2.09	Oxidation	Abs/.1mm	*ASTM D7414	>25	13.3	12.6	19.8	
	Base Number (BN)	mg KOH/g	ASTM D2896	8.0	7.36	7.40	5.32	



OIL ANALYSIS REPORT







Certificate 12367

Sample No. Lab Number : 06161694 Unique Number : 10997117

: WC0914280 Test Package : MOB 2

Received : 26 Apr 2024 **Tested** : 29 Apr 2024

Diagnosed : 01 May 2024 - Jonathan Hester

To discuss this sample report, contact Customer Service at 1-800-237-1369.

 st - Denotes test methods that are outside of the ISO 17025 scope of accreditation.

Contact: ZACK GRAVES zack.graves@cubedistrictenergy.com T: (470)596-8000

Statements of conformity to specifications are based on the simple acceptance decision rule (JCGM 106:2012) Report Id: OAKWINGA [WUSCAR] 06161694 (Generated: 05/02/2024 12:50:41) Rev: 1

Contact/Location: ZACK GRAVES - OAKWINGA

WINDER, GA

US 30680

F: