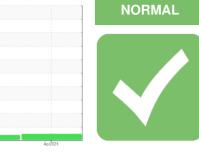


OIL ANALYSIS REPORT

Sample Rating Trend



K

CATERPILLAR 431 Component Diesel Engine

DIESEL ENGINE OIL SAE 15W40 (--- GAL)

SAMPLE INFORMATION metho

DIAGNOSIS

Recommendation

Resample at the next service interval to monitor.

Machine Id

Wear

All component wear rates are normal.

Contamination

There is no indication of any contamination in the oil.

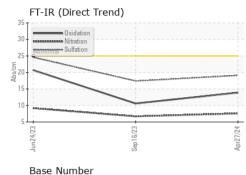
Fluid Condition

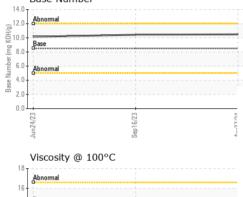
The BN result indicates that there is suitable alkalinity remaining in the oil. The condition of the oil is suitable for further service.

SAMPLE INFORM		method	limit/base	current	history1	history2
Sample Number		Client Info		RW0004730	RW0004785	RW0004417
Sample Date		Client Info		27 Apr 2024	16 Sep 2023	24 Jun 2023
Machine Age	hrs	Client Info		3845	3487	3162
Oil Age	hrs	Client Info		358	325	398
Oil Changed		Client Info		Changed	Changed	Changed
Sample Status				NORMAL	ATTENTION	ATTENTION
CONTAMINATION	N	method	limit/base	current	history1	history2
Fuel		WC Method	>5	<1.0	<1.0	0.9
Water		WC Method	>0.2	NEG	NEG	NEG
Glycol		WC Method		NEG	NEG	NEG
WEAR METALS		method	limit/base	current	history1	history2
Iron	ppm	ASTM D5185m	>100	12	15	35
Chromium		ASTM D5185m	>20	0	<1	1
Nickel	ppm	ASTM D5185m	>20	0	0	0
Titanium	ppm ppm	ASTM D5185m		0	0	<1
Silver		ASTM D5185m	>2	0	0	0
Aluminum	ppm	ASTM D5185m	>25	6	5	14
	ppm				5 1	
Lead	ppm	ASTM D5185m	>40	0 4		5
Copper	ppm	ASTM D5185m		-	15	82
Tin	ppm	ASTM D5185m	>15	<1	<1	2
Vanadium	ppm	ASTM D5185m		0	0	0
Cadmium	ppm	ASTM D5185m		0	0	0
ADDITIVES		method	limit/base	current	history1	history2
ADDITIVES Boron	ppm	method ASTM D5185m	limit/base 250	current 6	history1 4	history2 32
	ppm ppm					
Boron		ASTM D5185m	250	6	4	32
Boron Barium	ppm	ASTM D5185m ASTM D5185m	250 10	6 <1	4 0	32 0
Boron Barium Molybdenum	ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m	250 10	6 <1 64	4 0 35	32 0 44
Boron Barium Molybdenum Manganese	ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m	250 10 100	6 <1 64 <1	4 0 35 <1	32 0 44 <1
Boron Barium Molybdenum Manganese Magnesium	ppm ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m	250 10 100 450	6 <1 64 <1 887	4 0 35 <1 465	32 0 44 <1 534
Boron Barium Molybdenum Manganese Magnesium Calcium	ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m	250 10 100 450 3000	6 <1 64 <1 887 1248	4 0 35 <1 465 1766	32 0 44 <1 534 1837
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus	ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m	250 10 100 450 3000 1150	6 <1 64 <1 887 1248 1082	4 0 35 <1 465 1766 961	32 0 44 <1 534 1837 984
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc	ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m	250 10 100 450 3000 1150 1350	6 <1 64 <1 887 1248 1082 1248	4 0 35 <1 465 1766 961 1113	32 0 44 <1 534 1837 984 1206
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur	ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m	250 10 100 450 3000 1150 1350 4250	6 <1 64 <1 887 1248 1082 1248 3554	4 0 35 <1 465 1766 961 1113 3216	32 0 44 <1 534 1837 984 1206 3552
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS	ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m	250 10 100 450 3000 1150 1350 4250 limit/base >25	6 <1 64 <1 887 1248 1082 1248 3554 current	4 0 35 <1 465 1766 961 1113 3216 history1	32 0 44 <1 534 1837 984 1206 3552 history2
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon	ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m method	250 10 100 450 3000 1150 1350 4250 kimit/base >25 >158	6 <1 64 <1 887 1248 1082 1248 3554 <u>current</u> 4	4 0 35 <1 465 1766 961 1113 3216 history1 4	32 0 44 <1 534 1837 984 1206 3552 history2 6
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium	ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m	250 10 100 450 3000 1150 1350 4250 kimit/base >25 >158	6 <1 64 <1 887 1248 1082 1248 3554 <u>current</u> 4 1	4 0 35 <1 465 1766 961 1113 3216 history1 4 <1	32 0 44 <1 534 1837 984 1206 3552 history2 6 3
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium Potassium INFRA-RED	ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m	250 10 100 450 3000 1150 1350 4250 25 >25 >158 >20 limit/base	6 <1 64 <1 887 1248 1082 1248 3554 <i>current</i> 4 1 0 <i>current</i>	4 0 35 <1 465 1766 961 1113 3216 history1 4 <1 <1 <1 history1	32 0 44 <1 534 1837 984 1206 3552 history2 6 3 3 <1 <i>history2</i>
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium Potassium INFRA-RED Soot %	ppm	ASTM D5185m ASTM D5185m	250 10 100 450 3000 1150 1350 4250 Iimit/base >25 >158 >20 Iimit/base >3	6 <1 64 <1 887 1248 1082 1248 3554 <u>current</u> 4 1 0 <u>current</u> 0.8	4 0 35 <1 465 1766 961 1113 3216 history1 4 <1 <1 <1 <1 0.8	32 0 44 <1 534 1837 984 1206 3552 history2 6 3 3 <1 history2 1
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium Potassium INFRA-RED Soot % Nitration	ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m	250 10 100 450 3000 1150 1350 4250 i mit/base >25 >158 >20 i mit/base >3 >20	6 <1 64 <1 887 1248 1082 1248 3554 <i>current</i> 4 1 0 <i>current</i> 0.8 7.6	4 0 35 <1 465 1766 961 1113 3216 history1 4 <1 <1 <1 history1 0.8 6.7	32 0 44 <1 534 1837 984 1206 3552 history2 6 3 3 <1 <i>history2</i>
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium Potassium INFRA-RED Soot % Nitration Sulfation	ppm ppm ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m	250 10 100 450 3000 1150 1350 4250 Imit/base >25 >158 >20 Imit/base >3 >20	6 <1 64 <1 887 1248 1082 1248 3554 <u>current</u> 4 1 0 <u>current</u> 0.8 7.6 19.1	4 0 35 <1 465 1766 961 1113 3216 history1 4 <1 <1 <1 0.8 6.7 17.4	32 0 44 <1 534 1837 984 1206 3552 history2 6 3 3 <1 history2 1 9.2 24.6
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium Potassium INFRA-RED Soot % Nitration Sulfation	ppm ppm ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D7844 *ASTM D7624 *ASTM D7415	250 10 100 450 3000 1150 1350 4250 imit/base >25 >158 >20 imit/base >3 >20 >30	6 <1 64 <1 887 1248 1082 1248 3554 <i>current</i> 4 1 0 <i>current</i> 0.8 7.6 19.1 <i>current</i>	4 0 35 <1 465 1766 961 1113 3216 history1 4 <1 <1 <1 history1 0.8 6.7 17.4 history1	32 0 44 <1 534 1837 984 1206 3552 history2 6 3 3 552 history2 1 9.2 24.6 history2
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium Potassium INFRA-RED Soot % Nitration Sulfation FLUID DEGRADA Oxidation	ppm ppm ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D7844 *ASTM D7624 *ASTM D7415	250 10 100 450 3000 1150 1350 4250 imit/base >25 >158 >20 imit/base >3 >20 30 imit/base	6 <1 64 <1 887 1248 1082 1248 3554 <i>current</i> 4 1 0 <i>current</i> 0.8 7.6 19.1 <i>current</i> 13.9	4 0 35 <1 465 1766 961 1113 3216 history1 4 <1 <1 <1 0.8 6.7 17.4 history1 10.6	32 0 44 <1 534 1837 984 1206 3552 history2 6 3 3552 history2 1 9.2 24.6 history2 20.7
Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium Potassium INFRA-RED Soot % Nitration Sulfation	ppm ppm ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D7844 *ASTM D7624 *ASTM D7415	250 10 100 450 3000 1150 1350 4250 limit/base >25 >158 >20 limit/base >3 >20 >30 limit/base	6 <1 64 <1 887 1248 1082 1248 3554 <i>current</i> 4 1 0 <i>current</i> 0.8 7.6 19.1 <i>current</i>	4 0 35 <1 465 1766 961 1113 3216 history1 4 <1 <1 <1 history1 0.8 6.7 17.4 history1	32 0 44 <1 534 1837 984 1206 3552 history2 6 3 3 552 history2 1 9.2 24.6 history2



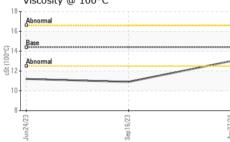
OIL ANALYSIS REPORT





Laboratory

Sample No.



VISUAL		method				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	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	>0.2	NEG	NEG	NEG
Free Water	scalar	*Visual		NEG	NEG	NEG
FLUID PROPERT	IES	method	limit/base	current	history1	history2
Visc @ 100°C	cSt	ASTM D445	14.4	13.0	0.9	11.2
GRAPHS						
Iron (ppm)			,- 10	Lead (ppm)		
Severe			8	Severe		
D-			edd			
0 - Abnormal			[€] 4	0 - Abnormal		
D			2			
4/23	6/23 +			4/23	8/23	
Jun24/23	Sep16/23		Apr27/24	Jun24/23	Sep16/23	
Aluminum (ppm)				Chromium (opm)	
0 Severe	1		5	Severe		
0 <mark>Abnormal</mark>			³	Abnormal		
0-			1	0-		
Jun24/23	Sep 16/23		Apr27/24	Jun 24/23	Sep 16/23	
	Sel		Ap			
Copper (ppm)				Silicon (ppm)	
			6	0		
D			E.4			
				Abnormal	1	
0			2	0		
	23		24 -		23	
Jun 24/23	Sep 16/23		Apr27/24	Jun24/23	Sep 16/23	
- Viscosity @ 100°C			1	Base Numbe		
			15.	0	•	
6			(b)HOX Base Number (mg KOH)	Abnormal		
Abnormal			E 10.	Base		
2			aquing 5.	D - Abnormal		
0-			3ase N			
	23		→ 0.	0++	23	
Jun24/23	Sep16/23		Apr27/24	Jun 24/23	Sep 16/23	
	60		<1	_	60	



Lab Number : 06 Diagnosed Unique Number : 11022270 : 13 May 2024 - Wes Davis US 49420 Test Package : MOB 2 Contact: DAN HALLACK KARL BUTCHER Certificate 12367 To discuss this sample report, contact Customer Service at 1-800-237-1369. shop@hallackcontracting.com * - Denotes test methods that are outside of the ISO 17025 scope of accreditation. T: (231)873-5081 Statements of conformity to specifications are based on the simple acceptance decision rule (JCGM 106:2012) F: (231)873-2889

Contact/Location: DAN HALLACK KARL BUTCHER - HALHAR

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