

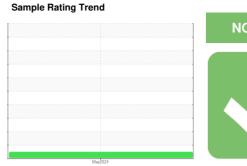
## **OIL ANALYSIS REPORT**

# **Engine Room**

# **CUMMINS Starboard Main Engine (S/N 46317418)**

**Starboard Marine Diesel** 

SHELL ROTELLA T4 15W40 (15 QTS)





## Recommendation

Resample at the next service interval to monitor. ( Customer Sample Comment: Pre-buy Survey Sample)

All component wear rates are normal.

## Contamination

There is no indication of any contamination in the

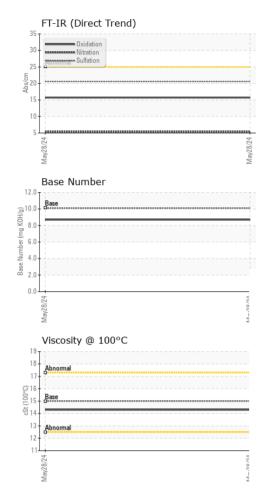
### Fluid Condition

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

Oil Age         hrs         Client Info         2             Oil Changed         Client Info         Not Changd             Sample Status         NORMAL             CONTAMINATION         method         limit/base         current         history1         history2           Fuel         WC Method         >5         <1.0             Water         WC Method         >0.1         NEG             Glycol         WC Method         NEG             WEAR METALS         method         limit/base         current         history1         history2           Iron         ppm         ASTM D5185m         >80         17             WEAR METALS         method         limit/base         current         history1         history2           Iron         ppm         ASTM D5185m         >80         17             WEAR METALS         method         limit/base         current         history1         history2           Iron         ppm         ASTM D5185m         >2         <1 </th <th></th> <th></th> <th></th> <th></th> <th>may2024</th> <th></th> <th></th>					may2024		
Sample Date   Client Info   28 May 2024       Machine Age   hrs   Client Info   1000	SAMPLE INFORM	MATION	method	limit/base	current	history1	history2
Machine Age   hrs   Client Info   1000	Sample Number		Client Info		WC0914828		
Oil Age         hrs         Client Info         2             Oil Changed         Client Info         Not Changd             Sample Status         NORMAL             CONTAMINATION         method         limit/base         current         history1         history2           Fuel         WC Method         >5         <1.0			Client Info		28 May 2024		
Oil Changed   Client Info   Not Changd   NORMAL     Not Changd   NORMAL     NORMAL     NORMAL     NORMAL     NORMAL     NORMAL     NORMAL   NORMAL     NORMAL     NORMAL   N	Machine Age	hrs	Client Info		_		
CONTAMINATION	Oil Age	hrs	Client Info		2		
CONTAMINATION	Oil Changed		Client Info		Not Changd		
Fuel   WC Method   S5   C1.0   C1.0	Sample Status				NORMAL		
Water         WC Method         >0.1         NEG             Glycol         WC Method         NEG             WEAR METALS         method         limit/base         current         history1         history2           Iron         ppm         ASTM D5185m         >80         17             Chromium         ppm         ASTM D5185m         >14         <1	CONTAMINATIO	N	method	limit/base	current	history1	history2
WEAR METALS	Fuel		WC Method	>5	<1.0		
WEAR METALS         method         limit/base         current         history1         history2           Iron         ppm         ASTM D5185m         >80         17             Chromium         ppm         ASTM D5185m         >14         <1	Water		WC Method	>0.1	NEG		
Iron	Glycol		WC Method		NEG		
Chromium         ppm         ASTM D5185m         >14         <1	WEAR METALS		method	limit/base	current	history1	history2
Nickel	Iron	ppm	ASTM D5185m	>80	17		
Titanium	Chromium	ppm	ASTM D5185m	>14	<1		
Silver	Nickel	ppm	ASTM D5185m	>3	<1		
Aluminum	Titanium	ppm	ASTM D5185m	>2	<1		
Lead	Silver	ppm	ASTM D5185m	>2	0		
Copper         ppm         ASTM D5185m         >25         2             Tin         ppm         ASTM D5185m         >2         <1	Aluminum	ppm	ASTM D5185m	>10	2		
Tin	Lead	ppm	ASTM D5185m	>11	<1		
Vanadium         ppm         ASTM D5185m         <1             Cadmium         ppm         ASTM D5185m         <1             ADDITIVES         method         limit/base         current         history1         history2           Boron         ppm         ASTM D5185m         266             Barium         ppm         ASTM D5185m         19             Molybdenum         ppm         ASTM D5185m         19             Manganese         ppm         ASTM D5185m         131             Magnesium         ppm         ASTM D5185m         2058             Phosphorus         ppm         ASTM D5185m         1037             Phosphorus         ppm         ASTM D5185m         1139             Sulfur         ppm         ASTM D5185m         3869             CONTAMINANTS         method         limit/base         current         history1         history2           Sodium         ppm         ASTM D5185m         >20	Copper	ppm	ASTM D5185m	>25	2		
Cadmium         ppm         ASTM D5185m         <1             ADDITIVES         method         limit/base         current         history1         history2           Boron         ppm         ASTM D5185m         266             Barium         ppm         ASTM D5185m         11             Molybdenum         ppm         ASTM D5185m         19             Manganese         ppm         ASTM D5185m         <1	Tin	ppm	ASTM D5185m	>2	<1		
ADDITIVES	Vanadium	ppm	ASTM D5185m		<1		
Boron	Cadmium	ppm	ASTM D5185m		<1		
Barium	ADDITIVES		method	limit/base	current	history1	history2
Molybdenum         ppm         ASTM D5185m         19             Manganese         ppm         ASTM D5185m         <1             Magnesium         ppm         ASTM D5185m         131             Calcium         ppm         ASTM D5185m         2058             Phosphorus         ppm         ASTM D5185m         1037             Zinc         ppm         ASTM D5185m         3869             Sulfur         ppm         ASTM D5185m         3869             CONTAMINANTS         method         limit/base         current         history1         history2           Silicon         ppm         ASTM D5185m         >25         7             Sodium         ppm         ASTM D5185m         >40         8             Potassium         ppm         ASTM D5185m         >20         7             INFRA-RED         method         limit/base         current         history1         history2           Soot %         %	Boron	ppm	ASTM D5185m		266		
Manganese         ppm         ASTM D5185m         <1             Magnesium         ppm         ASTM D5185m         131             Calcium         ppm         ASTM D5185m         2058             Phosphorus         ppm         ASTM D5185m         1037             Zinc         ppm         ASTM D5185m         1139             Sulfur         ppm         ASTM D5185m         3869             CONTAMINANTS         method         limit/base         current         history1         history2           Silicon         ppm         ASTM D5185m         >25         7             Sodium         ppm         ASTM D5185m         >40         8             Potassium         ppm         ASTM D5185m         >20         7             INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         0.1             Nitration         Abs/.1mm <td>Barium</td> <td>ppm</td> <td>ASTM D5185m</td> <td></td> <th>&lt;1</th> <td></td> <td></td>	Barium	ppm	ASTM D5185m		<1		
Magnesium         ppm         ASTM D5185m         131             Calcium         ppm         ASTM D5185m         2058             Phosphorus         ppm         ASTM D5185m         1037             Zinc         ppm         ASTM D5185m         1139             Sulfur         ppm         ASTM D5185m         3869             CONTAMINANTS         method         limit/base         current         history1         history2           Silicon         ppm         ASTM D5185m         >25         7             Sodium         ppm         ASTM D5185m         >40         8             Potassium         ppm         ASTM D5185m         >20         7             INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7624         >20         5.4             Sulfation         Abs/.1mm         *ASTM D7415         >30         20.6	Molybdenum	ppm	ASTM D5185m		19		
Calcium         ppm         ASTM D5185m         2058             Phosphorus         ppm         ASTM D5185m         1037             Zinc         ppm         ASTM D5185m         1139             Sulfur         ppm         ASTM D5185m         3869             CONTAMINANTS         method         limit/base         current         history1         history2           Silicon         ppm         ASTM D5185m         >25         7             Sodium         ppm         ASTM D5185m         >40         8             Potassium         ppm         ASTM D5185m         >20         7             INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         0.1             Nitration         Abs/:nm         *ASTM D7624         >20         5.4             Sulfation         Abs/:nm         *ASTM D7415         >30         20.6	Manganese	ppm	ASTM D5185m		<1		
Phosphorus         ppm         ASTM D5185m         1037             Zinc         ppm         ASTM D5185m         1139             Sulfur         ppm         ASTM D5185m         3869             CONTAMINANTS         method         limit/base         current         history1         history2           Silicon         ppm         ASTM D5185m         >25         7             Sodium         ppm         ASTM D5185m         >40         8             Potassium         ppm         ASTM D5185m         >20         7             INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         0.1             Nitration         Abs/cm         *ASTM D7624         >20         5.4             Sulfation         Abs/.1mm         *ASTM D7415         >30         20.6             FLUID DEGRADATION         method         limit/base         current         history1         history	Magnesium	ppm	ASTM D5185m		131		
Zinc         ppm         ASTM D5185m         1139             Sulfur         ppm         ASTM D5185m         3869             CONTAMINANTS         method         limit/base         current         history1         history2           Silicon         ppm         ASTM D5185m         >25         7             Sodium         ppm         ASTM D5185m         >40         8             Potassium         ppm         ASTM D5185m         >20         7             INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         0.1             Nitration         Abs/cm         *ASTM D7624         >20         5.4             Sulfation         Abs/.1mm         *ASTM D7415         >30         20.6             FLUID DEGRADATION         method         limit/base         current         history1         history2           Oxidation         Abs/.1mm         *ASTM D7414         >25         15.7 <t< td=""><td>Calcium</td><td>ppm</td><td>ASTM D5185m</td><td></td><th>2058</th><td></td><td></td></t<>	Calcium	ppm	ASTM D5185m		2058		
Sulfur         ppm         ASTM D5185m         3869             CONTAMINANTS         method         limit/base         current         history1         history2           Silicon         ppm         ASTM D5185m         >25         7             Sodium         ppm         ASTM D5185m         >40         8             Potassium         ppm         ASTM D5185m         >20         7             INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         0.1             Nitration         Abs/cm         *ASTM D7624         >20         5.4             Sulfation         Abs/.1mm         *ASTM D7415         >30         20.6             FLUID DEGRADATION         method         limit/base         current         history1         history2           Oxidation         Abs/.1mm         *ASTM D7414         >25         15.7	Phosphorus	ppm	ASTM D5185m		1037		
CONTAMINANTS         method         limit/base         current         history1         history2           Silicon         ppm         ASTM D5185m         >25         7             Sodium         ppm         ASTM D5185m         >40         8             Potassium         ppm         ASTM D5185m         >20         7             INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         0.1             Nitration         Abs/cm         *ASTM D7624         >20         5.4             Sulfation         Abs/.1mm         *ASTM D7415         >30         20.6             FLUID DEGRADATION         method         limit/base         current         history1         history2           Oxidation         Abs/.1mm         *ASTM D7414         >25         15.7	Zinc	ppm	ASTM D5185m		1139		
Silicon         ppm         ASTM D5185m         >25         7             Sodium         ppm         ASTM D5185m         >40         8             Potassium         ppm         ASTM D5185m         >20         7             INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         0.1             Nitration         Abs/cm         *ASTM D7624         >20         5.4             Sulfation         Abs/.1mm         *ASTM D7415         >30         20.6             FLUID DEGRADATION         method         limit/base         current         history1         history2           Oxidation         Abs/.1mm         *ASTM D7414         >25         15.7	Sulfur	ppm	ASTM D5185m		3869		
Sodium         ppm         ASTM D5185m         >40         8             Potassium         ppm         ASTM D5185m         >20         7             INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         0.1             Nitration         Abs/cm         *ASTM D7624         >20         5.4             Sulfation         Abs/.1mm         *ASTM D7415         >30         20.6             FLUID DEGRADATION         method         limit/base         current         history1         history2           Oxidation         Abs/.1mm         *ASTM D7414         >25         15.7	CONTAMINANTS	;	method	limit/base	current	history1	history2
Potassium         ppm         ASTM D5185m         >20         7             INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         0.1             Nitration         Abs/cm         *ASTM D7624         >20         5.4             Sulfation         Abs/.1mm         *ASTM D7415         >30         20.6             FLUID DEGRADATION         method         limit/base         current         history1         history2           Oxidation         Abs/.1mm         *ASTM D7414         >25         15.7	Silicon	ppm	ASTM D5185m	>25	7		
INFRA-RED	Sodium	ppm	ASTM D5185m	>40	8		
Soot %         %         *ASTM D7844         0.1             Nitration         Abs/cm         *ASTM D7624         >20         5.4             Sulfation         Abs/.1mm         *ASTM D7415         >30         20.6             FLUID DEGRADATION         method         limit/base         current         history1         history2           Oxidation         Abs/.1mm         *ASTM D7414         >25         15.7	Potassium	ppm	ASTM D5185m	>20	7		
Nitration         Abs/cm         *ASTM D7624         >20         5.4             Sulfation         Abs/.1mm         *ASTM D7415         >30         20.6             FLUID DEGRADATION         method         limit/base         current         history1         history2           Oxidation         Abs/.1mm         *ASTM D7414         >25         15.7	INFRA-RED		method	limit/base	current	history1	history2
Sulfation         Abs/.1mm         *ASTM D7415         >30         20.6             FLUID DEGRADATION         method         limit/base         current         history1         history2           Oxidation         Abs/.1mm         *ASTM D7414         >25         15.7	Soot %	%	*ASTM D7844		0.1		
FLUID DEGRADATION     method     limit/base     current     history1     history2       Oxidation     Abs/.1mm     *ASTM D7414     >25     15.7	Nitration	Abs/cm	*ASTM D7624	>20	5.4		
Oxidation Abs/.1mm *ASTM D7414 >25 <b>15.7</b>	Sulfation	Abs/.1mm	*ASTM D7415	>30	20.6		
	FLUID DEGRADA	NOITA	method	limit/base	current	history1	history2
	Oxidation	Abs/.1mm	*ASTM D7414	>25	15.7		
	Base Number (BN)	mg KOH/g	ASTM D2896	10.1	8.7		

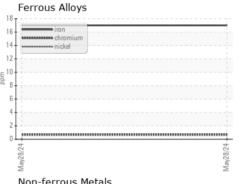


## **OIL ANALYSIS REPORT**



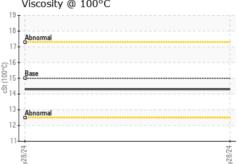
VISUAL		method	limit/base	current	history1	history2
White Metal	scalar	*Visual	NONE	NONE		
Yellow Metal	scalar	*Visual	NONE	NONE		
Precipitate	scalar	*Visual	NONE	NONE		
Silt	scalar	*Visual	NONE	NONE		
Debris	scalar	*Visual	NONE	NONE		
Sand/Dirt	scalar	*Visual	NONE	NONE		
Appearance	scalar	*Visual	NORML	NORML		
Odor	scalar	*Visual	NORML	NORML		
<b>Emulsified Water</b>	scalar	*Visual	>0.1	NEG		
Free Water	scalar	*Visual		NEG		
FILUR BROBER			11 1. 11			

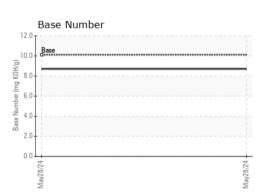
FLUID PROPER	HES	metnoa	ilmit/base	current	nistory i	nistory2
Visc @ 100°C	cSt	ASTM D445	15	14.3		



IV	UI	11	16	=1	11	J	15	' '	*16	= (	aı	5	
Τī													











Certificate 12367

Laboratory Sample No.

: WC0914828 Lab Number : 06196273 Unique Number : 11058396

Test Package : FLEET

: WearCheck USA - 501 Madison Ave., Cary, NC 27513 Received : 31 May 2024 Tested : 03 Jun 2024

Diagnosed : 03 Jun 2024 - Don Baldridge

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)

**AL CUNNINGHAM** 17443 145TH PLACE NE

WOODINVILLE, WA US 98072

Contact: AL CUNNINGHAM ceng\_al@msn.com T: (425)419-6592