

OIL ANALYSIS REPORT

Paul G. Blazer [Paul G. Blazer] Oil - Starboard Genset

Component **Starboard Genset**

DIESEL ENGINE OIL SAE 15W40 (8 GAL)

Recommendation

Resample at the next service interval to monitor. Please specify the brand, type, and viscosity of the oil on your next sample.

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.



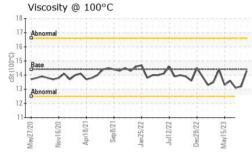
Sample Rating Trend

Sample Number Client Info WC0719545 WC0621766 WC0719415 Sample Date Client Info 04 Oct 2023 27 Aug 2023 07 Aug 2023 Machine Age hrs Client Info 11304 10789 10472 Oil Age hrs Client Info 1 500 214 Oil Changed Client Info N/A Changed N/A Sample Status Imit/base current history1 history2 Fuel WC Method >4.0 <1.0 <1.0 <1.0 Glycol WC Method >4.0 <1.0 <1.0 <1.0 WEAR METALS method limit/base current history1 history2 Iron ppm ASTM D5185m >50 4 15 5 Chromium ppm ASTM D5185m >2 <1 0 <1 1 Nickel ppm ASTM D5185m >12 3 <1 <1 <1 1 2 2							
Sample Date Client Info 04 Oct 2023 27 Aug 2023 07 Aug 2023 Machine Age hrs Client Info 11304 10789 10472 Oil Age hrs Client Info 1 500 214 Oil Changed Client Info N/A Changed N/A Sample Status Imit/base current history1 history2 Fuel WC Method >4.0 <1.0 <1.0 <1.0 Glycol WC Method >4.0 <1.0 <1.0 <1.0 Glycol WC Method >4.0 <1.0 <1.0 <1.0 Glycol WC Method >4.0 <1 <1 <1 <1 Chromium ppm ASTM D5185m >5 4 <1 <1 <1 <1 <1 <1 <1 <1 <1 <1 <1 <1 <1 <1 <1 <1 <1 <1 <1 <1 <1 <1 <1 <1	SAMPLE INFORM	IATION	method	limit/base	current	history1	history2
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Oil Age hrs Client Info 1 500 214 Oil Changed Client Info N/A Changed N/A Sample Status Imit/base Current history1 history2 Fuel WC Method >4.0 <1.0 <1.0 <1.0 Glycol WC Method >4.0 <1.0 <1.0 <1.0 Gromium ppm ASIM D5185m >50 4 15 5 Chromium ppm ASIM D5185m >2 <1 0 <1 Nickel ppm ASIM D5185m >1 <1 <1 <1 Silver ppm ASIM D5185m >1 <1 <1 <1 Auminum ppm ASIM D5185m >1 <1 <1 <1 Lead ppm ASIM D5185m >1 <1 <1 <1 Vanadium ppm ASIM D5185m >1 <1 <1 <1 Vanadium	Sample Date		Client Info		04 Oct 2023	27 Aug 2023	07 Aug 2023
Oli Changed Client Info N/A Changed N/A Sample Status Imit/base current NORMAL NORMAL NORMAL CONTAMINATION method imit/base current history1 history2 Fuel WC Method >4.0 <1.0 <1.0 <1.0 Glycol WC Method >6.0 <1.0 <1.0 <1.0 WEAR METALS method imit/base current history1 history2 Iron ppm ASTM D5185m >50 4 <1 <1 Othornium ppm ASTM D5185m >50 4 <1 <1 Nickel ppm ASTM D5185m >50 4 <1 <1 Nickel ppm ASTM D5185m >50 0 <1 <1 Aluminum ppm ASTM D5185m >12 3 <1 <1 Lead ppm ASTM D5185m >15 <1 <1 <1 Vanadium ppm ASTM D5185m 15 <1 <1 0 Cadmium ppm ASTM D5185m 15 <1 <1 0 Astm D5185m 10 0 0 0 <th>Machine Age</th> <th>hrs</th> <th>Client Info</th> <th></th> <th>11304</th> <th>10789</th> <th>10472</th>	Machine Age	hrs	Client Info		11304	10789	10472
Sample Status NORMAL NORMAL NORMAL NORMAL CONTAMINATION method limit/base current history1 history2 Fuel WC Method >4.0 <1.0 <1.0 <1.0 Glycol WC Method >4.0 <1.0 <1.0 <1.0 WC Method WC Method NEG NEG NEG WEAR METALS method limit/base current history1 history2 Iron ppm ASTM D5185n >50 4 15 5 Chromium ppm ASTM D5185n >2 1 0 <1 Nickel ppm ASTM D5185n >17 <1 2 2 Copper ppm ASTM D5185n >70 1 <1 4 Tin ppm ASTM D5185n >70 1 <1 0 Copper ppm ASTM D5185n 10 0 0 0 Addminum ppm <t< th=""><th>Oil Age</th><th>hrs</th><th>Client Info</th><th></th><th>1</th><th>500</th><th>214</th></t<>	Oil Age	hrs	Client Info		1	500	214
CONTAMINATION method limit/base current history1 history2 Fuel WC Method >4.0 <1.0 <1.0 <1.0 Glycol WC Method NEG NEG NEG NEG Iron ppm ASTM D5185m >50 4 15 5 Chromium ppm ASTM D5185m >50 4 1 <1 <1 Nickel ppm ASTM D5185m >5 0 0 <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 <t< th=""><th>Oil Changed</th><th></th><th>Client Info</th><th></th><th>N/A</th><th>Changed</th><th>N/A</th></t<>	Oil Changed		Client Info		N/A	Changed	N/A
Fuel WC Method >4.0 <1.0	Sample Status				NORMAL	NORMAL	NORMAL
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Titanium ppm ASTM D5185m <1 <1 <1 Silver ppm ASTM D5185m >5 0 0 <1	Chromium	ppm	ASTM D5185m	>4	<1	<1	<1
Silver ppm ASTM D5185m >5 0 0 <1 Aluminum ppm ASTM D5185m >12 3 <1	Nickel	ppm	ASTM D5185m	>2	<1	0	<1
Aluminum ppm ASTM D5185m >12 3 <1 <1 Lead ppm ASTM D5185m >17 <1	Titanium	ppm	ASTM D5185m		<1	<1	<1
Aluminum ppm ASTM D5185m >12 3 <1	Silver		ASTM D5185m	>5	0		<1
Copper ppm ASTM D5185m >70 1 <1 4 Tin ppm ASTM D5185m >15 <1	Aluminum		ASTM D5185m	>12	3	<1	<1
Copper ppm ASTM D5185m >70 1 <1	Lead	ppm	ASTM D5185m	>17	<1	2	2
Vanadium ppm ASTM D5185m 0 <1	Copper	ppm	ASTM D5185m	>70	1	<1	4
Cadmium ppm ASTM D5185m 0 <1	Tin	ppm	ASTM D5185m	>15	<1	<1	<1
ADDITIVES method limit/base current history1 history2 Boron ppm ASTM D5185m 250 121 98 116 Barium ppm ASTM D5185m 10 0 0 0 Molybdenum ppm ASTM D5185m 100 81 72 68 Manganese ppm ASTM D5185m <11 <1 2 Magnesium ppm ASTM D5185m 450 990 1014 829 Calcium ppm ASTM D5185m 3000 1618 1678 1391 Phosphorus ppm ASTM D5185m 1350 1067 995 884 Sulfur ppm ASTM D5185m 1350 1067 995 884 Sulfur ppm ASTM D5185m 125 4 4 4 Sodium ppm ASTM D5185m >25 4 4 4 Sodium ppm ASTM D5185m >20 2	Vanadium	ppm	ASTM D5185m		0	<1	0
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Barium ppm ASTM D5185m 10 0 0 0 Molybdenum ppm ASTM D5185m 100 81 72 68 Manganese ppm ASTM D5185m < 990 1014 829 Calcium ppm ASTM D5185m 450 990 1014 829 Calcium ppm ASTM D5185m 3000 1618 1678 1391 Phosphorus ppm ASTM D5185m 1150 852 798 723 Zinc ppm ASTM D5185m 1350 1067 995 884 Sulfur ppm ASTM D5185m 1350 1067 995 884 Sulfur ppm ASTM D5185m 14250 3645 3423 3342 CONTAMINANTS method imit/base current history1 history2 Silicon ppm ASTM D5185m >158 <1 2 6 Potassium ppm ASTM D5185m				11 1. 4			
Molybdenum ppm ASTM D5185m 100 81 72 68 Manganese ppm ASTM D5185m <1 <1 2 Magnesium ppm ASTM D5185m 450 990 1014 829 Calcium ppm ASTM D5185m 3000 1618 1678 1391 Phosphorus ppm ASTM D5185m 3000 1618 1678 1391 Phosphorus ppm ASTM D5185m 1350 1067 995 884 Sulfur ppm ASTM D5185m 1350 1067 995 884 Sulfur ppm ASTM D5185m 1350 1067 995 884 Sulfur ppm ASTM D5185m 25 4 4 4 Sodium ppm ASTM D5185m >25 4 4 4 Sodium ppm ASTM D5185m >20 2 <1 3 INFRA-RED method limit/base current </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
Manganese ppm ASTM D5185m <1		ppm					
Magnesium ppm ASTM D5185m 450 990 1014 829 Calcium ppm ASTM D5185m 3000 1618 1678 1391 Phosphorus ppm ASTM D5185m 1150 852 798 723 Zinc ppm ASTM D5185m 1350 1067 995 884 Sulfur ppm ASTM D5185m 4250 3645 3423 3342 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >25 4 4 4 Sodium ppm ASTM D5185m >25 4 4 4 Sodium ppm ASTM D5185m >20 2 <1 3 INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7624 >20 10.1 11.6 8.5 Sulfation Abs/.mm *ASTM D7415	Boron		ASTM D5185m	250	121	98	116
Calcium ppm ASTM D5185m 3000 1618 1678 1391 Phosphorus ppm ASTM D5185m 1150 852 798 723 Zinc ppm ASTM D5185m 1350 1067 995 884 Sulfur ppm ASTM D5185m 4250 3645 3423 3342 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >25 4 4 4 Sodium ppm ASTM D5185m >25 4 4 4 Sodium ppm ASTM D5185m >20 2 <1 3 INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0.1 0.2 0.1 Nitration Abs/.mm *ASTM D7415 >30 22.6 22.7 21.5 FLUID DEGRADATION method limit/base curre	Boron Barium	ppm	ASTM D5185m ASTM D5185m	250 10	121 0	98 0	116 0
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Zinc ppm ASTM D5185m 1350 1067 995 884 Sulfur ppm ASTM D5185m 4250 3645 3423 3342 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >25 4 4 4 Sodium ppm ASTM D5185m >25 4 4 4 Sodium ppm ASTM D5185m >25 4 4 4 Sodium ppm ASTM D5185m >20 2 <1 3 INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0.1 0.2 0.1 Nitration Abs/cm *ASTM D7415 >30 22.6 22.7 21.5 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25	Boron Barium Molybdenum Manganese	ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m	250 10 100	121 0 81 <1	98 0 72 <1	116 0 68 2
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CONTAMINANTSmethodlimit/basecurrenthistory1history2SiliconppmASTM D5185m<>25444SodiumppmASTM D5185m<>158<126PotassiumppmASTM D5185m<>202<13INFRA-REDmethodlimit/basecurrenthistory1history2Soot %%*ASTM D78440.10.20.1NitrationAbs/cm*ASTM D7624>2010.111.68.5SulfationAbs/.imm*ASTM D7415>3022.622.721.5FLUID DEGRADATIONmethodlimit/basecurrenthistory1history2OxidationAbs/.imm*ASTM D7414>2521.522.018.1	Boron Barium Molybdenum Manganese Magnesium Calcium	ppm ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m	250 10 100 450 3000	121 0 81 <1 990 1618	98 0 72 <1 1014 1678	116 0 68 2 829 1391
Silicon ppm ASTM D5185m >25 4 4 4 Sodium ppm ASTM D5185m >158 <1	Boron Barium Molybdenum Manganese Magnesium Calcium	ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m	250 10 100 450 3000 1150	121 0 81 <1 990 1618 852	98 0 72 <1 1014 1678 798	116 0 68 2 829 1391 723
Sodium ppm ASTM D5185m >158 <1	Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc	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	121 0 81 <1 990 1618 852 1067	98 0 72 <1 1014 1678 798 995	116 0 68 2 829 1391 723 884
Potassium ppm ASTM D5185m >20 2 <1	Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur	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	121 0 81 <1 990 1618 852 1067 3645	98 0 72 <1 1014 1678 798 995 3423	116 0 68 2 829 1391 723 884 3342
INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0.1 0.2 0.1 Nitration Abs/cm *ASTM D7624 >20 10.1 11.6 8.5 Sulfation Abs/.1mm *ASTM D7415 >30 22.6 22.7 21.5 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 21.5 22.0 18.1	Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS	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	250 10 100 450 3000 1150 1350 4250 limit/base	121 0 81 <1 990 1618 852 1067 3645 current	98 0 72 <1 1014 1678 798 995 3423 history1	116 0 68 2 829 1391 723 884 3342 history2
Soot % % *ASTM D7844 0.1 0.2 0.1 Nitration Abs/cm *ASTM D7624 >20 10.1 11.6 8.5 Sulfation Abs/.1mm *ASTM D7415 >30 22.6 22.7 21.5 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 21.5 22.0 18.1	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 ASTM D5185m	250 10 100 450 3000 1150 1350 4250 limit/base >25	121 0 81 <1 990 1618 852 1067 3645 <u>current</u> 4	98 0 72 <1 1014 1678 798 995 3423 history1 4	116 0 68 2 829 1391 723 884 3342 history2 4
Nitration Abs/cm *ASTM D7624 >20 10.1 11.6 8.5 Sulfation Abs/.1mm *ASTM D7415 >30 22.6 22.7 21.5 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 21.5 22.0 18.1	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 method ASTM D5185m	250 10 100 450 3000 1150 1350 4250 limit/base >25 >158	121 0 81 <1 990 1618 852 1067 3645 <u>current</u> 4 <	98 0 72 <1 1014 1678 798 995 3423 history1 4 2	116 0 68 2 829 1391 723 884 3342 history2 4 6
Sulfation Abs/.1mm *ASTM D7415 >30 22.6 22.7 21.5 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 21.5 22.0 18.1	Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium Potassium	ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m	250 10 100 450 3000 1150 1350 4250 limit/base >25 >158 >20	121 0 81 <1 990 1618 852 1067 3645 current 4 <1 2	98 0 72 <1 1014 1678 798 995 3423 history1 4 2 2 <1	116 0 68 2 829 1391 723 884 3342 history2 4 6 3
FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 21.5 22.0 18.1	Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium Potassium INFRA-RED	ppm ppm ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m	250 10 100 450 3000 1150 1350 4250 limit/base >25 >158 >20	121 0 81 <1 990 1618 852 1067 3645 current 4 <1 2 current	98 0 72 <1 1014 1678 798 995 3423 history1 4 2 <1 4 1 2 <1 history1	116 0 68 2 829 1391 723 884 3342 history2 4 6 3 3 history2
Oxidation Abs/.1mm *ASTM D7414 >25 21.5 22.0 18.1	Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium Potassium INFRA-RED Soot %	ppm i ppm i	ASTM D5185m ASTM D5185m	250 10 100 450 3000 1150 1350 4250 Iimit/base >25 >158 >20 Iimit/base	121 0 81 <1 990 1618 852 1067 3645 <u>current</u> 4 <1 2 <u>current</u>	98 0 72 <1 1014 1678 798 995 3423 history1 4 2 <1 4 2 <1 0.2	116 0 68 2 829 1391 723 884 3342 history2 4 6 3 3 history2 0.1
	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 ppm ppm	ASTM D5185m ASTM D5185m	250 10 100 450 3000 1150 1350 4250 <i>limit/base</i> >25 >158 >20	121 0 81 <1 990 1618 852 1067 3645 current 4 <1 2 current 0.1 10.1	98 0 72 <1 1014 1678 798 995 3423 history1 4 2 <1 2 <1 history1 0.2 11.6	116 0 68 2 829 1391 723 884 3342 history2 4 6 3 history2 0.1 8.5
Base Number (BN) mg KOH/g ASTM D2896 8.5 12.06 10.65 12.28	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 >20 >20	121 0 81 <1 990 1618 852 1067 3645 <u>current</u> 4 <1 2 <u>current</u> 0.1 10.1 22.6	98 0 72 <1 1014 1678 798 995 3423 history1 4 2 <1 4 2 <1 0.2 11.6 22.7	116 0 68 2 829 1391 723 884 3342 history2 4 6 3 3 history2 0.1 8.5 21.5
	Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium Potassium INFRA-RED Soot % Nitration Sulfation FLUID DEGRADA	ppm ppm ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D7844 *ASTM D7844	250 10 100 450 3000 1150 1350 4250 20 >25 >158 >20 imit/base >20 >30 imit/base	121 0 81 <1 990 1618 852 1067 3645 <i>current</i> 4 <1 2 <i>current</i> 0.1 10.1 22.6	98 0 72 <1 1014 1678 798 995 3423 history1 4 2 <1 kistory1 0.2 11.6 22.7 history1	116 0 68 2 829 1391 723 884 3342 history2 4 6 3 3 history2 0.1 8.5 21.5 history2

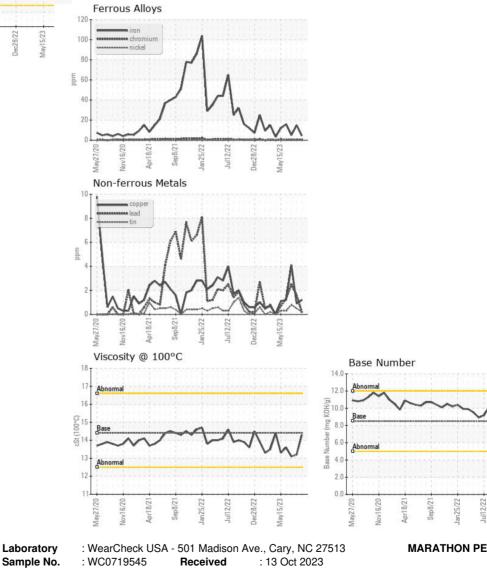


OIL ANALYSIS REPORT

Base Number 14.0 Base Number (mg K0H/g) 0.8 0.9 0.9 0.9 Abno Bas 2.0 0.0 Jan 25/22 Jul12/22 Dec28/22 -Sep 8/21 May15/23 May27/20



VISUAL		method	limit/base	current	history1	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	>0.1	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	14.3	13.2	13.1
GRAPHS						



: 16 Oct 2023



Test Package : IND 2 Certificate L2367 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)

Received

Diagnosed

Diagnostician : Wes Davis

: WC0719545

: 05978429

: 10695724

MARATHON PETROLEUM CO. 101 12TH ST CATLETTSBURG, KY US 41169 Contact: CORY GUMBERT cagumbert@marathonpetroleum.com T: (606)585-3950 F: x:

Dec28/22 May15/23

Sample No.

Lab Number

Unique Number