

OIL ANALYSIS REPORT

Area West Virginia [West Virginia] Oil - Starboard Main Engine

Starboard Main Engine

Fluid MARATHON 15W40 (150 GAL)

Recommendation

Resample at the next service interval to monitor. (Customer Sample Comment: Thurman Richardson)

Wear

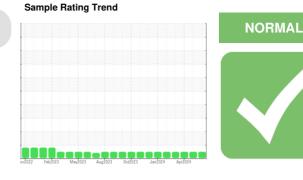
All component wear rates are normal.

Contamination

There is no indication of any contamination in the oil.

Fluid Condition

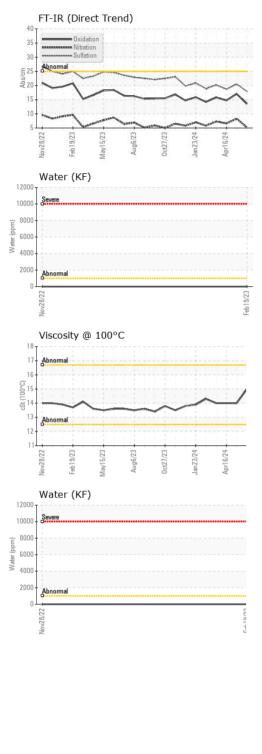
The BN result indicates that there is suitable alkalinity remaining in the oil. The condition of the oil is suitable for further service.



Sample Number Client Info WC0874853 WC0769379 Sample Date Client Info 09 Jun 2024 13 May 2024 16 Apr 2024 Machine Age hrs Client Info 43715 43193 42634 Oll Age hrs Client Info N/A Not Changed N/A Sample Status Client Info N/A Not Changed N/A CONTAMINATION method init/base current history Glycol WC Method >4.0 <1.0 <1.0 <1.0 Titanium ppm ASTM D5165m<>8 <1 <1 <1 <1 Nickel ppm ASTM D5165m<>13 <1 <1 <1 <1 Silver ppm ASTM D5165m<>13 <1 <1	SAMPLE INFORM	IATION	method	limit/base	current	history1	history2
Machine Age hrs Client Info 43715 43193 42634 Oil Age hrs Client Info 27 927 368 Oil Changed Client Info N/A Not Changd 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 imit/base current History1 History2 Iron ppm ASTM D5185m >75 2 5 2 Othomium ppm ASTM D5185m >2 0 <1 <1 Nickel ppm ASTM D5185m >3 <1 <1 2 2 Auminum ppm ASTM D5185m >18 <1 <1 2 2 Copper ppm ASTM D5185m >18 <1 <1 <1 1 1	Sample Number		Client Info		WC0874853	WC0874857	WC0769379
Oil Age hrs Client Info 27 927 368 Oil Changed Client Info N/A Not Changd N/A Sample Status Image Image NoRMAL NORMAL NORMAL CONTAMINATION method 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 >5.7 2 5 2 Chromium ppm ASTM D5185m >75 2 5 2 Chromium ppm ASTM D5185m >3 <1 <1 <1 1 1 1 1 5 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3 2 3	Sample Date		Client Info		09 Jun 2024	13 May 2024	16 Apr 2024
Oil Changed Client Info N/A Not Changd N/A Sample Status I Imit/base current Nistory1 NoRMAL CONTAMINATION method imit/base current history1 history2 Fuel WC Method >4.0 <1.0	Machine Age	hrs	Client Info		43715	43193	42634
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Głycoł WC Method NEG NEG NEG WEAR METALS method limil/base current history1 history2 Iron ppm ASTM D5185m<>75 2 5 2 Chromium ppm ASTM D5185m<>8 <1 <1 0 Nickel ppm ASTM D5185m<>2 <1 <1 0 Silver ppm ASTM D5185m<>3 <1 <1 0 Aluminum ppm ASTM D5185m<>15 3 2 3 Lead ppm ASTM D5185m<>14 <1 <1 1 Vanadium ppm ASTM D5185m<>14 <1 <1 1 Copper ppm ASTM D5185m <1 <1 <1 1 Cadmium ppm ASTM D5185m <1 <1 <1 <1 Cadmium ppm ASTM D5185m <11 16 25 Baron ppm ASTM D5185m <1423 1025	CONTAMINATION	١	method	limit/base	current	history1	history2
WEAR METALS method limit/base current history1 history2 Iron ppm ASTM D5185m >75 2 5 2 Chromium ppm ASTM D5185m >2 <1 <1 <1 Nickel ppm ASTM D5185m >2 <1 <1 0 Titanium ppm ASTM D5185m >2 0 <1 <1 0 Silver ppm ASTM D5185m >2 0 <1 <1 2 3 Lead ppm ASTM D5185m >18 <1 <1 2 2 3 Lead ppm ASTM D5185m >14 <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	Fuel		WC Method	>4.0	<1.0	<1.0	<1.0
Iron ppm ASTM D5185m >75 2 5 2 Chromium ppm ASTM D5185m >8 <1 <1 <1 Nickel ppm ASTM D5185m >2 <1 <1 0 Titanium ppm ASTM D5185m >2 0 <1 <1 Silver ppm ASTM D5185m >2 0 <1 <1 Aluminum ppm ASTM D5185m >18 <1 <1 2 Copper ppm ASTM D5185m >18 <1 <1 2 Copper ppm ASTM D5185m >80 1 5 2 Tin ppm ASTM D5185m <1 <1 <1 <1 Cadmium ppm ASTM D5185m <1 <1 <1 <1 Cadmium ppm ASTM D5185m 0 <1 <1 <1 0 Molybdenum ppm ASTM D5185m 11 1626 <th>Glycol</th> <th></th> <th>WC Method</th> <th></th> <th>NEG</th> <th>NEG</th> <th>NEG</th>	Glycol		WC Method		NEG	NEG	NEG
Chromium ppm ASTM D5185m >8 <1	WEAR METALS		method	limit/base	current	history1	history2
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Nickel ppm ASTM D5185m >2 <1 <1 0 Titanium ppm ASTM D5185m >3 <1	Chromium			>8	<1	<1	<1
Titanium ppm ASTM D5185m >3 <1 <1 <1 Silver ppm ASTM D5185m >2 0 <1	Nickel			>2	<1	<1	0
Silver ppm ASTM D5185m >2 0 <1 <1 Aluminum ppm ASTM D5185m >15 3 2 3 Lead ppm ASTM D5185m >18 <1 <1 2 Copper ppm ASTM D5185m >80 1 5 2 Tin ppm ASTM D5185m >14 <1 <1 1 Vanadium ppm ASTM D5185m >14 <1 <1 <1 Cadmium ppm ASTM D5185m <14 <1 <1 <1 <1 Cadmium ppm ASTM D5185m Current history1 history2 Boron ppm ASTM D5185m 66 64 69 Magnesium ppm ASTM D5185m 66 64 69 Magnesium ppm ASTM D5185m 11 162 1229 1183 1236 Phosphorus ppm ASTM D5185m 1 1229 1183 1236 1226 Sulfur ppm ASTM D5185m 2	Titanium			>3			<1
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Vanadium ppm ASTM D5185m				>14	<1	<1	1
Cadmium ppm ASTM D5185m <1							<1
Boron ppm ASTM D5185m 11 16 25 Barium ppm ASTM D5185m 0 <1 0 Molybdenum ppm ASTM D5185m 66 64 69 Manganese ppm ASTM D5185m <1 <1 0 Magnesium ppm ASTM D5185m 1626 1423 1525 Calcium ppm ASTM D5185m 1229 1183 1236 Phosphorus ppm ASTM D5185m 1197 1042 1207 Zinc ppm ASTM D5185m 1457 1246 1321 Sulfur ppm ASTM D5185m 20 5 4 5 Sodium ppm ASTM D5185m >20 5 4 5 Sodium ppm ASTM D5185m >20 1 2 3 Water % ASTM D5185m >20 1 2 3 INFRA-RED method imit/base current<	Cadmium					<1	<1
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Molybdenum ppm ASTM D5185m 66 64 69 Manganese ppm ASTM D5185m <1 <1 0 Magnesium ppm ASTM D5185m 1626 1423 1525 Calcium ppm ASTM D5185m 1229 1183 1236 Phosphorus ppm ASTM D5185m 1197 1042 1207 Zinc ppm ASTM D5185m 1457 1246 1321 Sulfur ppm ASTM D5185m 3995 3241 3626 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >20 5 4 5 Sodium ppm ASTM D5185m >20 1 2 0 Potassium ppm ASTM D5185m >20 1 2 3 Water % ASTM D6304 >0.1 NEG NEG NEG Nitration Abs/rm< *ASTM	ADDITIVES		method				history2
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Manganese ppm ASTM D5185m <1	Boron		ASTM D5185m	limit/base	11	16	25
Magnesium ppm ASTM D5185m 1626 1423 1525 Calcium ppm ASTM D5185m 1229 1183 1236 Phosphorus ppm ASTM D5185m 1197 1042 1207 Zinc ppm ASTM D5185m 1197 1042 1321 Sulfur ppm ASTM D5185m 3995 3241 3626 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >20 5 4 5 Sodium ppm ASTM D5185m >75 4 2 0 Potassium ppm ASTM D5185m >20 1 2 3 Water % ASTM D6304 >0.1 NEG NEG NEG INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 20 5.2 8.3 6.6 Sulf	Boron Barium	ppm	ASTM D5185m ASTM D5185m	limit/base	11 0	16 <1	25 0
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Phosphorus ppm ASTM D5185m 1197 1042 1207 Zinc ppm ASTM D5185m 1457 1246 1321 Sulfur ppm ASTM D5185m 3995 3241 3626 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >20 5 4 5 Sodium ppm ASTM D5185m >75 4 2 0 Potassium ppm ASTM D5185m >20 1 2 3 Water % ASTM D5185m >20 1 2 3 Soot % % ASTM D6304 >0.1 NEG NEG Soot % % *ASTM D7624 >20 5.2 8.3 6.6 Sulfation Abs/.mm *ASTM D7624 >20 5.2 8.3 6.6 Sulfation Abs/.1mm *ASTM D7415 >30 17.9 20.5 18.7	Boron Barium Molybdenum Manganese	ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m	limit/base	11 0 66 <1	16 <1 64 <1	25 0 69 0
Zinc ppm ASTM D5185m 1457 1246 1321 Sulfur ppm ASTM D5185m 3995 3241 3626 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >20 5 4 5 Sodium ppm ASTM D5185m >75 4 2 0 Potassium ppm ASTM D5185m >20 1 2 3 Water % ASTM D5185m >20 1 2 3 INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0.1 0.2 0.1 Nitration Abs/cm *ASTM D7624 >20 5.2 8.3 6.6 Sulfation Abs/.1mm *ASTM D7415 >30 17.9 20.5 18.7 FLUID DEGRADATION method limit/base current history1 histor	Boron Barium Molybdenum Manganese Magnesium	ppm ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m	limit/base	11 0 66 <1 1626	16 <1 64 <1 1423	25 0 69 0 1525
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Silicon ppm ASTM D5185m >20 5 4 5 Sodium ppm ASTM D5185m >75 4 2 0 Potassium ppm ASTM D5185m >20 1 2 3 Water % ASTM D6304 >0.1 NEG NEG NEG INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0.1 0.2 0.1 Nitration Abs/cm *ASTM D7624 >20 5.2 8.3 6.6 Sulfation Abs/.1mm *ASTM D7415 >30 17.9 20.5 18.7 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 13.5 17.0 14.7	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	limit/base	11 0 66 <1 1626 1229 1197	16 <1 64 <1 1423 1183 1042	25 0 69 0 1525 1236 1207
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Sodium ppm ASTM D5185m >75 4 2 0 Potassium ppm ASTM D5185m >20 1 2 3 Water % ASTM D6304 >0.1 NEG NEG NEG INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0.1 0.2 0.1 Nitration Abs/cm *ASTM D7624 >20 5.2 8.3 6.6 Sulfation Abs/.1mm *ASTM D7415 >30 17.9 20.5 18.7 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 13.5 17.0 14.7	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 ASTM D5185m		11 0 66 <1 1626 1229 1197 1457 3995	16 <1 64 <1 1423 1183 1042 1246 3241	25 0 69 0 1525 1236 1207 1321 3626
Potassium ppm ASTM D5185m >20 1 2 3 Water % ASTM D6304 >0.1 NEG NEG NEG INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0.1 0.2 0.1 Nitration Abs/cm *ASTM D7624 >20 5.2 8.3 6.6 Sulfation Abs/.1mm *ASTM D7415 >30 17.9 20.5 18.7 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 13.5 17.0 14.7	Boron Barium Molybdenum Maganese 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	limit/base	11 0 66 <1 1626 1229 1197 1457 3995	16 <1 64 <1 1423 1183 1042 1246 3241 history1	25 0 69 0 1525 1236 1207 1321 3626 history2
Water % ASTM D6304 >0.1 NEG NEG NEG INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0.1 0.2 0.1 Nitration Abs/cm *ASTM D7624 >20 5.2 8.3 6.6 Sulfation Abs/.1mm *ASTM D7415 >30 17.9 20.5 18.7 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 13.5 17.0 14.7	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	limit/base	11 0 66 <1 1626 1229 1197 1457 3995 current 5	16 <1 64 <1 1423 1183 1042 1246 3241 history1 4	25 0 69 0 1525 1236 1207 1321 3626 history2 5
Soot % % *ASTM D7844 0.1 0.2 0.1 Nitration Abs/cm *ASTM D7624 >20 5.2 8.3 6.6 Sulfation Abs/.1mm *ASTM D7415 >30 17.9 20.5 18.7 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 13.5 17.0 14.7	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	limit/base >20 >75	11 0 66 <1 1626 1229 1197 1457 3995 <u>current</u> 5 4	16 <1 64 <1 1423 1183 1042 1246 3241 history1 4 2	25 0 69 0 1525 1236 1207 1321 3626 history2 5 0
Nitration Abs/cm *ASTM D7624 >20 5.2 8.3 6.6 Sulfation Abs/.1mm *ASTM D7415 >30 17.9 20.5 18.7 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 13.5 17.0 14.7	Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium Potassium	ppm ppm ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m	limit/base >20 >75 >20	11 0 66 <1 1626 1229 1197 1457 3995 <u>current</u> 5 4 1	16 <1 64 <1 1423 1183 1042 1246 3241 history1 4 2 2 2	25 0 69 0 1525 1236 1207 1321 3626 history2 5 0 3
Nitration Abs/cm *ASTM D7624 >20 5.2 8.3 6.6 Sulfation Abs/.1mm *ASTM D7415 >30 17.9 20.5 18.7 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 13.5 17.0 14.7	Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium Potassium Water	ppm ppm ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m	limit/base >20 >75 >20 >0.1	11 0 66 <1 1626 1229 1197 1457 3995 <u>current</u> 5 4 1 NEG	16 <1 64 <1 1423 1183 1042 1246 3241 history1 4 2 2 2 NEG	25 0 69 0 1525 1236 1207 1321 3626 history2 5 0 3 NEG
Sulfation Abs/.1mm *ASTM D7415 >30 17.9 20.5 18.7 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 13.5 17.0 14.7	Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium Potassium Water INFRA-RED	ppm ppm ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m	limit/base >20 >75 >20 >0.1	11 0 66 <1 1626 1229 1197 1457 3995 current 5 4 1 NEG current	16 <1 64 <1 1423 1183 1042 1246 3241 history1 4 2 2 NEG history1	25 0 69 1525 1236 1207 1321 3626 history2 5 0 3 NEG history2
Oxidation Abs/.1mm *ASTM D7414 >25 13.5 17.0 14.7	Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium Potassium Vater INFRA-RED Soot %	ppm ppm ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m	limit/base >20 >75 >20 >0.1 limit/base	11 0 66 <1 1626 1229 1197 1457 3995 <u>current</u> 5 4 1 NEG <u>current</u> 0.1	16 <1 64 <1 1423 1183 1042 1246 3241 history1 4 2 2 2 NEG history1 0.2	25 0 69 0 1525 1236 1207 1321 3626 history2 5 0 3 NEG history2 0.1
	Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium Potassium Vater INFRA-RED Soot % Nitration	ppm ppm ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m	limit/base >20 >75 >20 >0.1 limit/base	11 0 66 <1 1626 1229 1197 1457 3995 <u>current</u> 5 4 1 NEG 0.1 5.2	16 <1 64 <1 1423 1183 1042 1246 3241 history1 4 2 2 NEG NEG history1 0.2 8.3	25 0 69 0 1525 1236 1207 1321 3626 history2 5 0 3 NEG NEG history2 0.1 6.6
	Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium Potassium Vater INFRA-RED Soot % Nitration Sulfation	ppm ppm ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m	limit/base >20 >75 >20 >0.1 limit/base >20 >30	11 0 66 <1 1626 1229 1197 1457 3995 <u>current</u> 5 4 1 NEG 0.1 5.2 17.9	16 <1 64 <1 1423 1183 1042 1246 3241 history1 4 2 2 NEG history1 0.2 8.3 20.5	25 0 69 0 1525 1236 1207 1321 3626 history2 5 0 3 NEG history2 0.1 6.6 18.7
	Boron Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium Potassium Water INFRA-RED Soot % Nitration Sulfation	ppm ppm ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m	limit/base >20 >75 >20 >0.1 limit/base >20 >30	11 0 66 <1 1626 1229 1197 1457 3995 Current 5 4 1 NEG 0.1 5.2 17.9 Current	16 <1 64 <1 1423 1183 1042 1246 3241 history1 4 2 2 2 NEG history1 0.2 8.3 20.5 history1	25 0 69 0 1525 1236 1207 1321 3626 history2 5 0 3 NEG history2 0.1 6.6 18.7



OIL ANALYSIS REPORT

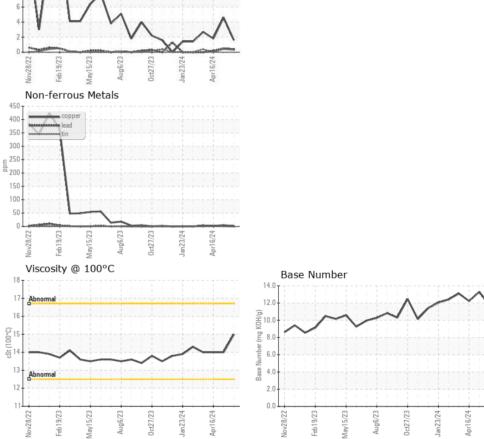


VISUAL		method	limit/base	current	history1	history2
White Metal	scalar	*Visual	NONE	NONE	NONE	NONE
Yellow Metal	scalar	*Visual	NONE	NONE	NONE	NONE
Precipitate	scalar	*Visual	NONE	NONE	NONE	NONE
Silt	scalar	*Visual	NONE	NONE	NONE	NONE
Debris	scalar	*Visual	NONE	NONE	NONE	NONE
Sand/Dirt	scalar	*Visual	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		15.0	14.0	14.0
СВАРИС						

Ferrous Alloys

14

14 12 10



Laboratory : WearCheck USA - 501 Madison Ave., Cary, NC 27513 MARATHON PETROLEUM CO. Sample No. : WC0874853 Received : 14 Jun 2024 101 12TH ST Lab Number : 06210367 Tested : 18 Jun 2024 CATLETTSBURG, KY Unique Number : 11083231 Diagnosed : 18 Jun 2024 - Don Baldridge US 41169 Test Package : IND 2 (Additional Tests: KF) Contact: CORY GUMBERT Certificate 12367 cagumbert@marathonpetroleum.com To discuss this sample report, contact Customer Service at 1-800-237-1369. T: (606)585-3950 * - Denotes test methods that are outside of the ISO 17025 scope of accreditation. F: x:

Statements of conformity to specifications are based on the simple acceptance decision rule (JCGM 106:2012)

Report Id: MARCAT [WUSCAR] 06210367 (Generated: 06/22/2024 19:35:05) Rev: 1

Submitted By: M/V WEST VIRGINIA

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