

OIL ANALYSIS REPORT

Area Kenova [Kenova] Oil - Starboard Main Engine

Starboard Main Engine

Fluid DIESEL ENGINE OIL SAE 15W40 (150 GAL)

Recommendation

Resample at the next service interval to monitor. (Customer Sample Comment: Adam fields)

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.

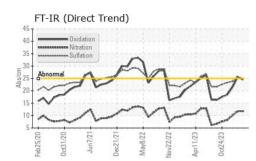


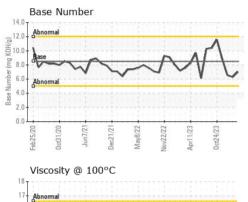
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Manganese ppm ASTM D5185m <1	Manganese ppm ASTM D5185m <1	Barium	ppm	ASTM D5185m	10	0	0	0
Magnesium ppm ASTM D5185m 450 633 599 574 Calcium ppm ASTM D5185m 3000 1686 1727 1586 Phosphorus ppm ASTM D5185m 1150 688 587 641 Zinc ppm ASTM D5185m 1350 817 768 789 Sulfur ppm ASTM D5185m 4250 2954 2744 2411 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >20 6 3 4 Sodium ppm ASTM D5185m >20 6 3 4 Sodium ppm ASTM D5185m >20 <1 0 3 Water % ASTM D6304 >0.1 NEG NEG NEG INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0.6	Magnesium ppm ASTM D5185m 450 633 599 574 Calcium ppm ASTM D5185m 3000 1686 1727 1586 Phosphorus ppm ASTM D5185m 1150 688 587 641 Zinc ppm ASTM D5185m 1350 817 768 789 Sulfur ppm ASTM D5185m 4250 2954 2744 2411 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >20 6 3 4 Sodium ppm ASTM D5185m >20 6 3 4 Sodium ppm ASTM D5185m >20 c1 0 3 Water % ASTM D5304 >0.1 NEG NEG NEG INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0.6	Molybdenum	ppm	ASTM D5185m	100	91	82	83
Calcium ppm ASTM D5185m 3000 1686 1727 1586 Phosphorus ppm ASTM D5185m 1150 688 587 641 Zinc ppm ASTM D5185m 1350 817 768 789 Sulfur ppm ASTM D5185m 4250 2954 2744 2411 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >20 6 3 4 Sodium ppm ASTM D5185m >20 6 3 4 Sodium ppm ASTM D5185m >20 6 3 4 Sodium ppm ASTM D5185m >20 <1 0 3 Water % ASTM D5804 >0.1 NEG NEG NEG INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0.6	Calcium ppm ASTM D5185m 3000 1686 1727 1586 Phosphorus ppm ASTM D5185m 1150 688 587 641 Zinc ppm ASTM D5185m 1350 817 768 789 Sulfur ppm ASTM D5185m 1350 817 768 789 Sulfur ppm ASTM D5185m 4250 2954 2744 2411 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >20 6 3 4 Sodium ppm ASTM D5185m >20 6 3 4 Sodium ppm ASTM D5185m >20 <1 0 3 Water % ASTM D6304 >0.1 NEG NEG NEG INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7624 >20	Manganese	ppm	ASTM D5185m		<1	0	2
Phosphorus ppm ASTM D5185m 1150 688 587 641 Zinc ppm ASTM D5185m 1350 817 768 789 Sulfur ppm ASTM D5185m 1350 817 768 789 Sulfur ppm ASTM D5185m 4250 2954 2744 2411 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >20 6 3 4 Sodium ppm ASTM D5185m >20 6 3 4 Sodium ppm ASTM D5185m >20 <1 0 3 Water % ASTM D6304 >0.1 NEG NEG NEG INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7624 >20 11.8 11.8 10.0 Sulfation Abs/.mm *ASTM D7415 >30 </th <th>Phosphorus ppm ASTM D5185m 1150 688 587 641 Zinc ppm ASTM D5185m 1350 817 768 789 Sulfur ppm ASTM D5185m 4250 2954 2744 2411 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >20 6 3 4 Sodium ppm ASTM D5185m >20 6 3 4 Sodium ppm ASTM D5185m >20 6 3 4 Sodium ppm ASTM D5185m >20 <1 0 3 Water % ASTM D6304 >0.1 NEG NEG NEG INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7624 >20 11.8 11.8 10.0 Sulfation Abs/.1m *ASTM D7624 >20</th> <th>Magnesium</th> <th>ppm</th> <th>ASTM D5185m</th> <th>450</th> <th>633</th> <th>599</th> <th>574</th>	Phosphorus ppm ASTM D5185m 1150 688 587 641 Zinc ppm ASTM D5185m 1350 817 768 789 Sulfur ppm ASTM D5185m 4250 2954 2744 2411 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >20 6 3 4 Sodium ppm ASTM D5185m >20 6 3 4 Sodium ppm ASTM D5185m >20 6 3 4 Sodium ppm ASTM D5185m >20 <1 0 3 Water % ASTM D6304 >0.1 NEG NEG NEG INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7624 >20 11.8 11.8 10.0 Sulfation Abs/.1m *ASTM D7624 >20	Magnesium	ppm	ASTM D5185m	450	633	599	574
Zinc ppm ASTM D5185m 1350 817 768 789 Sulfur ppm ASTM D5185m 4250 2954 2744 2411 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >20 6 3 4 Sodium ppm ASTM D5185m >20 6 3 4 Sodium ppm ASTM D5185m >20 6 3 4 Sodium ppm ASTM D5185m >20 <1 0 3 Water % ASTM D5304 >0.1 NEG NEG NEG INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7624 >20 11.8 11.8 10.0 Sulfation Abs/.mm *ASTM D7415 >30 25.1 25.2 23.8 FLUID DEGRADATION Method limit/base c	Zinc ppm ASTM D5185m 1350 817 768 789 Sulfur ppm ASTM D5185m 4250 2954 2744 2411 CONTAMINANTS method limit/base current history1 history2 Silicon ppm ASTM D5185m >20 6 3 4 Sodium ppm ASTM D5185m >158 5 2 6 Potassium ppm ASTM D5185m >20 <1 0 3 Water % ASTM D5185m >20 <1 0 3 Soot % % ASTM D5185m >20 <1 0 3 Soot % % ASTM D7844 0.6 0.6 0.5 Nitration Abs/cm *ASTM D7624 >20 11.8 11.8 10.0 Sulfation Abs/.1mm *ASTM D7624 >20 11.8 11.8 10.0 Sulfation Abs/.1mm *ASTM D7624 >20	Calcium	ppm	ASTM D5185m	3000	1686	1727	1586
SulfurppmASTM D5185m4250295427442411CONTAMINANTSmethodlimit/basecurrenthistory1history2SiliconppmASTM D5185m>20634SodiumppmASTM D5185m>158526PotassiumppmASTM D5185m>20<103Water%ASTM D6304>0.1NEGNEGNEGINFRA-REDmethodlimit/basecurrenthistory1history2Soot %%*ASTM D78440.60.60.5NitrationAbs/cm*ASTM D7624>2011.811.810.0SulfationAbs/.tm*ASTM D7415>3025.125.223.8FLUID DEGRADATIONmethodlimit/basecurrenthistory1history2OxidationAbs/.tm*ASTM D7414>2524.525.621.5	SulfurppmASTM D5185m4250295427442411CONTAMINANTSmethodlimit/basecurrenthistory1history2SiliconppmASTM D5185m>20634SodiumppmASTM D5185m>158526PotassiumppmASTM D5185m>20<103Water%ASTM D6304>0.1NEGNEGNEGINFRA-REDmethodlimit/basecurrenthistory1history2Soot %%*ASTM D78440.60.60.5NitrationAbs/cm*ASTM D7624>2011.811.810.0SulfationAbs/lmm*ASTM D7415>3025.125.223.8FLUID DEGRADATIONmethodlimit/basecurrenthistory1history2OxidationAbs/lmm*ASTM D7414>2524.525.621.5	Phosphorus	ppm	ASTM D5185m	1150	688	587	641
CONTAMINANTSmethodlimit/basecurrenthistory1history2SiliconppmASTM D5185m>20634SodiumppmASTM D5185m>158526PotassiumppmASTM D5185m>20<103Water%ASTM D6304>0.1NEGNEGNEGINFRA-REDmethodlimit/basecurrenthistory1history2Soot %%*ASTM D78440.60.60.5NitrationAbs/cm*ASTM D7624>2011.811.810.0SulfationAbs/.imm*ASTM D7415>3025.125.223.8FLUID DEGRADATIONmethodlimit/basecurrenthistory1history2OxidationAbs/.imm*ASTM D7414>2524.525.621.5	CONTAMINANTSmethodlimit/basecurrenthistory1history2SiliconppmASTM D5185m>20634SodiumppmASTM D5185m>158526PotassiumppmASTM D5185m>20<103Water%ASTM D6304>0.1NEGNEGNEGINFRA-REDmethodlimit/basecurrenthistory1history2Soot %%*ASTM D78440.60.60.5NitrationAbs/cm*ASTM D7624>2011.811.810.0SulfationAbs/lmm*ASTM D7415>3025.125.223.8FLUID DEGRADATIONmethodlimit/basecurrenthistory1history2OxidationAbs/.1mm*ASTM D7414>2524.525.621.5	Zinc	ppm	ASTM D5185m	1350	817	768	789
Silicon ppm ASTM D5185m >20 6 3 4 Sodium ppm ASTM D5185m >158 5 2 6 Potassium ppm ASTM D5185m >20 <1 0 3 Water % ASTM D6304 >0.1 NEG NEG NEG INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0.6 0.6 0.5 Nitration Abs/cm *ASTM D7624 >20 11.8 11.8 10.0 Sulfation Abs/.tmm *ASTM D7415 >30 25.1 25.2 23.8 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.tmm *ASTM D7414 >25 24.5 25.6 21.5	Silicon ppm ASTM D5185m >20 6 3 4 Sodium ppm ASTM D5185m >158 5 2 6 Potassium ppm ASTM D5185m >20 <1 0 3 Water % ASTM D6304 >0.1 NEG NEG NEG INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0.6 0.6 0.5 Nitration Abs/cm *ASTM D7624 >20 11.8 11.8 10.0 Sulfation Abs/.1mm *ASTM D7415 >30 25.1 25.2 23.8 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 24.5 25.6 21.5	Sulfur	ppm	ASTM D5185m	4250	2954	2744	2411
Sodium ppm ASTM D5185m >158 5 2 6 Potassium ppm ASTM D5185m >20 <1 0 3 Water % ASTM D6304 >0.1 NEG NEG NEG INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0.6 0.6 0.5 Nitration Abs/cm *ASTM D7624 >20 11.8 11.8 10.0 Sulfation Abs/.imm *ASTM D7415 >30 25.1 25.2 23.8 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.imm *ASTM D7414 >25 24.5 25.6 21.5	Sodium ppm ASTM D5185m >158 5 2 6 Potassium ppm ASTM D5185m >20 <1 0 3 Water % ASTM D6304 >0.1 NEG NEG NEG INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0.6 0.6 0.5 Nitration Abs/cm *ASTM D7624 >20 11.8 11.8 10.0 Sulfation Abs/.1mm *ASTM D7415 >30 25.1 25.2 23.8 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 24.5 25.6 21.5	CONTAMINANTS		method	limit/base	current	history1	history2
Potassium ppm ASTM D5185m >20 <1	Potassium ppm ASTM D5185m >20 <1	Silicon	ppm	ASTM D5185m	>20	6	3	4
Water % ASTM D6304 >0.1 NEG NEG NEG INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0.6 0.6 0.5 Nitration Abs/cm *ASTM D7624 >20 11.8 11.8 10.0 Sulfation Abs/.1mm *ASTM D7415 >30 25.1 25.2 23.8 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 24.5 25.6 21.5	Water % ASTM D6304 >0.1 NEG NEG NEG INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0.6 0.6 0.5 Nitration Abs/cm *ASTM D7624 >20 11.8 11.8 10.0 Sulfation Abs/.1mm *ASTM D7415 >30 25.1 25.2 23.8 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 24.5 25.6 21.5	Sodium	ppm	ASTM D5185m	>158	5	2	6
INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0.6 0.6 0.5 Nitration Abs/cm *ASTM D7624 >20 11.8 11.8 10.0 Sulfation Abs/.tmm *ASTM D7624 >30 25.1 25.2 23.8 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.tmm *ASTM D7414 >25 24.5 25.6 21.5	INFRA-RED method limit/base current history1 history2 Soot % % *ASTM D7844 0.6 0.6 0.5 Nitration Abs/cm *ASTM D7624 >20 11.8 11.8 10.0 Sulfation Abs/.1mm *ASTM D7615 >30 25.1 25.2 23.8 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 24.5 25.6 21.5	Potassium	maa	ASTM D5185m	>20	<1	0	3
Soot % % *ASTM D7844 0.6 0.6 0.5 Nitration Abs/cm *ASTM D7624 >20 11.8 11.8 10.0 Sulfation Abs/.1mm *ASTM D7415 >30 25.1 25.2 23.8 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 24.5 25.6 21.5	Soot % % *ASTM D7844 0.6 0.6 0.5 Nitration Abs/cm *ASTM D7624 >20 11.8 11.8 10.0 Sulfation Abs/.1mm *ASTM D7415 >30 25.1 25.2 23.8 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 24.5 25.6 21.5		1-1-					
Nitration Abs/cm *ASTM D7624 >20 11.8 11.8 10.0 Sulfation Abs/.1mm *ASTM D7415 >30 25.1 25.2 23.8 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 24.5 25.6 21.5	Nitration Abs/cm *ASTM D7624 >20 11.8 11.8 10.0 Sulfation Abs/.1mm *ASTM D7624 >20 11.8 11.8 10.0 Sulfation Abs/.1mm *ASTM D7415 >30 25.1 25.2 23.8 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 24.5 25.6 21.5	Water		ASTM D6304	>0.1			NEG
Sulfation Abs/.1mm *ASTM D7415 >30 25.1 25.2 23.8 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 24.5 25.6 21.5	Sulfation Abs/.1mm *ASTM D7415 >30 25.1 25.2 23.8 FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 24.5 25.6 21.5					NEG	NEG	
FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 24.5 25.6 21.5	FLUID DEGRADATION method limit/base current history1 history2 Oxidation Abs/.1mm *ASTM D7414 >25 24.5 25.6 21.5	INFRA-RED	%	method		NEG current	NEG history1	history2
Oxidation Abs/.1mm *ASTM D7414 >25 24.5 25.6 21.5	Oxidation Abs/.1mm *ASTM D7414 >25 24.5 25.6 21.5	INFRA-RED Soot %	%	method *ASTM D7844	limit/base	NEG current 0.6	NEG history1 0.6	history2 0.5
		INFRA-RED Soot % Nitration	% Abs/cm	method *ASTM D7844 *ASTM D7624	limit/base	NEG current 0.6 11.8	NEG history1 0.6 11.8	history2 0.5 10.0
	Base Number (BN) mg KOH/g ASTM D2896 8.5 7.03 6.29 6.55	INFRA-RED Soot % Nitration Sulfation	% % Abs/cm Abs/.1mm	method *ASTM D7844 *ASTM D7624 *ASTM D7415	limit/base >20 >30	NEG current 0.6 11.8 25.1	NEG history1 0.6 11.8 25.2	history2 0.5 10.0 23.8
Base Number (BN) mg KOH/g ASTM D2896 8.5 7.03 6.29 6.55		INFRA-RED Soot % Nitration Sulfation FLUID DEGRADA	% Abs/cm Abs/.1mm TION	method *ASTM D7844 *ASTM D7624 *ASTM D7415 method	limit/base >20 >30 limit/base	NEG current 0.6 11.8 25.1 current	NEG history1 0.6 11.8 25.2 history1	history2 0.5 10.0 23.8 history2

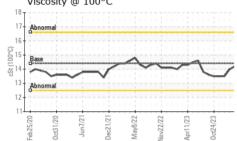
Sample Rating Trend



OIL ANALYSIS REPORT

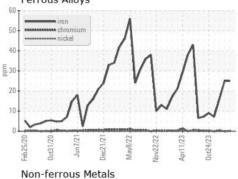


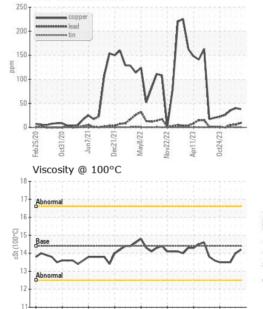


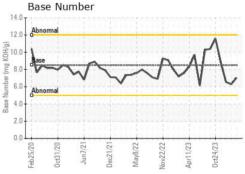


VISUAL		method	limit/base	current	history1	history2
White Metal	scalar	*Visual	NONE	NONE	LIGHT	NONE
Yellow Metal	scalar	*Visual	NONE	NONE	NONE	NONE
Precipitate	scalar	*Visual	NONE	NONE	NONE	NONE
Silt	scalar	*Visual	NONE	NONE	NONE	NONE
Debris	scalar	*Visual	NONE	NONE	NONE	NONE
Sand/Dirt	scalar	*Visual	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	14.2	14.0	13.5
GRAPHS						

Ferrous Alloys







Laboratory : WearCheck USA - 501 Madison Ave., Cary, NC 27513 MARATHON PETROLEUM CO. Sample No. : WC0859748 Received : 23 Apr 2024 101 12TH ST Lab Number : 06157890 Tested : 25 Apr 2024 CATLETTSBURG, KY Unique Number : 10993313 Diagnosed : 25 Apr 2024 - Sean Felton 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. Statements of conformity to specifications are based on the simple acceptance decision rule (JCGM 106:2012) F: x:

Jun7/21

Dec/1/71

Apr11/23

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Feb25/20

Submitted By: M/V KENOVA

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