

# **OIL ANALYSIS REPORT**

### Sample Rating Trend



Machine Id

# **MANNS X6**

**Starboard Main Engine** 

Delvac ESP 5w40 (23 GAL)

## **DIAGNOSIS**

#### Recommendation

We advise that you check for the source of water entry. Resample at the next service interval to monitor.

## Wear

The copper level is abnormal. In the absence of other significant wear metals, suspect copper due to sources other than wear (i.e. cooling core).

### Contamination

There is a moderate amount of particulates present in the oil. There is a moderate concentration of water present in the oil.

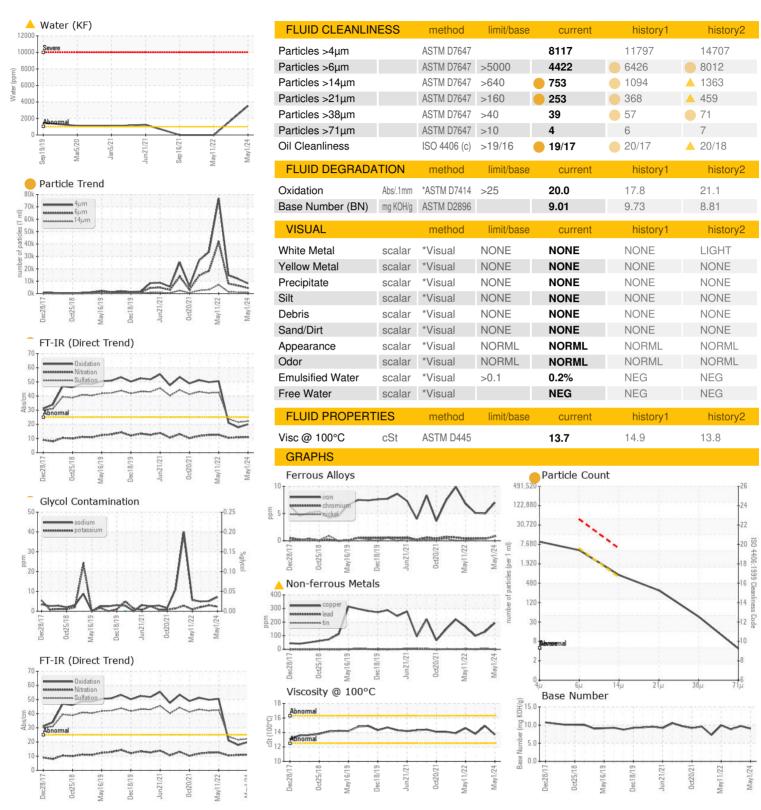
### **Fluid Condition**

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

Sample Date   Client Info   11 May 2024   08 Jan 2023   04 Nov 2022							
Sample Date	SAMPLE INFORM	ATION	method	limit/base	current	history1	history2
Machine Age         hrs         Client Info         14973         13003         12574           Dil Age         hrs         Client Info         500         429         520           Dil Oli Changed         Client Info         500         429         520           Dil Age         hrs         Client Info         N/A         Changed         Changed         Changed         Changed         Changed         Changed         ABNORMAL	Sample Number		Client Info		KL0013502	KL0008977	KL0008919
Dil Age	Sample Date		Client Info		01 May 2024	08 Jan 2023	04 Nov 2022
Contained   Client Info   N/A   ABNORMAL   ABNORMAL	Machine Age	hrs	Client Info		14973	13003	12574
ABNORMAL   ABNORMAL   ABNORMAL   ABNORMAL   ABNORMAL   CONTAMINATION   method   limil/base   current   history1   history2   history2	Oil Age	hrs	Client Info		500	429	520
CONTAMINATION         method         limit/base         current         history1         history2           Fuel         WC Method         >4.0         <1.0         <1.0         <1.0           WEAR METALS         method         limit/base         current         history1         history2           Iron         ppm         ASTM D5185m         >75         7         5         5           Chromium         ppm         ASTM D5185m         >8         <1         <1         <1         <1           Nickel         ppm         ASTM D5185m         >2         <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         <1	Oil Changed		Client Info		N/A	Changed	Changed
WEAR METALS	Sample Status				ABNORMAL	ABNORMAL	ABNORMAL
WEAR METALS	CONTAMINATION	I	method	limit/base	current	history1	history2
Pron	Fuel		WC Method	>4.0	<1.0	<1.0	<1.0
Chromium	WEAR METALS		method	limit/base	current	history1	history2
Nicke	ron	ppm	ASTM D5185m	>75	7	5	5
Nicke	Chromium	ppm	ASTM D5185m	>8	<1	<1	<1
Description	Nickel		ASTM D5185m	>2		<1	<1
Soliver	Titanium		ASTM D5185m	>3		<1	
Aluminum   ppm   ASTM D5185m   >15   2   <1   <1   Lead   ppm   ASTM D5185m   >18   <1   3   1   Copper   ppm   ASTM D5185m   >80   A 194   A 129   A 99   Fin   ppm   ASTM D5185m   >14   1   <1   <1   Vanadium   ppm   ASTM D5185m   >14   1   <1   <1   Vanadium   ppm   ASTM D5185m   <1   0   0   Cadmium   ppm   ASTM D5185m   <1   0   0    ADDITIVES   method   limit/base   current   history1   history2   Carron   ppm   ASTM D5185m   19   37   35   Carron   ppm   ASTM D5185m   0   0   0   Molybdenum   ppm   ASTM D5185m   63   16   57   Manganese   ppm   ASTM D5185m   63   16   57   Manganese   ppm   ASTM D5185m   1064   840   1090   Calcium   ppm   ASTM D5185m   887   1415   898   Phosphorus   ppm   ASTM D5185m   974   829   965   Calcium   ppm   ASTM D5185m   1202   1043   1268   Sulfur   ppm   ASTM D5185m   3563   3422   3529   CONTAMINANTS   method   limit/base   current   history1   history2	Silver				<1		0
Lead         ppm         ASTM D5185m         >18         <1         3         1           Copper         ppm         ASTM D5185m         >80         ▲ 194         ▲ 129         ▲ 99           Fin         ppm         ASTM D5185m         >14         1         <1         <1         <1           Vanadium         ppm         ASTM D5185m         <1         0         0         0           Cadmium         ppm         ASTM D5185m         <1         0         0         0           ADDITIVES         method         limit/base         current         history1         history2           Barium         ppm         ASTM D5185m         19         37         35           Barium         ppm         ASTM D5185m         0         0         0           Molybdenum         ppm         ASTM D5185m         63         16         57           Manganese         ppm         ASTM D5185m         1064         840         1090           Calcium         ppm         ASTM D5185m         887         1415         898           Phosphorus         ppm         ASTM D5185m         974         829         965           Zinc         p	Aluminum		ASTM D5185m	>15	2	<1	<1
Description	_ead				<1		1
Tin	Copper		ASTM D5185m	>80		<u>129</u>	A 99
Vanadium         ppm         ASTM D5185m         <1         0         0           Cadmium         ppm         ASTM D5185m         <1         0         0           ADDITIVES         method         limit/base         current         history1         history2           Boron         ppm         ASTM D5185m         19         37         35           Barium         ppm         ASTM D5185m         0         0         0           Molybdenum         ppm         ASTM D5185m         63         16         57           Manganese         ppm         ASTM D5185m         <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 <td></td> <td></td> <td>ASTM D5185m</td> <td>&gt;14</td> <td>1</td> <td>&lt;1</td> <td>&lt;1</td>			ASTM D5185m	>14	1	<1	<1
Cadmium         ppm         ASTM D5185m         <1         0         0           ADDITIVES         method         limit/base         current         history1         history2           Boron         ppm         ASTM D5185m         19         37         35           Barium         ppm         ASTM D5185m         0         0         0           Molybdenum         ppm         ASTM D5185m         63         16         57           Manganese         ppm         ASTM D5185m         <1	/anadium		ASTM D5185m		<1	0	0
Searon   ppm   ASTM D5185m   19   37   35	Cadmium	• •	ASTM D5185m		<1	0	0
Barium ppm ASTM D5185m 63 16 57  Manganese ppm ASTM D5185m 63 16 57  Manganese ppm ASTM D5185m 1064 840 1090  Calcium ppm ASTM D5185m 887 1415 898  Phosphorus ppm ASTM D5185m 974 829 965  Zinc ppm ASTM D5185m 1202 1043 1268  Sulfur ppm ASTM D5185m 3563 3422 3529  CONTAMINANTS method limit/base current history1 history2  Silicon ppm ASTM D5185m >20 4 3 3  Sodium ppm ASTM D5185m >75 7 5 5  Potassium ppm ASTM D5185m >20 2 3 2  Water % ASTM D6304 >0.1 △ 0.352  ppm Water ppm ASTM D6304 >1000 △ 3520  Glycol % *ASTM D6304 >1000 △ 3520  INFRA-RED method limit/base current history1 history2  Soot % % *ASTM D7844 0.3 0.2 0.3  Nitration Abs/cm *ASTM D7844 >20 11.0 10.8 10.5	ADDITIVES		method	limit/base	current	history1	history2
Description							
Manganese         ppm         ASTM D5185m         <1         <1         <1           Magnesium         ppm         ASTM D5185m         1064         840         1090           Calcium         ppm         ASTM D5185m         887         1415         898           Phosphorus         ppm         ASTM D5185m         974         829         965           Zinc         ppm         ASTM D5185m         1202         1043         1268           Sulfur         ppm         ASTM D5185m         3563         3422         3529           CONTAMINANTS         method         limit/base         current         history1         history2           Silicon         ppm         ASTM D5185m         >20         4         3         3           Sodium         ppm         ASTM D5185m         >20         2         3         2           Potassium         ppm         ASTM D5185m         >20         2         3         2           Nater         %         ASTM D6304         >0.1         0.352             Silycol         %         *ASTM D6304         >10.0         ASTM D5185m         NEG         NEG           INFRA-RED	Boron	ppm	ASTM D5185m		19	37	35
Manganese         ppm         ASTM D5185m         <1         <1         <1           Magnesium         ppm         ASTM D5185m         1064         840         1090           Calcium         ppm         ASTM D5185m         887         1415         898           Phosphorus         ppm         ASTM D5185m         974         829         965           Zinc         ppm         ASTM D5185m         1202         1043         1268           Sulfur         ppm         ASTM D5185m         3563         3422         3529           CONTAMINANTS         method         limit/base         current         history1         history2           Silicon         ppm         ASTM D5185m         >20         4         3         3           Sodium         ppm         ASTM D5185m         >75         7         5         5           Potassium         ppm         ASTM D5185m         >20         2         3         2           Water         %         ASTM D6304         >0.1         0.352             opm Water         ppm         ASTM D6304         >1000         3520             Glycol					-		
Magnesium         ppm         ASTM D5185m         1064         840         1090           Calcium         ppm         ASTM D5185m         887         1415         898           Phosphorus         ppm         ASTM D5185m         974         829         965           Zinc         ppm         ASTM D5185m         1202         1043         1268           Sulfur         ppm         ASTM D5185m         3563         3422         3529           CONTAMINANTS         method         limit/base         current         history1         history2           Silicon         ppm         ASTM D5185m         >20         4         3         3           Sodium         ppm         ASTM D5185m         >75         7         5         5           Potassium         ppm         ASTM D5185m         >20         2         3         2           Water         %         ASTM D6304         >0.1         0.352             Silycol         %         *ASTM D6304         >1000         3520             Glycol         %         *ASTM D2982         NEG         NEG         NEG           INFRA-RED	Barium	ppm	ASTM D5185m		0	0	0
Calcium         ppm         ASTM D5185m         887         1415         898           Phosphorus         ppm         ASTM D5185m         974         829         965           Zinc         ppm         ASTM D5185m         1202         1043         1268           Sulfur         ppm         ASTM D5185m         3563         3422         3529           CONTAMINANTS         method         limit/base         current         history1         history2           Gilicon         ppm         ASTM D5185m         >20         4         3         3           Sodium         ppm         ASTM D5185m         >75         7         5         5           Potassium         ppm         ASTM D5185m         >20         2         3         2           Water         %         ASTM D6304         >0.1         0.3552             appm Water         ppm         ASTM D6304         >1000         3520             Glycol         %         *ASTM D2982         NEG         NEG         NEG           INFRA-RED         method         limit/base         current         history1         history2           Soot	Barium Molybdenum	ppm	ASTM D5185m ASTM D5185m		0 63	0 16	0 57
Phosphorus         ppm         ASTM D5185m         974         829         965           Zinc         ppm         ASTM D5185m         1202         1043         1268           Bulfur         ppm         ASTM D5185m         3563         3422         3529           CONTAMINANTS         method         limit/base         current         history1         history2           Silicon         ppm         ASTM D5185m         >20         4         3         3           Sodium         ppm         ASTM D5185m         >75         7         5         5           Potassium         ppm         ASTM D5185m         >20         2         3         2           Water         %         ASTM D5185m         >20         2         3         2           Water         %         ASTM D5185m         >20         2         3         2           Water         %         ASTM D6304         >0.1         0.352             Opm Water         ppm         ASTM D6304         >1000         3520             Glycol         %         *ASTM D2982         NEG         NEG         NEG	Barium Molybdenum Manganese	ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m		0 63 <1	0 16 <1	0 57 <1
Zinc         ppm         ASTM D5185m         1202         1043         1268           Sulfur         ppm         ASTM D5185m         3563         3422         3529           CONTAMINANTS         method         limit/base         current         history1         history2           Silicon         ppm         ASTM D5185m         >20         4         3         3           Sodium         ppm         ASTM D5185m         >75         7         5         5           Potassium         ppm         ASTM D5185m         >20         2         3         2           Water         %         ASTM D6304         >0.1         △ 0.352             opm Water         ppm         ASTM D6304         >1000         △ 3520             Glycol         %         *ASTM D2982         NEG         NEG         NEG           INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7624         >20         11.0         10.8         10.5	Barium Molybdenum Manganese Magnesium	ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m		0 63 <1 1064	0 16 <1 840	0 57 <1 1090
Sulfur         ppm         ASTM D5185m         3563         3422         3529           CONTAMINANTS         method         limit/base         current         history1         history2           Silicon         ppm         ASTM D5185m         >20         4         3         3           Sodium         ppm         ASTM D5185m         >75         7         5         5           Potassium         ppm         ASTM D5185m         >20         2         3         2           Water         %         ASTM D6304         >0.1         0.352             opm Water         ppm         ASTM D6304         >1000         3520             Glycol         %         *ASTM D2982         NEG         NEG         NEG           INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         0.3         0.2         0.3           Nitration         Abs/cm         *ASTM D7624         >20         11.0         10.8         10.5	Barium Molybdenum Manganese Magnesium Calcium	ppm ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m		0 63 <1 1064 887	0 16 <1 840 1415	0 57 <1 1090 898
Silicon       ppm       ASTM D5185m       >20       4       3       3         Sodium       ppm       ASTM D5185m       >75       7       5       5         Potassium       ppm       ASTM D5185m       >20       2       3       2         Water       %       ASTM D6304       >0.1       0.352           opm Water       ppm       ASTM D6304       >1000       3520           Glycol       %       *ASTM D2982       NEG       NEG       NEG       NEG         INFRA-RED       method       limit/base       current       history1       history2         Soot %       %       *ASTM D7844       0.3       0.2       0.3         Nitration       Abs/cm       *ASTM D7624       >20       11.0       10.8       10.5	Barium Molybdenum Manganese Magnesium Calcium Phosphorus	ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m ASTM D5185m		0 63 <1 1064 887 974	0 16 <1 840 1415 829	0 57 <1 1090 898 965
Silicon         ppm         ASTM D5185m         >20         4         3         3           Sodium         ppm         ASTM D5185m         >75         7         5         5           Potassium         ppm         ASTM D5185m         >20         2         3         2           Water         %         ASTM D6304         >0.1         0.352             ppm         ASTM D6304         >1000         3520             Glycol         %         *ASTM D2982         NEG         NEG         NEG           INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         0.3         0.2         0.3           Nitration         Abs/cm         *ASTM D7624         >20         11.0         10.8         10.5	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		0 63 <1 1064 887 974 1202	0 16 <1 840 1415 829 1043	0 57 <1 1090 898 965 1268
Sodium         ppm         ASTM D5185m         >75         7         5         5           Potassium         ppm         ASTM D5185m         >20         2         3         2           Water         %         ASTM D6304         >0.1         ▲ 0.352             opm Water         ppm         ASTM D6304         >1000         ▲ 3520             Glycol         %         *ASTM D2982         NEG         NEG         NEG           INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         0.3         0.2         0.3           Nitration         Abs/cm         *ASTM D7624         >20         11.0         10.8         10.5	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 ASTM D5185m	limit/base	0 63 <1 1064 887 974 1202 3563	0 16 <1 840 1415 829 1043 3422	0 57 <1 1090 898 965 1268 3529
Potassium         ppm         ASTM D5185m         >20         2         3         2           Water         %         ASTM D6304         >0.1         ▲ 0.352             opm Water         ppm         ASTM D6304         >1000         ▲ 3520             Glycol         %         *ASTM D2982         NEG         NEG         NEG           INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         0.3         0.2         0.3           Nitration         Abs/cm         *ASTM D7624         >20         11.0         10.8         10.5	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 ASTM D5185m		0 63 <1 1064 887 974 1202 3563	0 16 <1 840 1415 829 1043 3422 history1	0 57 <1 1090 898 965 1268 3529
Water         %         ASTM D6304         >0.1         ▲ 0.352             opm Water         ppm         ASTM D6304         >1000         ▲ 3520             Glycol         %         *ASTM D2982         NEG         NEG         NEG           INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         0.3         0.2         0.3           Nitration         Abs/cm         *ASTM D7624         >20         11.0         10.8         10.5	Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon	ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m	>20	0 63 <1 1064 887 974 1202 3563 current	0 16 <1 840 1415 829 1043 3422 history1	0 57 <1 1090 898 965 1268 3529 history2
Oppm Water         ppm         ASTM D6304         >1000         ▲ 3520             Glycol         %         *ASTM D2982         NEG         NEG         NEG           INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         0.3         0.2         0.3           Nitration         Abs/cm         *ASTM D7624         >20         11.0         10.8         10.5	Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium	ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m	>20 >75	0 63 <1 1064 887 974 1202 3563 current 4	0 16 <1 840 1415 829 1043 3422 history1 3	0 57 <1 1090 898 965 1268 3529 history2 3
Glycol         %         *ASTM D2982         NEG         NEG         NEG           INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         0.3         0.2         0.3           Nitration         Abs/cm         *ASTM D7624         >20         11.0         10.8         10.5	Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium Potassium	ppm ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m	>20 >75 >20	0 63 <1 1064 887 974 1202 3563 current 4 7	0 16 <1 840 1415 829 1043 3422 history1 3	0 57 <1 1090 898 965 1268 3529 history2 3 5
INFRA-RED         method         limit/base         current         history1         history2           Soot %         %         *ASTM D7844         0.3         0.2         0.3           Nitration         Abs/cm         *ASTM D7624         >20         11.0         10.8         10.5	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	>20 >75 >20 >0.1	0 63 <1 1064 887 974 1202 3563 current 4 7 2 ▲ 0.352	0 16 <1 840 1415 829 1043 3422 history1 3 5	0 57 <1 1090 898 965 1268 3529 history2 3 5
Soot %         %         *ASTM D7844         0.3         0.2         0.3           Nitration         Abs/cm         *ASTM D7624         >20         11.0         10.8         10.5	Silicon Sodium Potassium Water ppm Water	ppm ppm ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D6304 ASTM D6304	>20 >75 >20 >0.1	0 63 <1 1064 887 974 1202 3563	0 16 <1 840 1415 829 1043 3422 history1 3 5 3	0 57 <1 1090 898 965 1268 3529 history2 3 5 2
Nitration         Abs/cm         *ASTM D7624         >20         11.0         10.8         10.5	Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium Potassium Water opm Water Glycol	ppm ppm ppm ppm ppm ppm ppm ppm ppm ppm	ASTM D5185m ASTM D6304 ASTM D6304 *ASTM D6304	>20 >75 >20 >0.1 >1000	0 63 <1 1064 887 974 1202 3563	0 16 <1 840 1415 829 1043 3422 history1 3 5 3	0 57 <1 1090 898 965 1268 3529 history2 3 5 2
	Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium Potassium Water opm Water Glycol INFRA-RED	ppm	ASTM D5185m ASTM D6304 *ASTM D6304 *ASTM D6304	>20 >75 >20 >0.1 >1000	0 63 <1 1064 887 974 1202 3563 current 4 7 2 ▲ 0.352 ▲ 3520 NEG	0 16 <1 840 1415 829 1043 3422 history1 3 5 3 NEG history1	0 57 <1 1090 898 965 1268 3529 history2 3 5 2 NEG history2
Sulfation Abs/.1mm *ASTM D7415 >30 <b>22.2</b> 21.5 23.8	Barium Molybdenum Manganese Magnesium Calcium Phosphorus Zinc Sulfur CONTAMINANTS Silicon Sodium Potassium Water opm Water Glycol INFRA-RED Soot %	ppm	ASTM D5185m ASTM D6304 ASTM D6304 *ASTM D6304 *ASTM D6304 *ASTM D7844	>20 >75 >20 >0.1 >1000	0 63 <1 1064 887 974 1202 3563 current 4 7 2 ▲ 0.352 ▲ 3520 NEG current 0.3	0 16 <1 840 1415 829 1043 3422 history1 3 5 3 NEG history1 0.2	0 57 <1 1090 898 965 1268 3529 history2 3 5 2 NEG history2 0.3



# OIL ANALYSIS REPORT







Certificate 12367

Laboratory

Sample No. Lab Number

: 06183444 Unique Number : 11034770

: WearCheck USA - 501 Madison Ave., Cary, NC 27513 : KL0013502

Received **Tested** Diagnosed

: 17 May 2024 : 22 May 2024 : 22 May 2024 - Jonathan Hester

Test Package: MOB 2 (Additional Tests: Glycol, KF, PrtCount) 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)

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658 FRONT ST, SUITE 127

Contact: BILL CALDWELL

**EXPEDITIONS** 

LAHAINA, HI

US 96761