Summary Report for dated 11-Sep-2018

OIL RATING
Remaining reserve of alkalinity (BN) in the oil is adequate. Contaminant elements Sodium, Aluminium and Silicon might be originated from the HFO. Vanadium and Nickel are HFO derived elements.

UNIT RATING
PQ and elemental Fe results suggest that the Iron level is within the acceptable limit.

Stuffing box performance
The stuffing box performance is evaluated by the share of System Oil in scrape down sample landed per unit.
The result of the latest cylinder scavenge drain oil sample is indicated by a black number identifying the cylinder unit of the engine. Any previous results of each cylinder unit are represented by a white number. Underlined cylinder sample numbers (e.g. 5) show results for cylinder oil samples of a low BN Cylinder Oil of BN < 60 mgKOH/g; if not underlined a Cylinder Oil of BN > 60 mgKOH/g is used. For further details either check the summary page containing all data from past main engine cylinder scapedown analyses or refer to the trend report for the individual cylinder number.
## MAIN ENGINE [CYLINDER SCRAPEDOWN]

### Manufacturer: MAN B&W
### Fuel (Sulphur [%wt]): (3.50%)  |  Model: Recommended
### Lubricant in Use: TARO SPECIAL HT 70  |  Manufacturer: 6S50MC-C

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>CYL 1</th>
<th>CYL 2</th>
<th>CYL 3</th>
<th>CYL 4</th>
<th>CYL 5</th>
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### Analysis

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<th>CYL 4</th>
<th>CYL 5</th>
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<td>BN [corr] [mgKOH/g]</td>
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<td>PQ Index [2ml (corr)]</td>
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<td>22</td>
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### Wear Elements [ppm]

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<th>Element</th>
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<th>CYL 3</th>
<th>CYL 4</th>
<th>CYL 5</th>
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<tr>
<td>Aluminium (Al)</td>
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<td>Copper (Cu)</td>
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### Contaminant Elements [ppm]

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<tr>
<th>Element</th>
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<th>CYL 3</th>
<th>CYL 4</th>
<th>CYL 5</th>
<th>CYL 6</th>
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</thead>
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<tr>
<td>Sodium (Na)</td>
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<td>24</td>
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<td>Nickel (Ni)</td>
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<td>Vanadium (V)</td>
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<td>95</td>
<td>122</td>
<td>87</td>
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### MAIN ENGINE [CYLINDERS] [Cylinder No 1]

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>MAN B&amp;W</th>
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<tbody>
<tr>
<td>Port Landed</td>
<td>Mozambique Port</td>
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<td>Fuel Grade</td>
<td>6S50MC-C</td>
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<td>Sampled By</td>
<td>2 / E</td>
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<tr>
<td>Lubricant in Use</td>
<td>TARO SPECIAL HT 70</td>
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#### Sample Details

<table>
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<tr>
<th>Rating</th>
<th>Sample No</th>
<th>Sampled Date</th>
<th>Engine Hours</th>
<th>Liner Hours</th>
<th>Crown Hours</th>
<th>Piston Ring Hours</th>
<th>Feed Rate[g/kwh]</th>
<th>Fuel,Sulphur[%wt]</th>
<th>Sys.Oil Dilution[%]</th>
<th>Rpm[mm²/s]</th>
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<tbody>
<tr>
<td>Normal</td>
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<td>21-Jul-18</td>
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<td>3.50</td>
<td>55.90</td>
<td>108.50</td>
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</table>

#### New Oil

<table>
<thead>
<tr>
<th>New Oil</th>
<th>OEM</th>
<th>System Oil</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>70.0</td>
<td>Dark</td>
<td>Appearance</td>
<td>Dark</td>
</tr>
<tr>
<td>21.0</td>
<td>14.8</td>
<td>BN[mgKOH/g] / (Corr)</td>
<td>42.4 / 46.9</td>
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<tr>
<td>&gt;200</td>
<td>12.63</td>
<td>KV@100°C[mm²/s] / (Corr)</td>
<td>19.34 / 20.84</td>
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<td>&lt;0.05</td>
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<td>Water[%wt]</td>
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<td>16</td>
<td>23</td>
<td>Sp. FR[g/kWh/%wt]</td>
<td>0.43</td>
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<tr>
<td>14</td>
<td>23/24</td>
<td>Load[%MCR]</td>
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<tr>
<td>16</td>
<td>23/24</td>
<td>PQ Index/2ml / (Corr)</td>
<td>23/24</td>
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#### Wear Elements [ppm]

<table>
<thead>
<tr>
<th>Contaminant Elements</th>
<th>ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Aluminium (Al)</td>
<td>6</td>
</tr>
<tr>
<td>&lt;1 Chromium (Cr)</td>
<td>2</td>
</tr>
<tr>
<td>4 Copper (Cu)</td>
<td>17</td>
</tr>
<tr>
<td>7 Iron (Fe) / (Corr)</td>
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<tr>
<td>1 Lead (Pb)</td>
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<tr>
<td>1 Tin (Sn)</td>
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<tr>
<td>9 Sodium (Na)</td>
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<td>7 Silicon (Si)</td>
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<td>&lt;1 Molybdenum (Mo)</td>
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<td>4 Nickel (Ni)</td>
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<td>&lt;1 Silver (Ag)</td>
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<td>14 Vanadium (V)</td>
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</table>

#### Oil Rating:

Remaining reserve of alkalinity in the oil is adequate. Contaminant elements Sodium, Aluminium and Silicon might be originated from the HFO. Vanadium and Nickel are HFO derived elements.

#### Unit Rating:

PQ and elemental Fe results suggest that the iron level is within the acceptable limit.

#### Action:

No action required.

Support: Support@tribocare.com  
Dated: 11-Sep-2018
MAIN ENGINE [CYLINDERS] [Cylinder No 2]

Manufacturer : MAN B&W
Port Landed : Mozambique Port
Fuel Grade :
Sampled By : 2 / E
Lubricant in Use : TARO SPECIAL HT 70

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<td>Engine Hours</td>
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<td>Liner Hours</td>
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<tr>
<td>Crown Hours</td>
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<tr>
<td>Piston Ring Hours</td>
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<tr>
<td>Feed Rate[g/kwh]</td>
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<td>Fuel,Sulphur[%wt]</td>
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<tr>
<td>Sp. FR[g/kWh%/wt]</td>
<td>0.43</td>
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<tr>
<td>Load[% MCR]</td>
<td>55.90</td>
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<td>Rpm[mm^3]</td>
<td>108.50</td>
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New Oil | OEM | System Oil | Analysis
---|-----|------------|---
70.0 | Dark | Appearance | Dark
14.8 | BN[mgKOH/g](/Corr) | 40.6 /44.1
21.0 | 12.63 | KV@100°C[mm²/s] (/Corr) | 18.70 / 19.80
270 | >200 | Flash Point[°C] | >200
<0.05 | Water[%wt] | 0.60
0.20 | Soot/Insoluble[%wt] | 0.40
16 | Sys.Oil Dilution[%] | 12
16 | Pq Index/2ml (/Corr) | 21 / 21

Wear Elements [ppm]

- Aluminium (Al) | 6
- Copper (Cu) | 4
- Iron (Fe) (/Corr) | 7
- Lead (Pb) | 1
- Tin (Sn) | 1
- Sodium (Na) | 9
- Silicon (Si) | 7
- Molybdenum (Mo) | 4
- Nickel (Ni) | 1
- Silver (Ag) | 14
- Vanadium (V) | 14

Contaminant Elements [ppm]

- Antimony Bearings
- Manganese
- Antimony
- Arsenic
- Barium
- Cadmium
- Chalk
- Chromium
- Copper
- Lead
- Mercury
- Nickel
- Nickel
- Silver
- Tin
- Vanadium
- Copper
- Lead
- Nickel
- Silver
- Tin
- Vanadium
- Copper
- Lead
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- Silver
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- Silver
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- Vanadium
- Copper
- Lead
- Nickel
- Silver
- Tin
- Vanadium
- Copper
- Lead
- Ni...
The information above is considered to be accurate as of the dates specified. We do not accept any liability, express or implied, is made as to the accuracy or completeness of the data and the information contained in this note.

Support: Support@tribocare.com

Dated: 11-Sep-2018
### MAIN ENGINE [CYLINDERS] [Cylinder No 4]

**Manufacturer**: MAN B&W  
**Model**: 6S50MC-C  
**Port Landed**: Mozambique Port  
**Fuel Grade**:  
**Sampled By**: 2 / E  
**Lubricant in Use**: TARO SPECIAL HT 70  
**Volume(ltr)**: 11000  
**Dispatched**: 03-Sep-18  
**Received**: 09-Sep-18  
**Recommended**: TARO SPECIAL HT 70

<table>
<thead>
<tr>
<th>Sample Details</th>
<th>1 (Current)</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating</td>
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<td></td>
</tr>
<tr>
<td>Sample No</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Sampled Date</td>
<td>21-Jul-18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engine Hours</td>
<td>42747</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liner Hours</td>
<td>42747</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crown Hours</td>
<td>42747</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Piston Ring Hours</td>
<td>5916</td>
<td></td>
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</tr>
<tr>
<td>Feed Rate[g/kwh]</td>
<td>1.50</td>
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<td></td>
</tr>
<tr>
<td>Fuel,Sulphur[%wt]</td>
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<td>Sp. FR[g/kWh [%wt]</td>
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<td>Load[%MCR]</td>
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<tr>
<td>Rpm[Min¹]</td>
<td>108.50</td>
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<table>
<thead>
<tr>
<th>New Oil</th>
<th>OEM</th>
<th>System Oil</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>70.0</td>
<td>Dark</td>
<td>Appearance</td>
<td>Dark</td>
</tr>
<tr>
<td>21.0</td>
<td>14.8</td>
<td>BN[mgKOH/g] (Corr)</td>
<td>41.1 /45.7</td>
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<tr>
<td>270</td>
<td>12.63</td>
<td>KV@100°C[mm²/s] (Corr)</td>
<td>18.01 /19.25</td>
</tr>
<tr>
<td>&gt;200</td>
<td>&lt;0.05</td>
<td>Flash Point[*°C]</td>
<td>&gt;200</td>
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<tr>
<td>0.20</td>
<td>16</td>
<td>Water[%wt]</td>
<td>0.60</td>
</tr>
<tr>
<td>28 /31</td>
<td>15</td>
<td>Soot/Insoluble[%wt]</td>
<td>0.40</td>
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<tr>
<td>18 /18</td>
<td>18 /18</td>
<td>Sys.Oil Dilution[%]</td>
<td>15</td>
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<tr>
<td>18 /18</td>
<td>18 /18</td>
<td>PQ Index/2ml (Corr)</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Wear Elements [ppm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminium (Al)</td>
</tr>
<tr>
<td>Chromium (Cr)</td>
</tr>
<tr>
<td>Copper (Cu)</td>
</tr>
<tr>
<td>Iron (Fe)</td>
</tr>
<tr>
<td>Lead (Pb)</td>
</tr>
<tr>
<td>Tin (Sn)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contaminant Elements [ppm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium (Na)</td>
</tr>
<tr>
<td>Silicon (Si)</td>
</tr>
<tr>
<td>Molybdenum (Mo)</td>
</tr>
<tr>
<td>Nickel (Ni)</td>
</tr>
<tr>
<td>Silver (Ag)</td>
</tr>
<tr>
<td>Vanadium (V)</td>
</tr>
</tbody>
</table>

### Oil Rating:
Remaining reserve of alkalinity in the oil is adequate. Contaminant elements Sodium, Aluminium and Silicon might be originated from the HFO. Vanadium and Nickel are HFO derived elements.

### Unit Rating:
PQ and elemental Fe results suggest that the iron level is within the acceptable limit.

### Action:
No action required.

Support: Support@tribocare.com

Dated: 11-Sep-2018
MAIN ENGINE [CYLINDERS] [Cylinder No 5]

Manufacturer: MAN B&W
Port Landed: Mozambique Port
Fuel Grade: 
Sampled By: 2 / E
Lubricant in Use: TARO SPECIAL HT 70
Volume(ltr): 11000
Received: 09-Sep-18

Sample Details

<table>
<thead>
<tr>
<th>Rating</th>
<th>1 (Current)</th>
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<th>3</th>
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</thead>
<tbody>
<tr>
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</tr>
<tr>
<td>Sample Date</td>
<td>21-Jul-18</td>
<td></td>
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</tr>
<tr>
<td>Engine Hours</td>
<td>42747</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liner Hours</td>
<td>42747</td>
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<tr>
<td>Crown Hours</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Feed Rate(g/kwh)</td>
<td>1.50</td>
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<td></td>
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<tr>
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<td></td>
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<tr>
<td>Sp. FR[g/kWh/%wt]</td>
<td>0.43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load[%MCR]</td>
<td>55.90</td>
<td></td>
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<tr>
<td>Rpm[min]</td>
<td>108.50</td>
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</tbody>
</table>

New Oil | OEM | System Oil | Analysis |
<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>70.0</td>
<td>Dark</td>
<td>Appearance</td>
<td>Dark</td>
</tr>
<tr>
<td>21.0</td>
<td>14.8</td>
<td>BN[mgKOH]/g /[Corr]</td>
<td>44.4 /46.6</td>
</tr>
<tr>
<td>270</td>
<td>12.63</td>
<td>KV@100°C[mm²/s] /[Corr]</td>
<td>18.63 /19.22</td>
</tr>
<tr>
<td>&gt;200</td>
<td>0.05</td>
<td>Flash Point[°C]</td>
<td>&gt;200</td>
</tr>
<tr>
<td>&lt;0.20</td>
<td>0.20</td>
<td>Water[%wt]</td>
<td>0.60</td>
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<tr>
<td>16</td>
<td>7</td>
<td>Soot/Insoluble[%wt]</td>
<td>0.40</td>
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<tr>
<td></td>
<td></td>
<td>Sys.Oil Dilution[%]</td>
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<tr>
<td></td>
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<td>PQ Index/2ml /[Corr]</td>
<td>19 /19</td>
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</table>

Wear Elements [ppm]

<table>
<thead>
<tr>
<th>Element</th>
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<th>&lt;1</th>
<th>4</th>
<th>7</th>
<th>1</th>
<th>1</th>
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<tbody>
<tr>
<td>Aluminium (Al)</td>
<td>6</td>
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<tr>
<td>Chromium (Cr)</td>
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<tr>
<td>Copper (Cu)</td>
<td>4</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron (Fe) /[Corr]</td>
<td>30 /31</td>
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<td></td>
</tr>
<tr>
<td>Lead (Pb)</td>
<td>&lt;1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tin (Sn)</td>
<td>1</td>
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</table>

Contaminant Elements [ppm]

<table>
<thead>
<tr>
<th>Element</th>
<th>9</th>
<th>7</th>
<th>&lt;1</th>
<th>4</th>
<th>&lt;1</th>
<th>14</th>
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</thead>
<tbody>
<tr>
<td>Sodium (Na)</td>
<td>25</td>
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<tr>
<td>Silicon (Si)</td>
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<tr>
<td>Molybdenum (Mo)</td>
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<tr>
<td>Nickel (Ni)</td>
<td>23</td>
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<tr>
<td>Silver (Ag)</td>
<td>&lt;1</td>
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</tr>
<tr>
<td>Vanadium (V)</td>
<td>90</td>
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</tbody>
</table>

Oil Rating:
Remaining reserve of alkalinity in the oil is adequate. Contaminant elements Sodium, Aluminium and Silicon might be originated from the HFO. Vanadium and Nickel are HFO derived elements.

Unit Rating:
PQ and elemental Fe results suggest that the iron level is within the acceptable limit.

Action:
No action required.

Support: Support@tribocare.com

Dated: 11-Sep-2018
Support: Support@tribocare.com
### Lubricant Analysis - Glossary

The service utilises the latest analytical techniques and computer programming to offer an advanced lubricant analysis package that provides a valuable lubricant monitoring tool for the ship operator.

#### Lubricant properties reported on lubricant analysis reports

- **Viscosity**: A measure of the resistance of a liquid to flow. Commonly referred to as the ‘thickness of an oil’.
- **Closed Flash Point**: Primarily a test for fuel dilution in engine oils. A decrease in flash point is generally an indication of fuel ingress which has contaminated the lubricant.
- **Insolubles**: A test for the total solids contamination in a lubricant such as combustion soot, dirt, oxidation products and metal wear debris.
- **Base Number**: Previously known as Total Base Number (TBN) is a measure of the reserve alkalinity of an engine oil and its ability to neutralise harmful acids.
- **Acid Number**: Tests the acidity of the oil. Certain oils have an inherent acidity level related to their additive chemistry. Increasing acidity may be indicative of the presence of organic acids derived from oil oxidation.
- **Water**: The percentage (by volume) of the total amount of water contamination.
- **PQ Index**: Not an oil property but an indices that provides a quantitative assessment, for trending purposes, of the amount of ferrous wear debris in the sample.
- **Asphaltenes**: Give an indication of heavy fuel derived components from raw fuel ingress and/or products of combustion from blow-by.

#### Elemental analysis with some typical sources

<table>
<thead>
<tr>
<th>Elements reported depend on machinery type and oil grade and are reported in PPM - Parts Per Million</th>
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</thead>
<tbody>
<tr>
<td>Aluminium Pistons, bearings, housings, fuel derivative</td>
</tr>
<tr>
<td>Antimony Bearings</td>
</tr>
<tr>
<td>Calcium Lubricant derivative</td>
</tr>
<tr>
<td>Chromium Piston rings</td>
</tr>
<tr>
<td>Copper Bearings, gears, oil coolers, pipe-work, piston-rod glands</td>
</tr>
<tr>
<td>Iron Cylinder liners, crankshafts, piston rings, gears</td>
</tr>
<tr>
<td>Lead Bearings</td>
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<tr>
<td>Magnesium Casings, housings, lubricant derivative</td>
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<tr>
<td>Manganese Cylinder liners</td>
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<tr>
<td>Molybdenum Piston rings</td>
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<tr>
<td>Nickel Bearings, valves, gears, fuel derivative</td>
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<tr>
<td>Potassium Salt Water</td>
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<tr>
<td>Phosphorus Lubricant derivative</td>
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<tr>
<td>Silicon Dust, dirt, fuel derivative, lubricant derivative</td>
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<tr>
<td>Silver Bearings</td>
</tr>
<tr>
<td>Sodium Salt water, coolant derivative, fuel derivative</td>
</tr>
<tr>
<td>Tin Bearings</td>
</tr>
<tr>
<td>Vanadium Fuel derivative</td>
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<tr>
<td>Zinc Lubricant derivative</td>
</tr>
</tbody>
</table>

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