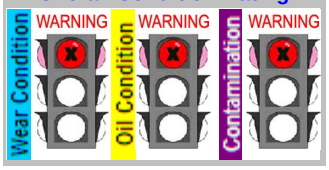
CUSTOMER
Code : **23023**
Name : **Ltd.**
Address : 250 Moo 12, Tambol Kron, Amphor Sawee, Chumporn 86130
Site :
Location :
Test code : 804 908 90900

EQUIPMENT
Unit ID : **506397**
Unit Type : Engine Nat Gas
Unit Make : GE JENBACHER
Unit Model : JMS 420 GS-B.L

OIL
Oil type / Viscosity : EXXON MOBIL 610
Oil System Capacity : 800 Liters

**Overall Condition Rating**




## Notes (Finding, Evaluation, Interpretation, Suggestion and Recommendation)

Free-water found in the bottom of the sample bottle.
Positive indication for water detected on crackle screening test.
X - Unable to perform viscosity at 100 C due to high water content in oil.
Additive levels (Sodium) indicates the probability that the water is from ethylene glycol and water (cooling system) mixture. Recommend cooling system pressure check.
Recommend immediately change oil, oil filter and flush system with clean oil to remove contamination, if the oil from this sample is still in use in this component.
Recommend resample 125 hours after this oil has been changed.

Somchai J / Andy Sitton

| Condition History | Test Method | Result | Current Sample Wear | Current Sample Oil | Current Sample Cont. | Previous Sample Wear | Previous Sample Oil | Previous Sample Cont. | Previous Sample Wear | Previous Sample Oil | Previous Sample Cont. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | W | W | W | W | W | N | W | C | N |
| **Lab ID** | | | 148636 | | | 131905 | | | 125416 | | |
| **Bottle ID** | | | 900145 | | | 900144 | | | 900141 | | |
| **Date Sampled** | | | 19-Nov-10 | | | 12-Mar-10 | | | 02-Dec-09 | | |
| **Oil Hours (Kms)** | | | 1068 | | | 1591 | | | 227 | | |
| **Unit Hours (Kms)** | | | 17068 | | | 13383 | | | 12019 | | |
| **Oil Added (Liters)** | | | | | | | | | | | |
| **Filters Hours (Kms)** | | | | | | | | | | | |
| **Wear Condition** | | | | | | | | | | | |
| **Wear Element** | **Method** | **Unit** | **RDE fine** | **RFS coarse** | | **RDE fine** | **RFS coarse** | | **RDE fine** | **RFS coarse** | |
| Iron | D-6595 | PPM | 62.6 W | 32.3 W | | 39.4 W | 19.5 C | | 36.9 W | 59.8 W | |
| Chromium | D-6595 | PPM | 1.2 | 0.0 | | 1.3 | 0.7 | | 0.7 | 1.1 | |
| Lead | D-6595 | PPM | 1.9 | 0.2 | | 0.0 | 0.0 | | 0.0 | 2.5 | |
| Copper | D-6595 | PPM | 41.8 W | 14.8 C | | 67.8 W | 37.1 W | | 107.6 W | 371.5 W | |
| Tin | D-6595 | PPM | 0.4 | 0.3 | | 0.0 | 1.5 | | 3.9 C | 15.5 W | |
| Aluminum | D-6595 | PPM | 6.8 | 11.5 C | | 4.9 | 4.3 | | 3.8 | 5.7 | |
| Nickel | D-6595 | PPM | 1.2 C | 0.0 | | 0.6 | 0.0 | | 0.4 | 0.8 | |
| Silver | D-6595 | PPM | 0.0 | 0.0 | | 0.0 | 0.1 | | 0.0 | 0.0 | |
| Molybdenum | D-6595 | PPM | 0.0 | 0.1 | | 2.1 | 0.4 | | 0.0 | 0.4 | |
| Titanium | D-6595 | PPM | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| **Oil Condition** | | | | | | | | | | | |
| Viscosity @ 40°C | D-445 | cSt | | | | | | | | | |
| Viscosity @ 100°C | D-445 | cSt | X | | | 14.9 C | | | 14.1 | | |
| Oxidation | FTIR | Abs | 22.1 W | | | 18.4 C | | | 14.3 | | |
| Nitration | FTIR | Abs | 19.5 W | | | 8.6 C | | | 7.0 | | |
| TAN | D-974 | mg KOH/g. | 2.29 C | | | 3.54 W | | | 2.03 C | | |
| TBN | D-4739 | mg KOH/g. | 1.0 W | | | 0.0 W | | | 4.5 | | |
| **Contamination** | | | | | | | | | | | |
| Water | FTIR | % (Wt.) | 1.541 W | | | 0.092 | | | 0.081 | | |
| Fuel | SAW | % (Wt.) | 0.00 | | | 0.00 | | | 0.00 | | |
| Glycol | FTIR | Abs | 0 | | | 0 | | | 0 | | |
| Soot | FTIR | % (Wt.) | 0.66 | | | 0.58 | | | 0.50 | | |
| | | | | | | | | | | | |
| Sodium | D-6595 | PPM | 610 W | | | 0 | | | 8 | | |
| Silicon | D-6595 | PPM | 20.6 C | 51.2 W | | 5.1 | 1.4 | | 4.7 | 5.6 | |
| **Additive Element** | | | | | | | | | | | |
| Boron | D-6595 | PPM | 0 | | | 0 | | | 0 | | |
| Magnesium | D-6595 | PPM | 25 | | | 13 | | | 9 | | |
| Calcium | D-6595 | PPM | 3218 | | | 3772 | | | 2902 | | |
| Barium | D-6595 | PPM | 0 | | | 0 | | | 0 | | |
| Phosphorus | D-6595 | PPM | 0 | | | 0 | | | 0 | | |
| Zinc | D-6595 | PPM | 5 | 3 | | 3 | 1 | | 5 | 4 | |
| **Additional Test** | | | | | | | | | | | |
| Flash Point | D-3828 | °C | | | | | | | | | |
| Viscosity Index | D-2270 | | | | | | | | | | |
| i-pH | | | 4.67 | | | | | | | | |

**Baseline and Alarm Limit**

**Alarm Limit**

Alarm Limit Matrix -Set Name (Equipment type / oil type)

Engine Biogas GE Jenbacher MB 610

| BASELINE | Reference Oil (RO) | RDE fine U-Caution | RDE fine U-Warning | RFS coarse U-Caution | RFS coarse U-Warning |
|---|---|---|---|---|---|
| | | | | | |
| Wear Condition | | | | | |
| Wear Element | RO | U-Caution | U-Warning | U-Caution | U-Warning |
| Iron | 0 | >15 | >20 | >15 | >20 |
| Chromium | 0 | >3 | >5 | >3 | >5 |
| Lead | 0 | >10 | >20 | >10 | >20 |
| Copper | 0 | >10 | >15 | >10 | >15 |
| Tin | 0 | >3 | >5 | >3 | >5 |
| Aluminum | 0 | >10 | >15 | >10 | >15 |
| Nickel | 0 | >1 | >2 | >2 | >3 |
| Silver | 0 | | | | |
| Molybdenum | 0 | | | | |
| Titanium | 0 | | | | |
| Oil Condition | | | | | |
| | RO | L-Warning | L-Caution | U-Caution | U-Warning |
| Viscosity @ 40°C | 131.4 | | | | |
| Viscosity @ 100°C | 13.5 | <11.5 | <12.2 | >14.8 | >15.5 |
| Oxidation | 14.2 | | | >17.7 | >21.3 |
| Nitration | 6.0 | | | >7.5 | >9 |
| TAN | 0.55 | | | >1.5 | >2.75 |
| TBN | 8.8 | <2 | <4.4 | | |
| Contamination | | | | | |
| | RO | | | U-Caution | U-Warning |
| Water | 0.043 | | | >0.1 | >0.15 |
| Fuel | | | | | |
| Glycol | | | | | |
| Soot | | | | | |
| | | RDE fine | | RFS coarse | |
| | | U-Caution | U-Warning | U-Caution | U-Warning |
| Sodium | 3 | >25 | >50 | | |
| Silicon | 4 | >16 | >23 | >8 | >15 |
| Additive Element | RO | | | | |
| Boron | 4 | >25 | >50 | | |
| Magnesium | 10 | | | | |
| Calcium | 3158 | | | | |
| Barium | 0 | | | | |
| Phosphorus | 0 | | | | |
| Zinc | 0 | | | | |
| Additional Test | RO | L-Warning | L-Caution | U-Caution | U-Warning |
| Flash Point | | | | | |
| Viscosity Index | | | | | |
| i-pH | | <4 | <4.5 | | |

Note: Alarm Limits are variable and dependent upon dataset size and to be used as general guideline.
No Sign or N : NORMAL , C or C : CAUTION ( first level warning limit ) , W or W : Warning ( second level warning limit )
U-Caution : Upper CAUTION Level L-Caution : Lower CAUTION Level
U-Warning : Upper WARNING Level L-Warning : Lower WARNING required Level
Baseline will be data of either "The new oil" or "Reference oil" or "Oil specification".
Accuracy of interpretation and recommendation are based on representatives sample and information supplied.
First Level Alarm .Alert Limit in Upper Level and/or Lower Level
Second Level Alarm Alert Limit in Upper Level and/or Lower Level
TNO = The new oil , RO = Reference oil , OS = Oil Specification
No warranty is expressed or implied for this report.

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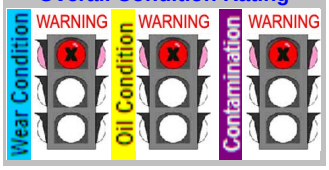
Website : http://www.focuslab.co.th
Tel : +66 2 361 8600 Fax : + 66 2 3618567
Email : focuslab@focuslab.co.th

CUSTOMER
Code : **23023**
Name : **Ltd.**
Address : 250 Moo 12, Tambol Kron, Amphor Sawee, Chumporn 86130
Site :
Location :
Test code : 804 908 90900

EQUIPMENT
Unit ID : **506397**
Unit Type : Engine Nat Gas
Unit Make : GE JENBACHER
Unit Model : JMS 420 GS-B.L

OIL
Oil type / Viscosity : EXXON MOBIL 610
Oil System Capacity : 800 Liters

**Overall Condition Rating**



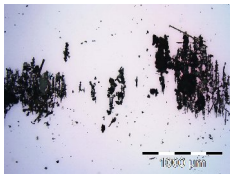
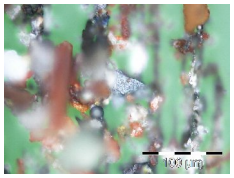
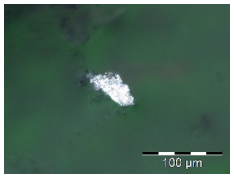

## Notes (Finding, Evaluation, Interpretation, Suggestion and Recommendation)

Red Oxide found in the ferrogram. Red Oxide are an indication of water contamination or rust.
Note the dirt particles detected in ferrogram.
Fatigue particles found in the ferrogram may be an indication of the dirt related fatigue wear.

| | Current Sample | Previous Sample | | |
|---|---|---|---|---|
| **Lab ID** | 148636 | 131905 | 125416 | Ferrographic Analysis |
| **Bottle ID** | 900145 | 900144 | 900141 | |
| **Date Sampled** | 19-Nov-10 | 12-Mar-10 | 02-Dec-09 | |
| **Oil Hours (Kms)** | 1068 | 1591 | 227 | |
| **Unit Hours (Kms)** | 17068 | 13383 | 12019 | |
| **Oil Added (Liters)** | | | | |
| **Filters Hours (Kms)** | | | | |

## Wear Condition

**Ferrographic Analysis** — **Typical Normal Ferrography**

| | | | | |
|---|---|---|---|---|
| Volume of Sample Used | 3.00 ml | ml | ml | ml |
| Image of Wear & Contaminants (Ferrogram) Magnification 50X |  | | | |
| Image of Wear & Contaminants (Ferrogram) Magnification 500X |  | | | |
| Image of Wear & Contaminants (Filtergram) Magnification 500X |  | | | |

| Wear & Contaminants Particles | %Rating | Size (Micron) | Particle Type | %Rating | Size (Micron) | Particle Type | %Rating | Size (Micron) | Particle Type | %Rating | Size (Micron) | Particle Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Normal Rubbing Wear | 17 | 2-5 | F | | | | | | | | | |
| Fatigue Wear | 20 | 15-60 | F | | | | | | | | | |
| Fatigue Sphere | 3 | 10-25 | F | | | | | | | | | |
| Severe Sliding Wear | | | | | | | | | | | | |
| Cutting Wear | | | | | | | | | | | | |
| Black Oxides | 10 | 10-40 | F | | | | | | | | | |
| Red Oxides | 25 | 15-60 | F | | | | | | | | | |
| Corrosive Wear | | | | | | | | | | | | |
| Dirt and Dust | 20 | 10-50 | C | | | | | | | | | |
| White metal | 5 | 20-50 | N | | | | | | | | | |

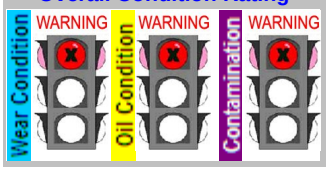
%Rating : Percent area covered by wear debris particles or contaminant particles
Size : Size in micron (0.001 mm) unit of wear debris particles or contaminant particles
**F** : Ferrous Wear Particle, **N** : Non-ferrous Wear Particle, **C** Contaminant Particle

CUSTOMER
Code : **23023**
Name : **Ltd.**
Address : 250 Moo 12, Tambol Kron, Amphor Sawee, Chumporn 86130
Site :
Location :
Test code : 804 908 90900

EQUIPMENT
Unit ID : **506397**
Unit Type : Engine Nat Gas
Unit Make : GE JENBACHER
Unit Model : JMS 420 GS-B.L

OIL
Oil type / Viscosity : EXXON MOBIL 610
Oil System Capacity : 800 Liters

**Overall Condition Rating**




**Lab ID :** 148636 **Date sampled :** 19-Nov-10 **Hours on Oil :** 1068 **Hours on Unit :** 17068 **Bottle ID :** 900145

## ส่วนที่ 1 : หน้าหลัก — Section 1 : Main Page

พบน้ำแยกชั้นที่ก้นขวดตัวอย่าง
พบว่ามีน้ำ โดยการทดสอบพื้นฐานโดย crackle test (คือการหยดน้ำมันหล่อลื่นบนแผ่นความร้อน)
ไม่สามารถวัดค่าความหนืดที่ 100 C ได้ เพราะมีปริมาณน้ำในน้ำมันสูงเกินไป
ระดับสารเคมี ปรุงแต่ง (Sodium) ชี้ว่า เป็นไปได้น้ำมาจาก ethylene glycol (เคมีน้ำหล่อเย็น) และ น้ำในระบบหล่อเย็น รวมกัน แนะนำตรวจสอบความดันของระบบน้ำหล่อเย็น
แนะนำให้ถ่ายน้ำมันและล้างระบบด้วยน้ำมันใหม่เพื่อขจัดสิ่งปนเปื้อน ถ้าน้ำมันหล่อลื่นนี้ยังคงใช้งานในขณะนี้
แนะนำเก็บตัวอย่างซ้ำอีกครั้งภายใน 125 ชั่วโมงหลังการเปลี่ยนถ่ายน้ำมันแล้ว

## ส่วนที่ 2 : หน้าที่สอง — Section 2 : Second Page

## ส่วนที่ 3 : หน้าของ Analytical Ferrography — Section 3 : Analytical Ferrography Page

สังเกต อนุภาคสิ่งสกปรกบนสไลด์เฟอร์โรแกรม
อนุภาคการสึกหรอแบบล้าตัวที่พบ อาจเกี่ยวเนื่องมาจากอนุภาคสิ่งสกปรกในระบบ

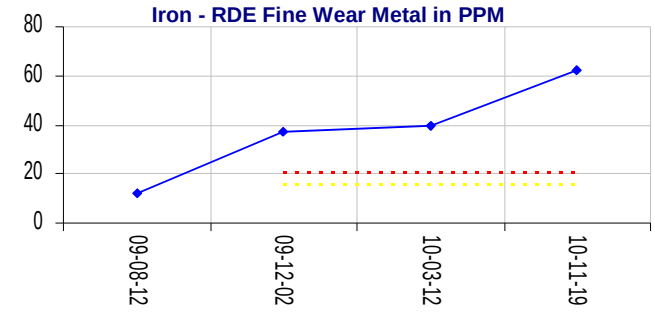
## ส่วนที่ 4 : หน้าของ Gravimetric Page — Section 4 : Gravimetric Page

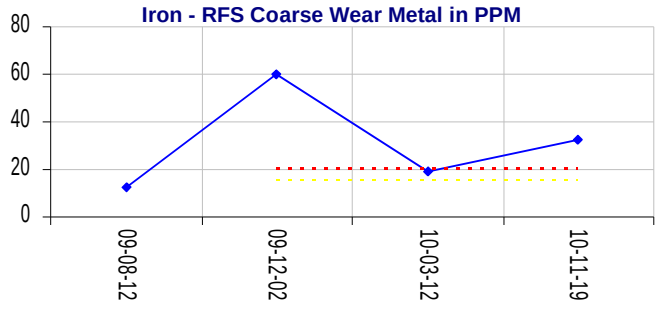
CUSTOMER
Code : **23023**
Name : **Ltd.**
Address : 250 Moo 12, Tambol Kron, Amphor Sawee, Chumporn 86130
Site :
Location :
Test code : 804 908 90900

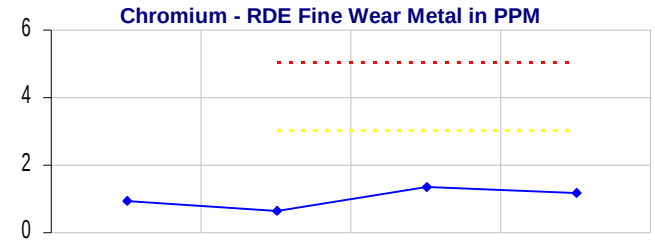
EQUIPMENT
Unit ID : **506397**
Unit Type : Engine Nat Gas
Unit Make : GE JENBACHER
Unit Model : JMS 420 GS-B.L

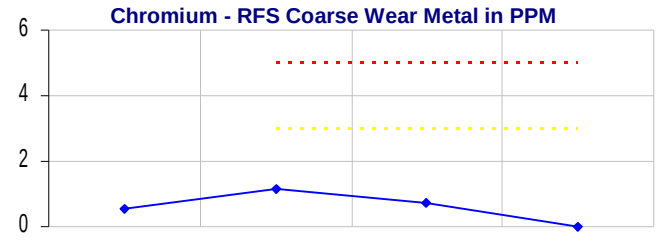
OIL
Oil type / Viscosity : EXXON MOBIL 610
Oil System Capacity : 800 Liters

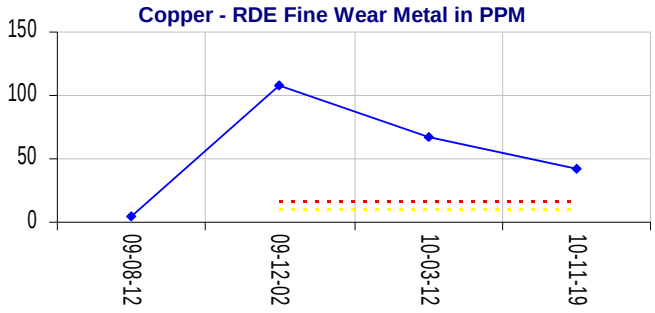
## Wear Condition

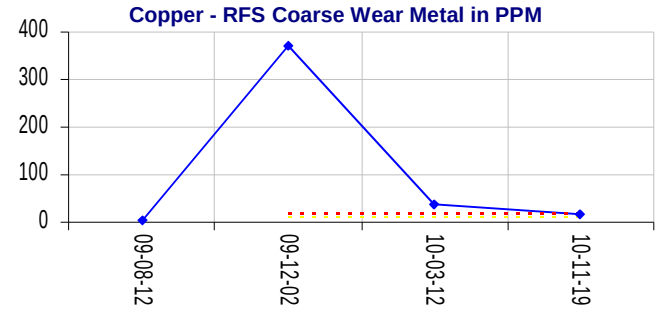


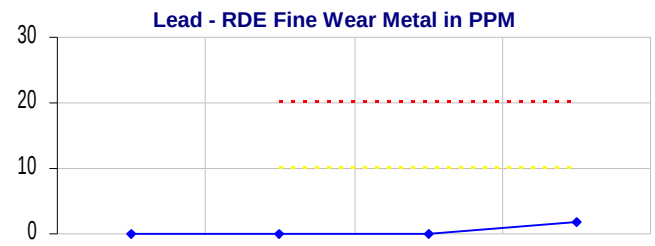



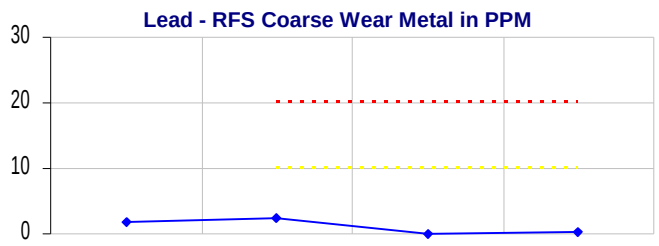



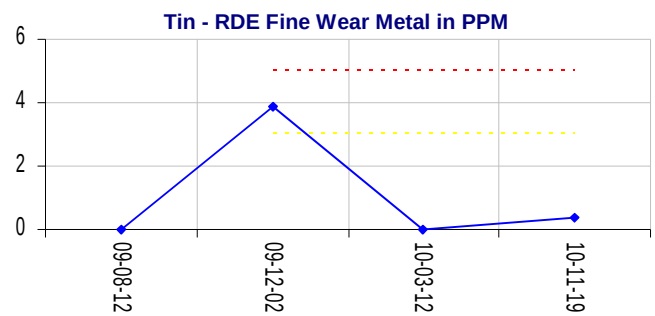



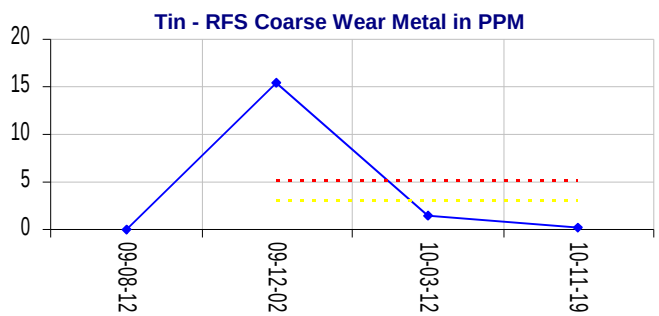



CUSTOMER
Code : **23023**
Name : **Ltd.**
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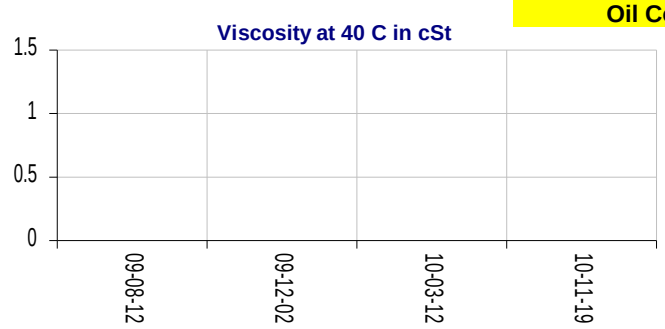
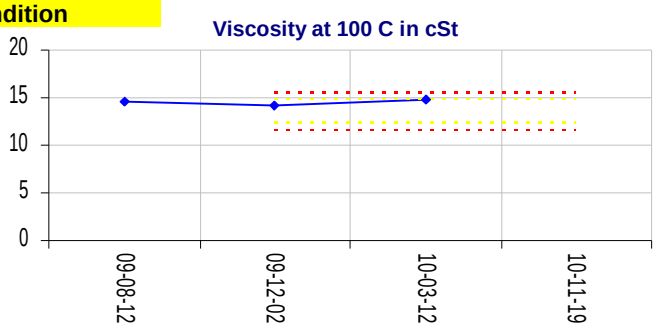
Site :
Location :
Test code : 804 908 90900

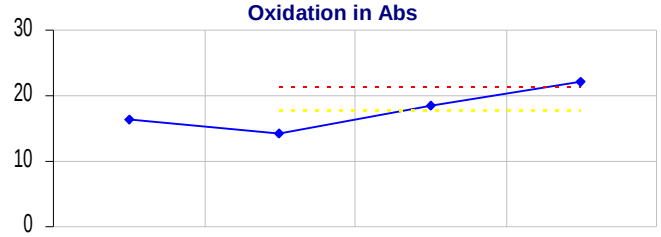
EQUIPMENT
Unit ID : **506397**
Unit Type : Engine Nat Gas
Unit Make : GE JENBACHER
Unit Model : JMS 420 GS-B.L

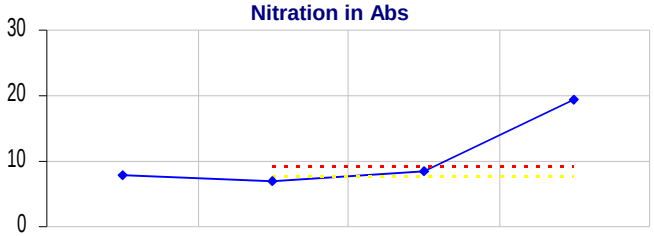
OIL
Oil type / Viscosity : EXXON MOBIL 610
Oil System Capacity : 800 Liters

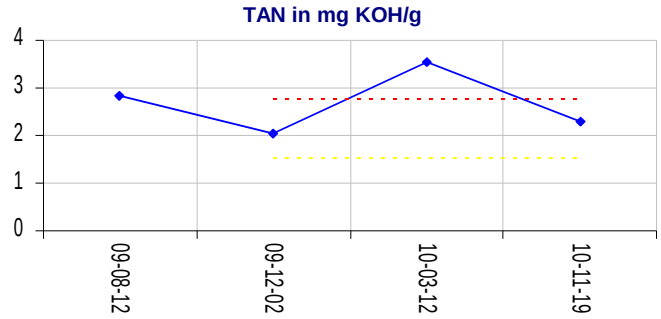
## Oil Condition

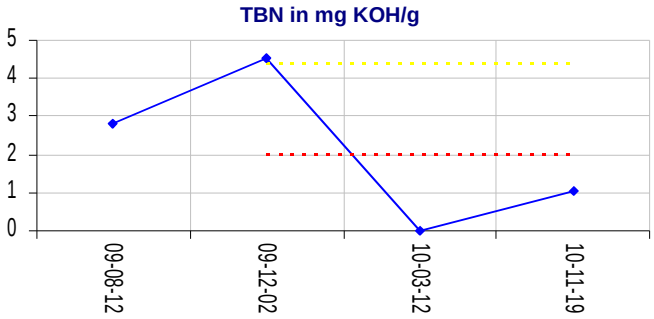


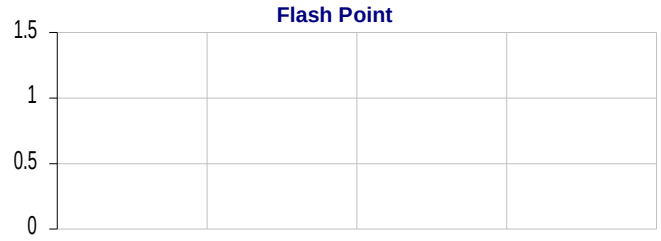



CUSTOMER
Code : **23023**
Name : **Ltd.**
Address : 250 Moo 12, Tambol Kron, Amphor Sawee, Chumporn 86130
Site :
Location :
Test code : 804 908 90900

EQUIPMENT
Unit ID : **506397**
Unit Type : Engine Nat Gas
Unit Make : GE JENBACHER
Unit Model : JMS 420 GS-B.L

OIL
Oil type / Viscosity : EXXON MOBIL 610
Oil System Capacity : 800 Liters

## Contamination Condition