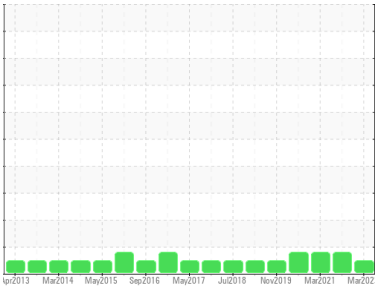
# OIL ANALYSIS REPORT

Sample Rating Trend



NORMAL

Area
**9**
Machine Id
## WINERGY GEARBOX WTG-907 (S/N 4836487-0020-8)
Component
**Wind Turbine Gearbox**
Fluid
**FUCHS RENOLIN UNISYN CKC ISO 320 (340 LTR)**

## DIAGNOSIS

**Recommendation**
Resample at the next service interval to monitor. Analytical Ferrography: Results appear to be fairly normal, but there is a potential concern present. The presence of black oxides and thermally discolored ferrous wear suggests that there may be a low lubricant level issue, or there may be a restriction preventing a component from getting lubricated properly through internal splash lubrication or something similar. There has been a notable shift in metals results, suggesting this system may have had a lubricant change and if that is the case then this may be residual from a previous issue. Consider checking thermography or other thermal testing if no work has been done on this system. Other than this potential thermal issue debris, there are no concerns with the wear and contamination, an d it appears to be running normally.

**Wear**
All component wear rates are normal.

**Contaminants**
The amount and size of particulates present in the system are acceptable. There is no indication of any contamination in the oil.

**Oil Condition**
The AN level is acceptable for this fluid. The condition of the oil is suitable for further service.

| SAMPLE INFORMATION | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Sample Number | | Client Info | | **WC0804445** | WC05504534 | WC0547227 |
| Sample Date | | Client Info | | **07 Mar 2023** | 31 Jan 2022 | 10 Mar 2021 |
| Machine Age | mths | Client Info | | **77** | 61 | 120 |
| Oil Age | mths | Client Info | | **77** | 0 | 65 |
| Oil Changed | | Client Info | | **Not Changd** | N/A | Not Changd |
| Sample Status | | | | **NORMAL** | ABNORMAL | ABNORMAL |

| WEAR METALS | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| PQ | | ASTM D8184 | >50 | **11** | 21 | 16 |
| Iron | ppm | ASTM D5185m | >65 | **36** | ▲ 77 | ▲ 88 |
| Chromium | ppm | ASTM D5185m | >3 | **<1** | <1 | 1 |
| Nickel | ppm | ASTM D5185m | >3 | **0** | 0 | <1 |
| Titanium | ppm | ASTM D5185m | >10 | **0** | 0 | 0 |
| Silver | ppm | ASTM D5185m | | **0** | <1 | 0 |
| Aluminum | ppm | ASTM D5185m | >10 | **<1** | 0 | 0 |
| Lead | ppm | ASTM D5185m | >5 | **0** | 0 | 0 |
| Copper | ppm | ASTM D5185m | >10 | **0** | <1 | <1 |
| Tin | ppm | ASTM D5185m | >10 | **<1** | 0 | <1 |
| Antimony | ppm | ASTM D5185m | >5 | **---** | --- | 0 |
| Vanadium | ppm | ASTM D5185m | | **0** | 0 | 0 |
| Cadmium | ppm | ASTM D5185m | | **0** | 0 | 0 |

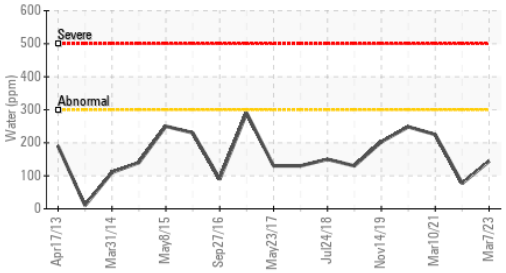
| ADDITIVES | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Boron | ppm | ASTM D5185m | 25 | **7** | 0 | 4 |
| Barium | ppm | ASTM D5185m | | **0** | 0 | 0 |
| Molybdenum | ppm | ASTM D5185m | | **0** | 0 | <1 |
| Manganese | ppm | ASTM D5185m | | **<1** | <1 | 1 |
| Magnesium | ppm | ASTM D5185m | | **<1** | 0 | 0 |
| Calcium | ppm | ASTM D5185m | 17 | **28** | 2 | 8 |
| Phosphorus | ppm | ASTM D5185m | 200 | **216** | 149 | 161 |
| Zinc | ppm | ASTM D5185m | | **5** | 1 | 0 |
| Sulfur | ppm | ASTM D5185m | 5000 | **6180** | 4375 | 4083 |

| CONTAMINANTS | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Silicon | ppm | ASTM D5185m | >15 | **0** | 0 | 0 |
| Sodium | ppm | ASTM D5185m | | **2** | <1 | 4 |
| Potassium | ppm | ASTM D5185m | >20 | **<1** | 0 | <1 |
| Water | % | ASTM D6304 | >0.03 | **0.014** | 0.007 | 0.022 |
| ppm Water | ppm | ASTM D6304 | >300 | **144.0** | 77.2 | 224.9 |

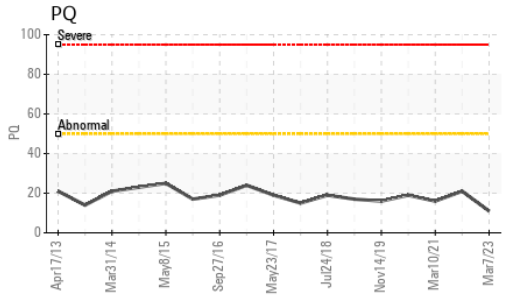
| FLUID CLEANLINESS | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Particles >4µm | | ASTM D7647 | | **7113** | 8466 | 2585 |
| Particles >6µm | | ASTM D7647 | >5000 | **239** | 723 | 230 |
| Particles >14µm | | ASTM D7647 | >640 | **7** | 12 | 8 |
| Particles >21µm | | ASTM D7647 | >160 | **2** | 2 | 3 |
| Particles >38µm | | ASTM D7647 | >40 | **0** | 0 | 0 |
| Particles >71µm | | ASTM D7647 | >10 | **0** | 0 | 0 |
| Oil Cleanliness | | ISO 4406 (c) | >--/19/16 | **20/15/10** | 20/17/11 | 19/15/10 |

# OIL ANALYSIS REPORT

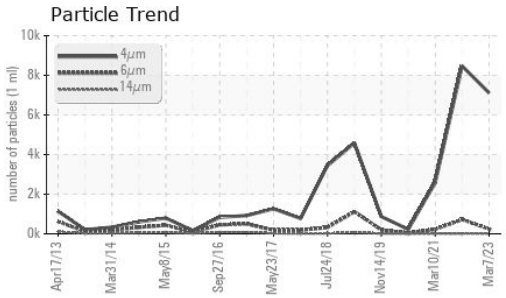
Water (KF)



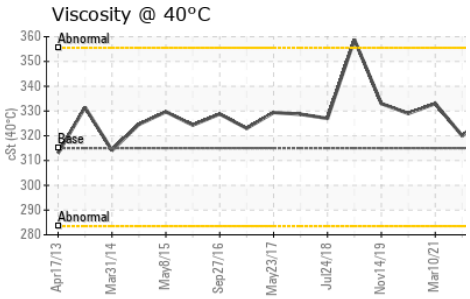

PQ



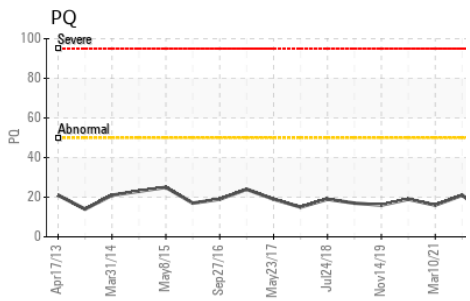

Particle Trend




Viscosity @ 40°C




PQ

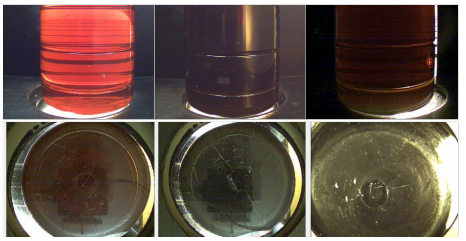



| FLUID DEGRADATION | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Acid Number (AN) | mg KOH/g | ASTM D8045 | 0.9 | **0.56** | 0.78 | 0.796 |

| 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 | >0.03 | **NEG** | NEG | NEG |
| Free Water | scalar | *Visual | | **NEG** | NEG | NEG |

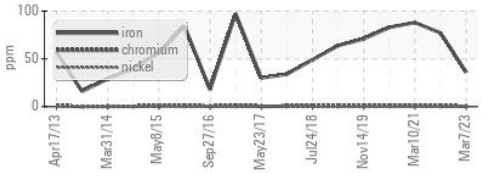
| FLUID PROPERTIES | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Visc @ 40°C | cSt | ASTM D445 | 315 | **329** | 320 | 333 |

| SAMPLE IMAGES | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|
| Color | | | | | |
| Bottom | | | | | |

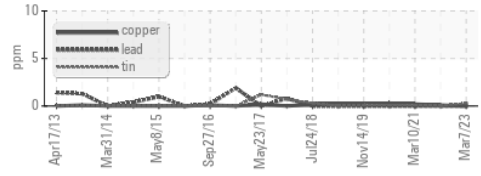


## GRAPHS

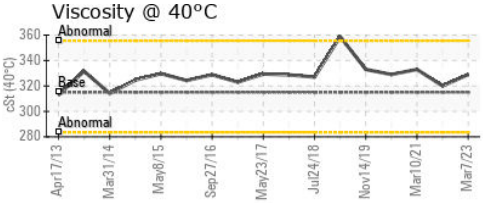
Ferrous Alloys



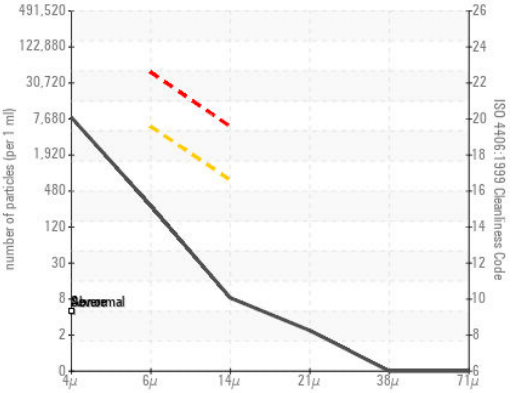

Non-ferrous Metals



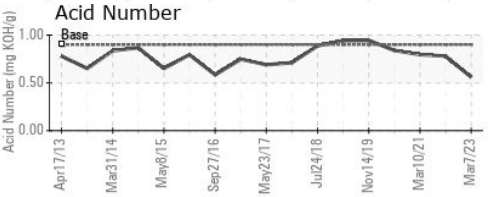

Viscosity @ 40°C




Particle Count




Acid Number




Certificate L2367

**Laboratory** : WearCheck USA - 501 Madison Ave., Cary, NC 27513
**Sample No.** : WC0804445 **Received** : 26 May 2023
**Lab Number** : 05857857 **Diagnosed** : 08 Jun 2023
**Unique Number** : 10492322 **Diagnostician** : Aaron Black
**Test Package** : IND 3 ( Additional Tests: KF, PrtCount )

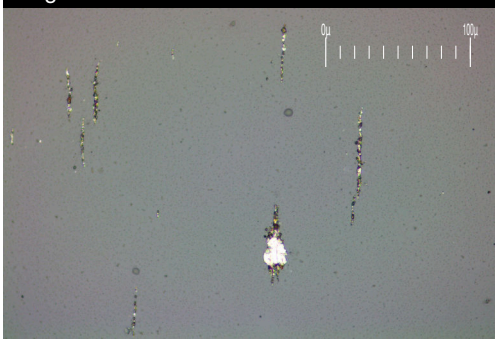
*To discuss this sample report, contact Customer Service at 1-800-237-1369.*
** - Denotes test methods that are outside of the ISO 17025 scope of accreditation.*
*Statements of conformity to specifications are based on the simple acceptance decision rule (JCGM 106:2012)*

**ENERGIA EOLICA**
STA ANA KM25 CARRETERA AL SUR, A 1KM DEL CRUCE
FRANCISCO MORAZAN, ZZ
HN
Contact: SANTOS DEL CID
sdelcid@dencmi.com
T: x:
F: x:

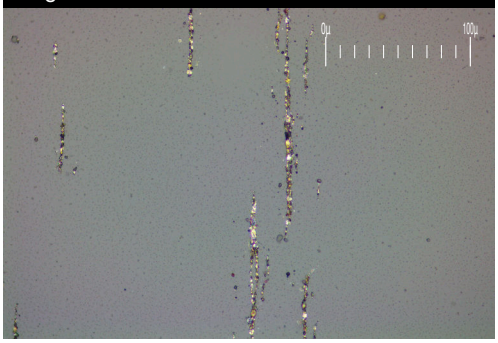
# FERROGRAPHY REPORT

Area
**9**
Machine Id
## WINERGY GEARBOX WTG-907 (S/N 4836487-0020-8)
Component
**Wind Turbine Gearbox**
Fluid
**FUCHS RENOLIN UNISYN CKC ISO 320 (340 LTR)**

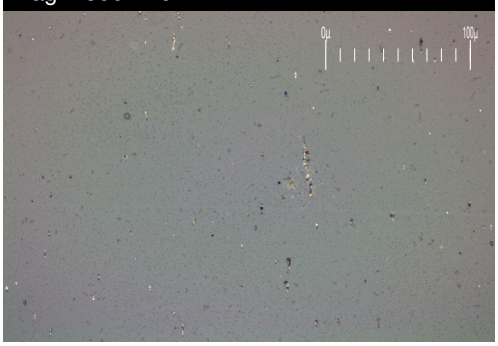
Magn: 500x Illum: RW



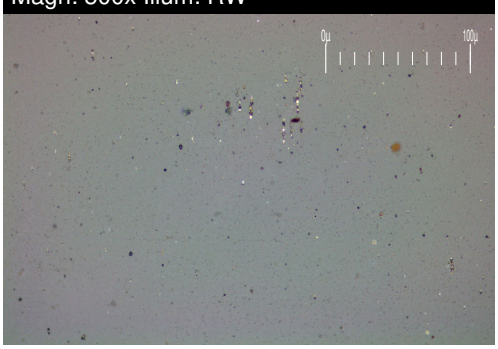
Magn: 500x Illum: RW



Magn: 500x Illum: RW



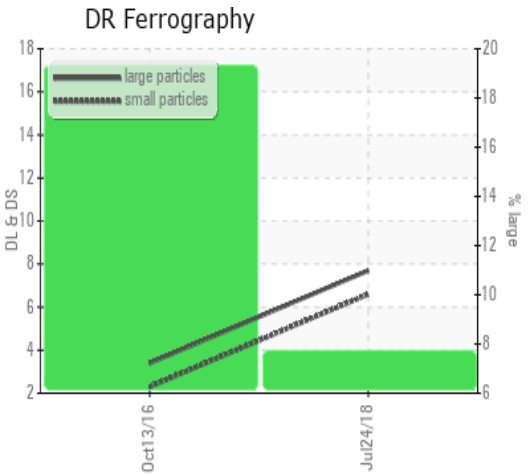
Magn: 500x Illum: RW



| FERROGRAPHY | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Ferrous Rubbing | Scale 0-10 | *ASTM D7684 | | **1** | 1 | |
| Ferrous Sliding | Scale 0-10 | *ASTM D7684 | | | | |
| Ferrous Cutting | Scale 0-10 | *ASTM D7684 | | | | |
| Ferrous Rolling | Scale 0-10 | *ASTM D7684 | | | | |
| Ferrous Break-in | Scale 0-10 | *ASTM D7684 | | | | |
| Ferrous Spheres | Scale 0-10 | *ASTM D7684 | | | | |
| Ferrous Black Oxides | Scale 0-10 | *ASTM D7684 | | **2** | | |
| Ferrous Red Oxides | Scale 0-10 | *ASTM D7684 | | | | |
| Ferrous Corrosive | Scale 0-10 | *ASTM D7684 | | | | |
| Ferrous Other | Scale 0-10 | *ASTM D7684 | | | | |
| Nonferrous Rubbing | Scale 0-10 | *ASTM D7684 | | | | |
| Nonferrous Sliding | Scale 0-10 | *ASTM D7684 | | | | |
| Nonferrous Cutting | Scale 0-10 | *ASTM D7684 | | | | |
| Nonferrous Rolling | Scale 0-10 | *ASTM D7684 | | | | |
| Nonferrous Other | Scale 0-10 | *ASTM D7684 | | | | |
| Carbonaceous Material | Scale 0-10 | *ASTM D7684 | | | | |
| Lubricant Degradation | Scale 0-10 | *ASTM D7684 | | | | |
| Sand/Dirt | Scale 0-10 | ASTM D7684 | | | | |
| Fibres | Scale 0-10 | *ASTM D7684 | | | | |
| Spheres | Scale 0-10 | *ASTM D7684 | | | | |
| Other | Scale 0-10 | *ASTM D7684 | | **2** | 1 | |

### WEAR

All component wear rates are normal.



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