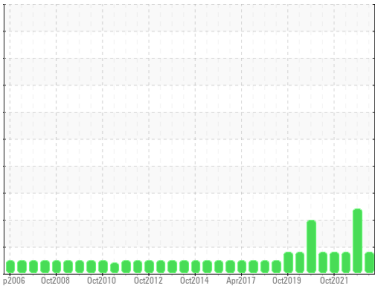
# PROBLEM SUMMARY

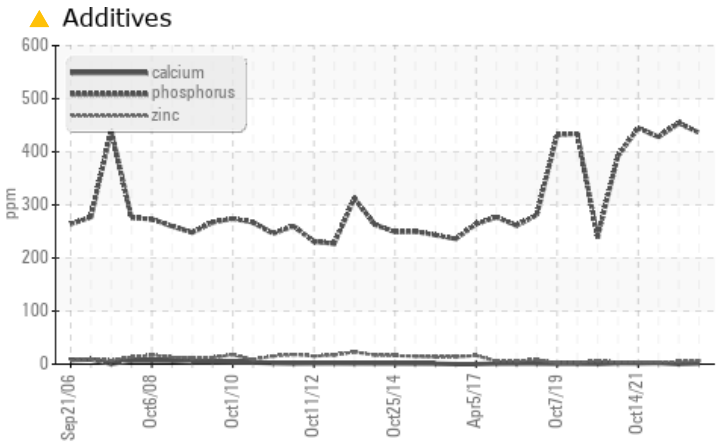
Sample Rating Trend



**ADDITIVES**

Area
**Kingsbridge SP-13584**
Machine Id
**T5**
Component
**Wind Turbine Gearbox**
Fluid
**CHEVRON PINNACLE WM 320 (--- LTR)**

## COMPONENT CONDITION SUMMARY




## RECOMMENDATION

Confirm the source of the lubricant being utilized for top-up/fill. Resample at the next service interval to monitor. NOTE: Please provide information regarding reservoir capacity, filter type and micron rating with next sample.

## PROBLEMATIC TEST RESULTS

| | | | | | | |
|---|---|---|---|---|---|---|
| Sample Status | | | | **ABNORMAL** | ABNORMAL | ABNORMAL |
| Phosphorus | ppm | ASTM D5185(m) | 300 | ▲ **436** | ▲ 454 | ▲ 428 |
| Sulfur | ppm | ASTM D5185(m) | 8000 | ▲ **3995** | ▲ 4084 | ▲ 3984 |

**Customer Id:** VESTAS
**Sample No.:** WC0783144
**Lab Number:** 02576948
**Test Package:** IND 2

*To manage this report scan the QR code*

*To discuss the diagnosis or test data:*
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*To change component or sample information:*
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gloria.gonzalez@wearcheck.com

## RECOMMENDED ACTIONS

| Action | Status | Date | Done By | Description |
|---|---|---|---|---|
| Information Required | --- | --- | ? | NOTE: Please provide information regarding reservoir capacity, filter type and micron rating with next sample. |
| Check Fluid Source | --- | --- | ? | Confirm the source of the lubricant being utilized for top-up/fill. |

## HISTORICAL DIAGNOSIS

**12 Apr 2023 Diag: Bill Quesnel**

DIRT

We advise that you check all areas where dirt can enter the system. We advise that you perform a filter service, and use off-line filtration to improve the cleanliness of the system fluid. The air breather requires service. If unrated, we recommend that you replace with a suitable micron rated and/or desiccant air breather. If rated, we recommend that you service/replace the breather. We recommend an early resample to monitor this condition.All component wear rates are normal. There is a moderate concentration of dirt present in the oil. The water content is negligible. Phosphorus and sulfur ppm levels are abnormally high. The AN level is acceptable for this fluid.

view report

**12 Apr 2022 Diag: Kevin Marson**

ADDITIVES

The oil is near the end of it`s useful service life, recommend schedule an oil change. Resample at the next service interval to monitor. NOTE: Please provide information regarding reservoir capacity, filter type and micron rating with next sample.All component wear rates are normal. The system cleanliness is acceptable for your target ISO 4406 cleanliness code. The water content is negligible. The system and fluid cleanliness is acceptable. Phosphorus and sulfur ppm levels are abnormally high. The AN level is acceptable for this fluid.

view report

**14 Oct 2021 Diag: Bill Quesnel**

ADDITIVES

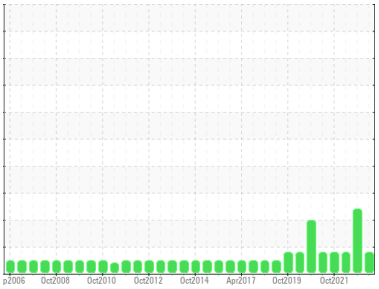
The oil is near the end of it`s useful service life, recommend schedule an oil change. Resample at the next service interval to monitor. NOTE: Please provide information regarding reservoir capacity, filter type and micron rating with next sample.All component wear rates are normal. The system cleanliness is acceptable for your target ISO 4406 cleanliness code. The water content is negligible. The system and fluid cleanliness is acceptable. Phosphorus and sulfur ppm levels are abnormally high. The AN level is acceptable for this fluid.

view report

# OIL ANALYSIS REPORT

Area
**Kingsbridge SP-13584**
Machine Id
**T5**
Component
**Wind Turbine Gearbox**
Fluid
**CHEVRON PINNACLE WM 320 (--- LTR)**

Sample Rating Trend




**ADDITIVES**

## DIAGNOSIS

**Recommendation**
Confirm the source of the lubricant being utilized for top-up/fill. Resample at the next service interval to monitor. NOTE: Please provide information regarding reservoir capacity, filter type and micron rating with next sample.

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

**Contamination**
The system cleanliness is acceptable for your target ISO 4406 cleanliness code. The water content is negligible. The system and fluid cleanliness is acceptable.

**Fluid Condition**
Additive levels indicate the addition of a different brand, or type of oil. 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 | | **WC0783144** | WC0783066 | WC0632600 |
| Sample Date | | Client Info | | **09 Aug 2023** | 12 Apr 2023 | 12 Apr 2022 |
| Machine Age | yrs | Client Info | | **0** | 0 | 0 |
| Oil Age | yrs | Client Info | | **0** | 0 | 0 |
| Oil Changed | | Client Info | | **N/A** | N/A | N/A |
| Sample Status | | | | **ABNORMAL** | ABNORMAL | ABNORMAL |

| WEAR METALS | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| PQ | | ASTM D8184* | >50 | **0** | 0 | 0 |
| Iron | ppm | ASTM D5185(m) | >75 | **8** | 7 | 6 |
| Chromium | ppm | ASTM D5185(m) | >5 | **0** | 0 | 0 |
| Nickel | ppm | ASTM D5185(m) | >10 | **<1** | 0 | <1 |
| Titanium | ppm | ASTM D5185(m) | >10 | **0** | <1 | 0 |
| Silver | ppm | ASTM D5185(m) | | **0** | 0 | 0 |
| Aluminum | ppm | ASTM D5185(m) | >10 | **0** | <1 | 0 |
| Lead | ppm | ASTM D5185(m) | >15 | **<1** | <1 | 0 |
| Copper | ppm | ASTM D5185(m) | >10 | **<1** | <1 | <1 |
| Tin | ppm | ASTM D5185(m) | >10 | **0** | 0 | 0 |
| Antimony | ppm | ASTM D5185(m) | >5 | **0** | 0 | 0 |
| Vanadium | ppm | ASTM D5185(m) | | **0** | 0 | 0 |
| Beryllium | ppm | ASTM D5185(m) | | **0** | 0 | 0 |
| Cadmium | ppm | ASTM D5185(m) | | **0** | 0 | 0 |

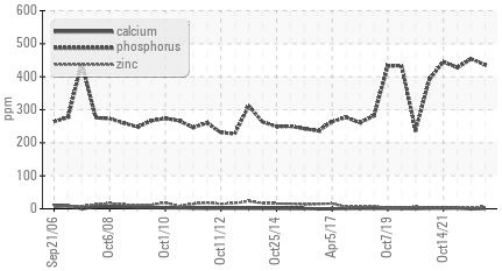
| ADDITIVES | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Boron | ppm | ASTM D5185(m) | 0 | **<1** | <1 | <1 |
| Barium | ppm | ASTM D5185(m) | 0 | **0** | 0 | 0 |
| Molybdenum | ppm | ASTM D5185(m) | 0 | **0** | 0 | 0 |
| Manganese | ppm | ASTM D5185(m) | | **0** | <1 | 0 |
| Magnesium | ppm | ASTM D5185(m) | 0 | **<1** | <1 | 0 |
| Calcium | ppm | ASTM D5185(m) | 0 | **1** | 0 | 2 |
| Phosphorus | ppm | ASTM D5185(m) | 300 | ▲ **436** | ▲ 454 | ▲ 428 |
| Zinc | ppm | ASTM D5185(m) | 0 | **6** | 4 | 4 |
| Sulfur | ppm | ASTM D5185(m) | 8000 | ▲ **3995** | ▲ 4084 | ▲ 3984 |
| Lithium | ppm | ASTM D5185(m) | | **<1** | <1 | <1 |

| CONTAMINANTS | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Silicon | ppm | ASTM D5185(m) | >10 | **10** | ▲ 11 | 10 |
| Sodium | ppm | ASTM D5185(m) | >10 | **1** | 1 | <1 |
| Potassium | ppm | ASTM D5185(m) | >20 | **0** | 0 | <1 |
| Water | % | ASTM D6304* | >0.02 | **0.007** | 0.006 | 0.005 |
| ppm Water | ppm | ASTM D6304* | >200 | **73.6** | 61.0 | 50.7 |

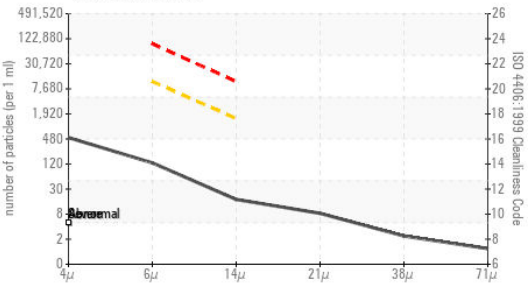
| INFRA-RED | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Soot % | % | ASTM D7844* | | **0** | 0 | 0 |
| Nitration | Abs/cm | ASTM D7624* | | **2.1** | 1.9 | 2.3 |
| Sulfation | Abs/.1mm | ASTM D7415* | | **47.7** | 46.8 | 27.6 |

# OIL ANALYSIS REPORT

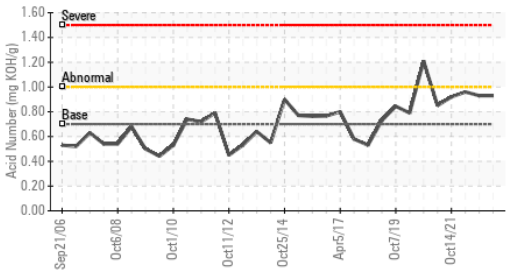
Additives



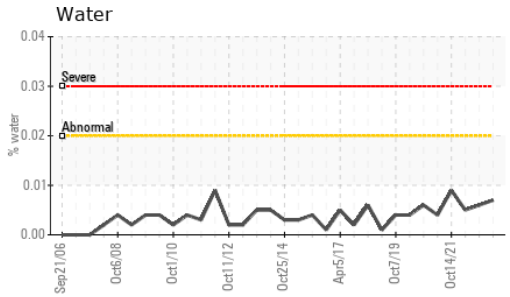

Particle Count



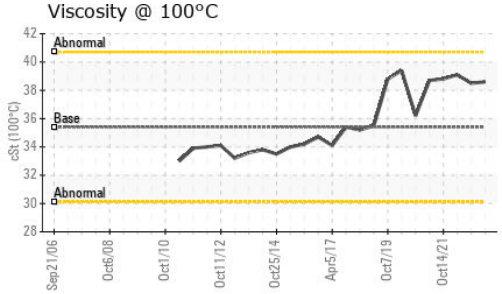

Acid Number




Water




Viscosity @ 100°C

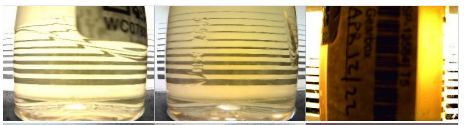



| FLUID CLEANLINESS | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Particles >4µm | | ASTM D7647 | | **456** | 4086 | 1008 |
| Particles >6µm | | ASTM D7647 | >10000 | **113** | 1471 | 193 |
| Particles >14µm | | ASTM D7647 | >1300 | **15** | 31 | 17 |
| Particles >21µm | | ASTM D7647 | >320 | **7** | 7 | 4 |
| Particles >38µm | | ASTM D7647 | >80 | **2** | 0 | 0 |
| Particles >71µm | | ASTM D7647 | >20 | **1** | 0 | 0 |
| Oil Cleanliness | | ISO 4406 (c) | >--/20/17 | **16/14/11** | 19/18/12 | 17/15/11 |

| FLUID DEGRADATION | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Oxidation | Abs/.1mm | ASTM D7414* | | **53.4** | 52.9 | 24.1 |
| Acid Number (AN) | mg KOH/g | ASTM D974* | 0.7 | **0.93** | 0.93 | 0.96 |

| 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* | >0.02 | **NEG** | NEG | NEG |
| Free Water | scalar | Visual* | | **NEG** | NEG | NEG |

| FLUID PROPERTIES | | method | limit/base | current | history1 | history2 |
|---|---|---|---|---|---|---|
| Visc @ 40°C | cSt | ASTM D7279(m) | 319 | **342** | 342 | 346 |
| Visc @ 100°C | cSt | ASTM D7279(m) | 35.4 | **38.6** | 38.5 | 39.1 |
| Viscosity Index (VI) | Scale | ASTM D2270* | 156 | **163** | 162 | 163 |

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

ISO 17025:2017 Accredited Laboratory

**Laboratory** : WearCheck - C8-1175 Appleby Line, Burlington, ON L7L 5H9 **Vestas American Wind Technology Inc.**
**Sample No.** : WC0783144 **Received** : 18 Aug 2023 1417 NW Everett Street
**Lab Number** : 02576948 **Diagnosed** : 23 Aug 2023 Portland, OR
**Unique Number** : 5630008 **Diagnostician** : Bill Quesnel US 97209
**Test Package** : IND 2 ( Additional Tests: FT-IR, KF, KV100, PQ, PrtCount, TAN Man, VI ) Contact: Nicole Philippi

*To discuss this sample report, contact Customer Service at 1-800-268-2131.* NiPhi@vestas.com
*Test denoted (*) outside scope of accreditation, (m) method modified, (e) tested at external lab.* T: (503)327-7683
*Validity of results and interpretation are based on the sample and information as supplied.* F: (503)327-0247