



Oil Analysis Report for Generator Equipped with Cummins KTA38 Engine

1. Objective

The objective of this report is to assess the performance and durability of EvoSyn 15W-40 CK-4, HDD oil through rigorous sampling and testing, with a specific focus on proving its capability to achieve extended drain intervals before requiring an oil change. By evaluating critical properties such as viscosity stability, oxidation resistance, and contaminant retention under prolonged operational conditions, this study aims to demonstrate that EvoSyn 15W-40 CK-4, HDD oil maintains superior performance and engine protection over extended periods compared to industry-standard fossil-based alternatives. The results should provide robust evidence to support claims of prolonged oil change intervals, ensuring enhanced efficiency and cost-effectiveness in demanding applications.

2. Introduction

This report provides a detailed analysis of the oil condition and engine performance for a single generator identified as 1,2mVA GEN-E (ID: 25479481), equipped with a Cummins KTA38 engine, with a total of 1466 hours at the beginning of this study. This independent analysis was conducted by Wearcheck Africa (Attached) to evaluate the performance of two different oils in the same generator over time. The generator was initially filled with Mineral Oil 15W-40 oil, and the first oil sample was taken after 300 hours of oil usage. The oil was then drained and replaced with EvoSyn 15W-40 oil, and the generator was run for an additional 301, 612, 913, and 1215 hours, with samples taken at each interval. This report includes summaries of the findings, additive analysis, viscosity analysis, graphical representations, and recommendations to ensure continued engine reliability.

3. Summary of Findings

The oil analysis results provide insights into the engine condition and lubricant performance for the generator as it transitioned between two oil types and continued operation with EvoSyn 15W-40.

Below is a summary of the five samples analysed:

- **Sample AH89922 (Mineral Oil 15W-40, 24 April 2025, 300 hours):** This sample represents the generator after 300 hours of operation with Mineral Oil 15W-40 oil. The viscosity (88.1 cSt at 40°C, 12 cSt at 100°C, VI: 129) was lower than expected for a 15W-40 oil, raising concerns about potential thermal breakdown or shearing. Fear of prolonged use of the oil and possible engine damage, the oil was drained immediately.
- **Sample AH89929 (EvoSyn 15W-40, 7 May 2025, 301 hours):** This sample was collected after 301 hours of operation with EvoSyn oil. The viscosity (96.5 cSt at 40°C, 14 cSt at 100°C, VI: 148) was within the expected range, with wear metals within acceptable ranges and no signs of abnormal contamination or degradation, indicating a successful transition to EvoSyn oil.



- **Sample AH89924 (EvoSyn 15W-40, 20 May 2025, 612 hours):** This sample reflects the generator after an additional 311 hours (totaling 612 hours). The viscosity (96.1 cSt at 40°C, 14 cSt at 100°C, VI: 149) remained stable, with normal wear rates and no unacceptable contamination or degradation, demonstrating EvoSyn oil’s consistent performance.
- **Sample AH89925 (EvoSyn 15W-40, 03 June 2025, 913 hours):** This sample was taken after an additional 301 hours (totaling 913 hours). The viscosity (95.7 cSt at 40°C, 14.1 cSt at 100°C, VI: 151) showed minor variation, with normal wear rates and no significant contamination, confirming EvoSyn oil’s suitability for extended drain intervals.
- **Sample AH89923 (EvoSyn 15W-40, 15 June 2025, 1215 hours):** This sample was taken after an additional 302 hours (totaling 1215 hours). The viscosity (98 cSt at 40°C, 14.4 cSt at 100°C, VI: 152) showed a slight increase, with stable wear metals and no significant contamination. The slight increases in calcium and sulphur (from additive analysis) are within acceptable limits, supporting EvoSyn’s performance for extended drain intervals.

The overall diagnosis for the generator with EvoSyn 15w40 is rated as **"NORMAL"** across all its samples, suggesting that the engine is operating within acceptable parameters with no immediate maintenance required. The transition from Mineral Oil 15W-40 to EvoSyn 15W-40 was effective, with the latter maintaining stable viscosity and satisfactory performance at 1215 hours, supporting the objective of prolonged oil change intervals.

4. Additive Analysis

The following analysis focuses on the elemental concentrations (in parts per million, ppm) of various additives and metals, as well as the Total Base Number (TBN). These metrics, combined with viscosity data, provide insight into the oil condition and engine wear state during the transition and extended operation.

4.1 Data Overview

The table below summarizes the elemental concentrations (in ppm) and TBN for all samples.

Sample ID	Oil Type	Date	Hours	Mg	Ca	Mo	Zn	P	B	S	TBN
AH89922	Mineral Oil 15W-40	24-Apr	300	11	3056	1	1243	1230	2	3493	9.8
AH89929	EvoSyn 15W-40 CK-4	07-May	301	865	1533	52	1282	1206	0	3399	9.3
AH89924	EvoSyn 15W-40 CK-4	20-May	612	911	1522	54	1275	1177	0	3282	9.2
AH89925	EvoSyn 15W-40 CK-4	03-Jun	913	914	1390	54	1289	1094	1	3186	9.2
AH89923	EvoSyn 15W-40 CK-4	15-Jun	1215	954	1447	58	1271	1132	0	3268	9.2

4.2 Detailed Analysis

- **Magnesium (Mg):** A significant increase from 11 ppm (Sample AH89922, Mineral Oil 15W-40) to 865 ppm (Sample AH89929, EvoSyn 15W-40), then to 911 ppm (Sample AH89924), 914 ppm (Sample AH89925), and 954 ppm (Sample AH89923), reflects a higher magnesium content in EvoSyn, likely as a detergent and alkalinity additive. The gradual increase to 954 ppm over 1215 hours indicates stable retention, supporting the oil's detergency.
- **Calcium (Ca):** A sharp decline from 3056 ppm (Sample AH89922) to 1533 ppm (Sample AH89929), 1522 ppm (Sample AH89924), 1390 ppm (Sample AH89925), and a rise to 1447 ppm (Sample AH89923) indicates a reduced calcium-based detergent package in EvoSyn. The increase at 1215 hours may reflect minor contamination or analytical variation but remains within acceptable limits.
- **Molybdenum (Mo):** An increase from 1 ppm (Sample AH89922) to 52 ppm (Sample AH89929), 54 ppm (Samples AH89924 and AH89925), and 58 ppm (Sample AH89923) indicates molybdenum as an anti-wear agent in EvoSyn. The slight rise at 1215 hours suggests minimal wear metal accumulation, consistent with normal wear rates.
- **Zinc (Zn) and Phosphorus (P):** Zinc levels vary slightly (1243–1289 ppm), and phosphorus declines from 1230 ppm (Sample AH89922) to 1206 ppm (Sample AH89929), 1177 ppm (Sample AH89924), 1094 ppm (Sample AH89925), and rises to 1132 ppm (Sample AH89923). These ZDDP components show stable Zn and a slight P increase at 1215 hours, indicating continued anti-wear protection.
- **Boron (B):** Trace amounts (2 ppm in Sample AH89922, 0–1 ppm in EvoSyn samples) suggest minimal presence in EvoSyn, with no significant impact.
- **Sulphur (S):** A decrease from 3493 ppm (Sample AH89922) to 3399 ppm (Sample AH89929), 3282 ppm (Sample AH89924), 3186 ppm (Sample AH89925), and a rise to 3268 ppm (Sample AH89923) reflects normal degradation, with the increase at 1215 hours within typical ranges.
- **Total Base Number (TBN):** A decline from 9.8 (Sample AH89922) to 9.3 (Sample AH89929), then stable at 9.2 (Samples AH89924, AH89925, AH89923) indicates excellent retention of acid-neutralizing capacity in EvoSyn.

4.3 Interpretation

- **Oil Change Impact:** The significant changes in magnesium, calcium, molybdenum, and viscosity between Sample AH89922 (Mineral Oil 15W-40) and EvoSyn samples confirm a successful transition to a different additive package and base oil formulation. EvoSyn 15W-40's higher viscosity and VI demonstrate improved stability.

- **Engine Wear:** Stable molybdenum (52–58 ppm) and zinc (1271–1289 ppm) levels indicate normal wear rates, supporting the "NORMAL" severity rating.
- **Oil Condition:** The stable viscosity (95.7–98 cSt at 40°C, 14–14.4 cSt at 100°C) and VI (148–152) in EvoSyn samples, combined with acceptable additive levels and stable TBN, suggest robust performance at 1215 hours. The slight increases in Ca, S, and P at 1215 hours are within normal limits.
- **No Contamination:** The absence of abnormal spikes in elements or viscosity suggests no significant contamination or unusual wear.

5. Graphical Analysis

The following table and chart illustrate viscosity trends over the sampling period:

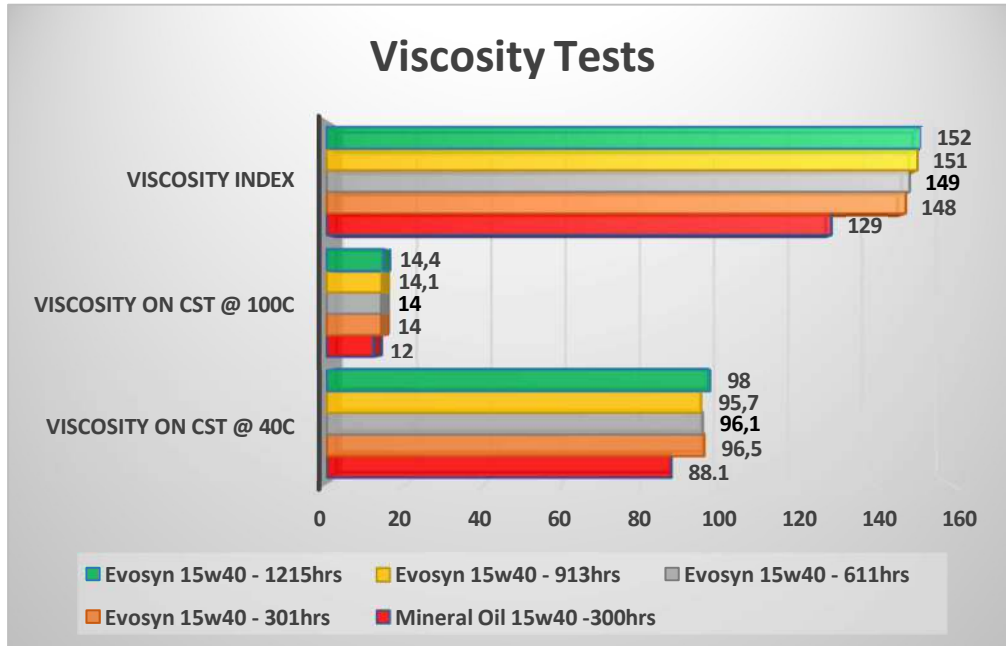
Viscosity Data Table

Sample ID	Oil Type	Hours	Viscosity at 40°C (cSt)	Viscosity at 100°C (cSt)	Viscosity Index
AH89922	Mineral Oil 15W-40	300	88.1	12.0	129
AH89929	EvoSyn 15W-40 CK-4	301	96.5	14.0	148
AH89924	EvoSyn 15W-40 CK-4	612	96.1	14.0	149
AH89925	EvoSyn 15W-40 CK-4	913	95.7	14.1	151
AH89923	EvoSyn 15W-40 CK-4	1215	98.0	14.4	152

Viscosity Trend Chart

The chart below visualizes the viscosity at 40°C, 100°C, and Viscosity Index across the samples, highlighting the stability of EvoSyn 15W-40 compared to Mineral Oil 15W-40.

- **Viscosity Trend Analysis:** The chart shows low viscosity for Mineral Oil 15W-40 at 300 hours (88.1 cSt at 40°C, 12 cSt at 100°C, VI: 129), indicating potential thermal breakdown. EvoSyn 15W-40 samples (300–1215 hours) maintain stable viscosity at 40°C (95.7–98 cSt) and 100°C (14–14.4 cSt), with a slight increase at 1215 hours. The VI (148–152) increases gradually, demonstrating superior temperature stability compared to Mineral Oil.
- **Wear Metal Levels:** Stable molybdenum (52–58 ppm) and zinc (1271–1289 ppm) levels across EvoSyn samples suggest consistent wear rates, with no significant increase at 1215 hours.



6. Recommendations

Based on the analysis, the following actions are recommended:

- Monitor Viscosity Post-Oil Change:** The low viscosity in Sample AH89922 (Mineral Oil 15W-40, 24 April 2025) confirms thermal breakdown concerns. EvoSyn 15W-40's stable viscosity (95.7–98 cSt at 40°C, 14–14.4 cSt at 100°C) up to 1215 hours indicates resolution of this issue. Continue monitoring viscosity to ensure stability beyond 1215 hours.
- Monitor TBN and Additives:** Track TBN and additive elements (e.g., Zn, P, Ca, S) to ensure EvoSyn 15W-40 maintains protective properties. The slight increases in Ca, S, and P at 1215 hours should be monitored to rule out contamination.
- Continue Regular Sampling:** The satisfactory results from EvoSyn samples (300, 600, 900, 1215 hours) indicate stable performance. Maintain regular oil sampling to monitor trends beyond 1215 hours.
- No Immediate Action Required:** The "NORMAL" severity rating suggests the engine is in good condition. Continue standard maintenance protocols.

7. Conclusion

The oil analysis for the Generator (Cummins KTA38, ID: 25479481) indicates normal wear rates and satisfactory oil conditions up to 1215 hours. Initially, Mineral Oil 15W-40 at 300 hours showed low viscosity (88.1 cSt at 40°C, 12 cSt at 100°C, VI: 129), suggesting thermal breakdown. After switching to EvoSyn 15W-40, the engine performed better, with stable viscosity (95.7–98 cSt at 40°C, 14–14.4 cSt at 100°C, VI: 148–152), normal wear rates, and no significant contamination up to 1215 hours. The slight increases in calcium, sulphur, and phosphorus at 1215 hours are within acceptable limits. The transition to EvoSyn 15W-40 supports extended drain intervals, with regular oil analysis recommended to ensure continued engine reliability at 1215 and beyond.