MOTORenovator NanoVit

EFFICIENCY TECHNOLOGIES

# Examination of additives for vehicle lubricants

## TÜV Thuringia examination

TÜV THÜRINGEN

# Preliminary remarks

Every relative movement between two solid bodies leads to friction and, as a result, abrasion or wear. The results are energy and material losses which, in Germany alone, are estimated to total between 35 and 40 billion Euros every year.

In order to reduce these losses, a structure capable of meeting the demands and a corresponding surface treatment are necessary. The lubricant must support these measures. Thus, the load capacity and wear-resistance of friction bearings depends on the viscosity of the lubricant; the fatigue lifetime of roller bearings on the viscosity, the use of additives and the purity of the lubricant; and the scuffing resistance of sprockets on the viscosity and the scuffing load capacity of the lubricant.

NanoVit's technology can satisfy these demands.

This presentation introduces the product "NanoVit Motor-Renovator". It has been drawn up in Cooperation with the TÜV-Thuringia, the MSH Mineralstoffhandel GmbH and Efficiency Technologies.

It contains extracts from the TÜV test report.

The goal was to prove that the Nano-Vit mixture is a completely new type of protection against wear, which accomplishes a reduction of wear of metallic materials.
By means of the NanoVit wear-resistance technology it is possible to guarantee permanent protection against wear in engines and in metallic materials.

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NanoVit MOTOR Renovator

Antragsdatum
Date of Application
14.03.2006

Aktenzeichen
File Reference
8141.076.06

gültig bis
valid until
ZGA 007/44

Antragsteller:

MSH - Mineralstoffhandel GmbH
Nicolaus-Otto-Straße 10
D-89079 Ulm - Donautal

Das Produkt NanoVit Motor-Renovator wurde durch den TÜV Thüringen im Rahmen einer Testreihe untersucht. Anhand der ermittelten Prüfergebnisse konnte folgende Produktwirkung nachgewiesen werden.

NanoVit Motor-Renovator besitzt folgende Produktwirkung

- Im Motor wird ein permanenter Verschleißschutz erzeugt
- Reinigt den Motor von Motorschlamm, Lacken und Harzen
- Die Motorleistung wird optimiert
- Der Schadstoffausstoß wird reduziert

TÜV THÜRINGEN
certificate of effectiveness

Prüfgrundlagen: Prüfbericht 8141.076.06

Arnstadt, 29. Mai 2006

TÜV Thüringen
Anlagentechnik GmbH & Co. KG
Ichtershäuser Str. 32
D-99310 Arnstadt

Dipl.-Ing. (FH) T. Heller

**TÜV Thuringia examination report**

The product, NanoVit Motor-Renovator, was examined within the scope of a series of tests. On account of the examination results determined, the following product effects could be proved:

NanoVit exhibits the following product effects

- A permanent resistance to wear is created in the engine
- The motor is cleansed of engine slurry, lacquers and resins
- The engine performance is optimised
- The emission of harmful substances is reduced

Test basics: Examination report 8141.076.06

# Examination of effectiveness

| Examination criteria | | |
|---|---|---|
| 1 | Resistance to wear | • Recording of friction and wear on metallic substrates<br>• Heating-up behaviour of the lubricant under the application of a certain wearing force |
| 2 | Cleansing of the lubricant circulatory system in the engine<br><br>Reduction of emissions in the exhaust gases<br><br>Optimisation of compression | • Analysis of solid particle content of motor oil<br><br>• Analysis of the concentration of harmful substances in exhaust gases<br><br>• Engine compression analysis before and after application of the product |
| 3 | Reduction of engine noise | • Recording and analysis of engine noises before and after application of the product |

# Examination of effectiveness

## 1. Test of resistance to wear / translatory oscillation test device

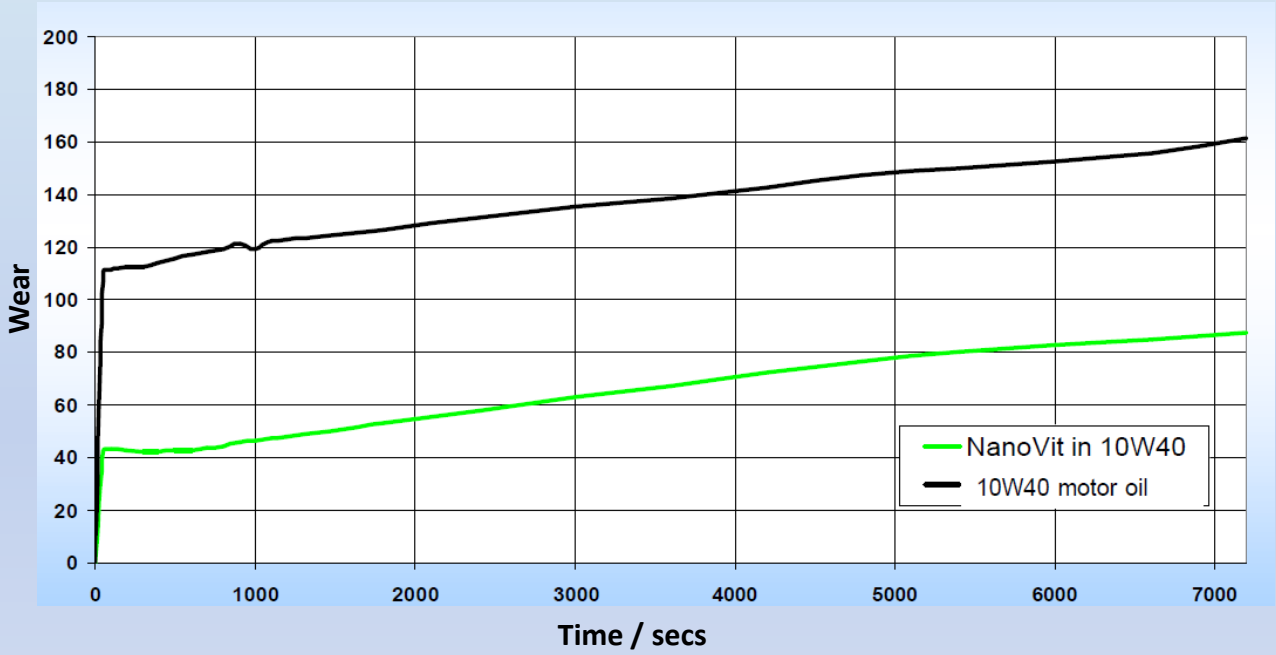
DIN 51 834 - part 2

Test force: 300 N
Test temperature: 50°C
Test duration: 120 min
Test object hardness: 62 HRC

# Examination of effectiveness

## 1. Test of resistance to wear / translatory oscillation test device

### NanoVit Motor-Renovator to 10W40 motor oil



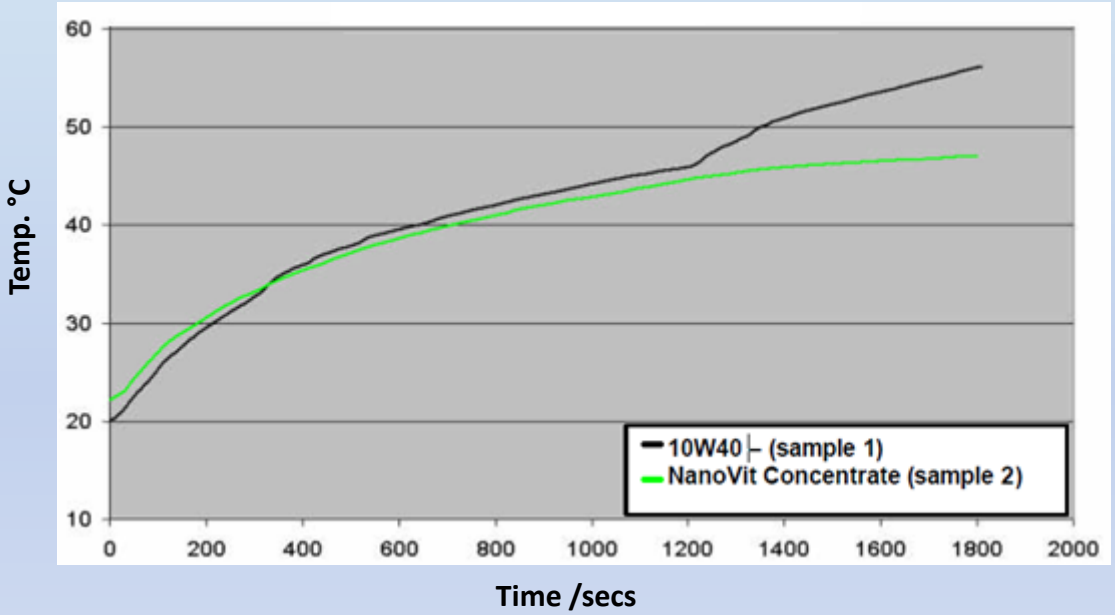

Test object 1 – No NanoVit

Test object 2 – With NanoVit

**Conclusion : The wear of test object 2 (NanoVit) is on average approximately 50% less than that of test object 1 (10W40 motor oil).**

# Examination of effectiveness

## 1. Test of resistance to wear / heating-up behaviour of a lubricant – **Test 1** under the influence of a wearing force (150 N)




The temperature curves of both tests do not deviate significantly from each other for the first 20 minutes (1200 s).

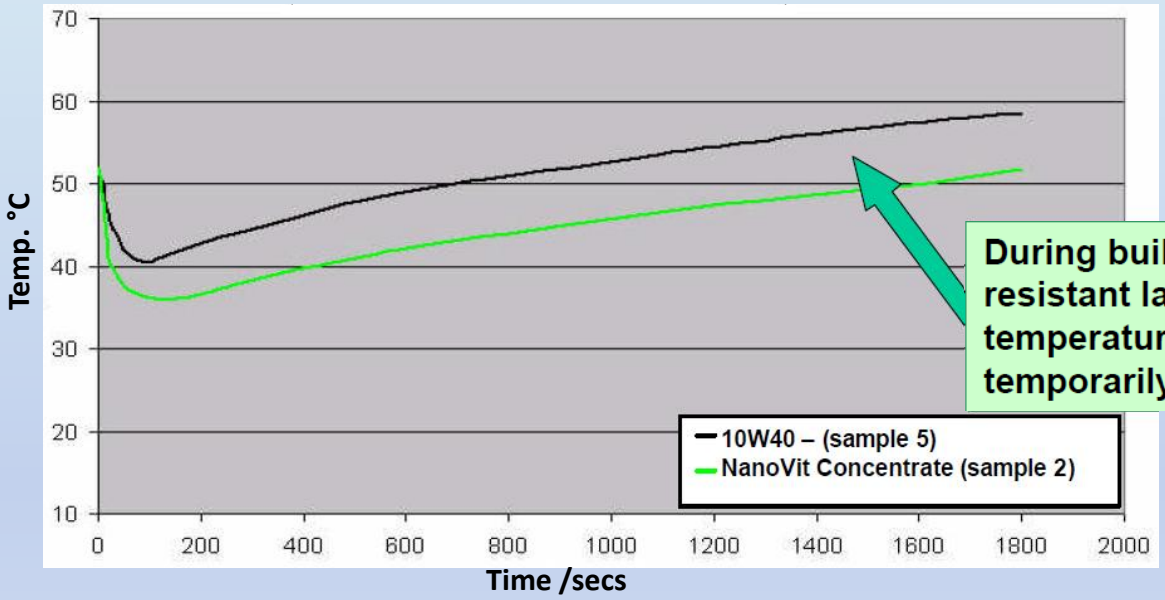
A clearly different temperature rise can be observed for sample 1 from 20 minutes onwards.

The temperature curve for test object 2 does not show any particular fluctuations. It settles at a temperature of 47 °C from 30 minutes onwards.

**Conclusion: It can be assumed that an active wear-resistant layer has formed on the surface of test object 2 from the 20th minute onwards.**

# Examination of effectiveness

## 1. Test of resistance to wear / heating-up behaviour of a lubricant – **Test 2** under the influence of a wearing force (150 N)




**The second experiment provides information as to whether the NanoVit mixture requires heat as well as wearing force for the creation of the wear-resistant layer.**

The NanoVit mixture in the application was mixed according to the manufacturer specifications (1 bottle to 5 litres of 10W40) and heated up to around 50°C.

The untreated 10W40 motor oil was also heated up to around 50 °C. The recorded temperature curves are basically similar. The curve of the NanoVit mixture application lies on average 5 °C below that of the untreated motor oil. This experiment was repeated a total of 8 times with the same result. Systematics can be observed here.

**Conclusion: For the creation of the wear-resistant layer, heat is also required alongside pressure.**
This energy is taken from the heated motor oil. Temporary cooling of the motor oil results, but this is no longer important following the creation of the wear-resistant layer.

# Conclusion for the wear-resistance behaviour

The main component of the NanoVit mixture is composed of a special mixture of a modified silicon compound, aluminium oxide, and plasma-treated graphite which, due to the treatment, retains its lubricating properties even at a temperature of **1200° C.**

In a micro-metallurgical process, the **NanoVit anti-friction layer** is built up on the kinematic friction surfaces. This layer is **elastic**, not stiff, and can stretch from 3 – 700 nm.

The **anti-friction layer** leads to optimisation of the play between the frictionally-coupled parts, a decrease in friction and increased hardness of the friction surfaces – i.e. to active resistance to wear.

The **motor oil** regains its original properties by means of the **process of renewing** the destroyed oil molecules via the Nano-mixture substances.

The **anti-friction layer** forms a permanent chemical bond with the friction-stressed metal surfaces, whereby both wear and friction are reduced and the **operational lifetime** of the unit is decisively prolonged.

# Examination of effectiveness

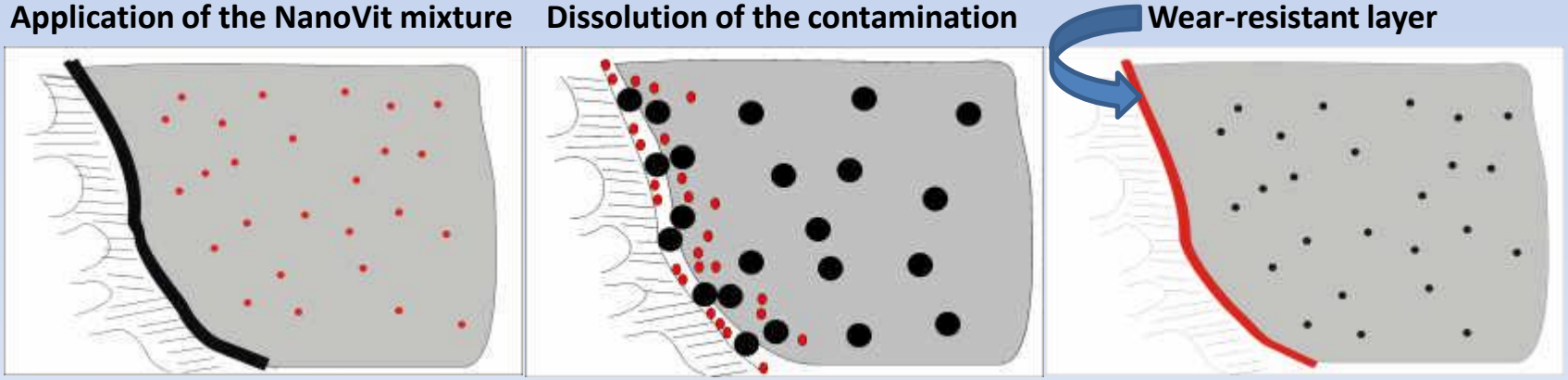
## 2. Cleansing of the oil and lubricant circulatory system

The test took place in the vehicle engine. To this end, an oil basis sample was taken from the lubricant circulatory system before applying the product.

After applying the 2 bottles of NanoVit mixture and driving 200 km, a further oil sample was taken.

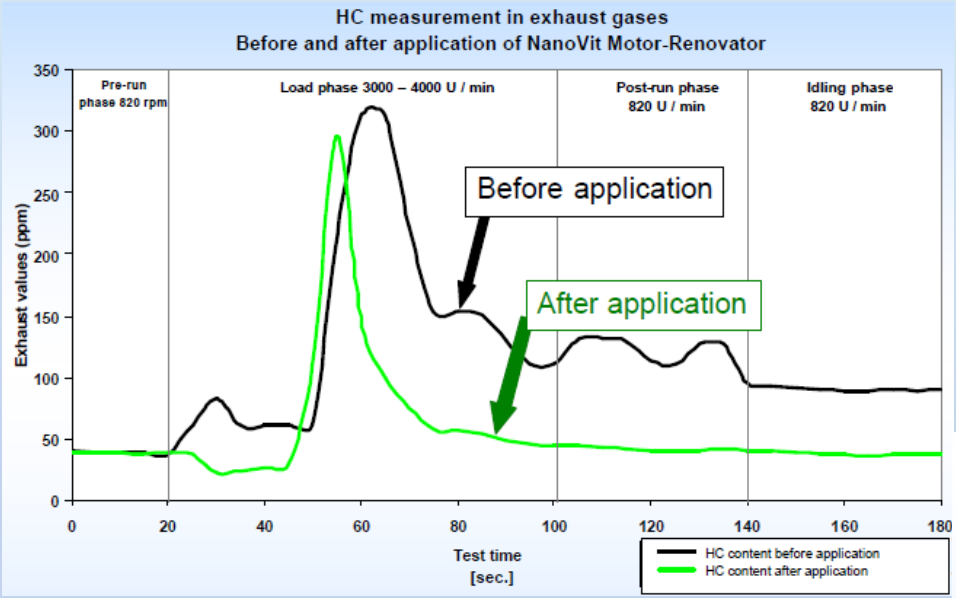
The solid particle analysis showed that approx. 20% more solids were present in the oil sample after application of the NanoVit mixture than in the oil basis sample.

**Functional method of the NanoVit mixture**



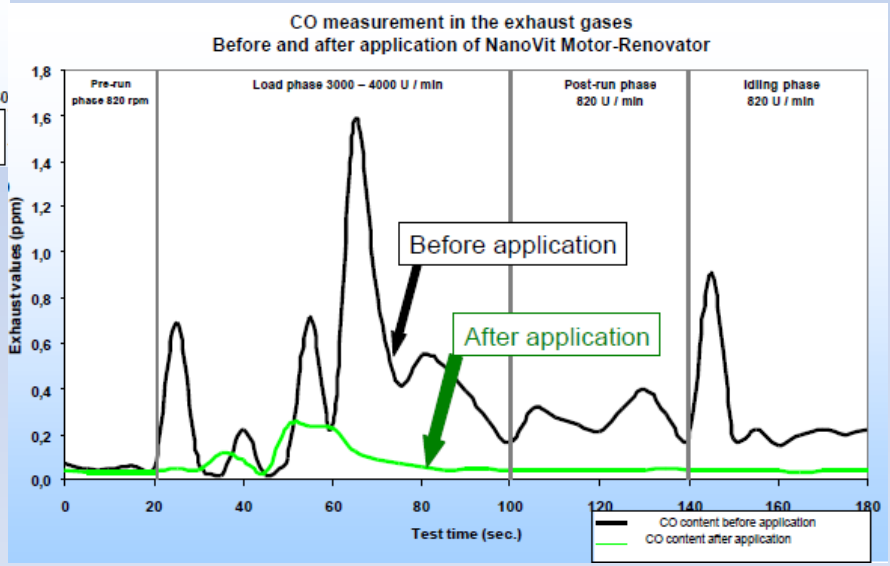
# Examination of effectiveness

## 2. Reduction of emissions in the exhaust gases




Decreased HC (Hydro carbon) level after application

Decreased CO (Carbon Monoxide) level after application



# Examination of effectiveness

## 2. Reduction of emissions in the exhaust gases

| Parameter | | Emissions | | Result | | |
|---|---|---|---|---|---|---|
| | | before application | after application | | | |
| CO | % vol | 0,277 | 0,041 | 85 | % | improvement |
| CO2 | % vol | 14,6 | 15,3 | | % | |
| HC | ppm | 105,7 | 39,6 | 63 | % | improvement |
| O2 | % vol | 0,111 | 0,269 | | % | |
| LAMBDA | | 0,994 | 0,956 | | % | |
| Rotation | min-1 | 812 | 816 | | | |

| |
|---|
| The vehicle idling exhaust gas values prior to start of the test were within the tolerance range of the exhaust gas examination measurement. Follow ing the load phase, the HC emission increased significantly. The exhaust gas values fluctuated and were unsteady. The vehicle settled at an HC value around 105 ppm. Following the application the exhaust values were already better in the pre-run phase. Following the load phase, rapid stabilisation occurred. The exhaust gas values were improved. |

| | | |
|---|---|---|
| After application of the product the exhaust gas values were | better | x |
| | worse | |

# Conclusion for the contaminant dissolution behaviour

With the application of the NanoVit Motor-Renovator product, a thorough cleansing of the system and the deposition of a micro-layer on the friction surfaces are guaranteed in a single process.

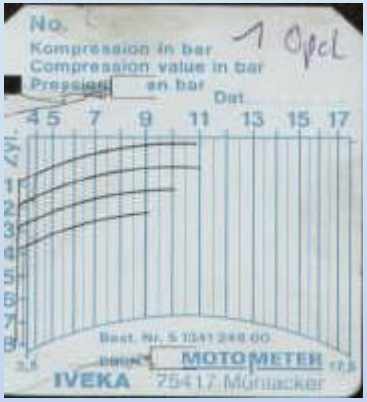
Carried by the motor oil, the NanoVit mixture particles penetrate and infiltrate the contaminants adhering to the inner surfaces of the engine.
The contaminants are dissolved and released into the motor oil in particle form.

The NanoVit mixture thereby takes into account that no caustic cleaning agents may be used in the engine, as these would damage the elastomers and lead to the engine leaking.

The improved exhaust gas values attest to the performance properties whilst at the same time the NanoVit ensures permanent resistance to wear.

# Examination of effectiveness

## 2. Optimisation of compression



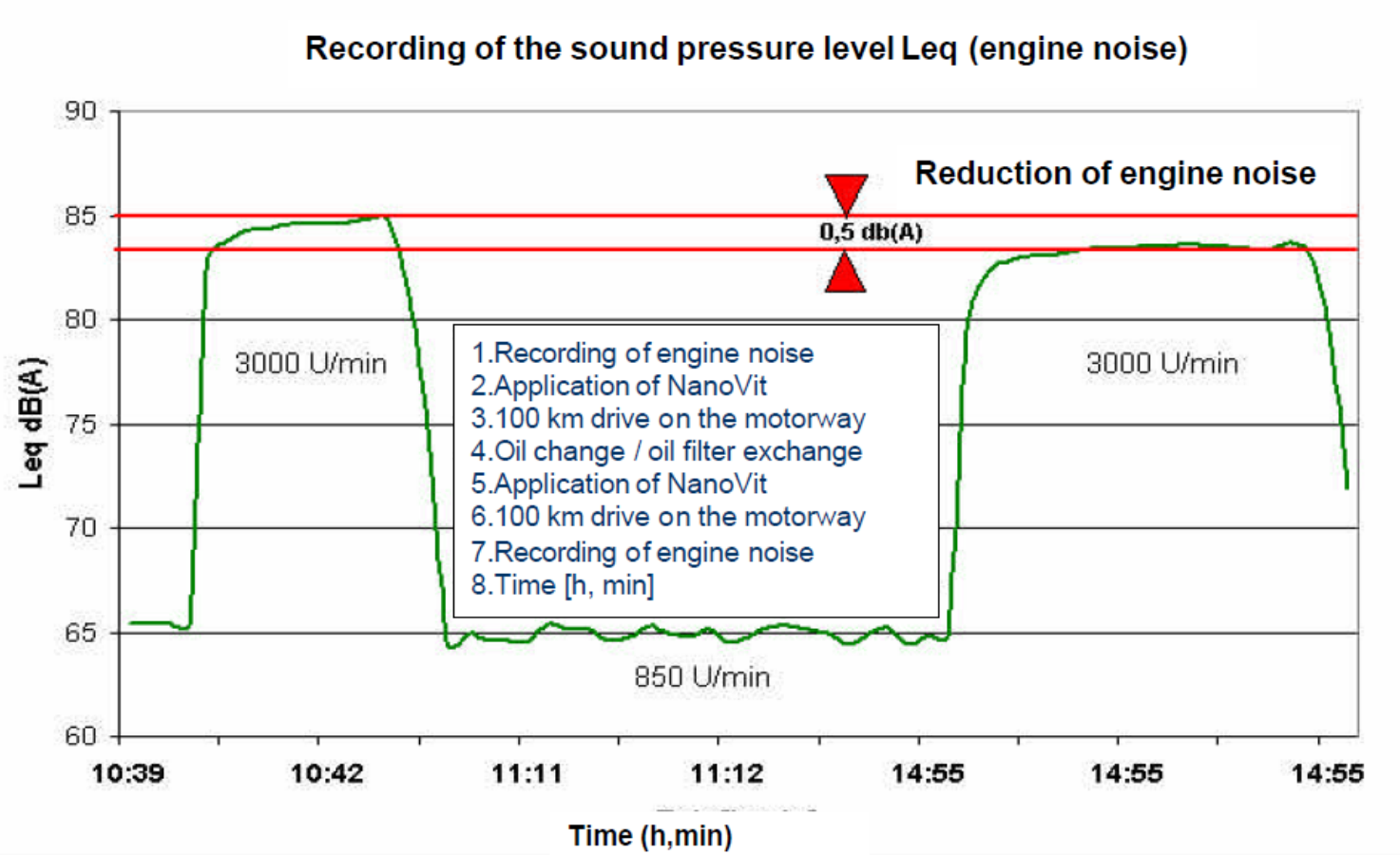

**Before the application**


**After the application**

| **Evaluation** | |
|---|---|
| The compression characteristic of the engine was very unsteady before the application. After 50 km a short stop of 5 minutes was made.<br>In the subsequent 50 km, a more dynamic power behaviour could already be determined by the driver at higher engine speeds. After 100 km, the compression characteristic can be viewed as being balanced and optimised. An absolute compression improvement of around 16 % was achieved. | |
| The engine performance was optimised | **x** |
| The driving behaviour of the vehicle was improved | **x** |

# Examination of effectiveness

## 3. Noise level analysis / analysis of the engine noise



# Conclusion for the performance optimisation and noise behaviour

The compression ratio is always an expression of the actual performance parameters as compared to the manufacturer's data.

A low compression ratio means, amongst others, that the actual engine performance is no longer produced.
Reasons are, for example, operationally caused contamination in the oil circulatory system.

On account of the effectiveness of the NanoVit Motor-Renovator and the related..
- cleansing of the friction surfaces,
- formation of an intermediate layer on the friction surfaces,
- and the formation of a micro-modified, repeatedly self-renewing layer,

...it was proved that an optimisation of performance and, on the basis of a noise analysis, an improvement of 0.5 dB was achieved. This is significant as an indicator of improved overall operation as it is significant in terms of vibration.

i.e. optimum compression = optimum performance parameters = reduced fuel and oil consumption = extended lifetime of the unit.

# Summary

The NanoVit mixture is intended for forming an anti-friction coating on friction surfaces and for the renovation of worn surfaces for moist, wet, semi-dry and dry friction at the limits.

The goal is to reduce the friction coefficient, mechanical stress and heat loss in the areas where it is applied, i.e. working machines and mechanisms.

Surfaces treated with NanoVit Motor-Renovator assume an optimum geometry for their further use and become precision parts with an operational lifetime increased many times over.

The application leads to:

- extended operational lifetime of the engine / unit
- improvement of the work coefficient (cos **f)**
- reduced power consumption of electrical appliances
- reduction in fuel consumption of internal combustion engines
- prolonged lifetime of lubricants (oil)
- reduction of CO/CH and other internal combustion engine exhaust gases
- reduction of vibration and noise levels

# Possible areas of application of NanoVit technology

- Engineering
- Motor vehicles (cars / commercial vehicles)
- Ships
- Power plants
- Agricultural machines
- Lifting machines and devices
- Mining machines
- Transmission systems
- Petrol and diesel engines / gas engines
- Electric motors
- Compressors
- Gearboxes
- Ball bearings
- and many more

# What Next?

**Interested in learning more, using the NanoVit material in your own products and applications, or would like to know more about our consumer product range?**

**Or would you like to test your procedures or range of services with our product technology, completely without obligation?**

**We, and also our partner TÜV-Thuringia, are at your disposal.**
**For further details, please visit our homepage:**
**www.nanovit.co.uk**

**Or contact the team at :**


Efficiency Technologies
Bluecube House
Unit 3, Blackhill Drive
Wolverton Mill
Milton Keynes
Buckinghamshire.
MK12 5TS
UK

EFFICIENCY TECHNOLOGIES

Tel +44 (0) 845 299 7898
Fax +44 (0) 203 292 1994
www.efficiencytechnologies.co.uk