



ANALYTICAL REPORT

ECO DTM AND ECO STABIFLEX

ECO DTM and ECO STABIFLEX are oil stabilizers designed for blending with any petroleum base lubricant of fluid, to improve lubricity during use and after shutdown.

Upon application of Flex-O d.o.o. (Ltd.), a quality and quantity analysis of delivered samples designated ECO DTM and ECO STABIFLEX have been made.

The charts below draws on average specifications of motor oils used on the Croatian market:

Chart No.1: Compatibility with Motor Oils

ANALYSIS	RESULTS	METHOD	AVERAGE SPECIFICATION
Density, 15°C kg/m ³	870	ASTM D 4052	879-889
Kinetic viscosity mm ² /s - at 40°C - at 100°C	220.33 35.32	ASTM D 445 ISO 3104	103.2 14.8
Ignition point, °C	216	ASTM D 97 ISO 2592	224-227
Sulfur content, % m/m	0.0035	ASTM D 3120	0.402-0.749
Zn content, % m/m	0.00034	AAS	0.093-0.120

Chart No.2: Analysis of Heavy Metals by Atomic Absorption Spectrophotometry (AAS)

METAL	% m/m CONCENTRATION RESULTS
Ni (Nickel)	<0.0005
Pb (Lead)	<0.0005
Cu (Copper)	<0.0002
Cr (Zirconium)	<0.0005
Zn (Zinc)	<0.00034
Hg (Mercury)	<0.0005
Cd (Cadmium)	<0.0005
V (Vanadium)	<0.002
Mb (Molybdenum)	<0.002

Petrol Engine Compression Ratio Test

A four-stroke petrol engine has been used to test walls of the cylinder and pistons of the engine for improved sealing capability of motor oil with the use of ECO DTM and ECO STABIFLEX oil stabilizers.

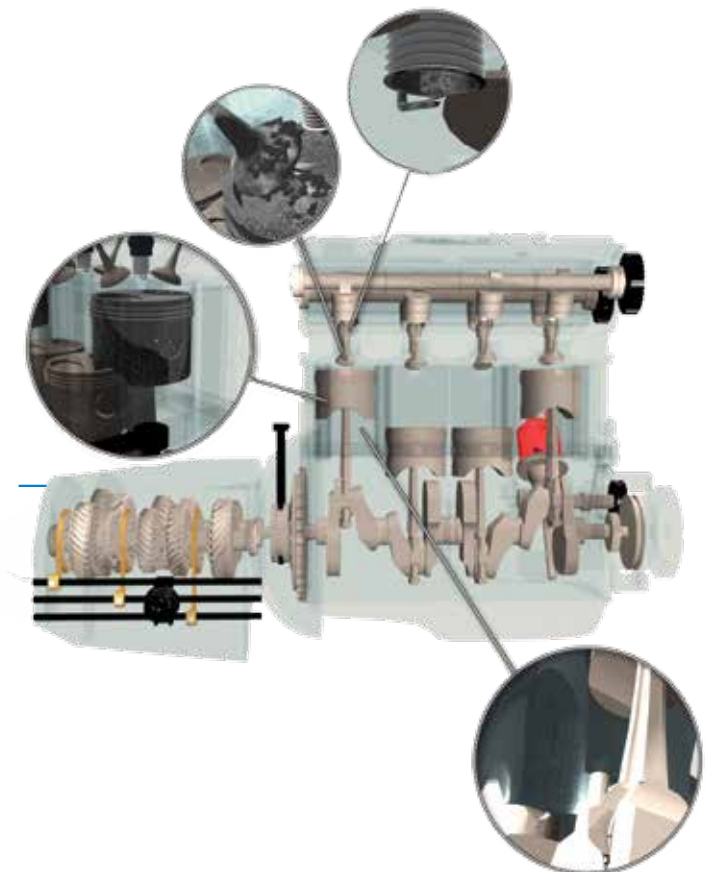
Engine cylinder compression ratio values have been measured with a manometer and compared.

a) Compression Ratio Measurement **without Additive in Motor Oil:**

Cylinder No.	Compression Ratio
1	11.0
2	13.5
3	11.0
4	12.0

b) Compression Ratio Measurement **with Additive in Motor Oil:**

Cylinder No.	Compression Ratio
1	12.2
2	13.5
3	12.8
4	13.0





Four-Stroke Petrol Engine Exhaust Gas Concentration Measurement

For measurement of the exhaust gas concentration, the same petrol engine as in item 1.2.4 has been used. Likewise, the measurement has been carried out in 2 phases:

- a) Before the addition of additive to the motor oil and;
- b) With the additive in the motor oil.

Measurements have been taken with the engine idle.

Note: Symbol HC designates uncombusted hydrocarbons.

a) Measurement of Gas Concentration with Additive Added to Motor Oil

Exhaust Gas	Concentration % vol
CO	7.31
CO ₂	6.93
HC	428.0 ppm Vol
O ₂	5.14

b) Measurement of Exhaust Gas Concentration with Additive Added to Motor Oil

Exhaust Gas	Concentration % vol
CO	2.99
CO ₂	8.50
HC	293
O ₂	6.59

Analysis by Infrared Spectrophotometry (IR)

The sample has been analysed by infrared spectrophotometry in 2 ways: a) Analysis of gas phase above liquids at room temperature (20°C) and b) Analysis of the liquid as such

a) Gas-Phase Analysis

A MIRAN 1A CVF infrared spectrophotometer has been used for the analysis. The infrared spectrophotometry shows there are no volatile hydrocarbonaceous components within wavelength range from 2.5 to 14 µm.

b) Liquid-Phase Analysis

A PERKIN-ELMER infrared spectrophotometer has been used for the analysis.

Presence of long-chain paraffins, without traces of other hydrocarbon types, has been established.

Likewise the presence of 34.3 ppm water has been established.



CONCLUSION

Test results of the delivered ECO DTM and ECO STABIFLEX samples lead us to conclude as follows:

- The IR analysis has identified long-chain hydrocarbons (paraffins) and no volatile components.
- S, water, N and Zn content as well as the content of other detected heavy metals: Ni, Pb, Cu, Cr, Hg, Cd, V, Mb lies well below maximum allowed limits, with some of them on the verge of detection.
- Coke (coke residue) has been detected in traces.
- Ash is well below maximum allowed limits.
- As regards density, it can be described as somewhat denser than diesel but thinner than motor oils. Therefore, its density value lies between those required for both products.
- Likewise, it is noticeable that due to presence of long-chain hydrocarbons (paraffins(=) in its composition, the distillation range is somewhat higher than that in diesels.
- The pour (filterability) point corresponds to periods from 16.04.-30.09., 01.10.-31.10. and from 01.03. to 15.04. whereas it is a bit lower from 01.11. to 29.02. where -10°C is required and ECO DTM and ECO STABIFLEX have -7°C , which must be taken into consideration during use. We would suggest it should be added in smaller amounts in this (winter) period so the fuel is not solidified due to low temperatures.
- As for kinematic viscosity, one can say that results obtained roughly correspond to those of motor oils whereas diesel fuel ECO DTM and ECO STABIFLEX is rather more viscous.
- Compression ratio measurements of the used petrol engine with and without additives shows an increase in compression ratio with an additive in motor oil.
- The exhaust gas concentration measurements (on the same four-stroke petrol engine) reveals that an additive in motor oil reduces the concentration of harmful exhaust gases. At this point however, we would not put this finding completely into correlation with the amount of additive in oil i.e. say there is a direct link between a reduction in the concentration of harmful exhaust gases and the use of additives in the motor oil. Namely, the engine in question required cogged belt replacement so that one cannot say for sure whether a reduction in the concentration of gas pollutants is attributed solely to additives or rather cogged belt replacement.

*Due to terms of privacy, the name of the engineer which performed these test is not disclosed. If you personally wish to request this or any additional documentation or information please contact us at flexo@flexo.hr we will be happy to submit any needed information.



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