



Technical Circular

0199 - 99 - 1119/5 EN



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DEUTZ Compact Engines

DEUTZ Oil Diagnosis, Lubricating Oil Change after Analysis

The 5th replacement is made on account of

- New determination of diesel fuel in lubricating oil
- New fax number ANAC Co.

General

DEUTZ oil diagnosis

DEUTZ, together with its service partners and a well-known partner laboratory, offers its customers the possibility of diagnosing the engine condition by means of a lubricating oil analysis. Initially, the DEUTZ oil diagnosis system will only be available in Europe. It is planned to extend it to other regions.

The DEUTZ oil diagnosis system can detect imminent engine damage in time and help to avoid it. The engine availability is increased. The following engine problems can be diagnosed by the lubricating oil analysis.

- Atypical increase in engine wear
- Too high a dust penetration (danger of high abrasive wear, e.g. on piston rings)
- Coolant penetration (danger of bearing wear)
- High soot penetration (increased viscosity, defective oil supply, increased wear)
- Too high a fuel content (too low a viscosity, reduced lubricant film thickness, wear)
- Increased wear due to acids from high sulphur content of the fuel

Note:
The part numbers indicated in this document are not subject to updating.
Binding for the identification of spare parts is exclusively the spare parts documentation.

Serious consequences of the diagnosed problems can be avoided by taking evasive action in time; this brings considerable advantages for the customer (longer engine operating time, higher equipment availability).



Gear and hydraulic oils can all be tested with the DEUTZ oil diagnosis. Since these components are not DEUTZ products, DEUTZ cannot provide any guarantee for the analysis results.

On no account may fuel samples be sent in. For one thing, the partner laboratory is not equipped for fuel analyses, for another, strict safety regulations apply for fuel. Engine in the run-in phase may have high metal concentrations. This is normal and does not influence the life expectancy of the engine.

Lubricating oil change after analysis

The oil change intervals specified in TR 0199-99-3002 can be extended by up to 100% by using the DEUTZ oil diagnosis, whereby a maximum interval of 1,000 h may not be exceeded in any case. The additional demand that at an oil change should be made at least once a year is extended to at least once every two years by the use of the DEUTZ oil diagnosis and the longlife oil filters.



The guarantee is only maintained when changing the lubricating oil after analysis when the DEUTZ oil diagnosis system is used.

Changing of the lubricating oil on the basis of the DEUTZ oil diagnosis may only be carried out for oils of class DQC II-05, DQC III-05 and DQC IV-05. When using lubricating oils which do not satisfy the aforementioned quality classes, the change intervals according to TR 0199-99-3002 must be observed.

DEUTZ recommends the use of original DEUTZ engine oils. Further information is available from your responsible DEUTZ partner.

The costs for the oil diagnoses will pay off for the customer over the life cycle of the engine due to savings on oil, working time and reductions in equipment failure times.

Description of the DEUTZ oil diagnosis

Taking oil samples

The customer can take the lubricating oil sample himself or together with the responsible DEUTZ partner, e.g. during maintenance. Taking the sample is prone to possible errors which can falsify the analysis results and the diagnoses considerably. To avoid sampling errors, the customer must observe the following rules:

- The engine oil must be warm when the sample is taken.
- The sample should be taken preferably with the engine running.
- The pertinent safety precautions must be taken when drawing off the oil sample.
- The oil is sucked out through a probe at the dipstick with the sampling pump of the diagnosis kit (the sampling pump can be ordered as an accessory). The probe is inserted in the dipstick opening so that its bottom end is at least 10 mm below the minimum filling level. The minimum filling level corresponds to the "MIN" dipstick mark.



- During an oil change, the oil sample can also be taken from the oil drain screw (first a sufficient amount of warm engine oil must run out and then the sample should be taken from the middle stream).
- The engine oil is filled directly into the sample bottle, clean, dry original oil diagnosis sample bottles should be used exclusively.
- The bottle is filled as full as possible (at least 80%).
- Further information can be found in DIN 51574 (Testing lubricants - Taking samples of lubricating oils from combustion engines).

Registration for the diagnosis system and orders of diagnosis kits (appendix 1)

The customer must register for the diagnosis system for the first time through his responsible DEUTZ partner. The form in appendix 1 should be used for this. The customer can use the same form to order analyses. This form is available from the DEUTZ partner.

The diagnosis kit consists of:

- Sample bottles
- Identity cards with a barcode label
- Dispatch envelopes with pre-printed address
- Sampling pump (optional)

The user can obtain his first diagnosis kit from his service partner.

The customer receives a secret user password from his analysis partner to be able to call his diagnostic data on the Internet under <http://www.anac-diagnosis.com>.

Identity card (appendix 2)

The identity card has several functions:

- To identify the sample bottle by the barcode label.
- To provide additional information which is essential for a correct diagnosis.
- To communicate personal comments and reasons for the oil diagnosis.

Therefore the sample bottle and the identity card must carry labels with the same number and also have the same barcode. It is also important that the fields on the identity card are filled in carefully according to the pre-printed designation.

The identity card already contains the appropriate company name and code (5 letters) for the respective user. The engine number must be entered in the Unit Number field.

The manufacturer and type of engine as well as the correct designation of the used lubricating oil must be entered in the appropriate fields in the bottom section when sending the first sample. Otherwise there is a risk that a wrong or incomplete diagnosis will be made.

The barcode label must be stuck on the sample bottle correctly, the bars must be horizontal (when the bottle is standing up).

Sending the lubricating oil sample

The carefully sealed sample bottle should be inserted together with the appropriate identity card in the dispatch envelope with the pre-printed address of the analysing laboratory. Affix the correct postage to the dispatch envelope and send it to the following address:

G.I.E. ANAC
Boite Postale 18
69360 Solaize - FRANCE



The sender must pay the postage. Please note that only dispatch envelopes with the correct postage will be accepted by the addressee.

The lubricating oil sample can also be sent to the responsible DEUTZ service partner who will then pass it on.

The customer can influence the total time until the diagnosis result is available by the type and speed of dispatch he chooses.

Notification of the diagnosis result

As a rule, the lubricating oil sample is handled within 24 hours of receiving the sample, the maximum handling time is 48 hours. Handling includes registration, analysis, interpretation and printing or provision of the diagnosis result in the Internet.

Two or three days should normally be allowed for travelling from the lab by post to customers in Germany for example. Deliveries to other European countries or overseas countries can take longer according to postal conditions.

In urgent cases, e.g. abnormal wear or extreme soiling, the customer will be informed by fax on the same day the sample is received. The diagnoses can also be sent by e-mail with an appended file (pdf format) or a link e-mail goes directly to the lab partner's Web site.

<http://www.anac-diagnosis.com>

There the result will be displayed on the day after making the diagnosis. Statistical evaluations and a current overview of all engines monitored by the DEUTZ oil diagnosis can be viewed daily in the database. The customer can access the Internet site at any time with his secret password.

The responsible DEUTZ partner provides the necessary access codes (ID and password) when the customer logs in to the diagnosis system. This form of electronic report dispatch is expressly recommended.

The results of the oil diagnosis will also be provided to the DEUTZ AG.

Diagnosis result (appendix 3)

The diagnosis consists of the following sections:

- Top right: General evaluation (green, orange or red)
- Administrative data, coloured identification of the diagnosis
- Customer data for device, oil sample
- Wearing elements and evaluation
- Foreign substances and evaluation
- Characteristic values of the oil and evaluation
- Information communicated by the customer and comments of the oil diagnosis expert
- Wear coefficient



Appendix 4 shows in detail how the analysis parameters are to be evaluated and what relations to wear processes exist.

Every analysis value is evaluated by a suffixed coloured box so that the customer can see the result at a glance.

- Green: Inconspicuous, value in normal dispersion range of all engines of this type
- Orange: Slight discrepancy which needs to be watched but no need for action at the present time.
- Red: Serious discrepancy, the actions suggested in the diagnosis report should be observed, consult your DEUTZ partner if necessary

This colour coding is based mainly on whether the relations of the various measured wear and soiling parameters to each other correspond to those from the collective of already measured engines of the same type or whether there are clear or strong deviations.

Lubricating oil change after analysis

Values for the lubricating oil change intervals are specified in the Technical Circular 0199-99-3002, in operating hours for industrial engines and in km for commercial vehicles. Dependencies of the change intervals on the exact engine type, certain performance limits, the oil quality and the engine workload are specified.

The oil change intervals specified in TR 0199-99-3002 can be extended by up to 100% with regular use of the DEUTZ oil diagnosis on the engine concerned if the total evaluation at the top right of the diagnosis report is green. For example: The interval can be extended up to 1,000 h instead of a standard interval of 500 h for the 1013, 2012 and 2013 series.

The oil diagnosis total evaluation colour coded in this way mainly includes the wear coefficient G.W.C. which puts the ratios of the wear metals to each other in relation to the corresponding reference values of the respective engine series (see explanations right at the end of this technical circular). The absolute values of the concentrations of the wear metals in oil are also included in the calculation of the wear coefficient.

1,000 h is the absolute maximum oil change interval for all DEUTZ compact engines. No extension is possible for engines with a standard interval of 1000 h (aspirated engines 1011). The absolute maximum oil change interval for commercial vehicle engines is 100,000 km.

Longer oil change intervals may only be used when the DEUTZ oil diagnosis is applied, oil analyses of other companies will not be accepted. Every single engine with longer oil change intervals must be diagnosed, transfer of the results to another identical engine is not permissible even when the same application profiles exist. The diagnosis must be continued over all extended oil change intervals, an extrapolation of the diagnosis result from one change interval to the next interval is not permissible. Only original DEUTZ spare parts are used. If damage occurs to an engine whilst it is still under guarantee in which these conditions were not observed with extended oil change times, the guarantee is voided. DEUTZ recommends its customers to use the DEUTZ oil diagnosis for the whole operating life of the engine. Early detection of damage is important especially for older engines.

Special longlife oil filters must be used for 1,000 h oil change intervals, because these have not yet been introduced for the 1013, 2012 and 2013 series, a maximum time of 750 h can be achieved at the moment for these engines.

The following table indicates the times at which oil samples are to be taken:

Oil sampling times, specifications in hours since the last oil change			
Standard interval	Intermediate analysis	Final analysis	
Specifications in concrete figures:			
500 h	450 h	750 h	1000 h
250 h	225 h	375 h	500 h
20,000 km	18,000 km	30,000 km	40,000 km
Specifications in general form:			
x	0.90 x	1.50 x	2.00 x

The right-hand column of this table is omitted if the intended extension of the oil change interval is not 100% but 50%.

If there is no green evaluated oil diagnosis, the desired extended interval cannot be achieved and an oil change must be made. If this case also occurs at the next change interval, it can be assumed that the engine type concerned in combination with the prevailing operating conditions already stresses the oil to such an extent that longer oil lives are not possible.

No extension may be applied for the first oil change interval. The table above must be used for the second oil change interval. The middle intermediate analysis may be omitted from the third oil change interval onwards.

Irregularities of individual diagnosis parameters may also occur during the standard oil change interval. But the use of the standard intervals is ensured by the stricter test bench continuous runs during the DEUTZ release procedures. If the oil diagnosis system recommends a premature oil change, however, (e.g. penetration by cooling water or dust damage), the recommendation must be followed and the cause of the damage searched for.

Service Information

This document has been created digitally and is valid without a signature.

Enclosure: Appendix 1 Registration and order form

Appendix 2 Reply card

Appendix 3 Example of an oil diagnosis

Appendix 4 Explanation of the oil analyses values



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Appendix 1: Registration and Order Form

Please mark the right/Zutreffendes bitte ankreuzen:

- Customer subscription/Kundenanmeldung
 Order/Bestellung

DEUTZ ÖI Diagnose (DOD)

Please fill out and send to ANAC/Bitte vollständig ausfüllen und an ANAC senden:

Fax: +49 211 9057 277

Sales representative/Purchaser Anmelder/Besteller	DOD – Code If known/falls bekannt	Date Datum

Product Order/Produktbestellung

Verpackungsinhalt:	5 x 1	10 x 1	50 x 1
EXPERT			
GAS			
Sampling pump/ Entnahmepumpe			

Customer Information/Kunden-Information

Please mark/Bitte ankreuzen:

- DEUTZ AG Service Partner Customer from Service Partner

Name of the company/ Firmenname	
Name of the responsible/ Ansprechpartner	
Street, No. Straße, Hausnummer	
ZIP, Locality, Country Postleitzahl, Ort, Land	
Telephone and Fax number, Mobile phone number	
E-Mail address	
DEUTZ Service Partner/ Zuständiger Deutz Service Partner (if concerned)	
Sister firm/Schwesterfirma (bei mehreren DOD Codes für Maschinenpark)	

Report Format/Einstellungen für Bericht



Please mark what you prefer/Bitte ankreuzen:

	Printer	FAX	E-Mail	Link E-Mail
All/Alle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Der Kunde willigt ein, dass Informationen über Bestellungen und die Ergebnisse der Öl Diagnose der DEUTZ AG zur Verfügung gestellt werden.
 The customer agrees that informations about orders and the results of the diagnosis are forwarded to DEUTZ AG.

Signature/Unterschrift

Appendix 2: Reply card

* DOD EXPERT *		13.03/2006	14
DEAW	DEUTZ AG		60010277
Kunde:			E
DOD Referenzen	D E A W	Datum Probe	
Aggregat Nummer			
Dieselmotor	<input type="checkbox"/>	G: Endantrieb LV	<input type="checkbox"/>
B: Getriebe	<input type="checkbox"/>	J: Endantrieb LH	<input type="checkbox"/>
C: Hydraulik	<input type="checkbox"/>	H: Endantrieb RV	<input type="checkbox"/>
D: Vorderachse	<input type="checkbox"/>	K: Endantrieb RH	<input type="checkbox"/>
		E: Hinterachse	<input type="checkbox"/>
		F: Lenkgetriebe	<input type="checkbox"/>
		I: Schwenkantrieb	<input type="checkbox"/>
		X: ?	<input type="checkbox"/>
Ölverweilzeit			Einheit
Gesamtleistung			Km <input type="checkbox"/> Bh <input type="checkbox"/>
Zwischenprobe	<input type="checkbox"/>	Nachfüllmenge in Liter	
Öl Marke	Produktname	Viskosität	
Kommentar :			 DEAW 60010277
Marke Fahrzeug			
Typ Fahrzeug			
Marke Aggregat			
Typ Aggregat			
			

A 2 Reply card



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Appendix 3: Example of an oil diagnosis



Deutz Oil Diagnosis
Ottostrasse 1
51149 Köln
Germany

1 DEUTZ

Your technical representative is
Rimmel Jürgen
TOTAL DEUTSCHLAND GMBH
Phone : 0049 211 9057 340
Mobile : 0162 1333 172
Fax : 0049302027793340
E-mail : juergen.rimmel@total.de
Werner Eltzner
TOTAL DEUTSCHLAND GMBH
Phone : 49 2 11 90 57 -3 5
Fax : 0049302027793
E-mail : werner.eltzner@total.de

DEUTZ AG
Ottostrasse 1
DE-51149 KÖLN

15 March 2006

Dear Customer,

The following diagnoses have been performed for you:

DOD references :

Your references :

■ **DEAW/-110/--1**

2322VX42 / 26 / Diesel engine

EXPERT

If you would find incorrect administrative data on the report, you can fax the corrections to the following fax number: +49 211 9057 277 . You will then get a corrected diagnosis report.

Yours sincerely,

The DOD team.

ANAC, ein Service der TOTAL-Gruppe

ISO 9001:2000

rot



DOD Referenzen : DEAW -110 ---1

Ihre Bezeichnung:

Maschine: 2322VX42 / 26

Aggregat: Dieselmotor

**DOD
EXPERT**



Marke und Typ:

Maschine: Liebherr A316

Aggregat: Deutz BF4M1013

ANAC / BE-ERTVELDE

Datum Diagnose: 15 mrz 2006

l : Total Rubia TIR 6400 15W40

	EXPERT	EXPERT	EXPERT	EXPERT	EXPERT
Probenahme	04-DEC-04	07-MAR-05	07-AUG-05	08-NOV-05	29-FEB-06
Probe-Nummer	145871I	145872I	145873I	145874I	145879I
Laufleistung	2750 BH	3200 BH	3700 BH	4000 BH	4450 BH
lverweilzeit	450 BH	450 BH	500 BH	300 BH	450 BH
Nachfllmenge	2 L	2 L	1 L		7 L

Verschleiß

	ppm	9	7	8	5	114
Eisen	ppm	9	7	8	5	114
Blei	ppm	6	5	5	2	23
Kupfer	ppm	13	7	11	5	32
Zinn	ppm	< 1	< 1	1	2	3
Chrom	ppm	2	2	< 1	< 1	9
Aluminium	ppm	3	3	1	2	15
Nickel	ppm	< 1	< 1	< 1	< 1	2

Fremdstoffe

	ppm	6	6	6	3	11
Si-Fremd	ppm	6	6	6	3	11
Russ	%	0.6	0.5	0.4	0.4	0.2
Wasser	%	NN	NN	NN	NN	NN
Frostschutz		NN	NN	NN	NN	NN
Kraftstoff	%	NN	NN	NN	NN	8.0

l

		NN	NN	NN	NN	NN
Dispergenz		NN	NN	NN	NN	NN
B.N	mgKOH/g	9.0	8.9	9.0	8.7	8.9
Visk. 40°C	mm2/s	103.2	103.2	100.5	102.8	70.3
Visk. 100°C	mm2/s	14.0	13.8	13.0	13.7	7.3
Visk.-Index		137	134	126	133	43
Sulfatasche	%	2.511	2.639	2.488	2.562	2.555

Verschleißkoeffizient

	1.23	0.99	1.26	0.90	3.96
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Ihre Angaben

- Anstieg des lvolumens

Interpretation der Diagnose

- Starke Verdnnung durch Diesel, was eine Absenkung der Viskositt sowie einen hohen Verschleiß von Kolben/Laufbuchsen (Eisen, Aluminium, Chrom) und Lagern (Blei, Kupfer) verursachte. Die Anwesenheit von Diesel im l erklrt den hohen lstand. Wir empfehlen, das Kraftstoffeinspritz-System zu berprfen und eine Zwischenprobe nach 200 BH zu nehmen um die Entwicklung zu verfolgen.

Bemerkungen

- Eine falsche Angabe kann zu einer fehlerhaften Diagnose fhren.



Appendix 4: Explanations of the oil analyses values

Colour coding of the diagnosis

The colour code in the box on the right of the respective concentrations is based on the comparison with reference values which were made for every engine series or engine type under consideration of the specific application.

- A small green rectangle shows you that the wear for this element was normal.
- A slight deviation in comparison with the normal values is indicated by an orange rectangle.
- A red rectangle informs you about a serious deviation. The length of the red rectangle is proportional to the size of the deviation.

Green

Normal wear

Even when the diagnosis is green, deviations from the normal wear and/or increased concentrations of foreign substances can be displayed. In this case the deviations are small and usually dependent on the application and hardly avoidable.

Orange

1. possibility

Slight deviations of some elements

2. possibility

Individual increased wear parameters which have no significant influence, however, on the wear condition of the engine. The condition may worsen, therefore the appropriate parameters should be paid particular attention in the subsequent analyses.

Red

The wear is very high in comparison with other engines of the same series or the same engine type and the same series.

There is an untypical correlation between the individual wear elements.



A red diagnosis does not always mean that you should leave the vehicle or open the engine. But it does require special attention. But before taking action on "non-green" diagnoses, you should ask yourself a few questions:

- Is the engine in the running-in phase (first oil change interval)?
 - Was there a temporary overloading of the engine ?
 - Were the oil change intervals extended ?
 - Have there been any changes in the engine maintenance behaviour ?
-

Consult your DEUTZ partner before deciding to open the engine.

The evaluation of the individual parameters is summarised as a total evaluation in the diagnosis report which is also identified by the described colour code green / orange / red in the large square at the top right. Extended oil change intervals may only be used for green total evaluations.

Wear elements

An engine is made up of individual components, the metal materials of which are known. The metal concentrations in the examined lubricating oil sample are determined by a used oil analysis, expressed in ppm (parts per million = mg/kg).

Origin of the wear elements

The origin and the concentration of the wear elements is typical for an engine series and engine type. Therefore the following list only gives you some idea of the most frequent origin of the elements.

Iron

Cylinder liners, valve actuator, cylinder block, oil pump etc.

Lead

Big end bearing, main bearing

Copper

Big end bearing, main bearing (together with lead), liners, axial bearing, turbocharger, oil cooler etc.

Tin

Big end bearing, main bearing, liners etc.

Chrome

Piston ring

Aluminum

Piston, big end bearing (in some engine series), etc.

Nickel

Piston bolt, camshaft, tappet, seat rings



The wear metals may originate from all movable parts which are lubricated with oil. The sub-units of the same oil circuit are enclosed (compressor, fuel injector). Engines in the run-in phase may have increased metal concentrations. This is normal and does not influence the life expectancy of the engine.

Foreign substances

In many cases abnormal engine wear may be caused by oil contamination during operation.

The following foreign substances are measured:

- silicon (foreign)
- soot



- water
- antifreeze
- fuel

Silicon (foreign) - silicon not coming from the engine

Unit: ppm (parts per million)

The foreign silicon is determined by subtracting the silicon from the wear of certain piston alloys from the Si value whereby appropriate correlations with other wear metals are used.

Possible causes of the silicon contamination:

Silicon with increased wear

- without contamination by coolant:

presence of dust in the oil, usually caused by leaks in the air aspiration system. You should look there first. Oil diagnoses from the first oil change interval may exhibit both increased silicon values (original dirt from the manufacturing process) and increased wear. This has no great effect on the life of the engine. Customers who give high priority to maximum life endurance of their engines are recommended to use a shorter first oil change interval even if this is no longer prescribed by DEUTZ for some time.

- with contamination by coolant (water or antifreeze)

The silicon comes from the additives of the antifreeze. The cause of the penetration by coolant must be found.

Silicon without increased wear

Were silicon pastes used to seal the engine in the course of engine repairs? Have you put an additive in the lubricating oil?

Soot

Soot is always produced when burning diesel fuel.

Too high a soot concentration may be a sign of:

- poor function of the injection system (nozzles, injection pump, valves...)
- lack of air (blocked air filter)
- insufficient compression
- overloading of the engine
- poor function of the turbocharger
- engine operated with increased exhaust backpressure

An increased soot concentration can lead to a rise in viscosity and increased wear. Soot is measured in weight %.

Water

Contamination by water may occur, among other things, due to:

- penetration by cooling water due to internal leakage
e.g. cylinder head gasket, O-rings, oil cooler, compressor
- Factors independent of the engine
e.g. engine wash, condensation by sampling cold oil,
contamination during sampling

When a leak occurs in the engine, coolant gets into the oil circuit; the water evaporates on coming into contact with the hot oil. There may then be no more water in the oil at the time it is sampled. In order to detect a possible leakage with certainty, the oil diagnosis evaluates the presence of antifreeze additives.

Fuel

If there is fuel in the lubricating oil, this may mean:

- fault in the injection system (dripping nozzles, poor atomisation of the fuel, worn plungers of the injection pumps, poor sealing of the injection pump, direct penetration by leakages)
- Incomplete combustion
- Difficult operating conditions, e.g. short distance operation, engine not reached operating temperature, long idling phases

Fuel in the oil leads to reduction in the oil viscosity



In engines which run under very specific operating conditions (low temperatures, extremely low workloads), a small amount of fuel in the oil may be normal.

ANAC is introducing a new method of determining diesel fuel. ANAC determines the fuel dilution in the used oil gas chromatographically by the new DIN EN 15199 (simulated distillation).

This method replaces the previous flashpoint method (FP). The GC method has substantial advantages over the flashpoint method because it also traces the heavy fractions of the fuel which do not evaporate from the oil at operating temperature. The concentration of fuel in the oil is specified in the same unit (vol%) as in the flashpoint method. However, the values found by the GC method are generally higher. ANAC therefore adapted the limit values for the colouring so that the colour of the diagnosis is not affected.

The introduction of this new method also allows ANAC (on request) to determine the presence of biodiesel (FAME, RME). Further information is available from your ANAC consultants.



Parameters of the oil

Viscosity

The kinematic viscosity (flow resistance of the oil) is specified in mm²/s. If the viscosity is also measured at 40°C in addition to the standard temperature of 100°C the viscosity index VI can be determined, a number for the temperature dependence of the viscosity (VI for mineral oils: approx. 100, VI for synthetic oils: e.g. 150). A high viscosity can increase wear and fuel consumption. Possible causes are:- High soot entry, oil ageing, presence of anti-freeze or high thermal load on the engine oil (increased evaporation loss).

A low viscosity can also increase the wear. Possible causes are: - Presence of fuel or decomposition of additives.

If a strong deviation of the viscosity (too high or too low) is indicated, it is absolutely essential to change the oil (see limit values chapter Lubricating oil change after analysis).

Generally the viscosity should not be more than one SAE class higher or lower.

Please always specify the oil designation and viscosity class on the reply card to allow a precise evaluation of the viscosity.

BN (Base Number), previously also TBN (Total Base Number)

The basic components contained in the lubricating oil serve to neutralise acids occurring in the combustion (sulphurous acids and sulphuric acid which are formed from the fuel sulphur but also nitrous acid which forms from nitric oxides and finally carbon acids caused by lubricating oil oxidation). The alkaline reserve of an engine oil is expressed by the base number (TBN = Total Base Number). This is gradually degraded during engine operation due to reactions with acids. The TBN generally may not drop by more than 50 % otherwise the damaging effects of the acid become too strong.

Sulphate ash

The sulphate ash content between new and used lubricants changes, for example, by metallic abrasion or dust (silicon). The ash content may give some indication of possible deposits of oil additives on hot engine parts or is a sign of the concentration of additive elements as a result of thermal overloading of the engine.

The residual dispergence of the lubricating oil

Among the numerous additives contained in the engine oil, detergent/dispersant additives play an important role in the good functioning of the engine oil. The detergent keeps the engine components clean whilst the dispersant additive holds the solid foreign bodies in a fine suspension and ensures that no deposits form. The additive is used up.

Our partner laboratory measures the remaining residual dispergence of the additive and marks the result with a colour code. In the event of an anomaly our partner laboratory alerts us to the serious situation, e.g. by the sentence: "The dispergence of the oil is exhausted." Too low a residual dispergence can have the following consequences:

- Too long an oil change interval
- Contamination by antifreeze
- Repeated oil change with cold engine

The wear coefficient G.W.C (Gross Wear Coefficient)

The wear coefficient is the ratio of wear of your engine to the average wear of all engines of the same make and the same series which are registered in ANAC. In other words the G.W.C. indicates precisely whether your engine wears more, less or to the same extent as is to be expected of other engines of the same type.

G.W.C <1,00 Engine wear less than the average wear for this engine type

G.W.C =1,00 Engine wear identical with the average wear for this engine type

G.W.C >1,00 Engine wear greater than the average wear for this engine type

The G.W.C is an indicator for the direction of the engine's "life curve".

When performing oil diagnoses with the aim of extended oil change intervals, G.W.C. values up to 1.50 are still evaluated with green. This means that a slight increase in wear is to be expected with extended oil change intervals in comparison with standard oil change intervals. The customer must therefore decide whether he gives more priority to a long life or to lower maintenance costs. He can also make this decision dependent on whether the real G.W.C. values for his engine are closer to 1.00 (no increased wear risk) or closer to 1.50 (50 % greater risk of wear) with extended oil change intervals.