LIQUI MOLY – Quality Made in Germany

Who we are:

- Founded 1957 in Ulm, Germany
- Voted #1 Oil Brand in Germany – ***8 Years in a ROW!!!***
- Premium Oil and Additive company in the Aftermarket with over 800 + employees
- Products are exported to over 120 countries
- Company owned research and production facilities
- LIQUI MOLY Motor Oils & Additives:

Quality Made in Germany!

The requirements for motor oil

LUBRICATE

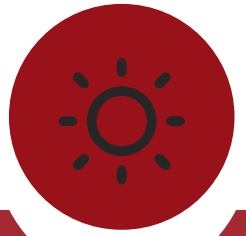
- frictional surfaces
- bearings
- piston / cylinder

COOL

- heat transfer pistons cylinders bushings

SEAL

- piston rings
- cylinder liners
- valve stems
- valve seals



CLEAN

- combustion residues
- abrasion particles
- acids/water/fuel residues

PROTECT

- prevent corrosion
- prevent oxidation
- reduce wear

How the requirements to the oil have changed

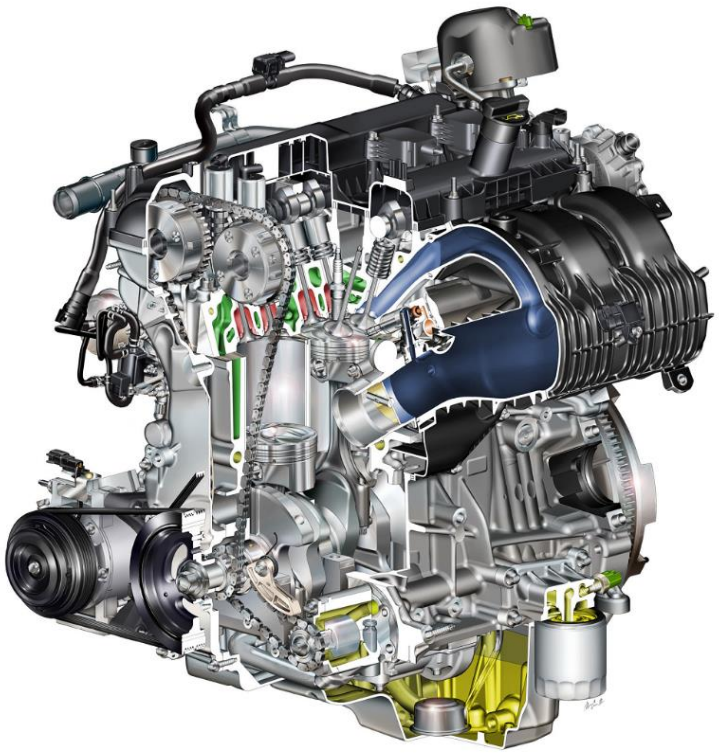
- **Downsizing**
  - Less oil volume, aeration & increased thermal and mechanical loading
    – lubricating

- **Turbo charging**
  - Temperature stability, Deposits, Lacquer
    - cooling

- **Direct injection**
  - Fuel dilution, Oxidation, Sludge, Soot, Wear
    - cleaning

- **Use of alternative fuels**
  - Increased oxidation, Corrosion (Organic acids), Nitration
    – protecting

- **Low viscosity motor oils**
  - Higher oil consumption, less oil pressure
    - sealing

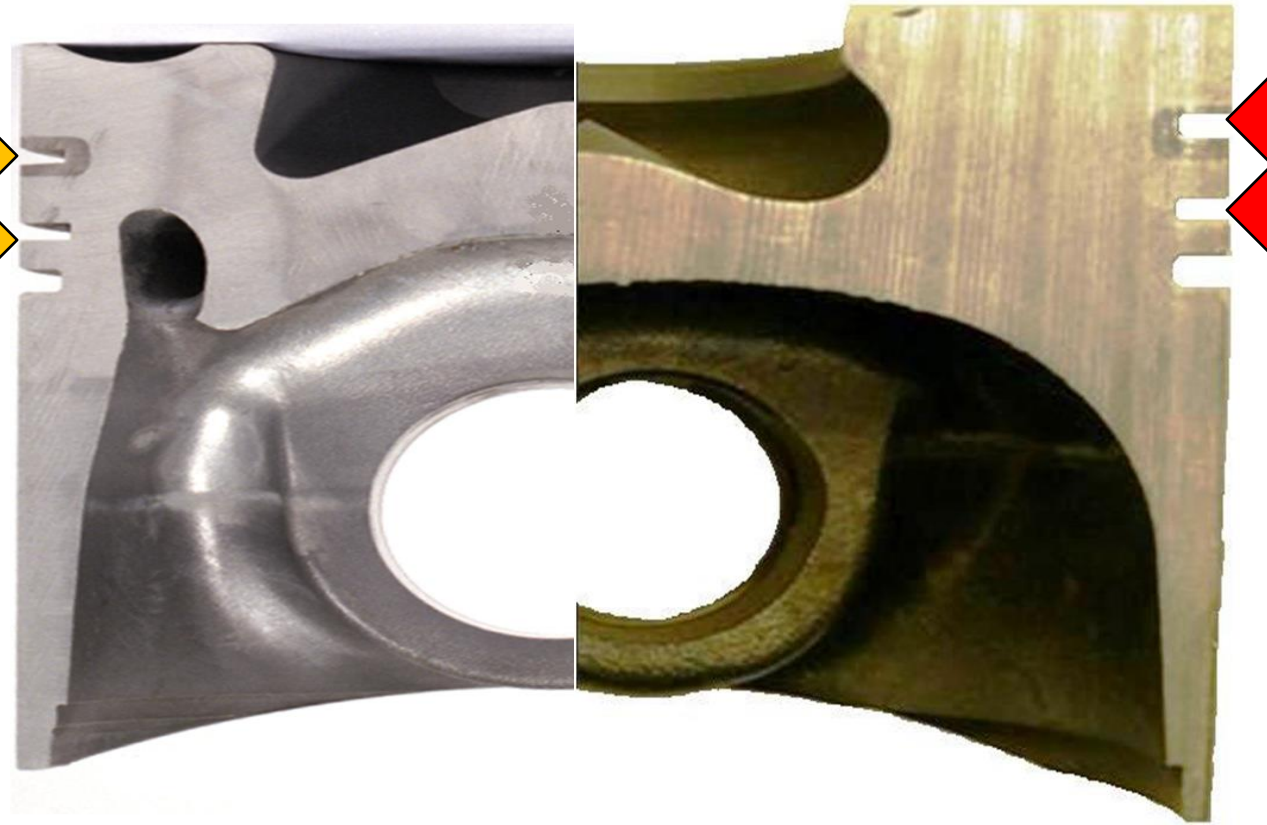


Piston temperatures HD vs. LD

Engines chosen are the two main test engines for HD and LD diesel piston cleanliness, as used in the ACEA test sequences

460 °F

390 °F



700 °F

500 °F

HD Diesel
MB OM441LA

LD Diesel
VW TDI 2.0

Future trends – **Technical facts**

- Gasoline Direct Injection (GDI) engines produce higher amounts of unwanted soot particles compared to standard gasoline engines.

- To fulfill future emission regulations some OEM's already build in **G**asoline **P**articulate **F**ilters (GPF).

- These GPF systems also require low-ash engine oils as in diesel engines with a DPF in order to maintain the maximum lifetime of the filter.

- Downsizing can lead to massive damages, mainly in direct injected and turbo charged engines at low speeds, called **LSPI** (Low Speed Pre-Ignition).

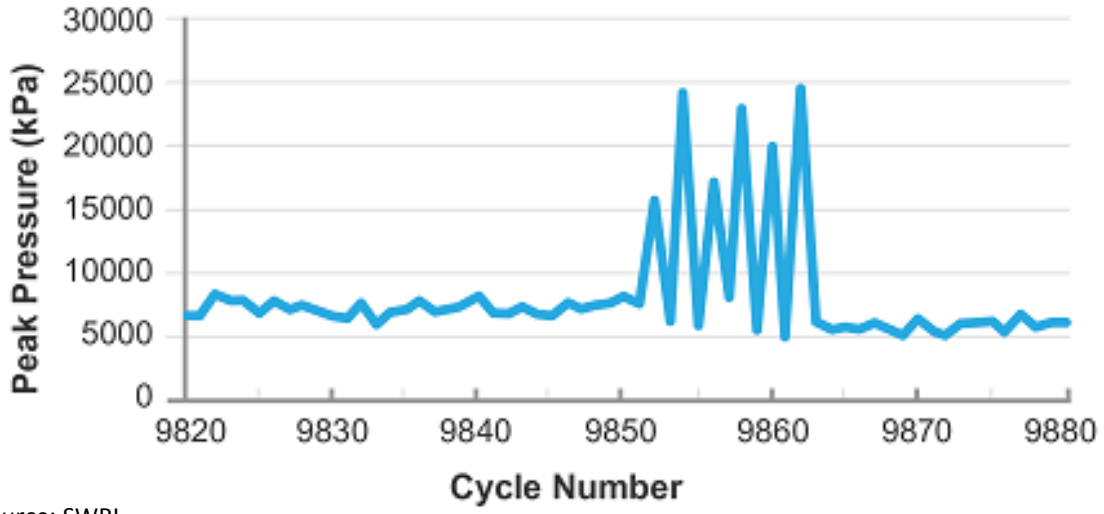
- The engine oil becomes more and more to a specific part of the engine which has been specially developed for a individual engine / exhaust gas treatment design.

- To achieve lower emissions the worldwide fuel quality must be enhanced.

Problem: LSPI

- LSPI : **L**ow **S**peed **P**re **I**gnition
- Almost all downsized turbocharged, gasoline direct injection engines are affected

→ Engine damage is the result !!!



Source: SWRI

What is Low Speed, Pre-Ignition?

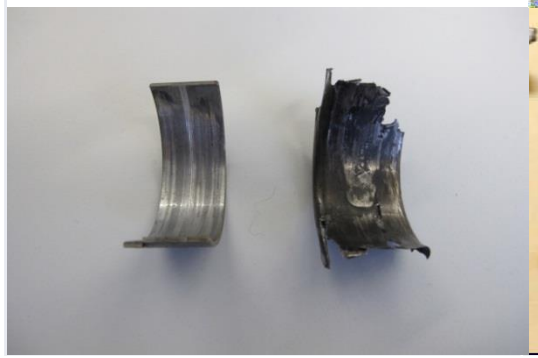
LUBRIZOL ADDITIVES 360

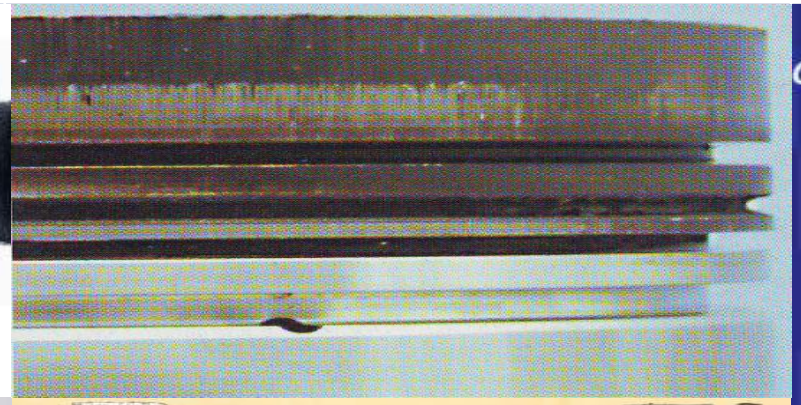
Future trends - **Basic facts of engine oils**

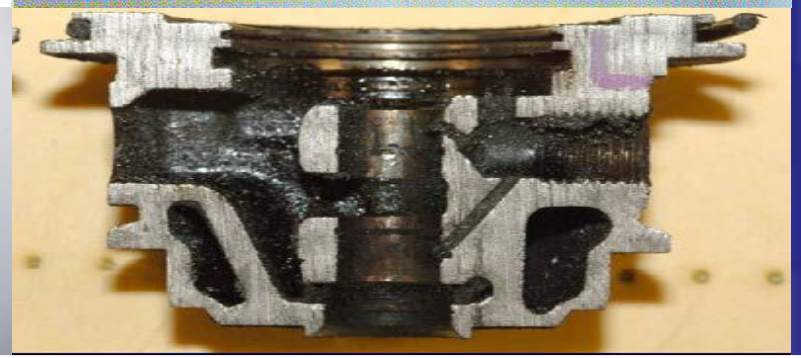
- All these facts are getting more and more crucial for future engine oil technology.
- Downsizing will further increase which leads to more stress and load on all parts of the engine and the engine oil as well.
- Since each OEM follows its own ways to reach current and future requirements for fuel efficiency and greenhouse gas reduction, the segmentation of engine oils will increase steadily.
- The use of specialized high quality products based on latest base oil and additive technology is fundamental.

The consequences of wrong oil quality …

Wear	Deposits	Oil Ageing & Oxidation



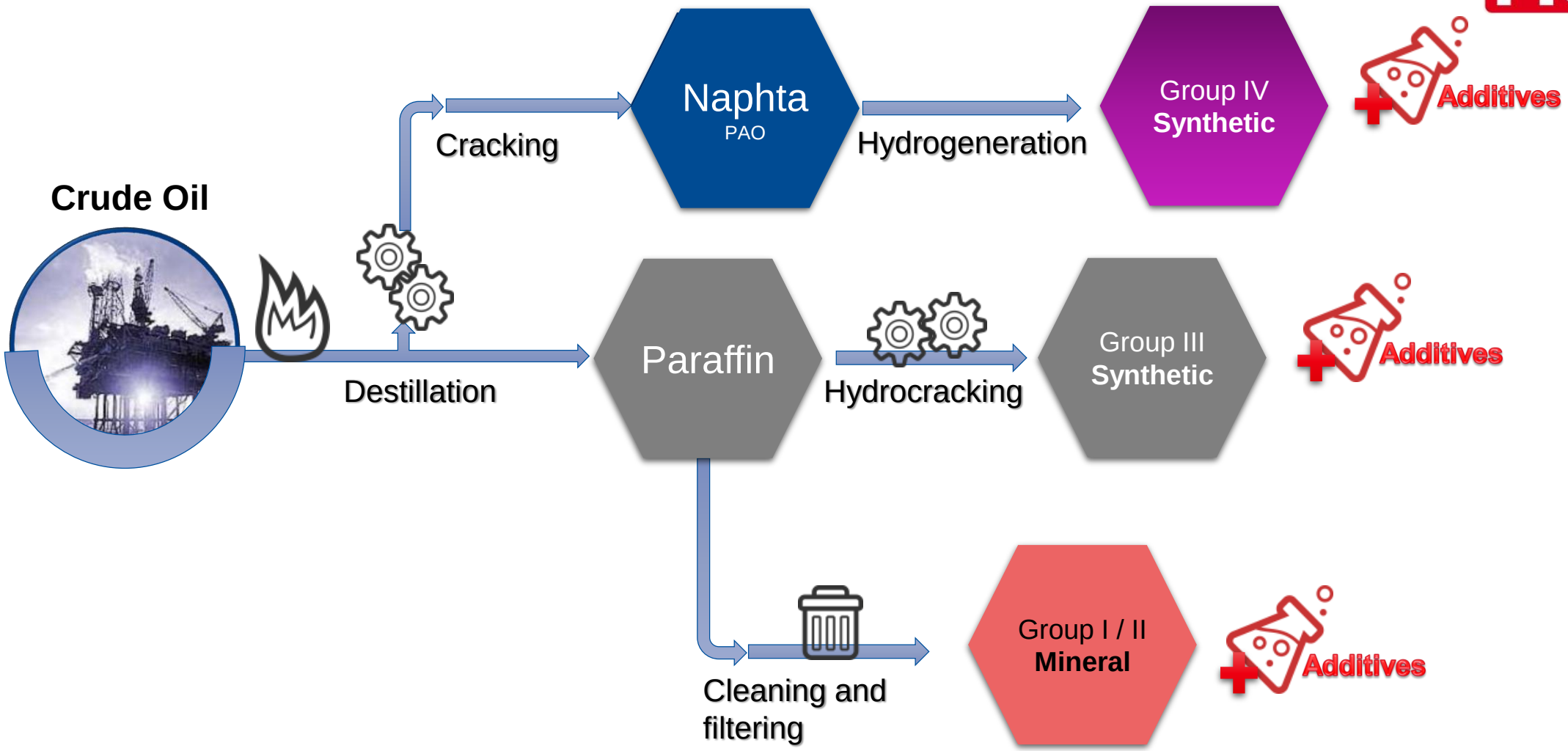




Result : lower engine performance and a high risk of damages !

The differences of mineral and synthetic oils

From crude oil to motor oil



API Base oil classification

API Base Oil Group	Saturates [%]	Sulfur [%]	Viscosity Index
API Group I	< 90	> 0,03	80 – 120
API Group II	> 90	< 0,03	80 – 120
API Group III	> 90	< 0,03	> 120
API Group III+ (not officially defined, yet)	> 90	< 0,03	typ. > 130
API Group IV	**P**oly-**a**lpha-**o**lefines (PAO)		
API Group V	Further base oils, not possible to classify in accordance to API Gruppe I – IV (Naphthenics, Esters, etc …)		

API group I / II : **Mineral Oil**

- Mineral base oil is made in the refinery from crude oil through distillation
- Technical properties of the base oil are limited.

+ good availability of the base oil
+ compatible with all kinds of materials
+ good adhesion to surfaces

- limited heat resistance / higher evaporation loss
- relatively high sulfur content
- weak oxidation stability
- high viscosity at cold temperature

100% mineral based motor oils do not meet the requirements of today´s engines and are not able to get a current valid OEM approval.

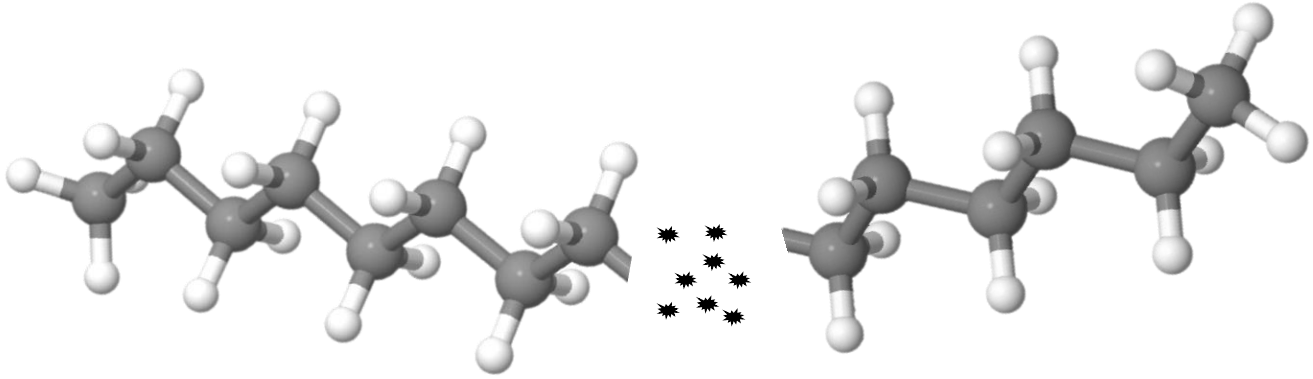
API group III / IV : **Fully Synthetic Oils**

What is “synthetic” oil ?

Synthetic oil is „tailored“ for specific applications.
The Hydro-Carbon molecular chains are cracked and rearranged in a new specific way.

Advantages:
Almost sulfur-free base oil, low evaporation loss, high pressure / high temperature resistant, suitable for extended oil drain intervals.

To meet the high requirements of modern engines it´s neccesary to use synthetic based oils to get a current valid OEM approval.



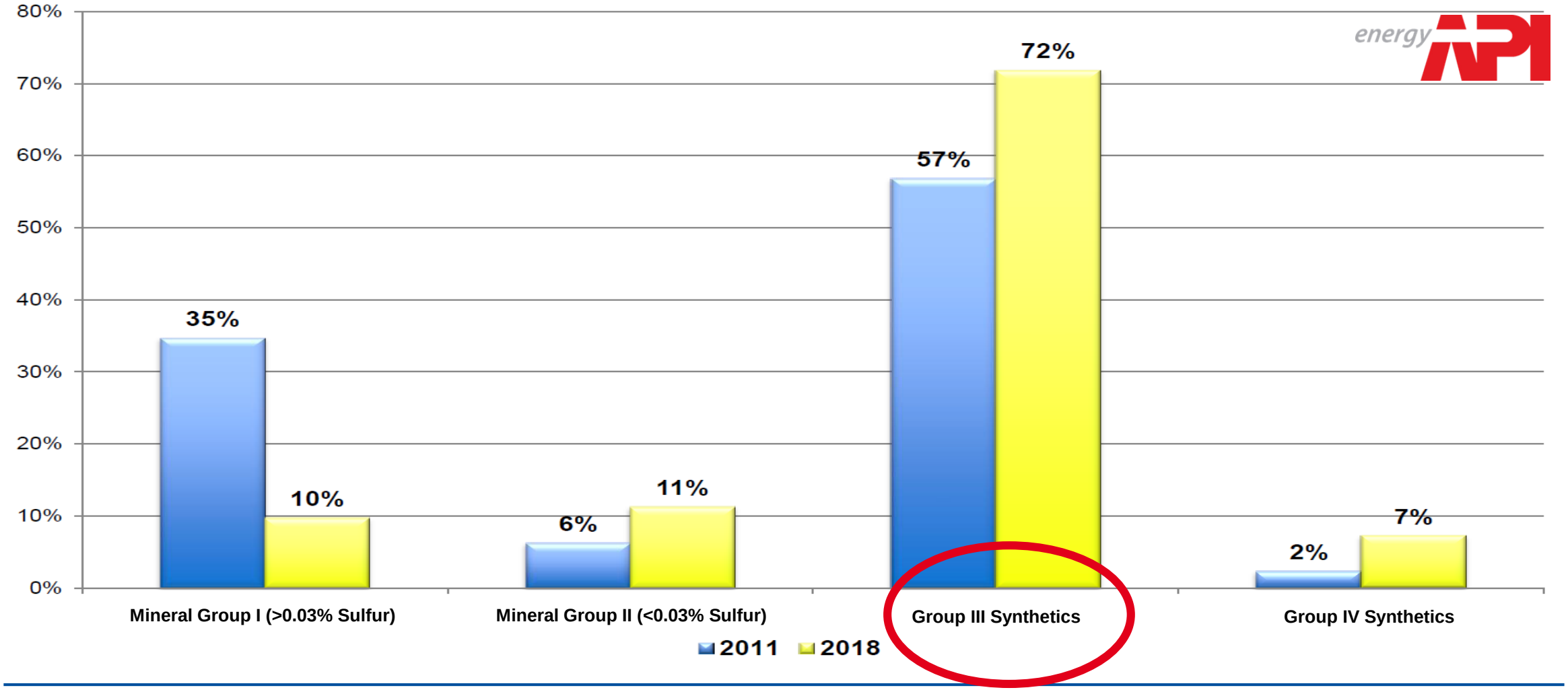
Note :
According to the

National Advertising Division®

all Group **III** and Group **IV** based oils are designated as “Fully Synthetic” oils.

Development of worldwide Base Oil use

Base Oil use in the passenger car sector 2011 and prognosis for 2018



Oils - a mixture of base oil and additives

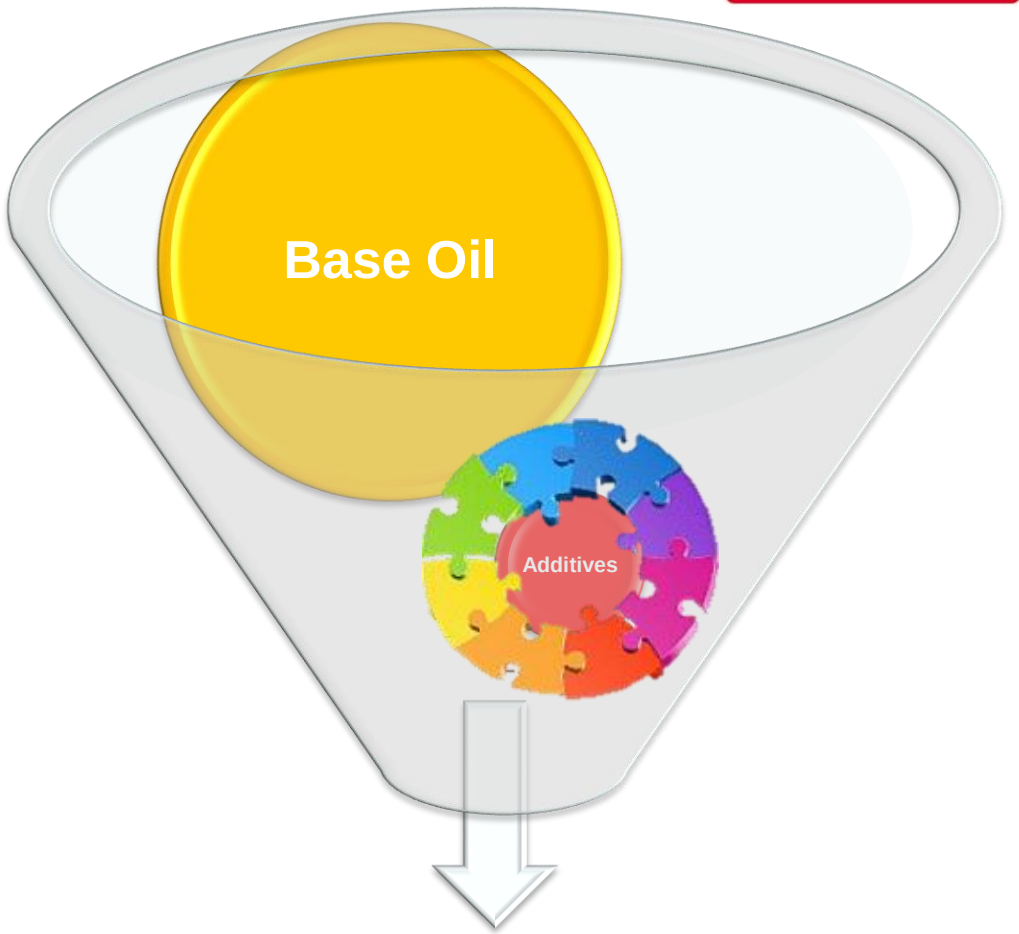
Additives are chemical ingredients in order to achieve performance.

A additive package contains among other chemicals for:

- **Surface effect**
  - Prevent carbonaceous deposits (Detergents)
  - Prevent sludge formation (Dispersants)
  - Reduce friction and prevent wear (FM and AW agents)

- **Quality improvement**
  - Good fluidity, stable lubricating film
  - Temperature stability at cold / heat
  - Keep rubber seals smooth

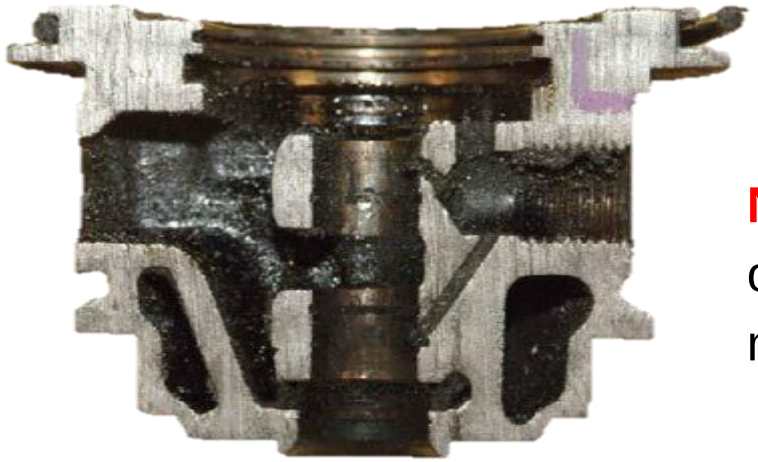
- **Protection effect**
  - Ingredients against foaming / aeration
  - Prevent oxidation and aging
  - Corrosion protection



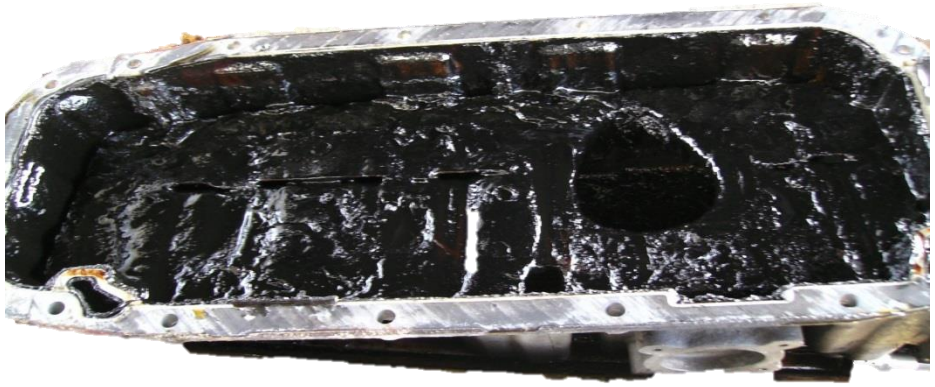
The mixture of base oil and additives decide where the oil can be used for.

Additives in the Motoroil

Detergents : substances which prevent the formation of deposits or free the engine from it.

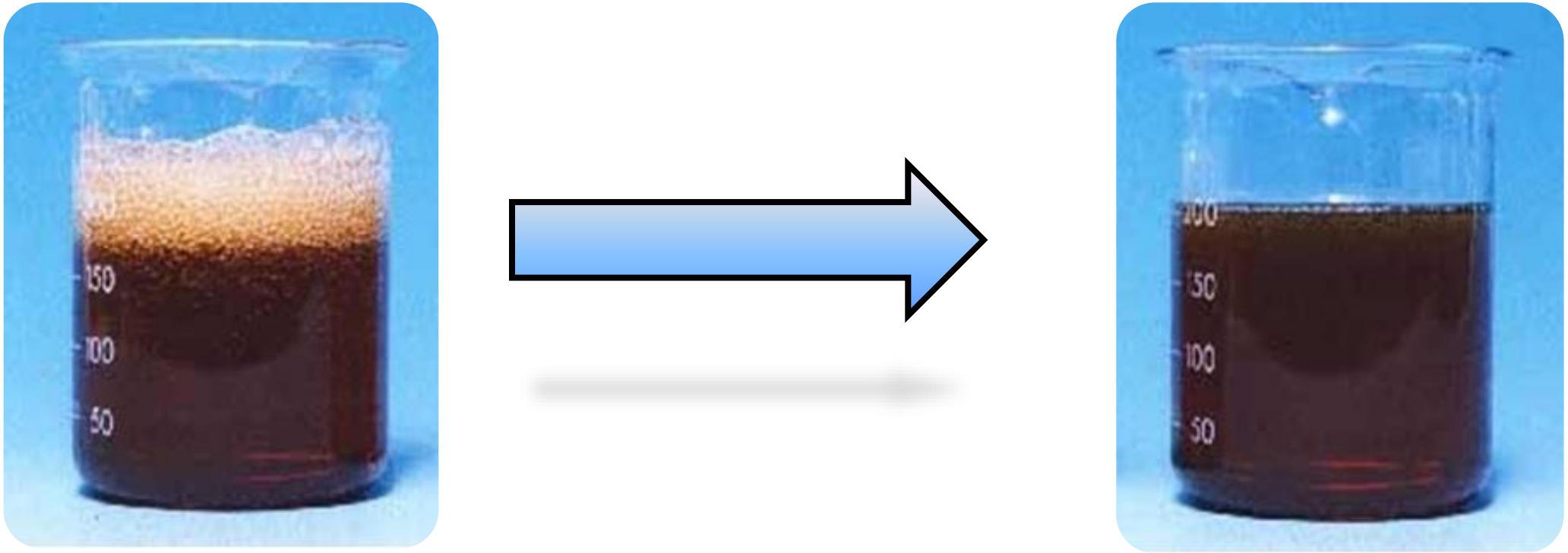


Negative samples, caused by extended oil service intervals and / or unsuited motor oil formulation



Additives in the Motoroil

Anti-Foam-Additives cause a significant reduction of air bubbles in the oil which is a resulting from the circulation of it.



Various silicones and polymers ensure that no air can be trapped in the oil or that any air bubbles burst immediately.

Additives in the Motoroil

Surface active agents: **E**xtreme **P**ressure Additives

Sulfur, Phosphorus, Chlorine,…

+ heat and pressure

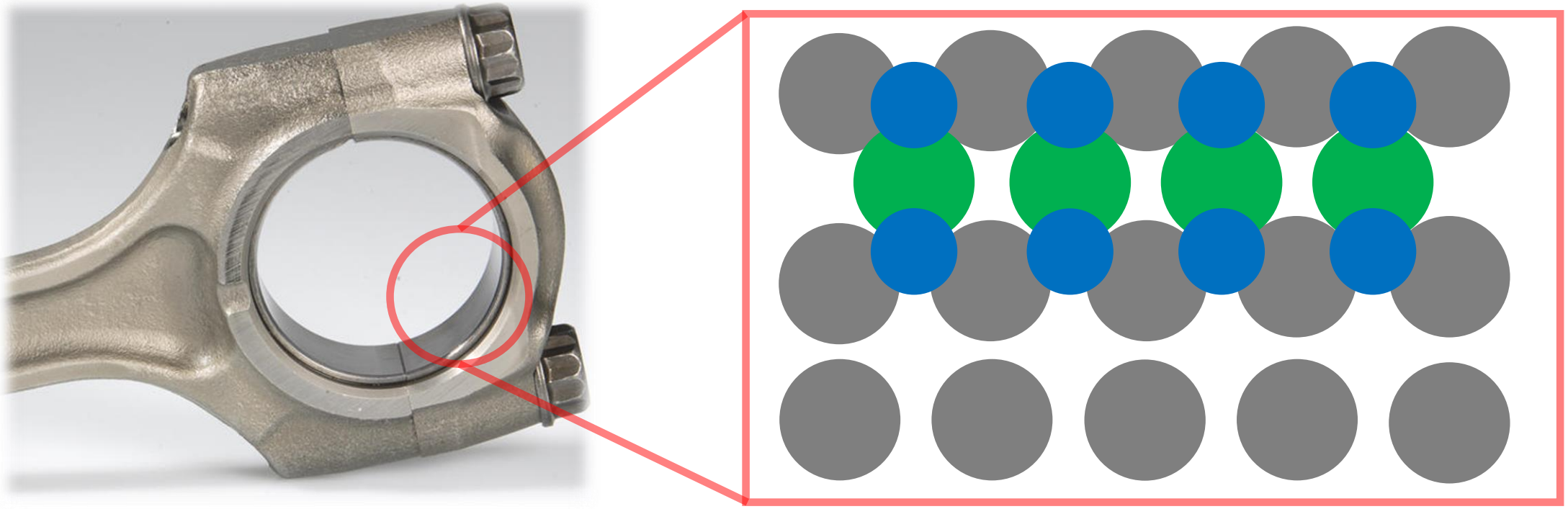
Chemical protective layer

Wear protection

Additives in the Motoroil

Surface active agents: **A**nti-**W**ear Additives

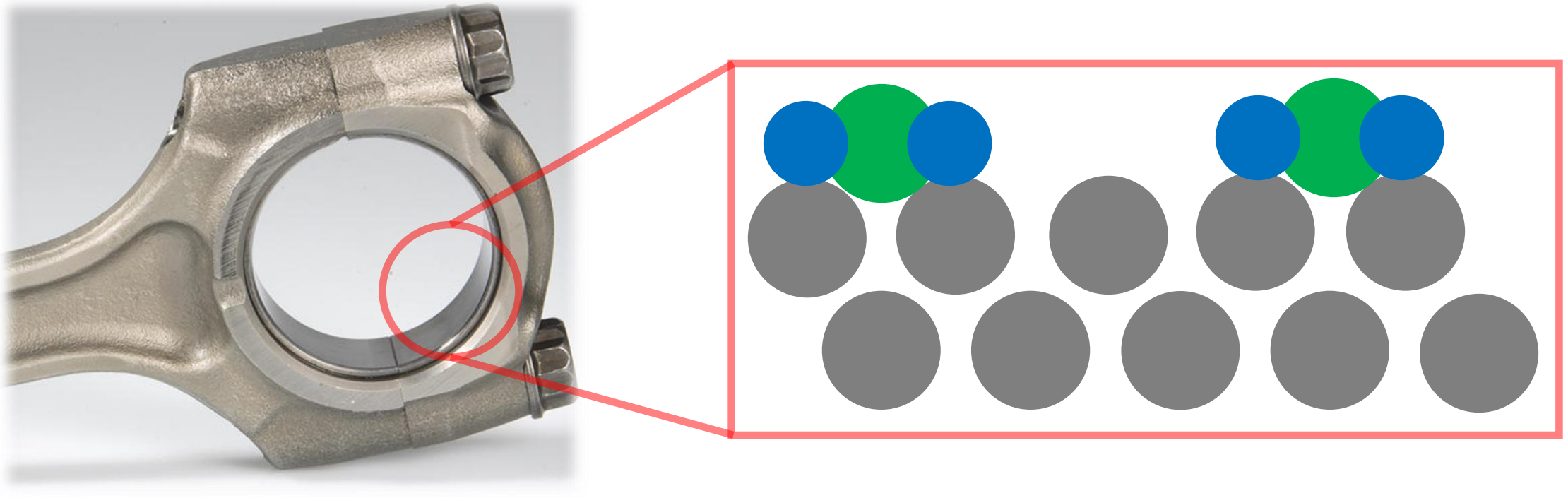
Anti-**W**ear agents such as Tungsten, Molybdenum, … form a additional layer on the surfaces of metal components under heat and pressure in order to reduce wear and tear.



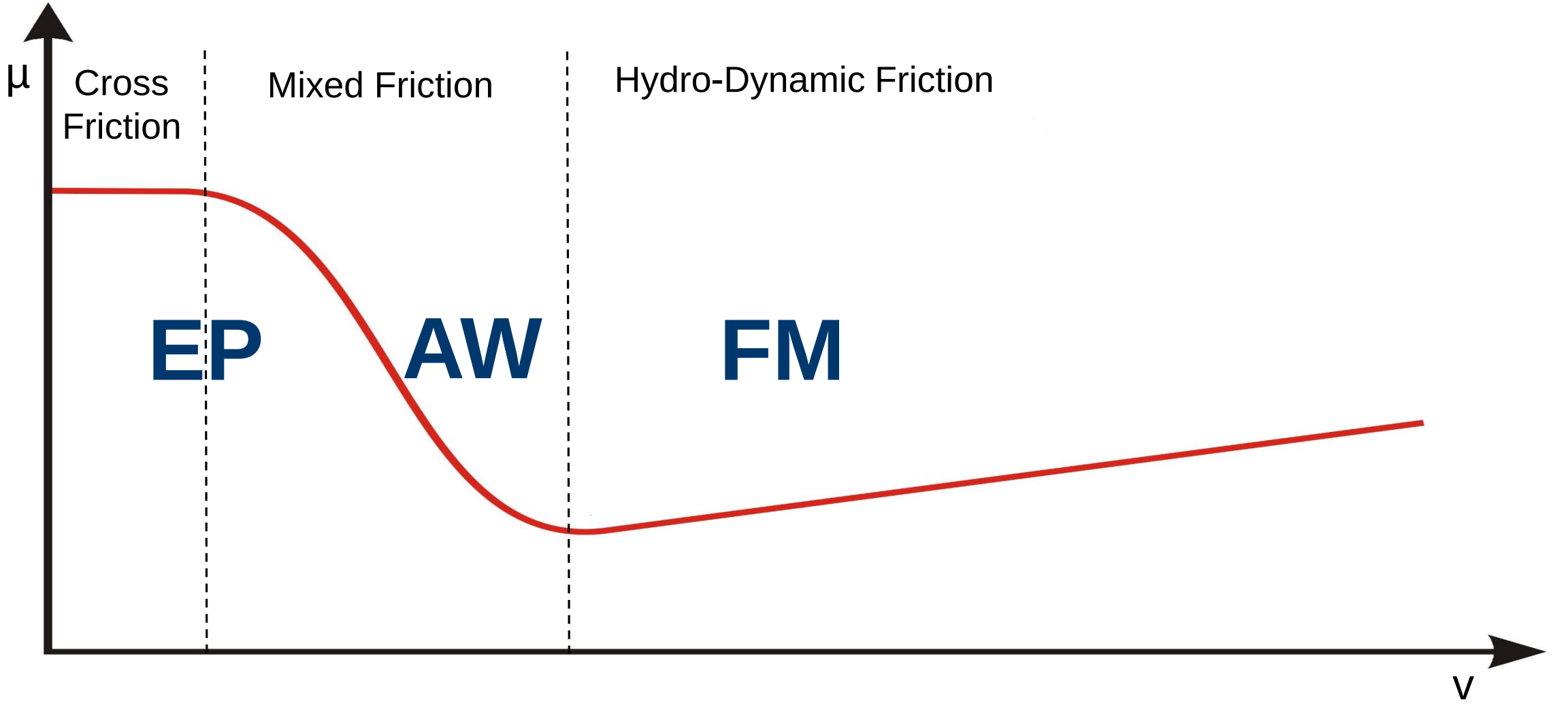
Additives in the Motoroil

Surface active agents: **F**riction **M**odifiers (FM)

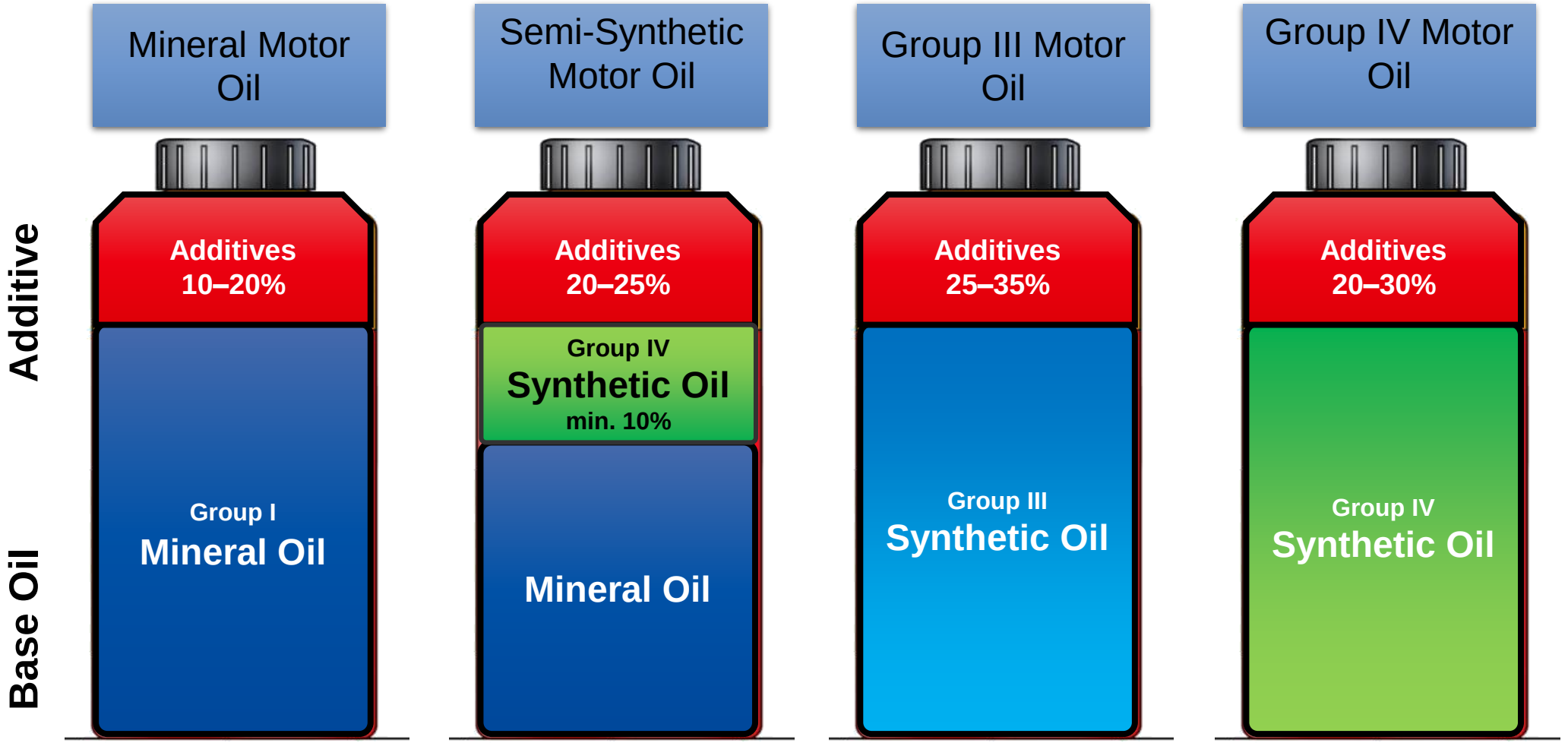
Friction **M**odifiers creates weak bonds on the surfaces and thereby reduce or increase the friction properties of a lubricant.



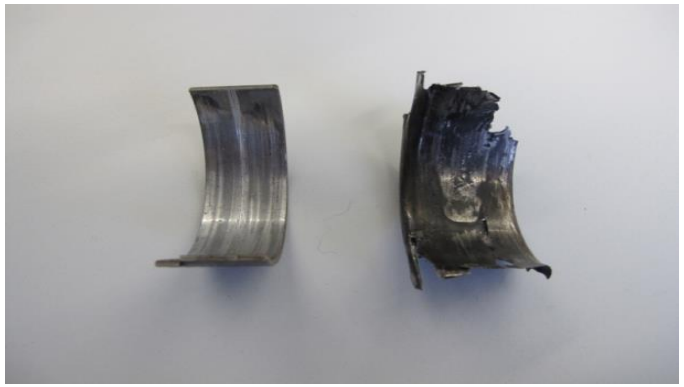
When do which additives work?

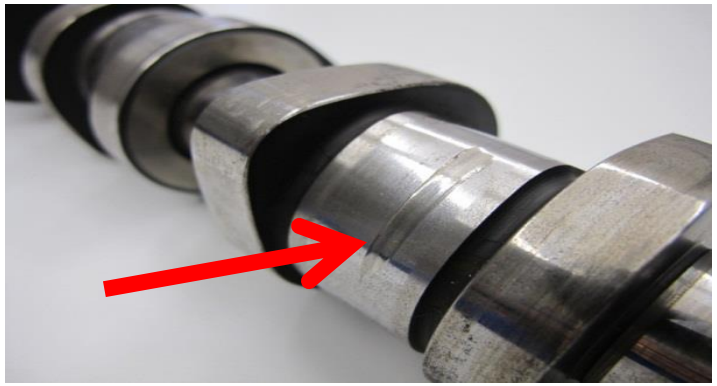


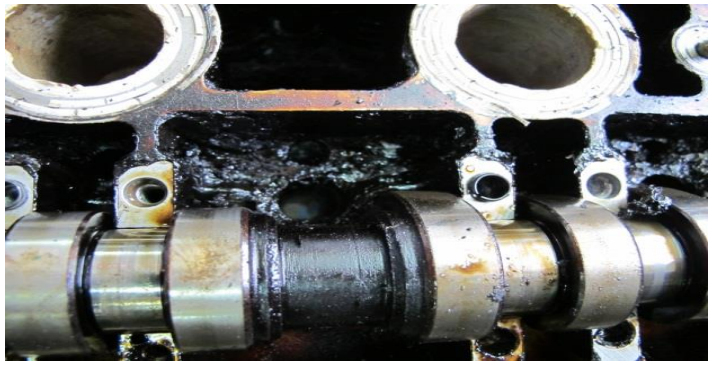
Oils - a mixture of base oil and additives



Consequences of using a inappropriate additive formulation







Classification of motor oils

energy API

AMERICAN PETROLEUM INSTITUTE FOR GASOLINE ENGINES CERTIFIED

SAE International

ILSAC

GF-1, GF-2, GF-3, GF-4, GF-5

ACEA

European Automobile Manufacturers Association

Viscosity : SAE International

SAE = **S**ociety of **A**utomotive **E**ngineers

Viscosity = flow property of liquids

SAE 5W-30

Low temperature behavior

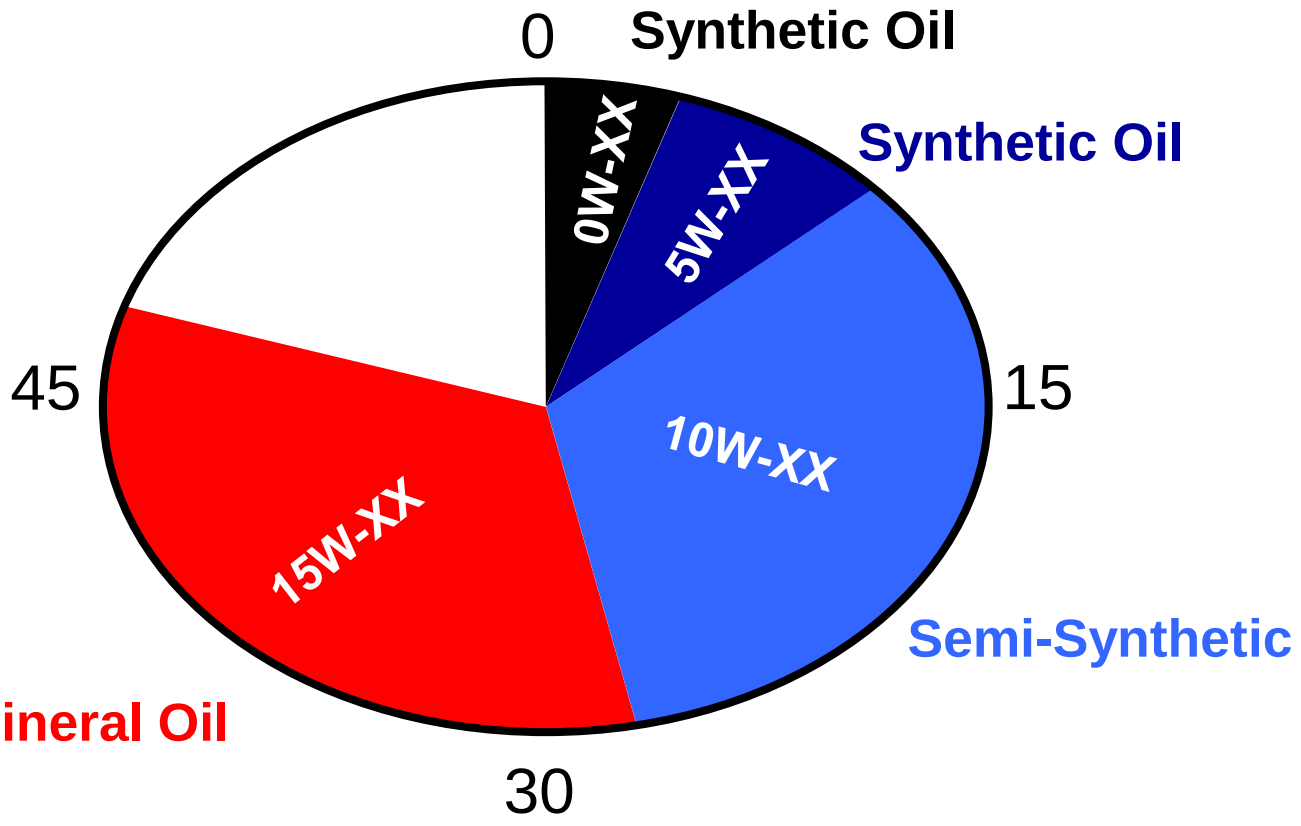
High temperature viscosity at +100 °C / 212 °F

SAE viscosity is not a performance grade !

Viscosity : SAE International

Time the oil needs to reach the remotest lube point

of the engine at oil temperature of 0°C / 32°F in seconds.



Classification of motor oils

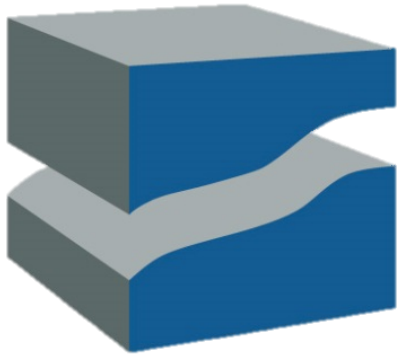
Performance classification

energy API

FOR GASOLINE ENGINES

ILSAC

GF-1, GF-2, GF-3, GF-4, GF-5



ACEA

European Automobile Manufacturers Association

Performance : **ILSAC for american & japanese gasoline vehicles**

International **L**ubricant **S**tandardiation **A**dvisory **C**omitee

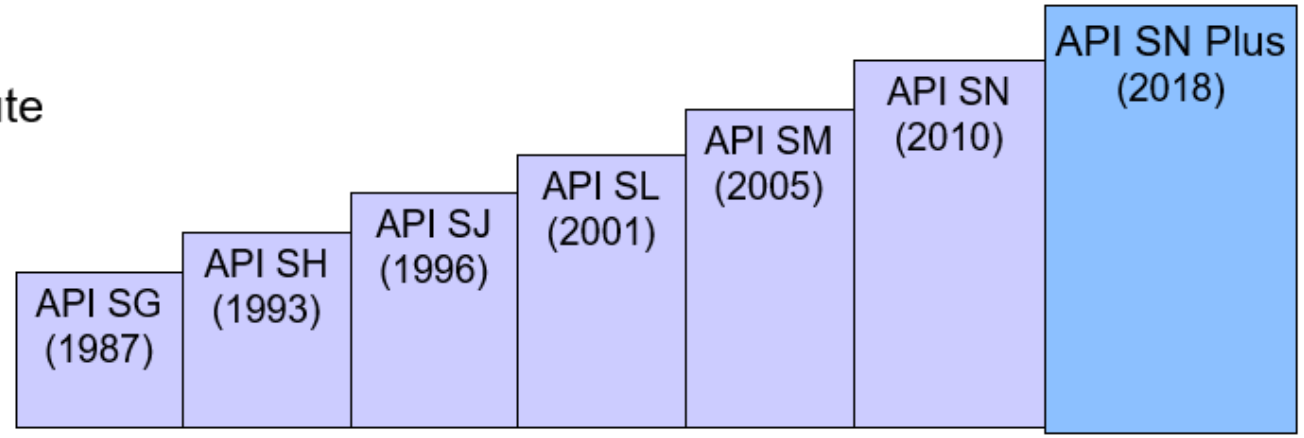
ILSAC STANDARD FOR PASSENGER CAR ENGINE OILS

Name	Status	Service
GF-5	Current	Introduced in October 2010, designed to provide improved high temperature deposit protection for pistons and turbochargers, more stringent sludge control, improved fuel economy, enhanced emission control system compatibility, seal compatibility, and protection of engines operating on ethanol-containing fuels up to E85.
GF-4	Obsolete	Use GF-5 where GF-4 is recommended.
GF-3	Obsolete	Use GF-5 where GF-3 is recommended.
GF-2	Obsolete	Use GF-5 where GF-2 is recommended.
GF-1	Obsolete	Use GF-5 where GF-1 is recommended.

Performance Level : **API for asian & american vehicles**

energy API = **A**merican **P**etroleum **I**nstitute

S (spark ignition) = **Gasoline**

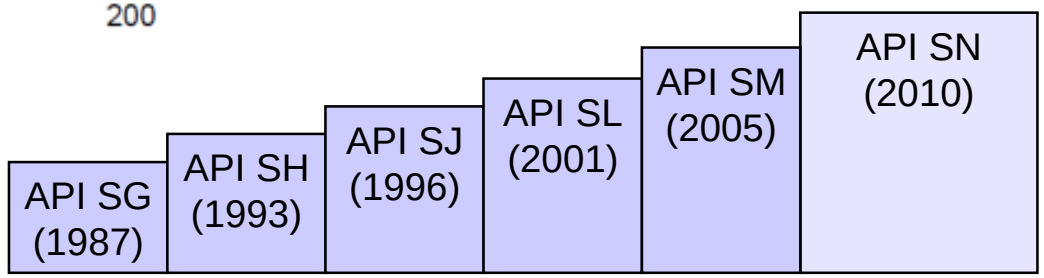


C (compression ignition) = **HD Diesel**

API Category & the Zinc level

Table G-1—Requirements for API Service Category SH by Viscosity Grade

Engine Test Requirements[a]—All Viscosity Grades			
Sequence IID	Pass		
Sequence IIIE	Pass		
Sequence VE	Pass		
L-38	Pass		
Bench Test and Measured Parameter	Viscosity Grade Performance Criteria[b]		
	SAE 5W-30	SAE 10W-30	SAE 15W-40
ASTM D5800 volatility loss, % max[c]	25	20	18
ASTM D2887 volatility loss at 371°C (700°F), % max[c]	20	17	15
ASTM D6795, % flow reduction, max		50	NR
ASTM D4951 or D5185, phosphorus % mass, max	0.12	0.12	NR
ASTM D92 flash point, °C, min[d]		205	
ASTM D93 flash point, °C, min[d]	185	190	200
ASTM D892 foaming tendency (Option A)			

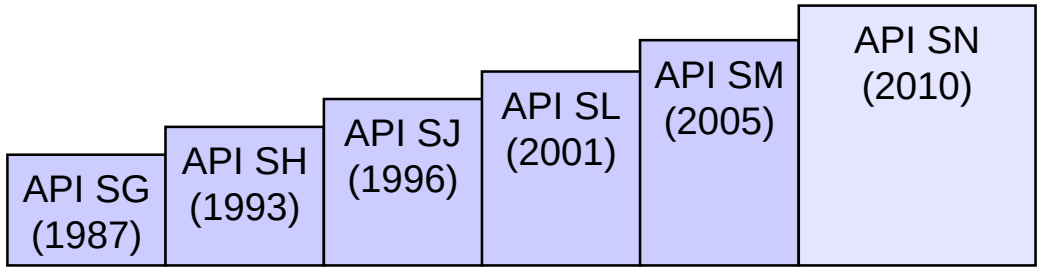


NR = Not Regulated

API Category & the Zinc level

Table G-3—Requirements for API Service Category SL by Viscosity Grade

Engine Test Requirements[a]—All Viscosity Grades		
Sequence IIIF or IIIG	Pass	
Sequence IVA	Pass	
Sequence VE	Pass Wear Only Or a minimum 0.08% phosphorus in the form of ZDDP	
Sequence VG[b]	Pass	
Sequence VIII	Pass	
	Viscosity Grade Performance Criteria	
Bench Test and Measured Parameter[a]	SAE 0W-20, SAE 5W-20, SAE 0W-30, SAE 5W-30, SAE 10W-30	All Others[c]
ASTM D4951 or D5185 phosphorus % mass, Max[d]	0.10[e]	NR

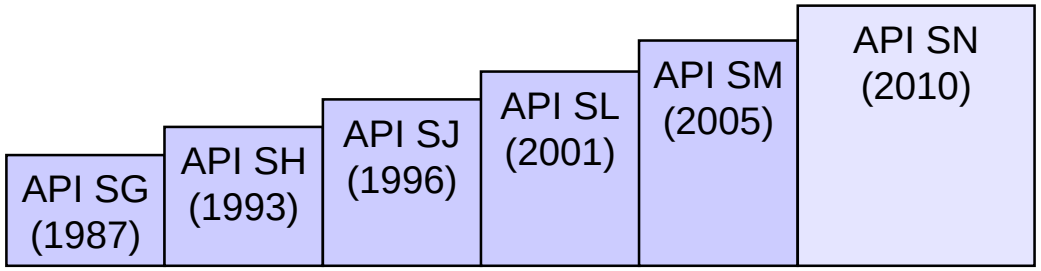


NR = Not Regulated

API Category & the Zinc level

Table G-5—Requirements for API Service Category SN and API SN with Resource Conserving

	API SN	API SN	API SN with Resource Conserving
	SAE 0W-16, SAE 5W-16, SAE 0W-20, SAE 5W-20, SAE 0W-30, SAE 5W-30, SAE 10W-30	Other Viscosity Grades	All Viscosity Grades[a]
ASTM D4951, phosphorus % mass, max[g]	0.08[h]	NR	0.08[h]
ASTM D4951, phosphorus % mass, min[g]			0.06[h]
ASTM D4951, or D2622, sulfur % mass, max[g]			
SAE 0W-16, 5W-16, 0W-20, 0W-30, 5W-20, and 5W-30	0.5[h]	NR	0.5[h]

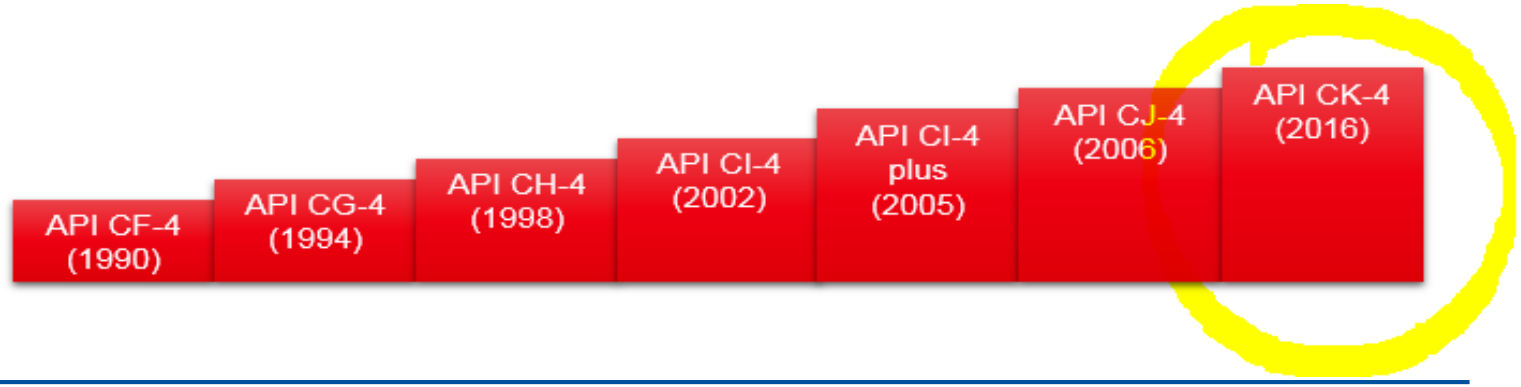


NR = Not Regulated

API „C“ category for asian & american HD Diesel engines

The latest API CK-4 classification :

- valid since December 1, 2016
- designed for 2017 model year and later Turbo Diesel engines
- low-SAPS formulation
- nearly all SAE viscosities are possible
- backward compatible to older API Cxx classifications
- when using API CJ-4 / API CK-4 the diesel fuel sulfur content is limited up to max. 500 ppm !
- when using CK-4 oil with higher than 15 ppm sulfur fuel, consult the engine manufacturer for service interval recommendations !



Performance Level : **ACEA for european car manufacters**

ACEA

EUROPEAN AUTOMOBILE MANUFACTURERS' ASSOCIATION

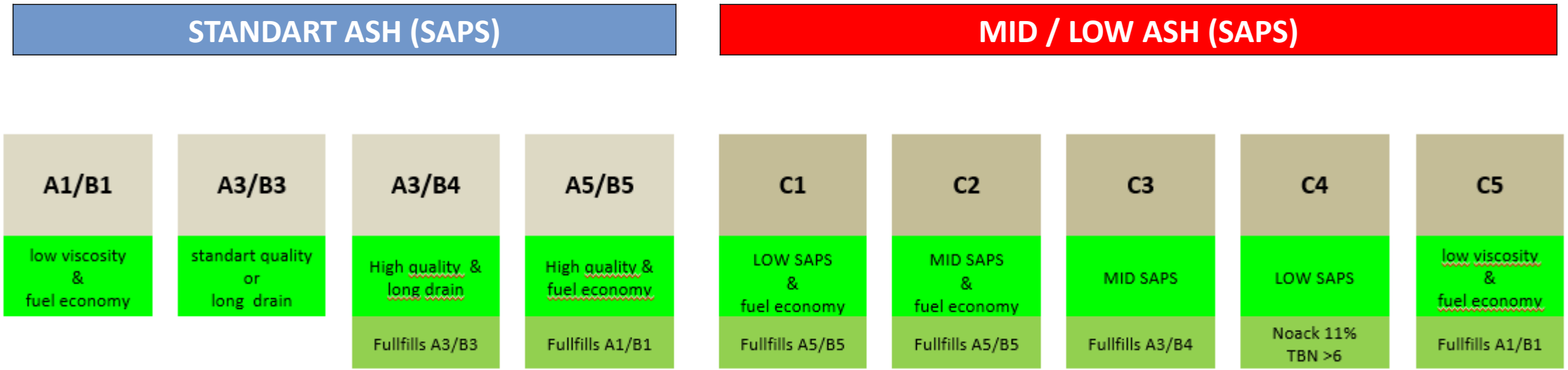
Differences between API and ACEA

ACEA
EUROPEAN AUTOMOBILE MANUFACTURERS' ASSOCIATION

ACEA differentiates much more than API.

- Due to the combination of the needs for both, gasoline and diesel driven engines, the additive composition of ACEA oils differs from pure API rated engine oils.
- Higher treat levels of additive packages are often necessary to reach the relevant ACEA specifications, especially to fulfill diesel test requirements. Due to that, API limitations for certain chemical elements may be exceeded in some cases, but performance is still the same.
- ACEA formulated engine oils often exceed the most current API „S“ category and are therefore not always tested individually according to API.

Performance Level : **ACEA for European car manufacters**

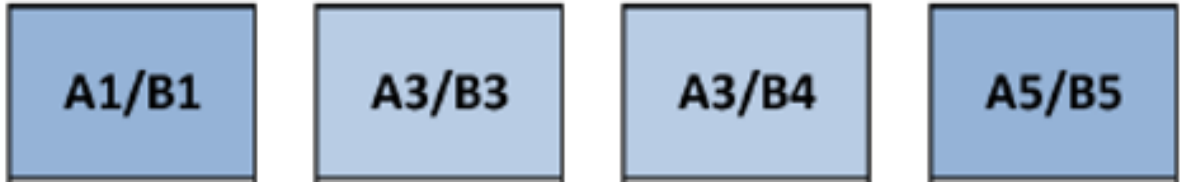


The use of SAPS-reduced, ACEA “C” rated oils in regular gasoline engines is – depending on the vehicle manufacturer – not prohibited in general, but due to the special properties of their additive package a **non** ACEA “C” rated oil is to be preferred when allowed.

ACEA 2017

Performance Level : **ACEA for european car manufacters**

ACEA A/B : for Gasoline and Diesel without DPF



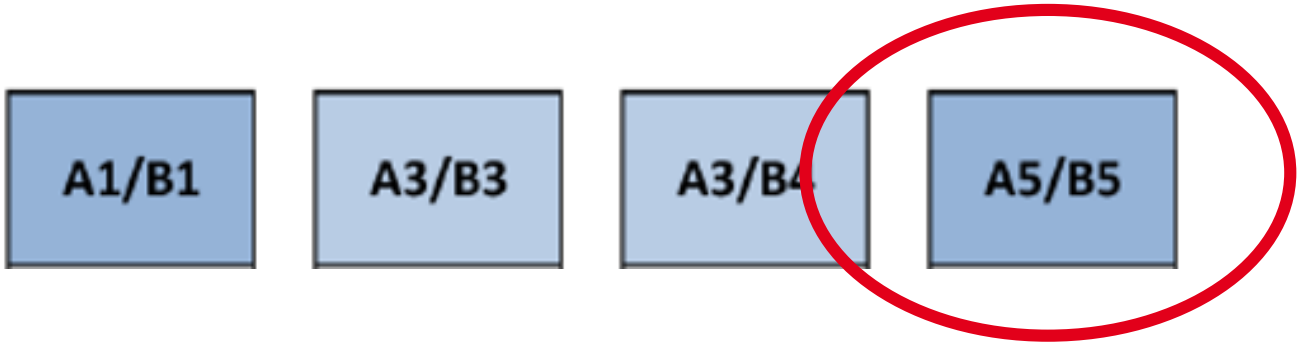
A1/B1 Category is removed with these Oil Sequences.

A3/B3 Stable, stay-in-grade Engine Oil intended for use in Passenger Car & Light Duty Van Gasoline & Diesel Engines and/or for extended drain intervals where specified by the engine manufacturer, and/or for year-round use of Low Viscosity Oils, and/or for severe operating conditions as defined by the Engine Manufacturer.

A3/B4 Stable, stay-in-grade Engine Oil intended for use in Passenger Car & Light Duty Van Gasoline & DI Diesel Engines, but also suitable for applications described under A3/B3.

A5/B5 Stable, stay-in-grade Engine Oil intended for use at extended Drain Intervals in Passenger Car & Light Duty Van Gasoline & Diesel Engines designed to be capable of using Low Viscosity Oils with HTHS Viscosity of 2.9 to 3.5 mPa·s. These Oils are unsuitable for use in certain Engines - consult vehicle-OEM's owner's manual/handbook in case of doubt.

What means „reduced HTHS-viscosity“ ?



- Engine oils with a reduced **H**igh **T**emperature **H**igh **S**hear viscosity have a lower internal resistance to shear at hot oil conditions in comparison to oils of the same SAE viscosity.
- All modern SAE xW-20 motor oils are such lowered HTHS oils and only suitable for use in specially developed engines.

→ **Benefit: additional fuel saving potential up to 3% in comparison to ACEA A3/B4**

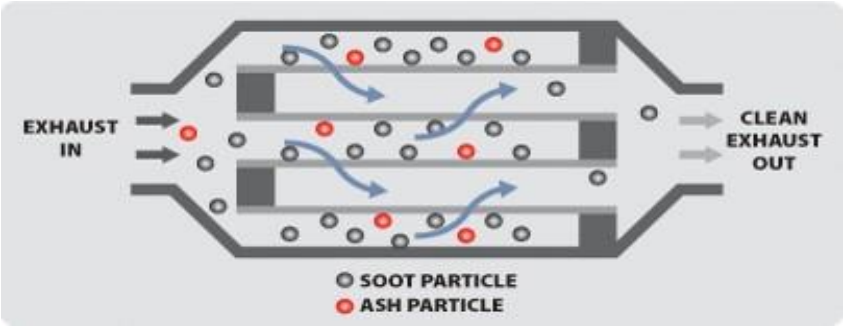
→ **Attention : engine has to be designed for such oils !**

Motor oil and the Diesel Particulate Filter …

Motor oil and the Diesel Particulate Filter …

Modern exhaust gas systems filter the finest particles out of the exhaust gas.

If the maximum filter capacity is reached the resistance inside the filter unit increases; the engine control unit modifies the fuel injection, exhaust gas temperature increases, the soot particles inside the filter burn.



Even the most modern engine oils and its additives generate a ash residue when they get burned. This residues add additional load to the particulate filter.

Therefore special oil formulations are prescribed for vehicles with DPF.
These are characterized by a low percentage of ash.
Such oils are named *Low Ash* or *Low SAPS* oils.

(SAPS = Sulphated **A**sh**, P**hosphor**, S**ulphur**)**

Motor oil and the Diesel Particulate Filter …

What does Low-SAPS mean ?

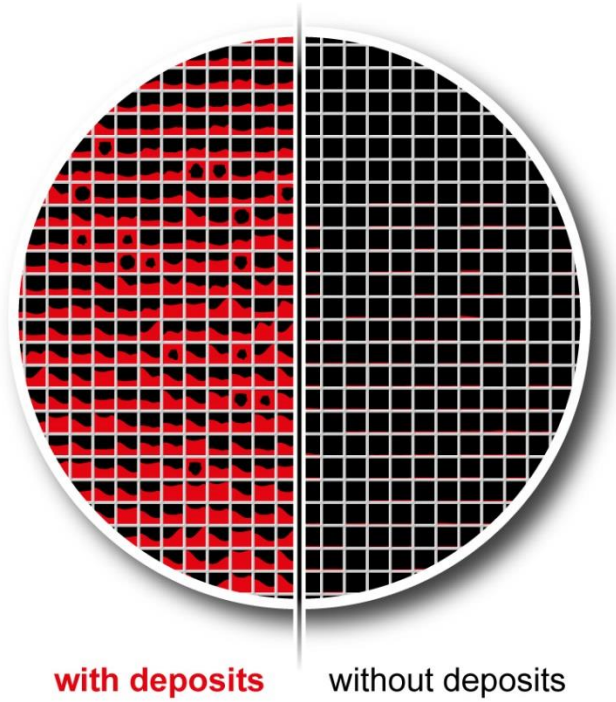
Sulphated Ash
- Wear protection
- Detergents

Phosphorus
- Wear protection
- Antioxidants

Sulphur
- Wear protection
- Detergents
- Antioxidants

Engine lubricant → Diesel Engine → Additional exhaust gas and particle pollution

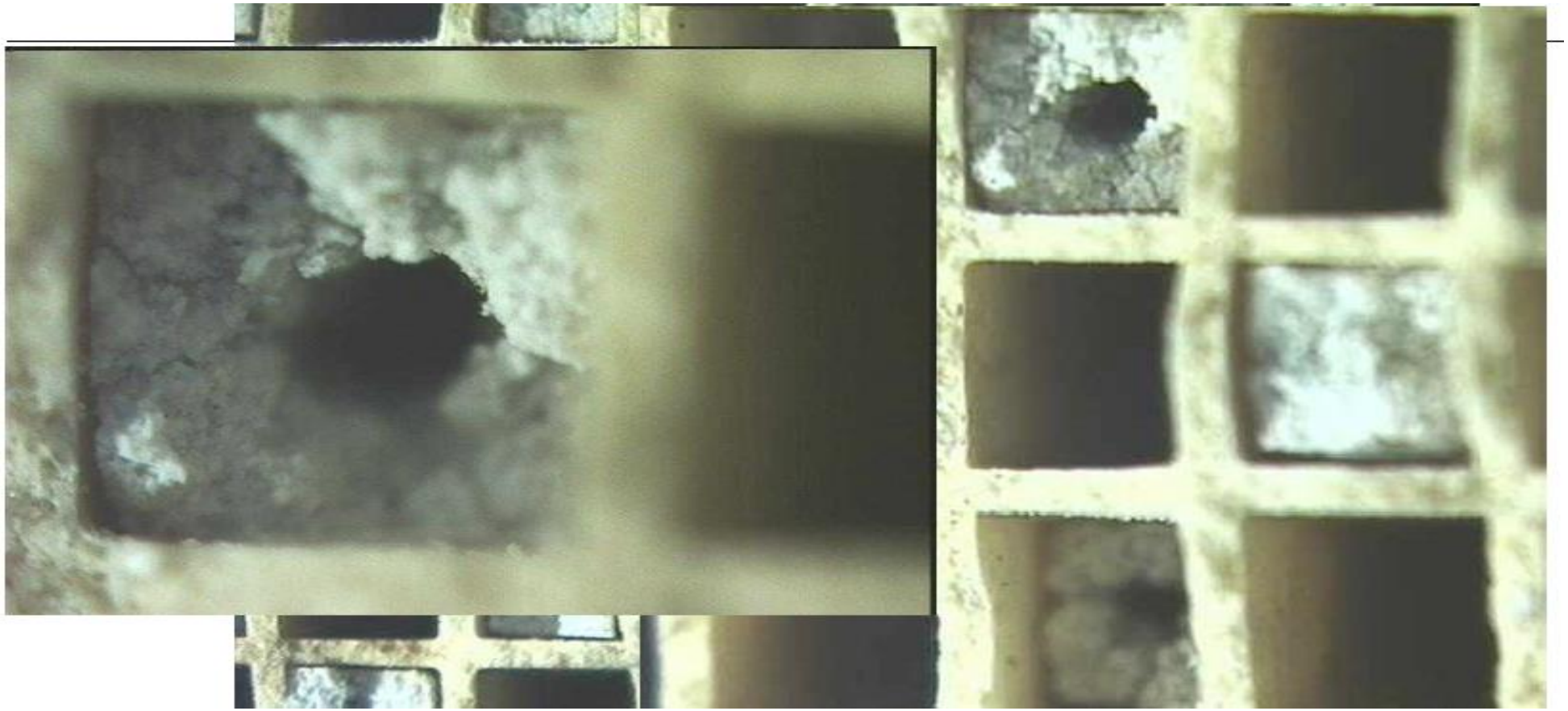
Cross section of a diesel particulate filter (illustration)



with deposits without deposits

The amount of certain addives in the additive package is lowered in order to reduce the amount of ash in the exhaust gas when oil gets burned.

The result of using wrong oil !



DPF filter clogged with ash - **cannot** be removed by a filter regeneration !

Performance Level : **ACEA for european car manufacters**

ACEA C : low / mid SAPS oil

- **C1** **ash content strongly reduced, HTHS viscosity lowered**
- **C2** **ash content reduced, HTHS viscosity lowered**
- **C3** **ash content reduced**
- **C4** **ash content strongly reduced, lower evaporation loss**
- **C5** **low ash, low viscosity & HTHS strongly reduced**

*The use of ACEA „C“ rated oils in regular gasoline vehicles is – depending on the vehicle manufacter – not prohibited in general but due to the special properties of their additive package a **non** ACEA „C“ rated oil is to be preferred.*

“Diesel Oil” vs. “ Gas Oil”

All LIQUI MOLY **“TOP TEC”** motor oils are “**C**” oils!

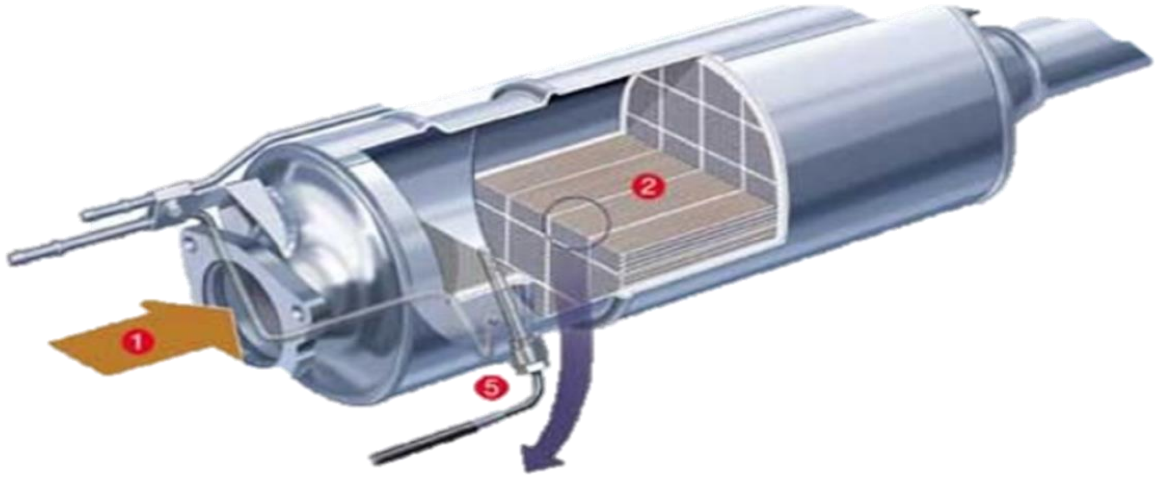
ACEA	Sulphated Ash	TBN
C3	≤ 0.8%	≥ 6.0

ACEA	Sulphated Ash	TBN
A3/B4	≥ 1.6%	≥ 10.0

- “C” oils contain approx. 1/2 the Sulphated Ash levels of “A/B” rated oils
- “C” oils have nearly 50% lower TBN (Total Base Number = reserve alkalinity) which shortens their lifespan in a poor gasoline quality environment

Pro-Line Diesel Particulate Filter Cleaning Set

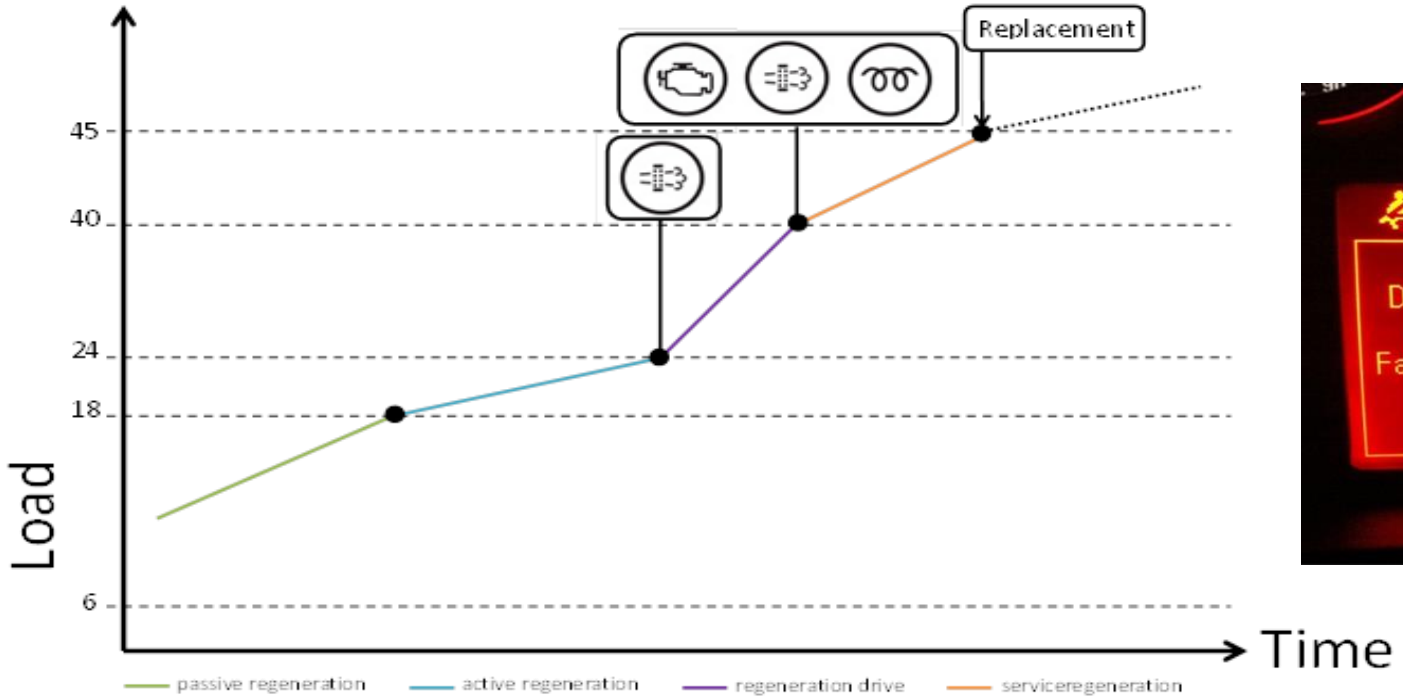
Operating instruction



- Turn off the engine, dismantle the pressure / temperature sensor and insert the probe.
- Spray the DPF Cleaner with 6-8 bar / 90-120 psi pressure towards the cold (max. 105°F / 40°C) surface of the DPF, let it soak for approx.10 – 15 min and flush the system with the DPF Purge .
- Re-assemble everything and start the regeneration process by strictly following the manufactures operation instructions.
- We further recommend to add **Diesel Purge #LM2005** into the diesel fuel filter housing after the treatment for effective injector cleaning during the warm-up process of the vehicle.

The four stages of DPF regeneration

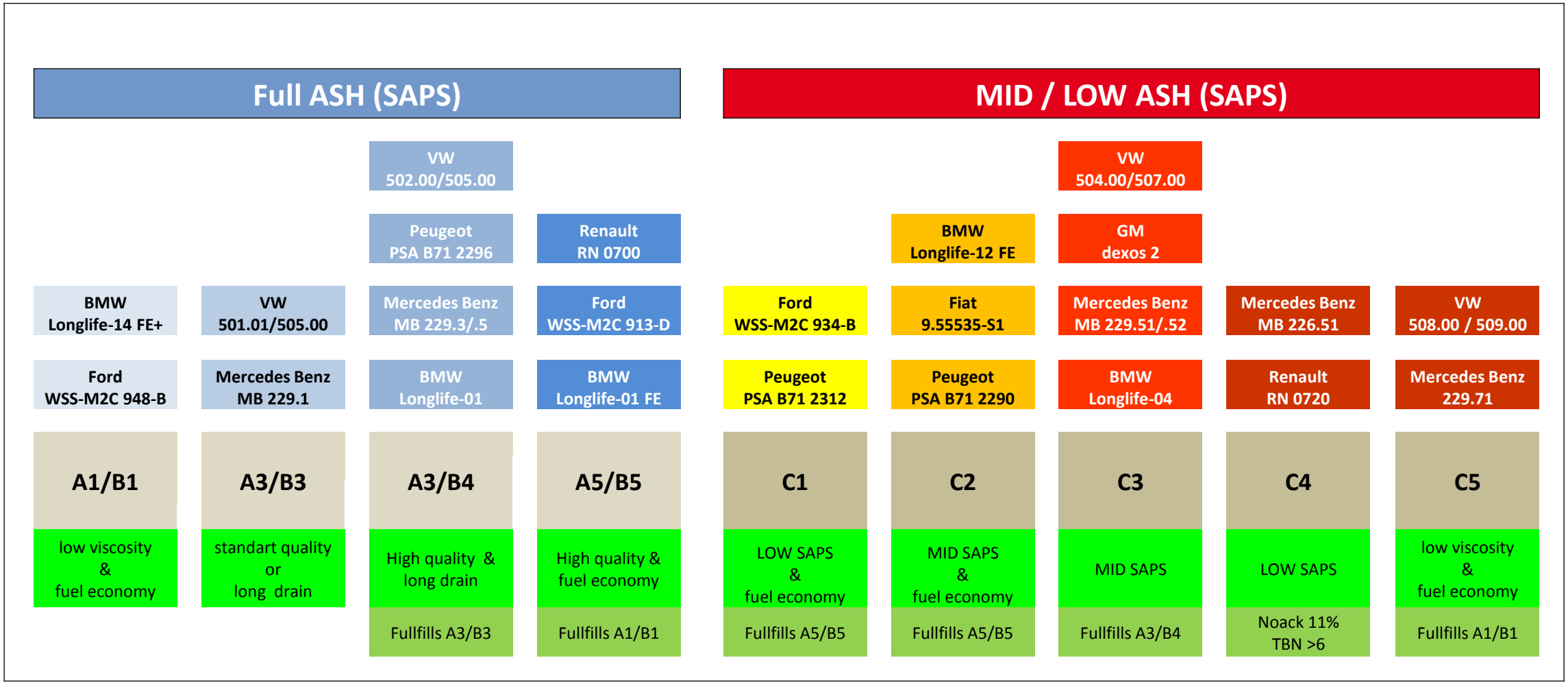
Sample of the DPF regeneration stages at VW 2.0 TDI engine



Specifications of vehicle manufactures

The “part number”

OEM specifications – on top of ACEA

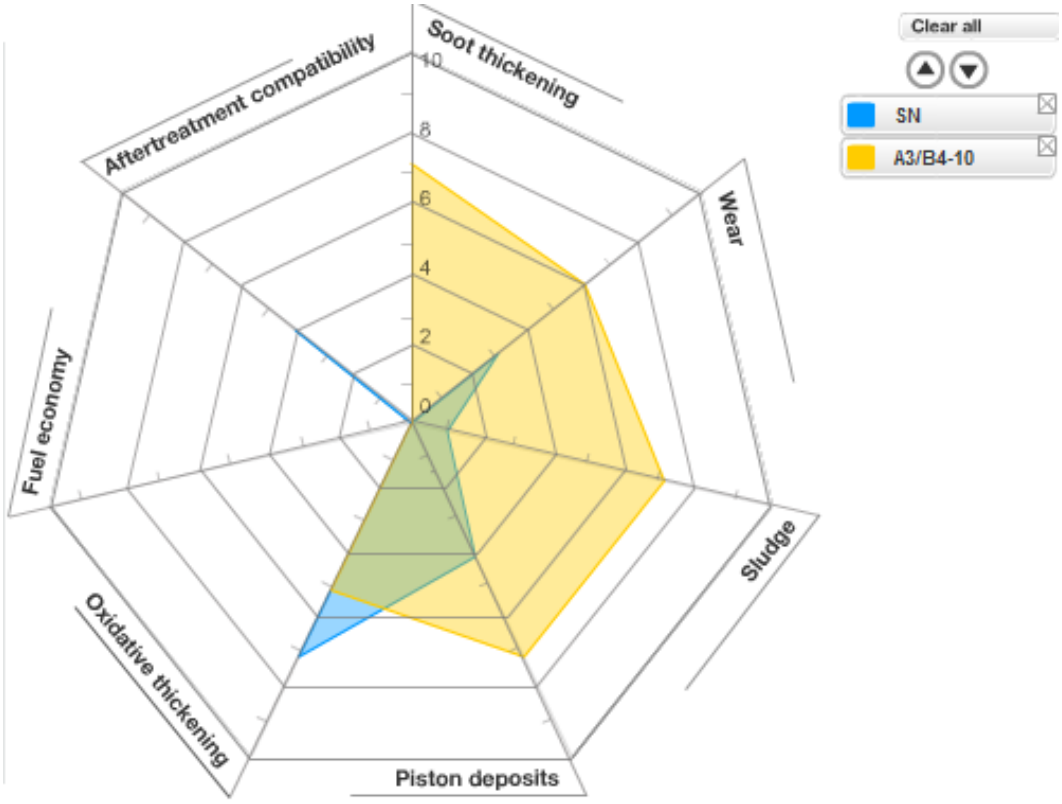


ACEA 2017

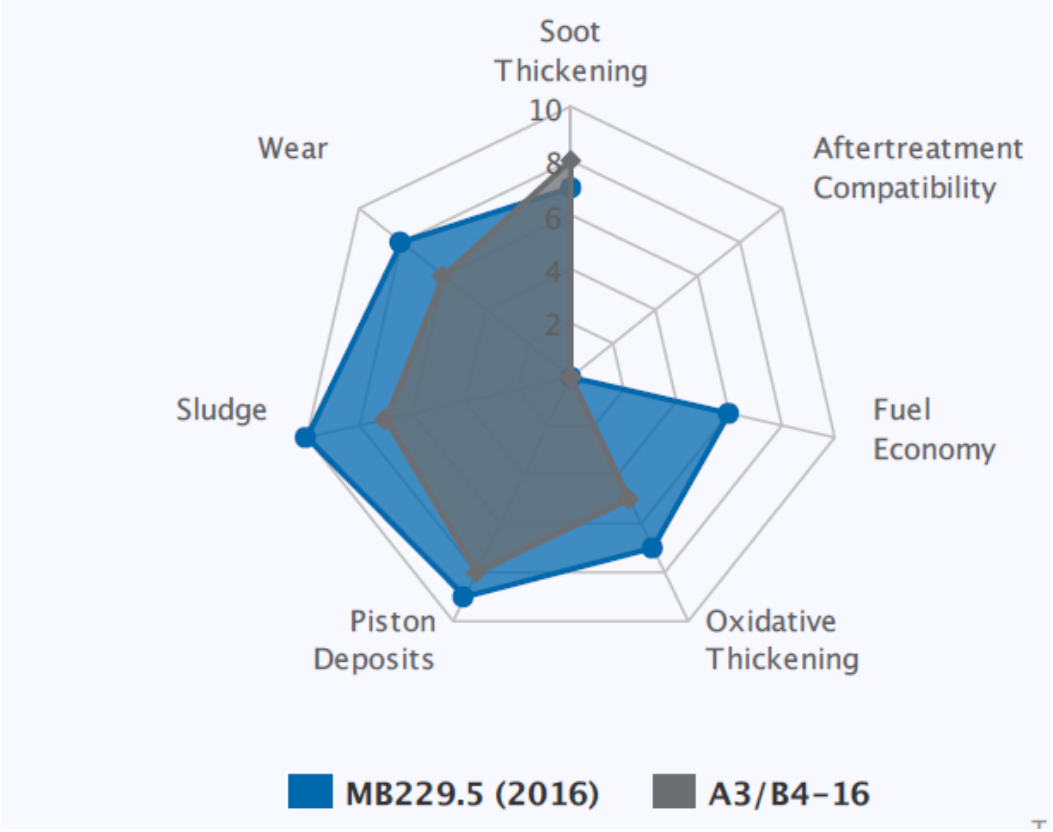
OEM approved motor oils

Why use OEM approved motor oils ?

API SN *vs.* ACEA A3/B4 performance

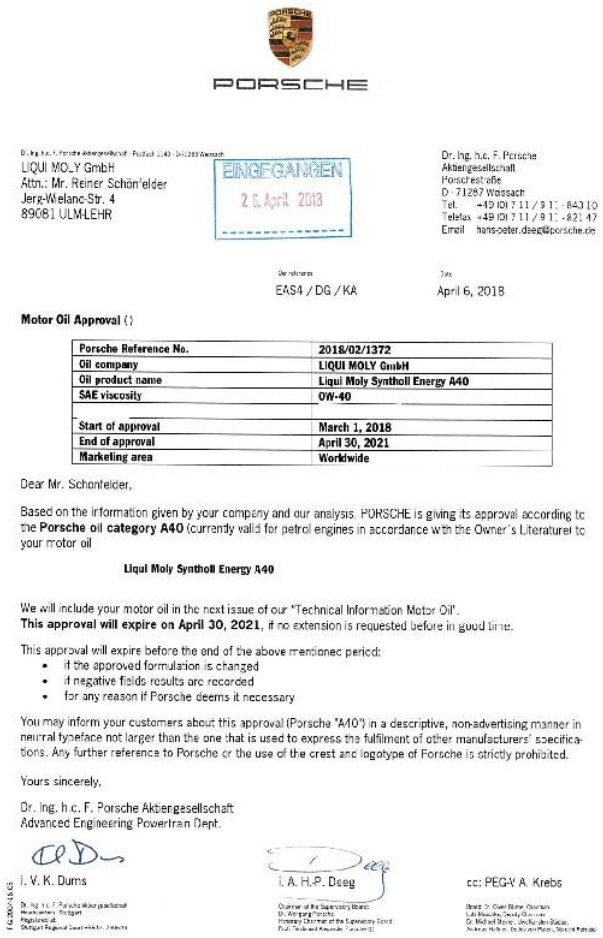


ACEA A3/B4 *vs.* OEM approval



OEM approved motor oils

- To get an official OEM approval letter the oil has to pass all the specific OEM in-house-tests.
- Depending on the given regulations the formulation of the oil has to be customized.
- **OEM approval always exceeds API / ACEA classification!**
- Mostly european car manufacturers use their own oil classification system.



PORSCHE

LIQUI MOLY GmbH
Attn.: Mr. Reiner Schön'elder
Jerg-Welanc-Str. 4
89081 ULM-LEHR

EINGEGANGEN
2 6. April 2013

Dr. Ing. h.c. F. Porsche
Aktiengesellschaft
Porschestraße
D-71287 Weissach
Tel. +49 (0) 7 11 / 9 11 - 843 10
Telefax +49 (0) 7 11 / 9 11 - 821 47
Email hans-peter.deeg@porsche.de

EAS4 / DG / KA

April 6, 2018

Motor Oil Approval ()

Porsche Reference No.	**2018/02/1372**
Oil company	**LIQUI MOLY GmbH**
Oil product name	**Liqui Moly Synthoil Energy A40**
SAE viscosity	**0W-40**
Start of approval	**March 1, 2018**
End of approval	**April 30, 2021**
Marketing area	**Worldwide**

Dear Mr. Schonfelder,

Based on the information given by your company and our analysis, PORSCHE is giving its approval according to the **Porsche oil category A40** (currently valid for petrol engines in accordance with the Owner's Literature) to your motor oil

Liqui Moly Synthoil Energy A40

We will include your motor oil in the next issue of our "Technical Information Motor Oil".
This approval will expire on April 30, 2021, if no extension is requested before in good time.

This approval will expire before the end of the above mentioned period:
- if the approved formulation is changed
- if negative fields results are recorded
- for any reason if Porsche deems it necessary

You may inform your customers about this approval (Porsche "A40") in a descriptive, non-advertising manner in neutral typeface not larger than the one that is used to express the fulfilment of other manufacturers' specifications. Any further reference to Porsche or the use of the crest and logotype of Porsche is strictly prohibited.

Yours sincerely,

Dr. Ing. h.c. F. Porsche Aktiengesellschaft
Advanced Engineering Powertrain Dept.

i. V. K. Dums

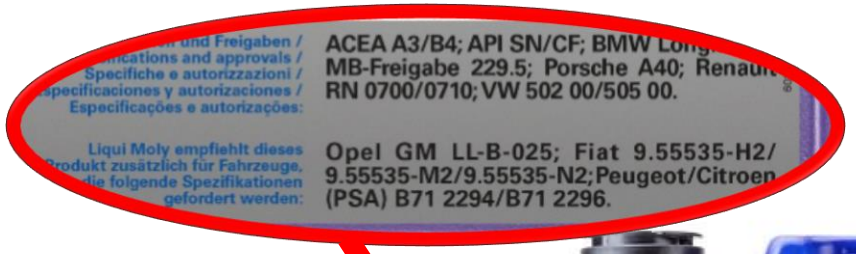
i. A. H.-P. Deeg

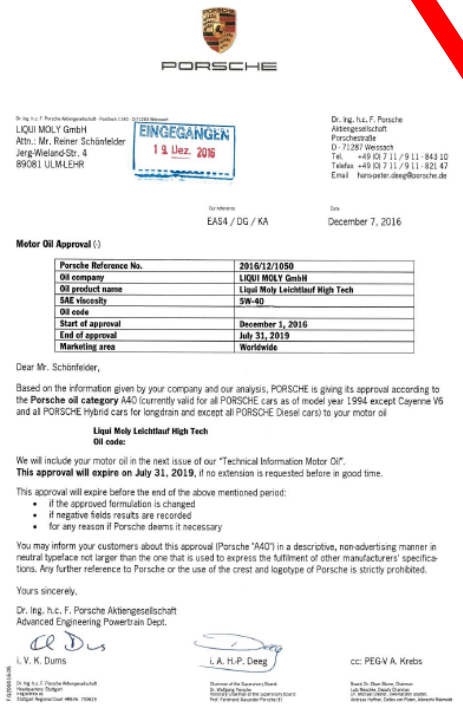
cc: PEG-V A. Krebs

Only oils with official OEM approval guarantee the requested quality, performance, protection and efficiency and are suitable for use even the car is still under OEM warranty.

First Approval – then viscosity!

Where to find the approvals / classifications ?





PORSCHE

LIQUI MOLY GmbH
Attn.: Mr. Reiner Schönfelder
Jerg-Wieland-Str. 4
89081 ULM-LEHR

EINGEGANGEN
19 Dez. 2016

Dr. Ing. h.c. F. Porsche
Aktiengesellschaft
Porschestraße
D - 71287 Weissach
Tel. +49 (0) 7 11 / 9 11 - 843 10
Telefax +49 (0) 7 11 / 9 11 - 821 47
Email hanspeter.deeg@porsche.de

EA54 / DG / KA

December 7, 2016

Motor Oil Approval (-)

Porsche Reference No.	**2016/12/1050**
Oil company	**LIQUI MOLY GmbH**
Oil product name	**Liqui Moly Leichtlauf High Tech**
SAE viscosity	**5W-40**
Oil code	
Start of approval	**December 1, 2016**
End of approval	**July 31, 2019**
Marketing area	**Worldwide**

Dear Mr. Schönfelder,

Based on the information given by your company and our analysis, PORSCHE is giving its approval according to the **Porsche oil category** A40 (currently valid for all PORSCHE cars as of model year 1994 except Cayenne V6 and all PORSCHE Hybrid cars for longdrain and except all PORSCHE Diesel cars) to your motor oil

Liqui Moly Leichtlauf High Tech
Oil code:

We will include your motor oil in the next issue of our "Technical Information Motor Oil".
This approval will expire on July 31, 2019, if no extension is requested before in good time.

This approval will expire before the end of the above mentioned period:

- if the approved formulation is changed
- if negative fields results are recorded
- for any reason if Porsche deems it necessary

You may inform your customers about this approval (Porsche "A40") in a descriptive, non-advertising manner in neutral typeface not larger than the one that is used to express the fulfilment of other manufacturers' specifications. Any further reference to Porsche or the use of the crest and logotype of Porsche is strictly prohibited.

Yours sincerely,

Dr. Ing. h.c. F. Porsche Aktiengesellschaft
Advanced Engineering Powertrain Dept.

i. V. K. Dums

i. A. H-P. Deeg

cc: PEGV A. Krebs

Specifications and approvals:
ACEA A3 • ACEA B4 • API SN • API CF • BMW Longlife-01 • MB-Approval 229.5 • Porsche A40 • Renault RN 0700 • Renault RN 0710 • VW 502 00 • VW 505 00

Product information PI 24/04/10/2017 LIQUI MOLY
Leichtlauf High Tech SAE 5W-40

Description
Modern top class low-friction, fully synthetic motor oil for all-season use in gasoline and diesel engines without diesel particulate filters (DPF).

Properties
- mixable with all commercially available motor oils
- smooth engine running
- outstanding engine cleanliness
- high shear stability
- saves fuel and reduces pollutant emissions
- tested for turbochargers and catalytic converters
- excellent wear resistance
- outstanding lubrication reliability
- long engine service life
- optimum stability to aging

Technical data

Pour point	-49 °F DIN ISO 3016
Evaporation loss (Noack)	10,0 % CEC-L-40-A-93
Flash point	450 °F DIN ISO 2592
Total base number	11,3 mg KOH/g DIN ISO 3771
Sulfate ash	1,0 - 1,6 g/100g DIN 51575
Color number (ASTM)	L 3,5 DIN ISO 2049

Areas of application
Ideally suited for modern gasoline and diesel engines with multi-valve technology, turbocharger and with or without charge air cooling. Especially suitable where there are long intervals between oil changes and heavy duty engine requirements.

Application
The operating instructions of the vehicle and engine manufacturers must be followed.

Available pack sizes

1 l Canister plastic	2331 GB-F-E-USA-CAN
5 l Canister plastic	2332 GB-F-E-USA-CAN
20 l Canister plastic	20122 GB-F-E-USA-CAN
1000 l Container	20731 D-GB

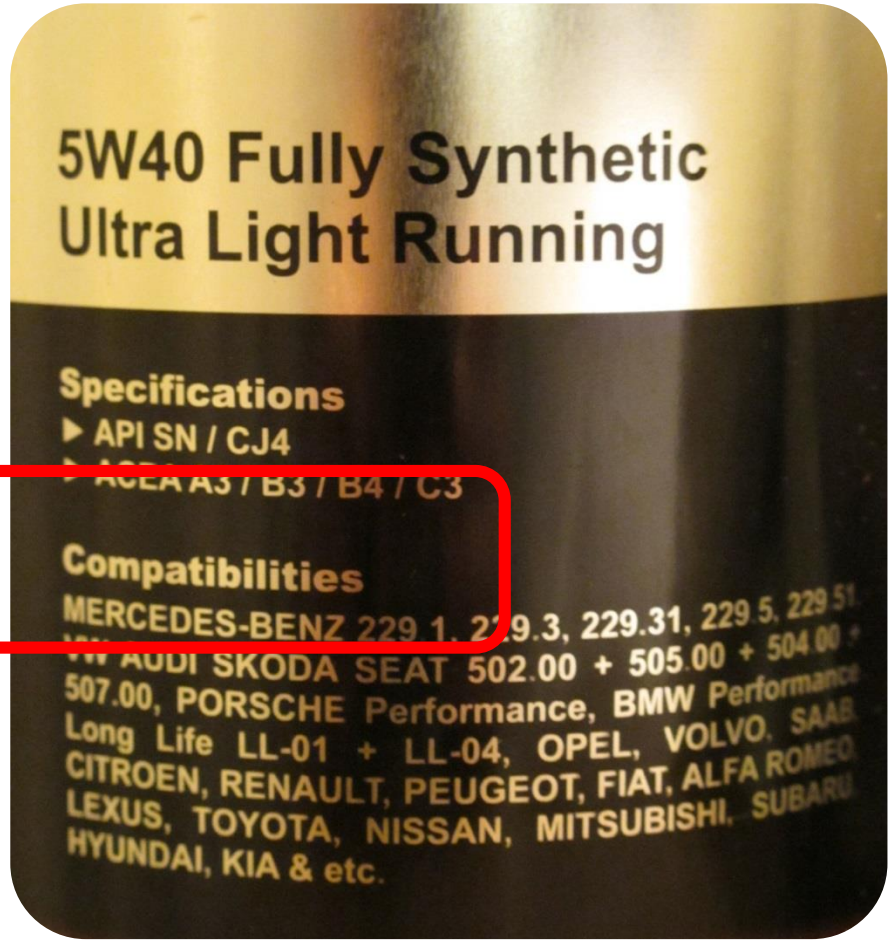
SAE class (engine oils)	5W-40 SAE J300
Density at 59 °F	0,855 g/cm³ DIN 51757
Viscosity at 104 °F	80,5 mm²/s ASTM D 7042-04
Viscosity at 212°F	14,0 mm²/s ASTM D 7042-04
Viscosity at -31 °F (MRV)	<= 60000 mPas ASTM D4684
Viscosity at -22 °F (CCS)	<= 6600 mPas ASTM D5293
Viscosity index	180 DIN ISO 2909
HTHS at 302 °F	>= 3,5 mPas ASTM D5481

Our information is based on thorough research and may be considered reliable, although not legally binding.

Approval letter availible!

www.liqui-moly.us

Attention: „Compatibility“ or real OEM Approval ?



Manufacturer´s OE Approvals

GASOLINE	DIESEL *(with DPF)*
LL-01 *(LL-98)*	LL 04
MB229.5 *(MB229.3)*	MB229.52 *(MB229.51/31)*
A40	C30
502.00 / 504.00 *(500.00)*	507 00 *(505 01)*

BMW
Mercedes-Benz
PORSCHE
Volkswagen
Audi

OEM Specs : **Mercedes Benz Gasoline**

<u>229.1 normal performance</u>
- all engines until 03/2002
- **out-of-date !**

<u>229.3 high performance</u>
- active service system
- covers 229.1

<u>229.5 highest performance</u>
- **higher requirements than 229.3**
- **requested for AMG models**
- **backwards compatible**

OEM Specs : **Mercedes Benz Diesel with DPF system**

229.31 low SAPS
- out-of-date

229.51 - low SAPS
- covers 229.31

229.52 – low SAPS

- **especially for Euro 6 / Blue Tec engines**
- **fully backwards compatible to 229.51**

OEM Specs : **BMW & MINI**

- Longlife 98
  - all engines until MY 01
  - **out-of-date**

- **Longlife 01**
  - **all Gasoline engines incl. M-series with turbo**
  - **Diesel without DPF**

- Longlife 04
  - **low SAPS, all Diesel with DPF**
  - **Gasoline only in central Europe !**

BMW & MINI - New oil specifications

BMW Longlife -14 FE+ Specification for selected Gasoline engines

The motor oil specification **BMW Longlife-14 FE** is valid **only** for
BMW **Gasoline** engines type N20, N42 and B*x*8 from 2014 and later.
Suitable viscosities are SAE 0W-20 and 5W-20 only.

Due to the reduced HTHS value Longlife -14 FE+ is not backwards compatible to any other BMW motor oil specification.

For the **service-fill** still the BMW Longlife -01 is approved for all BMW Gasoline engines (excl. older M-series) and can be used instead.

BMW LL -14 FE+ will be replaced in 2019 by BMW Longlife 17 FE+.

BMW & MINI – New oil specifications

BMW Longlife -12 FE Specification for Diesel engines

The motor oil specification **BMW Longlife -12 FE** is valid **only** for selected BMW **Diesel** engines (generation from 2013 onwards) and **not backward compatible to BMW Longlife-04.**

Viscosities are SAE 5W-20, 0W-30 and 5W-30.

For the **service-fill** still the BMW Longlife-04 spec. is approved for all BMW Diesel engines and can be used instead.

Engine B57
Diesel, 4-stroke, 6 cylinder, Line, 4 valves/cyl, BiTurbo, liquid cooled
Cylinder capacity: 2993 cc
Power output: 265 HP/195 kW at 4400 RPM
Capacity 5 liter

Use: Normal
Change 30000 km/24 months

OEM recommendation		
year-round	BMW Longlife-12 FE	SAE 0W-30
year-round	BMW Longlife-04	SAE 0W-30
year-round	BMW Longlife-04	SAE 0W-40
year-round	BMW Longlife-04	SAE 5W-30
year-round	BMW Longlife-04	SAE 5W-40

BMW *M-Series*

All ***M***-Series **without** Turbo charger
up to < 2010

All ***M***-Series **with** Turbo charger
BMW LL-01

OEM Specs : **Porsche**

Porsche A40 – Gasoline (all water cooled engines)

Porsche C30 – Diesel Engines & E-Hybrid

OEM Specs : **Volkswagen and Audi Gasoline**

500.00 : gasoline engines, out-of-date, replaced by 502.00
501.01: out-of-date, replaced by 502.00
502.00 : **most gasoline engines incl. turbo charged**
503.01: selected gasoline engines, out-of-date
504.00 : low-SAPS, most gasoline engines
- suitable for “longlife” oil drain interval (Europe only)
- covers 502.00

OEM Specs : **Volkswagen and Audi Diesel**

505.01 : Pump Injection (PD) and Common Rail diesel engines with DPF system

506.00: out-of-date, replaced by 507.00

506.01: out-of-date, replaced by 507.00

507.00 : **low-SAPS formulation for Common Rail Diesel engines with DPF**

- suitable for “longlife” oil drain interval (Europe only)

- covers 505.01

Specifications Volkswagen and Audi

The new VW **508.00** and **509.00** specification is a low-SAPS, ultra-low viscosity SAE 0W-20 motor oil introduced in 2016 and currently requested **only** for selected TSI / TFSI and TDI engines of the latest generation (year 2016 and later).

VW 508.00 / 509.00 is not backwards compatible to any other VW motor oil specification!

For service-fill at vehicles up to 2017 still
VW 502.00 / 504.00 is suitable for use and approved.

Current state : Oct. 2018

OEM Specs : **Ford Europe**

Special Tec F 5W-30

ACEA A5/B5
Ford WSS-M2C 913-A
Ford WSS-M2C 913-B
Ford WSS-M2C 913-C
Ford WSS-M2C-913-D

Duratec / Zetec

Special Tec F 0W-30

Ford WSS-M2C 950-A

Duratorq (Euro 6 Diesel)

Current state : Oct. 2018

OEM Specs : **Ford Asia & America**

Special Tec AA 5W-20

API SN / ILSAC GF-5
Ford WSS-M2C 925-A
Ford WSS-M2C 930-A
Ford WSS-M2C 945-A

EcoBoost (US)

Special Tec F ECO 5W-20

Ford WSS-M2C 948-B
JLR 03.5004

EcoBoost (EU)

Special Tec AA 5W-30

API SN / ILSAC GF-5
Ford WSS-M2C 946-A

EcoBoost (US)

OEM Specs : **General Motors / Saab**

GM **LL-A-025** – Longlife spec. Gasoline

↳ Replaced 2009 by **GM dexos2™**

GM **LL-B-025** – Longlife spec. Diesel

↳ Replaced 2009 by **GM dexos2™**

For gasoline engines GM dexos2™ is valid in Europe only!

OEM Specs : **Volvo**

Volvo VCC 95200377

Volvo VCC RBS0-2AE

specific engines from 2014 onwards

OEM Specs : **Jaguar & Land Rover**

The new Special Tec LR SAE 0W-20 is a modern, fully-synthetic premium class engine oil, which was developed for specific gasoline engines from Jaguar and Land Rover.

Specifications :

Jaguar/Land Rover STJLR.51.5122
ACEA A1/B1

SPECIAL TEC LL SAE 5W-30

The low-viscosity gasoline specialist !

Approved for latest Mercedes-Benz,
Volkswagen / Audi and BMW gasoline engines.

Specifications / Approvals :

- **Mercedes 229.5**
- **BMW Longlife-01**
- **VW 502.00 / VW 505.00**
- **GM-LL-A/B-025 (Saab)**
- **API SL**

LEICHTLAUF HIGH TECH SAE 5W-40

The high performance gasoline specialist !

Approved for latest Mercedes-Benz, Volkswagen / Audi, Porsche and BMW gasoline engines.

Specifications / Approvals :

- **Mercedes 229.5**
- **BMW Longlife-01**
- **Porsche A40**
- **VW 502.00 / VW 505.00**
- **API SN**

Synthoil Energy A40 SAE 0W-40

The Porsche specialist !

Specifications / Approvals :

Porsche A40
ACEA A3/B4
API SN

Recommendations :
BMW Longlife-98 / Longlife-01,
MB 229.3 / 229.5,
VW 502 00 / 505 00,
Ford WSS-M2C 937-A

TOP TEC 4605 SAE 5W-30

The low-SAPS Diesel Specialist !

Particularly suited for latest Mercedes and BMW Diesel engines with diesel particulate filter (DPF) !

<u>Specifications / Approvals :</u>

Mercedes 229.52 / 229.51

BMW Longlife-04

VW 505.00 / 505.01

GM dexos2™

ACEA C3

TOP TEC 4200 SAE 5W-30

The low-SAPS
VW & Audi Diesel Specialist !

Particularly suited for VW Diesel engines with diesel particulate filter (DPF) !

<u>Specifications / Approvals :</u>

VW 504.00 / 507.00
Porsche C 30
Mercedes 229.51
BMW Longlife-04
ACEA C3

LONGLIFE III SAE 5W-30

Specifications / Approvals :

- **VW 504.00 / 507.00 “Longlife III”**
- ACEA C3
- Mercedes 229.51
- BMW Longlife-04

TOP TEC 4100 SAE 5W-40

The low-SAPS Diesel Specialist for high-mileage engines!

Particularly suited for Diesel vehicles with diesel particulate filter (DPF) !

<u>Specifications / Approvals :</u>

VW 505.00 / 505.01

Mercedes 229.31

BMW Longlife-04

ACEA C3

Special Tec AA engine oils

Modern premium-class, fully synthetic engine oils which especially have been developed for the year-round use in latest **Asian** and **American** gasoline vehicles.

General specifications :

API SN
ILSAC GF-5

+ several OEM recommendations

Special Tec DX1 SAE 5W-30

New

The new GM dexos1™ Gen2 approval is backwards compatible and covers the obsolete GM dexos1.

Further the Special Tec DX1 SAE 5W-30 has the latest API SN Plus + RC and ILSAC GF-5 specification so it´s suitable for the use in all American and Asian **Gasoline** vehicles where an oil based on API / ILSAC with SAE 5W-30 is required.

<u>Specifications / Approvals</u>

GM dexos1™ Gen2 – Approval !!

API SN Plus + RC

ILSAC GF-5

Chrysler

Ford WSS-M2C 946-A

+ various other American and Asian gasoline vehicles

Specialty for older & high mileage engines

MoS_2 Antifriction SAE 10W-40 – first option for proven gasoline engines !

Extra wear protection through MoS_2 solid lubricants.
The semi-synthetic MoS_2 motor oil creates a high temperature resistant, heavy duty lubricant film on all frictioning and sliding surfaces.

Guarantees the greatest safety reserves even under extreme loads and heat during stop-and-go traffic, etc. Reduces oil consumtion and wear.

Special development from LIQUI MOLY for engines from the middle of the 1970´s up to the early 2000´s, especially recommended for all Air-Cooled engines built from approx. 1975 and later.

MOLYGEN New Generation

The next level of friction modifying

LIQUI MOLY

MOTORENÖLE
ADDITIVE
AUTOPFLEGE

MOLYGEN New Generation

INNOVATIVE. UNIQE. VALUABLE

Reduction of fuel consumption
up to 15% lower friction coefficient*

Always best performance
high thermal and pressure stability

Longer engine life
up to 30% less wear*

* 01.02.2016: Optimol Instruments Prüftechnik GmbH, München/Germany

MOLYGEN New Generation

Two premium products …

… in a perfect combination !

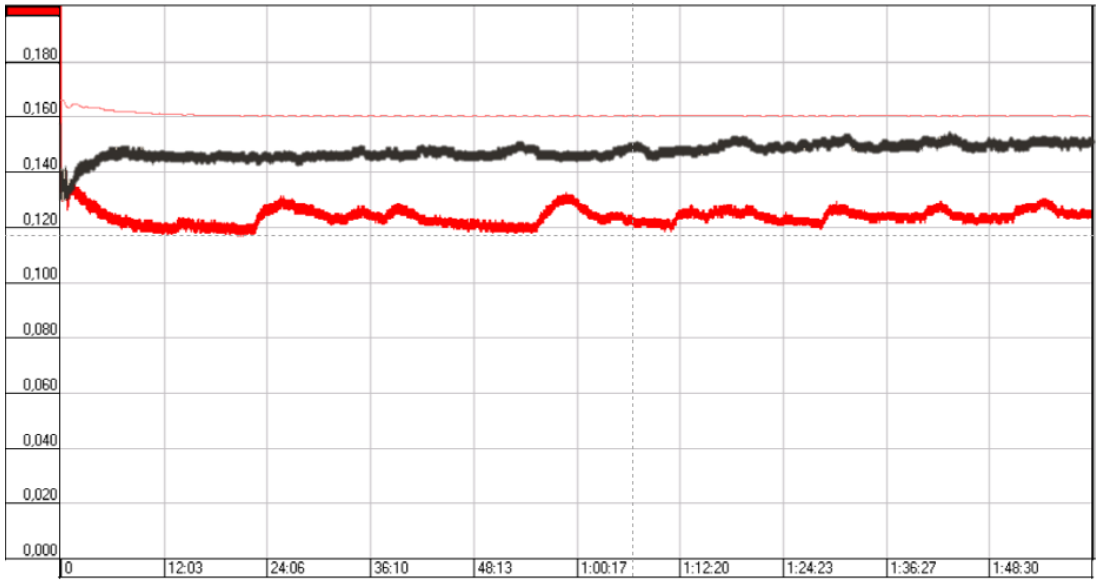
MOLYGEN New Generation

INNOVATIVE. UNIQE. VALUABLE

A perfectly balanced formulation of high-performance engine oil and a combination of advanced additive technology (tungsten and molybdenum) result in a synergistic effect for significantly lower friction.

Standard premium AA engine oil SAE 5W-30 vs. Molygen New Generation SAE 5W-30

Linear-Oscillation (SRV®) test



Friction coefficient

MOLYGEN New Generation

INNOVATIVE. UNIQE. VALUABLE

The optimum for high-end Asian and American gasoline engines with multi-valve technology and turbo charging. For the protection and value conservation of the engine even under extreme conditions.

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The optimum for high-end Asian and American gasoline engines with multi-valve technology and turbo charging. For the protection and value conservation of the engine even under extreme conditions.

MOLYGEN New Generation SAE 5W-50

Where to use :

- all gasoline vehicles where an motor oil according to API performance in SAE 5W-50 is recommended
- various off-road applications (e.g. racing use).

Note : not suitable for Ford Mustang´s, Corvette´s, GT-R´s … younger than approx. year 2000 !

(Ford and Chevrolet require OEM specifications and / or do not approve this viscosity.)

Specification : API SN

MOLYGEN New Generation

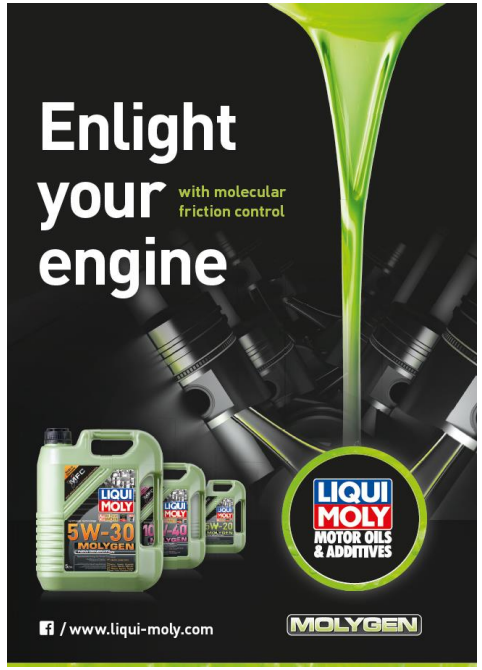
New Molygen Flyer / Topper / Advertisement

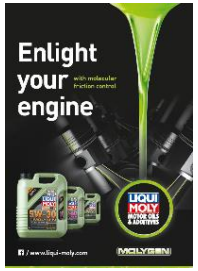
End-user letterfold flyer

Topper Futura-Shop

Advertisement Din A4

up to poster Din A1





MOLYGEN New Generation

INNOVATIVE. UNIQE. VALUABLE

High-Tech Motoroil for High-Tech vehicles.

API SN / ILSAC GF-5 Performance and a unique additive technology !

Summary : Motor oil classification

Same viscosity – different performance !

The important thing is not the viscosity, focus on the specification !

ACEA C3

API & ILSAC

ACEA A3/B4

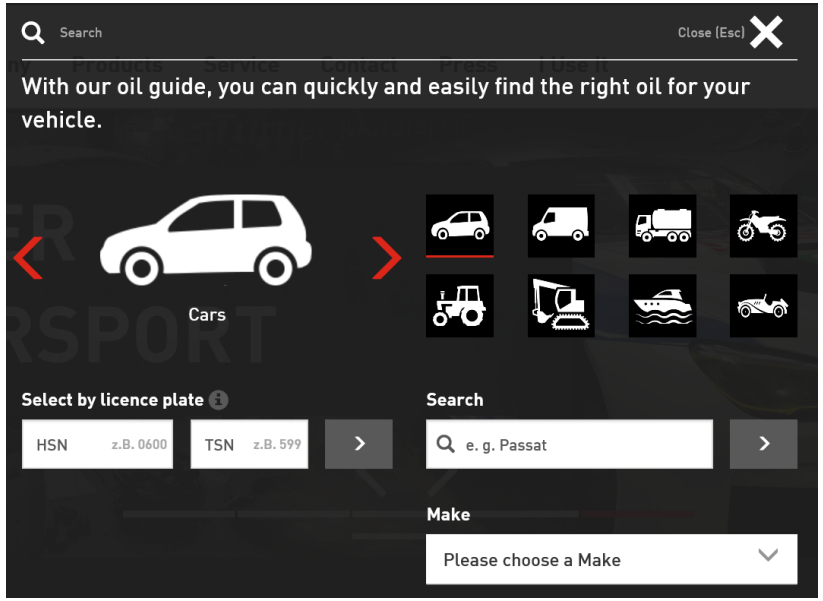
First Approval – then viscosity !

Summary : Future trends

- Global emission regulations drive to new engine technologies which will have big impacts on engine and drivetrain oils.
- Fuel economy regulations, combining combustion engines and hybrids, durability and the use of bio-based fuels bring new tasks for all parts of the lubricant.
- Only the use of high quality specialized engine oils preserves the value of the vehicle.
- Due to joint-ventures of European and American / Asian car manufacturers and more and more vehicles with a DPF / GPF system the ACEA is becoming increasingly important outside Europe.
- **Engine oils of the past should not be used for modern cars any more.**

How to find the right lubricant ?

- With our free LIQUI MOLY oil guides we offer fast and easy-to-use tools to find out which motor oils are suitable for which vehicle.



Online:
www.LIQUI-MOLY.US

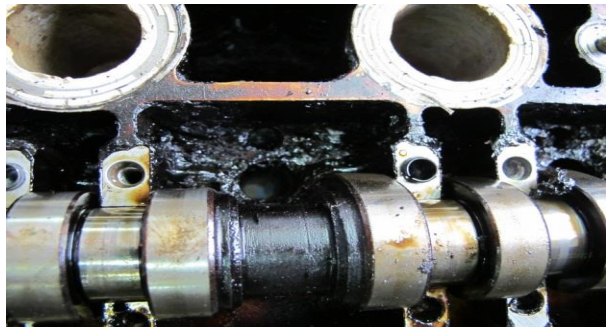
Brand Specific Flyers

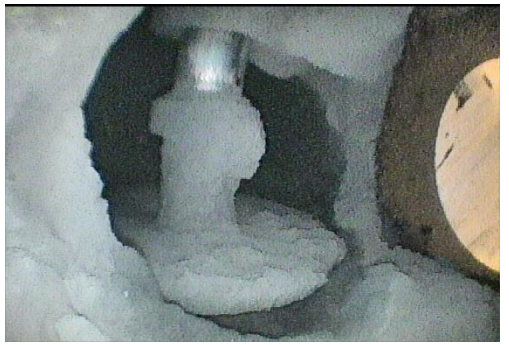
Printed Oil Guide

Additives – Preventing and Correcting

Common Oil and Fuel Related Problems

- Oil Sludge
- Oil Consumption
- Valvetrain Wear / Noisy Valvetrain
- Seal Weeping, Leaks and Smoking
- Injector Issues – Gas/Diesel
- High Mileage
- Domestic Performance
- Racing
- DPF Maintenance
- Cooling System





Result : lower engine performance and a high risk of damages !

LIQUI MOLY Additives

Two different product lines for targeted use :

“Liquid tools” designed for professional use

Preventive and regular use by the driver

Fuel Additives : **Gasoline**

Regular use by driver is recommended

Deposits ...

are one of the most common cause of engine malfunctions !

Cleaned injectors - injection like it should be !

Injector cleaned up.
Picture shows accurate fuel atomization.

- **Combustion powerful and most effective**
- **Economic fuel consumption**
- **Low emissions**

Optimal performance + economy

JECTRON Fuel Injection Cleaner

STARTING PROBLEMS	HIGH FUEL CONSUMTION	LOSS OF PERFORMANCE	DIRTY FUEL SYSTEM

Formulated to **clean and protect** the gasoline fuel system. Regular use keeps injection system in perfect working order.

- for rectifying problems such as difficulties with starting, irregular idling, poor throttle response, performance losses
- prevents by a durable protective coating
- protects of corrosion in the fuel system.

One can (300 ml) is sufficient for min. 25 l / 7 gal. up to max. 75 l / 20 gal. of gasoline.

→ Prevention (keep-clean effect), regular use (every approx. 2000 Km / 1200 miles)

Valve Clean

STARTING PROBLEMS	IDLING PROBLEMS	COMPRESSION LOSS	DEPOSITS ON INTAKE VALVE

- removes typical carbon deposits from intake valves (no DI-engines!) and pistons.
- decreases exhaust emissions.

- sufficient for min. 25 l / 7 gal. up to max. 75 l / 20 gal. of fuel.

→ Problem Solvent

Speed Tec Gasoline

STARTING PROBLEMS	IDLING PROBLEMS	WEAK PERFORMANCE

Speed Tec Gasoline expands and enhances normal fuel atomization into even smaller particles which burn faster & more efficient in the combustion chamber. The result is more performance “snap” on acceleration without increase horsepower overall. Speed Tec Gasoline

- does **not** affect the Octane number
- needs to be added every time you fill the gas tank

One can (150 ml) is sufficient for up to 75 l / 20 gal. of fuel (min. 25 l / 7 gal. required).

Hybrid Additive

New

LIQUI MOLY

FUEL OXIDATION AND AGEING	CORROSION	DEPOSITS

Hybrid vehicles are characterized by low fuel consumption and in some cases purely electric driving. This results in frequently cold operated engine as well as being started and stopped more often.
The fuel also remains in the tank for a relatively long time.

- removes carbon and deposits from gasoline injection system and injectors
- protects against corrosion.
- stabilizes the fuel and slows down oxidation and aging

Prevention, regular use is recommended.

Fuel Additives : **Diesel**

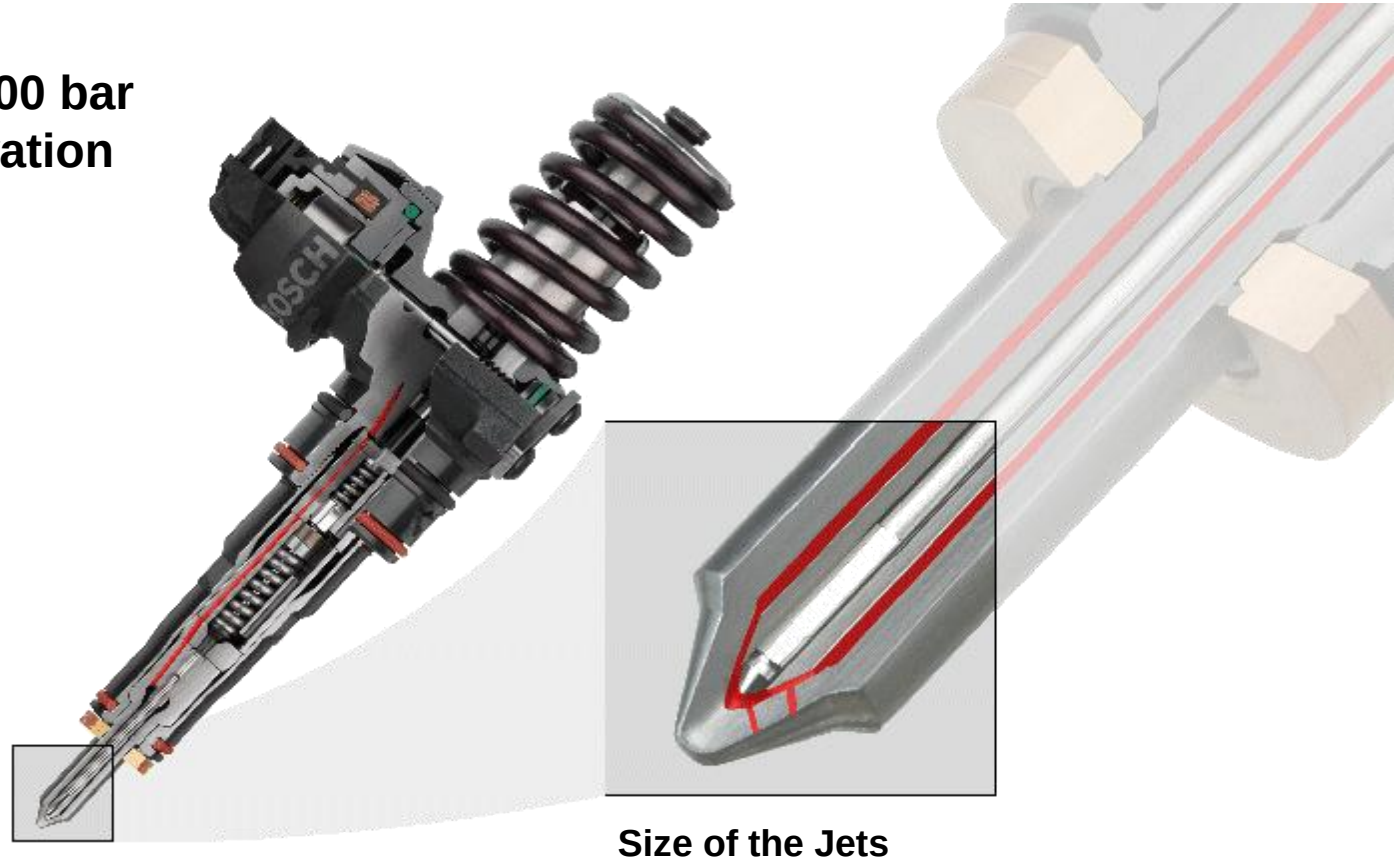
DO IT YOURSELF DIY DO IT YOURSELF

Regular use by the car driver is recommended

Direct Diesel Injection

Common-Rail Injector

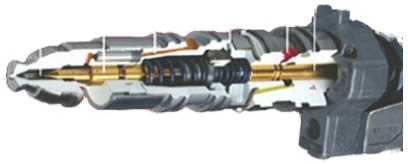
- injection pressure up to 37000 psi / 2500 bar
- electro-hydraulic or piezoelectric activation
- up to 7 portions per injection



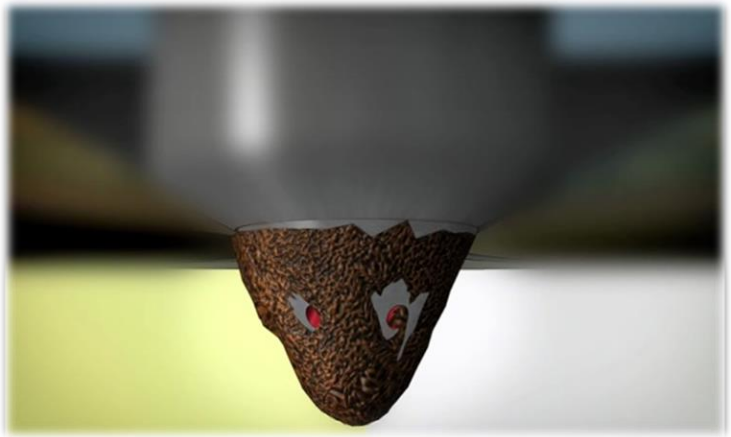
Size of the Jets
= 0.120 mm (120µm)
= needs clean Diesel

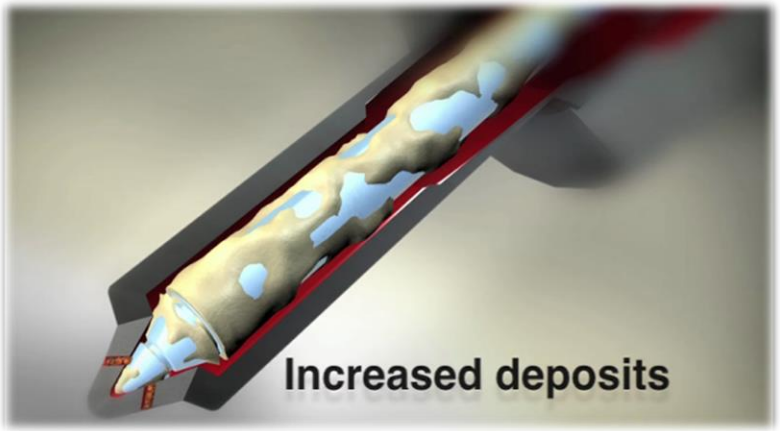
Direct Diesel Injection

Effects of medium- and low-quality fuel



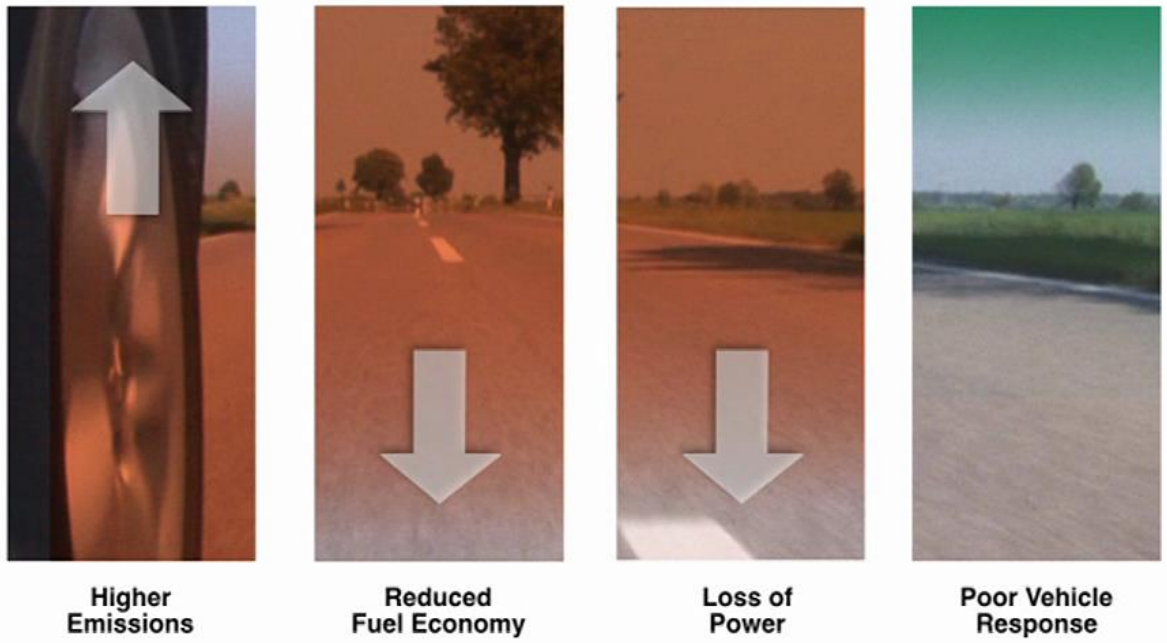
- Low and medium quality fuel increases the formation of deposits in the fuel system and in the engine.
- Low Cetane number extend wear and emissions and impede starting of the engine.
- Corrosion protection does not fulfill requirements
- Inconsistent lubrication creates wear in the pump and the injectors





Direct Diesel Injection

Consequences for the vehicle



Risk of engine blackout

Increased fuel consumption

→ Increased operating costs !

Deposits ...

... prevent !

… at the right time !

Super Diesel Additive

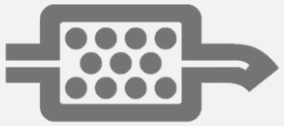
STARTING PROBLEMS	HIGH FUEL CONSUMTION	LOSS OF PERFORMANCE	DIRTY FUEL SYSTEM

Formulated **to clean and protect** the diesel fuel system. Regular use keeps injection system in perfect working order.

- for rectifying problems such as difficulties with starting, irregular idling, poor throttle response, performance losses, high soot
- improved combustion by increased Cetane value
- protects of corrosion in the diesel fuel system and increases the lubricity

One can (300 ml) is sufficient for min. 25 l / 7 gal. up to max. 75 l / 20 gal. of Diesel fuel.

Diesel Particulate Filter Protector

REDUCTION	SUPPORT
	

- **Reduces** the formation of soot during combustion in the engine
- **Improves** the regeneration of the DPF system

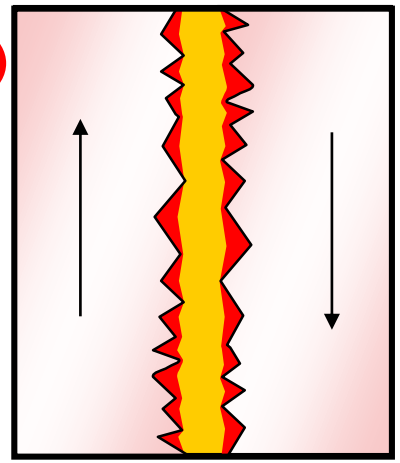
One can (300 ml) is sufficient for between 25 – 75 l / 7 – 20 gal. of Diesel fuel.

→ Prevention, regular use (every approx. 2000 Km / 1200 miles) is recommended
→ Add into the fuel tank after DPF cleaning

Oil Additives

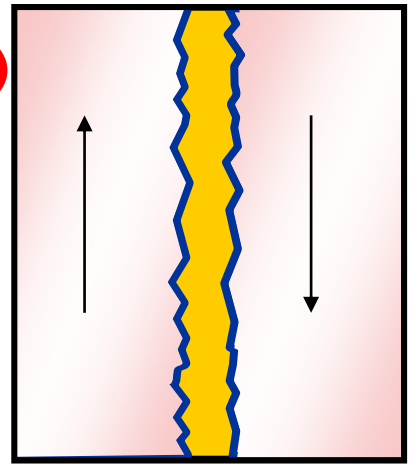
Opportunities to reduce friction and wear :

1



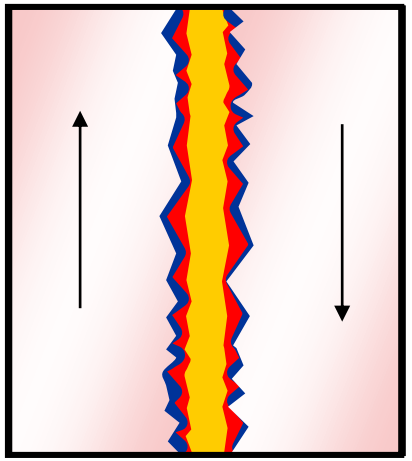
Solid lubricants
Fill the roughness of metal surfaces and leave a thin additional lubricating film.

2



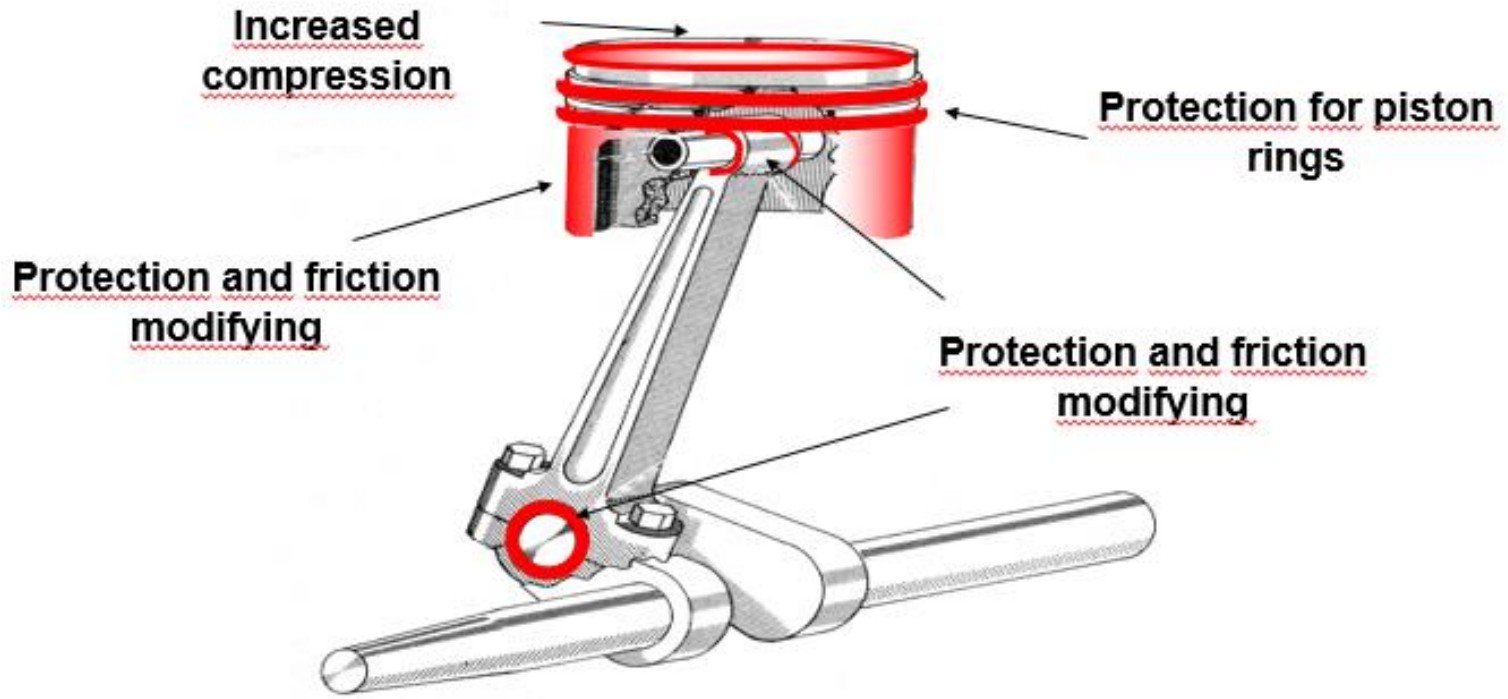
Chemical Agents
So called Friction Modifier harden the metal surface. Rough peaks of the surface get no longer destroyed but smoothed.

3



Combined
Combining both active principles. Micro ceramic solid lubricant is filling the roughness – a chemical reaction is hardening and softening the metal Surface.

The solid lubricants Ceramic and MoS_2



Our solid lubricants come with a particle size of < 1.0 µm (microns).
It is absolutely impossible that standard oil filter systems get blocked.
MoS_2 and Ceramic are extreme pressure and heat resistance,
very adhesive to surfaces and reduce the friction force between all moving parts in the oil system.

Anti-Friction Engine Treatment with MoS_2

WEAR	COMPRESSION LOSS	HIGH FUEL CONSUMTION	OIL CONSUMTION

- less friction for smooth running
- extremely adherent on surfaces, generates emergency-running properties
- protection in case of sudden oil loss
- compatible with any kind of materials

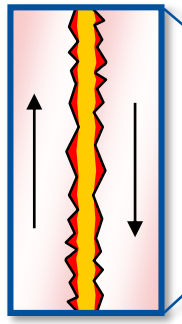
→ **Solid lubricant (MoS_2) for proven engines & manual gearboxes**

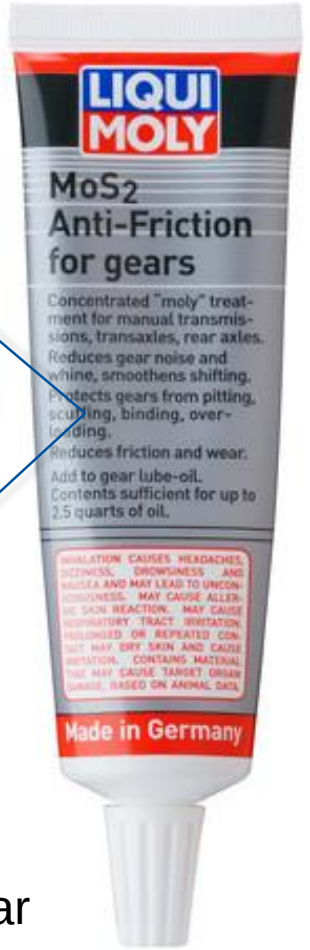
MoS_2 Anti-Friction for Gears

WEAR

DAMAGE

IMPROVE SHIFTING





MoS_2-Antifriction for Gears is a stabilized solid lubricant concentrate in mineral gear oil. Due to its high MoS_2 content it is suitable for all manual transmissions and for axle drives without a integrated self-locking differential.

- reduces friction and wear, noise absorbing properties
- promotes optimum shifting performance with lower gear oil temperatures
- for all kind of manual transmissions including high mileage gearboxes with existing wear

One tube (50g) is sufficient for up to 2.5 liters (2.64 U.S. QT) of mineral or synthetic based gear oil. Not suitable for automatic transmissions and other couplings that run in an oil bath!

LM 48 Installation Paste

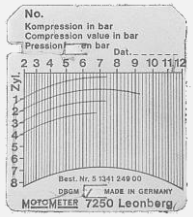
High performance MoS_2 paste for extreme demands.
It prevents run-in damage and seizing marks when working on bearings and sliding guides, when pressing bolts and bearing bushings, when pulling on roller bearing rings.

- for basic lubrication, prevents run-in damage.
- ”for-life” lubrication of joints and small components.

For installation, repair and maintenance in all technical sectors.

- Outstanding adherent
- High wear and temperature resistance (up to +850°F / 450 °C)
- Low coefficient of friction
- Good corrosion protection

Oil Additives : **Cera Tec**

WEAR	COMPRESSION LOSS	HIGH FUEL CONSUMTION	OIL CONSUMTION
			

Cera Tec is a high-tech two component additive with ceramic.

- long term wear protection for **modern** engines and manual gearboxes
- extremely high pressure and temperature resistant
- chemical coating lasts up to 50.000 Km / 30.000 miles
- optimizes fuel consumption and engine performance
- One can (300 ml) is sufficient for up to 5 liters /1.3 gal. motor oil.

→ **Combination of a solid lubricant and a chemical friction modifier**

Oil Additives : **Motor Oil Saver**

LEAKAGE	OIL CONSUMPTION

- prevents blue, smoky exhaust fumes
- rejuvenates dried out, porous, shrunken oil and valve stem seals.
- reduces oil consumption thru valve guides

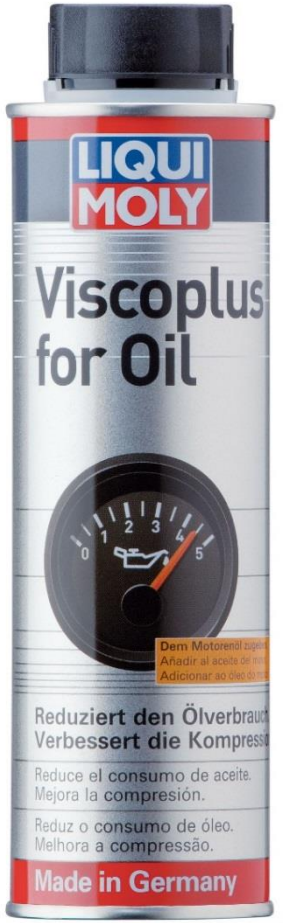
One 300 ml can of Motor Oil Saver is sufficient up to 5 liters (5.28 U.S. QT) of motor oil.
The product can be added at any time. Sealing first takes effect after about
600-800 km (400-500 miles).
To guarantee a lasting effect, add Motor Oil Saver every approx. 30.000 km /20.000 miles)

→ Problem solvent and prevention

Oil Additives : **Viscoplus for Oil**

LOW OIL PRESSURE

OIL CONSUMPTION



Viscoplus for Oil is a high-performance additive for stabilizing the viscosity of motor oils. It offers outstanding protection against mechanical and therefore permanent shear losses to the oil under extreme running conditions.

- prevents blue smoke and oil mist
- increases the service life of exhaust gas treatment systems

- one can (300 ml) is sufficient for up to 5 liters /1.3 gal. motor oil.
- **ideally suited for top-up use** (one bottle only per service interval)

→ Prevention & problem solvention

Oil Additives : **Hydraulic Lifter Additive**

TAPPET NOISE

Prevents hydro tappet noise. Lubrication holes and ducts in the oil circuit are cleaned. Promotes the accurate function of the hydraulic lifters and reduces wear.

- reduces hydraulic tappet noise
- cleans valve bores
- improves the lubrication properties of the oil

Suitable for all gasoline and diesel engines.
One bottle (300ml) is sufficient for up to 5 liters /1.5 gal motor oil.

→ Prevention & problem solvention

Power Steering Oil Leak Stop

LEAKAGE

LOSS OF PERFORMANCE

Optimally cares for rubber and plastic seals in hydraulic power steering systems.
Leaks caused by hardened, dried out and brittle seals are prevented and eliminated.
Reduces noise formation from the oil pump and improves hydraulic oil performance.

Only suitable for hydraulic power steering systems that are filled with
ATF II,**ATF III, Dexron VI and Central Hydraulic System** fluids.

- One tube (35 ml) is sufficient for up to 1 liter (0,3 gal.) of oil.
- Prevention & problem solvention

ATF Additive

LEAKAGE

LOSS OF PERFORMANCE

Optimally cares for rubber and plastic seals in automatic transmissions.
Leaks on transmissions caused by hardened, dried out and brittle seals are prevented and eliminated.
Reduces noise formation and improves the shifting properties in automatic transmissions.

Only suitable for automatic transmissions that are filled with **ATF II** and **ATF III** fluids (LIQUI MOLY ATF III, Top Tec ATF 1100 & Top Tec ATF 1200).

- One tube (250 ml) is suitable for up to 8 liter (2 gal.) of oil.
- Prevention & problem solvention

Radiator Cleaner & Radiator Stop Leak

LEAKAGE	DEPOSITS IN COOLING SYST.	OVERHEATING

- **Radiator Cleaner**

  Dissolves limestone and oily deposits, mud and sludge in the cooling system

  → Prevention & problem-solvent

- **Radiator Stop Leak**

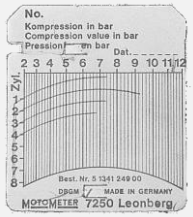
  Reliably seals, little leaks like micro cracks and porous solder joints

  → Prevention & problem-solvent

TRUCK *SERIES* Additives

THE LIQUI MOLY ADDITIVES FOR THE BIG BOYS TOYS !!!

Truck *Series* Oil Treatment

WEAR	COMPRESSION LOSS	HIGH FUEL CONSUMTION	OIL CONSUMTION
			

- Engine Armor with **MoS_2** for less friction and smooth engine running
- Extremely adherent on surfaces, generates a highly durable lubrication film for less wear
- Protection in case of sudden oil loss
- One can is sufficient for up to 7 liters (1.8 gal.) motor oil

- → Prevention
- → Regular use

Truck *Series* Complete Fuel System Cleaner

STARTING PROBLEMS	HIGH FUEL CONSUMTION	LOSS OF PERFORMANCE	DIRTY FUEL SYSTEM

- Removes carbon and deposits from injection system, injectors and carburettor
- Prevents by a durable protective coating (up to 2000km /1200 miles)
- Protects the whole fuel system from corrosion
- One can is sufficient for min. 25 liters (7 gal.) up to 115 liters (30 gal.) of gasoline

→ Prevention (keep-clean effect)
→ Regular use

Truck *Series* Complete Diesel System Cleaner

STARTING PROBLEMS	HIGH FUEL CONSUMTION	LOSS OF PERFORMANCE	DIRTY FUEL SYSTEM

Strong Cleaning Action, removes carbon and other deposits from the diesel fuel distribution system and injectors - effective on all injector systems !

→ Reduces exhaust gas pollutants and fuel consumption

→ Removes deposits from the entire diesel fuel system

→Suitable for all kind of diesel engines

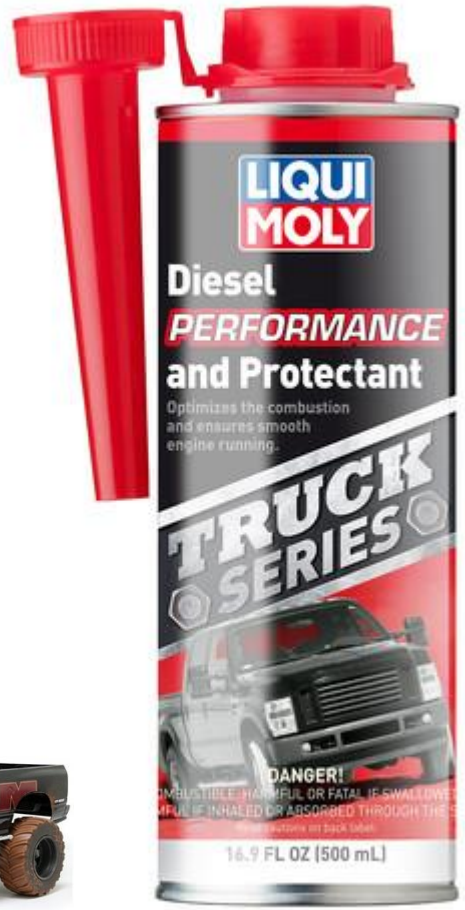
→One can is sufficent for min. 25 liters (7 gal.) up to 115 liters (30 gal.) of diesel fuel

→ Problem solver

Truck *Series* Diesel Performance and Protectant

STARTING PROBLEMS	HIGH FUEL CONSUMTION	LOSS OF PERFORMANCE	DIRTY FUEL SYSTEM

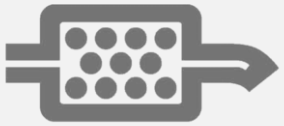
- Cleans and protects the fuel system against corrosion
- Lubricates the injection system
- Improved combustion by increased Cetan value
- One can is sufficient for min. 25 liters (7 gal.) up to 115 liters (30 gal.) of diesel fuel



→ Prevention (keep-clean effect)

→ Regular use (every 200km / 1200 miles)

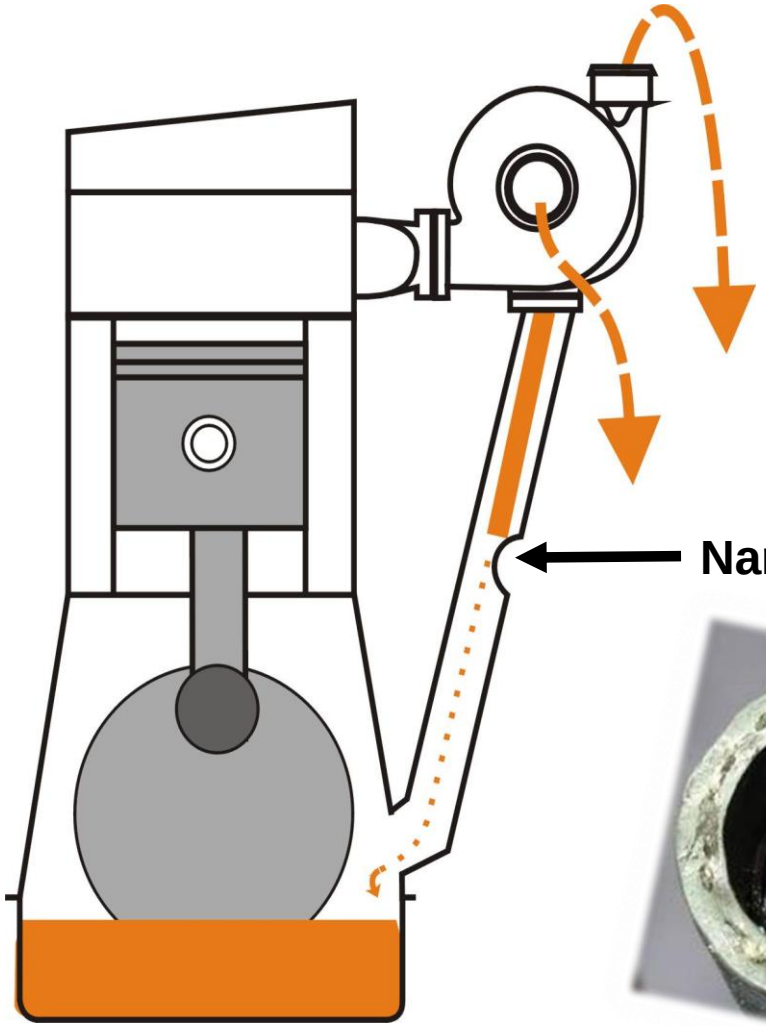
Truck *Series* DPF Protector

REDUCTION	SUPPORT
	

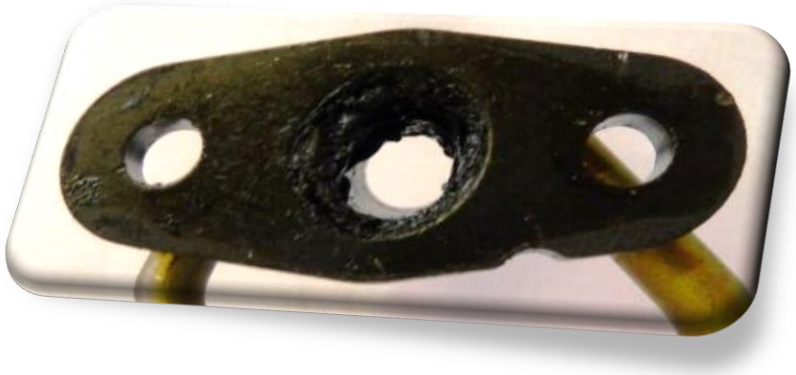
- **Reduces** the formation of soot particles during combustion in the engine
- **Improves** the regeneration of the DPF system
- One can is sufficient for min. 50 liters (14 gal.) up to 115 liters (30 gal.) of diesel fuel
- Add into the fuel tank after DPF cleaning

→ Prevention
→ Regular use (every 2000km /1200 miles)

PRO-LINE Engine Flush protects the turbocharger



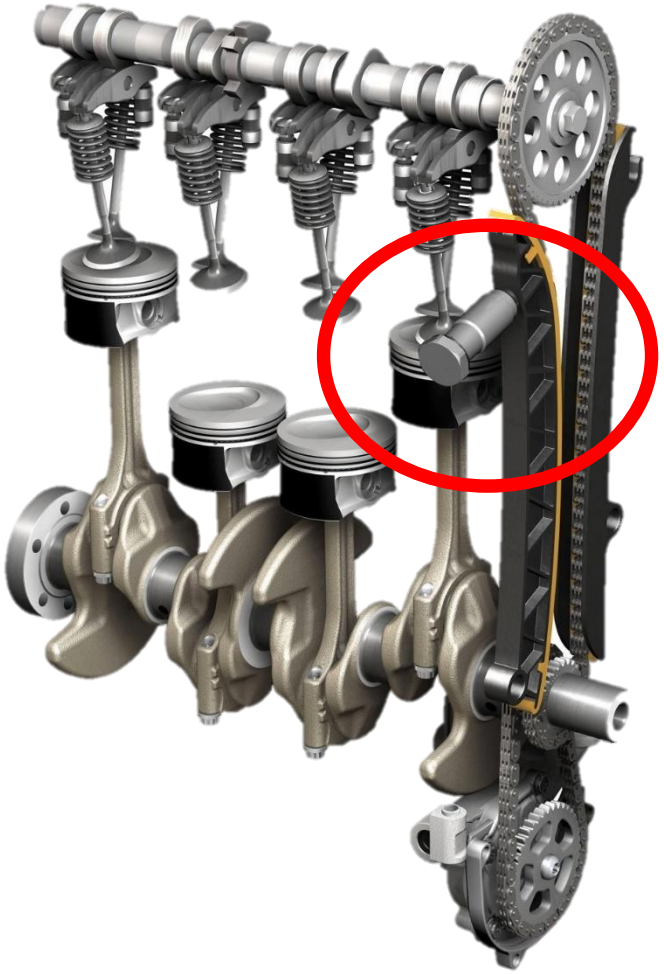
Narrowing of the oil rail because of deposits



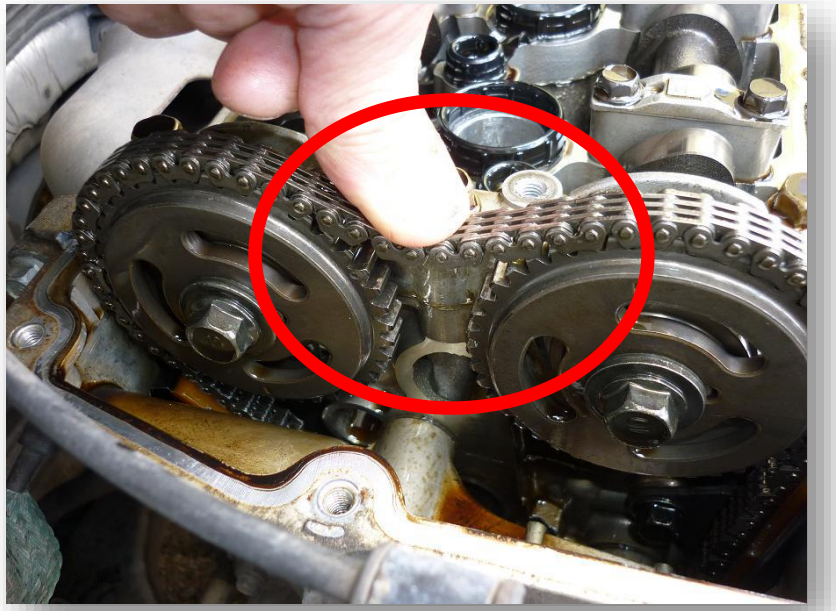
PRO-LINE Engine Flush optimizes the oil consumption

High oil consumption because of carbon deposits at the piston rings

Problem: Stretching / Skipping of the timing chain



Hydraulic chain tensioner



Stretched chain

Problem: stretching of the timing chain

The workshop solution for prevention: Regular cleaning & wear reduction !

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PROBLEM SOLVED

PRO-LINE Gasoline System Cleaner

STARTING PROBLEMS	HIGH FUEL CONSUMTION	LOSS OF PERFORMANCE	DIRTY FUEL SYSTEM

Strong cleaning action, removes carbon and other deposits from the gasoline system - effective on all gasoline injection and carburettor systems!

- restores precise injector dosage and atomisation
- secures the optimum drivability and lowest fuel consumption
- guarantees lower levels of pollutants in the exhaust

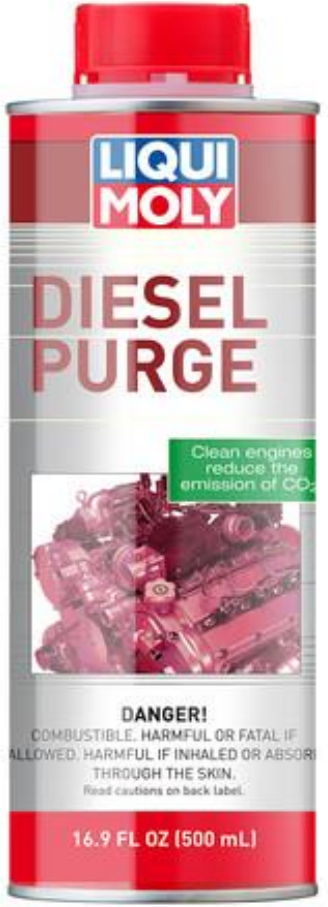
One can (500 ml) is sufficient for min. 25 liters / 7 gal. up to 70 liters /18 gal. of gasoline

→ Regular use at inspection

Diesel Purge

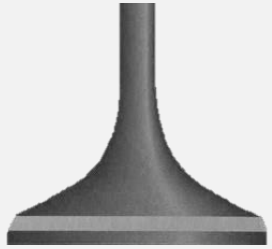
STARTUP PROBLEMS	LOSS OF PERFORMANCE	DIRTY FUEL SYSTEM

- removes deposits from injectors
- strong cleaning effect
- direct feed in fuel filter case (undiluted or mixture 1:1)
- **Workshop product**



Recommended after every fuel filter change as top up for the filter case !

PRO-LINE Intake System Cleaner Diesel

DEPOSITS IN EGR	DEPOSITS ON INTAKE VALVE	DEPOSITS IN INT. MANIFOLD
		

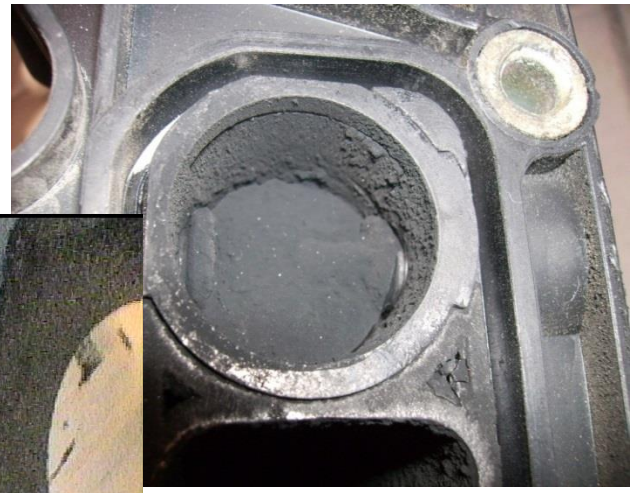
Special active solvent for removing typical carbon deposits in the intake and throttle valve area of diesel engines. **Regular use** (yearly) guarantees the functional performance of the moving parts and reduces fuel consumption.

Gain access to throttle body via intake or vacuum line behind air mass sensor and before throttle plate. Start the engine, accelerate and maintain approx. 2000 RPM. Spray in short intervals of 2-3 seconds.
One can (400 ml) is sufficient for one treatment.

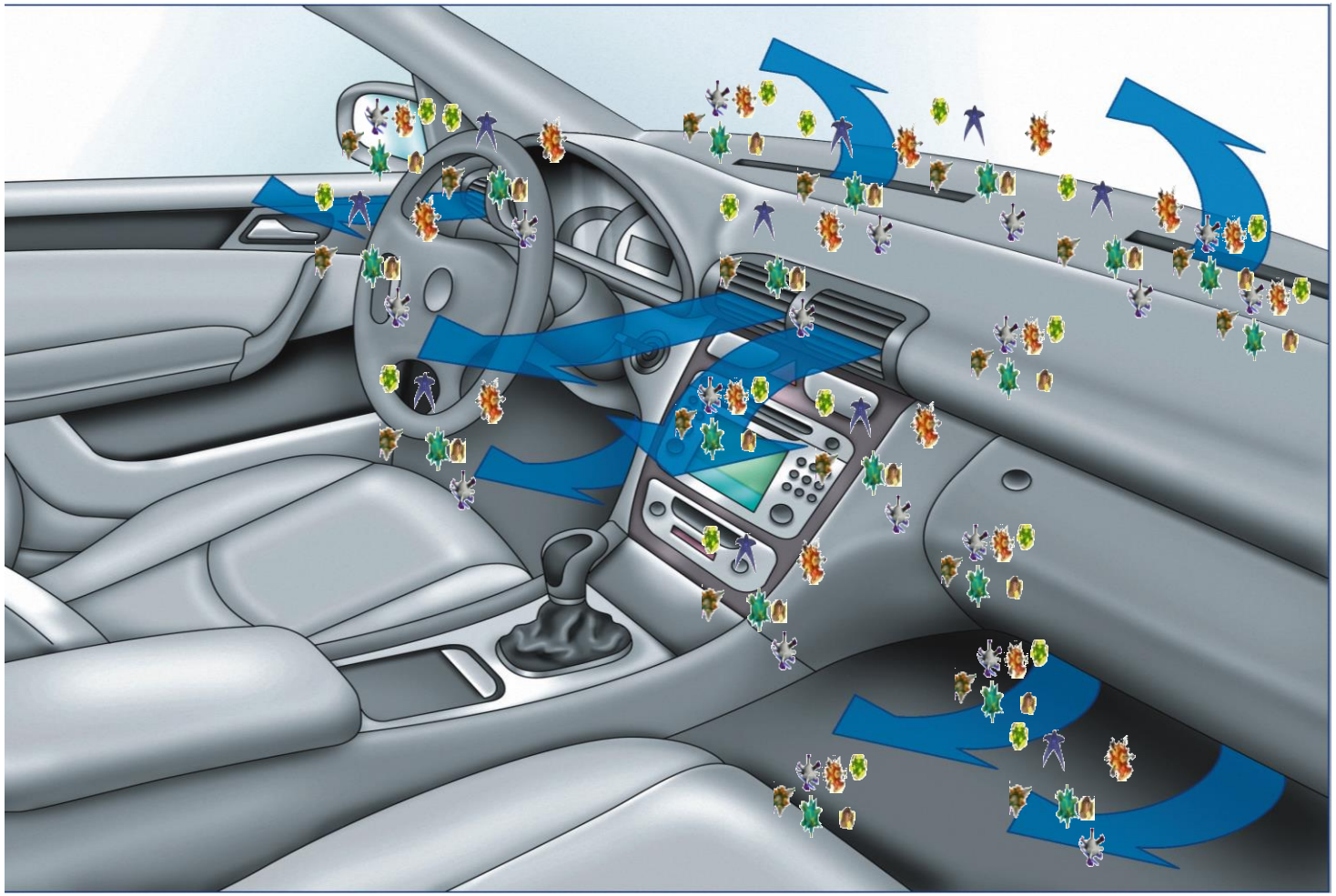
→ Prevention
→ Regular use at inspection

PRO-LINE Intake System Cleaner Diesel

Use of the cleaner is recommended during every service in order to prevent heavy deposits like this !



Active-2C A/C System Cleaner



- The cooling unit of a A/C is permanently wet due to condensing air humidity
- Molds, germs and bacteria grow well under such favorable conditions
- Foul smelling from air ducts when A/C is unused for some time
- Molds and germs can cause respiratory infections, allergies and even bronchial asthma

Active-2C A/C System Cleaner

Why flush the AirCon system with a liquid ?

Because a gas **never** can flush out mold and other deposits !

Active-2C A/C System Cleaner

How to do a proper AirCon cleaning service ?

Option 1 :

Clean the evaporator in a dismantled condition.

→ cost and time intensive

→ high risk of damaging parts during removal and installation

→ customer vehicle has to stay in the shop for several days

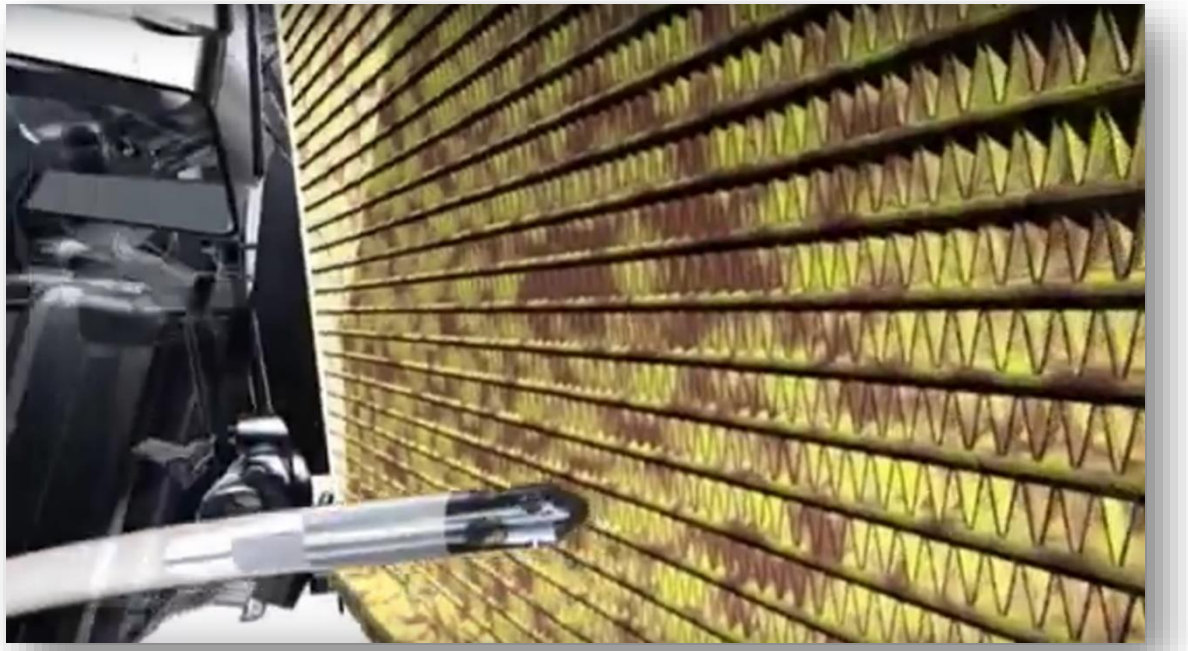
Active-2C A/C System Cleaner

Option 2 : Clean the evaporator in a fitted condition.

→ safe, simple and effective

→ great time-saving, the entire work is done in less than approx. 20 minutes

→ can be done during the regular vehicle service



Active-2C A/C System Cleaner

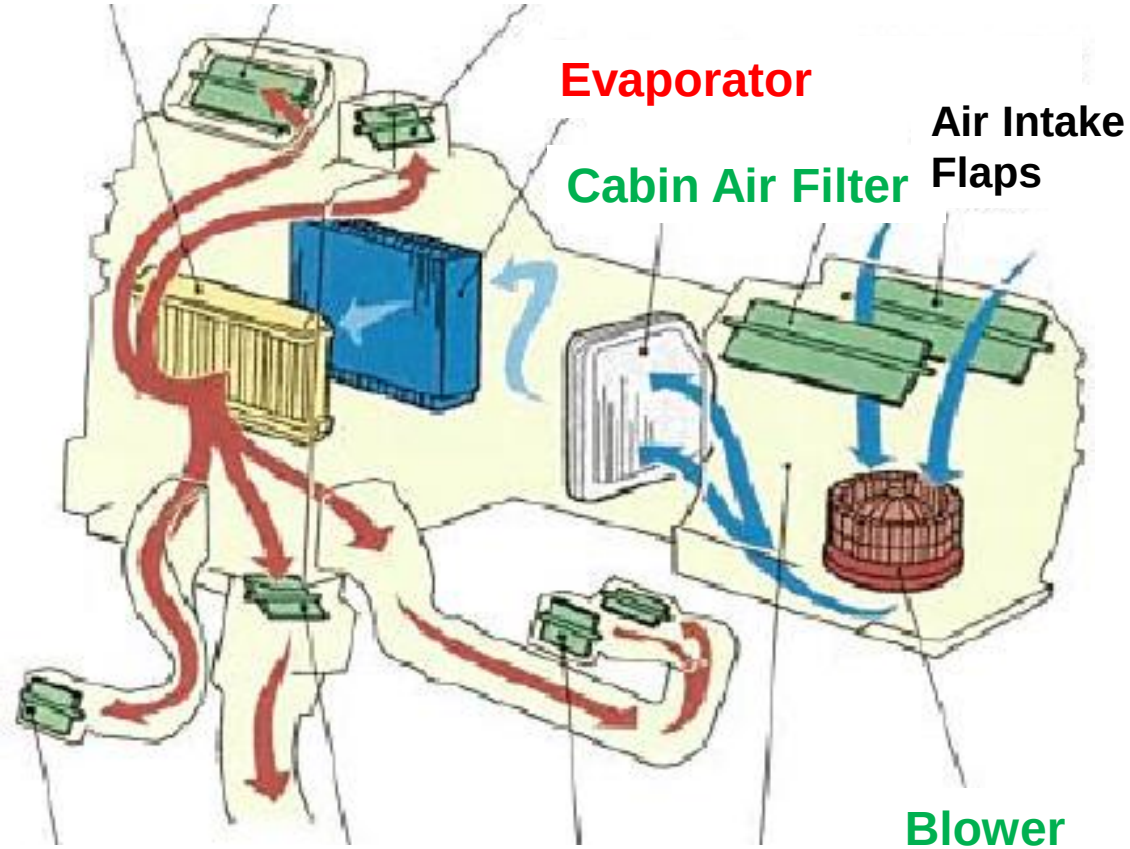
Effective cleaning fluid - not just an air freshener !

- Active 2 component cleaning liquid that is mixed together for activation immediately before use.
- this guarantees full performance of the product and a pleasant fresh fragrance in the car.
- to apply at every regular inspection, after the treatment replace the cabin air filter !

Cleaning gun with long flexible probe and rotatable jet (sprays 360°)
works with compressed air (6 bar / 90 psi)

Application :
Use 1 liter fluid & 2 activators per treatment !
Shelf-life: 2 years with unmixed components.

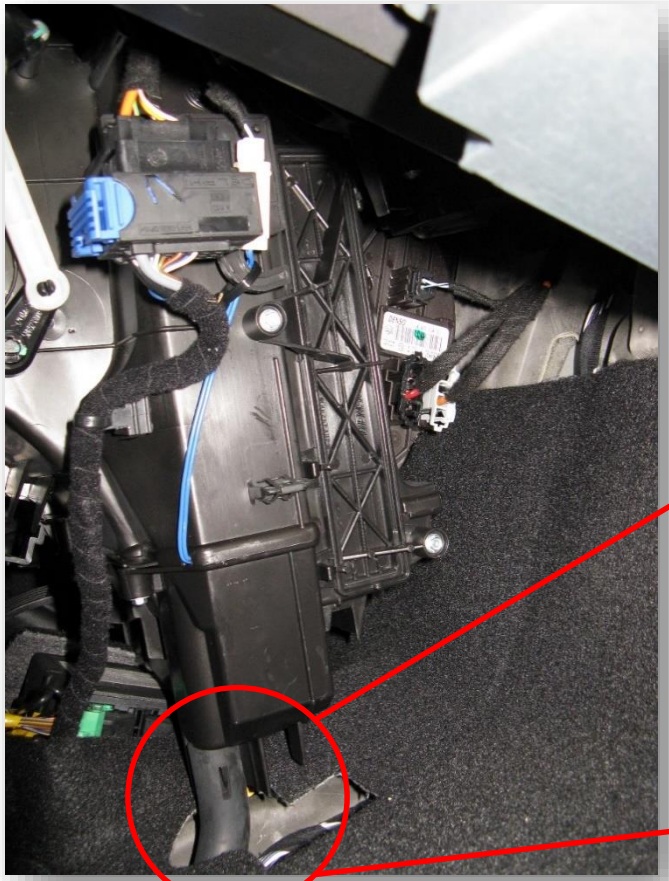
Active-2C A/C System Cleaner



Gain direct access to the evaporator by taking out
the blower or the cabin air filter – whatever is closer to the evaporator.

Four step operating instruction

Step 1: Check condensation drain for blockage



Four step operating instruction

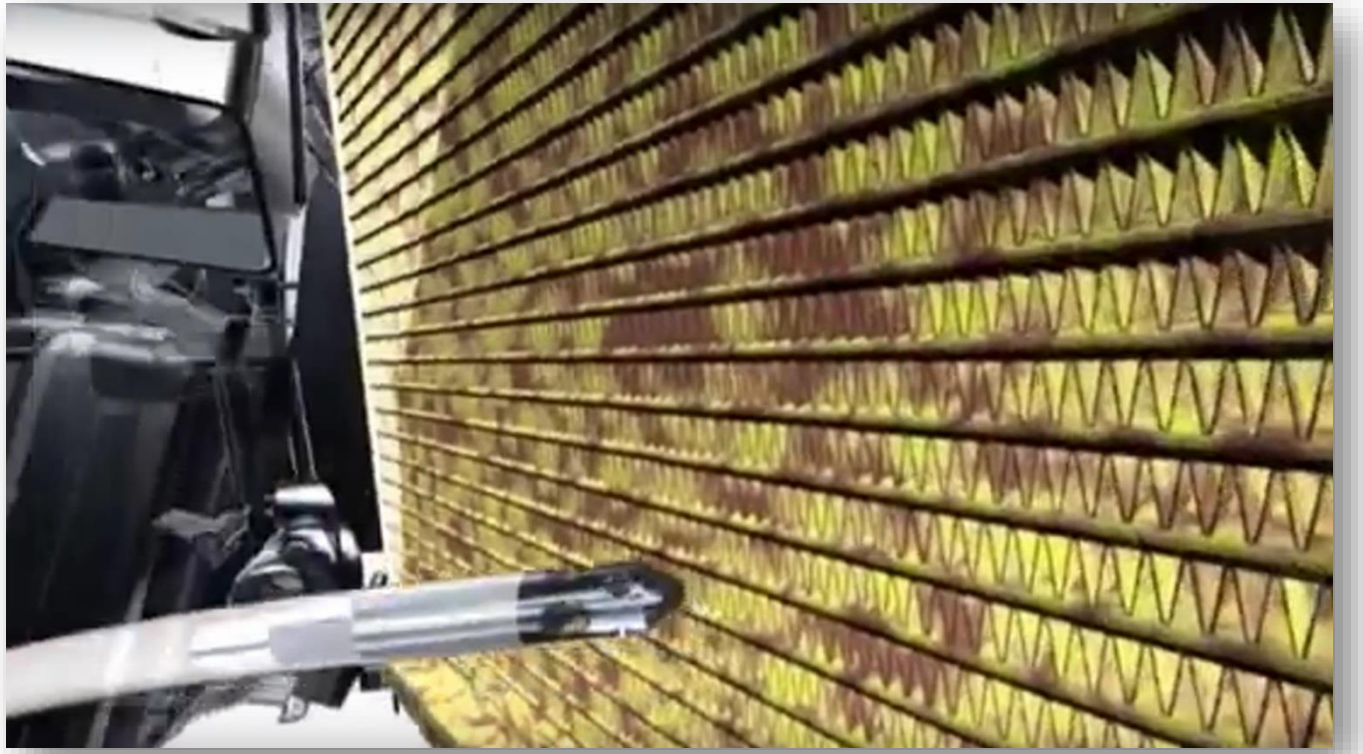
Step 2 : Create direct access to the evaporator surface…

… by taking out the cabin air filter

… or by removing the blower motor

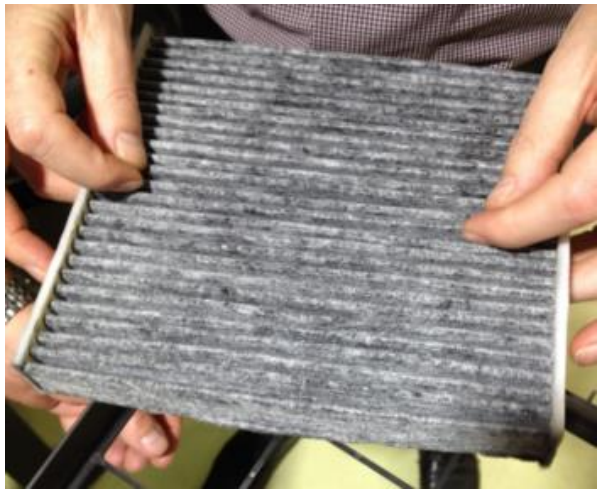
Four step operating instruction

Step 3 : Clean surface of the evaporator

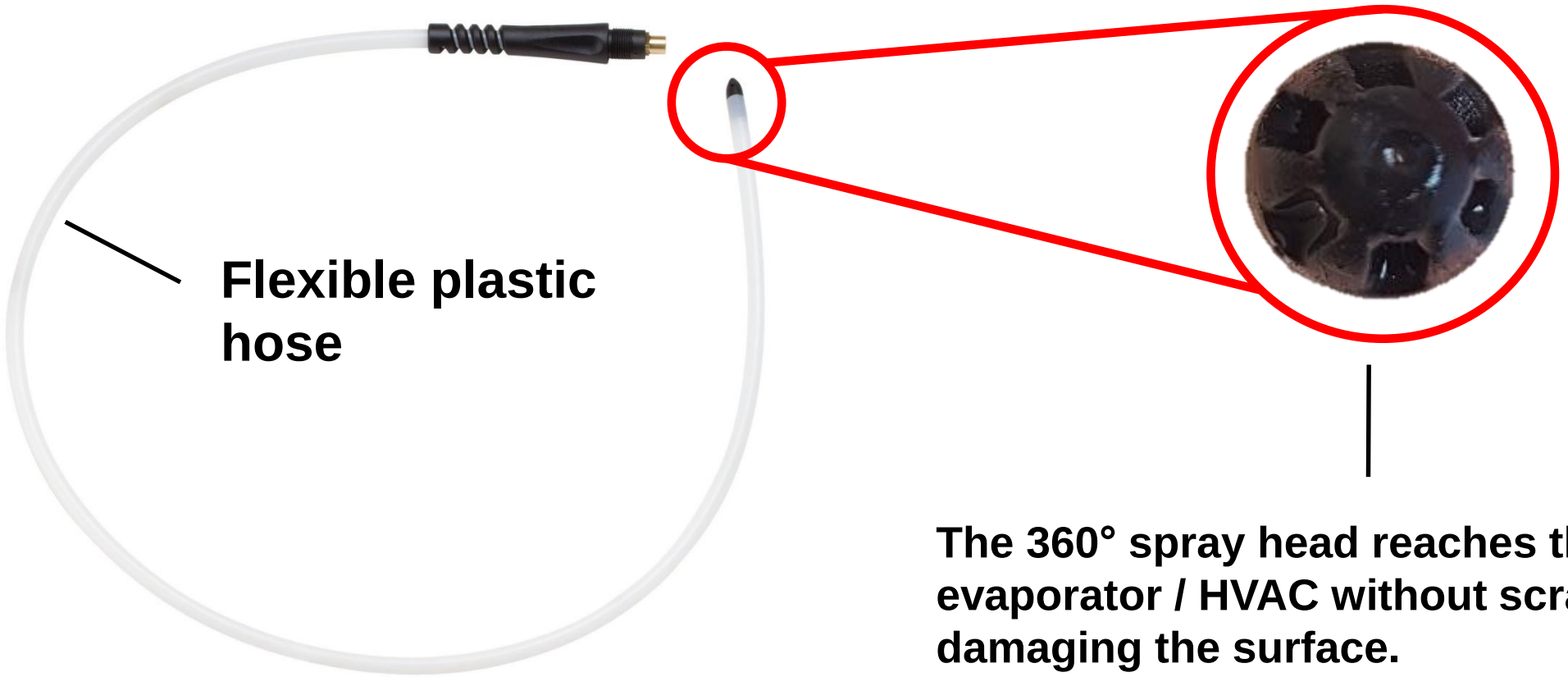


Apply the cleaning liquid directly to the evaporator surface and then reassemble all dismantled components.

Don´t forget to replace the cabin air filter afterwards !



The 360° flexible spray probe

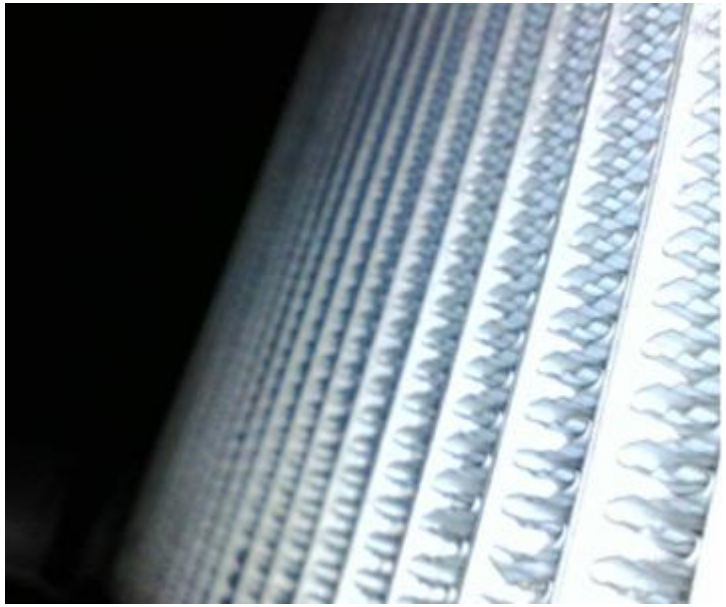


The 360° spray head reaches the entire evaporator / HVAC without scratching / damaging the surface.

Four step operating instruction

Step 4 : Ready!

What´s left is a protective film on the evaporator and HVAC surface that slows down the re-growth of bacteria and fungi.



Active-2C A/C System Cleaner

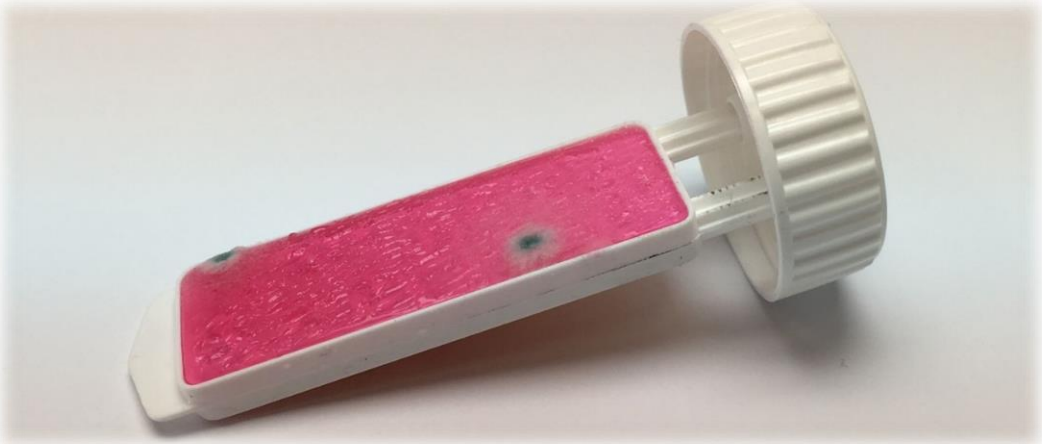
Active-2C A/C System Cleaner

Evaporator contamination before cleaning

A so-called dipslide in the picture. This allows swabs to be taken of surfaces in order to prove the contamination with bacteria and fungus.

Bacterial growth after 5 days*.

Fungal growth after 5 days*.



*samples stored 5 days at +25°C temperature with 70% humidity

Active-2C A/C System Cleaner

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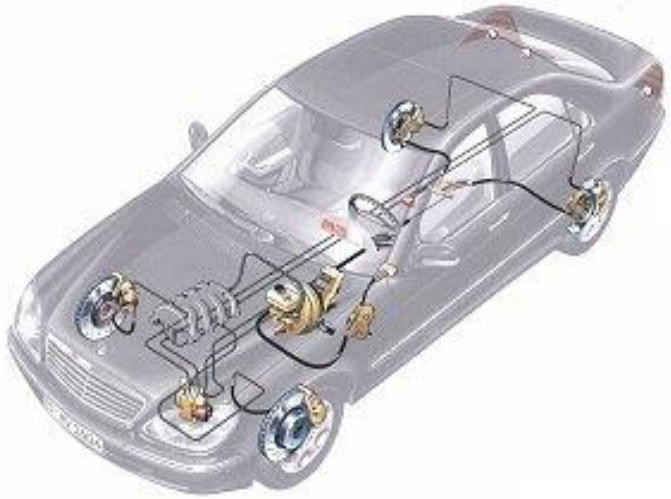
Brake Fluid

Brake fluid is a type of hydraulic fluid used in hydraulic brake and hydraulic clutch applications. It is used to transfer force into pressure and to amplify braking force.



Requirements for brake fluids :

- High boiling point
- High viscosity index (VI)
    - not too thin at heat → wear protection
    - not too thick at cold → fast response
- Corrosion protection
- Lubrication
- Water absorption
- Material compatibility

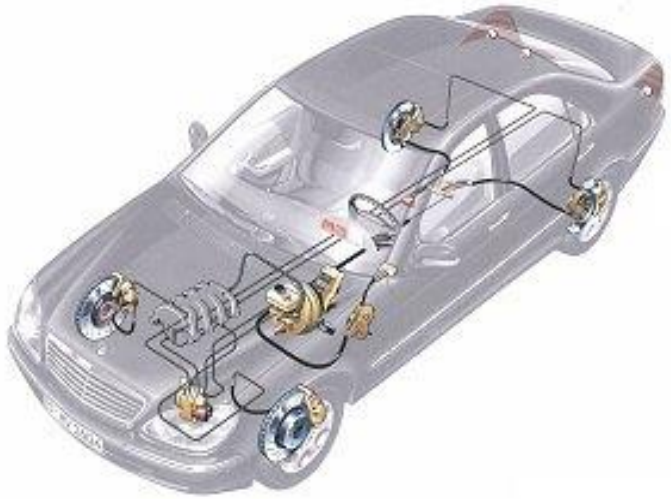
Brake Fluid

Specifications for brake fluids

Brake fluids must meet certain requirements as defined by **D**epartment **o**f **T**ransportation (**DOT**) for example.

	Dry boiling point	Wet boiling point	Viscosity limit	Primary constituent
DOT 2	190 °C (374 °F)	140 °C (284 °F)	?	Castor oil/alcohol
DOT 3	205 °C (401 °F)	140 °C (284 °F)	1500 mm2/s	Glycol Ether
DOT 4	230 °C (446 °F)	155 °C (311 °F)	1800 mm2/s	Glycol Ether/Borate Ester
LHM+	249 °C (480 °F)	249 °C (480 °F)	1200 mm2/s [6]	Mineral Oil
DOT 5	260 °C (500 °F)	180 °C (356 °F)	900 mm2/s	Silicone
DOT 5.1	260 °C (500 °F)	180 °C (356 °F)	900 mm2/s	Glycol Ether/Borate Ester

Wet boiling point defined as 3.7% water by volume.

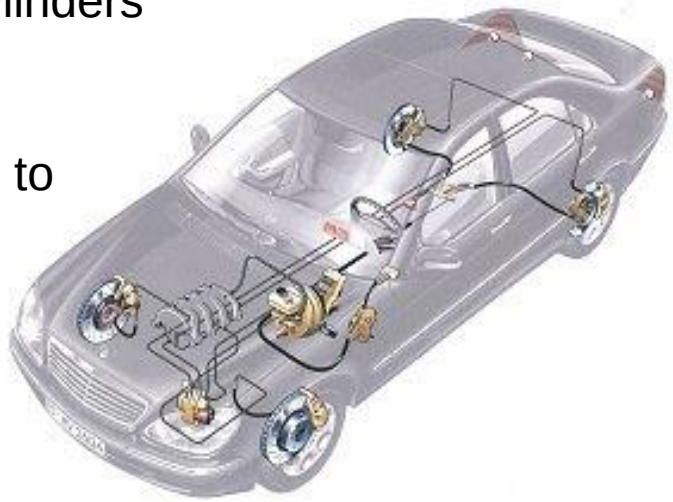


All approved fluids must be colorless or amber to be acceptable for street use according to DOT, except for DOT 5 silicone which must be purple.

Brake Fluid

Boiling point

Brake fluid is subjected to very high temperatures, especially in the wheel cylinders of drum brakes and disk brake calipers.
It must have a high boiling point to avoid vaporizing in the lines.
This vaporization is a problem because vapor is highly compressible relative to liquid and therefore negates the hydraulic transfer of braking force
- so the brakes will fail to stop the car !



Glycol-ether (DOT 3, 4, and 5.1) brake fluids are hygroscopic (water absorbing), which means they absorb moisture from the atmosphere under normal humidity levels.

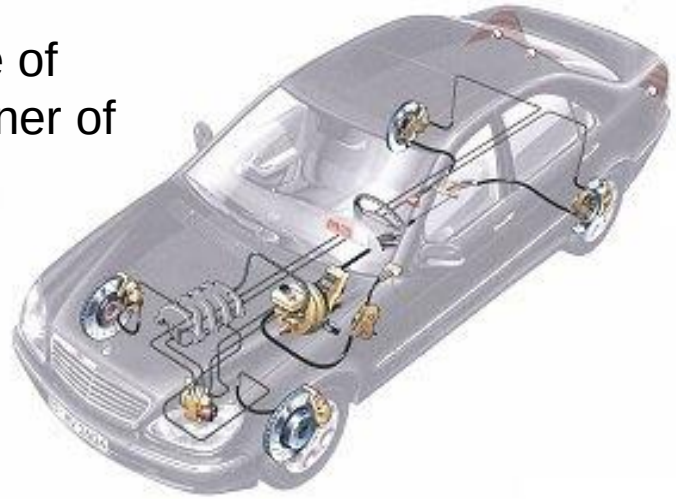
Silicone (DOT 5) brake fluids are hydrophobic and can maintain an acceptable boiling point over the fluid's service life but are more compressible than glycol fluids which leads to a “spongy” brake feeling. Further silicone based liquids are aggressive to non-compatible materials.

The higher the water content in the brake fluid, the lower is the boiling point !

Brake Fluid

Mixing of different brake fluids

To mix DOT 3 and DOT 4 brake fluid is possible, but in general only the type of brake fluid should be used that is written on the cap of the brake fluid container of the vehicle or which is approved by the vehicle manufacter.



To have a DOT 3 and DOT 4 compatible brake fluid
with DOT 5 specifications DOT 5.1 on Glycol-ether base was developed.

DOT 5 brake fluid (Silicone base) must **never** mixed with brake fluid of another type !

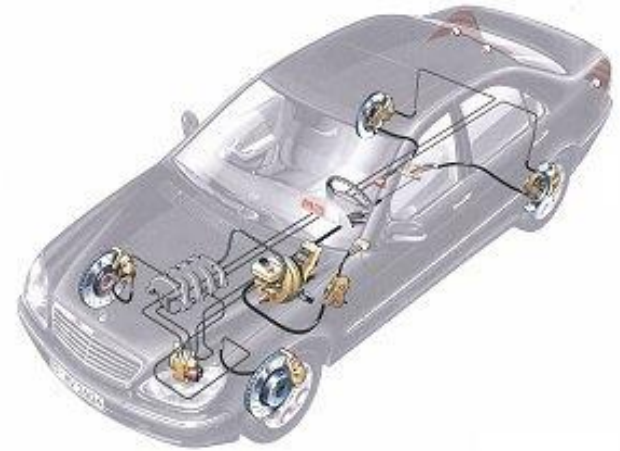
Observe manufacter´s instructions !

Brake Fluid

Brake Fluid RACE for motorsport

For the use in motorsport and it´s different requirements special brake fluids have been developed.
These liquids have a dry boiling point of more than 610°F (320°C).

Brake Fluid RACE is **not** designed for street use because it is strong hyrgoscopic and need to be changed frequently.



Observe manufacter´s instructions !