FAQ

Refilling motor oil: Can you mix motor oil in the car?

The mixability of modern motor oils with one another, regardless of the type, must be possible under any circumstances. For it is not always guaranteed that the average car driver will know which motor oil was used by the garage in an oil change.

Can a car manufacturer require a certain manufacturer of lubricants and other liquids for its vehicles?

No! You can, of course, always use the matching LIQUI MOLY product.

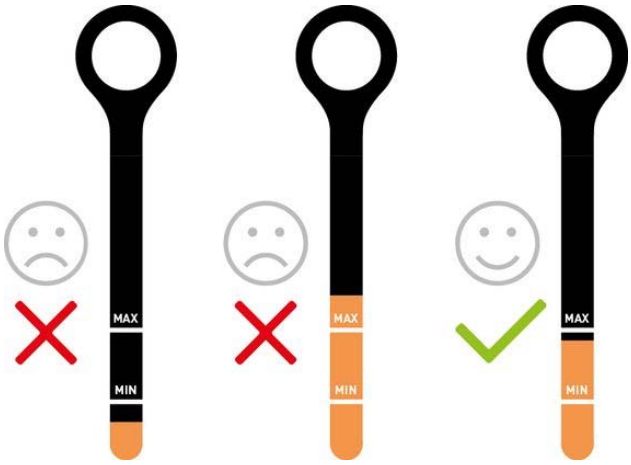
Filling motor oil: Can you simply add more motor oil to a car?

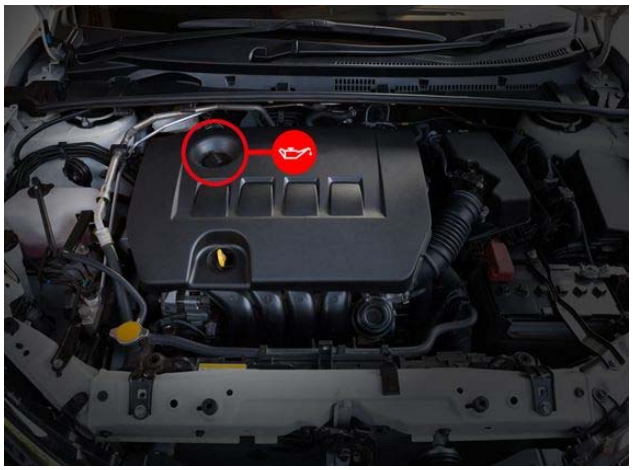
You do not need to be an expert to add more motor oil to a vehicle. Yet there are a few important things to bear in mind:

■Before the motor oil can be added to, the precise oil level has to be established. This takes place using the dip stick (mostly identified by color in the area of the oil filler neck). The vehicle must be on an even surface. To measure, simply pull out the dip stick, wipe off any oil, put it back in and pull it out again. Now the precise oil level can be read and, if necessary, easily corrected.

■On the dip stick, there is generally a liter between the marks of MIN. and MAX.

■The right oil has to be used. If this is not known, our **OIL GUIDE**





What happens if you add too much motor oil?

The oil level of the motor must always be correct, as both too little and too much oil can lead to serious damage of the motor. If you add too much oil, this can lead to the creation of many air bubbles. These air bubbles are then sucked by the oil pump and moved through the motor to the lubrication points. As air famously does not lubricate, greater wear is generated at the areas of friction to be lubricated, which can lead to motor damage.

A further problem of overfilling is increased oil pressure. This can lead to seals, which are supposed to keep the oil in the motor, being torn from their actual position or damaged and therefore the motor becoming leaky.

What does the acronym API stand for?

The acronym API stands for American Petroleum Institute. It sets the global quality requirements and testing criteria of lubricants, such as motor or gearbox oil.

Are petrol motor oil and diesel motor oil the same?

The question of which motor oil is suitable for diesel motors keeps coming up, again and again. But the times in which there were special motor oils for diesel motors are long gone. Modern motor oils fulfill both the requirements of petrol and diesel motors. What's important in the selection of the right motor oil is much more the specification or approval given by the vehicle manufacturer. If this is printed on the bottle label, then the oil can be used for the respective motor. Regardless of whether it's diesel or petrol.

What does light-brown sludge on the oil filler cap mean?

If a vehicle is mainly used for short journeys, this has the consequence that the condensation created by temperature differences mixes with the oil and does not evaporate. This oil/water emulsion is then deposited in the entire motor. This becomes visible at the oil filler cap in the form of light-brown sludge. In order to free the motor of this, LIQUI MOLY offers the oil sludge purge.

My oil is gray. Is this old oil?

The color of a motor oil provides no conclusions regarding quality or age. There are, therefore, chemical additives that superimpose on the actual color (amber) of the oil and therefore make it appear darker.

After how many kilometers does oil have to be added?

There is no general answer to how often a motor oil has to be refilled. Oil consumption can vary greatly even with motors identical in construction. If there is no oil level control fitted, the oil level should be checked every time you refuel and correspondingly reacted to.

Which motor oil do I need to use?

What's important in the selection of the right motor oil is the specification or approval given by the vehicle manufacturer, which can be found in the operating manual of the vehicle. If this is printed on the label of an oil, then this oil can be used for the respective motor. If you are not sure about this, our **OIL GUIDE** or our technical support by phone +49 731 1420-871 can help.

Check motor oil when cold or warm?

The fill level of the motor oil is always measured when it is warm. This ensures that the motor is in the temperature range in which it usually is, optimally supplied with lubricant.

Which motor oil should be used for snow blowers?

Fundamentally, the recommendation of the manufacturer should be followed when selecting the oil for snow blowers. However, experience shows that our **Special Tec LL 5W-30** covers the majority of snow blowers available on the market.

How can I tell that an oil change is really needed?

We keep receiving questions like "what do you think of a motor oil change after as long as two years?". Without a sound laboratory analysis of the old oil, the car driver cannot assess the condition of a motor oil by the color or by rubbing it between their thumb and index finger. When a change of the lubricant is necessary is decided either by the vehicle itself (variable) or the change was set by the manufacturer according to a fixed mileage or age. In the case of a variable change interval, the vehicle will tell you when a change is required. The mileage until the next change can simply be called up in the vehicle menu. Should a change be prescribed, the date is usually written on the oil note in the motor compartment or in the service booklet of the vehicle.

Does it damage the motor if I fill it with the wrong motor oil?

A definite yes! Modern motors are highly complex mechanical assemblies. Due to the high requirements expected of them they require a lubricant aligned to the materials and properties. If it does not receive this, the increased friction may lead to motor damage.

Why is my motor oil black again immediately after being changed?

As there are soot deposits in the oil circuit particularly in diesel motors, but also in petrol motors, the oil is often colored black after the first few revolutions of the motor. However, this is no reason to panic, as the oil is doing what it should: It is cleaning! While doing so, it is absorbing the soot deposits in the motor and then transporting it to the oil filter.

How long is oil good for?

The minimum durability in small containers is five years – assuming it is stored in a dry place at temperatures between + 5 °C and + 30 °C and is not in direct sunlight. The cellar, and not the garage, is ideally suited to storage.

My vehicle has been converted to gas, which oil should I use now?

Fundamentally, the specifications of the gas system manufacturer and the motor manufacturer should be observed. If the vehicle manufacturer approves more general specifications (e.g. ACEA C2/C3 or C4), then low ash oils according to this specification are to be preferred during gas operation. Furthermore, Cera Tec as an oil additive for gas-operated motors is of a fundamental advantage. A dose of 7% to 8% in the motor oil is optimum.

Does two-stroke oil become separated from the fuel after an extended storage period?

Two-stroke oil dissolves fully in fuel and does not become separated even after an extended storage period.

My vehicle manufacturer says I need to add a 5W-30 oil. Is this correct?

What is decisive for the selection of an oil is the quality and the manufacturer guidelines, not the viscosity. This information can be found on the container label. The 5W-30 specification relates only to the liquid condition of an oil at a certain temperature and is not a sign of quality.

Can mineral motor oils be mixed with synthetic motor oils?

Yes! The mixability of the motor oils with one another must be possible in order to guarantee refilling at any time. However – depending on the oil added – the quality or the properties of the existing oil are changed.

Why is the MoS2 low friction 10W-40 motor oil black, sludgy and looks like old oil?

Motor oil has molybdenum disulfide added to it. This anthracite-colored additive superimposes on the "normal" color of the oil.

FAQ

Can the oil additive also be mixed with fully synthetic motor oils?

Yes, this has been tested by a field test with company cars. The oil additive minimizes friction by approx. 30%.

Can two oil or fuel additives be used at the same time?

Yes, our additives are aligned to one another in their formula in such a way that they do not negatively influence themselves and the overall mixture. However, the dose specifications have to be observed, of course.

Can Motor Oil Saver also be used in vehicles with turbo motors?

Yes, as **Motor Oil Saver** contains softeners and viscosity improvers. It regenerates elastomer seals and has a slightly viscosity increasing effect at high temperatures. This creates a more efficient lubrication in turbo charger bearings.

For how many liters of fuel are LIQUI MOLY fuel additives designed?

Product Name	Item no.	Dose
mtx Carburetor Cleaner	5100	300 ml for up to 70 l
Injection Cleaner	5110	300 ml for up to 70 l
Valve Clean	1014	150 ml for up to 75 l
Super Diesel Additiv	5120	250 ml for up to 75 l
Diesel Purge	5170	500 ml for up to 75 l
Diesel Smoke Stop	5180	150 ml for up to 50 l
Diesel Lubricity Additive	5122	150 ml for up to 80 l
Diesel Flow Fit	5130	150 ml for up to 75 l

Does using Diesel Flow Fit in biodiesel or plant oil fuel improve the low temperature resistance?

No, with these fuels there is no improvement of the low temperature resistance.

By how many degrees Celsius is the low temperature resistance in summer diesel improved by using Diesel Flow Fit?

When using conventional summer diesel fuels, which have a low temperature resistance of 0 °C, an improvement to -6 ° to -8 °C is achieved when meeting the dose of **Diesel Flow Fit.**

Can Oil Additive or Motor Protect also be used in motorbikes?

For clutches that run in oil baths, 20 ml of additive can be added per liter of motor oil. This ensures there is no clutch slippage. Using **Motor Protect** on clutches running in oil baths is generally not recommended.

Does Motor Protect tolerate the new Longlife oils?

Yes, **Motor Protect** can be used in modern Longlife oils such as **Synthoil Longtime Plus 0W-30** and **Synthoil Longtime 0W-30.**

Can Motor Oil Saver (item no. 1005) also be used in clutches running in oil baths, e.g. wet clutches of motorbikes?

The use of **Motor Oil Saver** in motors with clutches running in oil baths can lead to clutch slippage due to the additives contained therein. In this case, we do not recommend its use.

Are Injection Cleaner or Valve Clean also intended for motorbikes?

Generally, yes. However, LIQUI MOLY has a special motorbike program in which this formula is specially aligned to the lower tank volume of the motorbikes.

FAQ

Are various products of the LIQUI MOLY care series silicone-free?

Generally, most care products include silicone. But silicone is also included in products by our competitors. Exceptions include paint cleaner or silicone remover, which are used for removal before painting.

FAQ

Does two-stroke oil become separated from the fuel after an extended storage period?

Two-stroke oil dissolves fully in fuel and does not become separated even after an extended storage period.

Can I add an HLP to the power steering of my vehicle?

No! HLP oils are hydraulic oils and are not intended for use in power steering. In the worst case this can lead to a failure of steering – particularly in low temperatures. Therefore please always observe the manufacturer approvals and requirements, as the steering is a safety-relevant component.

Are greases by LIQUI MOLY acid-free?

Yes!

FAQ

1. Terms from A – Z

ACEA

ACEA (Association des Constructeurs Européens d'Auto mobiles) has been the official successor organization of CCMC since 1/1/1996. It defines the quality of motor oils according to the requirements of European motor manufacturers.

ADDITIVE PACKAGE

An additive package is a mixture of various chemical materials that influence the properties of the motor oil in different ways.

ALKALINE RESERVES

The alkaline reserves of an oil neutralize acidic reaction products, which are created during the combustion of fuel.

API

The American Petroleum Institute (API) determines the global quality requirements and testing criteria for lubricants.

ATF

So-called Automatic Transmission Fluids (ATF) have a defined friction value and have a high viscosity index. The oils are mainly used in automatic transmissions and power steering.

BASE NUMBER

The base number shows the quantity of alkaline reserves in motor oils. In used oils the base number gives an idea of the remaining additives that have not yet been used.

BASE OIL

Base oil is the base product for the manufacture of lubricating oils. Base oils (mineral, hydrocracked or fully synthetic) are manufactured by various refinery processes.

CATALYTIC HYDROCRACKING

During catalytic hydrocracking, in the presence of a catalytic converter (e.g. synthetic aluminosilicates), and at a temperature of 500 °C the molecule chains are broken.

CRACKING

In cracking, long hydrocarbon molecules are broken up. These broken molecule chains form the base product for synthetic oils. ´

CRUDE OIL

Crude oil is a mixture mainly made up of hydrocarbons, which is created by the decomposition process of organic materials.

DISTILLATION

During distillation crude oil is heated under atmospheric pressure and disassembled into its natural components.

DETERGENTS

Detergents are wash-active substances that protect the motor against deposits. Also, detergents form the so-called alkaline reserves.

DEWAXING

During dewaxing wax crystals are removed from the corresponding distillate, in order to improve the pour point (the lowest temperature in which the oil is still flowing, when it is cooled under certain conditions)

DISPERSANTS

The dispersants contained in motor oil coat solid and liquid contamination in the oil and transport them to the oil filter.

EP ADDITIVES

Extreme Pressure additives (EP) form a "protective layer" on the metal surfaces under high pressure and great heat.

FULLY SYNTHETIC BASE OIL

Fully synthetic base oils are manufactured based on naphtha (petroleum). These oils have very good temperature and aging stability.

GL

GL means "Gear Lubricant" and identifies the pressure stability of a gearbox oil according to API.

HTHS VISCOSITY

High Temperature High Shear (HTHS) is the dynamic viscosity of a liquid measured at 150 °C under the influence of high shear forces.

HYDROCRACKED BASE OIL

Hydrocracked base oils are manufactured based on paraffin. These oils are currently state-of-the-art and are also used in cutting edge petrol/diesel motors.

HYDROCRACKING

During hydrocracking, long molecule chains are broken up in the presence of hydrogen. This hydrogen stores itself in the open chain ends and "repairs" the breakage.

HYDROFINISHING

Hydrofinishing is the addition of hydrogen during the manufacturing of mineral base oil for ensuring optimum aging stability.

JASO

The Japanese Automotive Standards Organisation (JASO) divides lubricating oils into various classes and is mainly used in the motorbike sector or in Asia.

LIMIT TEMPERATURE

The pump limit temperature identifies the temperature up to which the motor oil can still flow to the oil pump by itself.

LOWER TEMPERATURE VISCOSITY

This is the temperature at which a vehicle that is in good technical condition can still be started. The cold start safety is at approx. 5 °C over the limit pump temperature.

MINERAL BASE OIL

Mineral base oils are a direct product of crude petroleum distillation. This type of base oil is no longer used in modern motors.

NAPHTA

Naphta is petroleum, which represents a product of crude petroleum distillation.

PARAFFIN

Wax crystals that form the byproduct of the manufacture of mineral base oil are described as paraffin.

POUR-POINT

The pour point is the lowest temperature at which the oil just about flows when it is cooled down under certain conditions.

POUR-POINT-DEPRESSANT

A Pour Point Depressant (PPD additive) changes the structure of the wax crystals in the base oil and delays their growth. This minimizes the solidification point of the oil or improves the low temperature property.

REFINING

Refining is the removal/conversion of unwanted parts from vacuum distillation.

SAE International

SAE International (formerly the Society of Automotive Engineers) specifies the valid viscosity classes for motor and gearbox oils in the automotive industry, which manufacturers around the world conform to.

VACUUM DISTILLATION

In vacuum distillation objects are separated from distillation of the raffinate under a vacuum. With the vacuum the boiling point can be reduced by approx. 150 °C and therefore the cracking of the molecules is prevented.

VISCOSITY SINDEX

The Viscosity index (VI) describes the viscosity/temperature behavior of the oil. The higher the VI, the lower the change in viscosity across the entire temperature range.

VISCOSITY INDEX IMPROVERS

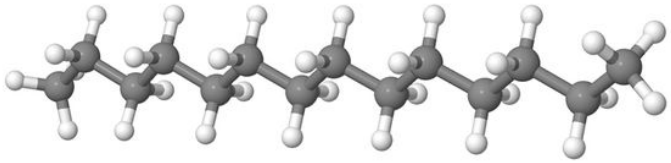
Viscosity index improvers are polymers that are constructed in such a way that they influence the temperature-dependent viscosity change of an oil.

VISCOSITY

Viscosity is the resistance (inner friction) of a fluid. The higher the resistance, the more viscous the oil is. The viscosity in motor and gearbox oils is given according to SAE.

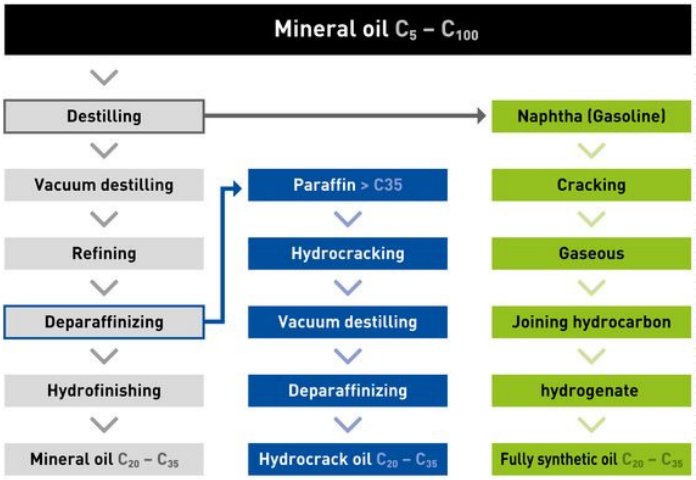
2. Crude petroleum

Crude petroleum was created by dead plankton that sank to the bottom of the seabed millions of years ago. Over the course of time, sand and stones built up on top of it. Due to this impermeable layer and under oxygen exclusion, pressure and heat, the conversion of these "lifeforms" into crude petroleum took place. The basic building blocks of crude petroleum are hydrocarbon compounds, which can occur in various chain lengths (C5 - C100).



3. Various base oils

Base oils form the base product for the manufacturing of motor oils. The various base oils (mineral, hydrocracked or fully synthetic) are manufactured by various refinery processes (see sketch).



3.1 Mineral base oil

Mineral base oil is the simplest and oldest form of base oil. In manufacturing the already described crude oil serves as a direct base product. The crude oil is heated in a furnace and disassembled into its natural components (distilled). Then unwanted and damaging components are removed from the distillate by the refining process or by dewaxing. Thanks to the subsequent hydrofinishing, the raffinate specifically has hydrogen added to it, which closes the open molecule chains and therefore significantly increases the aging stability.

3.2 Fully synthetic base oil

Fully synthetic base oil is mainly characterized by its very good thermal stability and cleaning performance. As high performance as it is, so laborious its manufacture also is. So-called naphtha (petrol without additives) serves as the base product. Naphta in cracked in the first step, which means that the molecule chains (C_5 – C_{12}) split open and are broken down to a length of C_2 – C_3. The former liquid is now gaseous. In the consequent synthesis process the short molecule chains (C_2 – C_3) are added to long molecule chains (C_{20} – C_{35}) and sealed by adding hydrogen (hydrogenation).

3.3 Hydrocracked base oil

Hydrocracked base oil combines the positive properties of mineral and fully synthetic base oils with one another. This base oil type offers a very good thermal stability and resistance to aging with simultaneously absolute material compatibility. The basis for hydrocracked base oils are formed by the paraffin taken from the mineral oil extraction. The paraffin is made up of long-chained molecule compounds (> C_{35}). These are split open in the presence of a catalytic converter under a pressure of 70 - 200 bar and temperatures of up to 500 °C and shortened to a useful length of C_{20} – C_{35} (catalytic hydrocracking). The liquid in the vacuum is subsequently distilled, in order to avoid the cracking of the molecule chains. In the last step, any paraffin deposits are removed

4. Additive package

In most cases the base oil alone is not sufficient to cover the many tasks that an oil has to fulfill in a motor, for example. For a reliable lubrication and seamless operation the base oils of additives are added. With the help of these additives, certain properties of the oil can be improved or completely new properties achieved. The list of the additives used for this is varied and long. The individual materials are, depending on the requirement, comprised in an additive package. This package added to the base oil heated from 40 °C to 60 °C and is stirred until it is completely dissolved in the oil. In modern motor oils the concentration of additives can be up to 30% or less than 1% in gearbox oils.

Fundamentally, you can differentiate between two types of additives:

■Additives that have an effect on the base oil, e.g. pour point improvers, anti-foam additives or viscosity index improvers.

■Additives that have an effect on the material surfaces (bearings, cylinders ...), e.g. bonding enhancers or friction modifiers (friction value improvers).

Here is a list of the properties of an oil that can be influenced by additives:

Characteristics	Influenceable by additives	Only possilbe by additives	Not influenceable by additives
low-temperature behaviour	●	○	○
Aging stability	●	○	○
Viscosity/ temperature behaviour	●	○	○
Corrosion protection	●	○	○
Dirt solving ability	●	●	○
Dispersing power	●	●	○
High presure properties	●	●	○
foaming characteristics	●	●	○
air discharging	○	○	●
Water separation	○	○	●

4.1 Detergents

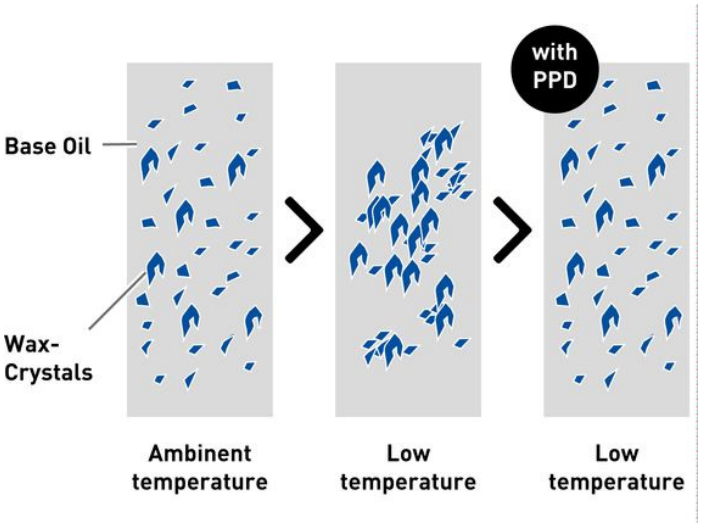
Detergents are wash-active substances in the oil, which prevent the formation of deposits or free the motor of them. If these are used up by exceeded oil change intervals, for example, the result is the increased formation of deposits (see picture). This causes friction to measurably increase in the motor, risking motor damage.

4.2 Extreme Pressure Additives

Extreme Pressure Additives (EP additives) are added to the oil in the form of sulfur or phosphorous in order to prevent fusing due to high pressures or loads of the friction partners. In this case, EP additives in lubricants are indispensable. Under high pressures or loads, high temperatures are created in the lubricant. This causes sulfur (sulfur carriers) or a phosphorous derivative (compounds containing phosphorous) to be released from the EP additive. Under these conditions, the released substance immediately reacts with the metal surface to metal sulfides or phosphates. The connections form on the metal surface layers that are sheared off under the high pressure, with which a fusing of the metal surfaces is prevented.

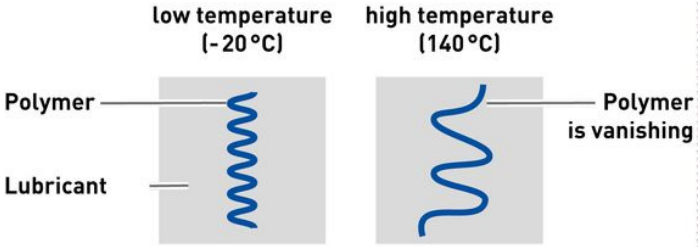
4.3 Pour-Point-Depressant (PPD)

The PPD additive is used to reduce the solidification point of the lubricant and therefore improve the low temperature properties. The wax crystals included in base oil are changed in their structure by the additive and their growth is significantly slowed down at low temperatures.



4.4 Viscosity index improvers

Viscosity index improvers are macromolecular polymers (combination of macromolecules) that are constructed in such a way that they influence the temperature-dependent viscosity change of an oil. The polymer contracts at low temperatures. This makes the resistance that the polymer opposes an invading body with smaller and the viscosity change of the base oil is equalized..



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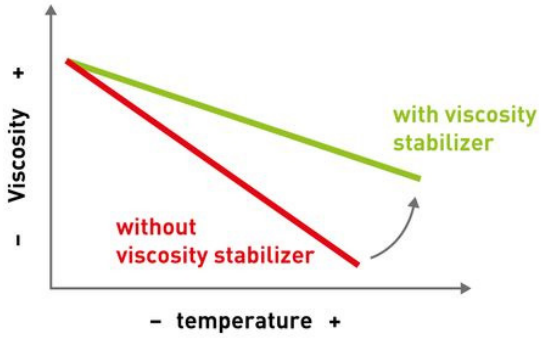
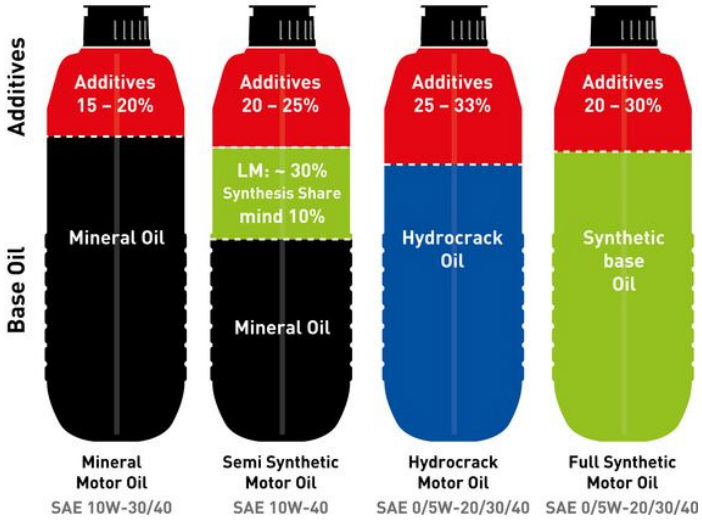


4.5 Anti-foam additives

An unwanted byproduct of circulation lubrication is the inclusion of small air bubbles in the motor oil. Anti-foam additives cause a significant reduction of foam created in the circulation of oil (air pockets).

4.6 Additive share in motor oils



5. Classification of motor oil

In order to select the correct motor oil, two pieces of information are required. Firstly, the viscosity, and, secondly, the quality is required. Numerous organizations have arisen over the past few decades for these classifications:

■SAE (Society of Automotive Engineers)

■API (American Petrol Institute)

■ACEA (Association des Constructeurs Européens d'Automobiles)

■ILSAC (International Lubricant Standardization and Approval Committee)

■JASO (Japanese Automotive Standards Organization)

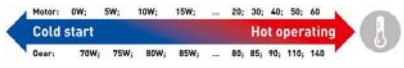
The well-known European vehicle or motor manufacturers (Mercedes-Benz, BMW, VW ...) conform to SAE for viscosity information and ACEA for quality information.

The motor oils to be used for import vehicles that were developed outside of Europe (Toyota, Mitsubishi, Chrysler ...) mainly conform to API or ILSAC and SAE.

5.1 Classifications by SAE

The viscosity gives only information about the inner friction of a motor or gearbox oil and therefore does not define any kind of qualitative properties. This means that a motor oil that fulfills a viscosity as per SAE has a prescribed flow behavior at various temperatures. The viscosity is divided into the cold start range (e.g. 0W) and the operating temperature range (e.g. 30). The higher the given figure, the more viscous the motor/gearbox oil is in the corresponding temperature range. The letter "W" identifies the winter suitability of the oil (multi-grade oil). If this addition is missing, then the oil may only be used in summer.

Up to which low temperature a motor/gearbox oil can be used depends on the flowability in the limit temperature range. The deeper the expected temperature, the less viscous the oil has to be.

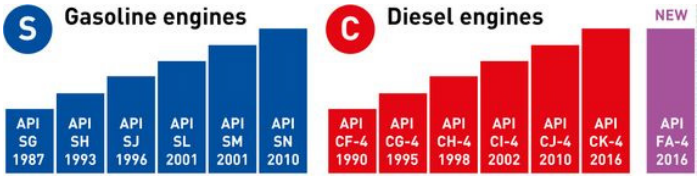


limit temperature for motor oil	
SAE 0W	-40 °C
SAE 5W	-35 °C
SAE 10W	-30 °C
SAE 15W	-25 °C
SAE 20W	-20 °C
SAE 25W	-15 °C

Limit temperature gear oil	
SAE 70W	-50 °C
SAE 75W	-35 °C
SAE 80W	-21 °C
SAE 85W	-20 °C

5.2 Classification by API

The American Petrol Institute fundamentally differentiates between two different types of motor oil: On the one hand, motor oils for gasoline motors (S), on the other, motor oils for diesel motors (C). The letter following the first letter, e.g. "G" or "H", defines the quality of the lubricant. The later in the alphabet this letter is, the higher quality the motor oil is. The higher classifications such as API SN can be used by API for the preceding classifications without hesitation, e.g. API SL. For motor oils for diesel motors a "4" can additionally be displayed. This addition identifies the suitability for large motors such as trucks or buses (heavy duty).



5.3 Classification by ACEA

The Association des Constructeurs Européens d`Automobiles forms the oil standard for European vehicle or motor manufacturers. Here – as with API – oils for petrol motors (A) and light diesel motors (B) are differentiated. Unlike with the API, at the ACEA every category has its own meaning and cannot be used backwards compatibly.

5.3.1 Car petrol and diesel motors

A1/B1	High-performance motor oil for petrol and diesel motors, so-called fuel economy motor oils with particularly low High Temperature High Shear viscosity (2,9 - 3,5 mPA*s). Reserved for viscosity class xW-20. Invalid since 12/2016.
A3/B4	High-performance motor oil for petrol and diesel motors, extends and replaces conventional motor oils like ACEA A2/B2 and A3/B3 and can be used for extended change intervals.
A5/B5	High-performance motor oil for petrol and diesel motors, so-called fuel economy motor oils with particularly low High Temperature High Shear viscosity (2,9 - 3,5 mPa*s). Reserved for viscosity classes are xW-30 and xW-40.

5.3.2 Car diesel motors with diesel particulate filters

C1	Category for low SAPS oil with reduced HTHS viscosity ≥ 2.9 mPa*s, low viscosity, performance as with A5/B5, but with very limited proportions of sulfate ash, phosphorous, sulfur.
C2	Category for low SAPS oil with reduced HTHS viscosity ≥ 2.9 mPa*s, low viscosity, performance as with A5/B5, with limited, but higher proportions of sulfate ash, phosphorous, sulfur compared to C1.
C3	Category for low SAPS oil with high HTHS viscosity ≥ 3.5 mPa*s, low viscosity, performance as with A3/B4, with limited, but higher proportions of sulfate ash, phosphorous, sulfur compared to C1.
C4	Category for low SAPS oil with high HTHS viscosity ≥ 3.5 mPa*s, low viscosity, performance as with A3/B4, with the same proportions of sulfate ash and sulfur, but increased proportion compared to C1.
C5	C5 category for mid-SAPS oil with reduced HTHS 2.6 – 2.9 mPas*s, low viscosity, for even more improved and optimum fuel savings, for vehicles with state-of-the-art exhaust aftertreatment systems, only for engines meeting the corresponding technical requirements.

5.3.3 Commercial vehicle diesel motors

E1	Category not up to date.
E2	Category not up to date.
E3	Category is included in ACEA E7.
E4	Based on MB 228.5, extended oil change possible, suitable for Euro 3 motors.

E5	Category is included in ACEA E7.
E6	Category for EGR motors with/without diesel particulate filters (DPF) and SCR-NOX motors. Recommended for motors with diesel particulate filters combined with sulfur-free fuel. Sulfate ash content max. 1%.
E7	Category for motors without diesel particulate filters (DPF) of the most EGR motors and the most SCR-NOX motors. Sulfate ash content max. 2 %.
E9	Category for motors with/without diesel particulate filters (DPF) of the most EGR motors and the most SCR-NOX motors. Recommended for motors with diesel particulate filters combined with sulfur-free fuel. Sulfate ash content max. 1%.

5.4 Classification by ILSAC

The International Lubricants Standardization and Approval Committee is very strongly based on the categories according to API in its classification of motor oils. There are five classification categories for petrol motors, but none for diesel motors.

ILSAC

GF-1	introduction year 1996, comparable with API SH, category not up to date
GF-2	introduction year 1997, comparable with API SJ
GF-3	introduction year 2001, comparable with API SL
GF-4	introduction year 2004, comparable with API SM
GF-5	introduction year 2010, comparable with API SN

5.4 Classification by JASO

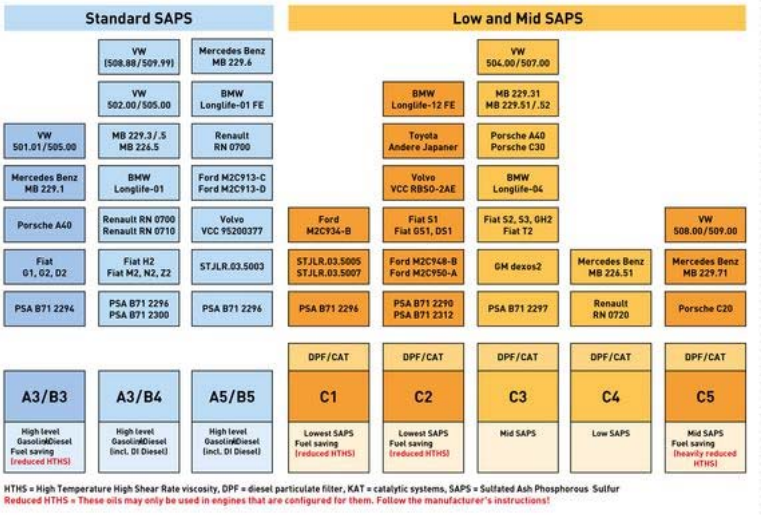
The Japanese Automobile Standard Organisation sets out the criteria for two-wheel oils. Here increased requirements of friction behavior (wet clutches), shear stability and burning behavior are set out. The JASO and API classifications are always occur together in the two-wheel sector.

JASO

MA	4-stroke motors – high friction value for motorbikes with wet clutches
MA 2	4-stroke motors – high friction value for motorbikes with wet clutches
MB	4-stroke motors – low friction value for motorbikes without wet clutches
FB	2-stroke motors – low cleaning, incomplete combustion
FC	2-stroke motors – high cleaning, almost complete combustion
FD	2-stroke motors – highest cleaning, complete combustion

6. Car manufacturer specifications

Based on European vehicle manufacturers, the prescribed vehicle specifications are based on the motor tests of the ACEA. In order to achieve a manufacturer approval for a certain oil, in addition to the respective ACEA test procedure, further motor tests and requirements must be fulfilled. An overview of which manufacturer specification is based on which ACEA classification can be seen here:



6.1 BMW

Approvals for BMW motors

Longlife-98	Based on ACEA A3/B3, can be used from model year '98, is replaced by Longlife-01
Longlife-01	Based on ACEA A3/B4, can be used from model year '01, is replaced by Longlife-04
Longlife-04	Based on ACEA C3, can be used from model year '04
Longlife-12 FE	Based on ACEA C2, can be used from model year '13, reduced HTHS viscosity, not backward compatible
Longlife-14 FE+	Based on ACEA A1/B1, can be used from model year '14, reduced HTHS viscosity, not backward compatible

6.2 Fiat/Alfa Romeo/Lancia

Approvals for Fiat, Alfa Romeo and Lancia motors

9.55535-CR1	Based on ILSAC GF-5 or API SN, viscosity class 5W-20
9.55535-DS1	Based on ACEA C2, viscosity class 0W-30
9.55535-G1	Based on ACEA A1 or A5, viscosity class 5W-30, special development for CNG motors
9.55535-G2	Based on ACEA A3, viscosity classes 10W-40 and 15W-40, can be used in older gasoline motors
9.55535-GH2	Based on ACEA C3, viscosity class 5W-40, special development for "1750 turbo motor"
9.55535-GS1	Based on ACEA C2, viscosity class 0W-30, special development for 0.9 Twin Air (turbo) motor
9.55535-H2	Based on ACEA A3, viscosity class 5W-40, suitable for extended change intervals
9.55535-M2	Based on ACEA A3/B4, viscosity classes 0W/5W-40, suitable for extended change intervals
9.55535-N2	Based on ACEA A3/B4, viscosity class 5W-40, suitable for gasoline and diesel turbo motors
9.55535-S1	Based on ACEA C2, viscosity class 5W-30, suitable for gasoline and diesel turbo motors with WIV
9.55535-S2	Based on ACEA C3, viscosity class 5W-40, suitable for gasoline and diesel motors with WIV
9.55535-S3	Based on ACEA C3, viscosity class 5W-30, special development for Chrysler, Jeep and Lancia

9.55535-T2	Based on ACEA C3, viscosity class 5W-40, special development for gas motors
9.55535-Z2	Based on A3/B4, viscosity class 5W-40, special development for twin turbo diesel motors

6.3 Ford

Approvals for FORD motors

WSS-M2C-913-A	Based on ACEA A1/B1
WSS-M2C-913-B	Based on ACEA A1/B1, backwards compatible with WSS-M2C-913-A
WSS-M2C-913-C	Based on ACEA A5/B5, backwards compatible with WSS-M2C-913-B
WSS-M2C-913-D	Based on ACEA A5/B5, replaces WSS-M2C-913-A, B and C
WSS-M2C-925-B	Based on API SM, backwards compatible with WSS-M2C-925-B, is replaced by WSS-M2C-948-B
WSS-M2C-917-A	Based on ACEA A3/B4, counterpart to VW 505.01
WSS-M2C-934-B	Based on ACEA C1, viscosity class 5W-30
WSS-M2C-948-B	Based on API SN, specially developed for Ford EcoBoost motors
WSS-M2C-950-A	Based on ACEA C2, specially developed for Euro 6 TDCi-engines, viscosity class 0W-30

6.4 Mercedes-Benz

Approvals for Mercedes-Benz motors

MB-Freigabe 229.1	For all cars up to 03/2002, is replaced by MB 229.3
MB-Freigabe 229.3	For intervals up to 30,000 km, is replaced by MB 229.5
MB-Freigabe 229.5	Stricter requirements than with 229.3, intervals up to 40,000 km possible
MB-Freigabe 229.31	Requirements as with 229.3 but low-ash, is replaced by MB 229.51
MB-Freigabe 229.51	Requirements as with 229.5 but low-ash, is replaced by MB 229.52
MB-Freigabe 229.52	Increased requirements of oxidation stability and fuel saving
MB-Freigabe 226.5	Based on Renault RN0700
MB-Freigabe 226.51	Based on Renault RN0720
MB-Freigabe 229.6	Based on ACEA A5/B5, not backward compatible
MB-Freigabe 229.71	Based on ACEA C5, not backward compatible

6.5 Opel

Approvals for OPEL motors

GM LL-A-025	Based on ACEA A3/B3, specification for petrol motors, is replaced by GM Dexos 2
GM LL-B-025	Based on ACEA A3/B4, specification for diesel motors, is replaced by GM Dexos 2
GM Dexos 2	Based on ACEA C3, applicable for all motors from model year '10

6.6 Peugeot/Citroën

Approvals for Peugeot motors

PSA B71 2290	Based on ACEA C3 with viscosity class 5W-30
PSA B71 2295	Based on ACEA A2/B2 for motors before model year 1998, no defined viscosity
PSA B71 2296	Based on ACEA A3/B4 with viscosity classes 0W-30, 0W-40, 5W-30 and 5W-40
PSA B71 2300	Based on ACEA A3/B4 with viscosity class xW-40, xW-50
PSA B71 2312	Based on ACEA C2 with viscosity class 0W-30

6.7 Porsche

Approvals for PORSCHE motors

A 40	Based on ACEA A3 with viscosity classes 0W-40 and 5W-40, for petrol motors from 1994
C 20	Based on ACEA C5, corresponds to VW 508.00/509.00, not backward compatible
C 30	Based on ACEA C3, corresponds to VW 504.00/507.00

6.8 Renault

Approvals for RENAULT motors

RN 0700	Based on ACEA A3/B4, permitted for all Renault petrol motors
RN 0710	Based on ACEA A3/B4, permitted for all Renault diesel motors without a particulate filters
RN 0720	Based on ACEA C4, permitted for all Renault diesel motors with particulate filters

6.9 Volkswagen

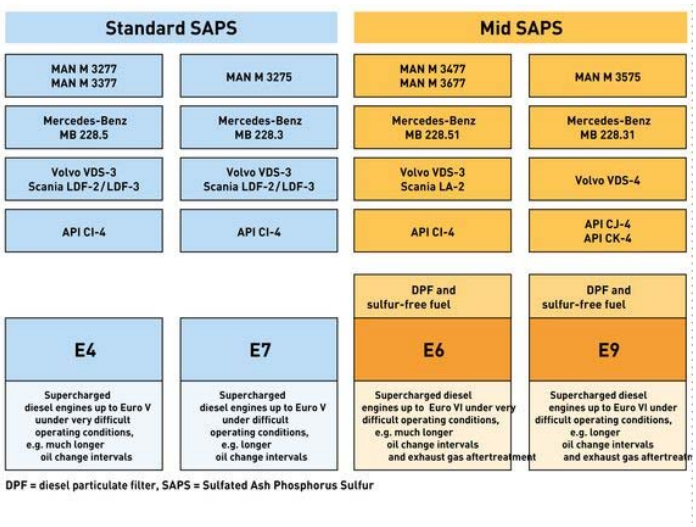
Approvals for VW motors

VW 500.00	Multi-grade oil with viscosity classes SAE 5W-X/10W-X, is replaced by VW 501.01

VW 501.01	Multi-grade oil with viscosity classes SAE 5W-X/10W-X, is replaced by VW 502.00
VW 502.00	Multi-grade oil for higher requirements
VW 503.00	Longlife specification for petrol motors, based on ACEA A1, viscosity classes 0W-30/5W-30
VW 503.01	Longlife specification for supercharged petrol motors, viscosity class 5W-30
VW 505.00	Multi-grade oil for vacuum and turbo diesel motors
VW 505.01	Multi-grade oil for unit injector motors, based on ACEA B4, viscosity class 5W-40
VW 506.00	Longlife specification for supercharged diesel motors, viscosity class 0W-30
VW 506.01	Longlife specification for unit injector motors
VW 504.00	Specification for petrol motors with and without Longlife service, replaces all petrol specifications listed above
VW 507.00	Specification for diesel motors with and without Longlife service, replaces all diesel specifications listed above (Except for R5 and V10 TDI motors before CW 22/06)
VW 508.00	Longlife IV-specification for petrol motors with and without Longlife service, is not backward compatible, viscosity class SAE 0W-20
VW 509.00	Longlife IV-specification for diesel motors with and without Longlife service, is not backward compatible, viscosity class SAE 0W-20

7. Commercial vehicle manufacturer specifications

Based on European vehicle manufacturers, the prescribed vehicle specifications are based on the motor tests of the ACEA or the API. In order to achieve a manufacturer approval for a certain oil, in addition to the respective ACEA/API test procedure, further motor tests and requirements must be fulfilled. An overview of which manufacturer specification is based on which ACEA/API classification is shown in the illustration below.



7.2 MAN

Approvals for MAN motors

M3275	SHPD motor oil, change interval of up to 60,000 km possible
M3277	UHPD motor oil, change interval of up to 80,000 km possible
M3377	Higher requirements of cleanliness/deposits than M3277, change interval according to display
M3477	Same as M3277 but low-ash for Euro 5 motors with DPF
M3677	Euro 6 motors with DPF, change interval up to 120,000 km possible

7.3 Renault

Approvals for RENAULT motors

RD/RD-2	Based on ACEA E3 + Volvo VDS-2
RLD/RLD-2	Based on ACEA E7 + Volvo VDS-3
RLD-3	Based on ACEA E9 + Volvo VDS-4
RXD	Based on ACEA E7 + Volvo VDS-3
RGD (Gas)	Based on ACEA E6 + Volvo VDS-3 + TBN >8

7.4 Scania

Approvals for SCANIA motors

Scania LDF	Based on ACEA E5
Scania LDF-2	Based on ACEA E7 applicable from Euro 4
Scania LDF-3	Based on ACEA E7 applicable from Euro 6
Scania Low Ash	Basis ACEA E6/E9 (low-ash)

7.1 Iveco

Approvals for IVECO motors

18-1804 FE	Based on ACEA E4/E5 with TBN content >14
18-1804 TLS E6	Based on ACEA E6 with TBN content >13
18-1804 T2 E7	Based on ACEA E7 with TBN content >14
18-1804 TLS E9	Based on ACEA E9 or API CJ-4
18-1804 TFE	Based on ACEA E4/E7 with TBN content >16

7.5 Volvo

Approvals for VOLVO motors

Volvo VDS	Based on API CD/CE, maintenance intervals up to 50,000 km possible
Volvo VDS-II	Based on ACEA E7, maintenance intervals up to 60,000 km possible
Volvo VDS-III	Based on ACEA E5, maintenance intervals up to 100,000 km possible
Volvo VDS-IV	Based on API CJ-4, short-distance, low-ash

8. Motorbike manufacturer specifications

In motorbike motors the manufacturers largely forgo their own oil specifications and use the API or JASO determined motor tests for determining oil quality. In addition to determining the oil quality, for motorbikes that are equipped with clutches running in oil baths (wet clutch), higher requirements of shear stability, burning behavior and, above all, friction behavior have to be fulfilled. Whether an oil fulfills these properties can be found out via the JASO specification, which has to be listed under the approvals.

Approvals for motorbike motors by JASO

JASO MA(2)	4-stroke motors – high friction value for motorbikes with wet clutches
JASO MB	4-stroke motors – low friction value for motorbikes without wet clutches
JASO FB	2-stroke motors – low cleaning, incomplete combustion
JASO FC	2-stroke motors – high cleaning, almost complete combustion
JASO FD	2-stroke motors – highest cleaning, complete combustion

9. Gearbox oil

In order to be able to ensure a malfunction-free operation, modern gearboxes require a modern high-performance lubricant, which protects the gearbox against friction and, at the same time, does not affect the shifting characteristics. The type and quantity of additives in the lubricant has a significant influence on various parameters, such as the shifting capacity, the change interval, the friction behavior and the wear protection. It is therefore urgently necessary that the classifications or approvals given by the manufacturer are upheld upon changing the gearbox oil. There are as many gearbox oils as there are types of gearbox. They are first roughly differentiated by manual gearbox or axle drive, automatic gearbox and dual-clutch gearbox. Within these upper groups there are various subgroups, which each need a special lubricant aligned to the construction type and purpose of use. In gearbox oils there is no uniform basis that the manufacturers are obliged to uphold (e.g. ACEA). This leads to a variety of special manufacturer approvals.

EXAMPLES

Mercedes-Benz:	24 ATF approvals (MB approval 236.x) 21 (Hypoid) gearbox oil approvals (MB approval 235.x)
Volkswagen:	14 ATF approvals (G 052 xxx, G055 xxx, G060 xxx) 15 (Hypoid) gearbox oil approvals (G 052 xxx, G055 xxx, G060 xxx)

9.1 Classification of gearbox oils

In order to at least be able to get a general answer as to what quality or which properties a gearbox oil corresponds to, over the course of the past few decades, division into by API for manual gearbox and axle drives and by Dexron for automatic gearboxes. The manufacturers made use of this division over a long period of time. After the gearbox became ever more complex, however, this division was no longer sufficient. The viscosity of the manual gearbox and axle drive is – as with motor oils – classified by SAE. The viscosity of automatic gearbox oils, so-called ATF oils (Automatic Transmission Fluid), is not classified by SAE, as the

viscosity is a part of the respective manufacturer approval.

9.1.1 API (manual gearbox or axle drive oils)

GL 1	low load hypoid or worm gearbox	0 % additives
GL 2	Worm gearbox (not in road vehicles)	up to 1.5 % additives
GL 3	Manual gearbox (vintage)	up to 2.7 % additives
GL 4	Manual gearbox, hypoid gearbox if permitted	up to 4 % additives
GL 5	Hypoid gearbox, manual gearbox if permitted	up to 6.5 % additives

9.1.2 GM Dexron (automatic gearbox)