1. Single-grade or multigrade oils

Single-grade engine oils SAE 10W, SAE 30, etc. only cover one SAE viscosity class and must among other things be changed depending on the climate zone and time of year.

The single-grade oils SAE 30 and SAE 40, which are suitable for high thermal loads on engines, make reliable cold starts more difficult or impossible at low outside temperatures and lead to undesirably high viscosity-related friction losses in the warm-up phase.

In contrast, the single-grade oils SAE W and SAE 1010W W-20 which are very suitable for cold starts are not suitable for use at high outside temperatures. These low-viscosity oils cannot ensure the necessary protection against wear.

Multigrade oils are engine oils which differ in comparison with single-grade oils by a slight temperature-dependent viscosity change. Due to their higher viscosity
inde
x
(lower viscosity/temperature dependence) they can be used in a relatively wide temperature range.

A correctly manufactured, shear-stable multigrade oil, e.g. SAE grade 10W-40, meets the requirements of SAE grade 10W at low temperatures for cold flow behavior and SAE grade 40 at high operating temperatures so that the oil change is independent of the time of year (in temperate climate).

1.1 Conventional multigrade engine oils

During the manufacture of conventional multigrade oils with a mineral oil basis, suitable base stock viscosity
inde
x
improvers (macromolecular polymers with an oil-thickening effect) are added.

A higher viscosity
inde
x
or multigrade character of the oils is achieved with these polymers. However, the VI improvers result in a non-Newton flow behavior. In other words, the viscosity of these oils is not only dependent on the temperature and the pressure, but also on the shear rate.

Depending on the shear resistance of the oils under high mechanical sheer loads in the engine, the polymer chains break resulting in a permanent loss of viscosity in the oils (permanent viscosity drop).

In addition to the permanent sheer loss, a temporary viscosity reduction may also occur, depending on the
ext
ent of the shear rate in the lubricating gap (reversible change in viscosity).

For all multigrade oils, therefore, we require a sufficient shear resistance, so that even after relatively long operating periods an adequate minimum viscosity is ensured.

It is therefore absolutely necessary to adhere precisely to the restrictions of the operational field of the SAE grades, as specified in the operating instructions and owner's manuals or on Sheet 224.1/.2.

1.2 Multigrade oils as low-friction oils

In the general public and in the media, "low-friction oils" are gaining more and more significance due to the increasing fuel prices and the growing oil change intervals.

In the Mercedes-Benz Specifications for Operating Fluids, low-friction oils have been approved for some time. However, these are not labeled as such on the individual sheets. This is due to the fact that the term "low-friction oil" has neither been standardized nor protected. Low-friction oils can be formed by lowering the viscosity, by using additives that lower the friction coefficient (friction modifiers) and by the use of special base stocks (synthetic oils or hydrocracking oils).

Currently in the European oil specifications there is neither a set engine or laboratory test, nor limits (e.g. for fuel saving or Fuel Economy) or test conditions which regulate the use of the designation "low-friction oil" in a binding manner. The term "low-friction oil" on the oil container is entirely the responsibility and at the discretion of the individual mineral oil companies. It should be pointed out here that there are also different definitions of a low-friction oil within the mineral oil industry.

In our opinion only such multigrade oils belong to the low-friction oils which belong to
SAE grades 0W-20, 0W-30, 0W-40, 5W-30, 5W-40, 10W-30, or 10W-40 and show a measurable fuel saving potential (with proof e.g. in the M 111 Fuel Economy in accordance with
CEC L-54-T-96, compared with the 15W-40 reference oil RL 191). However, these oils must not increase wear, make the engine dirtier, significantly reduce viscosity due to shearing or increase oil consumption.

For Sheets 229.3, 229.31 and 229.5 only such low-friction oils are approved which achieve a fuel consumption advantage of at least 1.0% or 1.7% in the M 111 Fuel Economy Test (CEC L-54-T-96) compared with the 15W-40 reference oil RL 191.

By using particularly suitable base stocks (e.g. synthetic oils or hydrocracking oils) it is possible to manufacture shear-resistant low-friction oils having a high viscosity
inde
x.
These low-viscosity multigrade oils have lower viscosity-related friction and flow losses and good cold starting properties due to their improved cold flow behavior.

On the other hand, these low-friction oils must not have a viscosity that is too low in the high-temperature range because this in turn could increase the proportion of
mi
xe
d friction and wear. During the warm-up phase, e.g. with mainly city-center traffic and low oil temperatures, fuel savings are possible with low-friction oils. With increasing distances, the fuel savings effect is reduced.

With regard to the level of savings that can be achieved specifically with low-friction oils, there are publications with very
different
ex
amination and test results, which in part go far beyond the actual savings for driving in practice.

In addition, the additional costs of these products in turn can consume potential fuel savings to some
ext
ent (cost/benefit ratio). It is therefore left to the vehicle operator whether he would like to use an approved low-friction oil due to the driving mode (short distance use, long distance use).

2. Friction-reducing additives (friction modifiers)

In the low temperature range, where hydrodynamic lubrication in some engine compone

---

3. Special additives for lubricants for reducing friction and wear

For the operation of motor vehicles and engines, only blended oils are approved. These lubricants are produced from selected base stocks (on a mineral, partially or fully synthesized basis) by adding chemical oil-soluble additives and therefore have, in addition to a high lubricating effect, all the properties demanded from a good lubricant, such as reducing friction and wear, corrosion protection,

oiliness, dispersal properties and detergent effect, a resistance to aging, foaming prevention, cold flow properties, etc.
From our point of view, there is no reason to add special additives.

Details are given in Sheet 219.0 of the Specifications for Operating Fluids (special additives for lubricants).