BB00.40-P-0222-00A	Use of single-grade/multigrade engine oils and low-friction engine oils	Sheet 222.0	

MODEL ALL

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 10W and SAE 20W-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 index (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 oil viscosity index improvers (macromolecular polymers with an oil-thickening effect) are added.

A higher viscosity index or multigrade character of the oils is achieved with these polymers.

However, the VI improvers result in a non-Newtonion 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 may 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 extent 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, so-called "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 oils (synthetic oils or hydrocracking oils).

The European oil specifications currently do not contain any defined engine or laboratory test nor any limits

(e.g. for fuel economy) or test conditions that bindingly regulate the use of the designation "low-friction oil". The specification "low-friction oil" on the oil container is the responsibility of and at the discretion of the individual mineral oil company. It is noted here that there are different ratings for the definition of a low-friction oil even within the mineral oil industry.

In our opinion, only those multigrade oils that belong to SAE grades 0W-20, 0W-30, 0W-40, 5W-30, 5W-40, 10W-30 or 10W-40 and

demonstrate a measurable fuel savings potential (with proof e.g. in M 111 fuel economy test, according to CEC L-54-T-96, compared to 15W-40 reference oil RL 191) can be classified as low-friction oils. 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, 229.5 and 229.51, 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 oils (e.g. synthetic oils or hydrocracking oils) it is possible to manufacture shear-resistant low-friction oils having a high viscosity index. 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 mixed 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 examination 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 extent (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 components prevails, friction-reducing additives have no effect on friction. Only under more or less mixed friction conditions, which occur in particular at high temperatures, with low viscous oils and under high loads, can friction-reducing additives reduce friction. The effectiveness of other additives in the oil may also be affected, i.e. impaired, by the oil-soluble additives, and therefore careful testing is absolutely necessary.

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 oils (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 detergency, 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).