1.0 General information

The type of engine oil used is a decisive factor when it comes to ensuring proper functioning of and a long service life for an engine.

The engine oil is expected to overcome very wide-ranging tasks under all the operating conditions that may arise.

What is required is not only that the engine is always filled with an adequate quantity of oil, but that the quality and viscosity of the oil matches the technical status of the engine and the operating conditions. The requirements concerning engine oils depend on the engine design, the operating conditions, the oil-change intervals and the fuel quality.

A modern engine oil must fulfill a range of tasks that extend far beyond their actual function as a lubricant. The main requirements are:

- High level of protection against wear and reduction of friction:

  Wear through friction leads to a reduction in the efficiency of engines. It must therefore be kept as low as possible by the engine oil.

  In general, the term wear is used to refer to the abrasion of material or damage to the surface of frictional partners. High wear values lead either to a reduction in service life (e.g. bearing, piston-ring or cam wear) or to acute malfunctioning (scoring/scuffing).

- Favourable viscosity/temperature characteristics:

  The viscosity is a measure of the internal friction of a fluid.
  The viscosity of an engine oil must not be too high when the engine is cold, in order to make starting easier, allow the oil to flow quickly to the parts in need of lubrication and to keep fuel consumption low.
  At high temperatures and engine speeds, however, a minimum viscosity is required, in order to minimise contact between the frictional partners by means of an adequately thick lubricating film.

- High residue-scavenging, cleaning and neutralising capability (good dispersant/detergent effect):

  While an engine is running, combustion residues and oxidation products (some of which are acidic in nature), and abrasion and dirt particles from the air intake are constantly finding their way into the oil circuit. The engine oil must neutralise the acidic components, prevent the residues from settling and agglomerating and keep sludge and coke deposits on all the engine components lubricated by the oil as low as possible.

- High thermal stability:

  There must be no impermissible decomposition and change in viscosity even when the oil is subjected to extreme thermal loading.

- High oxidation and ageing stability:

  Oxidation is the absorption of oxygen by the hydrocarbons contained in the oil. Oxidation products change the viscosity of the oil, promote corrosion on certain metals and encourage sludge formation.
  Oil ageing refers both to oxidation and any other chemical and physical change that occurs in the oil while the engine is running.

- Slight tendency to vaporise:

  Every engine oil consists of components of differing volatility.
  The "apparent" oil consumption caused by vaporisation of readily volatile compounds should be as low as possible.

- Favourable foaming characteristics:

  When the engine is running, the oil is swirled around to a great extent with air. Heavy foaming leads to poorer lubricity and reduced oil flow.
  For these reasons, the oil should on the one hand absorb as little air as possible and on the other hand not tend towards forming stable foams. After absorbing air, the oil must release it again immediately.

- High level of protection against corrosion:

  The engine oil must prevent corrosion of engine components not only when the engine is in use, but also when the vehicle is laid up over a longer period.

- Unproblematic mixability / compatibility:

  All engine oils must be able to be mixed with each other to any degree, even **synthetic with mineral** oils, without this resulting in any incompatibility reactions.

Another requirement is compatibility with all the materials wetted by the oil, in particular, seal materials, hoses and paints.

- High thermal conductivity / good cooling capability:

  The oil also has an important role to play in cooling the engine. It must transport heat not only away from the friction points, but also a major proportion of the heat generated during combustion, e.g. by means of splash oil on the pistons and cylinder barrels.

- Restricted tendency to form combustion residues:

  When the engine is running, a limited amount of oil inevitably finds its way into the combustion chambers and is combusted there. Residues that build up in the combustion chambers lead to an unwanted increase in compression and encourage auto-ignition.

- Long shelf life:

  When stored properly in closed containers, engine oil must be able to be stored for a long time without suffering any reduction in quality.

Not even very good base oils are able to fulfill all of these requirements on their own. Oils for today's generation of engines therefore contain a high proportion of carefully matched additives. It is these that bestow the required characteristics on the oil.

Initial-running or breaking-in oils

Breaking-in oils, i.e. oils that provide extra protection against corrosion and better breaking-in characteristics, are to be regarded as a special case with respect to operation and operating conditions, and are not intended for use in Service.