



- **Why does ZF develop transmission fluids?**

Every new generation of modern vehicles and transmissions is required to meet yet more challenging requirements. In the end, this is also true of transmission fluid. Moreover, certain oil properties are now absolutely essential for the optimum function of specific transmission components (“oil as a design element”).

To assure optimum performance and shift comfort, each transmission type needs to be filled with a perfectly matched oil.
- **What tasks do lubricants need to perform?**

Prevention of friction and wear of sliding or rotating machine components inside a transmission. ZF transmission fluids are designed to protect, preserve and seal machine components, reduce fuel consumption and increase performance.
- **What requirements does a lubricant have to meet in a commercial vehicle transmission?**

For most components, oil as a lubricating and cooling fluid is relevant for their function as well as their service life. Moreover, the requirements for the various transmission components are very specific and to some extent conflicting. For gearings and bearings, for example, designers endeavor to achieve the lowest-possible friction values for a favorable transmission efficiency rating. In contrast, clutches and synchronizers require high friction coefficients in order to function properly. Good oil as defined by ZF is one whose properties perfectly match the functions of a specific transmission.
- **What is understood by the term ‘synthetic oils’?**

‘Synthetic oil’ is really a marketing term, and is interpreted differently from one country to another. A more reliable guide is the API classification issued by the American Petroleum Institute. API Group 1 includes mineral oils. API Groups 2 and 3 include hydrogen-treated mineral oils, some of which are now referred to as ‘synthetic’. Synthetic oils as subsumed in API Group 4 are polyalphaolefins, which are artificially constructed from other compounds.
- **What properties do synthetic oils possess?**

The main advantage of polyalphaolefins is their high thermal stability, which permits relatively long oil change intervals even with elevated oil temperatures. A further advantage is their relatively flat, shear-stable viscosity-temperature characteristic. These oils are therefore especially suited for cold or hot climatic regions.
- **What does viscosity mean?**

Viscosity is a measure of the flow resistance of an oil. With high viscosities, thick lubricating films are created which protect gearings and bearings from wear. Lower viscosities usually mean less churning loss, i.e. a higher level of efficiency and thus less fuel consumption. With manual transmissions, the shift forces increase with rising viscosity, i.e. shift comfort gets worse.



- **What causes the viscosity of an oil to change?**  
Temperature fluctuations (warm = low-viscosity / cold = high-viscosity) as well as shearing (viscosity decrease during use) or aging (viscosity increase). In the engine area, the ingress of fuel and soot also plays a role.
- **How can lubricants be adapted to suit particular requirements?**  
Through the addition of additives (additives account for up to 25% of volume in heavy-duty oils).
- **What does 'SAE' stand for in the classification of viscosity ranges (e.g. SAE 15W-40)?**  
SAE is the abbreviation for 'Society of Automotive Engineers' in the USA.
- **What are viscosity-index improvers?**  
Very large molecules which increase the viscosity of oil at high temperatures (=> multigrade oils for a wider temperature range). Disadvantages: Efficiency is lost through shear (oil becomes thinner), i.e. depending on the quality of the viscosity-index improver, the viscosity of such oils can drop noticeably after only short periods of operation.
- **Can you mix mineral oil with synthetic oil?**  
Polyalphaolefin-based synthetic oils can easily be mixed with mineral oil. However, this reduces quality, and oil change intervals need to be shortened accordingly.
- **Can a transmission operated for a long time with synthetic oil be changed over to mineral oil?**  
  
Yes. However, you cannot expect the same performance. The same is true of the additive package, which is mostly designed to be more efficient in synthetic oils. Consultation of the ZF List of Lubricants is necessary.
- **Can high-quality oil be changed less frequently?**  
Yes. The oil change intervals are specified in the ZF List of Lubricants.
- **What is wrong with using low-cost oil if you change it more frequently?**  
Low-cost oil may from the start fail, which will result in wear and contamination. It is advisable to use synthetic products, especially if oil temperatures are high.
- **Is it possible to use different viscosities than the ones specified?**  
The viscosity categories appropriate for the individual units are specified in the relevant ZF lists of lubricants. Deviations are not permitted.
- **What specific properties should a transmission fluid possess?**  
In addition to general properties, such as lubricating and cooling, corrosion protection etc., modern transmissions frequently require oil properties which are not on the data sheet for a grade of oil (friction characteristics, compatibility with special materials, special protection for high-load bearings or gearings, etc. We therefore urgently recommend using only the transmission fluids approved for a specific transmission according to a ZF list of lubricants.



- **What is a pour point?**  
It is the lowest temperature at which a liquid will continue to flow when cooled under defined conditions. Determination of the pour point: DIN ISO 3016.
- **What is shear stability?**  
To improve viscosity-temperature behavior, viscosity -index improvers (oil-soluble polymers) are added to many oils. Depending on the quality of these additives, the viscosity of oils of this kind can decline significantly after only short periods of operation. This drop in viscosity during use is referred to as shear loss. Oils without appreciable viscosity decline during use are shear-stable.
- **What are EP/AW additives (anti-wear additives)?**  
Active substances intended to reduce wear in the mixed-friction range. These additives ultimately protect bearings and gearings subjected to high loads.
- **What does scuffing load capacity mean?**  
Scuffing load capacity describes the protective effect of oil regarding seizing damage. This is assessed by a special gear test during which load is increased in stages. The figure quoted indicates the level of applied force at which this kind of damage first starts to appear.
- **What is meant by improved thermal stability?**  
With high oil sump temperatures, the usable life of oil is limited. Through the use of synthetic basic oils (polyalphaolefins) and appropriate oil additives, thermal stability can be noticeably increased.
- **What does flashpoint mean?**  
Flashpoint refers to the lowest temperature at which a flammable liquid will give off enough vapor to ignite briefly when exposed to an ignition source.
- **What does ignition point mean?**  
The ignition point is the lowest temperature at which self-ignition of the liquid vapors occurs.