Performance Profile

ADDINOL®
THE ART OF OIL • SINCE 1936

Requirements on hydraulic oils in use

Whether agricultural equipment, tractors and wheel loaders, industrial applications such as presses or injection moulding machines, but also heavy truck tippers or municipal vehicles in road traffic, we encounter hydraulic systems everywhere in everyday life.

The requirements for the use of hydraulic fluids are versatile and increase with the further development of the technologies applied. More compact designs, smaller oil volumes and special design features (e.g. smaller lubricating gaps) mean higher temperatures, pressures and loads for the lubricant used. In addition, the systems are often in operation around the clock and operators place high expectations on their efficiency.

The quality of the lubricant used has an impact on the service life and productivity of the systems. Here, lubricants are demanded which meet the requirements perfectly and ensure the reliable operation of the systems at all times and with maximum efficiency.

ADDINOL Hydraulic fluids
for maximum efficiency and trouble-free operation

The ADDINOL range includes hydraulic fluids for stationary or mobile plants with normal requirements and under special conditions:

- → **applications exposed to water, dirt and abrasive particles**
- → **usage under extreme temperature conditions (e.g. arctic climate conditions or cold stores) and changing temperatures (outdoor hydraulics in year-round operation)**
- → **high pressure loads**
- → **environmentally sensitive areas**
- → **applications in food, cosmetics and pharmaceutical sector**
- → **fire-hazard plants**

Benefit from high-performance lubricants

The specifications defined in DIN 51524 represent the minimum requirements on hydraulic fluids. For most hydraulic systems, manufacturers specify fluids according to DIN 51524 Part 2 "HLP" or Part 3 "HVLP". The corresponding minimum requirements refer to demulsifying capacity, purity level, air release properties and filterability. In addition, compliance with the desired viscosity class and viscosity-temperature behaviour are important.

Hydraulic oils of the same class appear comparable at first glance. On closer inspection, however, there are clear quality differences of hydraulic fluids on the market with regard to the specific properties.

The performance of the hydraulic fluids from Leuna clearly exceeds the standard requirements according to DIN 51524.

The selection of high-quality base oils and specially tailored additive packages make ADDINOL hydraulic oils a quality product. Thanks to the in-house production at the company's own site in Leuna and strict quality controls, ADDINOL guarantees stable quality at the highest level. The optimal adjustment of the technical parameters from purity level over filterability up to air release properties supports a long service life of both oils and lubricated components. This ensures reliable and efficient operation of the system; it reduces maintenance costs and minimizes downtimes.

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Purity level

Manufacturers define the maximum permissible degree of contaminants for their systems and components: the so-called purity level. The purity level is an indicator of how carefully the oil has been produced and filled. According to DIN 51524-2 (HLP) and DIN 51524-3 (HVLP) the following purity level is required: **21/19/16.**

If the oil used does not meet these requirements, there is a risk of negative effects on the function and performance, but also on the service life of the components. Possible consequences range from wear and deposits to complete functional failure. Impurities carried in represent an enormous danger for the function of seals and control valves. By improving the oil cleanliness or reducing the particle content, a significant extension of the operating time can be achieved.

ADDINOL hydraulic fluids are manufactured under high standards at the production site in Leuna. Their quality speaks for itself. Compared to the requirements of DIN 51524-2 and DIN 51524-3, they have a significantly better purity level **(see Chart 1)**. They ensure reliable protection of the system components and safe operation. Maintenance costs are reduced significantly.

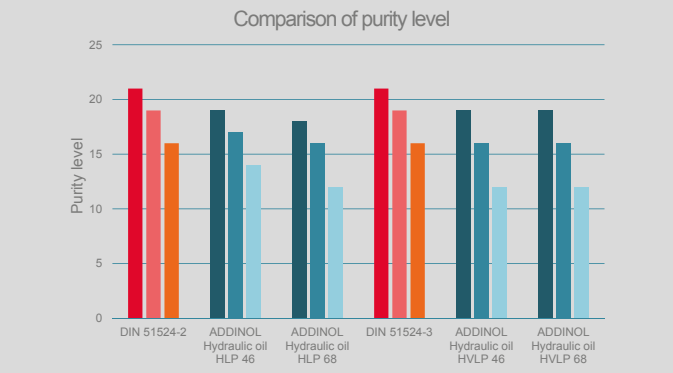


Chart 1) The purity level of an oil is usually determined by automatic particle counting using a laser. It provides information on the particle size. This means, there is no distinction by type or consistency, but constituents such as water, air or additives are recorded as well. The first number refers to particles > 4 µm, the second to particles > 6 µm and the third to particles > 14 µm.

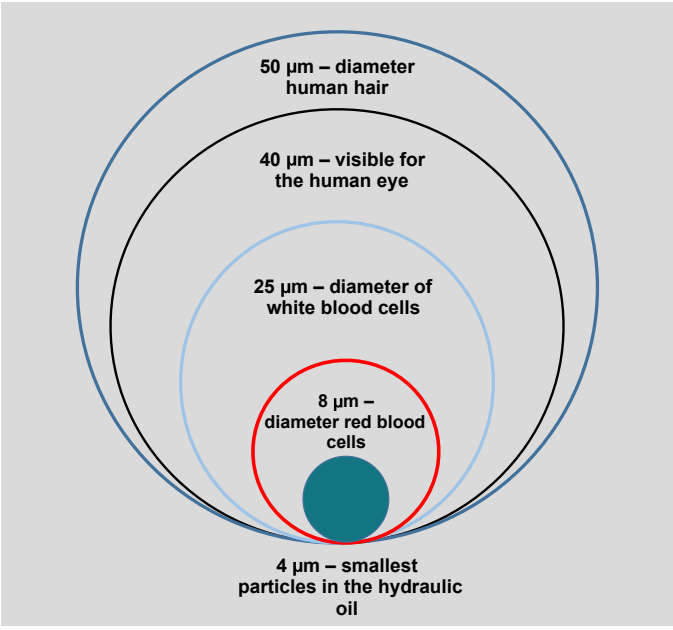
Filterability

The purity level of an oil can be improved during operation by appropriate filtration. However, it is not possible to turn an oil with inadequate properties into a quality product by filtration! The initial values must fit!

The pre-condition is the filterability of the oil. It describes the property of separating impurities using a filter. Impurities can both enter the system from the outside and occur in the system during operation, e.g. due to abrasion. They are unavoidable **(see Picture 1)**. They impair the lubricating properties, accelerate oil ageing and lead to component wear. This results in disturbances during operation or even shutdowns.

Under certain circumstances, supposedly ”cheap“ hydraulic oils cannot be filtered at all. This can lead to heavy wear, pressure increase due to clogged filters with respective effects on the pumps and their performance, and even to total failure of the system.

ADDINOL hydraulic fluids achieve best results in the filterability test. With the help of the appropriate filter technology, impurities in the form of solid particles, water and ageing products can be reliably controlled. The oils have a long service life and safely protect the system components against wear. Optimum plant performance is guaranteed and maintenance costs are reduced.



Picture 1) Hydraulic systems operate with gap dimensions in the micrometer range between 1 and 5 µm. Contamination in the range of 15 µm is already considered a coarse particle in modern systems. For better understanding: the human eye perceives particles up to a size of **35-40 µm**. *This shows that any visible contamination already represents a serious danger for components and aggregates.*

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Demulsibility

After contamination by solids, contamination by water is the second most common cause of failure for hydraulic systems. According to DIN 51524-2 and 51524-3, the water content in a fresh oil must not exceed 0.05 %.

ADDINOL hydraulic fluids have a very low water content of approx. 0.01 % and therefore offer the best preconditions to minimize the risk of corrosion.

Due to humidity in combination with temperature variation, but also due to incorrect storage of the fresh oil, the water content in the system can be significantly higher. The direct introduction of water is also possible and difficult to avoid. Cooling water leaks, cleaning and maintenance measures and the production process itself can lead to water ingress. If the free water is separated or forms an emulsion with the oil, the performance of the lubricant is considerably impaired. In addition, accelerated oil ageing, corrosion and damage due to cavitation and wear occur.

Demulsifying behaviour therefore plays a major role in many hydraulic systems. For oils with good water separation properties, free water can be optimally separated from the oil and simply drained off.

The ADDINOL hydraulic oils of the class HLP and HVLP have the best demulsifying behaviour **(see Chart 2)** and thus provide reliable protection against corrosion, cavitation and wear. Optimum lubricity is guaranteed even under difficult conditions.

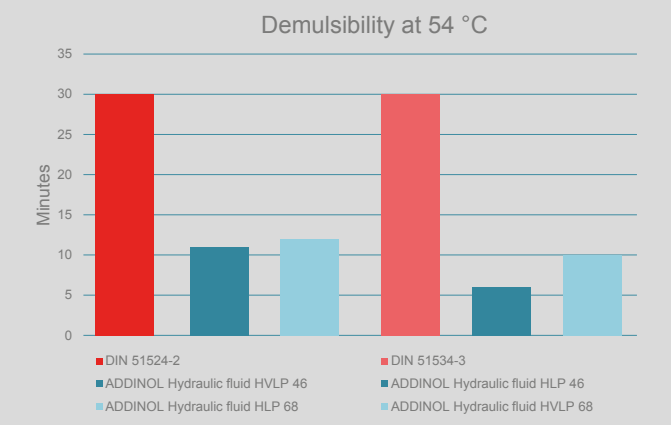

Chart 2: Demulsibility of ADDINOL HLP 46 and 68 as well as HVLP 46 and 68 compared to DIN requirements.

Extra tip! Have the water content of your systems determined using the Karl Fischer method in addition. This achieves more accurate results than other methods.

By the way! For hydraulic systems that operate under the influence of water, dirt and dust, oils with excellent detergent properties are required. The ADDINOL Hydraulic oils HLPD and HVLPD bind dirt particles and water and transport them reliably to the filter.

Air release and foaming properties

Lubricating oils contain air, which has no negative effects on lubricity and system components in dissolved form. If there are pressure and/or temperature variations, however, dissolved air can be released resulting in air bubbles. Besides, it is difficult to avoid the introduction of air during operation. Air bubbles impair the lubrication and cooling performance of a lubricant. They lead to compressibility, i.e. the optimum control of the components is no longer guaranteed. The first sign of this is often increased noise generation in the unit. If free air is present in the system, pumps must deliver a higher output. Energy losses and a reduced service life of the components are the result. Cavitation and the so-called diesel effect also occur. For the lubricant itself, the introduction of air leads to accelerated ageing.

ADDINOL hydraulic fluids have an excellent air separation capacity **(see Chart 3)** and control air reliably. Negative effects

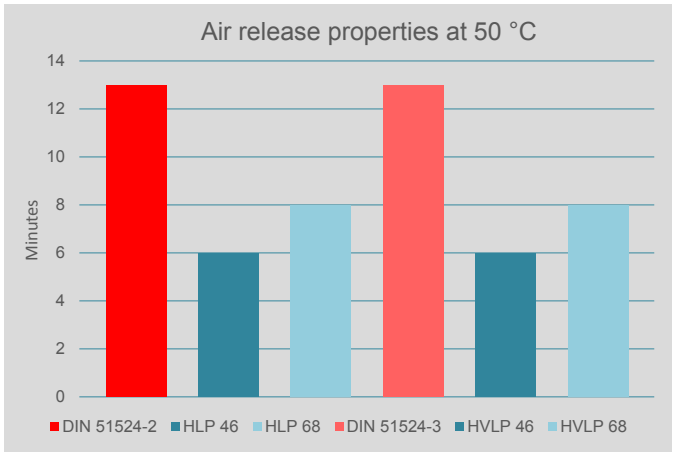

Chart 3) Air release properties describe the time during which air bubbles are separated from the oil. This behaviour depends on the base oils used and cannot be influenced by additives. For this reason, the choice of high-quality base oils with the best air release properties is absolutely crucial.

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on system components are prevented and optimum efficiency is guaranteed.

The introduction of air, impurities, oxidation, but also special design parametres can lead to foam formation during operation. Foam impairs the lubricity of a hydraulic oil and prevents optimum power transmission. In addition, foam leads to abrasive wear and entails risks for the environment, as it promotes oil discharge.

Thanks to the careful formulation, ADDINOL hydraulic fluids achieve the best values for foaming behaviour **(see Chart 4)** and thus ensure optimum lubrication of the systems.

Experience from our analysis service shows that supposedly inexpensive hydraulic oils cannot do without the addition of defoamers based on silicone oil. These are surface-active, i.e. they settle on the lubricating film and are filtered out. This means that reliable protection against foam formation is no longer guaranteed.

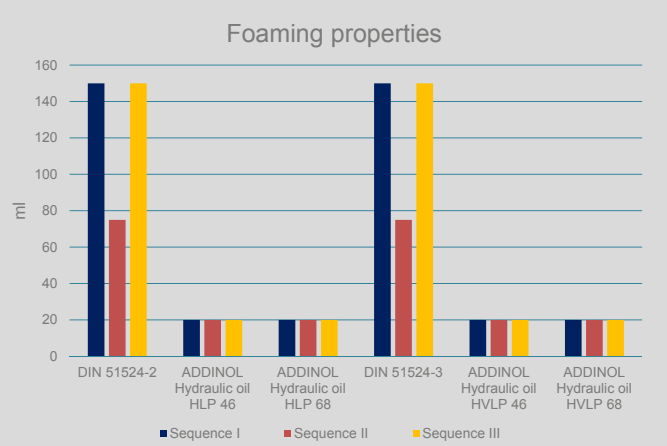

Chart 4) The foaming behaviour of a lubricant determines the time it takes for air bubbles on the surface to burst. The foam volume is defined according to ASTM D 892 in three sequences 10 minutes after air introduction respectively: sequence I at 24°C, sequence II at 93.5°C and sequence III at 24°C after 93.5°C.

Viscosity index

In addition to reliable control of impurities of all kinds, the flow behaviour of hydraulic fluids during operation and above all at limit temperatures plays a decisive role. These properties are described by the viscosity index and influence the reliable lubrication of all components. At cold start or outdoor use, the quick supply of all lubrication points must be ensured in order to guarantee the functioning of the system. If the flowability of the lubricant used is insufficient, fatigue and wear occur. This results in slow reaction times and increased energy consumption. Even at high temperatures, a stable lubricating film must be ensured; otherwise, wear and cavitation may occur.

The high quality of the base oils used with a naturally high VI and additives ensures best response behaviour and maximum efficiency at all temperatures when using ADDINOL hydraulic oils.

Made in Leuna – ADDINOL convinces in operation

The movement of great weights has occupied mankind for thousands of years. Goldhofer AG specialises in transportation solutions for heavy loads and special haulage on-road and off-road. They have been a quality leader on the market for many decades. Many of these high-performance applications are using hydraulic oils made by ADDINOL.

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High-performance lubricants

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