

MAHLE

A/C compressor oil
PAG and PAO oils

BEHR[®]


BrainBee[®]
WORKSHOP SOLUTIONS

Many types of oil are available— which one is recommended?



Oil plays an important role
in air conditioning systems.

Whether you're changing the air conditioning compressor oil or topping it up during an air conditioning service, the oil in the air conditioning system performs vital functions—just like the blood in the human body.

That's why using a high-grade air conditioning compressor oil is crucial for ensuring that the system can be used safely and for a long time. Just like in an engine, the use of low-grade or incorrect oils results in increased wear, premature failure of the air conditioning compressor, and loss of the warranty or legally binding warranty.

The wrong choice can lead to damage. Vehicle- or manufacturer-specific instructions must be followed carefully.

PAG oil

Performance for a good atmosphere

Product characteristics

- PAG oils are fully synthetic, hygroscopic oils based on polyalkylene glycol
- Used during construction by many vehicle and compressor manufacturers in air conditioning systems with refrigerant R134a, available at various viscosities
- Special new PAG oils 46 YF and 100 YF suitable for both R1234yf and R134a refrigerants

Advantages and effect

- PAG oils are highly miscible with R134a (PAG oils 46 YF and 100 YF can also be mixed with R1234yf) and are suitable for lubricating the air conditioning systems of most passenger cars and commercial vehicles.
- It's important to choose the right viscosity class when using PAG oils (PAG 46, PAG 100, PAG 150). The vehicle manufacturer's specifications and approved products should be taken into account.

Additional details

The disadvantage of PAG oils is that they are hygroscopic, which means that they absorb and bind moisture from the ambient air.

If the moisture content in the air conditioning system is too high, this can contribute to the formation of acids and corrosion, resulting in damage to components and leaks.

For this reason, any oil containers that have been opened must be resealed immediately; the residual oil will also only have a limited shelf life. This applies in particular to the fresh oil containers in air conditioning service units.



PAO 68 oil and PAO 68 Plus UV oil

Product characteristics

- Not hygroscopic: unlike other oils, these do not absorb any moisture from the ambient air
- Can be used as an alternative to a range of PAG oils (see the usage overview): stock one oil instead of three
- Successfully used in practice for more than 20 years
- Helps to increase the air conditioning system's performance
- No adverse effects on components in the air conditioning circuit (also applies to use in air conditioning service units/ confirmed by manufacturers on the basis of sealed tube tests in accordance with the ASHRAE 97 standard)
- Available with (PAO 68 Plus UV oil) or without the addition of a contrast agent (PAO 68 oil)

Advantages and effect

PAO 68 oil

- Being nonhygroscopic, PAO oil is easy to use in workshops. The required amount of oil can also be taken from large containers (e.g., 5 liters).
- A low degree of refrigerant solubility in the oil means that the PAO oil is not diluted and retains its full viscosity in the compressor.
- Oil film inside the components creates a better seal and decreases friction between the compressor's moving parts.
- Reduced operating temperature and wear.
- Results in increased operational safety and reduces noise, running time, and energy consumption by the compressor.



PAO 68 Plus UV oil

- Same positive characteristics as PAO 68 oil
- Additional admixture of a fluorescent contrast agent for UV leak detection
- Low vol% concentration of the contrast agent with the following advantages: preserves the oil's positive characteristics and avoids negative effects on system components or service equipment

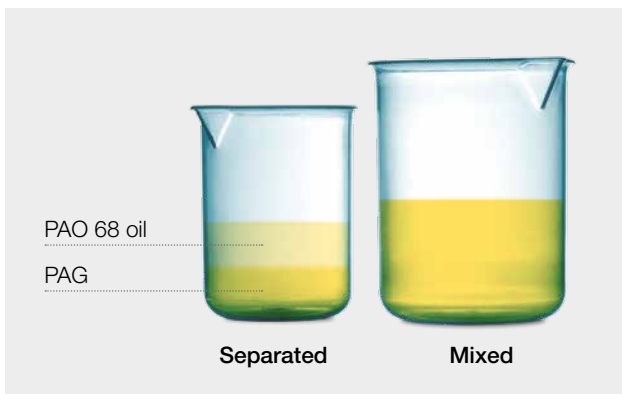
Additional details

Is PAO 68 oil compatible with other oils?

- PAO 68 oil does not damage fluoroelastomer materials, such as hoses and seals.
- Since PAO 68 oil is compatible with many other lubricants and refrigerants, it can be used both when topping up and when changing the system's entire oil volume. Its molecular structure and density mean that, although PAO 68 oil can be mixed to a certain extent with other oils, it separates from them again when it settles and does not form a permanent bond.
- This guarantees that the necessary viscosity of the oils is maintained and there is no change in the overall viscosity (see figures on the following page).

How was PAO 68 Plus UV oil tested?

- PAO 68 Plus UV oil has been tested by the manufacturer and by independent institutes. For example, its chemical stability was established using the “sealed tube test” in compliance with the ASHRAE 97 standard. This test evaluates the interaction between the refrigerant, the refrigerant oil, the various O-ring materials, and the metals that are used in air conditioning systems.
- All the tests produced positive results, confirming that negative effects on components in the vehicle air conditioning system or the air conditioning service unit can be excluded. PAO 68 Plus UV oil can thus be added directly to a component, such as an air conditioning compressor, or introduced into the refrigerant circuit via the air conditioning service unit.



Can PAO 68 oil be used in situations where there are problems with humidity?

- PAO 68 is not hygroscopic—i.e., unlike other oils, it does not absorb any moisture from the ambient air. This means that humidity-related problems, such as the icing up of components or the formation of acids, can be combated by using only PAO 68 oil. The range of possible uses and the storage stability of PAO 68 oil are significantly greater than for conventional oils.

Special properties and characteristics

- No risk of oil collecting in the evaporator and the associated deterioration in cooling performance
- An oil film in the components improves the seal
- Reduction in the friction between the components
- Lower energy consumption by the compressor
- Unique combination of highly refined, synthetic oil and special performance-enhancing additives
- Extensive operating range (–68°C to 315°C)
- Low vol% concentration of the highly active contrast agent in PAO 68 Plus UV oil, which means the system components and service units are protected and subject to reduced wear



PAO 68 AA1 Clear Version oil (without leak detecting agent) is also approved for use with R1234yf and in electric air conditioning compressors in hybrid and electric vehicles.

The oils in comparison

Type of oil	Application	Remark
PAG oils for refrigerant R134a	<p>There are various PAG oils with different flow characteristics (viscosities) for use with refrigerant R134a.</p> <p>As PAG oils are hygroscopic, cans do not have a long shelf life once opened.</p>	Standard PAG oils are not suitable for refrigerant R1234yf or for electrically driven air conditioning compressors.
PAG YF oil for refrigerants R1234yf and R134a	<p>There are also a number of PAG oils with different flow characteristics (viscosities) for use with refrigerant R1234yf.</p> <p>What makes these PAG oils from MAHLE/BRAIN BEE special is that they are not only suitable for use with the refrigerant R1234yf but can also be used with the refrigerant R134a.</p> <p>As PAG oils are hygroscopic, cans do not have a long shelf life once opened.</p>	PAG oil YF is suitable for both R1234yf and R134a refrigerants.
PAG SP-A2 oil for refrigerants R1234yf and R134a	For use in electrically driven air conditioning compressors that have been filled ex works with a special PAG oil.	
PAO oil 68 for refrigerant R134a, and in some cases for refrigerant R1234yf and others	<p>Can be used as an alternative to the various PAG oils that are offered for R134a. Advantage: PAO 68 oil is nonhygroscopic—i.e., unlike other oils, it does not absorb any moisture from the ambient air.</p> <p>The two different PAO oils offered by MAHLE/BRAIN BEE (AA1 and AA3) can be used in conjunction with numerous different refrigerants (see product overview).</p>	PAO 68 AA1 Clear Version oil (without leak detecting agent) can also be used with the new refrigerant R1234yf as well as in electrically driven air conditioning compressors in hybrid and electric vehicles.



From oil type to air conditioning compressor type

MAHLE reference number/ MAHLE Service Solutions reference number	Product	Viscosity class	Contents	Can be used for refrigerant	Can be used for	Can be used for air conditioning compressor types
PAG oil						
ACPL 19 000P 1010350038XX	PAG oil	ISO 46	250 ml	R134a	Air conditioning systems in vehicles with conventional gasoline or diesel engines (passenger cars, commercial vehicles, agricultural and construction machinery)	All compressor types except for electrically driven compressors
ACPL 20 000P 1010350039XX	PAG oil	ISO 100	250 ml	R134a	Air conditioning systems in vehicles with conventional gasoline or diesel engines (passenger cars, commercial vehicles, agricultural and construction machinery)	All compressor types except for electrically driven compressors
ACPL 21 000P 1010350040XX	PAG oil	ISO 150	250 ml	R134a	Air conditioning systems in vehicles with conventional gasoline or diesel engines (passenger cars, commercial vehicles, agricultural and construction machinery)	All compressor types except for electrically driven compressors
PAG YF oil						
ACPL 22 000P 1010350284XX	PAG YF oil	ISO 46	250 ml	R1234yf, R134a	Air conditioning systems in vehicles with conventional gasoline or diesel engines (passenger cars, commercial vehicles, agricultural and construction machinery)	All compressor types except for electrically driven compressors
ACPL 23 000P 1010350283XX	PAG YF oil	ISO 100	250 ml	R1234yf, R134a	Air conditioning systems in vehicles with conventional gasoline or diesel engines (passenger cars, commercial vehicles, agricultural and construction machinery)	All compressor types except for electrically driven compressors
PAG SP-A2 oil						
ACPL 9 000P 1010350482XX	PAG SP-A2 oil	ISO 46	250 ml	R1234yf, R134a	Air conditioning systems in hybrid and electric vehicles	Electrically driven compressors filled ex works with special PAG oil

MAHLE reference number/ MAHLE Service Solutions reference number	Product	Viscosity class	Contents	Can be used for refrigerant	Can be used for	Can be used for air conditioning compressor types
PAO 68 AA1 – Clear Version (without leak detecting agent)						
ACPL 10 000P 1010350483XX	PAO AA1 Clear Version	ISO 68	1.0 L	R1234yf, R134a, R413a,	Air conditioning systems in vehicles with conventional gasoline or diesel engines (passenger cars, commercial vehicles, agricultural and construction machinery) Air conditioning systems in hybrid and electric vehicles Air conditioning systems in refrigerated trucks	All compressor types (including electrically driven compressors) except for vane compressors
ACPL 11 000P 1010350484XX	PAO AA1 Clear Version	ISO 68	500 ml	R22, R12, R507a,		
ACPL 14 000P 1010350486XX	PAO AA1 Clear Version	ISO 68	5.0 L	R500, R502, R513a		
PAO 68 AA1 – PLUS UV						
ACPL 15 000P 1010350487XX	PAO AA1 PLUS UV	ISO 68	500 ml	R134a, R413a,	Air conditioning systems in vehicles with conventional gasoline or diesel engines (passenger cars, commercial vehicles, agricultural and construction machinery) Air conditioning systems in refrigerated trucks	All compressor types except for vane compressors and electrically driven compressors
ACPL 16 000P 1010350488XX	PAO AA1 PLUS UV	ISO 68	1.0 L	R22, R12, R507a,		
ACPL 17 000P 1010350489XX	PAO AA1 PLUS UV	ISO 68	5.0 L	R500, R502		
PAO 68 AA3 – Clear Version (without leak detecting agent)						
ACPL 13 000P 1010350485XX	PAO AA3 Clear Version	ISO 100	1.0 L	R1234y, R134a, R413a, R513a	Air conditioning systems in vehicles with conventional gasoline or diesel engines as well as electric and hybrid drives (passenger cars, commercial vehicles, agricultural and construction machinery)	Especially for vane compressors
PAO 68 AA3 – PLUS UV						
ACPL 18 000P 1010350490XX	PAO AA3 PLUS UV	ISO 100	1.0 L	R134a, R413a	Air conditioning systems in vehicles with conventional gasoline or diesel engines (passenger cars, commercial vehicles, agricultural and construction machinery)	Especially for vane compressors

Product overview

Product	Application	Air conditioning compressor type	Refrigerant	Viscosity class	Contents	MAHLE reference number/ MAHLE Service Solutions reference number
PAG oil	Vehicle air conditioning systems*	All types**	R134a	PAG I (ISO 46)	250 ml	ACPL 19 000P 1010350038XX
	Vehicle air conditioning systems*	All types**	R134a	PAG II (ISO 100)	250 ml	ACPL 20 000P 1010350039XX
	Vehicle air conditioning systems*	All types**	R134a	PAG III (ISO 150)	250 ml	ACPL 21 000P 1010350040XX
PAG YF oil	Vehicle air conditioning systems*	All types**	R1234yf, R134a	PAG I (ISO 46)	250 ml	ACPL 22 000P 1010350284XX
	Vehicle air conditioning systems*	All types**	R1234yf, R134a	PAG II (ISO 100)	250 ml	ACPL 23 000P 1010350283XX
PAG SP-A2 oil	Air conditioning systems in hybrid and electric vehicles*	Electrically driven compressors filled ex works with special PAG oil	R1234yf, R134a	PAG (ISO 46)	250 ml	ACPL 9 000P 1010350482XX
PAO 68 oil	Vehicle air conditioning systems*	All types (except vane compressors)	R1234yf, R134a, R413a, R513a, R22	AA1 (ISO 68)	500 ml	ACPL 11 000P 1010350484XX
	Air conditioning systems in hybrid and electric vehicles*	Electric compressors	R1234yf, R134a, R513a	AA1 (ISO 68)	1.0 l	ACPL 10 000P 1010350483XX
	Refrigerated trucks (fresh produce delivery vehicles)	Reciprocating compressors	R1234yf, R134a, R507a, R500, R513a	AA1 (ISO 68)	5.0 l	ACPL 14 000P 1010350486XX
	Refrigerated trucks (fresh produce delivery vehicles)	Reciprocating compressors	R507a, R502, R513a, R22			
	Vehicle air conditioning systems*	Vane compressors	R134a, R413a, R513a	AA3 (ISO 100)	1.0 L	ACPL 13 000P 1010350485XX
PAO 68 Plus UV oil	Vehicle air conditioning systems*	All types** (except vane compressors)	R134a, R413a, R22	AA1 (ISO 68)	500 ml	ACPL 15 000P 1010350487XX
	Refrigerated trucks (fresh produce delivery vehicles)	Reciprocating compressors**	R134a, R507a, R500	AA1 (ISO 68)	1.0 l	ACPL 16 000P 1010350488XX
	Refrigerated trucks (freezer vans)	Reciprocating compressors**	R507a, R502, R22	AA1 (ISO 68)	5.0 l	ACPL 17 000P 1010350489XX
	Vehicle air conditioning systems*	Vane compressors**	R134a, R413a	AA3 (ISO 100)	1.0 L	ACPL 18 000P 1010350490XX

* Passenger cars, trucks, and agricultural and construction machinery

** Except for electric air conditioning compressors





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