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Технические характеристики

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PAG and PAO oils



Oil plays an important role
in air conditioning systems.

There are many types of oil.
Which one is recommended?

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

That is 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 guarantee.

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

PAG oil

Performance for a good atmosphere

Product features

- PAG oils are fully synthetic, hygroscopic oils based on polyalkylene glycol.
- Used in production by many vehicle and air conditioning 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 is important to choose the right viscosity class when using PAG oils (PAG 46, PAG 100, PAG 150). The vehicle manufacturer 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 container that has been opened must be resealed immediately, and the residual oil will only have a limited shelf life. This applies particularly to fresh oil containers in air conditioning service units.



New to the range

New PAG SP-A2 oil from Sanden for special, electric Sanden air conditioning compressors
Part number ACPL 9 000P/8FX 351 213-141

PAO 68 oil and PAO 68 Plus UV oil

Product features

- Nonhygroscopic: in contrast to 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 application overview): stock one oil instead of three.
- Successfully used in practice for more than 20 years.
- Helps increase the performance of the air conditioning system.
- 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 (PAO 68 oil) the addition of a contrast agent.

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 air conditioning compressor.
- The oil film inside the components creates a better seal and decreases friction between the air conditioning compressor's moving parts.
- Reduction of operating temperature and wear.
- Results in increased operational safety and reduces noise, running time, and energy consumption by the air conditioning 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 volume percent 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.

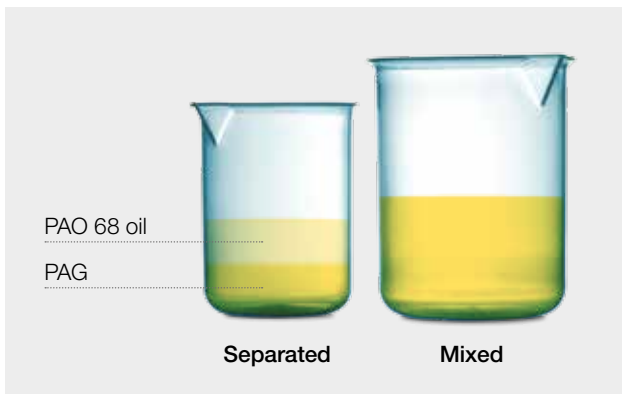
Additional details

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 entire system oil quantity. Due to its molecular structure and density, PAO 68 oil can be mixed to a certain extent with other oils, but 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 figure 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 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 station 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 case of moisture problems?

- PAO 68 oil is not hygroscopic—i.e., unlike other oils, it does not absorb any moisture from the ambient air. This means that moisture-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.

Characteristic features and properties

- No risk of oil collecting in the evaporator and the associated deterioration in cooling performance
- Oil film in the components improves the seal
- Reduction in friction between the components
- Lower energy consumption by the air conditioning compressor
- Unique combination of highly refined, synthetic oil and special performance-enhancing additives
- Very wide operating range (-68°C to $+315^{\circ}\text{C}$)
- Low volume percent 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

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



Comparison of A/C compressor oils

Type of oil	Application	Comments
<p>PAG oils For refrigerant R134a</p>	<p>There are various PAG oils with different flow characteristics (viscosities) for use with refrigerant R134a.</p> <p>PAG oils are hygroscopic. This means that cans do not have a long shelf life once opened.</p>	<p>Standard PAG oils are not suitable for refrigerant R1234yf or for electrically driven A/C compressors.</p>
<p>PAG YF oil For refrigerants R1234yf and R134a</p>	<p>Various PAG oils with different flow characteristics (viscosities) for use with refrigerant R1234yf are also available.</p> <p>What makes these PAG oils from MAHLE 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>PAG oils are hygroscopic. This means that cans do not have a long shelf life once opened.</p>	<p>PAG YF oil is suitable for both R1234yf and R134a refrigerants.</p>
<p>PAG SP-A2 oil For refrigerants R1234yf and R134a</p>	<p>For use in electric A/C compressors, such as those manufactured by Sanden and Hanon.</p>	
<p>PAO 68 oil For refrigerant R134a, and in some cases for refrigerant R1234yf and others</p>	<p>Can be used as an alternative to the various PAG oils that are offered for R134a (has the advantage of not being hygroscopic—i.e., in contrast to other oils, it does not absorb any moisture from the ambient air).</p> <p>The two different PAO oils offered by MAHLE (AA1 and AA3) can be used in conjunction with many different refrigerants (see product overview).</p>	<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 A/C compressors in hybrid and electric vehicles.</p>

From oil type to A/C compressor type

MAHLE part number/former Behr Hella Service part number	Product	Viscosity class	Contents	Can be used for refrigerant	Can be used for	Can be used for A/C compressor type
PAG oil						
ACPL 1 000P 8FX 351 213-031	PAG oil	ISO 46	240 ml	R134a	A/C 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 2 000P 8FX 351 213-041	PAG oil	ISO 150	240 ml	R134a	A/C 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 3 000P 8FX 351 213-051	PAG oil	ISO 100	240 ml	R134a	A/C 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 7 000P 8FX 351 213-121	PAG YF oil	ISO 46	240 ml	R1234yf, R134a	A/C 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 8 000P 8FX 351 213-131	PAG YF oil	ISO 100	240 ml	R1234yf, R134a	A/C 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 8FX 351 213-141	PAG SP-A2 oil	ISO 46	250 ml	R1234yf, R134a	A/C systems in hybrid and electric vehicles	Electrically driven compressors, e.g., those manufactured by Sanden and Hanon

MAHLE part number/former Behr Hella Service part number	Product	Viscosity class	Contents	Can be used for refrigerant	Can be used for	Can be used for A/C compressor type
PAO 68 AA1 – Clear Version (without leak detecting agent)						
ACPL 10 000P 8FX 351 214-021	PAO AA1 Clear Version	ISO 68	1.0 L	R1234yf R134a R413a R22	A/C systems in vehicles with conventional gasoline or diesel engines (passenger cars, commercial vehicles, agricultural and construction machinery)	All compressor types (including electrically driven compressors) except for vane compressors
ACPL 11 000P 8FX 351 214-031	PAO AA1 Clear Version	ISO 68	500 ml	R12 R507a R500 R502 R513a	A/C systems in hybrid and electric vehicles	
ACPL 14 000P 8FX 351 214-101	PAO AA1 Clear Version	ISO 68	5.0 L		A/C systems in refrigerated trucks	
PAO 68 AA1 – Plus UV						
ACPL 15 000P 8FX 351 214-201	PAO AA1 Plus UV	ISO 68	500 ml	R134a R413a R22	A/C systems in vehicles with conventional gasoline or diesel engines (passenger cars, commercial vehicles, agricultural and construction machinery)	All compressor types except for vane compressors
ACPL 16 000P 8FX 351 214-211	PAO AA1 Plus UV	ISO 68	1.0 L	R12 R507a R500 R502	A/C systems in refrigerated trucks	
ACPL 17 000P 8FX 351 214-221	PAO AA1 Plus UV	ISO 68	5.0 L			
PAO 68 AA3 – Clear Version (without leak detecting agent)						
ACPL 13 000P 8FX 351 214-081	PAO AA3 Clear Version	ISO 100	1.0 L	R1234y R134a R413a R513a	A/C systems in vehicles with conventional gasoline or diesel engines (passenger cars, commercial vehicles, agricultural and construction machinery)	Specifically for vane compressors
PAO 68 AA3 – Plus UV						
ACPL 18 000P 8FX 351 214-281	PAO AA3 Plus UV	ISO 100	1.0 L	R134a R413a	A/C systems in vehicles with conventional gasoline or diesel engines (passenger cars, commercial vehicles, agricultural and construction machinery)	Specifically for vane compressors

Product overview

Product	Application	A/C compressor type	Refrigerant	Viscosity class	Contents	MAHLE part number/former Behr Hella Service part number
PAG oil	Vehicle A/C systems*	All types**	R134a	PAG I (ISO 46)	240 ml	ACPL 1 000P 8FX 351 213-031
	Vehicle A/C systems*	All types**	R134a	PAG II (ISO 100)	240 ml	ACPL 3 000P 8FX 351 213-051
	Vehicle A/C systems*	All types**	R134a	PAG III (ISO 150)	240 ml	ACPL 2 000P 8FX 351 213-041
PAG YF oil	Vehicle A/C systems*	All types**	R1234yf R134a	PAG I (ISO 46)	240 ml	ACPL 7 000P 8FX 351 213-121
	Vehicle A/C systems*	All types**	R1234yf R134a	PAG II (ISO 100)	240 ml	ACPL 8 000P 8FX 351 213-131
PAG SP-A2 oil	A/C systems in hybrid and electric vehicles	Electric compressors	R1234yf R134a	PAG (ISO 46)	250 ml	ACPL 9 000P 8FX 351 213-141
PAO 68 oil	Vehicle A/C systems*	All types (except vane compressors)	R1234yf R134a R413a R22 R513a			
	A/C systems in hybrid and electric vehicles	Electric compressors	R1234yf R134a R513a	AA1 (ISO 68)	500 ml	ACPL 11 000P 8FX 351 214-031
	Refrigerated trucks (fresh produce delivery vehicles)	Reciprocating compressors**	R1234yf R134a R507a R500 R513a	AA1 (ISO 68)	1.0 L	ACPL 10 000P 8FX 351 214-021
	Refrigerated trucks (freezer vans)	Reciprocating compressors**	R507a R502 R513a R22	AA1 (ISO 68)	5.0 L	ACPL 14 000P 8FX 351 214-101
	Vehicle A/C systems*	Vane compressors**	R134a R413a R513a	AA3 (ISO 100)	1.0 L	ACPL 13 000P 8FX 351 214-081
PAO 68 Plus UV oil	Vehicle A/C systems*	All types** (except vane compressors)	R134a R413a R22	AA1 (ISO 68)	500 ml	ACPL 15 000P 8FX 351 214-201
	Refrigerated trucks (fresh produce delivery vehicles)	Reciprocating compressors**	R134a R507a R500	AA1 (ISO 68)	1.0 L	ACPL 16 000P 8FX 351 214-111
	Refrigerated trucks (freezer vans)	Reciprocating compressors**	R507a R502 R22	AA1 (ISO 68)	5.0 L	ACPL 17 000P 8FX 351 214-221
	Vehicle A/C systems*	Vane compressors**	R134a R413a	AA3 (ISO 100)	1.0 L	ACPL 18 000P 8FX 351 214-281

* Passenger cars, commercial vehicles, agricultural and construction machinery

** Except for electric air conditioning compressors

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