

Engine 356.9, 364.9, 366.9, 904.9, 906.9

Engine 356.9, 364.9, 366.9, 401.9, 421.9, 422.9, 440.9, 441.9, 442.9, 445.9, 446.9

Engine 401.9, 402.9, 421.9, 422.9, 423.9, 440.9, 441.9, 442.9, 443.9, 445.9, 446.9, 457.9, 541.9, 542.9, 906.9

Engine 354.9, 904.9, 364.9

Engine 354.9, 356.9, 357.9, 364.9, 366.9, 904.9, 906.9

Engine 601.940 /943, 602.940 /980, 611.981 /987, 612.981

Modification notes

9.5.05	Content updated		
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This information contains the results of the latest studies and therefore supersedes all previous information on the subject FAME/biodiesel fuel. All older versions should be replaced with the current version immediately. This edition is also suitable for passing on to customers.

Preliminary remarks

Three abbreviations are common in describing biodiesel fuels.

FAME	fatty acid methyl ester Generic term used in the EC Standards
PME	Plant oil methyl ester Generic term used previously in German-speaking areas
RME	Rape oil methyl ester, biodiesel fuel from rape seed oil

Notes on operation with FAME

1. Approvals

The following vehicle/engines are approved or not approved for operation with FAME.

Model	Engine	FAME operation possible	Conversion required
930, 932, 933, 934, 950.0/1/2/3, 952.0/1/2/3, 953.1/3, 954.0/1/2	BR 500	Yes	No
950.5/6, 952.5/6, 953.6, 954.5, 970, 972, 974, 975, 976	BR 900	Yes	No
940, 942, 943, 944	Model designation 457.9	Yes	No
957	BR 900	Yes	No
673, 674, 676	BR 900	Yes	No
667, 668, 670	BR 900	Yes	Yes
667, 668, 670	BR 600	No	---
414	BR 600	No	---
615, 616, 617, 619, 673, 674, 675, 676, 677, 678, 679	BR 300	Yes, as of model year 1988	No
625, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659	BR 400	Yes, as of model year 1988	Yes
405, 437	BR 900	Yes	No
417, 418, 427, 435, 437	BR 300	Yes, as of model year 1988	No
408	BR 600	No	---
667, 668, 670	BR 300	No	---
901, 902, 903, 904, 905	BR 600	No	---
638.1, 638.2	BR 600	No	---
639.7, 639.8	BR 600	No	---
601, 602, 611	BR 600	No	---
631	BR 600	No	---
OEM engines	BR 500	Yes	No

	Model designation 457.9	Yes	No
	BR 400	Yes, as of model year 1988	Yes
	BR 900	Yes	No
	BR 300	Yes, as of model year 1988	No
	BR 600	No	---

- The use of FAME in busses must first be approved by EvoBus
- For models 667, 668 and 670 with engine series 900, it is necessary to replace standard fuel lines and seals with FAME-resistant versions before operation with FAME.
- Replace leak fuel lines of injection nozzles on engine series 400 with FAME-resistant version and connect to fuel feed.

- On OM 447hIA OEM engines, it is also necessary to replace the standard EHAB with FAME-resistant version.
- All of the information, notes and limitations in this Service Information are also valid for EURO 4 and EURO 5 engines.
- EPA 04 version engines (with cooled exhaust gas recirculation) are not approved for operation with FAME.

2. Fuel

- The fuel must conform to DIN EN 14214. Operation with lower quality fuel can lead to damage and malfunctions. Our company is not liable for irregularities and damage resulting from poor quality fuel.
- FAME or diesel fuel may be used alternately. The various mixtures of FAME and standard diesel fuel occurring in the vehicle fuel tank in such cases is acceptable.
- The use of diesel fuel with a max. 5% FAME is safe. This mixture can also be used in vehicles that are not approved for operation with FAME. This mixture does not have an effect on the oil change interval.


- The European DIN EN 14214 standard requires the following low-temperature stabilities for FAME:

Time period	Low-temperature stability down to
15.04. - 30.09.	0 °C
01.10. - 15.11.	-10 °C
16.11. - 28.02.	-20 °C
01.03. - 14.04.	-10 °C

- A fuel preheater is necessary if the low-temperature stability is not adequate or at lower ambient temperatures. The addition of flow improvement additives for diesel fuel does not change the low-temperature stability of FAME.
- As a matter of principle, we do not approve of the use of vegetable oils as an alternative to diesel fuel or FAME due to negative experiences (engine damage resulting from carbon deposits, deposits in combustion chambers and oil sludging).

3. Engine oil and maintenance

- Preferably, engine oils in accordance with MB-Specifications for Operating Fluids Sheet 228.5 are to be used when operating with FAME. Engine oils as per Sheet 228.3 can also be used if the oil change interval is shortened.
- A certain quantity of fuel always mixes with the engine oil over the pistons and cylinders. Due to its high boiling point, FAME does not evaporate and remains in the engine oil. Under certain conditions a chemical reaction can occur between FAME and engine oil. This can result in engine damage.

 Thus when operating with FAME and with FAME-diesel mixtures, the oil change interval must be shortened.

- Engines with the special version MY8 (larger oil pan for Actros) have an increased oil change interval when operating with FAME.
- A special version is also in preparation for several vehicles: code MJ9 (advantage package for operation with FAME). It includes a fuel prefilter with water separator, an additional tank/combination tank for operation with auxiliary heaters and some modifications to the engine. The special version MJ9 allows an extended oil change interval for engines operated with FAME. More information about the availability will be announced.
- Increased engine oil intervals for engines operated with FAME are possible for OEM engines. The engines must be equipped with special version code MK21 (engine measures) and code MK21 (fuel prefilter with water separator).

Oil change intervals for operation with biodiesel (FAME)

Vehicle/ Engine	Oil quality	Long-distance haulage	Short-distance haulage	Severe operations
Model 615, 616, 617, 619, 673, 674, 675, 676, 677, 678, 679 with engine series 300	228.3 228.5	15,000 km	10,000 km	3,000 km
Model 625, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659 with engine series 400	228.5 228.3	30,000 km 15,000 km	20,000 km 10,000 km	6,000 km 3,000 km

Model 625, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659 with engine series 400 with long-life oil filter	228.5 228.3	40,000 km 25,000 km	25,000 km 15,000 km	15,000 km 6,000 km
Model 944 with engine series 457.9, without maintenance system (MS)	228.5 228.3	25,000 km 15,000 km	15,000 km 10,000 km	8,000 km 5,000 km
Model 940, 942, 943, 944 with engine series 457.9, without maintenance system (MS), without special version MJ9	228.5 228.3	25,000 km 15,000 km	15,000 km 10,000 km	7,500 km 5,000 km
Model 940, 942, 943, 944 with engine series 457.9, without maintenance system (MS), with special version MJ9	228.5 228.3	50,000 km 30,000 km	30,000 km 20,000 km	15,000 km 10,000 km
Model 673, 674, 676 with engine series 900	228.5 228.3	15,000 km 15,000 km	15,000 km 10,000 km	3,000 km 3,000 km
Model 950.5/6, 952.5/6, 953.6, 954.5, 970, 972, 974, 975, 976 with engine series 900	228.5 228.3	30,000 km 15,000 km	15,000 km 10,000 km	8,000 km 5,000 km
Model 970, 972, 974, 975, 976 with engine series BR 900, without special version MJ9	228.5 228.3	25,000 km 15,000 km	15,000 km 10,000 km	7,500 km 5,000 km
Model 970, 972, 974, 975, 976 with engine series BR 900, with special version MJ9	228.5 228.3	50,000 km 30,000 km	30,000 km 20,000 km	15,000 km 10,000 km

Oil change intervals for operation with biodiesel (FAME)

Vehicle/ Engine	Oil quality	
Model 944 with engine series 457.9, with maintenance system (MS)	228.3 228.5	Set the sulfur content in the maintenance system to >0.8%, max. 30% of the interval for operation with fossil diesel fuel
Model 940, 942, 943, 944 with engine series 457.9, with maintenance system (MS), without special version MJ9	228.3 228.5	Set the sulfur content in the maintenance system to >0.8%. A max. 30% of the interval for operation with fossil diesel fuel can be reached
Model 940, 942, 943, 944 with engine series 457.9, with maintenance system (MS), with special version MJ9	228.3 228.5	Set the sulfur content in the maintenance system to 0.3 - 0.8%. A max. 50% of the interval for operation with fossil diesel fuel can be reached
Model 950.0/1/2/3, 952.0/1/2/3, 953.1/3, 954.0/1/2 with engine series 500, with maintenance system (MS)	228.3 228.5	Set the sulfur content in the maintenance system to >0.8%. A max. 30% of the interval for operation with fossil diesel fuel can be reached
Model 930, 932, 933, 934 with engine series 500, with maintenance system (MS)	228.3 228.5	Set "FAME" in the maintenance system. A max. 30% of the interval for operation with fossil diesel fuel can be reached
Model 930, 932, 933, 934 with engine series 500, with maintenance system (MS), with special version MY8		Set "FAME" in the maintenance system. A max. 45% of the interval for operation with fossil diesel fuel can be reached
Model 930, 932, 933, 934 with engine series 500, with maintenance system (MS), with special version MJ9		Set "FAME" in the maintenance system. A max. 50% of the interval for operation with fossil diesel fuel can be reached
Model 930, 932, 933, 934 with engine series 500, with maintenance system (MS), with special version MY8, with special version MJ9		Set "FAME" in the maintenance system. A max. 75% of the interval for operation with fossil diesel fuel can be reached
Model series 957 with engine series 900, with maintenance system (MS)	228.3 228.5	Set the sulfur content in the maintenance system to >0.8%. A max. 30% of the interval for operation with fossil diesel fuel can be reached
Model 950.5/6, 952.5/6, 953.6, 954.5, 970, 972, 974, 975, 976 with engine series 900 with maintenance system (WS)	228.3 228.5	Set the sulfur content in the maintenance system to >0.8%. A max. 30% of the interval for operation with fossil diesel fuel can be reached
Model 952, 952, 954 with engine series 900, with maintenance system (MS), without special version MJ9	228.3 228.5	Set the sulfur content in the maintenance system to >0.8%. A max. 30% of the interval for operation with fossil diesel fuel can be reached
Model 952, 952, 954 with engine series 900, with maintenance system (MS), with special version MJ9	228.3 228.5	Set the sulfur content in the maintenance system to 0.3 - 0.8%. A max. 30% of the interval for operation with fossil diesel fuel can be reached
Model 405, 408, 418, 427, 437 with engine series 300	228.3 228.5	400 operating hours
Model 405, 408, 418, 427, 437 with engine series 900	228.5	600 hours of operation

OEM engine oil change intervals for operation with biodiesel (FAME)

Engine	
Engines without special version for operation with FAME	Reduce oil change interval to 30% of the oil change interval for engines operated with fossil diesel fuel
Engines without special versions MK21 and MK04	Reduce oil change interval to 50% of the oil change interval for engines operated with fossil diesel fuel

i Always observe the specified oil change intervals. Exceeding the oil change interval can lead to engine damage.

Severe operating conditions

Severe operating conditions include:

- Extremely short-distance hauling
- Extremely poor road conditions
- Driving with all-wheel drive
- High quantities of dust
- Operation on construction site
- Operation of municipal vehicles or comparable operating conditions
- Firefighting vehicles or vehicles used in agriculture and forestry
- Mileage of < 10,000 km per year

- The fuel and engine oil filter should be changed approx. 1000 km after conversion to FAME due to the danger of clogging resulting from loosened deposits (FAME has a high cleaning effect).
- Operation with FAME requires shorter replacement intervals for the fuel filter. The fuel filter should be changed each time the engine oil is changed.
- If old deposits from the fuel system are transported to the fuel filter, this could reduce the service life of the filter. A specially approved fuel pre-filter can be installed to improve this condition. Vehicles with special version MJ9 and OEM engines with special version MK04 already have a fuel prefilter installed.

i The inline pumps require a very fine special fuel filter as a measure against internal wear. Installation of fuel filter elements which have not been approved leads to increased wear of the inline pumps.

4. Engine performance and cold starting

- Due to the energy contained in the fuel, the engine performance is reduced by approx. 8 % when FAME is used. This leads to a correspondingly higher fuel consumption in comparison to operation with diesel fuel. Correction of the engine performance is not permissible.
- Unimog: at extremely low outdoor temperatures, we recommend the installation of a flame-starting system or grid heater.
- When the engine is shut down for a longer period of time, we recommend flushing with diesel fuel to avoid sticking in the fuel system. To do this, drive the vehicle for at least 30 minutes. Operating with FAME is not practical on vehicles which are not used for long periods of time (e.g. fire department).

5. Auxiliary heaters

- Generally, all auxiliary heaters can be operated with diesel fuel or heating oil from an additional/combination tank. This ensures the proper operation of the auxiliary heater at low outside temperatures.

6. Miscellaneous

- The exhaust emissions are similar to that of diesel fuel; the black smoke is significantly lower.
- FAME is a very effective solvent. For this reason, avoid contact with paint. We assume no liability for paint damage resulting from contact with FAME.
- Not all manufacturers of engine oils are capable of processing engine oils on a second refined basis which have ester residues from operation with FAME. Please consult your used oil dealer in this regard.

- The typical odor of the FAME exhaust gases is occasionally considered to be unpleasant, particularly after longer periods of operation at idle. On several OEM engines, the installation of an oxidation catalytic converter by the vehicle/equipment manufacturer can reduce the unpleasant odor.
- Our company assumes no warranty for damage resulting from the use of poor quality FAME or failure to observe our specifications for operation with FAME. The resulting irregularities and subsequent damage are not within our range of responsibility.

	Service Information: Retrofitting a fuel prefilter	Engine 541.9 in model 950, 952, 953, 954 Engine 542.9 in model 950, 952, 954	SI47.20-W-0001A
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