OM 904-926 LA BlueTec®, OM 904-926 LA

Operating Instructions

Mercedes-Benz

Symbols

⚠	Warning
	Environmental note
❗	Possible vehicle damage
ℹ	Tip
▶	Instructions
▷▷	Continuation symbol
(▷ page)	Page reference

Welcome to the world of Mercedes-Benz

Familiarise yourself with your engine and read the Operating Instructions before you use the engine. This will help you to avoid endangering yourself or others.

The standard equipment and product description of your engine may vary, depending on individual specifications. This is described on the engine data card.

Mercedes-Benz constantly updates its engines to the state of the art.

Mercedes-Benz reserves the right to make changes to the following:

- design
- equipment
- technical features

You cannot therefore base any claims on the data, illustrations or descriptions in this manual.

The manual/instructions are comprised of:

- Operating Instructions
- Maintenance Booklet

Always keep these documents together with the engine/vehicle/device. These documents should be passed on to the new owner if you sell the engine/vehicle/device.

You can find out about your engine's important functions in German and English in the online Owner's Manual at: http://www.mercedes-benz.de/betriebsanleitungen

The technical documentation team at Daimler AG wishes you safe and pleasant motoring.

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Environmental note

Environmental note

Daimler AG has a declared policy of comprehensive environmental protection.

The objectives are to use the natural resources which form the basis of our existence on this planet sparingly and in a manner which takes the requirements of both nature and humanity into account.

You also can help to protect the environment by operating your engine in an environmentally responsible manner.

The fuel consumption and wear and tear of an engine depend upon the conditions under which it is operated. For this reason, you should:

- not warm up the engine in neutral
- switch off the engine during operation-related delays
- monitor the fuel consumption
- carry out the specified maintenance work.

Always have maintenance work carried out at a qualified specialist workshop, e.g. a Mercedes-Benz or MTU Service Centre.

Operating safety and vehicle approval

Operating safety

The operating safety of an engine depends on its professional installation in the overall system (e.g. the vehicle or working machinery). As the operator of the engine, you also affect its safe operation.

Through compliance with the prescribed maintenance intervals, you fulfil part of the requirements for safe operation of the engine.

However, safe operation of the engine also depends upon its proper use, which includes, for example, regular checks of the oil level.

⚠ WARNING

Accidents can occur as a result of engine damage caused by improper use of the engine.

Therefore, please follow the engine operating instructions included in the Owner's Manual.

⚠ WARNING

Faulty or incomplete maintenance work, as well as disregarded maintenance intervals, can decrease the engine's operating life, cause engine damage and lead to accidents.

Therefore, please follow the engine operating instructions included in the Owner's Manual.

Notes on electronic systems

⚠ WARNING

If work on electronic equipment and its software is carried out incorrectly, this equipment could stop working. The electronic systems are networked via interfaces. Tampering with these electronic systems could cause malfunctions in systems which have not been modified. Malfunctions such as these can seriously jeopardise the vehicle's operating safety and therefore your own safety.

Other work or modifications incorrectly carried out on the vehicle could also jeopardise operating safety.

Some safety systems only function when the engine is running. You should therefore never switch off the engine when driving.

Conversion parts and modifications to the engine

⚠ WARNING

Unauthorised changes to the engine can reduce its functionality and safety, lead to accidents and consequently to personal injury. Always have maintenance or modification to the engine carried out at a qualified specialist workshop which has the necessary

▷▷

specialist knowledge and tools to carry out the work required. Mercedes-Benz recommends that you use a Mercedes-Benz or MTU Service Centre for this purpose.

! Unauthorised intervention in the injection system and the engine electronics can affect the performance and emissions of the engine. Compliance with factory settings and legal environmental protection conditions can then no longer be guaranteed.

The implied warranty does not cover damage resulting from unauthorised modifications to the engine.

Safety/emergency running program

The engine is equipped with an electronic control system, which monitors both the engine and itself (self-diagnosis).

When the electronic control system detects a malfunction, one of the following measures is automatically implemented after an appraisal of the malfunction:

- The corresponding warning lamp displays the faults occurring during operation (▷ page 25).
- In conjunction with the electronic engine control, fault codes can be shown on a display.
- The system switches to a suitable backup function for the continued, albeit restricted operation of the engine (e.g. constant emergency running speed).

⚠ WARNING

If maintenance and repair work on the engine is not carried out correctly, the operation and safety may be affected, which can result in accidents and personal injury.

Always have work on or modifications to the engine carried out at a qualified specialist workshop that has the necessary special skills and tools for the work required.

Mercedes-Benz recommends a Mercedes-Benz or MTU Service Centre.

The Daimler diagnostic tester can be attached to the 14-pin diagnostic socket on the equipment, or to the service plug according to the EU Directive. Both the malfunction message memory and the saved engine data can be read by this device.

Warning lamp electronics (example)

Genuine Mercedes-Benz parts

Make sure of the suitability of the replacement parts for your engine. Parts that lead to a modification of the engine/vehicle/equipment are considered in many countries to render the general operating permit invalid.

Such modifications include, for example:

- modifications that change the approved equipment type/vehicle type, as defined by the general operating permit.
- modifications that could endanger road users or persons in the vicinity of the vehicle/equipment.
- modifications that change the exhaust or noise level.

The use of unapproved parts can adversely affect safety levels.

Environmental note

For more economic repairs, Mercedes-Benz offers Mercedes-Benz reconditioned assembly and parts as part of the recycling process. The same quality standards and warranty apply as to new parts.

You can find more information on recommended conversion parts and accessories, as well as permitted technical modifications at a Mercedes-Benz or MTU Service Centre (▷ page 11).

Always state the engine number with the model designation when ordering genuine Mercedes-Benz parts. You can find the numbers on the identification plate of your engine (▷ page 100) and on the engine data card (▷ page 100).

BlueTec® exhaust gas aftertreatment

The engines meet the requirements of the relevant emissions level and are correspondingly certified.

Compliance with emissions laws and regulations is a condition of the operating permit for the vehicle/equipment.

Engines with BlueTec® exhaust gas aftertreatment must be operated with AdBlue®/DEF in order to meet the emissions laws and regulations.

The operating permit is invalidated if the vehicle/equipment is operated without AdBlue®/DEF. The legal consequence of this is that operation of the vehicle/equipment is no longer permitted. This may be an offence or a breach of road traffic regulations in certain countries. Special concessions granted either at the time of purchase or to reduce operating costs of the vehicle/equipment, e.g. reduced taxes or tolls, may also be rendered retroactively invalid. This can be the case in the country of registration. Or also in another country where you operate the vehicle/equipment.

Legal requirements

If the engine/vehicle/equipment is not operated within the limits of the emissions laws and regulations, it can lead to sanctions.

This normally affects the following operating states:

- driving without AdBlue®/DEF
- the permissible nitrogen oxide (NOx) thresholds are exceeded
- there is a fault or emissions-relevant malfunction in the monitoring or exhaust gas aftertreatment system

You can find details in the “Engine diagnostics indicator lamp” section(▷ page 94).

Fault detected in the monitoring system

If the monitoring system detects a fault in the BlueTec® exhaust gas aftertreatment, operation is limited in accordance with the relevant regulations (▷ page 37).

Correct use

The engine may only be installed as contractually specified.

The manufacturer of the end product is responsible for the correct installation and compatibility of the engine in the overall system.

The engine may not be modified. If the engine is modified, Mercedes-Benz and MTU do not accept responsibility for any damage arising as a result.

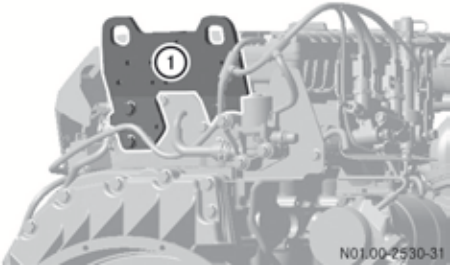
Correct use of the engine requires adherence to the instructions in this Owner's Manual. This also requires compliance with the maintenance intervals and the professional execution of maintenance work in accordance with this Owner's Manual.

Transport

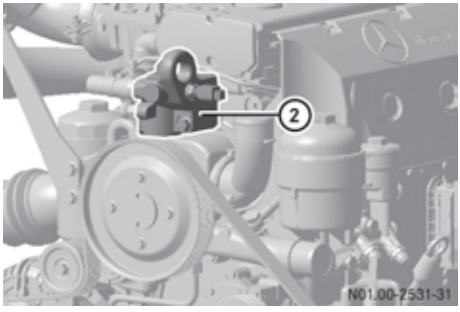
⚠ WARNING

The engine can detach and cause injuries if it overturns or falls out.

- To lift the engine, only use lifting points attached to the engine.
- Only use Mercedes-Benz transport equipment intended for this purpose.
- Only lift and transport the engine in the installation position. Also, observe the maximum permitted angle of 30° while lifting the engine in and out of vehicles.



Lifting point flywheel-side (example)



Lifting point belt-side (example)

Installation

The engine may only be installed as contractually specified.

The manufacturer of the end product is responsible for the correct installation and compatibility of the engine in the overall system.

Observe the sections "Correct use" (▷ page 9) and "Modification and changes to the engine" (▷ page 7).

The Operating Instructions contains information required for installation in the "Technical Data" section" (▷ page 101).

Please consult a Mercedes-Benz or MTU Service Centre if you have any questions (▷ page 11).

Information on the implied warranty

A well-developed network of Mercedes-Benz and MTU Service Centres is available to carry out maintenance work.

Mercedes-Benz and MTU Service Centres:

- have special equipment and tools as well as specialists who receive continuous training
- guarantee that your engine is repaired and maintained thoroughly and expertly
- carry out all repairs within the framework of the engine warranty and the implied warranty
- carry out all maintenance work expertly
- confirm in the Maintenance Booklet that the maintenance work has been carried out at the required time
- handle warranty claims that are admissible according to the sales contract

Please observe the instructions and recommendations as well as the maintenance services in the Maintenance Booklet. Please observe these instructions even if you let a third party use and care for your engine. This is the only way to ensure that you do not lose your entitlements.

If the prescribed maintenance work is not carried out, claims can only be decided after the manufacturer has inspected the claim.

During the engine warranty period in particular, have the prescribed maintenance service carried out as follows:

- regularly
- punctually
- at a qualified specialist workshop which has the necessary specialist knowledge and tools to carry out the work required.

  Mercedes-Benz recommends that you use a Mercedes-Benz or MTU Service Centre for this purpose. In particular, work relevant to safety or on safety-related systems must be carried out at a qualified specialist workshop.

If there are legal requirements on exhaust gas aftertreatment, please note that:

- maintenance on the engines must be carried out according to specific regulations and using special measuring devices.
- it is prohibited to modify or tamper with components relevant to emissions.

All Mercedes-Benz and MTU Service Centres are aware of the relevant regulations.

Maintenance work does not include repair work. Repair work requires a separate order.

You may also consult a Mercedes-Benz or MTU Service Centre for further information.

Qualified specialist workshop

A qualified specialist workshop has the necessary specialist knowledge, tools and qualifications to carry out the work required on the engine to a professional standard. This is especially important for work relevant to safety.

A qualified specialist workshop must carry out the required service, maintenance and repair work and document it according to the specifications of Daimler AG. Failure to comply with these specifications could lead to the loss of warranty entitlements.

Mercedes-Benz recommends that you use a Mercedes-Benz or MTU Service Centre.

Always have the following work on the vehicle carried out at a qualified specialist workshop:

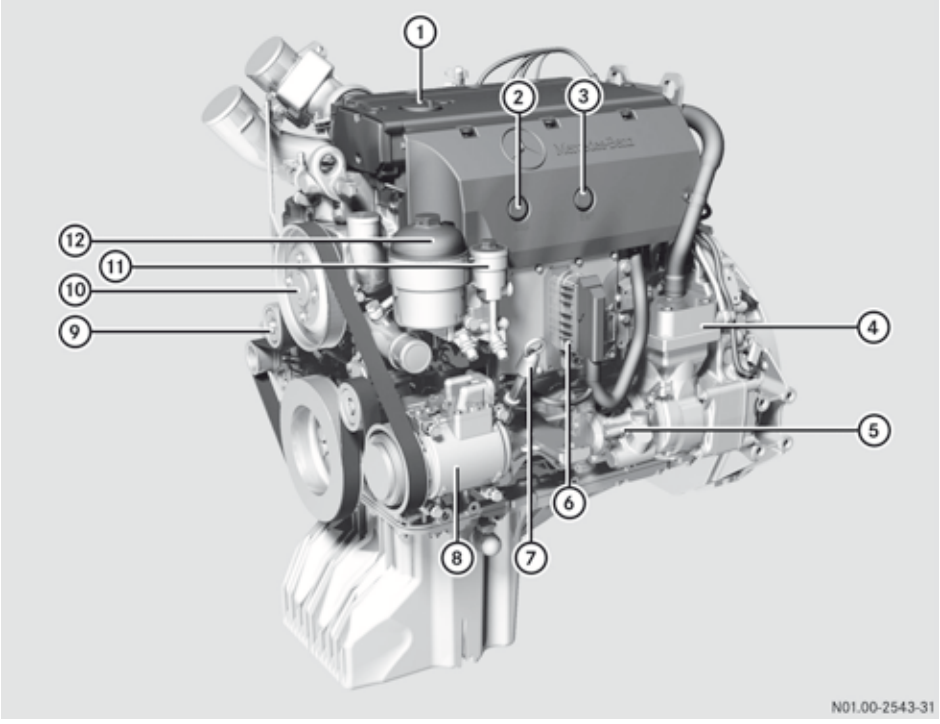
- work relevant to safety
- service and maintenance work
- repair work
- modifications such as installations or conversions
- work on electronic components

Please have warranty and ex gratia work carried out at authorised workshops/Service Centres.

- For on-highway applications, contact a Mercedes-Benz Service Centre.
- For off-highway applications, contact an MTU or MTU-authorised Mercedes-Benz partner.

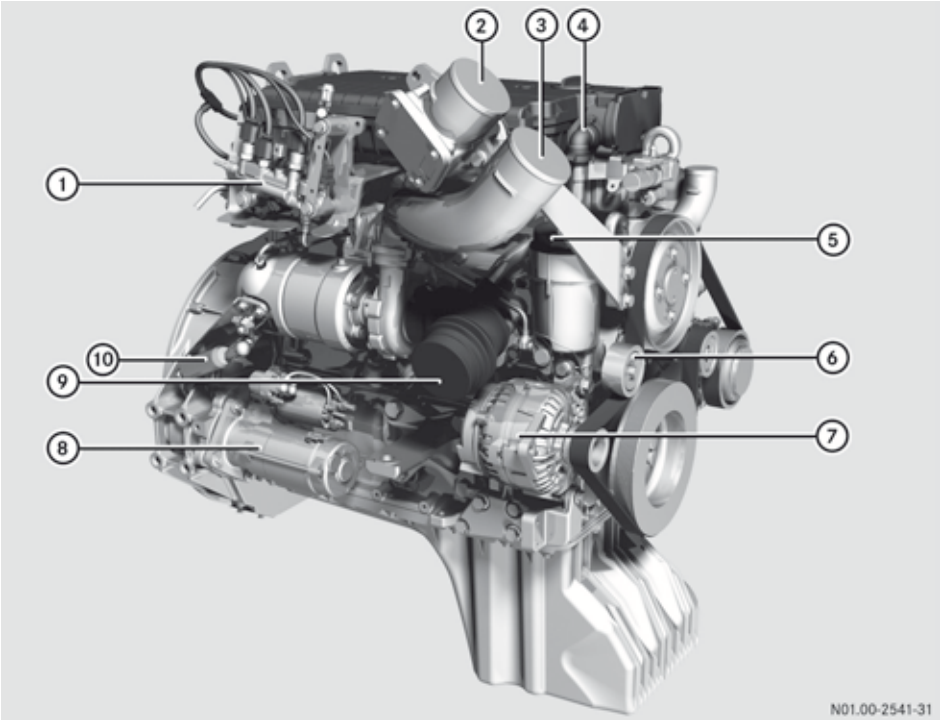
Exterior view

Engine overview



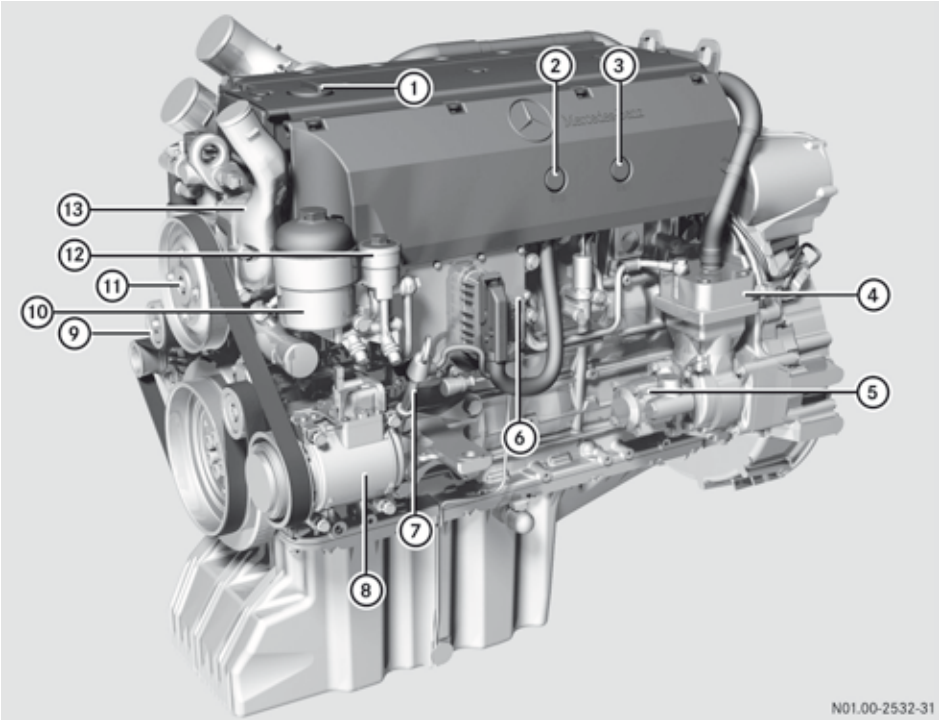
Engine overview OM 904 LA

① Filler neck
② Stop button
③ Start button
④ Air compressor
⑤ Power-steering pump
⑥ Engine control (MR) control unit
⑦ Oil dipstick
⑧ Refrigerant compressor
⑨ Tensioning pulley
⑩ Coolant pump
⑪ Fuel prefilter
⑫ Fuel filter



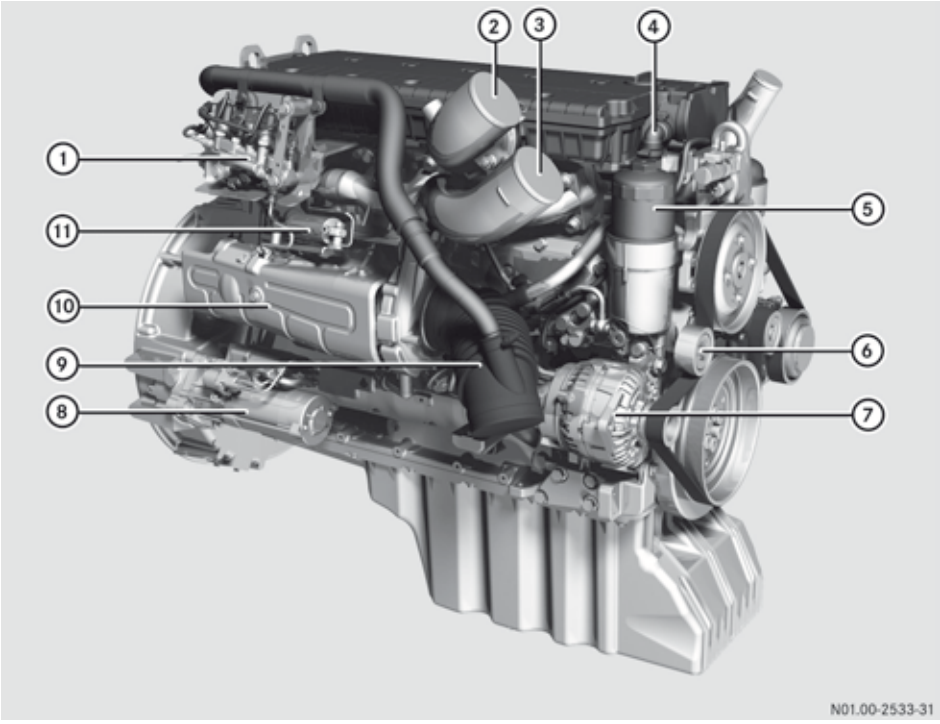
Engine overview OM 904 LA

① AdBlue®/DEF metering unit
② Charge air pipe of the charge-air cooler
③ Charge air pipe to the charge-air cooler
④ Crankcase ventilation hose
⑤ Oil filter
⑥ Tensioning pulley
⑦ Alternator
⑧ Starter
⑨ Intake air inlet
⑩ Engine brake



Engine overview OM 906 LA

① Filler neck
② Stop button
③ Start button
④ Air compressor
⑤ Power-steering pump
⑥ Engine control (MR) control unit
⑦ Oil dipstick
⑧ Refrigerant compressor
⑨ Tensioning pulley
⑩ Fuel filter
⑪ Coolant pump
⑫ Fuel prefilter
⑬ Coolant outlet to the radiator

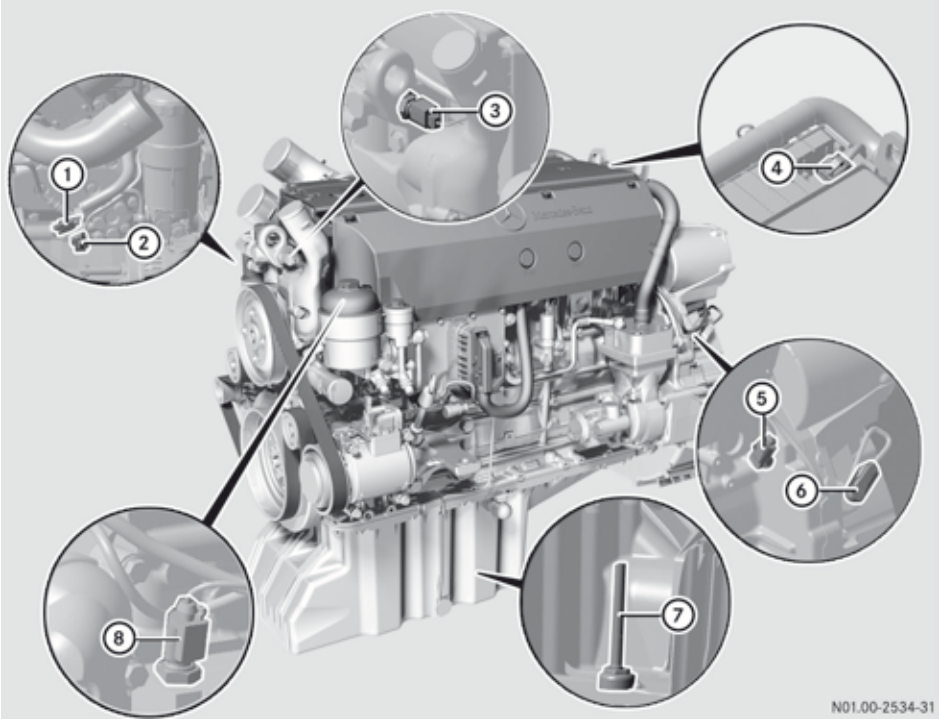


Engine overview OM 906 LA

① AdBlue®/DEF metering unit
② Charge air pipe of the charge-air cooler
③ Charge air pipe to the charge-air cooler
④ Crankcase ventilation hose
⑤ Oil filter
⑥ Tensioning pulley
⑦ Alternator
⑧ Starter
⑨ Intake air inlet
⑩ Exhaust gas turbocharger
⑪ Engine brake

Sensors overview

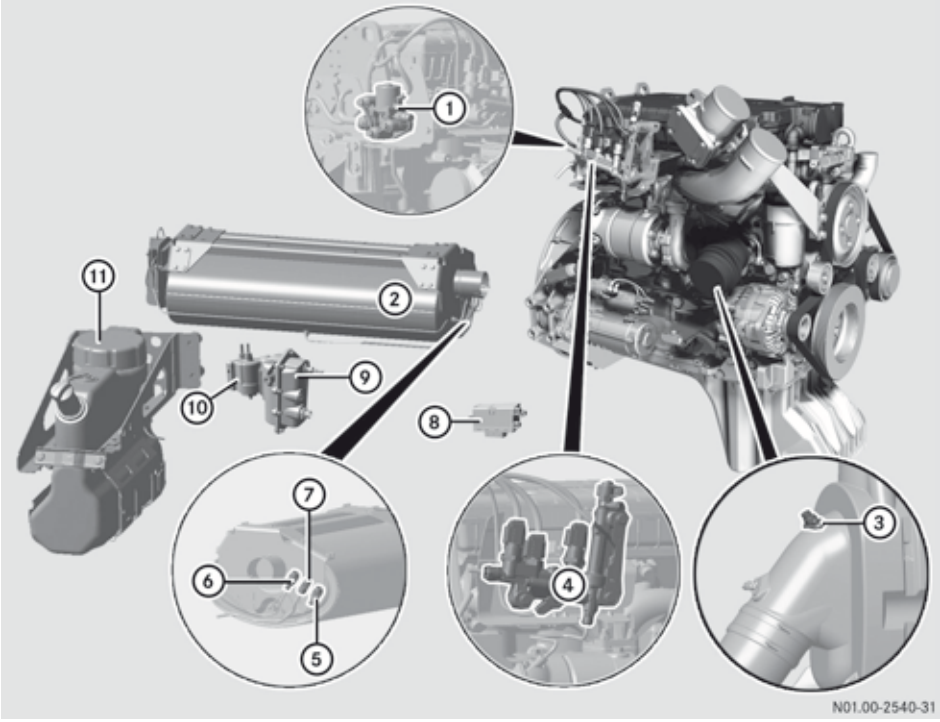
Sensors, general



Example: OM 926 LA

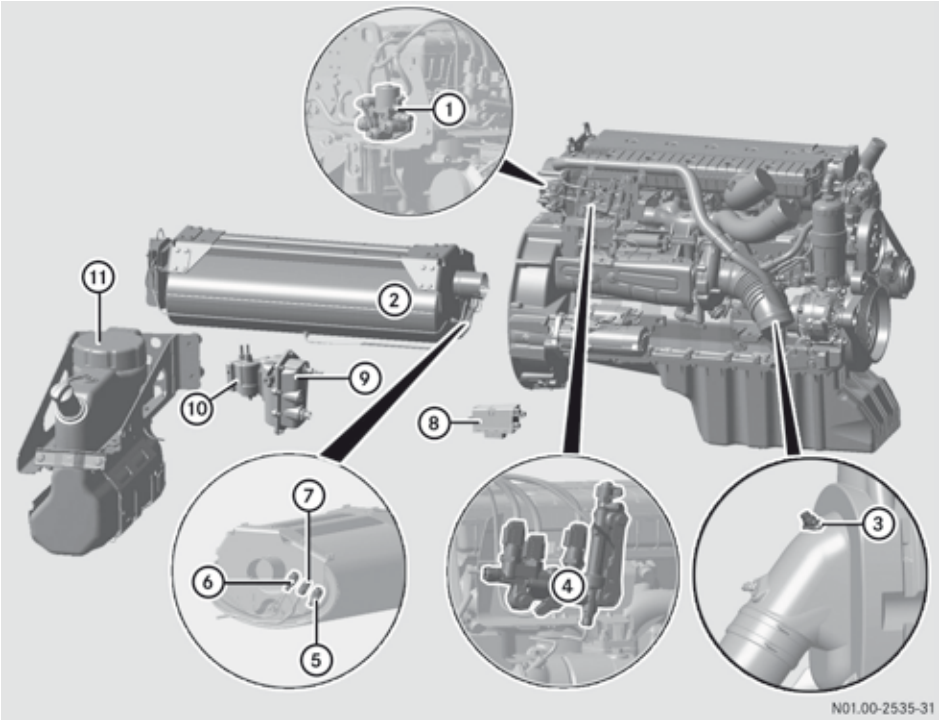
① Oil temperature
② Oil pressure
③ Coolant temperature
④ Charge-air temperature/charge-air pressure
⑤ TDC sensor (on camshaft gear)
⑥ Crankshaft position sensor (on flywheel)
⑦ Oil level
⑧ Fuel temperature

AdBlue®/DEF components



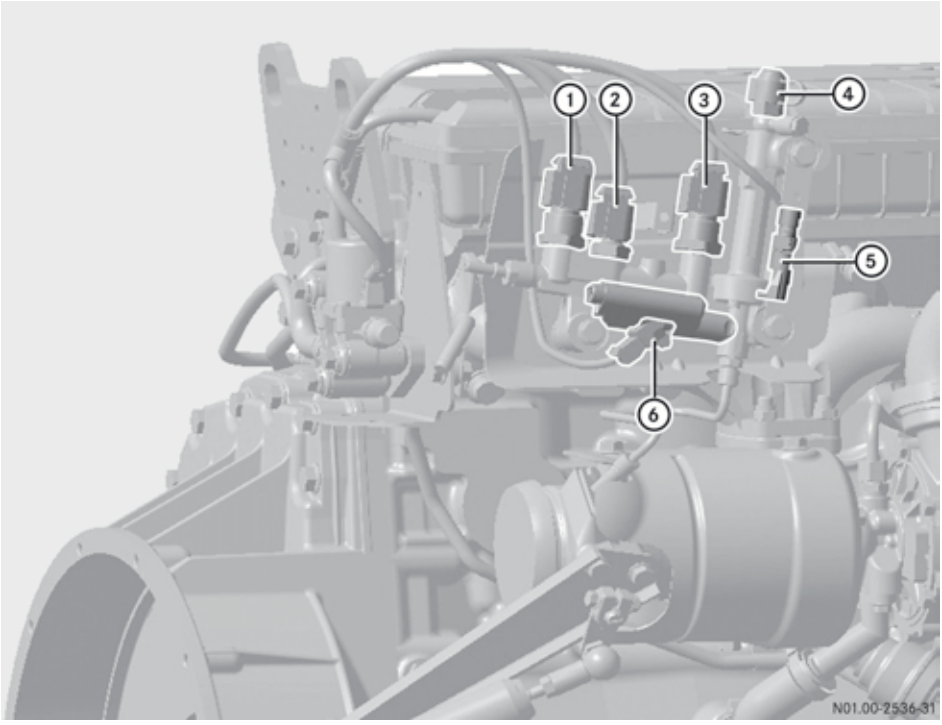
BlueTec® sensors, overview OM 924 LA

① Valve preheating, AdBlue®/DEF system
② Silencer
③ Temperature and humidity sensor (air filter, clean air side)
④ Metering unit
⑤ Temperature sensor downstream of catalytic converter
⑥ NOx sensor
⑦ Temperature sensor upstream of catalytic converter
⑧ SCR frame module
⑨ Supply unit
⑩ AdBlue®/DEF filter
⑪ AdBlue®/DEF tank



BlueTec® sensors, overview OM 926 LA

① Valve preheating, AdBlue®/DEF system
② Silencer
③ Temperature and humidity sensor (air filter, clean air side)
④ Metering unit
⑤ Temperature sensor downstream of catalytic converter
⑥ NOx sensor
⑦ Temperature sensor upstream of catalytic converter
⑧ SCR frame module
⑨ Supply unit
⑩ AdBlue®/DEF filter
⑪ AdBlue®/DEF tank



BlueTec® sensors and test connection on the metering unit. Example: OM 926 LA

① AdBlue®/DEF pressure sensor
② AdBlue®/DEF temperature sensor
③ Pressure sensor for compressed air
④ Metering unit test connection
⑤ Metering unit heater
⑥ Metering valve

General information

Description of the engine

The engine is a water-cooled four-stroke diesel engine with direct injection.

The cylinders are arranged in a row. Each cylinder has two inlet valves and one outlet valve.

Each cylinder has its own fuel injection pump (unit pump) with a short high-pressure fuel injection line to the multi-hole nozzle at the centre of the combustion chamber. The unit pumps sit directly in the crankcase and are driven by the camshaft.

The engine is equipped with exhaust gas turbocharger and intercooler as standard. The engine can be equipped with optional engine brakes (brake valve and constant throttle valves).

It is a low-emission engine. Start of injection, injection period and injection quantity are controlled entirely electronically.

Electronic drive control

The engine has a fully electronic control system which, along with the engine and its associated sensors, consists of the following components:

- the engine control unit (MR) and
- the drive control unit (FR) and/or other vehicle-specific control units, e.g. ADM
- SCR frame module (only for engines with BlueTec® exhaust gas aftertreatment)

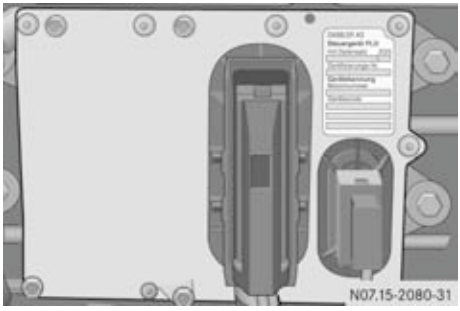
The control units are interconnected by a CAN line (Controller Area Network line) which facilitates the exchange of all necessary data.

In addition to the engine and the BlueTec® exhaust gas aftertreatment, the electronic engine control also monitors itself. Depending on the malfunctions/failures that occur, a safety and emergency mode (▷ page 8) may be automatically selected.

For vehicle engines, the electronic engine control only allows the engine to be started when the transmission is in neutral.

Engine control unit (engine resident)

The engine control unit is on the left side of the engine.



Example: OM 926 LA engine control unit

The engine control unit processes values from the FR (drive control) unit and the ADM. These are, for example, the value from the position sensor (accelerator pedal), the engine brake or engine start/stop, etc.

These values are analysed together with data from the engine sensors. They are compared with the charts or characteristic curves stored in the engine control unit.

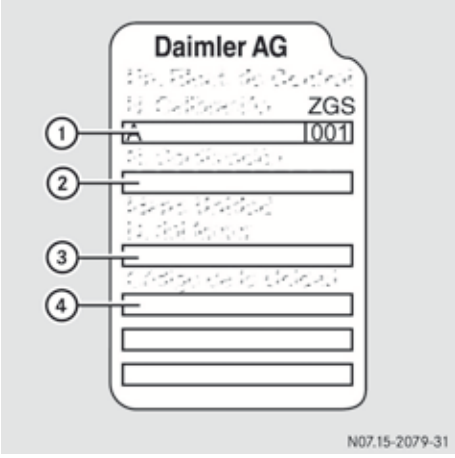
Data from the sensors derives from, e.g.:

- charge-air pressure and charge-air temperature
- coolant temperature
- fuel temperature
- oil pressure

Start of injection, injection period and injection quantity are calculated on this basis and the unit pump is controlled via the solenoid valve accordingly.

If BlueTec® exhaust gas aftertreatment is available, the associated sensors are also analysed and the AdBlue®/DEF dosage is controlled.

ⓘ To obtain a replacement engine control unit, you will require all the data on the control unit type plate.



Control unit type plate

① Data record
② Certification no.
③ Engine number
④ Equipment code

FR (drive control) unit or ADM (on the equipment)

The engine can be adapted to the various operation-specific requirements using the FR (drive control) unit or the adaptation module ADM.

Example: FR (drive control) unit

Various operation specific data such as engine idling speed, maximum working engine speed or speed limiter are stored in the FR (drive control) unit or the ADM.

The FR (drive control) unit or the ADM receives data from:

- user (values from the position sensor, engine start/stop)
- engine brake switch
- other systems (e.g. acceleration skid control)
- engine control unit (e.g. oil pressure and coolant temperature)

Values for the engine control (MR control unit) are derived from this and conveyed via the CAN line.

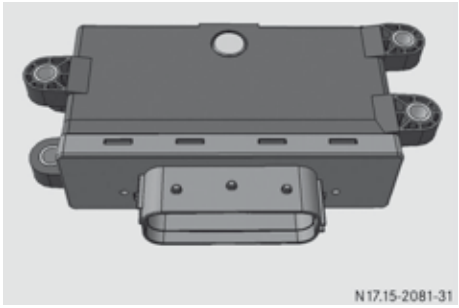
The FR (drive control) unit or the ADM controls various displays, e.g. the electronics warning lamp, the engine brake and the constant throttle valve.

If the electronic engine control detects a fault, the fault code is saved in the control units. It can be read out with the corresponding diagnostic testers (STAR DIAGNOSIS or minidiag2).

In addition, the FR/MR electronics warning lamp is switched on.

Mercedes-Benz diagnostic testers can be connected to the 14-pin diagnostic socket on the equipment or with the EU compliant service connector. Both fault memory and stored engine data can be read out using this equipment.

SCR frame module (on the frame)

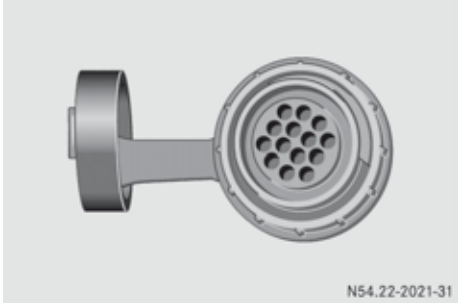


SCR frame module

The SCR frame module reads signals and transmits them via the CAN line to the engine control unit.

The following signals are read:

- Temperature sensor upstream of the SCR catalytic converter
- Temperature sensor downstream of the SCR catalytic converter
- NOx sensor downstream of the SCR catalytic converter
- Combination sensor for level and temperature in the AdBlue®/DEF tank
- Combination sensor for humidity and air charge temperature



Example: diagnostic socket

Example: EU compliant service connector

Warning and indicator lamps

Engine, general

Symbol[1]	Reason for display/displayed message	
 Text in the engine symbol: "CHECK"	Fault lamps	Impermissible operating conditions
 Text in the engine symbol: "STOP"	STOP lamp	Serious fault[2]
	Electronic engine control malfunction	Lights up in the event of an electronic engine control malfunction. Engine may only be operated in emergency mode.
	Charge current (power generation)	Lights up in the event of a charge current (power generation) malfunction. If the warning lamp does not go out after starting the engine, or if it goes on while the engine is running, the alternator or poly-V-belt is faulty.
	Cold-start aid	Lights up if the cold-start aid is active.

BlueTec® exhaust gas aftertreatment on-highway version[3]

The following indicator lamps could be available on the instrument panel:

Symbol[1]	Reason for display/displayed message	
	AdBlue®/DEF level	Fault message/action required (warning before reduction in operating performance)
	Engine indicator lamp	Exhaust system fault
 NO_x bulb	Reduction in operating performance	Active torque limitation

1 Symbols may vary depending on the vehicle/equipment version.
2 In addition, a warning tone may sound.
3 On-highway: vehicles with MOT approval.

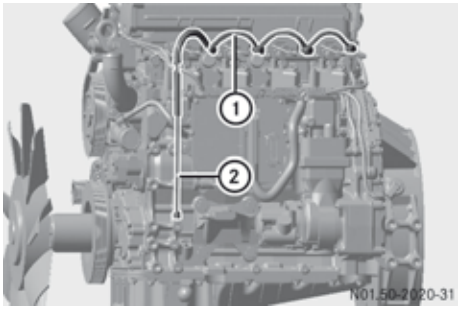
BlueTec® exhaust gas aftertreatment off-highway version[4]

The following indicator lamps could be available on the instrument panel:

Symbol[1]	Reason for display/displayed message	
	AdBlue®/DEF level	Fault message/action required (warning before reduction in operating performance)
CHECK ENGINE	Check engine/exhaust gas aftertreatment	Fault and misuse (failure in the monitoring system)
LIM lights up (level 1)	Torque/speed limiter active[2]	Slight reduction in operating performance
LIM flashes (level 2)		Significant reduction in operating performance

Continuous brake

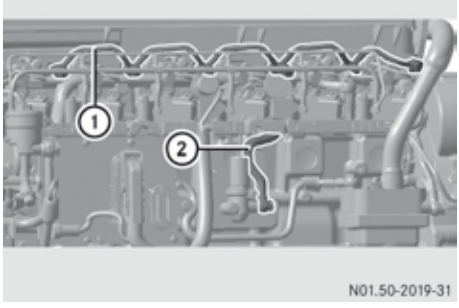
If increased braking power is required, the engine can be equipped with a brake valve downstream from the exhaust gas turbocharger in conjunction with constant throttle valves.



OM 904 LA/OM 924 LA constant throttle valve

① Constant throttle valve

② Pneumatically-actuated line



OM 926 LA constant throttle valve

① Constant throttle valve

② Hydraulically-actuated line

The brake valve uses exhaust back pressure to increase braking power. The constant throttle valves bring about a reduction of the compression pressure in the power stroke (third stroke), whilst the compression (second stroke) is not significantly affected.

The constant throttle valve is an additional valve in the cylinder head. When open, the constant throttle valve establishes a connection between the combustion chamber and

4 Off-highway: vehicles without MOT approval.

1 Symbols may vary depending on the vehicle/equipment version.

2 In addition, a warning tone may sound.

exhaust port. This brings about the desired decompression during the power stroke.

When the engine brake is activated, the constant throttle valves are opened. For OM 904/OM 924 engines, the actuation is pneumatic. For OM 906/OM 926 engines, the actuation is hydraulic. The brake valve on the exhaust gas turbocharger is also closed.

The engine brake is actuated by the FR (drive control) unit (▷ page 23) or the ADM.

The engine brake is always deactivated below 900 rpm. This prevents the engine from stalling. The engine brake is automatically deactivated even if the position sensor (e.g. accelerator pedal) is in use.

ⓘ In emergency mode (constant engine speed), the engine brake can only be activated in overrun mode at increased engine speed. Once the constant engine speed is reached, the engine brake is automatically deactivated again.

Cold-start aid

The cold-start aid makes it easier to start the engine at low outside temperatures (below –15 °C); it is activated when the outside temperature falls below –4 °C.

Environmental note

At outside temperatures below about –4 °C the cold-start aid minimises emissions (after starting the engine). In addition, it reduces the load on the starter motor and batteries and enables the engine to be started more rapidly. For this reason you should only start the engine after the indicator lamp goes out.

▶ **To activate the cold-start aid:** turn the vehicle key to the drive position in the ignition lock.
The indicator lamp lights up in the instrument panel.

▶ After the indicator lamp goes out, start the engine within 30 seconds.

The cold-start aid is automatically deactivated if:

- the engine is not started within 30 seconds of the indicator lamp going out.
- the engine is started while the indicator lamp is still lit.
- the coolant temperature reaches around 0 °C while the engine is running.

At a coolant temperature above approximately –4 °C, the indicator lamp goes out after approximately 2 seconds (function check). At a coolant temperature below approximately –4 °C, the indicator lamp goes out after approximately 20 seconds.

Have the cold-start aid checked and repaired at a qualified specialist workshop. Mercedes-Benz recommends that you use a Mercedes-Benz or MTU Service Centre for this purpose (▷ page 11). Work relevant to safety or on safety-related systems must be carried out at a qualified specialist workshop.

Safety precautions

Damage to the engine can also lead to personal injury. In order to avoid engine damage, the following safety precautions must be adhered to.

Safety precautions

- Only start the engine when the batteries are firmly attached.
- Do not disconnect the batteries when the engine is running.
- Do not use a rapid charger to start the engine.
- Only perform the jump-starting procedure with separate batteries.
- Note, the battery terminals must be disconnected when rapid charging the batteries.
- Observe the operating instructions of the rapid battery charger.
- Please note, when carrying out electric welding work, that the batteries must be disconnected and both of the cables ("+" and "-") must be firmly attached to each other.
- The control unit connectors may only be connected/disconnected when the electrical system is switched off.
- Incorrect control unit-power supply polarity (e.g. by connecting up the batteries incorrectly) can cause irreparable damage to the control units.
- Tighten diesel injection system connections to the prescribed tightening torque.
- If temperatures above 80 ℃ are to be expected (e.g. in a drying oven), the control unit on the engine must be removed.
- Only use the appropriate testing probes when taking measurements from electrical connectors (e.g. a Mercedes-Benz connection set). Telephones and two-way radio devices that are not connected to an external aerial, can cause malfunctions in the vehicle electronics and thus endanger the operating safety of the engine.

Staff qualifications

⚠ WARNING

If maintenance and repair work on the engine is not carried out correctly, the operation and safety may be affected, which can result in accidents and personal injury.

Always have work on or modifications to the engine carried out at a qualified specialist workshop that has the necessary special skills and tools for the work required.

Mercedes-Benz recommends a Mercedes-Benz or MTU Service Centre.

The engine should only be operated, maintained and repaired by trained personnel who have been briefed and authorised by the operator. The minimum legal age for personnel carrying out maintenance and repair work must be observed.

Organisational measures

The responsibilities for operation, maintenance and repairs are to be determined by the operator. Give the Operating Instructions and the Maintenance Booklet to the personnel that are charged with operating or carrying out work on the engine.

⚠ WARNING

Before operating the engine, please read these Operating Instructions. Please also first read the operating instructions of the vehicle or the machine to which the engine is fitted. You may not recognise dangers and may injure yourself or others.

Instruct personnel on how to operate the engine using the Operating Instructions. When doing so, put special emphasis on safety-relevant information. This is particu-

larly important for personnel that only work occasionally on the engine.

Always keep the Operating Instructions and the Maintenance Booklet readily accessible, in the area of engine operation.

In addition to the Operating Instructions, other general, country-specific, legal and other binding regulations on accident prevention and environmental protection must be adhered to.

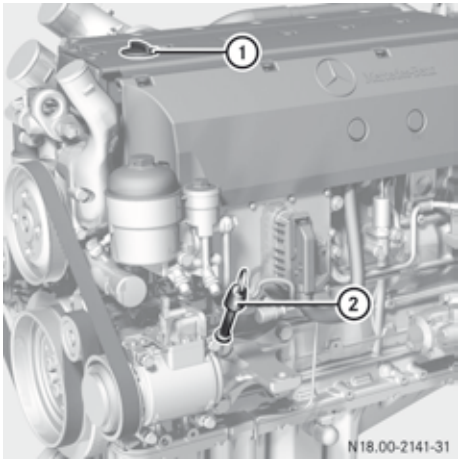
Operation

Preparation for operation

At the factory, the engine is filled with 5W30 initial operation oil that complies with Sheet 225.6 of the Mercedes-Benz Specifications for Service Products.

These high-quality engine oils are beneficial to the running-in process. They also allow you to make the first oil change in accordance with the applicable oil change intervals for normal operation. This eliminates the need for special initial operation oils and the additional oil change otherwise required.

The extended maintenance intervals can only be observed if engine oils complying with Sheet 228.5 of the Mercedes-Benz Specifications for Service Products are used.



Example: OM 926 LA

① Filler neck

② Oil dipstick

Engine oil level

Check the engine oil level on a regular basis, e.g. every week or each time you refuel.

- ▶ Park the vehicle/equipment on a horizontal surface.
- ▶ Engage the parking brake.
- ▶ Switch off the engine.
- ▶ If the engine is at normal operating temperature: wait about one minute. If the engine is cold: wait about 5 to 10 minutes.
- ▶ Check the engine oil level with oil dipstick ②. The oil level should be between the upper and lower marks on oil dipstick ②.
- ▶ If necessary, add oil via filler neck ①.

Do not add too much oil when topping up. Topping up with too much oil can result in damage to the engine or the catalytic converter. Drain or siphon off excess oil.

Adding coolant

- ▶ Information on coolant mixture ratio (▷ page 76).
- ▶ Filling the cooling system (▷ page 48).

Refuelling

Use summer or winter fuel depending on the season (▷ page 50).

! When refuelling ensure that conditions are clean and do not allow water to enter the tank and thus contaminate the fuel.

Refuelling with AdBlue®/DEF

Only use AdBlue®/DEF that complies with DIN 70070/ISO 22241. Do not use any additives. If AdBlue®/DEF comes into contact with painted or aluminium surfaces when filling the tank, rinse the affected surfaces immediately with plenty of water.

Bleeding the fuel system

The bleeding of a fuel system that has been run dry takes place when the engine is next started after refuelling. Automatic continuous bleeding takes place in the filter.

i The battery must be sufficiently charged when the engine is started in order for the fuel system to be bled.

ⓘ Use the integrated hand pump (▷ page 68) to bleed the heated-fuel pre-filter with water separator mounted on the vehicle or equipment.

Starting the engine for the first time

Preparation

Carry out the work listed under "Preparing for operation" before operating the engine for the first time (▷ page 34).

Observe the information contained in the equipment/vehicle manufacturer's operating instructions.

- ▶ Connect a power supply.
- ▶ Switch on the ignition.
- ▶ Start the engine using the key in the ignition lock or the start button on the engine. Do not depress the accelerator or clutch pedal while doing so. For equipment, the neutral position must be engaged.

As a safety function, the electronic engine control system facilitates the possibility of only allowing the engine to be started when the transmission or equipment is in neutral.

⚠ WARNING

Make sure you do not touch any hot or moving engine components (e.g. exhaust manifold, poly-V-belt, fan) when the engine is running. You could injure yourself.

Be aware of the road and traffic situation when working on public roads and secure your position accordingly.

⚠ WARNING

There is a danger of limbs being caught, pulled in and thereby crushed or severed by rotating engine parts.

Therefore you should:

- keep a safe distance between yourself and rotating engine parts, including when the engine is being started.
- wait until all engine parts have stopped moving before carrying out any work on the engine.
- wear work clothing which is fastened and close-fitting. Wear a hair net if necessary. Remove jewellery such as watches and necklaces.

⚠ WARNING

When opening the coolant expansion tank, there is a risk of scalding due to hot coolant spraying out. The cooling system and coolant expansion tank are pressurised when the engine is at operating temperature. Wear gloves and eye protection.

Only open the coolant expansion tank when the coolant temperature is below 50 °C.

⚠ WARNING

Coolant contains glycol and is therefore toxic. Do not swallow the coolant. See a doctor immediately if you swallow coolant.

Make sure that coolant does not come into contact with skin, eyes or clothing. In case of contact with eyes, rinse immediately with plenty of clean water. Clean affected areas of skin and clothing with soap and water immediately. Change any affected clothing immediately.

Starting the engine for the first time

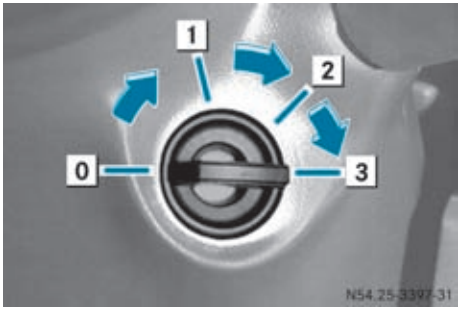
- ▶ **To check coolant level:** leave the engine running at a moderate engine speed for around five minutes.
- ▶ If the coolant temperature is less than 50 °C, check the coolant level again. Add coolant.

If a heating system is connected to the cooling system, all heating system valves must be opened while the cooling system is being topped up. Otherwise, there might be too little

coolant in the coolant circuit after it is filled. Only close the heating system valves once the engine has been running for a brief period and, where applicable, the coolant has been topped up.

- ▶ Check the engine for leaks.
- ▶ Check all hose fittings, hose clamps and pipe connections on the engine as well as the oil feed and return lines on the exhaust gas turbocharger for leaks and firm seating.
- ▶ Around five minutes after switching off the engine, check the engine oil level with the dipstick.
  The oil level should be between the upper and lower marks on the dipstick.
- ▶ Check the seating of the bracket secured to the engine.
- ▶ Check the tightness of bolts on the exhaust manifold, engine mountings, coolant pump, starter motor and air compressor.

Starting and stopping the engine with the key



Example: ignition lock

0 To insert/remove the vehicle key
1 Steering unlocked/radio position
2 Drive position (ignition)
3 Start position

- ▶ Secure the vehicle/equipment against rolling away.
- ▶ Shift the transmission to neutral or engage neutral on the equipment.
- ▶ **To start the engine:** turn the key in the ignition lock to drive position 2.
- ▶ Vehicles/equipment with a hot-water auxiliary heater: preheat the engine at outside temperatures below –20 °C before starting.
- ▶ Vehicles/equipment with cold-start aid: wait until the indicator lamp in the instrument cluster goes out.
- ▶ Turn the key to start position 3 in the ignition lock. While doing so, do not depress the accelerator pedal. For equipment, keep the idling function active.
- ▶ When the engine has started, release the key.
  Depending on the vehicle/equipment, the idling speed is automatically adjusted to around 600 rpm. Depending on the nature of the work to be performed, higher engine idling speeds are also possible.
- ▶ If the engine does not start, interrupt the starting procedure after no more than 30 seconds.
- ▶ Turn the key in the ignition lock back to the stop at key position 0.
- ▶ Repeat the starting procedure after approximately one minute.
- ▶ After three starting attempts, wait approximately three minutes before trying again.
- ▶ Observe the oil pressure gauge immediately after having started the engine.

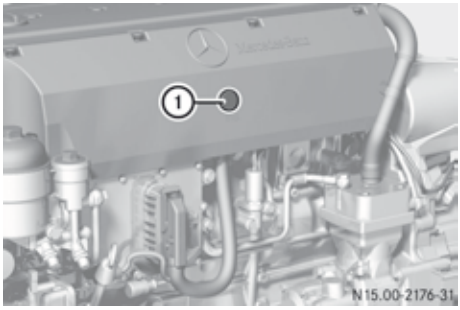
! After starting the engine, let it run at engine idling speed until the oil pressure is displayed. If no oil pressure is displayed after approximately 10 seconds, switch off the engine. Determine the cause. The operating safety of the engine is jeopardised.

Starting and stopping the engine with the start/stop button

- ▶ Switch on the ignition.
- ▶ Shift to neutral.

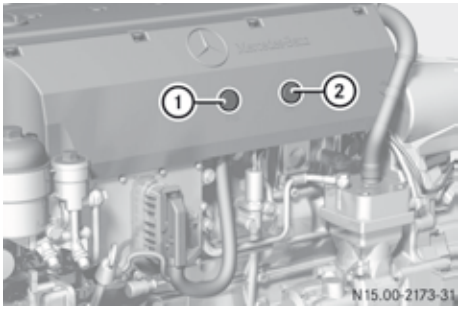
i The start button will not function if a gear is engaged or the equipment is in an operating position.

Engine with one button



- **To start the engine:** press start/stop button ①.
  The engine starts and runs at engine idling speed.
- **To start the engine and increase the engine speed:** press and hold start/stop button ①.
  The engine starts and runs at engine idling speed. After about three seconds, the engine speed increases.
- Hold down start/stop button ① until the desired engine speed is reached.
  After releasing start/stop button ①, the engine continues to run at the currently set speed. The engine speed can be increased up to the limiting speed.
- **To stop the engine:** press start/stop button ① again.
  The engine switches off.

Engine with two buttons

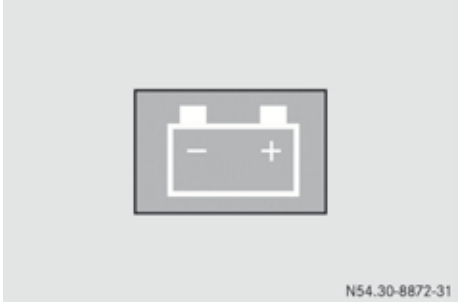


- **To start the engine:** press start button ②.
  The engine starts and runs at engine idling speed.
- **To increase the engine speed:** while the engine is running, press start button ② again and hold it down until the desired engine speed is reached.
  After releasing start button ②, the engine continues to run at the currently set speed. The engine speed can be increased up to the limiting speed.
- **To stop the engine:** while the engine is running, press stop button ①.
  The engine switches off.
- **To turn the engine over without starting it:** press and hold start button ② and stop button ① at the same time.
  The engine turns over without starting.
- Release start button ② and stop button ①.
  The engine remains at a standstill.

Operational monitoring

Charge current

The charge current indicator lamp must go out after the engine has started.



Example: charge current indicator lamp

If the [ ] indicator lamp does not go out, or if it lights up while the engine is running, switch off the engine and check the poly-V-belt.

! Make sure that the poly-V-belt contact surfaces are not damaged (e.g. torn), oily or glazed, as this could cause the poly-V-belt to slip. Do not run the engine without a poly-V-belt. Otherwise, the alternator and coolant pump are not driven, which results in engine damage.

Further information can be found in the "Checking the poly-V-belt for wear" (▷ page 66) and "Replacing the poly-V-belt" sections (▷ page 97).

Electronic engine control

The electronics warning lamp must go out after the engine has started.

Example: electronics warning lamp

If the electronics warning lamp does not go out, or if it lights up while the engine is running, there is a malfunction in the electronic engine control system.

Each malfunction is stored in the system with its own fault code. Temporary faults are also stored.

Fault codes can be read using the Mercedes-Benz diagnostic tester STAR DIAGNOSIS or minidiag2 (▷ page 8). If the electronics warning lamp lights up while the engine is running, read or determine the fault code.

Oil pressure

! Once the operating temperature has been reached, the engine oil pressure may not drop below the following values:

- 2.5 bar at rated speed
- 0.5 bar at idling speed

If the oil pressure falls below these values, stop the engine and trace the cause.

Operating restrictions with on-highway applications

The electronics monitor:

- the display, level and quality of the AdBlue®/DEF reducing agent
- the efficiency of the catalytic converter in accordance with the permitted thresholds for nitrogen oxide emissions (NOx).

Requirements for vehicles

The engine output can be automatically reduced the first time the vehicle is stationary if:

- the AdBlue®/DEF reservoir is empty
- the permitted thresholds for nitrogen oxide (NOx) emissions are exceeded.

Torque reduction

If the AdBlue®/DEF is used up or if there is a fault, the indicator lamp in the instrument panel lights up or flashes. The display also shows a message. The engine output is only reduced after a fault is detected and confirmed after up to four journeys.

The degree of torque reduction depends on the vehicle category:

- vehicles above 7.5 t: torque reduction by approximately 40%
- vehicles below 7.5 t: torque reduction by approximately 25%

Fault in the monitoring system

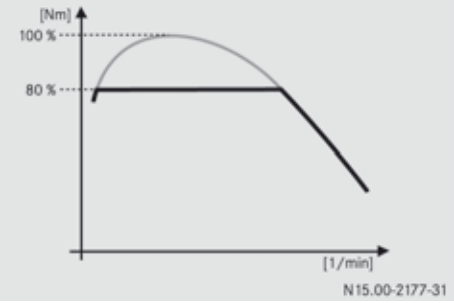
If a fault is detected in the electronic monitoring of the exhaust gas aftertreatment sys-

tem, the torque is reduced automatically after 36 operating hours of the engine.

Operating restrictions for off-highway engines

Minor operating restriction

The available torque is reduced within a period of 10 minutes. The torque is reduced across the entire engine speed range to 80% of the maximum torque (see the diagram below).



Reduction in output during minor operating restriction

Major operating restriction

The transition between a minor and a major operating restriction is achieved by a gradual reduction in engine speed and torque. The reduction takes place over a period of 60 minutes.

- The engine torque is reduced from 80% of the rated value by 1% per minute to 20% of the rated value.
- Simultaneously, the engine speed is reduced over the period of 60 minutes from the initial value to 1000 rpm.

Emergency override

A button is optionally available for overriding the operating restriction in an emergency. The override function makes the full engine output available for up to 30 minutes and can be used a maximum of three times. The override can only be activated between the start of the operating restriction system and the end of the major operating restriction. The override function is also used to reset the operating restriction after the fault is corrected. This is the case, for example, after filling up with AdBlue®/DEF of the correct quality.

Deleting the fault memory

A fault stored in the fault memory because of the operating restriction system cannot be deleted with a conventional reading device. Faults can only be deleted using the Daimler/MTU maintenance system.

Repeated violations

In the event of repeated violations, the periods for the trigger signals and continuous reduction are shortened. When a fault is eliminated (for example the NOx sensor is replaced or reconnected), the operating restrictions are reset. Normal operation can be resumed. If a fault occurs again because of the operating restriction system within 40 hours, the periods of the operating restriction system are shortened.

Example: if a fault reoccurs within 40 hours of the first elimination, the time until the operating restriction comes into effect is halved. If the same fault occurs within 40 hours of the second fault being rectified, the times are shortened to a quarter.

Stopping and switching off the engine

⚠ WARNING

When switching off the equipment or parking the vehicle, make sure that the exhaust system does not come into contact with combustible objects, e.g. dry leaves, grass or other highly flammable materials.

- ▶ Park the vehicle/equipment.
- ▶ Secure the vehicle/equipment against rolling away.
- ▶ Shift the transmission into neutral/decouple the drive system.

Let the engine idle for approximately two minutes before switching off the engine if:

- the coolant temperature is very high (over 90 °C).
- the engine has been operated at full output.

▶ **To switch off the engine:** turn the vehicle key in the ignition lock back to the stop at position 0.

▶ Press the start/stop button on the engine or on the engine shutoff device on the equipment.

▶ Safeguard the vehicle/equipment against rolling away.

! Stop the engine immediately if:

- the oil pressure falls or fluctuates significantly.
- the power output or engine speed decreases and the position of the position sensor (accelerator) remains constant.
- heavy smoke is emitted from the exhaust.
- the coolant or engine oil temperature rises steeply.
- abnormal noises suddenly come from the engine or exhaust gas turbocharger.

i When you switch off the engine, BlueTec® exhaust gas aftertreatment automatically flushes the exhaust system with fresh air. Residues of AdBlue®/DEF on the metering unit or the injection nozzle might otherwise impair the function of BlueTec® exhaust gas aftertreatment. Depending on the engine's previous operating load, BlueTec® exhaust gas aftertreatment may flush the exhaust system several times.

When BlueTec® exhaust gas aftertreatment flushes the exhaust system, an air valve is activated. You may then hear a hissing sound. This hissing sound does not indicate a leak in the compressed-air system.

Continuous brake

The airbrake and the constantly open throttle valves are employed as continuous brakes.

⚠ WARNING

Do not activate the continuous brake (engine brake/retarder) on slippery road surfaces. The wheels may otherwise become locked and the vehicle could skid.

You can utilise the engine's braking effect, particularly on long downhill gradients, if you:

- activate the continuous brake
- shift to a lower gear in good time

Driving tips

Running-in

Equipment

Observe the equipment manufacturer's running-in notes.

Vehicles

The running-in period of the engine has a significant effect on the vehicle, especially for the:

- service life
- operating reliability
- economy

Observe the following notes during the running-in period up to 2000 km (30 operating hours):

- avoid subjecting the engine to full load.
- run-in the engine with care using differing speeds and engine revs.
- avoid high engine revs.
- do not drive at more than ¾ of the maximum road speed for each gear.
- change gear in good time.
- do not shift down to brake the vehicle.
- in the case of vehicles with automatic transmission, do not press the accelerator

pedal beyond the point of resistance (kick-down) and only engage the shift ranges **4**, **3**, **2**, or **1** when driving slowly.

After 2000 km (30 operating hours), you can gradually bring the vehicle up to full road and increased engine speeds.

Fuel consumption

General information

Fuel consumption depends on:

- the type of fuel used (diesel fuel, fatty acid methyl ester FAME fuel)
- the machine version
- the operating mode
- the operating conditions
- the attached equipment (e.g. hydraulic pumps, mowers, etc.)

For these reasons, exact details about any single engine's fuel consumption cannot be provided.

Machine version

The following components influence fuel consumption:

- tyres (e.g. tyre pressure, tyre condition)
- body type
- drive train (e.g. transmission ratio)
- additional equipment (e.g. automatic climate control, auxiliary heating)

Operating mode

Your operating mode can help to keep the fuel consumption down:

- anticipate road and traffic conditions.
- avoid frequent acceleration and braking.
- stay within the economical engine speed range.

Operating conditions

Fuel consumption can increase due to poor operating conditions.

Observe the following notes:

- avoid driving in mountainous terrain.
- do not allow the engine to idle when the vehicle is stationary.
- do not drive with unnecessary weight.
- avoid frequent cold starts.
- avoid frequent short journeys.

AdBlue® consumption

AdBlue®/DEF consumption is between 4 and 8% of the fuel consumption, depending on engine use.

Engine oil consumption

After running in the engine, oil consumption may reach 0.5% of the vehicle's fuel consumption.

More arduous operating conditions and increased distance covered could result in engines exceeding this oil consumption value.

Refuelling

Fuels

Important safety notes

⚠ WARNING

Fuel is highly flammable. Therefore, fire, naked flames and smoking are prohibited when handling fuel.

Deactivate the auxiliary heating when refuelling to prevent fuel vapours from igniting on the auxiliary heating exhaust system.

Fuel is toxic and constitutes a health hazard. Therefore, you should make sure that:

▷▷

- fuel does not come into contact with skin, eyes or clothing.
- you do not inhale fuel vapours.
- children are kept away from fuel.

If you or anyone else comes into contact with fuel:

- wash eyes immediately with plenty of clean water if fuel comes into contact with the eyes and consult a doctor.
- clean affected areas of skin with soap and water immediately.
- change out of clothing which has come into contact with fuel immediately.
- if fuel is swallowed, a doctor should be consulted immediately.

⚠ WARNING

Do not use petrol to refuel vehicles with a diesel engine. Do not mix diesel with petrol. This would result in damage to the fuel system and engine, which could lead to a vehicle fire.

! AdBlue®/DEF is not a fuel additive and must not be added to the diesel tank. If AdBlue®/DEF gets into the diesel tank, this could lead to engine damage.

! Do not use petrol to refuel vehicles with a diesel engine. Even small amounts of petrol result in damage to the fuel system and engine.

! If you fill the tank with the wrong fuel by accident, do not start the engine. Otherwise, the fuel lines may be contaminated. Notify a qualified specialist workshop and have the fuel tank and fuel lines fully drained.

! Do not add any special fuel additives to the diesel fuel or fatty acid methyl ester FAME fuel.

Special fuel additives can lead to:

- malfunctions
- damage to the catalytic converter
- engine failure

You will find further information on fuel in the "Service products" section (▷ page 50).

Environmental note

If fuels are handled improperly, they pose a danger to persons and the environment. Do not allow fuels to run into the sewage system, the surface waters, the ground water or into the ground.

Before filling the tank

- ▶ Switch off the engine.
- ▶ Secure the vehicle/equipment against rolling away.
- ▶ Switch off the auxiliary heating system.
- ▶ Observe the fuel grade (▷ page 50).

! If you are refuelling the vehicle from drums or canisters, filter the fuel before refuelling.

This prevents malfunctions in the fuel system caused by contaminated fuel.

i Regularly check the fuel prefilter with the heated water separator for condensation (▷ page 86).

AdBlue®/DEF

Important safety notes

⚠ WARNING

If the AdBlue®/DEF tank cap is opened at high temperatures, ammonia vapours may escape.

Ammonia vapours have a pungent odour and particularly irritate:

- skin
- mucous membranes
- eyes

The vapours may cause a burning sensation in the eyes, nose and throat as well as irritation of the throat and watering eyes.

Avoid inhaling ammonia vapours.

⚠ WARNING

AdBlue®/DEF must not come into contact with skin, eyes or clothing.

- If AdBlue®/DEF comes into contact with your eyes or skin, rinse affected areas with clean water immediately.
- If AdBlue®/DEF is swallowed, immediately rinse your mouth out with a lot of clean water and drink plenty of water.
- Change clothing that is soiled with AdBlue®/DEF immediately.
- If allergic reactions occur, consult a doctor immediately.

Keep AdBlue®/DEF out of the reach of children.

! The BlueTec® exhaust gas aftertreatment will cease to function correctly if you:

- fill the AdBlue®/DEF reservoir with cleaning agent or other service products or fuels
- mix in additives
- dilute AdBlue®/DEF

Only use AdBlue®/DEF in accordance with DIN 70070/ISO 22241.

Notify a qualified specialist workshop in the event of incorrect filling.

You will find further information on AdBlue®/DEF in the "Service products" section (▷ page 54).

Environmental note

Dispose of AdBlue®/DEF in an environmentally responsible manner.

Before filling the tank

- ▶ Switch off the engine.
- ▶ Secure the vehicle/equipment against rolling away.
- ▶ Switch off the auxiliary heating system.

Bleeding the fuel system

If the fuel system is run dry, the system will be bled the next time the engine is started after refuelling. Automatic continuous bleeding takes place in the filter.

The battery must be sufficiently charged during the starting procedure to ensure that the fuel system can be bled.

Bleed the heated fuel prefilter with water separator mounted on the vehicle or equipment using the integrated hand pump (▷ page 86).

Winter operation

Cold-start aids

The following notes should be observed at the start of the cold season.

Fuel

⚠ WARNING

There is an increased risk of fire when handling fuels as they are highly flammable. Avoid fire, naked flames and sparks, and refrain from smoking when handling fuels.

Use cold-resistant diesel fuel (▷ page 50).

Jump-starting

⚠ WARNING

The use of liquid or gaseous starting aids can cause explosions. This may result in severe injuries.

Do not use liquid or gaseous starting aids such as ether or Startpilot to start the engine.

Engine oil

When changing the oil, select an engine oil that is compatible with the SAE classification and the outside temperatures expected during the period of use (▷ page 46).

Coolant

⚠ WARNING

When opening the coolant expansion tank, there is a risk of scalding due to hot coolant spraying out. The cooling system and coolant expansion tank are pressurised when the engine is at operating temperature. Wear gloves and eye protection.

Only open the coolant expansion tank when the coolant temperature is below 50 °C.

⚠ WARNING

Coolant contains glycol and is therefore toxic. Do not swallow the coolant. See a doctor immediately if you swallow coolant.

Make sure that coolant does not come into contact with skin, eyes or clothing. In case of contact with eyes, rinse immediately with plenty of clean water. Clean affected areas of skin and clothing with soap and water immediately. Change any affected clothing immediately.

Check the antifreeze protection properties of the coolant in good time and increase the antifreeze/corrosion inhibitor concentration if necessary (▷ page 48).

Batteries

⚠ WARNING

Comply with safety precautions and take protective measures when handling batteries.

Risk of explosion

Fire, naked flames and smoking are prohibited when handling the battery. Avoid creating sparks.

Battery acid is caustic. Avoid contact with the skin, eyes or clothing.

Wear suitable protective clothing, in particular gloves, an apron and a face mask.

Immediately rinse acid splashes off with clean water. Consult a doctor if necessary.

Wear eye protection.

Keep children away.

Observe this Owner's Manual.

Always aim to achieve the full charge status. You can do this by means of careful maintenance and low electrical consumption. The cold start capacity is reduced when it is very cold. For example, at -10 °C it is only around 60 % of the normal capacity.

Notes for when the engine is out of use

If the engine/vehicle/equipment is to be out of use for longer than three weeks, disconnect the negative terminal on the battery. This prevents the batteries from being discharged by no-load current consumers. If the engine/vehicle/equipment is to be out of use for a longer period, remove the batteries and store them in a dry, well-ventilated area. Recharge the batteries:

- before operating the engine/vehicle/equipment again or
- at least every three months for longer periods of disuse.

If the engine/vehicle/equipment is out of use for a long period, store the batteries in a heated area if possible. Ensure good ventilation when recharging. Refer to the "Decommissioning the engine" section (▷ page 80) for further information.

Service products

Introduction to service products

⚠ WARNING

Service products are hazardous to health. They contain toxic and caustic substances.

Service products are highly flammable.

For this reason, observe the following instructions to prevent injuries to yourself and others:

- Do not inhale the vapours. When indoors, always ensure there is sufficient ventilation to prevent intoxication.
- Do not let service products come into contact with skin, eyes or clothing. Should contact occur, however, clean the affected areas of skin with water to prevent caustic burns and other injuries.

  In the event of eye contact, wash eyes thoroughly with plenty of clean water.
- Fire, naked flames and smoking are forbidden when handling service products due to their high flammability.
- Observe the usage and warning notices on the containers.

The use of approved service products is an integral part of the implied warranty.

! Special additives (except approved fuel additives) are neither required nor approved for use with approved service products. Additives could cause damage to the assemblies. Therefore, do not mix any additives with service products.

You are responsible for the results of using fuel additives.

Environmental note

Dispose of service products in an environmentally-responsible manner.

Service products are, for example:

- fuels (e.g. diesel)
- lubricants, e.g. engine and transmission oils, hydraulic fluids, greases
- antifreeze, coolant
- AdBlue®/DEF (BlueTec® exhaust gas aftertreatment reduction agent)

Approved service products fulfil the highest quality standards and are documented in the Mercedes-Benz Specifications for Service Products. Damage caused by the use of service products that have not been approved invalidates the implied warranty. For this reason, only use service products that have been approved for your engine.

You can recognise service products approved by Mercedes-Benz by the following inscription on the container:

- MB Approval (e.g. Approval 228.5)

  or
- MB Approval 228.5

Other labels and recommendations relating to the quality or indicating that the product meets a certain specification are not necessarily approved by Mercedes-Benz. Further information is available from any Mercedes-Benz or MTU Service Centre (▷ page 11).

ⓘ Information about service products that have been tested and approved by Mercedes-Benz for your engine is available online at **http://bevo.mercedes-benz.com/**

ⓘ The specification and availability of lubricants may vary. Individual lubricants may no longer be available, especially for older engines. Information is available from any Mercedes-Benz or MTU Service Centre (▷ page 11).

Engine oils

Notes on engine oils

Only use engine oils that comply with the Mercedes-Benz Specifications for Service Products.

The following engine oils are approved:

- Sheet no. 228.5 / 228.3 standard quality multi-grade engine oils
- Sheet no. 228.51 / 228.31 low-ash multi-grade engine oils
- Sheet no. 228.2 standard quality single-grade engine oils
- Sheet no. 225.6 multi-grade engine oils, initial operation oils

! Engine oils of a different quality grade are not permissible and may damage the engine.

Mercedes-Benz particularly recommends engine oils that comply with Sheet no. 228.5 of the Mercedes-Benz Specifications for Service Products.

These engine oils are of a high standard of quality and have a beneficial effect on:

- engine wear
- fuel consumption
- exhaust emissions

The maximum interval for oil change is only achieved with engine oils of a particularly high quality grade.

i You can find information on the quality grade, e.g. Sheet no. 228.5, and the viscosity, e.g. SAE class 5W-30, from the designation on the oil container.

Scope of use

For engines in vehicles/equipment operating with diesel fuel, only use multi-grade engine oils compliant with Sheet no. 228.5 / 228.51 / 228.3 / 228.31 or single-grade engine oils compliant with Sheet no. 228.2.

For engines without BlueTec® exhaust gas aftertreatment, multi-grade oils compliant with Sheet no. 228.1 and single-grade oils compliant with Sheet no. 228.0 can also be used.

For vehicle/equipment operation with FAME fatty acid methyl ester fuel (bio-diesel fuel), only use engine oils compliant with Sheet no. 228.5 / 228.51 / 228.3 / 228.31.

For engines without BlueTec® exhaust gas aftertreatment, oils compliant with Sheet no. 228.1 can also be used. This is also required for a mixture of conventional diesel fuels and FAME fatty acid methyl ester fuels (bio-diesel fuel).

Multi-grade engine oils compliant with Sheet no. 228.5 / 228.51 / 228.3 / 228.31 / 228.1 can be used throughout the year. Depending on the fuel quality (fuel sulphur content or FAME fatty acid methyl ester fuel), the oil change intervals may be shortened. For details, see the Maintenance Booklet.

Single-grade engine oils compliant with Sheet no. 228.2 / 228.0 only cover an SAE class (viscosity) for a certain temperature range. Change the engine oil to an SAE class suitable for the time of year and the respective outside temperatures.

The use of low-ash engine oils is permissible but not essential. When low-ash engine oils compliant with Sheet no. 228.51 and 228.31 are used, a low-sulphur diesel fuel (less than 50 ppm, 0.005 % by weight) should be used. If this low-sulphur diesel fuel is not available, standard oils compliant with Sheet no. 228.5 / 228.3 / 228.2 should be used.

Oil change

Oil change intervals are dependent on the following:

- the operating conditions of the vehicle
- the grade of the engine oil used
- the fuel grade (sulphur content)
- the fuel type, e.g. FAME fatty acid methyl ester fuel

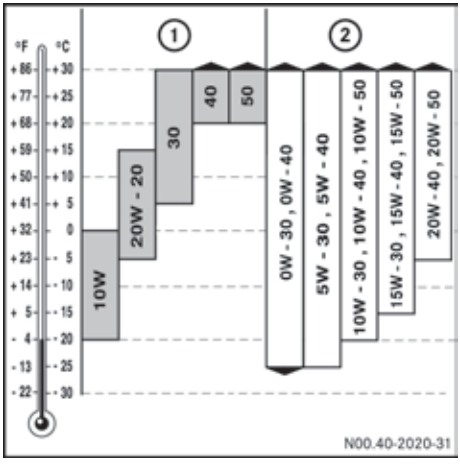
For more details, see the Maintenance Booklet.

! If you do not use oil for all-year-round operation in your engine, change the engine oil right at the beginning of the cold season. Use only an approved engine oil in the specified SAE classification.

If the SAE class (viscosity) of the engine oil used is not suitable for continually low outside temperatures below −20 °C, this could cause engine damage.

The specified temperatures of the SAE class always refer to freshly added oil. Engine oil ages during driving due to soot and fuel residue. This impairs the characteristics of the engine oil, particularly at low outside temperatures.

Mercedes-Benz strongly recommends that, at outside temperatures below −20 °C, you use engine oils of SAE class 5W-30.



Engine oil SAE classes (viscosity)

① Single-grade engine oils

② Multi-grade engine oils

▶ Select the SAE class of engine oil in accordance with outside temperatures.

ⓘ You can only achieve the maximum oil change intervals by using engine oils of particularly high quality (e.g. in accordance with Sheet no. 228.5 of the Mercedes-Benz Specifications for Service Products).

Environmental note

If you operate your vehicle using FAME fatty acid methyl ester fuel (bio-diesel), special precautions must be taken and national specifications complied with when disposing of engine oils. Information is available from any Mercedes-Benz or MTU Service Centre.

Adding/topping up the engine oil

Do not add too much oil. If you add too much oil, the engine or the catalytic converter could be damaged. Drain or siphon off any excess oil.

When topping up, Mercedes-Benz recommends that you only use engine oil of the same grade and SAE class as the oil filled at the last oil change.

Check the oil level before topping up the engine oil (▷ page 34).

You can find more information on topping up the engine oil in the “Changing the engine oil and filter” section (▷ page 62).

Miscibility of engine oils

The benefits of high-quality engine oils are diminished if you mix them.

Engine oils are differentiated according to:

- engine oil brand
- quality grade (Sheet no.)
- SAE viscosity class

If, in exceptional circumstances, the type of engine oil currently used in the engine is not available, another mineral or synthetic engine oil may be used. Make sure it is approved for Mercedes-Benz.

Observe the notes in the Service Booklet.

Coolants

Coolant additive with antifreeze properties

The coolant is a mixture of water and corrosion inhibitor/antifreeze.

The corrosion inhibitor/antifreeze in the coolant has the following properties:

- anti-corrosion protection
- antifreeze protection
- increases the boiling temperature

Leave the coolant in the engine all year round in order to prevent corrosion and to increase the boiling point. Also do this in countries with hot outside temperatures.

Check the corrosion inhibitor/antifreeze concentration in the coolant every six months.

Only use approved corrosion inhibitor/antifreeze agents.

Topping up coolant

When topping up, only use prepared coolant with 50% by volume corrosion inhibitor/antifreeze agent.

Before topping up, observe the quality of the corrosion inhibitor/antifreeze agent in the cooling system (Sheet no.). Corrosion inhibitors/antifreeze agents compliant with Sheet 325.3 and 326.3 must not be mixed with those of Sheet 325.0/2 or 326.0/2.

Only top up using a corrosion inhibitor/antifreeze agent of the same quality grade.

Miscibility of corrosion inhibitor/antifreeze agents

! Corrosion inhibitors/antifreeze agents that comply with Sheet 325.3 and 326.3 must not be mixed with those of Sheet 325.0/2 or 326.0/2. This prevents damage to the engine cooling system.

Renewing coolant

Coolant change with antifreeze protection:

- every three years if using corrosion inhibitor/antifreeze agent compliant with Sheet 325.0/2 and 326.0/2
- every five years if using corrosion inhibitor/antifreeze agent compliant with Sheet 325.3 and 326.3

Coolant change with corrosion inhibitor/antifreeze agent compliant with Sheet 325.3, 326.3: before adding this corrosion inhibitor/antifreeze agent, the cooling system must first be flushed (▷ page 76).

When renewing the coolant, ensure that it contains 50% by volume of corrosion inhibitor/antifreeze agent. This corresponds to antifreeze protection down to −37 ℃.

Do not exceed 55% by volume (antifreeze protection down to approximately −45 ℃). Heat dissipation properties are otherwise impaired.

The water in the coolant must meet certain requirements, which are often fulfilled by drinking water. The water must be treated if its quality does not meet the required standards.

Please note the Mercedes-Benz Specifications for Service Products, Sheet number 310.1.

Further information about operating and road safety for your engine/vehicle/equipment is available from any Mercedes-Benz or MTU Service Centre (▷ page 11).

Coolant additive without antifreeze properties

If your vehicle does not need antifreeze protection, e.g. in countries with consistently high outside temperatures, you can, as an exception, use a coolant additive.

Instead of corrosion inhibitor/antifreeze additive, add a coolant additive compliant with Sheet number 312.0 of the Mercedes-Benz Specifications for Service Products to the water.

Improvers (corrosion-inhibiting oils) are not permitted.

Renew the coolant annually.

Further information about the required water quality and approved coolant additives without antifreeze protection is available from any Mercedes-Benz or MTU Service Centre (▷ page 11).

Diesel fuels

Important safety notes

⚠ WARNING

Fuel is highly flammable. Fire, naked flames and smoking as well as the use of auxiliary heaters (sparks) are therefore prohibited when handling fuel.

Switch off the engine and the auxiliary heating before refueling.

⚠ WARNING

Avoid contact with fuels.

It is hazardous to your health if your skin comes into direct contact with fuels or you breathe in fuel vapours.

! If you are using drums or canisters to refuel the engine/vehicle/equipment, you should filter the fuel before filling.

This prevents malfunctions in the fuel system caused by contaminated fuel.

! Only refuel with commercially available diesel vehicle fuel that complies with the European standard EN 590.

EN 590 describes a sulphur-free fuel with a maximum sulphur content of 10 ppm. However, it is also permitted to operate engines with BlueTec® exhaust gas aftertreatment with up to 50 ppm.

For engines without BlueTec® exhaust gas aftertreatment, the maintenance intervals must be reduced when operating with higher sulphur contents. For details on this, see the table below. Even if the maintenance intervals are reduced, operation with higher sulphur contents will lead to increased engine wear, especially on the fuel injectors.

When necessary, use only approved fuel additives.

There is otherwise a risk of impaired engine performance or engine and catalytic converter damage. The use of appropriate fuel additives is your responsibility.

! Fuel grade in accordance with EN 590 is prescribed as mandatory for engines with BlueTec® exhaust gas aftertreatment. If diesel fuel which does not comply with EN 590 is used, it can damage the exhaust system.

Fuel grade

The following is an overview of typical sulphur content in percent by weight of fuel available in various countries. You may obtain information about current country-specific fuel sulphur contents from any Mercedes-Benz or MTU Service Centre (▷ page 11).

i In some countries, diesel fuel of differing sulphur contents is available. Diesel fuel with a lower sulphur content is sold under the name "Euro diesel" in some countries.

Fuel sulphur content table

The following overview specifies the current country-specific sulphur content of fuel in diesel fuel in percent by weight (% by weight).

You can find a continually updated table of fuel sulphur contents in specific countries in the Mercedes-Benz Specification for Service Products, Sheets 136.1 and 136.2 at http://bevo.mercedes-benz.com.

Countries that are mentioned more than once offer different fuel grades with varying fuel sulphur contents in parallel. No information is available for countries that are not listed.

The maintenance intervals for engine oil and filter replacement must be adapted depending on the fuel grade used. The higher the sulphur content in diesel fuel, the shorter the maintenance intervals for engine oil and filter replacement. Observe the notes in the Maintenance Booklet.

Fuel sulphur content (proportion by weight, in percent)		
Continent	**Country**	**% by weight**
Europe, CIS	Albania[5], Armenia, Azerbaijan, Belarus, Belgium, Bosnia-Herzegovina, Bulgaria, Denmark, Germany, Estonia, Finland, France, Georgia, Greece, United Kingdom, Ireland, Iceland, Italy, Croatia, Latvia, Lithuania, Luxembourg, Malta, Macedonia, Moldova, Montenegro, Netherlands, Norway, Austria, Poland, Portugal, Romania, Sweden, Switzerland, Serbia, Slovakia, Slovenia, Spain, Czech Republic, Turkey, Turkmenistan, Ukraine, Hungary, Cyprus	0 ... 0.1
	Albania, Georgia, Macedonia, Moldova, Russia, Ukraine, Uzbekistan	0.1 ... 0.3
	Kazakhstan, Kyrgyzstan, Croatia, Turkmenistan, Turkey, Ukraine, Uzbekistan	0.3 ... 0.8
Australia, Oceania	Australia, French Polynesia, New Zealand	0 ... 0.1
	Fiji Islands, New Caledonia	0.3 ... 0.8
Asia	Bangladesh, Bhutan, Brunei, China, Hong Kong, India, Japan, Cambodia, Laos, Nepal, Philippines, Singapore, Sri Lanka, South Korea, Taiwan, Thailand	0 ... 0.1
	China, Indonesia, Malaysia, Mongolia, Tajikistan	0.1 ... 0.3
	Myanmar (Burma), Pakistan, Vietnam	0.3 ... 0.8
Southwest Asia, Middle East	Israel, Qatar, Lebanon, Oman, Palestine, West Bank	0 ... 0.1
	Oman, United Arab Emirates	0.1 ... 0.3
	Bahrain, Kuwait, Lebanon, Saudi Arabia, Syria	0.3 ... 0.8

5 Diesel fuels with the sales designation "Euro diesel" only.

Fuel sulphur content (proportion by weight, in percent)		
Continent	**Country**	**% by weight**
	Iran, Iraq, Jordan, Yemen	0.8 ...
North America	Canada, Mexico, USA	0 ... 0.1
Central America, South America, the Caribbean	Argentina[6], Bolivia, Brazil, Chile	0 ... 0.1
	Argentina, Brazil, Columbia, Costa Rica, Ecuador, Suriname, Trinidad and Tobago, Uruguay	0.1 ... 0.3
	Dominican Republic, El Salvador, Guatemala, Honduras, Cuba, Panama, Peru, Venezuela	0.3 ... 0.8
Africa	Egypt, Algeria, Morocco, South Africa	0 ... 0.1
	Angola, Morocco, Mauritius, Tunisia	0.1 ... 0.3
	Benin, Ghana, Kenya, Libya, Malawi, Mali, Mozambique, Nigeria, Zambia, Senegal, Tanzania	0.3 ... 0.8
	Burkina Faso, Congo, Ethiopia, Ghana, Kenya, Madagascar, Morocco, Sudan, Uganda	0.8 ...

Diesel fuels at low temperatures

At low outside temperatures, paraffin separation may cause the flow properties of the diesel fuel to be insufficient.

To prevent operating problems, diesel fuel with improved flow properties is available in the winter months.

Winter diesel fuels are reliable down to outside temperatures of −22 °C in Germany and other Central European countries. You can normally use winter diesel fuel without problems at the outside temperatures expected in the country where it is on sale.

Fuel additives

General notes

Fuel additives used to improve flow characteristics are flow improvers.

Do not add flow improvers to winter diesel fuel guaranteed to operate down to −22 °C. The cold flow properties of the fuel may deteriorate as a consequence of the flow improver.

If summer diesel fuel or winter diesel fuel with less resistance to low temperatures is in use, add a quantity of flow improver, depending on the outside temperatures.

Add the fuel additive to the diesel fuel in good time, before paraffin separation causes the diesel fuel's flow properties to be insufficient. Malfunctions as a result of paraffin separation can only be rectified by heating up the complete fuel system.

The engine can be equipped with a heated fuel prefilter with water separator. This also improves the flow characteristics of the diesel fuel by approximately 8 °C.

Flow improvers

The effectiveness of flow improvers cannot be guaranteed with all fuels. Follow the manufacturer's recommendations. Information about approved flow improvers is available

6 Shell Pura only.

from all Mercedes-Benz or MTU Service Centres (▷ page 11).

If you add a flow improver to the FAME fatty acid methyl ester fuel, the fuel's resistance to low temperatures does not change.

Fatty acid methyl ester (FAME) fuel (bio-diesel)

General notes

! To avoid damage to the assemblies and components, observe the following points when using FAME fatty acid methyl ester fuel:

- have the fuel filter and the oil filter replaced approximately 1000 km after switching to FAME fatty acid methyl ester fuel.
- have the oil filter and the fuel filter replaced at every oil change.
- the oil will have to be changed and the oil filter replaced much more frequently.
- FAME fatty acid methyl ester fuel shortens the service life of conventional fuel filters. For this reason, Mercedes-Benz recommends the installation of a special fuel prefilter. Information about this is available at any qualified specialist workshop, e.g. a Mercedes-Benz or MTU Service Centre.
- only add FAME fatty acid methyl ester fuel in compliance with DIN EN 14214. Fuel additives or fuels that do not comply with DIN EN 14214 may cause malfunctions or engine damage.
- FAME fatty acid methyl ester fuel corrodes painted surfaces. Do not allow FAME fatty acid methyl ester fuel to come into contact with the paintwork. Rinse off FAME fatty acid methyl ester fuel with water immediately.
- preferably only add engine oil in accordance with Sheet no. 228.5/51 or 228.3/31 of the Mercedes-Benz Specifications for Service Products.
- if the vehicle is not used for long periods of time, FAME fatty acid methyl ester fuel can clog fuel system components. For this reason, use all the FAME fatty acid methyl ester fuel before long periods of time when the vehicle is not used. Fill up the fuel tank with conventional diesel fuel. Allow the engine to run for at least one hour before switching off the vehicle/equipment.
- Mercedes Benz recommends that you do not use FAME fatty acid methyl ester fuel for engines that are not used for long periods of time, e.g. fire engines.
- the auxiliary heating may only be operated with conventional diesel fuel. Otherwise, the system may malfunction. Conventional diesel fuel already contains a percentage of FAME fatty acid methyl ester fuel. Therefore, do not add more than 5% FAME fatty acid methyl ester fuel to conventional diesel fuel.

  An additional fuel tank is required for conventional diesel fuel for the auxiliary heating system, if you operate the vehicle:
  - using FAME fatty acid methyl ester fuel
  - using a mixture of conventional diesel fuel and more than 5% FAME fatty acid methyl ester fuel.

Environmental note

If the vehicle runs on FAME fatty acid methyl ester fuel, ask your disposal plant whether you have to collect the engine oil separately. Not all manufacturers of refined products (lubricant manufactured from used engine oil) can process engine oil which has been enriched with FAME fatty acid methyl ester fuel.

Observe the special notes and national regulations when disposing of engine oils. Information about this is available at any qualified specialist workshop, e.g. any Mercedes-Benz or MTU Service Centre.

Operate your engine using pure FAME fatty acid methyl ester fuel compliant with DIN EN 14214. You can also operate your engine using a mixture of conventional diesel fuel and FAME fatty acid methyl ester fuel. This also applies to engines with BlueTec® exhaust gas aftertreatment.

Observe the specifications in accordance with Sheet no. 135.0 of the Mercedes-Benz Specifications for Service Products for operation with FAME fatty acid methyl ester fuel.

Operating the vehicle with FAME fatty acid methyl ester fuel results in:

- a slightly higher fuel consumption
- a slightly reduced engine power output
- increased white smoke after a cold start

Low outside temperatures

FAME fatty acid methyl ester fuel compliant with DIN EN 14214 can be used reliably at outside temperatures down to −20 °C.

For lower temperatures, the engine can be equipped with a fuel preheating system. This improves the flow characteristics of the FAME fatty acid methyl ester fuel according to the heat output installed.

AdBlue®/DEF

Notes on AdBlue®/DEF

AdBlue®/DEF is a non-flammable, non-toxic, colourless, odourless and water-soluble liquid.

The terms "Urea" and "DEF" (Diesel Exhaust Fluid) are also used for "AdBlue®".

! Only use AdBlue®/DEF in accordance with DIN 70070/ISO 22241. Do not use any additives.

If AdBlue®/DEF comes into contact with painted or aluminium surfaces when filling the tank, rinse the affected area immediately with plenty of water.

High outside temperatures

⚠ WARNING

If the AdBlue®/DEF tank cap is opened at high temperatures, ammonia vapours may escape.

Ammonia vapours have a pungent odour and particularly irritate:

- skin
- mucous membranes
- eyes

The vapours may cause a burning sensation in the eyes, nose and throat as well as irritation of the throat and watering eyes.

Avoid inhaling ammonia vapours.

⚠ WARNING

AdBlue®/DEF must not come into contact with skin, eyes or clothing.

- If AdBlue®/DEF comes into contact with your eyes or skin, rinse affected areas with clean water immediately.
- If AdBlue®/DEF is swallowed, immediately rinse your mouth out with a lot of clean water and drink plenty of water.
- Change clothing that is soiled with AdBlue®/DEF immediately.
- If allergic reactions occur, consult a doctor immediately.

Keep AdBlue®/DEF out of the reach of children.

The chemical composition of AdBlue®/DEF can break down if it heats up to 50 °C over a long period (e.g. as a result of direct sunlight on the tank). This creates ammonia vapour.

Low outside temperatures

AdBlue®/DEF freezes at a temperature of approximately −11 °C. Winter operation is also ensured for temperatures below −11 °C.

At low temperatures, AdBlue®/DEF crystals may form on the coiled hose between the engine and the silencer. This crystallisation does not pose a risk to the correct operation

of BlueTec® exhaust gas aftertreatment. The AdBlue®/DEF crystals can be removed with clean water if necessary.

Additives, tap water

! Do not mix additives to AdBlue®/DEF. Do not dilute AdBlue®/DEF with tap water. This could destroy the BlueTec® exhaust gas aftertreatment system.

Storage

Only use containers made of the following materials to store AdBlue®/DEF:

- Cr-Ni steels in accordance with DIN EN 10 088-1/2/3
- Mo-Cr-Ni steels in accordance with DIN EN 10 088-1/2/3
- Polypropylene
- Polyethylene

! Containers made of the following materials are not suitable for the storage of AdBlue®/DEF:

- aluminium
- copper
- copper alloys
- unalloyed steel
- galvanised steel

If AdBlue® is stored in these types of container, constituents of these metals may dissolve and damage the BlueTec® exhaust gas aftertreatment beyond repair.

Disposal

Environmental note

Dispose of AdBlue®/DEF in an environmentally responsible manner.

Observe laws and regulations on the disposal of AdBlue®/DEF in the country concerned.

Purity

! Impurities in AdBlue®/DEF, e.g. due to other service products, cleaning products or dust, may lead to:

- increased emission values
- damage to the catalytic converter
- engine damage
- malfunctions in BlueTec® exhaust gas aftertreatment.

Ensure that AdBlue®/DEF is always pure to avoid malfunctions in BlueTec® exhaust gas aftertreatment.

If AdBlue®/DEF is pumped from the tank, e.g. during repairs, do not use this fluid to refill the tank. Otherwise the purity of the fluid would no longer be guaranteed.

Cleaning and care

Notes on care

⚠ WARNING

Always keep care products sealed and out of the reach of children. Always follow the instructions for the use of the care products.

Do not use fuel as a cleaning agent. Fuels are highly flammable and constitute a health hazard.

Regular care helps to maintain the value of the engine.

Mercedes-Benz recommends that you only use care products that have been approved for Mercedes-Benz. You can obtain these care products from any Mercedes-Benz or MTU Service Centre (▷ page 11).

High-pressure cleaning

! The exhaust gas aftertreatment system may only be cleaned when it is cool. The sensors can otherwise be damaged.

! When cleaning, never point the water jet at the exhaust pipe. The system may otherwise be damaged.

! When using a high-pressure cleaner, keep a minimum distance between the high-pressure nozzle and the engine parts. Otherwise, parts of the engine may be damaged.

Observe the following minimum distances:

- about 70 cm with round-spray jets
- about 30 cm with 25° flat-spray jets
- about 30 cm with concentrated-power jets

! Keep the water jet moving constantly while cleaning. In this way, you will avoid causing damage.

Do not point the water jet at:

- electrical components
- plug connectors
- seals
- hoses

Cleaning the engine

! Observe the following notes when cleaning the engine. This avoids malfunctions and damage to the engine.

- When using high-pressure or steam cleaners, do not point the spray directly at electrical components and electric cables.
- Make sure that no water enters the air intake and ventilation openings.
- Treat the engine with preservative agents after it has been cleaned. When doing so, protect the belt drive system from the preservative agent.
- Use only wax preservative for engines according to sheet number 385.4 of the Mercedes-Benz Specifications for Service Products.

Maintenance

General information

⚠ WARNING

Before carrying out maintenance or repair work, you must read the relevant sections of the technical documentation relating to maintenance and repair measures, e.g. the Operating Instructions and workshop information.

In particular, first familiarise yourself with the legal regulations, e.g. work safety and accident prevention regulations.

You could otherwise fail to recognise dangers and injure yourself or others.

Always have maintenance work carried out at a qualified specialist workshop which has the necessary specialist knowledge and tools to carry out the work required.

Mercedes-Benz recommends that you use a Mercedes-Benz or MTU Service Centre for this purpose. All work relevant to safety or on safety-related systems must be carried out at a qualified specialist workshop.

⚠ WARNING

Maintenance work that is carried out incorrectly or not at all, e.g. not changing the oil filter or not observing maintenance intervals, can cause engine damage. Engine damage can lead to an increased risk of accidents.

Therefore, observe the notes on engine maintenance in these Operating Instructions.

Environmental note

If circumstances demand that you have to do some maintenance work yourself, environmental protection requirements must be observed. When disposing of service products, e.g. engine oil, you must comply with the legal requirements. This also applies to all parts, e.g. filters, that have been in contact with service products. For vehicles run on FAME (fatty acid methyl ester) fuel, the special instructions on disposing of engine oil must be observed. For more information, visit a qualified specialist workshop, e.g. a

Mercedes-Benz or MTU Service Centre. Dispose of empty containers, cleaning cloths and care products in an environmentally responsible manner. Observe the instructions for care products. Do not let the engine run longer than necessary when stationary.

All maintenance work and maintenance intervals refer to genuine Mercedes-Benz parts and accessories that have been expressly approved for the engine by Mercedes Benz.

The scope of maintenance and frequency of maintenance work depend on the different operating conditions and are listed in the Maintenance Booklet.

Have any work that is carried out confirmed with an entry in the Maintenance Booklet. This proof of regular maintenance is always required for any warranty claims.

Please also observe the maintenance instructions for special accessories.

Work schedule overview

Maintenance work overview

	With BlueTec®	Without BlueTec®
Maintenance schedule for maintenance service		
Engine: oil and filter change		
AP18.00-W-0101C[7] **Operation with diesel fuel:** carry out an oil and filter change at least every **two years**.	•	•
AP18.00-W-0101C[7] **Operation with FAME fuels (bio-diesel):** carry out an oil and filter change at least **once a year**.	•	•
Check and adjust the fluid level		
AP20.00-W-2010A[7] Engine cooling system: check corrosion/antifreeze protection. Adjustment subject to a separate invoice. In the event of fluid loss, find the cause and remedy it.	•	•
Engine		
AP13.22-W-1351A[7] Check poly-V-belt for wear and tear and damage.	•	•
Additional maintenance work every second maintenance service (Z2)		
AP05.30-W-0560A[7] Check V2 valve clearance, adjust (first maintenance service, third, fifth, seventh, etc.).	•	•
AP14.40-W-1481A[7] Replace AdBlue®/DEF filter.	•	
Additional work every third maintenance service (Z3)		
AP47.20-W-0730B[7] Fuel prefilter: cleaning the filter element.	•	•
AP47.20-W-0783A[7] Fuel prefilter with water separator: replace fuel filter.	•	•
AP47.20-W-0780A[7] Fuel filter: replace fuel filter element. For operation with FAME fuels (bio-diesel): replace fuel filter at the same time as renewing the engine oil and replacing the filter.	•	•
Engine brake: check condition and setting.	•	•

7 Work item number of the Mercedes-Benz workshop information system (WIS).

Maintenance work by year	With BlueTec®	Without BlueTec®
Once a year (J1)		
Check for areas of abrasion and incorrect routing. In the event of fluid loss, find cause and remedy.		
AP14.40-W-1490A[7] Filling the AdBlue®/DEF pressure reservoir.	•	
AP00.20-W-0050A[7] Check for leaks and condition of assemblies.	•	•
AP00.20-W-0051A[7] Lines and hoses, sensor cables – check for leaks and condition.	•	•
AP09.00-W-0953A[7] Intake pipe between air filter, charge-air cooler and engine - check for leaks and condition.	•	•
AP20.20-W-T052A[7] All reservoirs, covers, bellows, protective caps.	•	•
AP20.00-W-2050A[7] Heating system: condition check, radiator, lines and hoses.	•	•
Every three years (J3)		
Engine		
AP20.00-W-2080A[7] Renew coolant, according to Sheet Number of the antifreeze/anti-corrosion additive in the Specifications for Service Products, every three or five years (observe coolant mixture ratio). If very dirty: clean the cooling system (for a separate order).	•	•
AP09.10-W-0980A[7] Replace air filter element according to equipment/vehicle manufacturer's specifications. Observe installation date.	•	•
Final inspection		
Visual check/road test/test rig: check that the equipment is safe to operate/check that the vehicle is roadworthy.	•	•

7 Work item number of the Mercedes-Benz workshop information system (WIS).

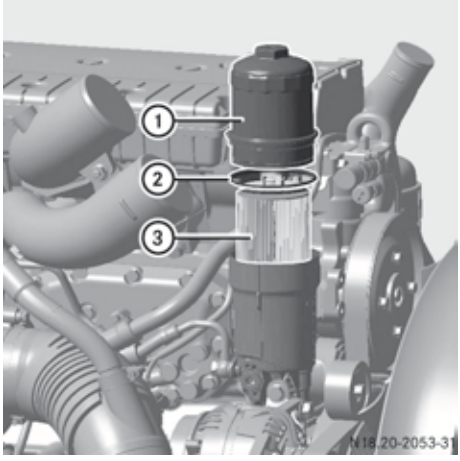
Work schedules

Changing the engine oil and filter

Temperature for oil and filter change

Only change the engine oil when the engine is at normal operating temperature.

Oil filter replacement



! Make sure that no foreign objects enter the filter housing. Never wipe the filter housing out because lint or dirt can enter the oil circuit.

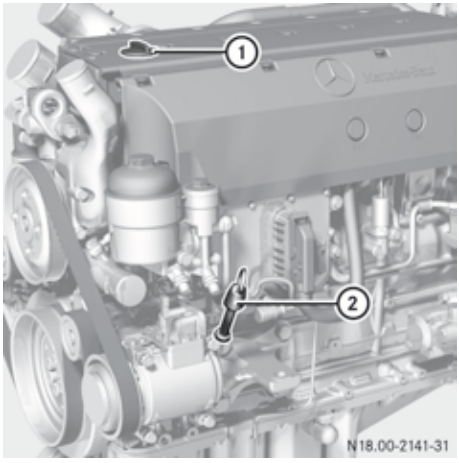
- ▶ Unscrew oil filter cap ① using a socket spanner insert (SW 36). Allow the oil to drain from the filter housing.
- ▶ Remove oil filter cap ① with oil filter element ③ and unclip oil filter element ③ by pressing in a sideways direction.
- ▶ Replace sealing ring ② on cap ①. Lightly grease the sealing ring.
- ▶ Insert new oil filter element ③ into oil filter cap ① and press until it clips into place.
- ▶ Screw on oil filter cap ① with the oil filter element and tighten. Tightening torque: 25 Nm.

Siphoning and draining engine oil

Environmental note

Dispose of engine oil and filters in accordance with the applicable regulations for your location.

i Only siphon off/drain engine oil with the engine at normal operating temperature.



Example: OM 926 LA

① Filler neck

② Oil dipstick

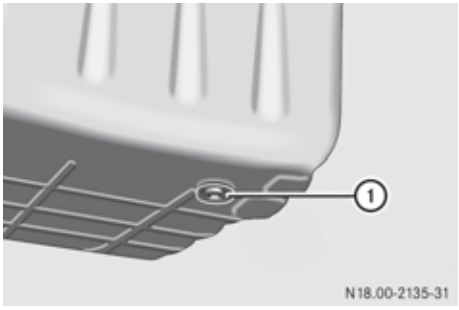
- ▶ **To siphon off engine oil:** pull out oil dipstick ②.
- ▶ Insert the extractor system into the guide tube, using an O-ring to seal it.
- ▶ Siphon off the engine oil through the guide tube.

i Observe the extraction pump operating instructions.

⚠ WARNING

Hot engine oil escaping under pressure can scald your skin and eyes.

Wear suitable protective gloves, protective clothing and safety goggles.

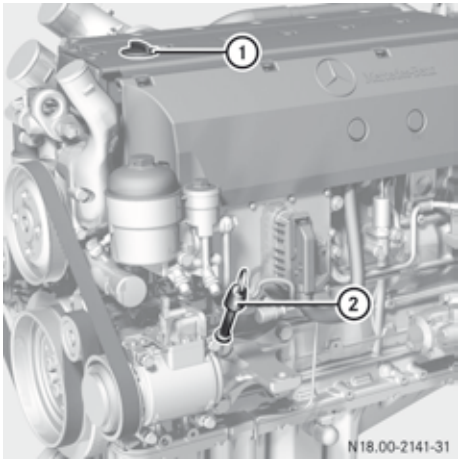


Example: drain plug

- ▶ **To drain off engine oil:** place a suitable collecting receptacle under drain plug ① on the underside of the oil pan.
- ▶ Carefully unscrew drain plug ① and allow the oil to drain out.
- ▶ Screw in and tighten drain plug ① with a new seal (tightening torque (▷ page 105)).

An oil drain hose is available as optional equipment.

Adding engine oil



Example: OM 926 LA

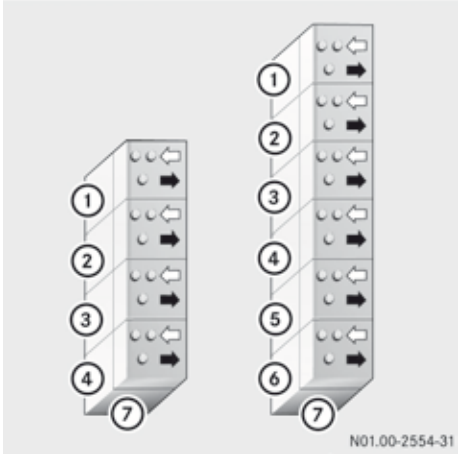
- ▶ Add new engine oil to the engine via filler neck ① up to the maximum mark on dipstick ②. Select the SAE viscosity class of engine oil in accordance with outside temperatures.
- ▶ Start the engine without depressing the accelerator pedal. When running at idling speed, observe the oil pressure display.

! Keep the engine running at idling speed until an oil pressure reading is displayed. If no oil pressure is displayed after approximately 10 seconds, switch off the engine. Determine the cause.

- ▶ Check the oil filter cap and the drain plug for leaks.
- ▶ Check the oil level after about 5 minutes and add oil up to the upper marking on the oil dipstick.

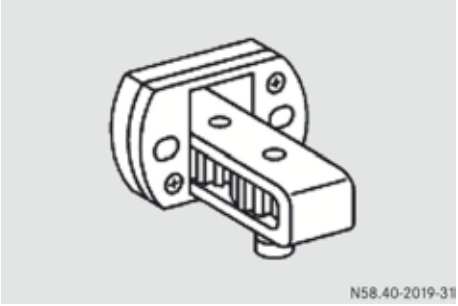
Checking valve clearance, adjusting

Layout of cylinders and valves



① - ⑥ Cylinder number
⇦ Intake valve
⇨ Exhaust valve
⑦ Flywheel side

Special tool



Cranking device 904 589 04 63 00

Valve adjustment tool 422 589 00 11 00 (no image)

Valve clearance

Inlet valves		0.40 mm
Exhaust valve		0.60 mm
Test tolerance	Inlet valves	+/- 0.05 mm
	Exhaust valve	+/- 0.10 mm

The tolerance is only applicable for checking, not as a valve clearance setting.

Adjust the valve clearance when the engine is cold (at least 30 minutes after stopping the engine, even if it has only been operated for a brief period).

⚠ WARNING

If not properly secured, a vehicle might accidentally be set in motion, knocking somebody down or trapping them or causing an accident and injuring you or others.

- Always prevent the vehicle from rolling away by applying the parking brake and, if necessary, using chocks.
- Shift the transmission into neutral.
- Only turn the engine over using the cranking device provided for this purpose.

⚠ WARNING

If the engine starts automatically, there is a risk of injury by limbs being crushed between the moving parts.

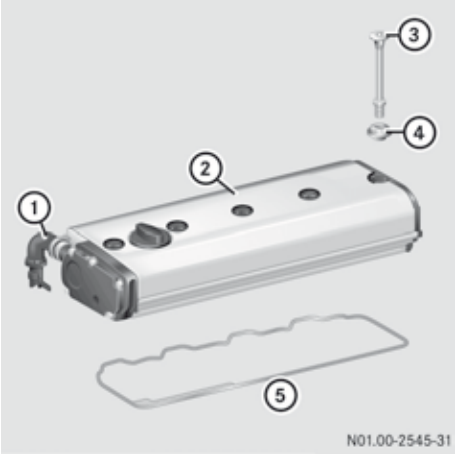
Secure the engine against unintentional starting before carrying out maintenance or repair work.

⚠ WARNING

The engine becomes very hot while it is running and remains so for some time after it has stopped. It will cause burns if touched.

Before starting any work on the engine, allow all engine parts to cool down, or wear suitable gloves and items of clothing to protect yourself from being burned on hot engine components.

Removing and fitting the cylinder head covers



Example: cylinder head cover

① Engine ventilation hose
② Cylinder head cover
③ Bolt
④ Sealing washer
⑤ Seal

- ▶ Clean very dirty cylinder head covers before removal.
- ▶ Remove engine ventilation hose ① from cylinder head cover ②.
- ▶ Remove cylinder head cover ②.
- ▶ Remove seal ⑤ between the cylinder head cover and the cylinder head.
- ▶ Clean the sealing surfaces of the cylinder head cover and the cylinder head.

Example: flywheel inspection hole

- ▶ Unscrew the cap from the inspection hole in the flywheel housing.
- ▶ Fit the cranking device 904 589 04 63 00 (▷ page 64) to the flywheel housing inspection hole. Tightening torque: 25 Nm.

Valve clearance setting

Valve clearance setting OM 904/924 LA

Crankshaft position	Cylinder/valves to be adjusted					
	1	2	3	4	5	6
4th cylinder valve overlap	I/E	I	A	-		
1st cylinder valve overlap	-	A	I	I/E		

I – inlet valve

E – exhaust valve

Valve clearance setting OM 906/926 LA

Crankshaft position	Cylinder/valves to be adjusted					
	1	2	3	4	5	6
6th cylinder valve overlap	I/E	I	A	I	A	-
1st cylinder valve overlap	-	A	I	A	I	I/E

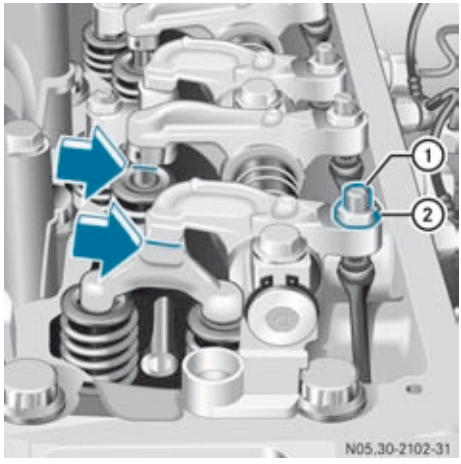
I – inlet valve

E – exhaust valve

Adjust all valve clearances at two crankshaft positions.

- ▶ Use the cranking device to turn the crankshaft until cylinder no. 6 / cylinder no. 4 is at TDC valve overlap (cylinder no. 1 at ignition TDC).
- ▶ Turn cylinder no. 1 to TDC valve overlap (cylinder no. 6 at ignition TDC).
- ▶ Check and adjust the valve clearance of all valves in accordance with the table above.

Checking and adjusting the valve clearance



- ▶ Measure the valve clearance between the rocker arm and valve bridge using a feeler gauge (arrow). It should be possible to pull through the feeler gauge with only light resistance.
- ▶ Loosen counternut ② to permit adjustment of the valve clearance. Adjust the valve clearance by turning adjustment screw ①.
- ▶ Tighten the counternut again (tightening torque (▷ page 105)).
- ▶ Check the valve clearance again and correct.

Concluding work

- ▶ Replace the gaskets on the cylinder head covers.
- ▶ Put on the cylinder head covers and tighten them (tightening torque (▷ page 105)).
- ▶ Remove the cranking device from the flywheel housing inspection hole.
- ▶ Screw on the cap of the inspection hole of the flywheel housing and tighten it (tightening torque: 25 Nm).
- ▶ After fitting, run the engine and check the cylinder head cover area for leaks.

Checking poly-V-belt for wear and damage.

⚠ **WARNING**

Faulty poly-V-belts can tear, the belt or parts of it could then be thrown off the engine, thereby causing injury to others.

- Always observe the specified maintenance intervals for poly-V-belts.
- If damage is detected, replace the poly-V-belt concerned immediately.

! If the poly-V-belt is torn, there is no drive to the coolant pump and the alternator. The engine may overheat as a result.

- Check the poly-V-belt condition regularly.
- Replace the poly-V-belt concerned immediately if there are any signs of damage.

Special tool

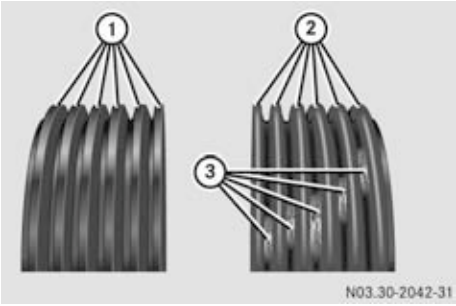
Cranking device: 904 589 04 63 00 (▷ page 64).

Checking the poly-V-belt.

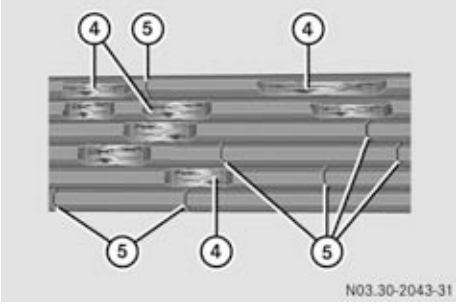
- ▶ Fit the cranking device to the flywheel housing inspection hole. Tightening torque: 25 Nm.
- ▶ Make a chalk mark on the poly-V-belt.
- ▶ Check the poly-V-belt for damage section by section; to do this, turn the engine or poly-V-belt gradually using the cranking device until the chalk mark is reached again.
- ▶ Remove the cranking device.
- ▶ Screw the cap into the inspection hole in the flywheel housing and tighten. Tightening torque: 25 Nm.
- ▶ **Replace the poly-V-belt:** (▷ page 97).

Patterns of damage

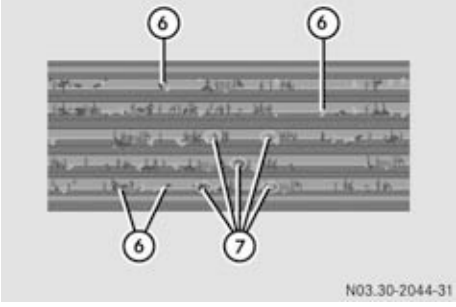
! Replace the poly-V-belts if one of the following damage patterns occurs on the poly-V-belt.



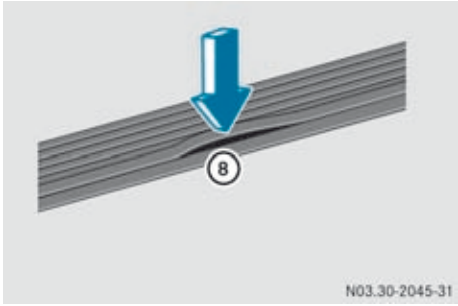
① New condition (for comparison; trapezoidal ribs)
② Single-sided wear: wedge-shaped ribs
③ Cord visible at the base of the belt



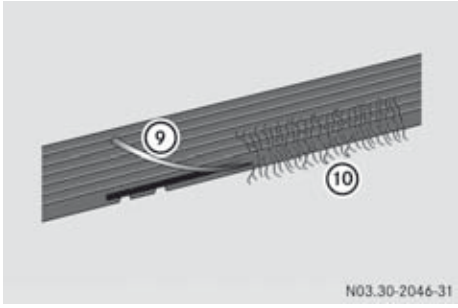
④ Breaks in the ribs
⑤ Transverse cracks in several ribs



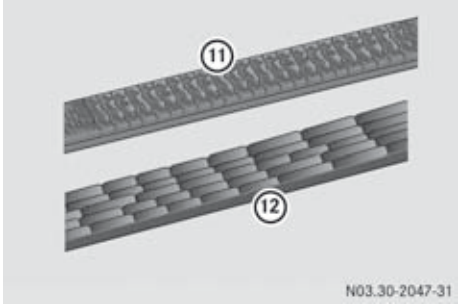
⑥ Rubber nodules at the base of the belt
⑦ Deposits of dirt or stones



⑧ Rib detached from the base of the belt



⑨ Cord torn out of the side
⑩ Outer cord frayed

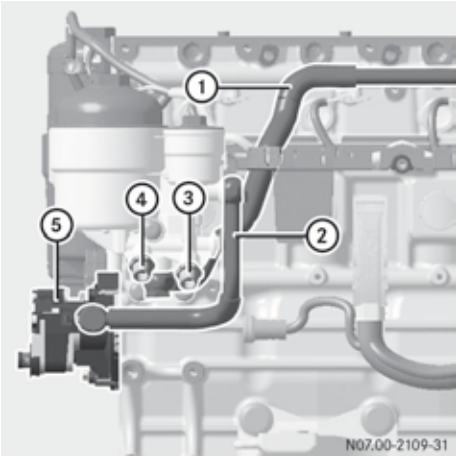


⑪ Transverse cracks on the back of the belt
⑫ Transverse cracks in several ribs

▶ Check the poly-V-belt for damage regularly.

Fuel circuit

The following picture shows the arrangement of the fuel connectors with the fuel filter mounted on the engine.



① Leakage fuel from the engine
② To the fuel pump
③ From the fuel tank
④ Fuel return line to the fuel tank
⑤ Fuel pump

Fuel prefilter with water separator: replacing the fuel filter

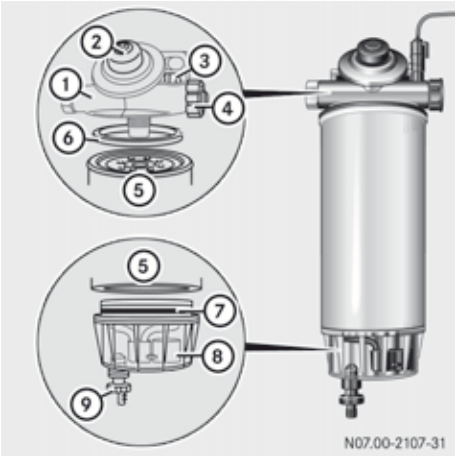
⚠ WARNING

There is an increased risk of fire when handling fuels as they are highly flammable. Avoid fire, naked flames and sparks, and refrain from smoking when handling fuels.

Environmental note

Dispose of used filter elements, seals and fuel residue in accordance with relevant local regulations.

The fuel prefilter is fitted on the equipment or vehicle. Observe the operating and maintenance instructions in the equipment/vehicle operating instructions for the fuel prefilter.



- ▶ Vehicle with fuel prefilter at tank level: close shutoff valve ④.
- ▶ Place a collector under water drain valve ⑨.
- ▶ Open water drain valve ⑨ and bleed screw ③. Collect the escaping water/fuel mixture.
- ▶ Unscrew filter element ⑤ from filter head ①.
- ▶ Unscrew water separator ⑧ from filter element ⑤ and clean or replace as necessary.
- ▶ Replace filter element ⑤.
- ▶ Screw water separator ⑧ with new sealing ring ⑦ onto filter element ⑤ until it is hand-tight. Lubricate sealing ring ⑦ with a thin coat of engine oil beforehand.
- ▶ Screw filter element ⑤ with new sealing ring ⑥ onto filter head ① until it is hand-tight. Lubricate sealing ring ⑥ with a thin coat of engine oil beforehand.
- ▶ Close water release valve ⑨.
- ▶ Vehicle with fuel prefilter at tank level: open shutoff valve ④.
- ▶ Push fuel hand pump ② repeatedly until the fuel escapes free of bubbles from bleed screw ③.
- ▶ Close bleed screw ③.

- ▶ Start the engine and bleed the fuel system. Run the engine for approximately 1 minute. The fuel system bleeds automatically. If the engine stalls or does not start, bleed the fuel system manually (▷ page 86).
- ▶ Check the fuel prefilter with water separator for leaks while the engine is running.

Replacing the fuel filter element

⚠ WARNING

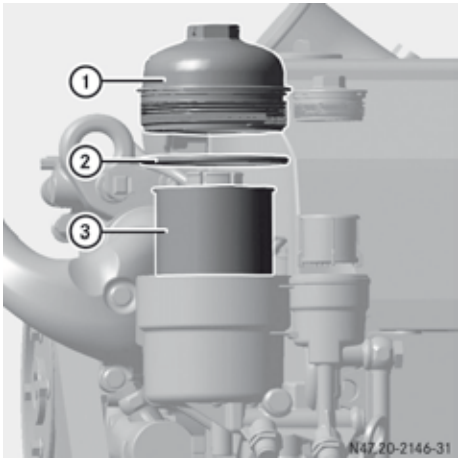
There is an increased risk of fire when handling fuels as they are highly flammable. Avoid fire, naked flames and sparks, and refrain from smoking when handling fuels.

Environmental note

Dispose of used filter elements, seals and fuel residue in accordance with relevant local regulations.

Environmental note

If the diesel fuel level (fuel tank) is above engine height, the feed line must be blocked off during filter replacement. Otherwise, diesel can drain out.



Example: OM 926 LA

- ▶ Clean the outside of the filter housing.
- ▶ Open the fuel filler cap to prevent excess pressure in the fuel tank.
- ▶ Unscrew fuel filter cap ① using a socket spanner insert (SW 36).
- ▶ Pull fuel filter cap ① with filter element ③ out of the filter housing slightly. Allow the fuel to drain off.
- ▶ Remove the cap and filter element. Unclip the filter element by pressing the sides of the lower edge of the filter element.
  - Make sure that no foreign objects enter the filter housing.
  - Never wipe inside the filter housing.
  - The ingress of water must be prevented.
- ▶ Replace sealing ring ② with a new one (grease lightly).
- ▶ Clip new filter element ③ into housing cover ①.
- ▶ Screw on and tighten oil filter cap ① with filter element ③ (tightening torque: 25 Nm).
- ▶ Put on the fuel filler cap and tighten it.
- ▶ Start the engine and bleed the fuel system (▷ page 86).
- ▶ Run the engine for approximately 1 minute. The fuel system bleeds automatically.
  If the engine stalls or does not start, bleed the fuel system manually.
- ▶ Check the fuel filter for leaks with the engine running.

Replacing the AdBlue®/DEF filter

⚠ WARNING

If the AdBlue®/DEF tank cap is opened at high temperatures, ammonia vapours may escape.

Ammonia vapours have a pungent odour and particularly irritate:

- skin
- mucous membranes
- eyes

The vapours may cause a burning sensation in the eyes, nose and throat as well as irritation of the throat and watering eyes.

Avoid inhaling ammonia vapours.

⚠ WARNING

AdBlue®/DEF must not come into contact with skin, eyes or clothing.

- If AdBlue®/DEF comes into contact with your eyes or skin, rinse affected areas with clean water immediately.
- If AdBlue®/DEF is swallowed, immediately rinse your mouth out with a lot of clean water and drink plenty of water.
- Change clothing that is soiled with AdBlue®/DEF immediately.
- If allergic reactions occur, consult a doctor immediately.

Keep AdBlue®/DEF out of the reach of children.

⚠ WARNING

The AdBlue®/DEF lines and all connected components are pressurised during operation and could be hot, even after the engine has been switched off. There is a risk of burns. When opening the pressurised system, there is a risk of scalding due to hot AdBlue®/DEF spraying out.

- Wait at least 5 minutes after switching off the engine before starting work on the exhaust gas aftertreatment system.
- Open line connections and caps on system components slowly. Cover the area that you are disconnecting with a cloth.
- Wear suitable protective gloves, protective clothing and safety goggles.

! If AdBlue®/DEF gets into the coolant circuit (even minute amounts), thermostats and temperature sensors will be damaged.

- Always keep AdBlue®/DEF completely separate from other service products.
- Do not use the same containers and fluid collecting pans for AdBlue®/DEF and other service products.
- Do not continue to use service products that contain traces of AdBlue®/DEF.

! Individual components of the BlueTec® system react very sensitively to even the slightest trace of impurities in AdBlue®/DEF.

- Only use containers and fluid collecting pans that are clean and suitable for AdBlue®/DEF.
- Do not continue to use AdBlue®/DEF which contains traces of impurities.

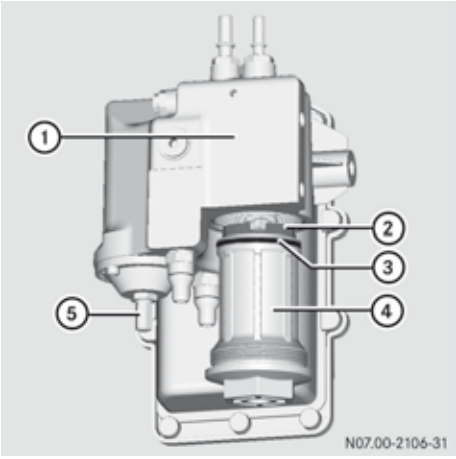
Fire fighting measures

AdBlue®/DEF is not flammable. In the event of a fire, NH_3 (ammonia) may be released. This may result in a risk of poisoning. Measures to extinguish a fire must therefore be adapted to suit the surroundings.

Environmental note

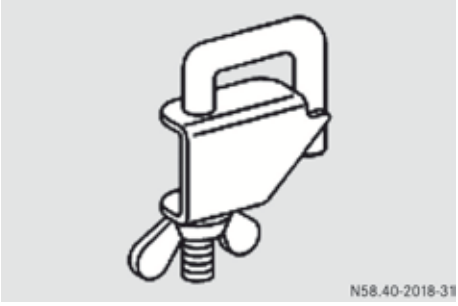
Disposing of AdBlue®/DEF:

- Due to its easy degradability, small amounts of spilt AdBlue®/DEF can be washed into the sewage system without any problems.
- Larger amounts of AdBlue®/DEF must be disposed of correctly, observing the regulations on waste treatment/disposal.
- Packaging that is contaminated with AdBlue®/DEF residue must be treated in the same way as AdBlue®. Packaging should be emptied as thoroughly as possible, cleaned appropriately and then recycled.



AdBlue®/DEF pump/filter unit

① Pump module
② Filter element
③ O-ring
④ Filter bowl
⑤ Dust protection cap



Hose clamp 000 589 54 37 00

- ▶ Clamp the feed and return lines on the pump/filter unit using hose clamps.
- ▶ Place a suitable receptacle under the pump/filter unit to collect any AdBlue®/DEF fluid that escapes.
- ▶ Unscrew filter bowl ④ from the pump/filter unit.
- ▶ Remove filter element ②.
- ▶ Smear O-ring ③ on new filter element ② thinly with MB silicon grease before assembly.
- ▶ Insert new filter element ② into filter bowl ④. Use MB silicon grease as a lubricant.
- ▶ Screw filter bowl ④ into pump module ① and tighten. Tightening torque: 32 Nm.

! Only MB silicon grease is permissible as a lubricant. Use MB silicon grease very sparingly, otherwise damage to the exhaust gas aftertreatment system could result. The system is self-bleeding and does not need to be bled manually.

Filling the AdBlue®/DEF pressure reservoir

Important safety notes

⚠ WARNING

If the AdBlue®/DEF tank cap is opened at high temperatures, ammonia vapours may escape.

Ammonia vapours have a pungent odour and particularly irritate:

- skin
- mucous membranes
- eyes

The vapours may cause a burning sensation in the eyes, nose and throat as well as irritation of the throat and watering eyes.

Avoid inhaling ammonia vapours.

⚠ WARNING

AdBlue®/DEF must not come into contact with skin, eyes or clothing.

- If AdBlue®/DEF comes into contact with your eyes or skin, rinse affected areas with clean water immediately.
- If AdBlue®/DEF is swallowed, immediately rinse your mouth out with a lot of clean water and drink plenty of water.
- Change clothing that is soiled with AdBlue®/DEF immediately.
- If allergic reactions occur, consult a doctor immediately.

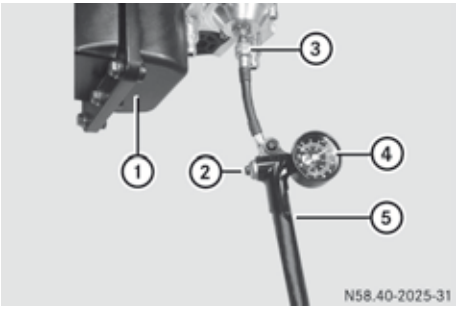
▷▷

Keep AdBlue®/DEF out of the reach of children.

Environmental note

Dispose of AdBlue®/DEF in an environmentally responsible manner.

You will find further information on AdBlue®/DEF in the "Service products" section (▷ page 54).



Special tool 001 589 00 71 00 pump

① Supply unit with pressure reservoir
② Pressure release
③ Filling hose
④ Filling pressure gauge
⑤ Pump

▶ **To check the pressure:** unscrew the dust protection cap from the valve of pressure reservoir ①.

▶ Screw filling hose ③ onto the valve of the pressure reservoir.

▶ Read the pressure on pressure gauge ④.

The pressure must be adjusted to 3.2 (±0.2) bar. The operating pressure of 3.2 (±0.2) bar may not be exceeded. Otherwise malfunctions may occur in the system.

▶ Increase or reduce the pressure if necessary.

▶ **To increase the pressure:** press pump lever ⑤.

Adjust the pressure to 0.2 bar above the specified operating pressure. When the filling hose is disconnected from the valve, a pressure loss of 0.2 bar takes place.

▶ **To reduce the pressure:** press button ② several times.

▶ Only if the pump module or the pressure reservoir was not replaced: **check the pressure:** if the pressure was increased, it must be tested again after at least 5 minutes.

To do this, check the pressure as described above.

If the drop in pressure is only approximately 0.2 bar, the pressure reservoir is OK.

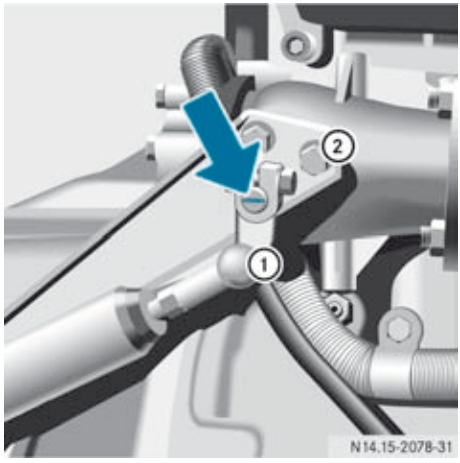
If a greater pressure loss is apparent, the pressure reservoir must be replaced.

▶ If the pressure reservoir is OK:

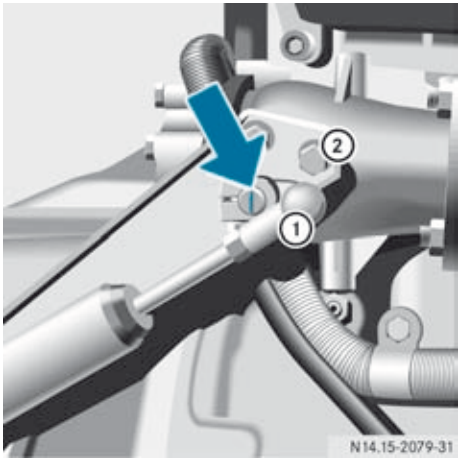
Equalise the pressure loss.

▶ Screw the dust protection cap onto the valve of the pressure reservoir.

Engine brake - checking condition and setting



Throttle valve lever in rest position



Throttle valve lever in operating position

- ▶ Remove the wire circlip from the ball socket of the engine brake cylinder.
- ▶ Press the ball socket off the ball coupling of throttle valve lever ①.
- ▶ Check the engine brake cylinder, ball coupling, ball socket and the throttle valve shaft for wear.
- ▶ Check the seating of the throttle valve lever on the throttle valve shaft and retighten the clamp screw if necessary.
- ▶ Lubricate the ball socket with heat-resistant lubricant (part number A000 989 76 51).
- ▶ Press the ball socket back onto the ball coupling, fit the wire circlip.
- ▶ When the engine brake is applied, throttle valve lever ① must rest on bracket ② in the working position (cylinder extended).

  The throttle valve lever must also rest on bracket when the engine brake cylinder is in the rest position (cylinder retracted). If this is the case, the return spring pretension of the engine brake cylinder is adequate.
- ▶ Check the position of the throttle valve shaft: when the engine brake is in the rest position, the notch must be horizontal. In the working position, the notch must be vertical.

Engine cooling system

Checking and correcting the fluid level and the antifreeze/corrosion inhibitor

⚠ WARNING

When opening the coolant expansion tank, there is a risk of scalding, due to hot coolant spraying out. The cooling system and coolant expansion tank are pressurised when the engine is at operating temperature. Wear gloves and eye protection.

Open the coolant expansion tank only at a coolant temperature below 50 °C .

⚠ WARNING

Coolant contains glycol and is therefore toxic. Do not swallow the coolant. See a doctor immediately if you swallow coolant.

Make sure that coolant does not come into contact with skin, eyes or clothing. In case of contact with eyes, rinse immediately with plenty of clean water. Clean affected areas of skin and clothing with soap and water immediately. Change any affected clothing immediately.

Only check the coolant level when the coolant temperature is under 50 °C. Check the antifreeze/corrosion inhibitor concentration before correcting the coolant level. Only top up with a prepared coolant having an antifreeze/corrosion inhibitor concentration of 50% by volume. corrosion inhibitor/antifreeze agent.

Before topping up, check the quality of the antifreeze/corrosion inhibitor (Sheet. No.) in the cooling system. Corrosion/antifreeze additives compliant with Sheet 325.3 and 326.3 must not be mixed with those of Sheet 325.0/2 or 326.0/2. Only top up with corrosion inhibitor/antifreeze agent of the same quality grade (▷ page 48). This helps to prevent damage to the engine.

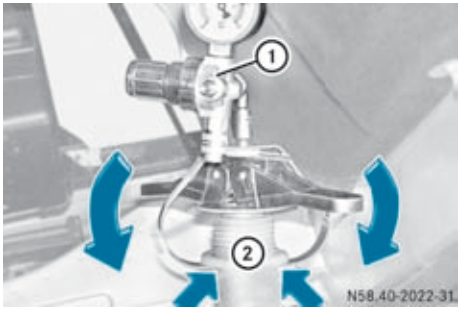
- ▶ Open the engine cooling system cap slowly, relieving the excess pressure.
- ▶ Check the antifreeze/corrosion inhibitor concentration using a testing device. The correct concentration of 50% antifreeze/corrosion inhibitor by volume in the coolant provides antifreeze protection down to -37 °C. If a lower level of antifreeze protection is indicated, correct the mixture ratio.

! If the concentration of antifreeze/corrosion inhibitor is too low, there is a risk of engine damage as a result of corrosion/cavitation in the cooling system.

Avoid concentrations greater than 55% by volume corrosion inhibitor/antifreeze agent. Otherwise, the maximum antifreeze protection down to -45 °C will not be attained. Heat dissipation and antifreeze protection deteriorate at higher concentrations.

- ▶ **To check the coolant level:** the cooling system is filled correctly if the coolant is level with the mark in the filler neck.

Cooling and heating system – condition check of radiator, lines and hoses



Special tool: pressure tester tool

- ▶ Heating systems: open all control valves and shutoff valves for the heating system.
- ▶ Remove the coolant expansion tank cap.
- ▶ Check the coolant level and top up if necessary.
- ▶ Check/correct the coolant antifreeze protection content.
- ▶ Dry the inside of coolant filler neck ② with a lint-free cloth.
- ▶ Mount pressure tester tool ① on the filler neck of the coolant expansion tank.
- ▶ Connect the compressed-air hose with tyre inflation connection to pressure tester tool ① and set it to a test pressure of 1.0 bar.

  The test pressure should correspond to the value at which the cooling system pressure relief valve opens. The opening pressure can be determined from the code on the cap or pressure relief valve.

  Example: code 100 = 1.0 bar excess pressure.
- ▶ After about 5 - 10 minutes, read the drop in pressure on the manometer of tester ①. After 5 - 10 minutes, there must be no drop in pressure detected on the manometer. Do not exceed the test pressure and the test time, as this may damage the cooling and heating system.
  If the cooling system/heating system is leaking, this will become apparent due to a drop in pressure, indicated by the manometer on tester ①.
- ▶ If there is a loss of pressure in the cooling system leading to visible loss of coolant, have the leak in the cooling or heating system repaired.
- ▶ If there is a pressure drop with no visible loss of coolant: have the cause identified and immediately rectified by a qualified specialist workshop.

  Mercedes-Benz recommends that you use a Mercedes-Benz or MTU Service Centre for this purpose (▷ page 11). Work relevant to safety or on safety-related systems must be carried out at a qualified specialist workshop.
- ▶ Release the pressure using pressure tester tool ① and remove pressure tester tool ① from the coolant expansion tank filler neck.

- ▶ Check the coolant level and correct if necessary.
- ▶ Replace coolant expansion tank cap and tighten it.

Renewing the coolant

⚠ WARNING

When opening the coolant expansion tank, there is a risk of scalding, due to hot coolant spraying out. The cooling system and coolant expansion tank are pressurised when the engine is at operating temperature. Wear gloves and eye protection.

Open the coolant expansion tank only at a coolant temperature below 50 °C .

⚠ WARNING

Coolant contains glycol and is therefore toxic. Do not swallow the coolant. See a doctor immediately if you swallow coolant.

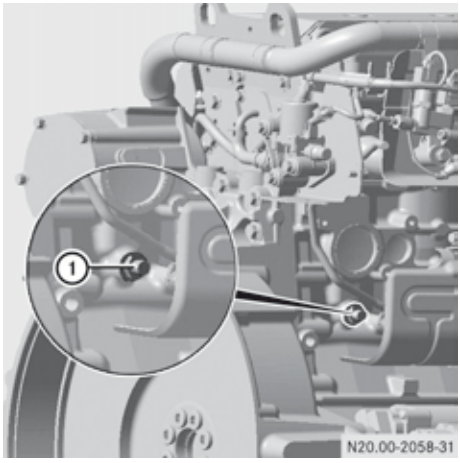
Make sure that coolant does not come into contact with skin, eyes or clothing. In case of contact with eyes, rinse immediately with plenty of clean water. Clean affected areas of skin and clothing with soap and water immediately. Change any affected clothing immediately.

Before renewing the coolant, check the cooling and heating system for leaks and condition. Have the coolant renewal confirmed in the Maintenance Booklet.

Draining the coolant

Environmental note

Dispose of used coolant in accordance with current local regulations.



- ▶ Undo the engine cooling system cap slowly, relieving the excess pressure, and remove it.
- ▶ Heating systems: open the heating system temperature control (control valve).
- ▶ Cover the lines etc. under the drain plugs.
- ▶ Place a suitably sized receptacle underneath to catch the coolant.
- ▶ Plug the drain hose onto coolant drain plug ① on the crankcase.
- ▶ Release drain plug ① and collect the coolant.
- ▶ Clear blocked drainage openings of deposits.
- ▶ Tighten coolant drain plug ① on the engine with a new seal (tightening torque: 60 Nm).
- ▶ Screw in other drain plugs (without hose connection) with new seals (tightening torque (▷ page 105)).

! Old coolant and corrosion deposits must be rinsed out thoroughly.

If the cooling system is heavily contaminated, flush it thoroughly before refilling.

Adding coolant

- ▶ Add coolant.
- ▶ Start the engine and run it at varying speeds for approximately 1 minute.
- ▶ Add coolant mixed to the prescribed ratio until it reaches the lower edge of the filler neck.
- ▶ Switch off the engine and seal the cooling system again.

Observe any further information in the operating instructions from the equipment/vehicle manufacturer.

! Corrosion inhibitors/antifreeze agents that comply with Sheet 325.3 and 326.3 must not be mixed with those of Sheet 325.0/2 or 326.0/2. This prevents damage to the engine cooling system.

Cleaning the cooling system

⚠ **WARNING**

The cooling system is pressurised. Hot coolant can escape under pressure when the cooling system is opened and scald your skin and eyes.

- Only open the cooling system at coolant temperatures below 90 °C.
- Unscrew the cap slowly and release any excess pressure completely before opening the cap fully.
- Wear suitable protective gloves, protective clothing and safety goggles when handling coolant.

⚠ **WARNING**

Coolant contains glycol and is therefore toxic. Do not swallow the coolant. See a doctor immediately if you swallow coolant.

Make sure that coolant does not come into contact with skin, eyes or clothing. In case of contact with eyes, rinse immediately with plenty of clean water. Clean affected areas of skin and clothing with soap and water immediately. Change any affected clothing immediately.

Environmental note

Collect used coolant, cleaning solutions and detergents and dispose of them in an environmentally responsible manner in accordance with applicable local regulations.

- ▶ Remove foreign objects (dust, insects, etc.) from the radiator core fin. You can do this by blowing them out with compressed air, or by spraying water from the rear side of the radiator.

! Only apply moderate pressure when cleaning, since the radiator fins could otherwise be damaged.

- ▶ Drain off coolant when the engine is cold (▷ page 75).
- ▶ If a heater is connected to the cooling system, open the regulating valves fully.

Flushing the cooling system

- ▶ Fill the cooling system with fresh water and leave the system running for approximate five minutes.
- ▶ Switch off the engine and drain off the water completely.
- ▶ Repeat the flushing process at least twice.
- ▶ Fill the cooling system with new corrosion inhibitor/antifreeze agent. Observe the antifreeze protection (▷ page 73).

Degreasing the cooling system

- ▶ If necessary, degrease the cooling system with a suitable cleaning agent. Information is available from any Mercedes-Benz or MTU Service Centre (▷ page 11).

Checking for leaks and general condition – assemblies

▶ Carry out a visual inspection of the engine for signs of leaks. Slight dampness around sealed joints can be ignored.

! More severe leaks, where there is constant oil loss, must be rectified immediately.

Lines, hoses and sensor cables – checking for leaks and general condition

▶ Carry out a visual check for leaks from lines and hoses. At the same time, check that all lines and hoses are undamaged, are routed so they do not chafe and are secured correctly.

▶ Check the intake pipe between the air filter and the engine for leaks and check the condition.

▶ Check the intake pipe and bellows from the air filter as well as the charge-air cooler for the engine for damage and for leaks at connection points.

▶ Check the air compressor intake pipe and crankcase ventilation for damage and leaks at connection points.

▶ Check all hose clamps for correct seating. Retighten or replace loose hose clamps.

▶ Replace porous, leaking or damaged lines and bellows.

⚠ **WARNING**

The engine becomes very hot while it is running and remains so for some time after it has stopped. It will cause burns if touched.

Before starting any work on the engine, allow all engine parts to cool down, or wear suitable gloves and items of clothing to protect yourself from being burned on hot engine components.

⚠ **WARNING**

There is a danger of limbs being caught, pulled in and thereby crushed or severed by rotating engine parts. Therefore you should:

- keep a safe distance between yourself and rotating engine parts, including when the engine is being started.
- wait until all engine parts have stopped moving before carrying out any work on the engine.
- wear work clothing which is properly fastened and close-fitting. Wear a hair net if necessary. Remove jewellery such as watches and necklaces.

Decommissioning the engine

Particular measures are necessary when the engine/vehicle/equipment is to be decommissioned.

Decommissioned engines are engines that are not operated for a month or more after assembly or after repair work has been carried out.

For engines that have been run in, this applies after 12 months' standing time.

Decommissioning for up to 12 months

- When decommissioning an engine/vehicle/equipment, keep it in a covered, dry and well-ventilated area. The room temperature should not fall below -10 °C in order prevent the AdBlue®/DEF from freezing.

  If this is not possible, these measures must be carried out after 6 months rather than 12.

Measures prior to decommissioning

- Clean the engine/vehicle/equipment thoroughly.
- Remove any patches of corrosion from the engine.
- Change the engine oil and oil filter if the last oil change was carried out more than 20,000 km (around 300 operating hours) ago or if the oil is older than 12 months.
- Disconnect the earth lines from the batteries (this prevents self-discharge due to closed-circuit accessories).
- Charge the batteries. Check the battery fluid levels before and after charging.
- Check and adjust the concentration of anti-corrosion/antifreeze additives in the coolant.
- Check and adjust the level of coolant or renew coolant.
- Fill up the AdBlue®/DEF supply reservoir completely so that AdBlue® cannot crystallise out.
- Fuel prefilter with heated water separator: drain off the water separator.

Engine/vehicle/equipment with exhaust gas aftertreatment

- **Decommissioning for more than 12 months:** fill up the AdBlue®/DEF supply reservoir completely.
- **Decommissioning for more than 24 months:** drain off and dispose of AdBlue®/DEF. When disposing of AdBlue®/DEF, observe the relevant national laws and regulations.
- When outside temperatures are low, AdBlue®/DEF crystals may form on the coiled hose between the engine and silencer. Remove the crystals with plenty of water.

Engine/vehicle/equipment run on FAME (Fatty Acid Methyl Ester) bio-diesel fuel

- Empty the fuel tank to the point where the remaining fuel still allows the engine to be operated for 15 to 30 minutes each month during its decommissioned period.
- Start the engine at least once a month and leave it running for 15 to 30 minutes at an engine speed of around 900 rpm. Doing so purges the fuel system or diesel injection system with fuel. This prevents any caulking of the fuel injectors.

Measures during decommissioning

- Before starting the engine, check the engine oil level and the coolant level.
- Start the engine and leave it running for 15 to 30 minutes at an engine speed of no more than 900 rpm.
- While the engine is running, observe the indicators for oil pressure, coolant temperature and oil temperature.
- While the engine is running, select every gear that can be selected while stationary.

- Leave the engine running until the air compressor cutoff pressure is reached.
- Fuel prefilter with heated water separator: drain off the water separator.
- Recharge the batteries every three months. Check the battery fluid levels before and after charging.
- Change the engine oil and oil filter every 24 months.

Measures prior to decommissioning

- Empty the fuel tank and fill up with new fuel. When disposing of fuels, observe the relevant national laws and regulations.
- Fuel prefilter with heated water separator: replace filter element.
- Replace fuel filter.
- Replace air filter cartridge.
- Change engine oil and oil filter.
- Check coolant level.
- If coolant needs refilling, check and adjust the concentration of anticorrosion/antifreeze in the coolant. Before refilling coolant, note the quality of the previously filled anticorrosion/antifreeze (▷ page 48).
- Check the charge status of the battery and recharge if necessary. Check the battery fluid levels before and after charging.
- Connect the earth lines to the batteries.
- Check that the electrical system is functioning correctly.
- Check cables, hoses and lines for tears and leaks.
- Start the engine and leave it running for 15 to 30 minutes at an engine speed of no more than 900 rpm.
- While the engine is running, observe the indicators for oil pressure, coolant temperature and oil temperature.
- Vehicles with auxiliary heating: activate the auxiliary heating.
- Check oil levels in the steering system, engine, transmission and drive axles.
- Check that the electrical system, steering system and brakes are functioning correctly.
- Clean the engine/vehicle/equipment thoroughly.

Protecting the engine

Engine protective treatment applies to all fitted and removed vehicle, industrial and OEM engines as well as new engines, reconditioned engines and short block engines.

Engines that have been removed must be protected against moisture (rain or spray water) using special measures.

Protective treatment for up to 12 months

On new engines no additional protection measures are required, as long as initial operation oil compliant with Sheet 225.6 and coolant were added at the engine factory. Engines which have covered a distance of up to 300 km or which have been operated for up to 6 hours may be considered new.

- Clean the engine thoroughly and remove patches of corrosion.
- All machined exterior and unpreserved surfaces must be greased or sprayed with preservative agent according to Sheet 385.4. This is regardless of the duration of the protective treatment. Examples of this are the flywheel and pulley keyway.
- Where possible, carry out protective measures on the fitted engine in the storage location.
- After protective measures are complete, the engine must not be started again.
- Engine oil and coolant must be filled to the maximum level. Observe the temperature ranges when selecting engine oil and coolant.

- Close off all openings on the engine (e.g. on the charge-air housing, exhaust etc.) with an oil-soaked rag.
- Drain off the coolant completely for engines that have been removed. Unscrew the coolant drain plug on the engine block to do so. When screwing in the coolant drain plug, observe the tightening torque.
- Relieve the tension in the poly-V-belt. The poly-V-belt can remain routed.
- If the engine has been filled with coolant, the cooling system must first be filled with water. It must then be filled with a mixture of water and improver compliant with Sheet 311.0. Coolant without antifreeze protection compliant with Sheet 312.0 may also be used.

Protective treatment for 12 to 36 months

Carry out all measures in "Protective treatment for up to 12 months". The fuel system, combustion chambers and air compressor also require protective measures.

Carry out protective measures for the fuel system

▶ Completely fill the fuel tank with diesel fuel.

▶ Start the engine and allow it to run for 15-30 minutes at approximately 900 rpm.

Carry out protective measures for the combustion chambers

Only carry out protection measures for the combustion chambers when the engine is cold (coolant temperature under 50 °C).

Only use initial operation oil compliant with Sheet 225.6 for the protection of the combustion chambers.

▶ Detach the charge-air housing from the cylinder heads.

▶ Briefly press the start button on the engine. At the same time, pour approximately 15 – 20 cm^3 initial operation oil into each cylinder.

Protecting the air compressor

Carry out the protection of the air compressor at the same time as the combustion chamber protection.

▶ On the air intake side of the air compressor, pour a maximum of 5 cm^3 of initial operation oil compliant with Sheet 225.6 into the air compressor.

After protective measures

▶ Refit all removed engine parts. Observe the tightening torques.

! After protective measures are complete, the engine must not be started again.

Protective treatment for longer than 36 months

When carrying out protective treatment for over 36 or 18 months, repeat the protection measures as in "Protective treatment for 12 to 36 months".

▶ Drain off engine oil that has been added.

▶ The oil filter does not have to be replaced.

Shipping by sea or engine protective treatment in tropical countries

Carry out all measures in "Protective treatment for 12 to 36 months". The fuel system, combustion chambers and air compressor also require protective measures.

The following work is required for engines that have been run in (distance of over 300 km or running time of over 6 operating hours):

- Drain off engine oil and replace the oil filter. Add initial operation oil compliant with Sheet 225.6.
- Fill or top up the cooling system with the specified coolant. Before refilling coolant, note the quality of the previously filled anticorrosion/antifreeze (▷ page 48).
- Carry out protective measures for the fuel system.
- Warm up the engine at medium engine speeds and allow it to run for approximately 5 to 10 minutes at operating temperature (coolant temperature 75-95 °C).
- Switch off the engine and check the oil level.
- Add oil up to the upper marking on the oil dipstick.
- Hermetically seal all engine openings.
- Drain off the coolant completely for engines that have been removed. Unscrew the coolant drain plug on the engine block to do so.

Re-commissioning

- Remove all plugs or rags that have been fitted.
- Fit removed engines and connect all cables, hoses and lines.
- Remove protective agents and greases from all protected areas, such as the flywheel, pulley keyway etc.
- Tension the poly-V-belt as per the regulations.
- Renew the engine oil and replace the oil filter before re-commissioning. Add oil up to the upper marking on the oil dipstick.
- Add coolant. Observe the concentration of anticorrosion/antifreeze additives. Before refilling coolant, note the quality of the previously filled anticorrosion/antifreeze (▷ page 48).
- New engines: add initial operation oil compliant with Sheet 225.6.
- Engines that have been run in (distance of over 300 km or running time of over 6 operating hours): before starting the engine, lubricate the lubrication points on the engine as necessary, e.g. ball couplings or engine brakes.
- Start the engine and leave it running until it is at operating temperature (coolant temperature approximately 75 to 95 °C). While doing so, observe the indicators for oil pressure, coolant temperature and oil temperature.

General notes

⚠ WARNING

If maintenance and repair work is carried out on the engine incorrectly, this can cause engine failure. Engine failure can lead to an increased risk of accidents.

Maintenance and repair work on the engine may only be carried out by personnel who have undergone the appropriate training.

Always have work on or modifications to the engine carried out at a qualified specialist workshop which has the necessary specialist skills and tools for the work required. Mercedes-Benz recommends that you use a Mercedes-Benz or MTU Service Centre for this purpose.

Apart from careful operation and maintenance of the engine it is also important that malfunctions be rectified in good time.

You can rectify certain malfunctions yourself (▷ page 89).

Have malfunctions that you cannot eliminate yourself rectified at a qualified specialist workshop.

Mercedes-Benz recommends that you go to a Mercedes-Benz or MTU Service Centre, as they have the necessary knowledge and tools to carry out the required work (▷ page 11). In particular, work relevant to safety or on safety-related systems must be carried out at a qualified specialist workshop.

Bleeding the fuel system

Fuel system without fuel prefilter

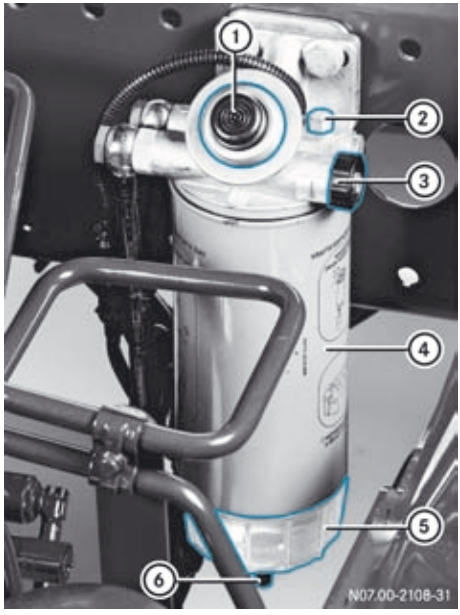
Automatic bleeding

! Do not bleed the fuel system by operating the starter motor for an extended period of time. You could otherwise damage the starter motor.

▶ Turn the starter motor for up to 30 seconds without interruption until the engine is running smoothly.
The fuel system is automatically bled when the tank is empty (▷ page 35).

Fuel system with fuel prefilter

Fuel prefilter overview



Example: fuel prefilter

① Fuel hand pump
② Vent valve
③ Shutoff valve
④ Filter housing
⑤ Water separator with inspection window
⑥ Water release valve

If water has collected in inspection window ⑤, drain the fuel prefilter before bleeding.

Draining the fuel prefilter

Environmental note

Dispose of the water-fuel mixture in an environmentally responsible manner.

Drain the fuel prefilter regularly.

- ▶ Place a collector under water release valve ⑥.
- ▶ On vehicles with fuel prefilter at tank level: close shutoff valve ③.
- ▶ Unscrew water release valve ⑥.
- ▶ Briefly press fuel hand pump ① and collect the fuel/water mixture.
- ▶ Close water release valve ⑥.
- ▶ On vehicles with fuel prefilter at tank level: open shutoff valve ③.
- ▶ Start the engine and allow it to run for about one minute.
  The fuel system is bled automatically.
- ▶ Check the fuel system for leaks.

Bleeding the fuel prefilter with the fuel hand pump

The fuel prefilter must only be bled when:

- the fuel tank is empty or
- the fuel filter has been replaced.

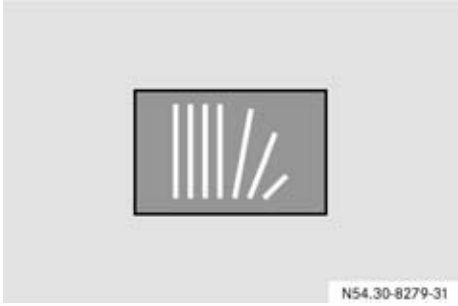
- ▶ Unscrew the fuel tank filler cap.
- ▶ Place the collector underneath the fuel prefilter.
- ▶ Open shutoff valve ③ fully.
- ▶ Open vent valve ②.
- ▶ Only press fuel hand pump ① until the fuel escaping from vent valve ② is free of bubbles. Do not continue to pump.
- ▶ Close vent valve ②.
- ▶ Close the fuel tank filler cap.
- ▶ Start the engine.
  The fuel system is bled automatically.

! Do not continue to press the fuel hand pump after the engine has started. This could otherwise damage the hand pump.

Activating engine emergency running mode

Emergency mode for on-highway applications

Emergency mode can be activated for road vehicles with Euro 4/5 certified engines (on-highway engines).



Example: indicator lamp malfunction

The engine is equipped with an electronic management system that monitors both the engine and itself (self-diagnostic system).

The [ ] indicator lamp lights up in the event of a malfunction. Error messages can be displayed as code or text in the display, depending on the vehicle's display format.

After a malfunction, the engine can be activated again in emergency mode with a limited constant engine speed. In engine emergency running mode, the accelerator pedal is not operational and the engine speed is limited to approximately 1300 rpm.

- ▶ **To activate engine emergency running mode**: stop the vehicle, paying attention to the road and traffic conditions.
- ▶ Engage the parking brake.
- ▶ Switch off the engine.
- ▶ Restart the engine after approximately 10 seconds.

i The STAR DIAGNOSIS or minidiag2 diagnostic equipment can be connected to the 14-pin diagnostic socket or by using the EU-compliant service connector. The fault memory and engine data can be read out

using this diagnostic equipment. Information is available from any Mercedes-Benz or MTU Service Centre (▷ page 11).

Emergency mode for off-highway applications

Full engine output can be activated with an emergency switch for devices with Euromot 3B or Tier 4i certified engines (off-highway applications). Emergency mode can only be activated for 30 minutes, and only if the vehicle has the appropriate equipment.

For further information, see the device's operating instructions.

Troubleshooting

Engine problems

⚠ WARNING

If maintenance work is carried out incorrectly, the operating safety of your vehicle may be affected. You could lose control of the vehicle and cause an accident. The safety systems may also no longer be able to protect you or others as they are designed to.

Always have service work carried out at a qualified specialist workshop. The qualified specialist workshop must have the specialist skills and tools necessary to carry out the work. Mercedes-Benz recommends that you use a Mercedes-Benz or MTU Service Centre for this purpose. In particular, work relevant to safety or on safety-related systems must be carried out at a qualified specialist workshop.

Apart from careful operation and maintenance of the engine it is also important that malfunctions be rectified in good time. You can rectify certain faults yourself.

Have malfunctions that you cannot eliminate yourself rectified at a qualified specialist workshop. Mercedes-Benz recommends that you use a Mercedes-Benz or MTU Service Centre for this purpose (▷ page 11).

Problem	Possible causes/consequences and ▶ Solutions
Drive pinion does not turn or turns too slowly.	Battery is not sufficiently charged. ▶ Charge the battery.
	Connecting cable to the starter motor is loose. ▶ Tighten the cable on the terminal. If necessary, solder on a new terminal.
	Starter motor solenoid switch is faulty or starter motor is faulty. ▶ Have it checked at a qualified specialist workshop.
Engine does not start or stalls again immediately.	Fuel tank is empty. ▶ Refill the fuel tank (▷ page 41).
	Fuel filter is blocked. ▶ Replace the filter element (▷ page 69).
	The fuel prefilter contains water. ▶ Drain the fuel prefilter (▷ page 68).
	Fuel prefilter is blocked. ▶ Replace the filter element (▷ page 68).
	Fuel system or filter is leaking. ▶ Replace the seals.

Problem	Possible causes/consequences and ▶ Solutions
	Fuel is not resistant to cold. ▶ Replace the fuel prefilter (▷ page 68). ▶ Replace the fuel filter (▷ page 69). ▶ Use winter fuel (▷ page 52).
	Incorrect engine oil viscosity. ▶ Alter the engine oil viscosity to the conditions of use (▷ page 47).
Engine does not start correctly.	There is a malfunction in the engine control unit. ▶ Read out the MR (engine control) unit, have it checked at a qualified specialist workshop.
	There are leaks or there is insufficient pressure in the low-pressure fuel circuit. ▶ Carry out a check for leaks (visual check). ▶ Have the pressure tested at a qualified specialist workshop.
Engine stops inadvertently.	MR (engine control) unit is faulty (total failure). ▶ Consult a qualified specialist workshop.
	Power supply to the MR/ADM control units is interrupted or there is a short circuit in the wiring. ▶ Have the power supply checked at a qualified specialist workshop.
	There are leaks or there is insufficient pressure in the low-pressure fuel circuit or the fuel pump drive is faulty. ▶ Check for leaks (visual check). ▶ Have the fuel pressure tested at a qualified specialist workshop.
Engine is in emergency running mode.	There is an interruption to the MR/ADM control unit's data flow. ▶ Read out the control unit's fault memory. ▶ Have it checked at a qualified specialist workshop.
Engine surges, vibrates or runs irregularly.	Crankshaft sensor or TDC sensor (on camshaft gear wheel) is faulty or the signal is missing. ▶ Consult a qualified specialist workshop.
	There is a malfunction in the fuel system. ▶ Read out the fault code. ▶ Have it checked at a qualified specialist workshop.

Problem	Possible causes/consequences and ▶ Solutions
The engine's output is poor (lack of power).	Air filter is dirty or blocked. ▶ Replace the air filter element.
	Charge-air temperature is too high - charge-air cooler or radiator exterior is dirty. ▶ Clean the outsides of the charge-air cooler and radiator.
	Coolant temperature is too high. ▶ Check the temperature sensor, replace as necessary, check the fan speed. ▶ Thermostat malfunction: consult a qualified specialist workshop.
	Malfunction in the fuel system (blocked, leaking) ▶ Visual inspection for leaks ▶ Consult a qualified specialist workshop.
	Charge-air system is leaking, hose clamp on charge-air hose loose or faulty ▶ Check the charge-air system for leaks. ▶ Check the charge-air pressure sensor and replace if necessary. ▶ Consult a qualified specialist workshop.
	Engine brake flap is faulty or stuck. ▶ Function check and visual inspection (▷ page 72).
	The "engine diagnostics" indicator lamp is flashing (▷ page 94). The AdBlue®/DEF tank is empty. ▶ Top up AdBlue®/DEF tank (▷ page 42).
	The "exhaust gas aftertreatment" indicator lamp lights up. There is an emissions-relevant fault or malfunction in the exhaust gas aftertreatment system. Faults or malfunctions could result in damage to the exhaust gas aftertreatment system. ▶ Have the exhaust gas aftertreatment system checked as soon as possible at a qualified specialist workshop.
There is an interruption in the tractive power.	There is an increased voltage drop to the MR/ADM control unit (loose contact). ▶ Check the battery terminal clamps and the connectors on the MR/ADM control unit for secure seating and corrosion.

Problem	Possible causes/consequences and ▶ Solutions
Engine braking effect is poor.	There is an engine brake flap malfunction or a fault in the actuation. ▶ Carry out a function check/visual check. ▶ Consult a qualified specialist workshop.
Fuel consumption is too high.	Connection points (unit pump - line and fuel injectors) are leaking ▶ Have a qualified specialist workshop check for leaks. ▶ Misfiring: have the engine checked at a qualified specialist workshop.
Engine cuts off too early (maximum engine speed cannot be reached).	Electronic engine speed control unit is faulty or parameterised incorrectly. ▶ Consult a qualified specialist workshop.
Engine gets too hot (according to coolant temperature gauge).	There is not enough coolant in the cooling system. ▶ Top up, bleed (▷ page 76)
	Coolant temperature sensor or display is faulty. ▶ Replace sensor or display.
	Poly-V-belt is damaged. ▶ See “Replacing the poly-V-belt” (▷ page 97).
	Fan does not switch on correctly. ▶ Consult a qualified specialist workshop.
	Radiator is dirty on inside or choked with limescale; radiator is very dirty on outside. ▶ Clean and remove limescale.
	Thermostat is faulty. ▶ Check and replace as necessary. ▶ Consult a qualified specialist workshop.
Charge current indicator lamp does not light up while the engine is not running.	Lamp is defective or supply line is interrupted. ▶ Replace lamp or repair interruption.
Charge current indicator lamp lights up when the engine is running.	Poly-V-belt is too loose. ▶ Check belt tensioner for proper functioning.

Problem	Possible causes/consequences and ▶ Solutions
	Poly-V-belt is torn. ▶ Replace poly-V-belt (▷ page 97).
	Alternator or sensor is defective. ▶ Check alternator or sensor. ▶ Consult a qualified specialist workshop.
Engine emits black smoke.	Air filter is very dirty. ▶ Replace the air filter element.
	Engine brake is faulty. ▶ Consult a qualified specialist workshop.
	Exhaust gas turbocharger is faulty. ▶ Carry out a visual check. ▶ Consult a qualified specialist workshop.
	Misfiring, fuel injector is faulty. ▶ Consult a qualified specialist workshop.
Exhaust fumes are blue.	The oil level in the engine is too high; the crankcase ventilation system is faulty; engine oil has entered the combustion chamber. ▶ Adjust the oil level correctly. ▶ Have the crankcase ventilation system checked at a qualified specialist workshop.
Exhaust fumes are white.	Coolant is entering the combustion chamber. ▶ Have a pressure loss test carried out at a qualified specialist workshop.
Engine “knocks”.	The engine is misfiring. ▶ Consult a qualified specialist workshop.
Knocking noise from the bearings.	There is bearing damage. ▶ Consult a qualified specialist workshop.
There are abnormal sounds.	Leaks in intake pipe and exhaust pipe cause whistling noise. ▶ Repair leaks; replace seals if necessary.

Problem	Possible causes/consequences and ▶ Solutions
	Turbine or compressor wheel is scraping the housing; foreign objects in the compressor or turbine; seized bearing in rotating parts. ▶ Have the exhaust gas turbocharger checked at a qualified specialist workshop.
	Valve clearance is too big. ▶ Check clearance; adjust (▷ page 63).

BlueTec® exhaust gas aftertreatment indicator (on-highway version)

⚠ WARNING

If service work is carried out incorrectly, the operating safety of your vehicle/equipment may be affected. You could lose control of the vehicle/equipment and cause an accident. The safety systems may also no longer be able to protect you or others as they are designed to.

Always have service work carried out at a qualified specialist workshop. The qualified specialist workshop must have the specialist skills and tools necessary to carry out the work. Mercedes-Benz recommends that you use a Mercedes-Benz or MTU Service Centre for this purpose. In particular, work relevant to safety or on safety-related systems must be carried out at a qualified specialist workshop.

Problem	Possible causes/consequences and ▶ Solutions
The [engine] indicator lamp lights up briefly and goes out again.	if there are no malfunctions, the [engine] indicator lamp lights up briefly during the instrument cluster's display check and then goes out again.
The [engine] indicator lamp flashes. Simultaneously, a display message with a red status indicator appears in the display. [truck] [fuel]	The AdBlue®/DEF tank is empty. There is a fault. The engine output may be reduced[8]. ▶ Follow the instructions in the display messages.
The [engine] indicator lamp lights up permanently.	The BlueTec® exhaust gas aftertreatment system has a fault or an emissions-relevant malfunction. A malfunction or fault could damage the BlueTec® exhaust gas aftertreatment. The engine output may be reduced[8]. ▶ Have the BlueTec® exhaust gas aftertreatment checked as soon as possible at a qualified specialist workshop.

Engines with BlueTec® exhaust gas aftertreatment:

When the AdBlue®/DEF tank is filled or the fault is rectified, full engine power will be available again. If the system check does not detect any other faults, the [engine] indicator lamp goes out. It may take several journeys/working cycles to complete the system check.

BlueTec® exhaust gas aftertreatment indicator (off-highway version)

AdBlue®/DEF level low

If the AdBlue®/DEF level is too low, the system registers the following warnings:

AdBlue®/DEF level	System message
Trigger 1: Level 20% or less	The [AdBlue] AdBlue®/DEF indicator lamp lights up.
Trigger 2: Level 10% or less	The [AdBlue] AdBlue®/DEF indicator lamp lights up.

8 The engine output is not reduced in the case of emergency vehicles, e.g. fire engines.

AdBlue®/DEF level	System message
30 minutes after trigger 2	• The AdBlue®/DEF indicator lamp flashes. • The LIM torque limitation indicator lamp lights up.
60 minutes after trigger 2	• The AdBlue®/DEF indicator lamp flashes. • The LIM torque limitation indicator lamp lights up if the torque value prior to tightening is between 80 - 50%. • The LIM torque limitation indicator lamp flashes if the torque value prior to tightening is less than 50%.

AdBlue®/DEF quality not OK

If the AdBlue®/DEF quality is not OK, the system registers the following warnings:

AdBlue®/DEF quality	System message
Trigger 3: AdBlue®/DEF quality is not OK	The AdBlue®/DEF indicator lamp lights up.
60 minutes after trigger 3	• The AdBlue®/DEF indicator lamp flashes. • The LIM torque limitation indicator lamp lights up.
180 minutes after trigger 3	• The AdBlue®/DEF indicator lamp flashes. • The LIM torque limitation indicator lamp lights up if the torque value prior to tightening is between 80 - 50%. • The LIM torque limitation indicator lamp flashes if the torque value prior to tightening is less than 50%.

Fault in the monitoring system

If faults occur, the system registers the following warnings:

Fault	System message
Trigger 4: • AdBlue®/DEF tank sensor missing • AdBlue®/DEF metering line or metering valve missing • AdBlue®/DEF metering line or metering valve blocked • AdBlue®/DEF metering pump missing • SCR cable set missing • NOx sensor missing • AdBlue®/DEF temperature sensor missing • Exhaust temperature sensor missing	• The AdBlue®/DEF indicator lamp lights up. • The LIM torque limitation indicator lamp lights up.
60 minutes after trigger 4	• The AdBlue®/DEF indicator lamp flashes. • The CHECK ENGINE indicator lamp lights up. • The LIM torque limitation indicator lamp lights up.
180 minutes after trigger 4	• The AdBlue®/DEF indicator lamp flashes. • The CHECK ENGINE indicator lamp lights up. • The LIM torque limitation indicator lamp lights up if the torque value prior to tightening is over 50%. • The LIM torque limitation indicator lamp flashes if the torque value prior to tightening is less than 50%.

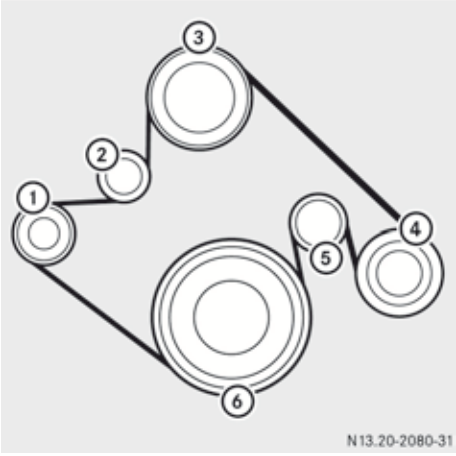
Replacing the poly-V-belt

If the poly-V-belt is torn or shows damage patterns (▷ page 66), it must be replaced.

⚠ WARNING

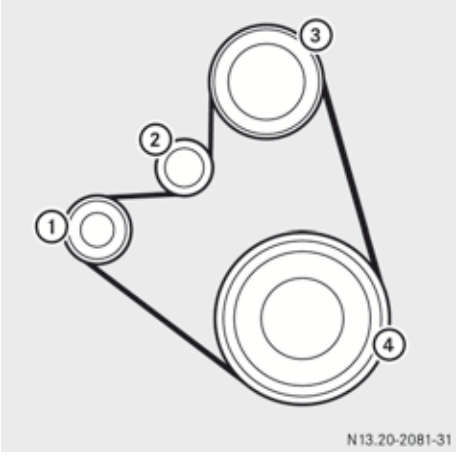
The tensioning device is spring-tensioned. When it is loosened or tightened, there is a risk of injury from crushing or entrapment in pretensioned parts.

- Always carry out work on the tensioning device with extreme care.
- Make sure that the tool is handled correctly.



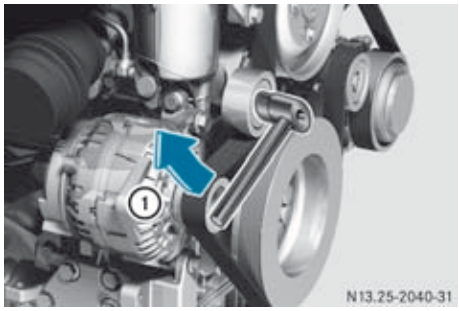
Poly-V-belt routing (engine with refrigerant compressor)

① Alternator
② Tensioning pulley
③ Coolant pump
④ Refrigerant compressor
⑤ Guide pulley
⑥ Crankshaft



Poly-V-belt routing (engine without refrigerant compressor)

① Alternator
② Tensioning pulley
③ Coolant pump
④ Crankshaft

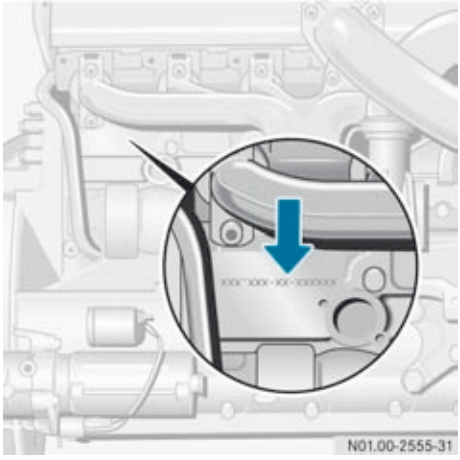


① Releasing the poly-V-belt (example)

- ▶ Fit the spanner with extension element and 15 mm socket spanner insert into the tensioning device.
- ▶ Swing the tensioning pulley up and remove the poly-V-belt.
- ▶ Swing back the tensioning device.
- ▶ Check that both the tensioning device and the belt pulley are in perfect condition (e.g. check for worn bearings on the tensioning device, tensioning pulley and guide pulleys as well as for wear on belt pulleys).
- ▶ Replace faulty parts.
- ▶ Lay the new poly-V-belt on all belt pulleys, except for the tensioning pulley (see the illustration for poly-V-belt routing).
- ▶ Swing the tensioning pulley up using the lever, lay the poly-V-belt on the tensioning pulley and swing the tensioning pulley back.
- ▶ Remove the spanner and check for correct seating of the poly-V-belt on the belt pulleys.

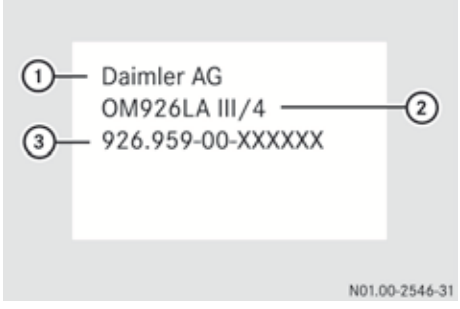
Vehicle identification plate

The identification plate is located on the left-hand side of the engine underneath the Start/Stop button or Start/Stop buttons. The identification plate data is stamped directly onto the crankcase.



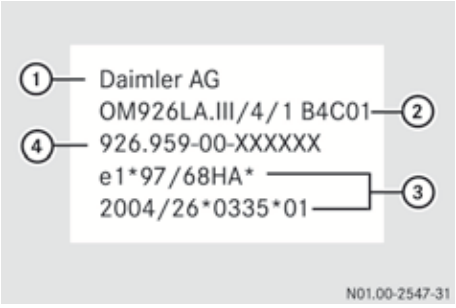
Information on the identification plate

The following data is contained on the identification plate in the form of numbers stamped directly onto the crankcase:



Example: identification plate for road vehicles (on-highway engine)

① Manufacturer's name
② Engine type description
③ Engine number



Example: identification plate for non-road vehicles (off-highway engines)

① Manufacturer's name
② Engine type description
③ Type approval number
④ Engine number

Engine model designation

Example: engine model designation

OM	9XX	L	A	
OM				Oil engine (diesel)
	9XX			Engine type
		L		Intercooler
			A	Exhaust gas turbocharger

Engine data card

The engine data card (A4 sheet) forms an integral part of the documents belonging to the engine and should always be kept with the Maintenance Booklet. It contains details about the design of the engine, including special features.

The engine data card must be presented or the complete engine number must be specified for the procurement of genuine Mercedes-Benz parts.

Engine data card

The engine data card describes the scope of delivery from the Mercedes-Benz factory. Later changes to the scope of delivery are not recorded on the data card.

Conversion parts on the engine which change the scope of the engine delivered by Mercedes-Benz must be recorded on the data card.

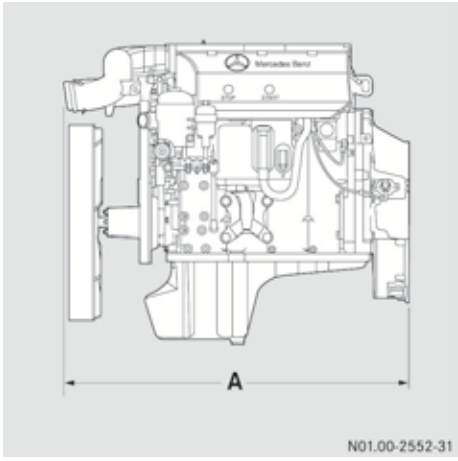
In order to prevent incorrect ordering of replacement parts, the Mercedes-Benz replacement parts service must also be informed.

Engine data

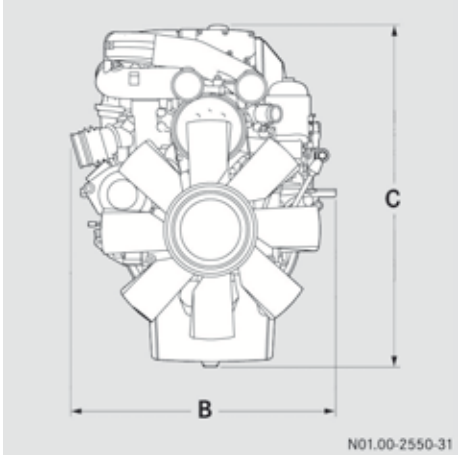
Dimensions and weights

All data refers to the standard version of the respective engine type. Deviations may occur, depending on the installation situation in the vehicle/equipment.

Dimensions



Example: engine length



Example: engine width and height

	OM 904 LA OM 924 LA	OM 906 LA OM 926 LA
A = engine length	830 mm	1078 mm
B = engine width	645 mm	645 mm
C = engine height	925 mm	940 mm

Weights

	OM 904 LA OM 924 LA	OM 906 LA OM 926 LA
Dry engine maximum	395 kg	530 kg
Wet engine maximum	420 kg	573 kg

General data

All data refers to the standard version of the respective engine type. Data for other versions is available on request.

Engine	Engine type	OM 904 LA OM 924 LA	OM 906 LA OM 926 LA
	Assembly model series	904.9 924.9	906.9 926.9
	Type	In-line engine with turbocharging and intercooler	
	Combustion principle	4-stroke diesel direct injection	
	Number of cylinders	4	6
	Hole	102 mm 106 mm	102 mm 106 mm
	Piston displacement	130 mm 136 mm	130 mm 136 mm
	Engine capacity	4250 cm^3 4800 cm^3	6370 cm^3 7200 cm^3
	Type of cooling system	Forced circulation cooling	
	Engine rotation direction	Anticlockwise (when looking at the flywheel)	
Valve clearance	Intake valve	0.40 mm	0.40 mm
	Exhaust valve	0.60 mm	0.60 mm
Starter motor	Starter	Electric	Electric
	Voltage	24 V	24 V
	Output	4.0 kW	4.0 kW
Battery	Voltage	12 V/24 V	12 V/24 V
	Cold-discharge test current	Maximum 450 A	Maximum 450 A
	Cold start ability	Up to maximum -20 °C (battery charge level 75%)	
Alternator	Voltage	28 V	28 V
	Current intensity	80 A	80 A

Operating data

Engine type		OM 904 LA/OM 924 LA	OM 906 LA/OM 926 LA
Rated engine speed		2200 rpm	2200 rpm
Effective engine speed range		2500 rpm	2500 rpm
Idling speed		Approximately 600 rpm	Approximately 600 rpm
Engine brake permissible up to		2700 rpm	2700 rpm
Engine speed limiter (emergency running mode)		1300 rpm	1300 rpm
Oil pressure	At idling speed	Minimum 0.5 bar	Minimum 0.5 bar
	At nominal engine speed	Minimum 2.5 bar	Minimum 2.5 bar
Coolant temperature	Normal operation	Approximately 80 – 95 °C	Approximately 80 – 95 °C
	Maximum permissible coolant temperature	100 °C	100 °C

Capacities

		Capacity approximately	Service product (sheet no.[9])
Engine with oil filter	OM 904 LA/OM924 LA	13 l - 16 l	For all engines: Engine oil (228.2, 228.3, 228.31, 228.5, 228.51) For engines without BlueTec®, also: Engine oil (228.0, 228.1)
	OM 906 LA/OM 926 LA	24 l - 29 l	
Fuel tank	Vehicle operation using diesel fuel	–	Diesel fuels (131.0)
	Vehicle operation with fatty acid methyl ester	–	Fatty acid methyl ester fuel (135.0)
Exhaust gas aftertreatment	AdBlue®/DEF	–	AdBlue®/DEF according to DIN 70070/ISO 22241

9 MB Specifications for Service Products.

			Capacity approx-imately	Service product (sheet no.[9])
	AdBlue®/DEF filter sealing rings		–	MB silicon grease
Cooling system (without intercooler)	Total capacity	OM 904/924 LA OM 906/926 LA	8.5 litres 12.5 litres	Coolant (310.1, 325.0/2, 326.0/2, 325.3, 326.3)
	Corrosion inhibitor/antifreeze agent volume down to -37 °C	OM 904/924 LA OM 906/926 LA	4.25 litres 6.25 litres	
	Corrosion inhibitor/antifreeze agent volume down to -45 °C	OM 904/924 LA OM 906/926 LA	4.7 litres 6.9 litres	
	Coolant additive (coolant without antifreeze protection)	OM 904/924 LA OM 906/926 LA	0.11 litres 0.16 litres	Coolant additive (310.1, 312.0)
Engine compartment	Protective wax		–	Wax preservative (385.4)
Engine brake	Heat-resistant lubricant		–	Heat-resistant lubricant (part number A000 989 76 51)

Tightening torques

All threads on mechanical components and the corresponding contact surfaces must be clean, smooth and coated with engine oil. Other lubricants lead to substantially different tightening torques.

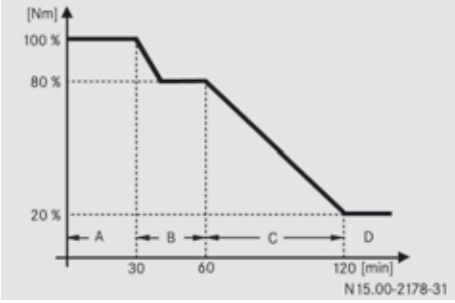
Engine	Cylinder head cover	Light alloy (with oil filler cap)	25 Nm
		Plastic (without oil filler cap)	20 Nm
	Adjusting the valve clearance	Counternut on the rocker arm adjustment screw	50 Nm
	Inspection hole cap on the timing case		25 Nm
	Flywheel housing rotation device		25 Nm
	Charge-air housing on the cylinder head		30 Nm
Fuel system	Cap on the fuel filter housing		25 Nm

9 MB Specifications for Service Products.

Oil circuit	Drain plug on the oil pan	M 20 x 1.5	70 Nm
		M 26 x 1.5	90 Nm
	Oil filter cap on the oil filter housing		40 Nm
Cooling system	Coolant drain screw	On the crankcase	60 Nm
		On the radiator	2 Nm
Exhaust gas aftertreatment	Filter bowl on AdBlue®/DEF pump module		32 Nm

Operating restriction - off-highway version

AdBlue®/DEF level low



Insufficient AdBlue®/DEF left; warning and sequence of operating restriction

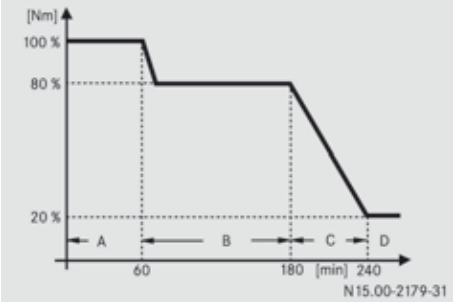
A Acknowledged fault

B Minor operating restriction

C Speed/torque reduction

D Major operating restriction

AdBlue®/DEF quality not OK/fault in the monitoring system



Poor AdBlue®/DEF quality and misuse; warning and sequence of operating restriction

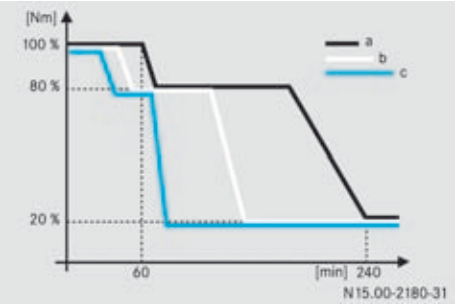
A Acknowledged fault

B Minor operating restriction

C Speed/torque reduction

D Major operating restriction

Recurring fault



a Regular operating restriction
b Operating restriction after first recurrence of fault
c Operating restriction after second recurrence of fault

Imprint

Internet

You will find further information about Mercedes-Benz engines, Daimler AG and Togum AG on the Internet at:

www.mercedes-benz.com

www.daimler.com

www.mtu-online.com

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