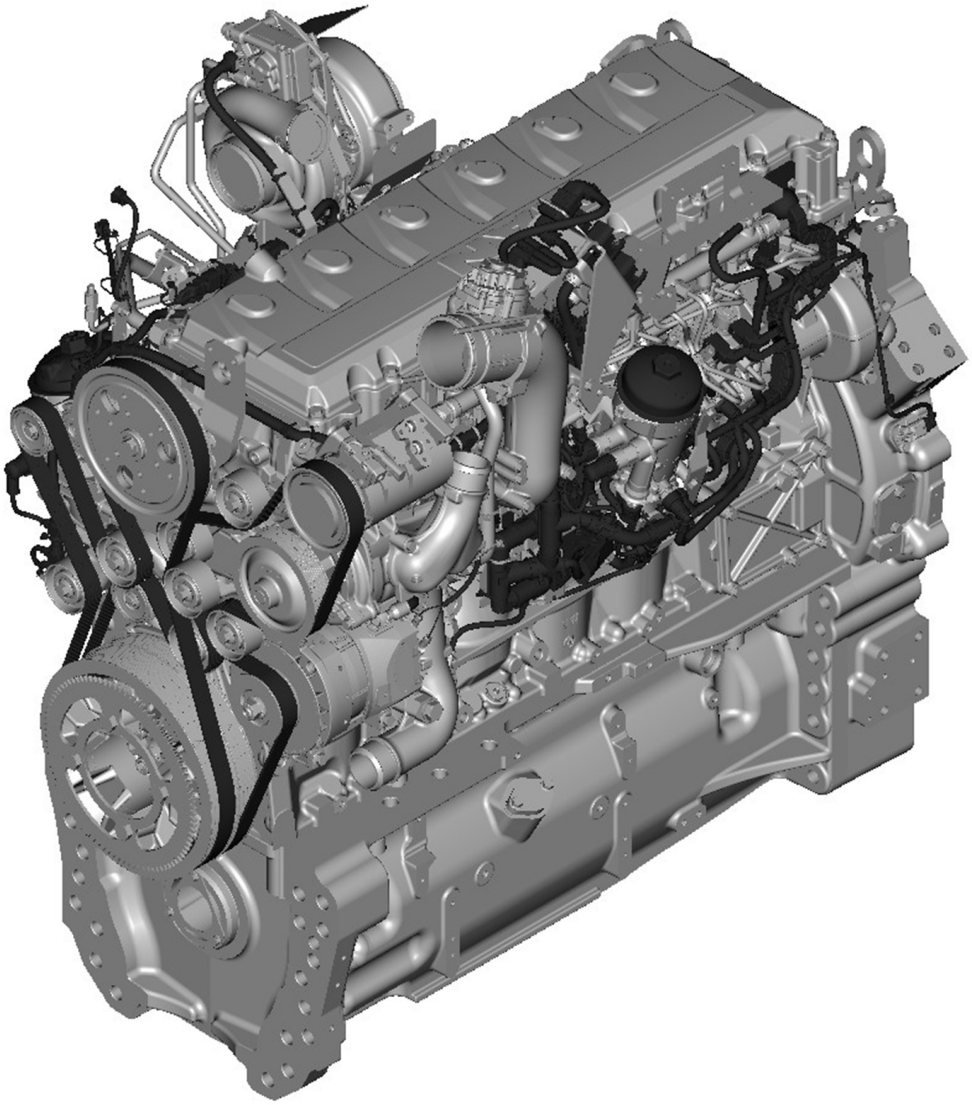

Repair Manual

MAN Industrial Diesel Engines

D1556 LE5XX

MAN Engines

Repair Manual

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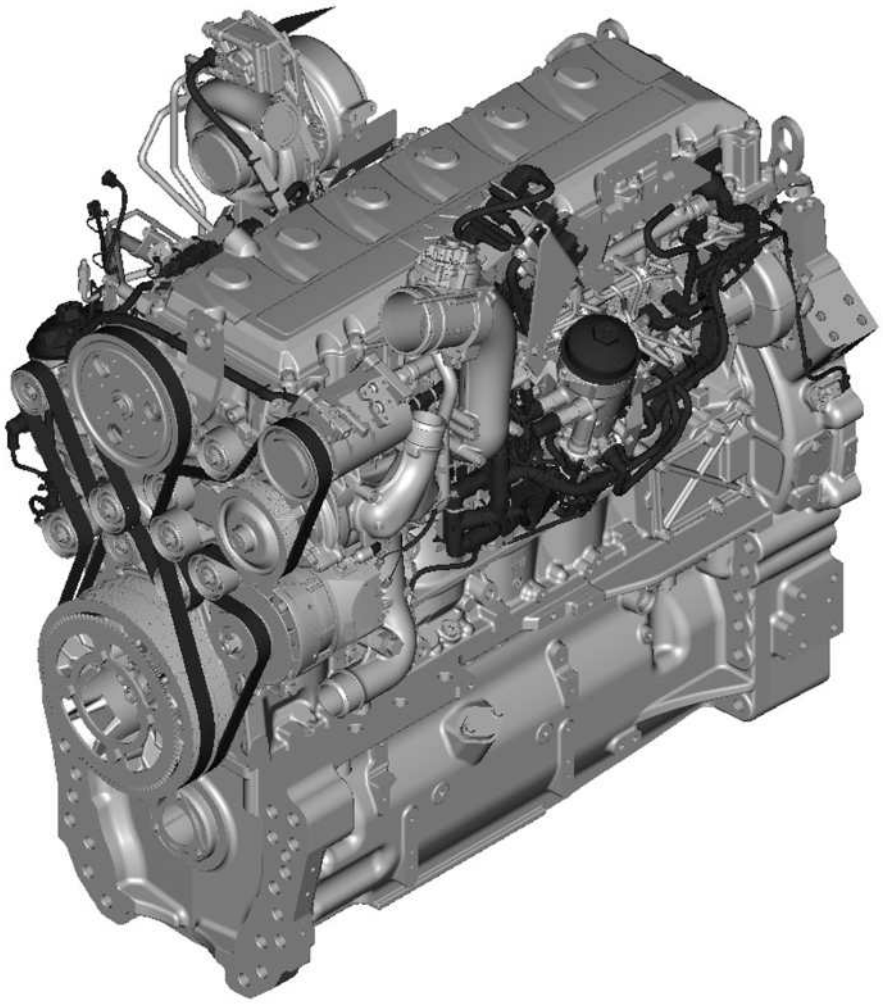
D1556 LE5XX



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1.1 Preface

Preface

This repair manual is intended to provide assistance in performing repairs correctly on vehicles and units. The technical details were correct at the time of going to press.

This publication assumes that persons who use it possess the requisite technical knowledge in handling vehicles and units.

Pictures and the corresponding descriptions are typical snapshots; they do not always correspond to the unit in question or its peripherals, but this does not necessarily mean they are incorrect. In such cases, plan and execute the repair work accordingly.

Repair work on complex attachment units should be entrusted to our customer service or to the customer service of the manufacturing company. These units are mentioned specifically in the text.

The repair jobs are divided up into sections and subsections. Each subsection starts with a page of jobs to do in advance. The jobs to do in advance contain a summary of the main prerequisites for the repair section in question. A detailed description of work can follow the jobs to do in advance.

Important instructions concerning technical safety and the safety of personnel are specifically highlighted, as indicated below.

1.2 Service

MAN Service is at your disposal for technical queries and to provide you with information.

Tip for users

Please mention the engine type, engine number and the order number with all communication.

You can contact us anytime via phone or e-mail, see Imprint.

1.3 Explanation of icons

Warnings

Warnings in this instruction are identified by icons. The information has been introduced with signal words that express the extent of risk or danger.

Follow the instructions in all cases and proceed with care in order to prevent accidents, personal injury and material damage.

⚠ DANGER

Describes an immediate dangerous situation that will lead to severe injuries or death if it is not avoided.

For this reason:

•

⚠ WARNING

Describes a potentially dangerous situation that may lead to severe injuries or death if it is not avoided.

For this reason:

•

⚠ CAUTION

Describes a potentially dangerous situation that may lead to minor or moderate injuries if it is not avoided.

For this reason:

•

NOTICE

Describes a potentially dangerous situation that may lead to damage to property if it is not avoided.

For this reason:

•

Tips and Recommendations

Tip for users

Tips and recommendations as well as information for efficient and trouble-free operation.

ENVIRONMENTAL WARNING

Tips on conduct for environmental protection.

General information

• This symbol indicates a listing at the first level.

►This symbol displays an action or series of actions.

1 This symbol displays the position of a graphic in the text.

[1] This symbol displays the position of a special tool in the text.

2.1 General

Only personnel with the proper training are permitted to perform maintenance or repair work on the engine.

The present manual must be read and understood carefully and completely.

The instructions refer to an engine in a removed[1] and dry[2] condition.

The safety regulations of the overall system must also be observed when working on the installed engine. These are not included in the present manual.

The engine must be located on a suitable device, e.g. the assembly device of MAN Truck & Bus SE.

The assembly device can be obtained from a contact of MAN Truck & Bus SE.

The following sections include **summaries** of important regulations, listed according to major topics. The intention is to provide the knowledge needed to avoid accidents which could lead to injury, damage and environmental pollution. **Please note that these are merely brief extracts taken from various accident prevention regulations and cannot replace them.** Naturally, all other safety regulations must be observed and the appropriate measures taken.

Additional direct references to danger are contained in the instructions at points where there is a potential danger.

Accidents may happen in spite of all precautionary measures having been taken. In such an eventuality, obtain immediate medical assistance from a doctor. This is particularly important if the accident involves skin contact with corrosive acid, fuel penetration under the skin, scalding by hot oil, antifreeze spraying into eyes, crushing of limbs, etc.

[1]The engine is located on a suitable assembly device. [2]There are no fluids (e.g. lubricant, coolant) in the engine

2.2 Requirements of personnel

Qualifications

- **each trained person** has been instructed by qualified personnel about the tasks assigned to him/her and the potential dangers of working on an engine.
- **Qualified personnel**, by virtue of their professional training, knowledge and experience, as well as of their knowledge of the relevant provisions, are capable of undertaking the tasks assigned to them.

The personnel must be briefed and trained regularly. The training must be recorded for better tracking of the training.

MAN Truck & Bus SE regularly provides product and application training. These training sessions can provide the necessary expertise.

Contact information for the MAN Engine Academy.

↗ http://www.engines.man.eu/global/de/ueber-man-engines/man-engine-academy/Themen.html

2.3 Regulations to prevent accidents with personal injury

During inspection, adjustment and repair work

- Secure units during their removal.
- Keep assemblies, ladders, steps, walkways and their surrounding areas free of oil and grease. Accidents due to slipping may cause severe injuries.
- **Checking, adjusting and repair measures may only be performed by authorized specialist personnel.**
- The main battery switch must be switched off during installation work.
- When performing maintenance and repair work, ensure that the engine cannot be started inadvertently by unauthorized persons.
- Only authorized personnel are allowed to start and operate the engine.
- Do not use any tools that are not in perfect condition.

Operating the engine

- Only authorized personnel are allowed to start and operate the engine.

- Do not get too close to rotating parts when the engine is running. Wear close-fitting work clothes.
- Ensure that there is adequate ventilation in enclosed spaces.
- Do not touch equipment at operating temperature with bare hands. Risk of burns! Do not work with bare hands, especially when performing an oil change (units at operating temperature).
- Open the coolant circuit only after the engine has cooled.
- The tool must be approved by MAN and in good technical condition.

Suspended loads

- Do not lift heavy parts with physical strength. Use suitable means.

  Procedure:
- Carefully secure single components and component groups to the lifting equipment so that there is no danger.
- Only use suitable and serviceable lifting equipment and lifting gear with a sufficient load rating.
- Only lift the engine from the provided lifting eyes using the crane lifting gear.
- Persons are not allowed to stand below an engine hanging from a crane hook. Keep the lifting gear in order.

Bodies and special bodies

- Comply with the safety instructions and regulations issued by the body manufacturer in question if bodies or special bodies are fitted.

Working on high-pressure lines

- Do not attempt to tighten, loosen or open pipes and hoses (e.g. in the lubrication circuit, coolant circuit and hydraulic oil circuit) whilst they are pressurized:

Risk of injury from escaping liquids!

Work on the electrical system

- Only start units when the batteries are properly connected.
- Do not disconnect batteries whilst the engine is running.
- Only start units when they are completely connected to the electronic control system.
- Do not use a quick-charger to start the unit. Use only separate batteries as a starting aid.
- The battery terminals must be removed to quick-charge the batteries.

  Observe the quick-charger's Operating Instructions.
- For arc welding work, the batteries must be disconnected and both cables (+ and -) firmly connected with each other.
- The connections of the control units may only be disconnected/connected when the electrical system is switched off.
- Reversal of the control-unit supply-voltage polarity (e.g. if batteries are connected with the polarity reversed) can cause irreparable damage to the control units.
- Screw on the connections on the injection system using the prescribed tightening torques.
- At expected temperatures above 80 °C (e.g. in a drying oven), the control units must be removed.
- Use only matching test lines for measurements at plug connectors.
- Telephones and radios that are not connected with an outside aerial can lead to a vehicle electronics malfunction. This represents a threat to the operational safety of the unit.

Important: battery gases are explosive!

- Oxyhydrogen gas may form in enclosed battery boxes. Take particular care after the engine has been running for an extended period or after charging the batteries with a battery charger.
- Avoid short circuits caused by polarity reversal or by placing metal objects (spanners, pliers, etc.) on the battery terminals.
- Disconnect the batteries of disabled engines or recharge them every 4 weeks.
- When the batteries are disconnected, gas may be ignited by sparks produced by other continuously operating consumers that are not shut down. Before disconnecting, ventilate the battery box sufficiently!

Caution! Battery acid is poisonous and corrosive.

- Please observe the manufacturer's specifications.

- Wear suitable protective clothing (gloves) when handling batteries. Do not tip or tilt batteries as acid may emerge.
- Only measure voltage with suitable measuring devices! The input resistance of the measurement device must be at least 10 MΩ.
- Disconnect or connect the cable harness connectors of electronic control units only when the ignition is switched off.

Electric welding

- Please observe the welding instructions.
- Connect the “ANTIZAP SERVICE SENTRY” protection device (MAN part number 80.78010.0002) as described in the instructions accompanying the device
- If this device is not available, disconnect the batteries and firmly connect the positive lead to the negative lead so that a conductive circuit is created.
- Always place the ground of the welding equipment as close as possible to the welding location. Do not lay welding equipment cable in parallel to the electrical cables in the vehicle.
- When carrying out welding tasks in the immediate vicinity of control units, the plug connectors must be disconnected. In doing so, observe the instructions and regulations contained in the section EDC Control Units.

Painting

- If paint spraying is to be carried out, do not expose the electronic components to high temperatures (max. 95 °C) for more than brief periods; a time of up to 2 hours is permissible at a maximum of 85 °C.
- Disconnect the batteries.
- Remove sensitive electrical components.
- Painting of bolt connections in the high-pressure section of the injection system is **not** permitted. Risk of dirt ingress in the event of repairs

Work on plastic tubes – risk of damage and fire

- Plastic tubes must not be subject to mechanical or thermal load.

2.4 Regulations for avoiding injury and environmental contamination

Preventative measures to protect your health

- Avoid extended, excessive or repeated skin contact with service products, process materials, diluting agents and solvents.
- Protect the skin using a suitable skin protection agent or protective gloves.
- Do not use service products, auxiliary substances, thinners or solvents to clean the skin.
- Wash contaminated skin thoroughly with soap and water.
- Special cleaning agents make it easier to clean dirty hands.
- Apply a greasy skin cream after cleaning skin.
- Change out of clothing or shoes which have become soaked with oil.
- Never put oil-soaked rags into your clothing pockets.

Coolant

Treat undiluted antifreeze as hazardous waste. Follow the instructions issued by the relevant local authority when disposing of used coolant (mixture of antifreeze and water).

Cleaning the cooling circuit

Do not pour cleaning fluids and rinsing water down the drain when this practice is restricted by specific local regulations. However, the cleaning fluid and rinsing water must, in all cases, be passed through an oil separator with a sludge trap.

Cleaning the filter insert

When blowing compressed air through the filter insert, make sure the filter dust is collected by an extractor system, or is blown into a dust collection bag. Otherwise, use a respiratory protection mask. Wear suitable rubber gloves or use a skin barrier cream when washing out the element, because cleaning agents have aggressive grease-dissolving characteristics.

Engine oil, transmission oil, filter cartridges, inserts and box-type filters, desiccant cartridges

Filter inserts, cartridges and box-type filters (oil and fuel filters, desiccant cartridges for the air dryer) are classified as hazardous waste materials. Please observe instructions issued by the relevant local authority on the disposal of the parts mentioned above.

Used engine oil and transmission oil

Lengthy or repeated skin contact with any type of engine oil or transmission oil removes grease from the skin. This can cause dry skin, irritation or skin inflammation. In addition to these hazards, used engine oil contains dangerous materials which can trigger dangerous skin diseases. It is particularly important to wear gloves during an oil change.

2.5 Liability limitations for replacement parts and accessories

General

All information and instructions in this manual have been compiled taking into consideration the applicable standards and regulations, the state-of-the-art technology as well as our knowledge and experience acquired over a period of several years.

MAN does not assume any liability for damage caused as a result of:

- Non-observance of this manual
- Use that is not in accordance with specifications
- Use of untrained personnel
- Unauthorized alterations
- Technical changes
- Use of non-approved spare parts and service products

In case of special designs, the actual scope of supply, the use of additional ordering options or on account of the latest technical modifications may vary from the explanations and illustrations described here.

The obligations agreed upon in the delivery agreement and the General Terms and Conditions of Business of MAN Truck & Bus shall apply in addition to the statutory regulations valid at the time of the conclusion of the contract.

2.6 Guidelines for preventing damage and premature wear on the engine

General

- The engine is built exclusively for the application corresponding to the scope of supply -*as defined by the equipment manufacturer*- (designated use).
- The intended use also includes compliance with the operating and maintenance conditions defined by the manufacturer. The engine must only be used, maintained and repaired by personnel who are acquainted with it and have been instructed about any potential dangers.
- The manufacturer does not assume any liability for damage resulting from unauthorised modifications to the engine.

  Manipulation of the injection and control system may also affect the performance and exhaust-gas values of the unit. Compliance with legal environmental regulations would then no longer be guaranteed.
- If malfunctions occur, determine the cause and remedy the problem immediately so that no serious damage occurs.
- Clean the engine thoroughly before repairing. Ensure that no dirt, sand or foreign objects get into the unit during repair work.
- Only use original spare parts. Installation of parts of by other manufacturers can sometimes cause major damage, for which the workshop carrying out the repair bears the responsibility. Follow the instructions in the section on Limitation on Liability for Accessories and Parts.
- Never run an engine dry, i.e. always make sure that it has been filled with lubricating oil before running it.
- Never run engines that have not been filled with coolant beforehand.
- Use a suitable information sign to clearly indicate units that are not ready to be operated.
- Use service products only in accordance with MAN regulations; otherwise the manufacturer's warranty is rendered void.

For basic information concerning service products, see the publication "Service Products for MAN Diesel Engines".

You can find approved products on the Internet at:

↗ https://my.man-mn.com/portal/irj/asp

- Do not replenish engine oil/transmission oil above the max. mark. Do not exceed the maximum permitted operational tilt.
- Non-observance can result in serious damage to the engine.

2.7 Limp-home program for engines with an electronic control unit

General information

Engines have an electronic control system that monitors the engine as well as itself (self-diagnosis).

As soon as there is a malfunction, the malfunction is evaluated and one of the following measures is initiated:

- Output of a fault message with a diagnostic memory entry.
- Changeover to suitable, yet limited operation. Have malfunctions rectified immediately by MAN Customer Service.
- If MAN-cats® is used, the diagnostic memory entry is output directly.

2.8 Information for working on the common rail system

General

- A jet of fuel can penetrate the skin. Atomised fuel represents a fire hazard.
- Never loosen the bolt connection on the fuel high-pressure side of the common rail system when the engine is running (high-pressure line from the high-pressure pump to the rail, at the rail and on the cylinder head to the fuel injector). Whilst the engine is running, the lines are constantly carrying fuel under a pressure of 1600 bar or more. Wait for at least one minute before undoing bolt connections to allow the pressure to drop. MAN-cats® must be used to check that the system is depressurized at the rail.
- Do not remain in the vicinity of the engine when it is running.

Information for individuals with pacemakers

- Any changes made to the original engine cabling can result in the limit values specified in pacemaker safety regulations being exceeded, e.g. non-twisted injector cables or installing the test box (bushing box).
- There is no danger to the driver or any passengers with pacemakers, in approved operation.
- Vehicle operators with heart pacemakers are not at risk from systems with MAN Common Rail engines, in approved operation.
- The product, in its original condition, complies with all the currently known limit values for heart pacemakers.

Special information for people with pacemakers

- Any changes made to the original engine cabling can result in the limit values specified in pacemaker safety regulations being exceeded, e.g. non-twisted injector cables or installing the test box (bushing box).
- Wearers of pacemakers must remain a minimum of 20 cm from the running engine.

Risk of damage due to ingress of dirt

- The components of the diesel fuel-injection system consist of high-precision parts that are subjected to extreme loads. Owing to this high level of precision engineering, **strict rules of cleanliness** must be followed when working on the fuel system.
- Even particles of dirt as small as **0.002 mm** can cause component failure.
- The engine and engine compartment must be cleaned (steam cleaned) before work is performed on the clean side of the fuel system. The fuel system must be closed when cleaning takes place.
- Perform a visual inspection for leaks or damage to the fuel system.
- Do not aim jet of steam cleaner at electrical components, or fit covers to protect them.
- Place the engine in a clean area of the workshop where none of the work causes dust to be swirled up (sanding, welding, brake repairs, brake checks, performance tests etc.).

- Avoid air movements (possible swirling up of dust due to starting of engines, the workshop heating / ventilation system, due to draughts etc.).
- The area of the still closed fuel system must be cleaned and dried by means of compressed air.
- Use a suitable extractor unit (industrial extractor unit) to remove loose dirt particles such as paint chippings and insulating material.
- Use a new and clean cover in areas of the engine compartment where dirt particles can become loose.
- Before starting disassembly, wash your hands and put on a clean working overall.
- After the clean-side fuel system has been opened, it is not permitted to use compressed air for cleaning.
- Only lint-free cleaning cloths are allowed to be used on the fuel system.
- Clean tools and working equipment before starting work.
- Only tools that show no sign of damage (e.g. cracked chromium plating) must be used.
- Materials such as cloths, cardboard or wood must not be used when removing and fitting components, as particles and fibres may become detached from such materials.
- If paint flakes should be produced when loosening connections (e.g. due to painting over the connections), these must be carefully removed before the bolt connection is finally undone.
- All removed components on the clean side of the fuel system must be plugged **immediately** at their connection openings using suitable caps.
- These sealing parts must remain packaged dust-tight until use and must be disposed of after being used once.
- The components must then be stored carefully in a clean, closed container.
- **Never** expose these components to used cleaning or testing fluids.
- New parts must only be taken out of the original packaging immediately before use.
- Work on removed components must be performed only at a work place equipped for this purpose.
- If removed parts are shipped, always use the original packaging of the new part.

2.9 Handling DEF

DEF is a 32.5% urea solution that is used for NO_x reduction in the SCR catalytic converter. The DEF used must conform with standard ISO 22241. Observe the DEF safety data sheets.

In the event of contact with DEF, immediately take suitable measures:

- **Eye contact:** Immediately rinse the entire eye with clean water continuously for at least 15 minutes. Prior to that, the eye should be checked for contact lenses. If the eye has a contact lens, please remove it first. Seek medical attention immediately in the event of physical symptoms.
- **Skin contact:** Wash areas concerned thoroughly with soap and water. Seek medical attention immediately in the event of physical symptoms.
- **If swallowed:** Do not induce vomiting. Seek immediate medical assistance.
- **Contaminated clothing:** Immediately change clothes and wash any areas on skin that have come into contact thoroughly with soap and water.

When **opening components containing DEF**, small amounts of ammonia fumes can escape. Do not inhale the ammonia fumes. Ammonia fumes are especially irritating to the eyes, mucous membranes and skin. The working area should be **well-ventilated**.

DEF has a **corrosive effect**

on many materials. Clean components concerned thoroughly

with water or a suitable cleaning agent.

Unintended release of DEF:

- **Small amounts:** Absorb with liquid-binding material. Dispose of binding agent in the correct manner.
- Prevent **large amounts** from entering water drain facilities or the ground. If large amounts cannot be intercepted, the local authorities must be notified.

The **storage temperature** of DEF should not exceed 25°C. Storage should take place in well-ventilated and liquid-tight locations.

2.10 Engine overhaul

General information on performing an engine overhaul

A range of very different factors affect the engine service life. It is therefore not possible to indicate the exact number of operating hours before a major overhaul is due.

We are of the opinion that opening an engine or performing a general overhaul is not required, as long as the engine has good compression values and the following operating values do not deviate considerably from those determined at start-up.

- Charging pressure
- Exhaust gas temperature
- Coolant and lubricating oil temperatures
- Oil pressure and oil consumption
- Smoke behavior

The following criteria have considerable influence on the engine's service life:

- Correct performance setting according to deployment
- Correct installation
- Approval of the installation by authorised personnel
- Regular maintenance according to the maintenance schedule
- For the selection and quality of lubricating oil, fuel and coolant, please see the publication "Service products for MAN diesel engines"

2.11 Assembly information

Assembly information

Fitting nuts and bolts

- Lightly lubricate nuts and bolts on the threading and the contact surface of the bolt head.
- Refer to the reference values in works standard M 3059 for screw connections without specially prescribed tightening torques

Installation of micro-encapsulated bolts

- Comply with the application guidelines in works standard MAN 222 when using micro-encapsulated bolts.

Reuse of bolts and nuts

- Check bolt heads, threads and nuts for wear and ease of movement, replace if necessary
- Only reuse bolts and nuts if they are not worn!

Installing pipe assemblies

Danger: Pipes of all kinds may not be bent! - Danger of breakage!

Mounting gaskets

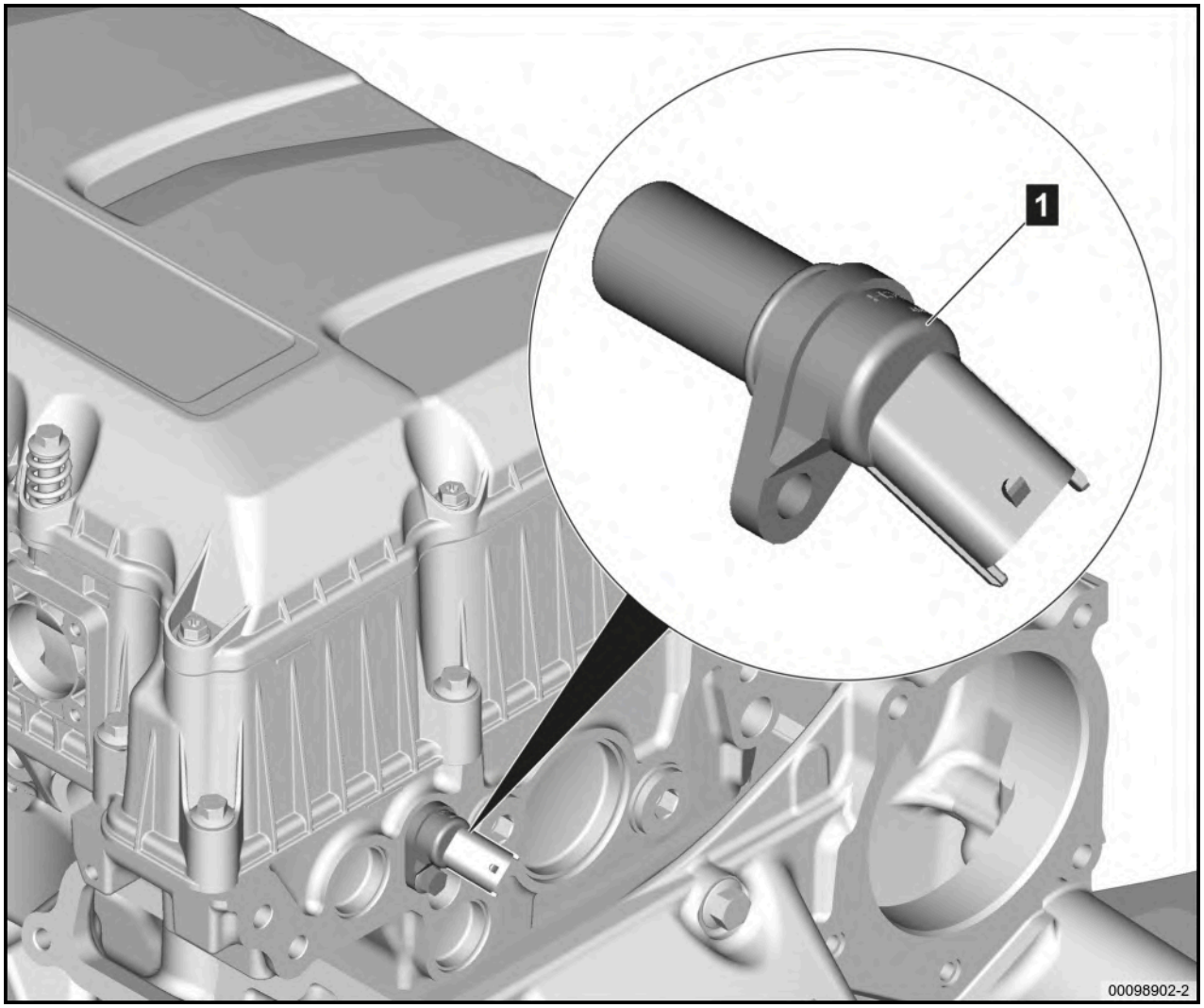
- Only use MAN genuine gaskets
- Make sure that the areas to be sealed are undamaged and clean.
- Do not use adhesives or sealing compounds. If necessary, to facilitate installation, use a little grease to stick the gasket to the part to be mounted.
- Tighten bolts evenly to prescribed tightening torque.

Mounting O-rings

- Only use MAN genuine O-rings.
- Make sure that the areas to be sealed are undamaged and clean.
- Generally apply engine oil on O-rings as per MAN Standard 3277 for installation.

3.1.1 Cable harnesses, plug connector, vertical

3.1.1.1 Removing/installing the camshaft speed sensor



key

1 Speed sensor of camshaft

Technical data

Tightening torques

Mounting bolt, camshaft speed sensor in cylinder head.. M6x16-8.8..... ..... 8 ± 1 Nm

Consumables

Installation lubricant P-80 ..... 09.15014-0031

Important information

⚠ CAUTION

Risk of injury from sharp edges

Sharp ends on the cable ties if wrong tool is used.

For this reason:

- Only tighten and trim cable ties using the cable tie pliers.

NOTICE

Risk of component damage if unsuitable tools are used

For this reason:

- Assemble component without impact screwdriver.

NOTICE

Risk of component damage from contaminants

For this reason:
- Clean components and sealing surfaces before assembly by suitable means.
- Protect cleaned surfaces from re-contamination.

NOTICE

Risk of component damage due to incorrect installation

Cable harness will be damaged.

For this reason:
- Document the routing of the cable harness and mark the installation position.
- Mark the installation position, method of attachment and the position of the cable harness fasteners.

NOTICE

Risk of component damage due to incorrect installation

Electrical cable damage due to over-tightening of the cable ties.

For this reason:
- Follow the instructions for use of the cable tie pliers.

NOTICE

Risk of damage to components caused by incorrect handling

Irreparable damage to the plug connectors.

For this reason:
- Before removal, mark the installation position of the cables, connectors and cable ties.
- Protect plug connectors and contacts from entry of dirt or impurities.
- When installing, route and secure the cables, connectors and cable ties as marked without chafing, kinking and tension.

Tip for users

Limited operation due to faulty entries in the diagnostic memory
- Before removing switches or sensors, read out the diagnostic memory and document it
- Always install switches and sensors with new O-rings or seals
- After installing switches or sensors, read out the diagnostic memory and delete if required

Tip for users

The repair manual describes the repair method of an engine variant as an example.

Pictures and the corresponding descriptions do not always correspond to the engine being repaired as it was not possible to take into account all engine variants.

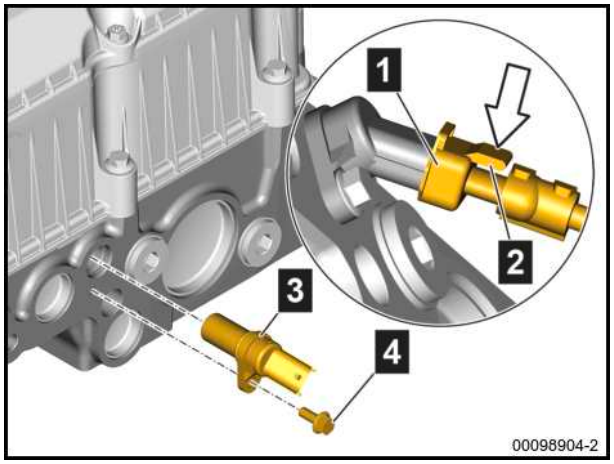
In such cases, plan and execute the repair work accordingly.

Special tools

1		**Cable tie pliers** Quantity 1 Tightening and cutting the cable ties	08.02960-0100

Removing the camshaft speed sensor

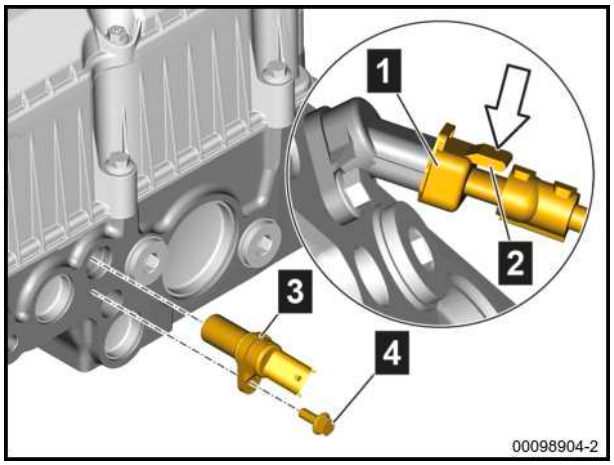
Removing the speed sensor



- ►Disconnect the cable ties
- ►Unlock and unplug the plug connector **1** by pressing the spring shackle **2**
- ►Unscrew the mounting bolt **4** and remove along with the speed sensor **3**
- ►Pull the O-ring off the speed sensor **3**
- ►Clean the sealing surfaces

Installing the camshaft speed sensor

Installing the speed sensor



Tip for users

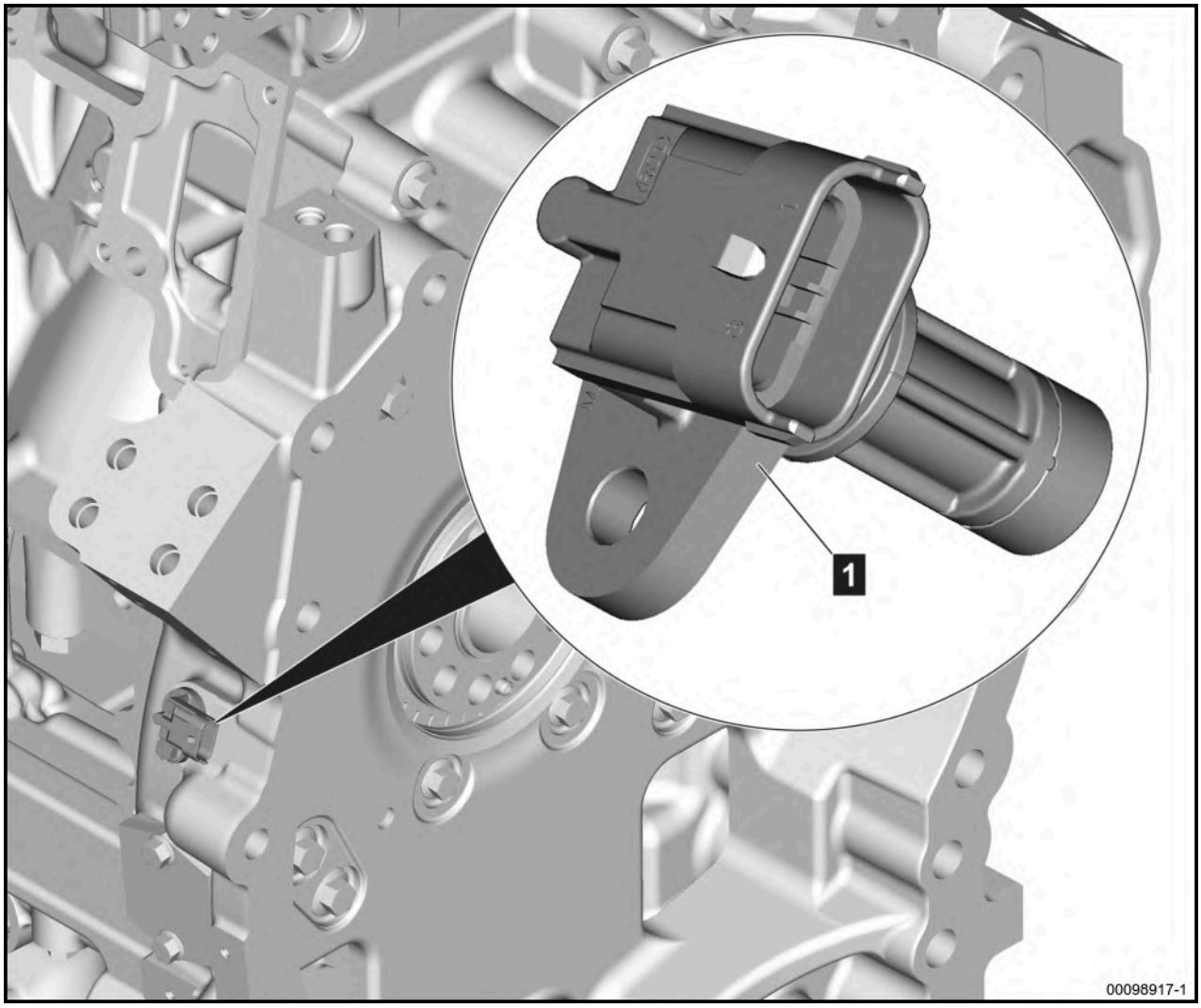
In new speed sensors, a new O-ring is already installed.

- ►Clean the sealing surfaces
- ►Replace the O-ring if re-using
- ►Apply a thin layer of P-80 installation lubricant to the new O-ring and fit it to the speed sensor **3**
- ►Insert the speed sensor **3**
- ►Screw in and tighten the mounting bolt **4**

Tightening torque..... ..... 8 ± 1 Nm

- ►Plug in the electrical plug connector **1**, pressing until the spring shackle **2** engages
- ►Fit the cable ties as marked and tighten and trim them using the cable tie pliers [1]

3.1.1.2 Removing/installing the crankshaft speed sensor



key

1 Crankshaft speed sensor

Technical data

Tightening torques

Mounting bolt, crankshaft speed sensor in flywheel housing	M6x16-8.8	8 ± 1 Nm

Consumables

Installation lubricant P-80	09.15014-0031

Important information

⚠ CAUTION

Risk of injury from sharp edges

Sharp ends on the cable ties if wrong tool is used.

For this reason:

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For this reason:

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Cable harness will be damaged.

For this reason:
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- Mark the installation position, method of attachment and the position of the cable harness fasteners.

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Special tools

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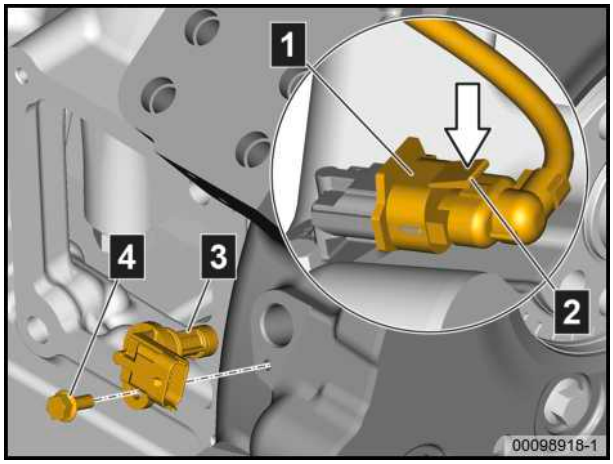
Removing the crankshaft speed sensor

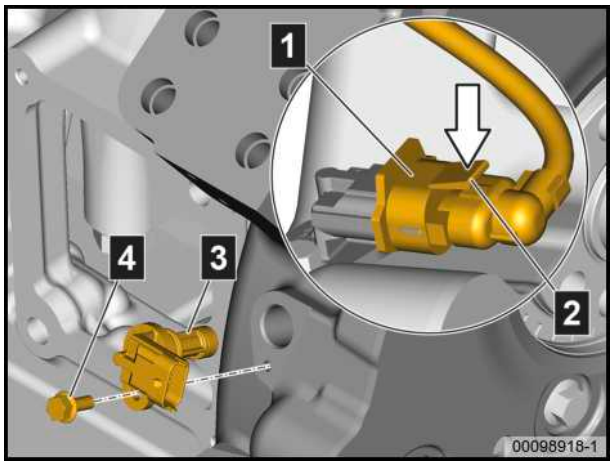
Removing the speed sensor



- ►Disconnect the cable ties
- ►Unlock and unplug the plug connector **1** by pressing the spring shackle **2**
- ►Unscrew the mounting bolt **4** and remove along with the speed sensor **3**
- ►Pull the O-ring off the speed sensor **3**
- ►Clean the sealing surfaces

Installing the crankshaft speed sensor

Installing the speed sensor



Tip for users

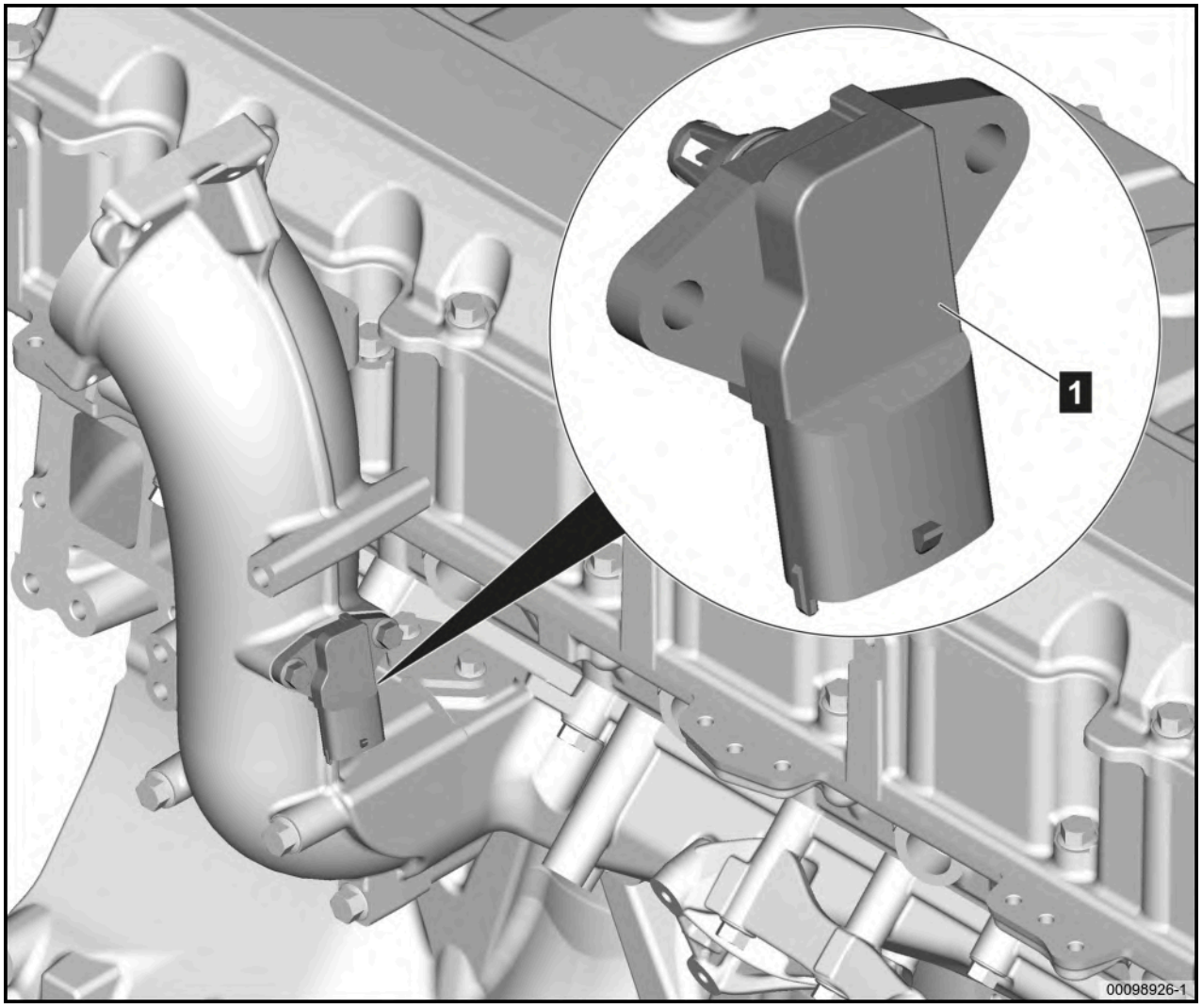
In new speed sensors, a new O-ring is already installed.

- ►Clean the sealing surfaces
- ►Replace the O-ring if re-using
- ►Apply a thin layer of P-80 installation lubricant to the new O-ring and fit it to the speed sensor **3**
- ►Insert the speed sensor **3**
- ►Screw in and tighten the mounting bolt **4**

Tightening torque..... .... 8 ± 1 Nm

- ►Plug in the electrical plug connector **1**, pressing until the spring shackle **2** engages
- ►Fit the cable ties as marked and tighten and trim them using the cable tie pliers [1]

3.1.1.3 Removing/installing the charge pressure sensor



key

1 Pressure sensor

Technical data

Tightening torques

Mounting bolt, pressure sensor on charge-air manifold....M6x16-8.8..... ..... 9 + 1 Nm

Consumables

Installation lubricant P-80 ..... 09.15014-0031

Important information

NOTICE

Risk of component damage if unsuitable tools are used

For this reason:

- Assemble component without impact screwdriver.

NOTICE

Risk of component damage from contaminants

For this reason:

- Clean components and sealing surfaces before assembly by suitable means.
- Protect cleaned surfaces from re-contamination.

NOTICE

Risk of component damage due to incorrect installation

Cable harness will be damaged.

For this reason:

- Document the routing of the cable harness and mark the installation position.
- Mark the installation position, method of attachment and the position of the cable harness fasteners.

NOTICE

Risk of damage to components caused by incorrect handling

Irreparable damage to the plug connectors.

For this reason:

- Before removal, mark the installation position of the cables, connectors and cable ties.
- Protect plug connectors and contacts from entry of dirt or impurities.
- When installing, route and secure the cables, connectors and cable ties as marked without chafing, kinking and tension.

Tip for users

Limited operation due to faulty entries in the diagnostic memory

- Before removing switches or sensors, read out the diagnostic memory and document it
- Always install switches and sensors with new O-rings or seals
- After installing switches or sensors, read out the diagnostic memory and delete if required

Tip for users

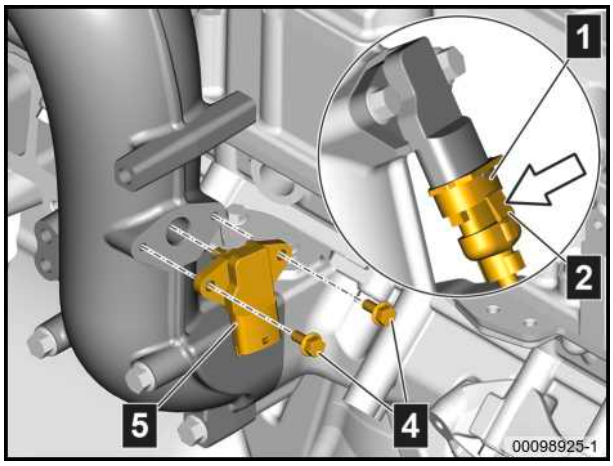
The repair manual describes the repair method of an engine variant as an example.

Pictures and the associated descriptions do not always correspond to the engine being repaired as it was not possible to take into account all engine variants.

In such cases, plan and execute the repair work accordingly.

Removing the charging pressure sensor

Removing the pressure sensor



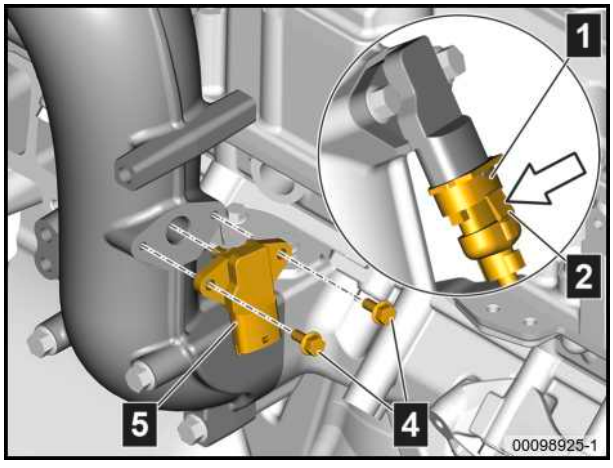
- ►Unlock and unplug the plug connector 1 by pressing the spring shackle 2
- ►Unscrew the mounting bolts 4 and remove with the pressure sensor 3
- ►Pull the O-ring off the pressure sensor 3
- ►Clean the sealing surfaces

Installing the charging pressure sensor

Installing the pressure sensor

Tip for users

In new pressure sensors, a new O-ring is already installed.

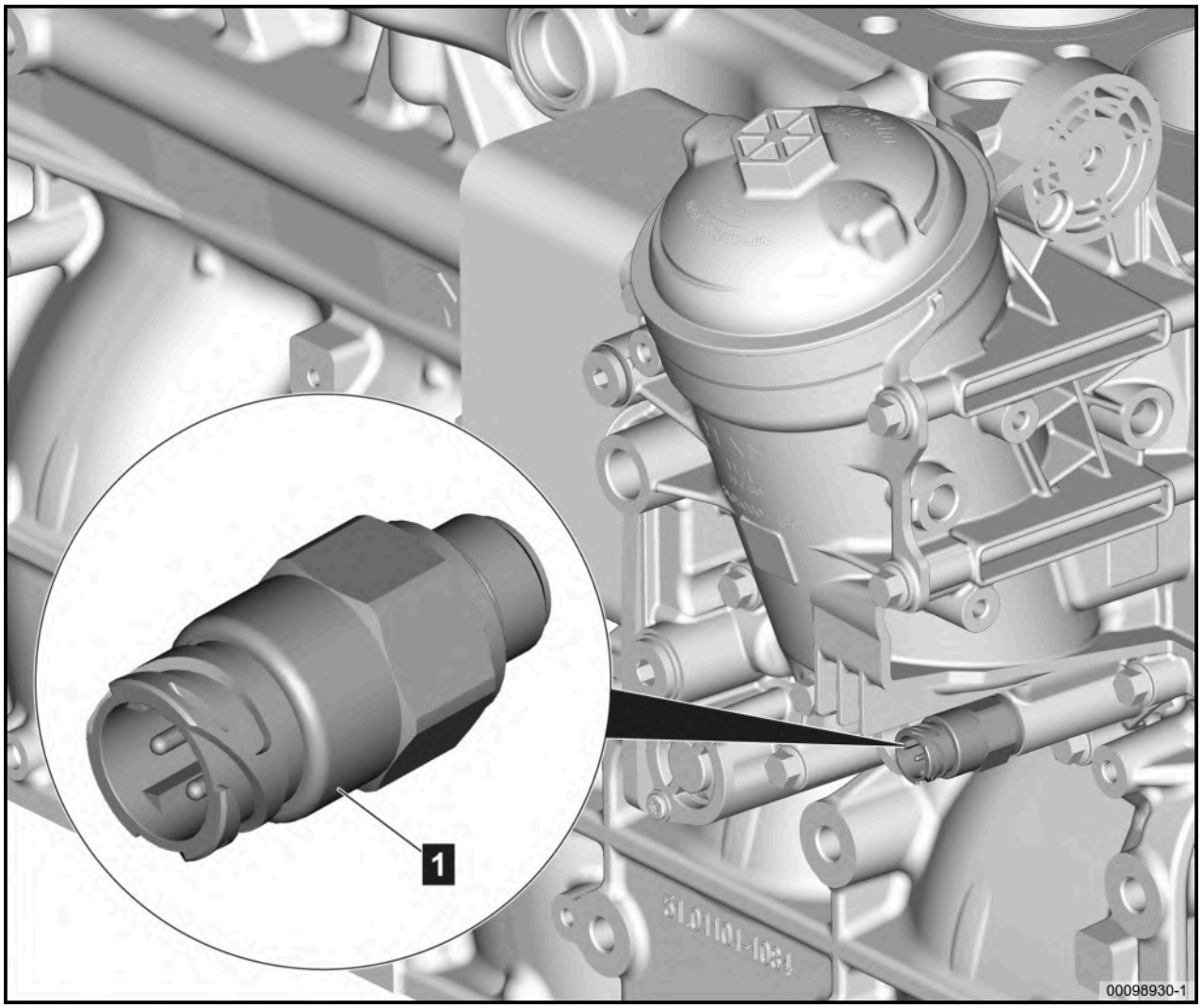


- ►Clean the sealing surfaces
- ►Replace the O-ring if re-using
- ►Apply a thin layer of P-80 installation lubricant to the new O-ring and fit it to the pressure sensor 3
- ►Insert the pressure sensor 3
- ►Screw in and tighten the mounting bolts 4

Tightening torque..... ..... 9 + 1 Nm

►Plug in the electrical plug connector **1**, pressing until the spring shackle **2** engages

3.1.1.4 Removing/installing the oil pressure sensor



key

1 Oil pressure sensor

Technical data

Tightening torques

Oil pressure sensor in oil module..... M18x1.5..... ..... 45 + 5 Nm

Consumables

Engine oil ..... For more information see the MAN service product database.

Important information

NOTICE

Risk of component damage if unsuitable tools are used

For this reason:

- Assemble component without impact screwdriver.

NOTICE

Risk of component damage from contaminants

For this reason:

- Clean components and sealing surfaces before assembly by suitable means.
- Protect cleaned surfaces from re-contamination.

NOTICE

Risk of component damage due to incorrect installation

Cable harness will be damaged.

For this reason:

- Document the routing of the cable harness and mark the installation position.
- Mark the installation position, method of attachment and the position of the cable harness fasteners.

NOTICE

Risk of damage to components caused by incorrect handling

Irreparable damage to the plug connectors.

For this reason:

- Before removal, mark the installation position of the cables, connectors and cable ties.
- Protect plug connectors and contacts from entry of dirt or impurities.
- When installing, route and secure the cables, connectors and cable ties as marked without chafing, kinking and tension.

Tip for users

Limited operation due to faulty entries in the diagnostic memory

- Before removing switches or sensors, read out the diagnostic memory and document it
- Always install switches and sensors with new O-rings or seals
- After installing switches or sensors, read out the diagnostic memory and delete if required

Tip for users

The repair manual describes the repair method of an engine variant as an example.

Pictures and the associated descriptions do not always correspond to the engine being repaired as it was not possible to take into account all engine variants.

In such cases, plan and execute the repair work accordingly.

Literature reference

For information on engine oil see the MAN service product database.

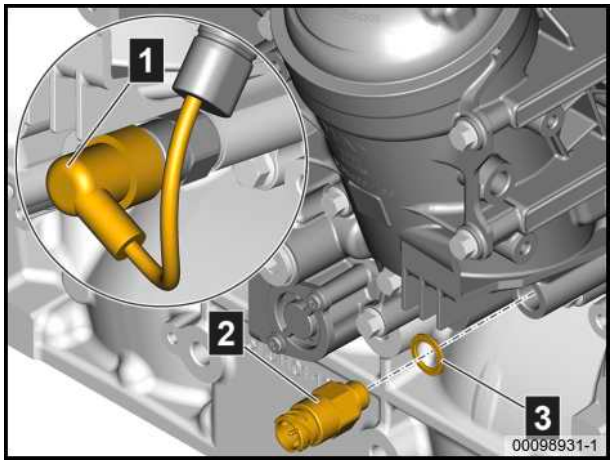
↗ https://ws-public.man-mn.com/portal/irj/asp

Special tools

1		**Plug housing wrench** Quantity 1 Opening/closing the electrical plug connectors with bayonet catch	80.99603-0418

Removing the oil pressure sensor

Unscrewing the pressure sensor



►Release the electrical connection bayonet catch **1** using the wrench for the plug housing [1]

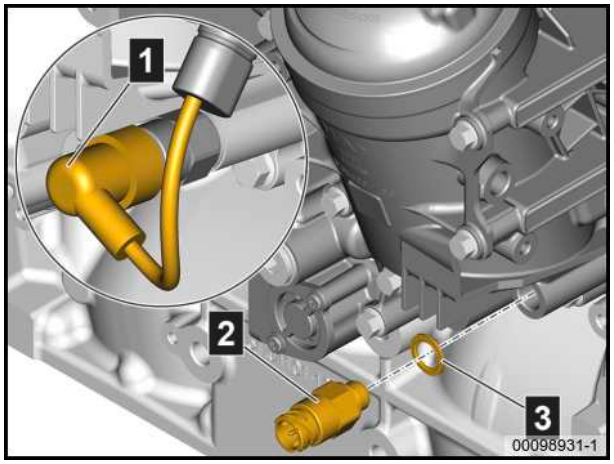
►Disconnect the electrical connection **1**

►Unscrew the pressure sensor **2** and remove it with the seal **3**

►Clean the sealing surfaces

Installing the oil pressure sensor

Screwing in the pressure sensor

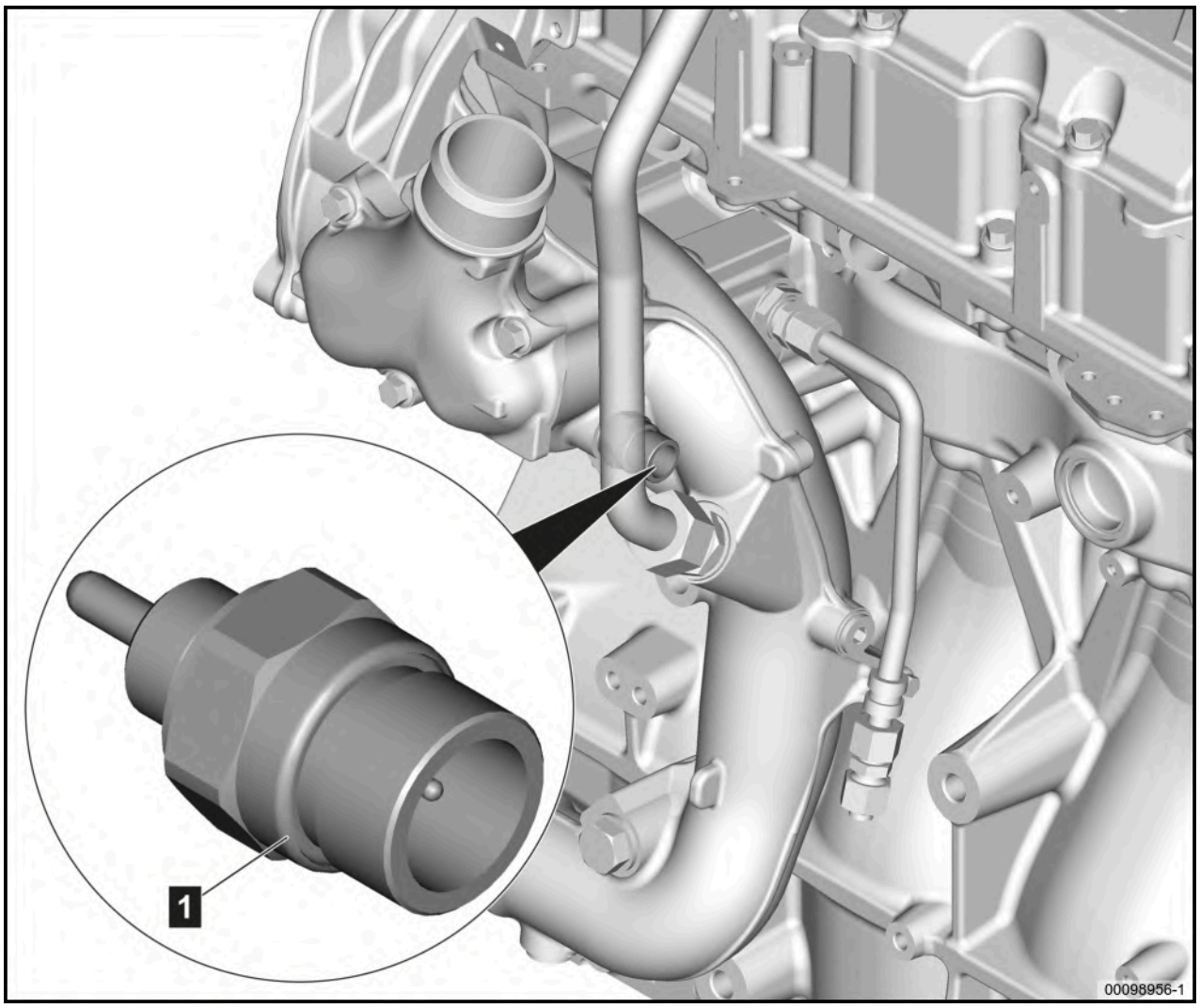


- ►Clean the sealing surfaces
- ►Thinly apply clean engine oil on the thread of the pressure sensor **2**
- ►Screw in and tighten the pressure sensor **2** with a new sealing ring **3**

Tightening torque..... .... 45 + 5 Nm

- ►Attach the electrical connection **1** to the pressure sensor **2**
- ►Engage the electrical connection bayonet catch **1** using the wrench for the plug housing [1]

3.1.1.5 Removing/installing the coolant temperature sensor



key

1 Coolant temperature sensor

Technical data
Tightening torques

Coolant temperature sensor in distributor housing..... M16x1.5..... ..... 45 + 5 Nm

Consumables

Engine oil ..... For more information see the MAN service product database.

Important information

⚠ CAUTION

Risk of injury from sharp edges

Sharp ends on the cable ties if wrong tool is used.

For this reason:

- Only tighten and trim cable ties using the cable tie pliers.

NOTICE

Risk of component damage if unsuitable tools are used

For this reason:

- Assemble component without impact screwdriver.

NOTICE

Risk of component damage from contaminants

For this reason:

- Clean components and sealing surfaces before assembly by suitable means.
- Protect cleaned surfaces from re-contamination.

NOTICE

Risk of component damage due to incorrect installation

Cable harness will be damaged.

For this reason:

- Document the routing of the cable harness and mark the installation position.
- Mark the installation position, method of attachment and the position of the cable harness fasteners.

NOTICE

Risk of component damage due to incorrect installation

Electrical cable damage due to over-tightening of the cable ties.

For this reason:

- Follow the instructions for use of the cable tie pliers.

NOTICE

Risk of damage to components caused by incorrect handling

Irreparable damage to the plug connectors.

For this reason:

- Before removal, mark the installation position of the cables, connectors and cable ties.
- Protect plug connectors and contacts from entry of dirt or impurities.
- When installing, route and secure the cables, connectors and cable ties as marked without chafing, kinking and tension.

Tip for users

Limited operation due to faulty entries in the diagnostic memory

- Before removing switches or sensors, read out the diagnostic memory and document it
- Always install switches and sensors with new O-rings or seals
- After installing switches or sensors, read out the diagnostic memory and delete if required

Tip for users

The repair manual describes the repair method of an engine variant as an example.

Pictures and the associated descriptions do not always correspond to the engine being repaired as it was not possible to take into account all engine variants.

In such cases, plan and execute the repair work accordingly.

Literature reference

For information on engine oil see the MAN service product database.

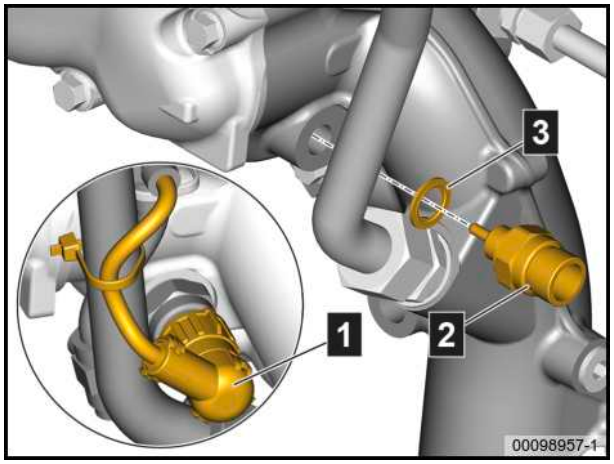
↗ https://ws-public.man-mn.com/portal/irj/asp

Special tools

1		**Plug housing wrench** Quantity 1 Opening/closing the electrical plug connectors with bayonet catch	80.99603-0418
2		**Cable tie pliers** Quantity 1 Tightening and cutting the cable ties	08.02960-0100

Removing the coolant temperature sensor

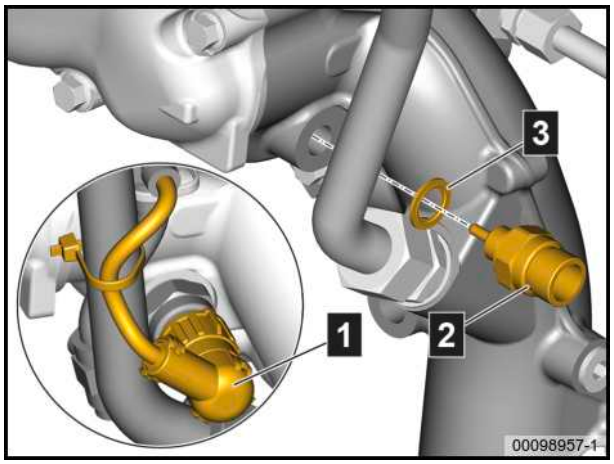
Unscrew the temperature sensor



- ►Disconnect existing cable ties
- ►Release the electrical connection bayonet catch **1** using the wrench for the plug housing [1]
- ►Disconnect the electrical connection **1**
- ►Unscrew the temperature sensor **2** and remove with the seal **3**
- ►Clean the sealing surfaces

Installing the coolant temperature sensor

Screw in the temperature sensor

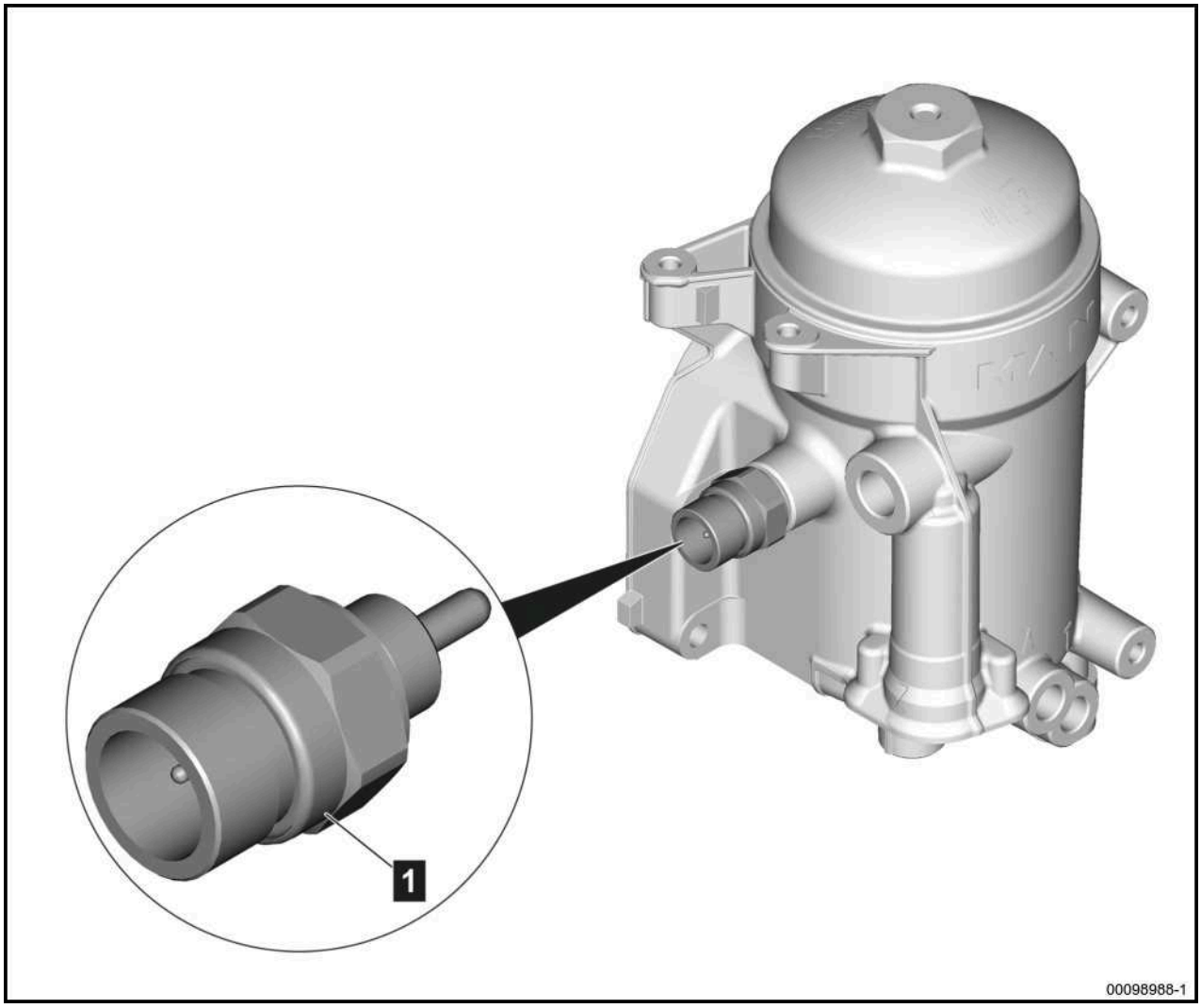


- ►Clean the sealing surfaces
- ►Thinly apply clean engine oil to the thread of the temperature sensor **2**
- ►Screw in the temperature sensor **2** with a new seal **3** and then tighten

Tightening torque..... .... 45 + 5 Nm

- ►Position the electrical connection **1** on the temperature sensor **2**
- ►Engage the electrical connection bayonet catch **1** using the wrench for the plug housing [1]
- ►Fit the cable ties as marked and tighten and trim them using the cable tie pliers [2]

3.1.1.6 Removing/installing the EDC fuel temperature sensor



key

1 Fuel temperature sensor

Technical data

Tightening torques

Fuel temperature sensor in fuel service center (KSC)	M14x1.5	45 + 5 Nm

Consumables

Engine oil	For more information see the MAN service product database.

Important information

⚠ CAUTION

Risk of injury from sharp edges

Sharp ends on the cable ties if wrong tool is used.

For this reason:

- Only tighten and trim cable ties using the cable tie pliers.

NOTICE

Risk of component damage if unsuitable tools are used

For this reason:

- Assemble component without impact screwdriver.

NOTICE

Risk of component damage from contaminants

For this reason:
- Clean components and sealing surfaces before assembly by suitable means.
- Protect cleaned surfaces from re-contamination.

NOTICE

Risk of component damage due to incorrect installation

Cable harness will be damaged.

For this reason:
- Document the routing of the cable harness and mark the installation position.
- Mark the installation position, method of attachment and the position of the cable harness fasteners.

NOTICE

Risk of component damage due to incorrect installation

Electrical cable damage due to over-tightening of the cable ties.

For this reason:
- Follow the instructions for use of the cable tie pliers.

NOTICE

Risk of damage to components caused by incorrect handling

Irreparable damage to the plug connectors.

For this reason:
- Before removal, mark the installation position of the cables, connectors and cable ties.
- Protect plug connectors and contacts from entry of dirt or impurities.
- When installing, route and secure the cables, connectors and cable ties as marked without chafing, kinking and tension.

NOTICE

Risk of component damage due to ingress of dirt

The ingress of dirt causes damage to the common rail system / fuel system.

For this reason:
- Thoroughly clean the working environment before starting any work.
- Ensure absolute cleanliness when working on the system.
- Avoid moisture.
- Always detach only one fuel line.
- Close the component connections immediately using new, clean protective sleeves.
- Replace any protective sleeves and plugs that have been used once.

Tip for users

Limited operation due to faulty entries in the diagnostic memory

- Before removing switches or sensors, read out the diagnostic memory and document it
- Always install switches and sensors with new O-rings or seals
- After installing switches or sensors, read out the diagnostic memory and delete if required

Tip for users

The repair manual describes the repair method of an engine variant as an example.

Pictures and the associated descriptions do not always correspond to the engine being repaired as it was not possible to take into account all engine variants.

In such cases, plan and execute the repair work accordingly.

ENVIRONMENTAL WARNING

Danger of environmental pollution caused by improper handling of service products

Considerable damage is caused to the environment.

For this reason:

- Comply with country-specific safety regulations.
- Use appropriate and suitably sized containers to collect service products.
- Store service products only in original containers.
- Use suitable binders to absorb leaking service products and dispose of the waste properly.
- If required, inform the relevant municipal authorities about the damage.
- Run cleaning fluid and rinse water through an oil separator with sludge trap.

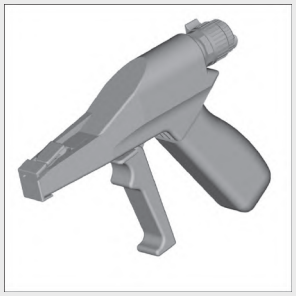
Literature reference

For information on engine oil see the MAN service product database.
↗ https://ws-public.man-mn.com/portal/irj/asp

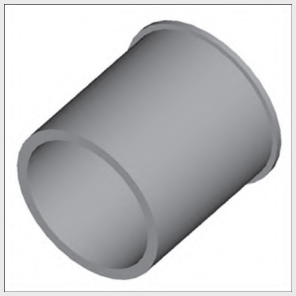
Special tools

1 

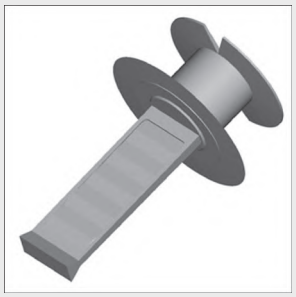
Plug housing wrench 80.99603-0418
Quantity 1
Opening/closing the electrical plug connectors with bayonet catch

2 

Cable tie pliers 08.02960-0100
Quantity 1
Tightening and cutting the cable ties

3 

Protective sleeve 81.96002-0514
Quantity 1
Closing off the GPN 200 Z28 x 20 temperature sensor

4 

End plug 81.96002-0521
Quantity 1
Closing off GPN 330 L14 KSC

Removing the EDC fuel temperature sensor

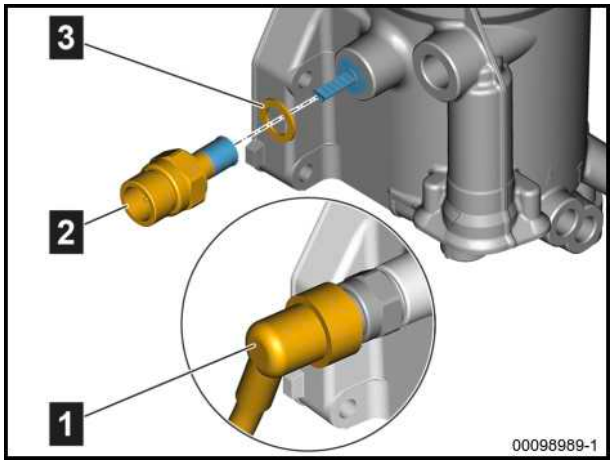
Unscrew the temperature sensor

ENVIRONMENTAL WARNING

Risk of water and soil contamination

For this reason:

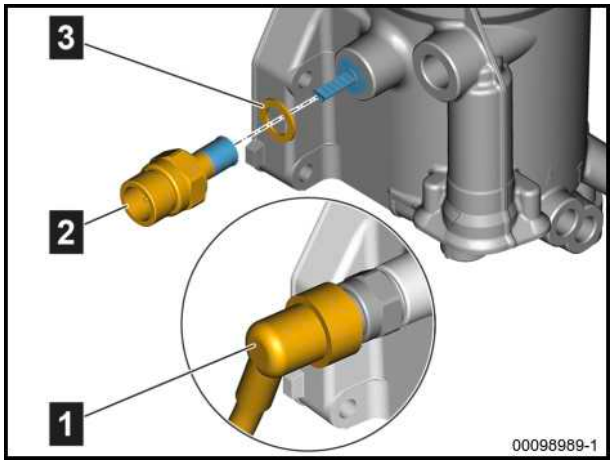
• Use appropriate and suitably sized containers to collect service products.



►Disconnect existing cable ties
►Release the electrical connection bayonet catch **1** using the wrench for the plug housing [1]
►Disconnect the electrical connection **1**
►Unscrew the temperature sensor **2** and remove with the seal **3**
►Clean the sealing surfaces
►Close off the temperature sensor **2** with the protective sleeve [3]
►Close off the fuel service center (KSC) with end plug [4]

Installing the EDC fuel temperature sensor

Screw in the temperature sensor



►Remove the protective sleeve and end plug
►Clean the sealing surfaces
►Thinly apply clean engine oil to the thread of the temperature sensor **2**
►Screw in the temperature sensor **2** with a new seal **3** and then tighten

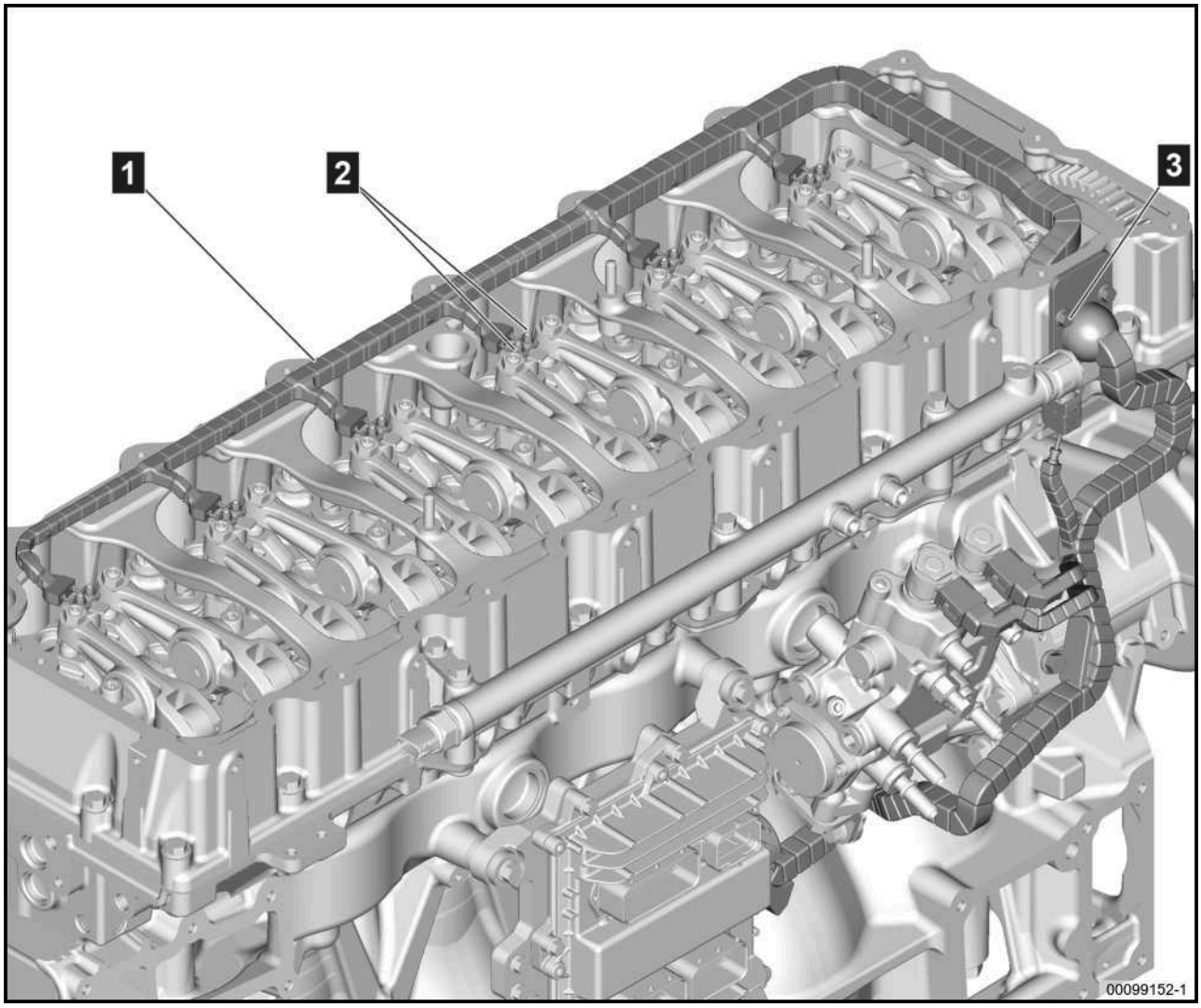
Tightening torque..... .... 45 + 5 Nm

►Position the electrical connection **1** on the temperature sensor **2**
►Engage the electrical connection bayonet catch **1** using the wrench for the plug housing [1]
►Fit the cable ties as marked and tighten and trim them using the cable tie pliers [2]

3.1.1.7 Removing/installing the injector cable harness (common rail)

Preparations

►Removing/installing the cylinder head cover, Page 219
►Removing/installing the fuel filter, Page 404



key

1 Injector cable harness
2 Injector cable harness injector mounting nut
3 Injector cable harness mounting bolt

Technical data

Tightening torques

Mounting nut, injector cable harness to injector	M4	2.0 Nm to 2.4 Nm
Mounting bolt, injector cable harness on frame of the cylinder head cover	M6x16-8.8	10 ± 1 Nm
Mounting bolts, bracket on crankcase	M8x40-10.9	12 - 14 Nm

Test values and settings

Distance between plug and plug housing	8 mm

Consumables

Installation lubricant P-80	09.15014-0031

Important information

⚠ CAUTION

Risk of injury from sharp edges

Sharp ends on the cable ties if wrong tool is used.

For this reason:

- Only tighten and trim cable ties using the cable tie pliers.

NOTICE

Risk of component damage due to incorrectly tightened bolted connections

For this reason:
- Only use an impact screwdriver for initial tightening to max. 50% of the prescribed final torque.
- Final tightening must always be performed using a torque wrench.

NOTICE

Risk of component damage due to incorrect installation

Cable harness will be damaged.

For this reason:
- Document the routing of the cable harness and mark the installation position.
- Mark the installation position, method of attachment and the position of the cable harness fasteners.

NOTICE

Risk of component damage due to incorrect installation

Electrical cable damage due to over-tightening of the cable ties.

For this reason:
- Follow the instructions for use of the cable tie pliers.

NOTICE

Risk of damage to components caused by incorrect handling

Irreparable damage to the plug connectors.

For this reason:
- Before removal, mark the installation position of the cables, connectors and cable ties.
- Protect plug connectors and contacts from entry of dirt or impurities.
- When installing, route and secure the cables, connectors and cable ties as marked without chafing, kinking and tension.

NOTICE

Risk of damage to components caused by incorrect handling

Irreparable damage to plug connectors and engine control units from spread contacts and damaged contacts.

For this reason:
- Fully release the lock when installing or removing the plugs.
- Protect loosened plug connectors and contacts from entry of dirt or impurities.
- Check cable harnesses and plug connectors only with suitable test device.
- Connect/disconnect the plug connectors of electronic control units only when the ignition is switched off.

Tip for users

The repair manual describes the repair method of an engine variant as an example.

Pictures and the associated descriptions do not always correspond to the engine being repaired as it was not possible to take into account all engine variants.

In such cases, plan and execute the repair work accordingly.

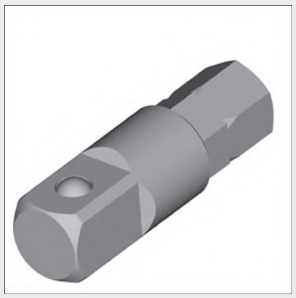
Special tools

1		**Cable tie pliers** Quantity 1 Tightening and cutting the cable ties	08.02960-0100

2

Torque screwdriver 08.06510-9024
Quantity 1
Torque screwdriver with dial and socket for interchangeable blade 0.4 - 2.0 Nm / 122 x Ø35 mm
Pulling off the injector cable in conjunction with:
- Adapter 08.06139-9029
- Socket wrench insert 08.06141-0700

3



Adapter 08.06139-9029
Quantity 1
Adapter 1/4" square
Tightening the injector cable in conjunction with:
- Torque screwdriver 08.06510-9024
- Socket wrench insert 08.06141-0700

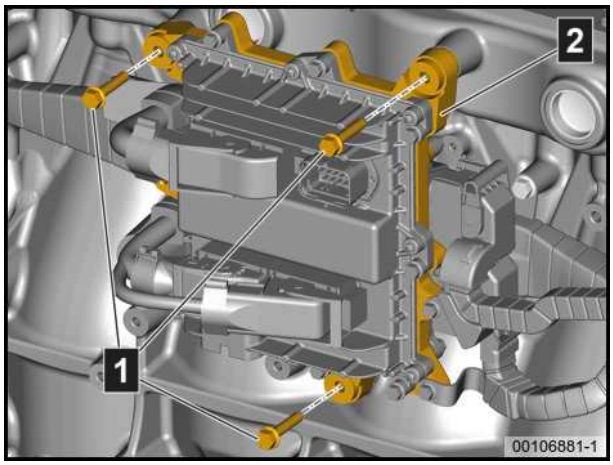
4

Size 7 socket wrench insert 08.06141-0700
Quantity 1
Tighten the injector cable in conjunction with:
- Torque screwdriver 08.06510-9024
- Adapter 08.06139-9029

Removing the injector cable harness (common rail)

Loosening the cooling plate / bracket for the control unit (EDC)

►Unscrew and remove the mounting bolts **1**
►Carefully detach the bracket **2** from the crankcase



Disconnecting the electrical connections

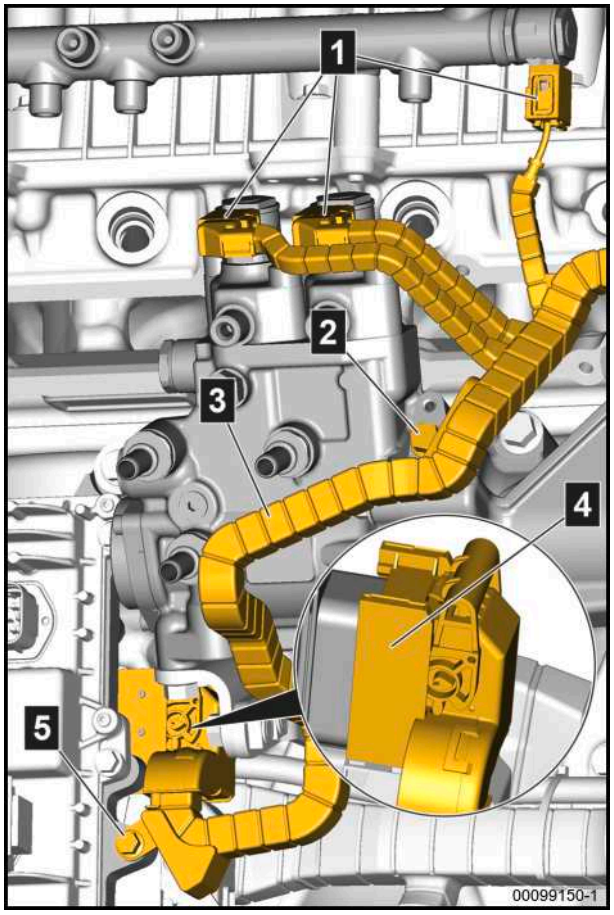
NOTICE

Risk of damage to components caused by incorrect handling

Irreparable damage to plug connectors and engine control units from spread contacts and damaged contacts.

For this reason:

- When installing the plug, first open the plug lock completely and then insert and lock the plug connector.
- Protect loosened plug connectors and contacts from entry of dirt or impurities.
- Check cable harnesses and plug connectors only with suitable test device.
- Connect/disconnect the plug connectors of electronic control units only when the ignition is switched off.



►Mark the installation position of the injector cable harness **3**

►Unscrew and remove the mounting bolts **2** and **5**

►Free the injector cable harness **3** by cutting the cable ties

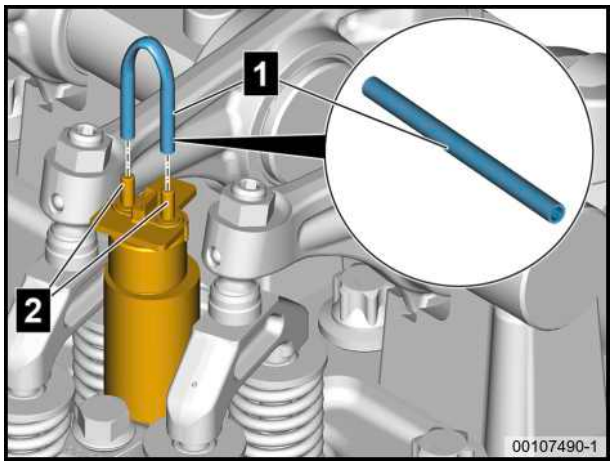
►Completely disengage the lock and pull the plug **4** out of the engine control unit

►Unlock and unplug the plug connectors **1**

Assembly instructions: secure the QR plate to the injector

Tip for users

The QR plate (with code) must remain on the injector, therefore secure against loss by pulling hose over grub screws.



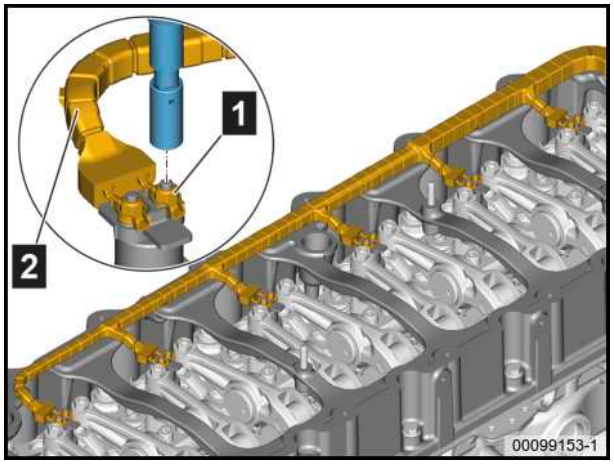
Part number of hose **1**: 04.27100-0203 (Internal diameter 3.5 mm)

►Pull the hose **1** over both grub screws **2**

Disconnecting the electrical connection to the injector

Tip for users

Do not lose or damage the QR plate (with code) on the injector during removal and installation.

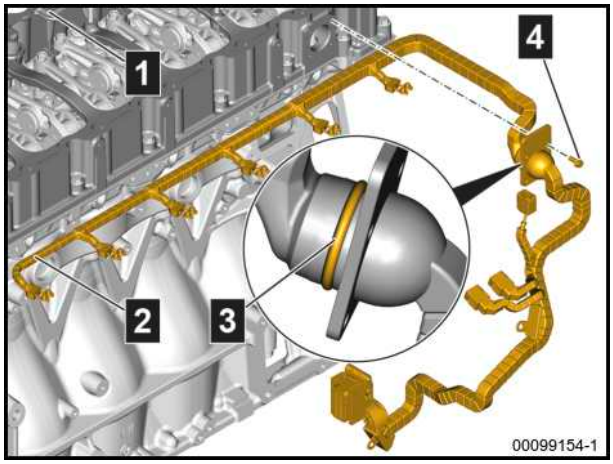


►Unscrew the mounting nuts **1**

►Remove the injector cable harness **2** from the injector

►Secure the QR plate (with code) on the injector against loss using the hose (04.27100-0203), see assembly instructions; secure QR plate to injector

Detaching the injector cable harness



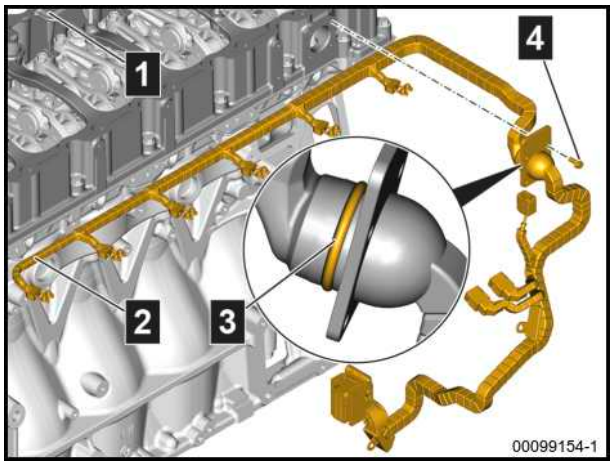
- ►Unscrew the mounting bolts 4
- ►Mark the installation position of injector cable harness 2 in relation to frame of the cylinder head cover 1
- ►Carefully pull out the injector cable harness 2 from frame of the cylinder head cover 1
- ►Detach the O-ring 3 from the sealing flange
- ►Clean the sealing surfaces

Installing the injector cable harness (common rail)

Attaching the injector cable harness

Tip for users

In new high injector cable harnesses, a new O-ring is already installed.



- ►Clean the sealing surfaces
- ►Replace the O-ring if re-using
- ►Apply a layer of P-80 installation lubricant to the new O-ring 3 and fit it to the injector cable harness
- ►Carefully insert the injector cable harness 2 into the frame of the cylinder head cover 1

NOTICE

Risk of component damage due to incorrect installation

The injector cable harness is damaged if installed incorrectly.

For this reason:

- Do not twist the injector cable harness when inserting it into the frame of the cylinder head cover.
- Carefully insert the injector cable harness into the respective bracket on the frame of the cylinder head cover.

- ►Carefully position the injector cable harness 2 onto the frame of cylinder head cover 1 as marked
- ►Screw in and tighten the mounting bolts 4

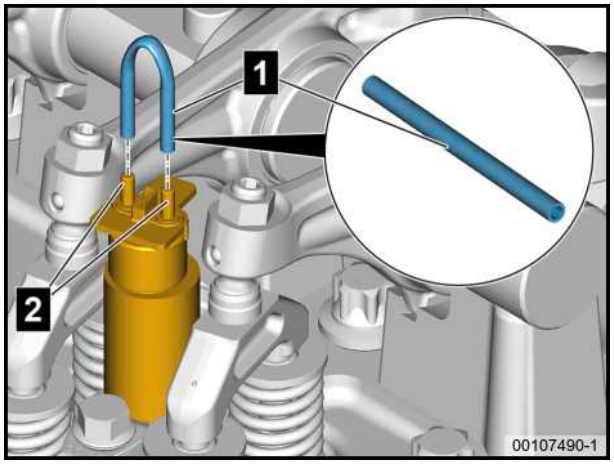
Tightening torque..... .... 10±1 Nm

Assembly instructions: QR plate on injector

Tip for users

The QR plate (with code) must remain on the injector.

►Pull off the hose **1** from both grub screws **2**



Connecting the electrical connections to the injector

►Assemble the special tool consisting of a torque screw driver [2], adapter [3], and a socket wrench insert [4]

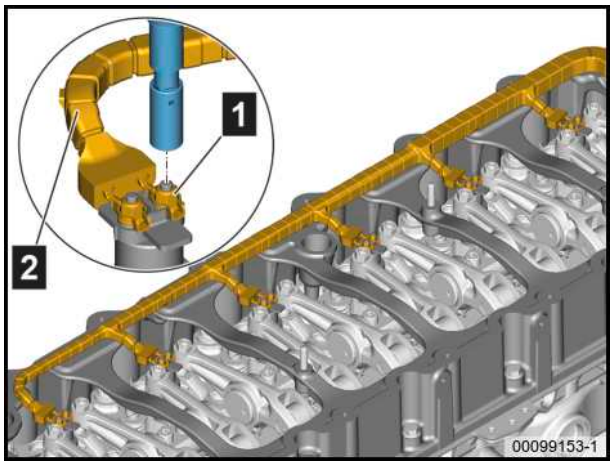
NOTICE

Risk of component damage due to incorrect installation

Risk of short circuit due to cable lugs touching.

For this reason:

- Cable lugs must not come into contact after assembly.
- Observe the tightening torques.



►Remove the hose (04.27100-0203) from the grub screws on the injector, see assembly instructions QR plate on injector

►Position the injector cable harness **2** on the injector

►Screw on the mounting nut **1** and tighten using the special tool

Tightening torque.. .... 2.0 Nm to 2.4 Nm

Connecting the electrical connections

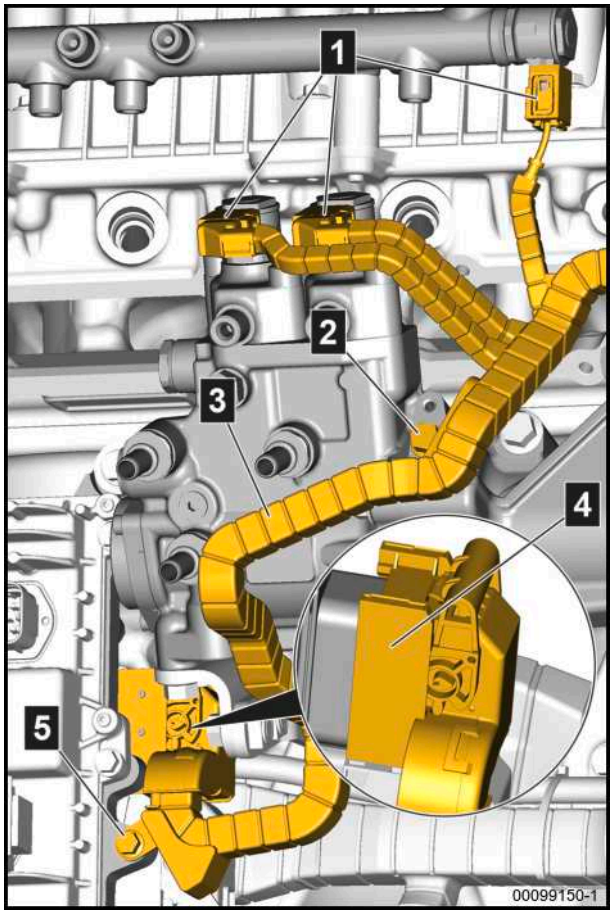
NOTICE

Risk of damage to components caused by incorrect handling

Irreparable damage to plug connectors and engine control units from spread contacts and damaged contacts.

For this reason:

- When installing the plug, first open the plug lock completely and then insert and lock the plug connector.
- Protect loosened plug connectors and contacts from entry of dirt or impurities.
- Check cable harnesses and plug connectors only with suitable test device.
- Connect/disconnect the plug connectors of electronic control units only when the ignition is switched off.



►Press on the plugs 1 until they engage
►Open the lock of the plug 4 completely
►Insert the plug 4 into the engine control unit and completely engage the lock
►Position the injector cable harness on the fixing points
►Screw in and tighten the mounting bolts 2 and 5
►Route the cable harness 3 as marked and secure with cable ties
►Tighten and cut ends of cable ties using the cable tie pliers [1]

Checking the electrical connection for correct fit

►Check clearance A of plug 2 in relation to the timing case 4

Clearance A..... 8 mm

If the clearance A is greater than 8 mm, undo the lock completely and disconnect the plug connection.

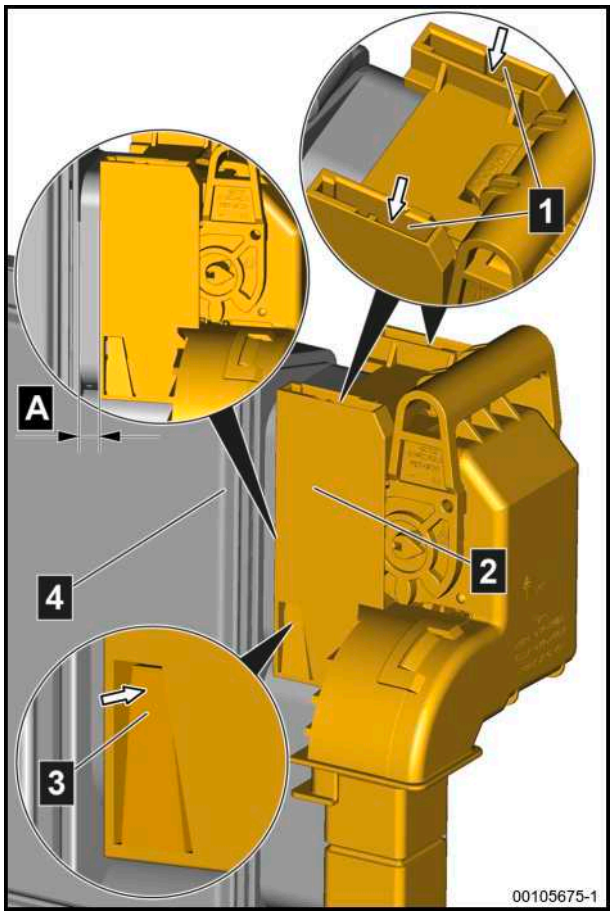
If the plug cannot be fitted in the correct position, it must be disassembled and repaired according to the manufacturer's instructions.

Then reconnect the electrical connection, see Connecting electrical connections.

►Locking rails 3 must be positioned on the inside of the plug housing 2.

If locking rails are not positioned on the inside, undo the lock completely and disconnect the plug connection.

If the plug cannot be fitted in the correct position, it must be disassembled and repaired according to the manufacturer's instructions.



Then reconnect the electrical connection, see Connecting electrical connections.

►Check the end latching position of the plug 2 and the lugs by visual inspection and by touching.

If locking rails are not mounted evenly in the guide 1 when the plug connector 2 is locked, undo the lock completely and disconnect the plug connector.

If the plug cannot be fitted in the correct position, it must be disassembled and repaired according to the manufacturer's instructions.

Then reconnect the electrical connection, see Connecting electrical connections.

Attaching the cooling plate / bracket for the control unit (EDC)

NOTICE

Risk of damage to components if damping elements are reused

For this reason:
- Replace any damping elements that have been loosened once.

►Position the bracket 3 with new damping elements 2 and 4

Tip for users

If using micro-encapsulated bolts, the time between the tightening stages must not exceed 2 minutes.

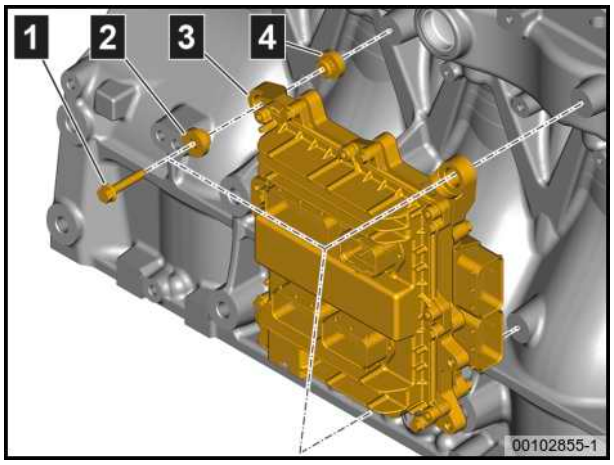
NOTICE

Risk of damage to components if bolts are reused

For this reason:
- Replace any mounting bolts that have been removed once.

►Screw in and tighten new mounting bolts 1

Tightening torque..... ..... 12 - 14 Nm



3.1.1.8 Removing/installing the engine oil temperature sensor