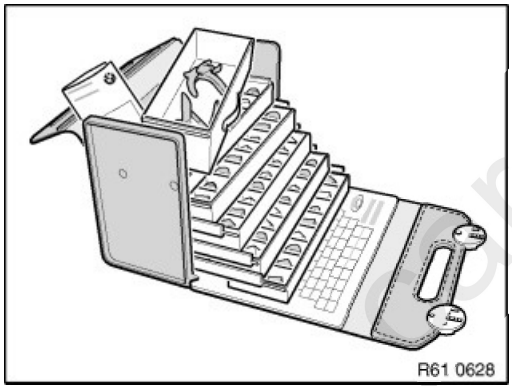
61 13 ... Butt connector for repairing a plug connection

Special tools required:

- 61 0 300
- 61 4 340
- 61 0 240

Caution!

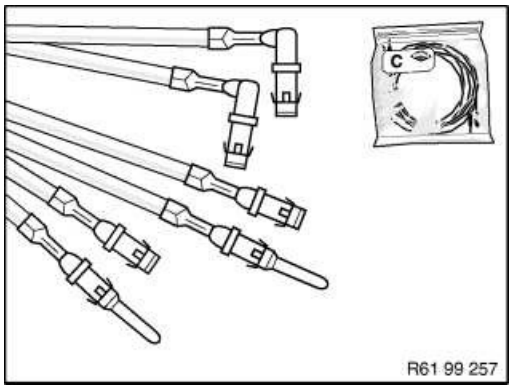
1. Identify cause of damage (e.g. sharp-edged body components, faulty electrical loads, jammed mechanisms, corrosion caused by ingress of water, etc.).
2. Reading out the fault memory
3. Eliminate cause of damage.
4. Disconnect battery negative terminal
5. Make sure that no safety-related system according to circuit diagram (e.g. antilock braking system, active rear-axle kinematics, airbags, etc.) are influenced. Otherwise replace faulty wiring harness or use repair cable (sourcing reference: BMW Parts Department)
6. Carry out function test and read out fault memories again
7. Eliminate new faults if applicable and clear fault memories



Note:
The repair range IV for vehicle electrical system contained the required special tools and individual parts for retrofitting and repair work with the aid of fan connectors.

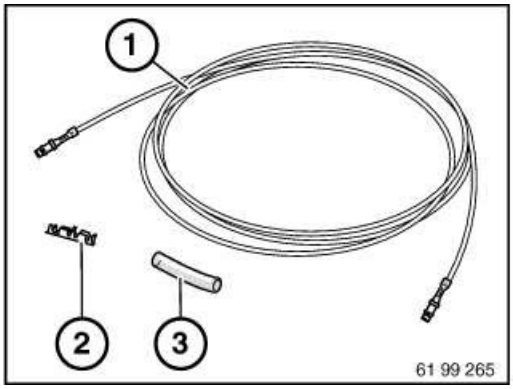
The case can no longer be ordered. Order individual parts for wiring harness repair through BMW Parts Department.

- Refer to Service Information:
  SI 02 04 07 341



Choose repair kit.

Example: Repair kit, circular connector system D 2.5.

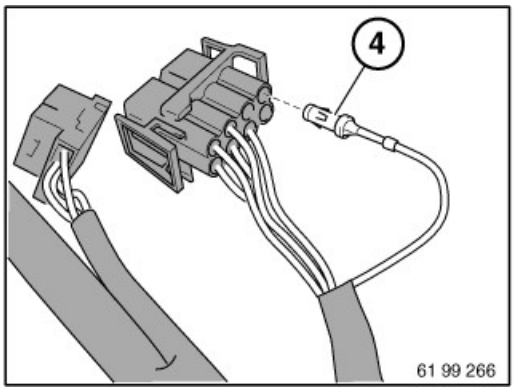


Remove following parts:

(1) Pre-packaged end of cable with requisite wire cross-section

(2) Crimp connector for selected wire cross-section

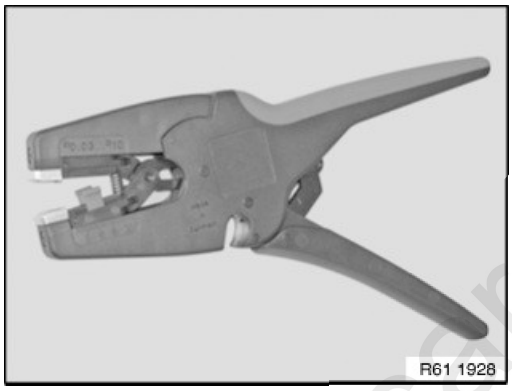
(3) Shrink-fit hose



Open secondary lock on housing.

Mark damaged contact (4) with socket number of housing and press it out of housing using appropriate special tool contained in special tool set 61 0 300).

See repair instructions
Notes for opening contacts and locks of different plug contact systems.



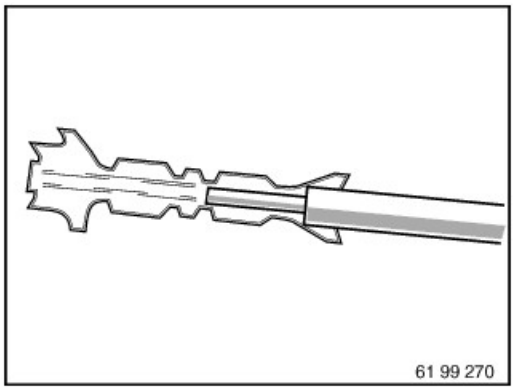
Caution!

- Check maximum length of repair cable
- If more than one wire is to be repaired, the individual interfaces must be offset so that the wiring harness is not too thick at the repaired point.

Adhere to following procedure:

- Cut off wire with faulty contact at point which is easily accessible
- Strip insulation from end of wire at wiring harness end
- Cut preassembled wire end to length and strip insulation

Refer also to repair instruction:
Cutting to length and stripping insulation from cables



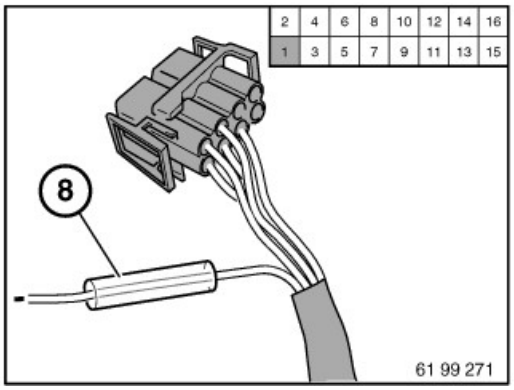
Crimp butt connector on preassembled wire end.

Special tools:

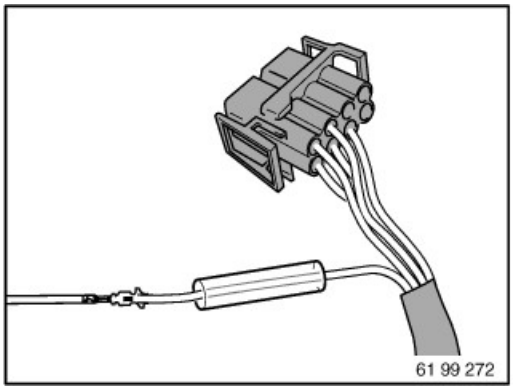
- 61 4 340 (0.35 - 2.5 sq mm)
- 61 0 240 (4.0 - 6.0 sq mm)

See repair instructions
Crimping on stop parts

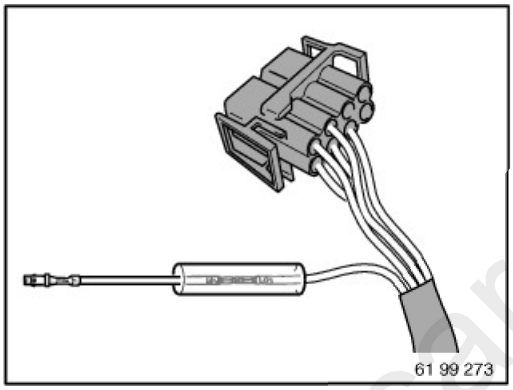
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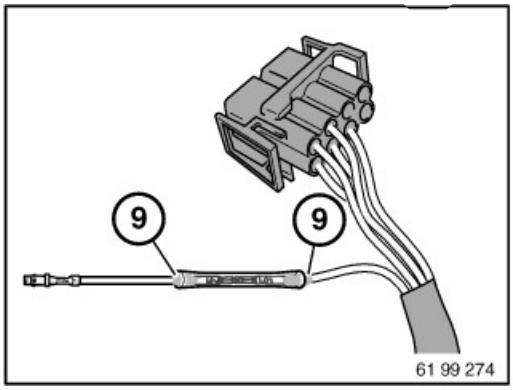
Push shrink-fit hose (8) onto free wire end.



Crimp unused wire end to butt connector.



Pull shrink-on sleeve over butt connector.



Caution!

Do not burn shrink-on sleeve.

With hot air blower, shrink the shrink-on sleeve on both sides (9) of shrink-fit hose until glue emerges uniformly all round.

Insert contact in housing.

Close secondary lock on housing.

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11 00 ... Handling components after flood damage

Flood damage can occur if the permissible fording depth of a vehicle is exceeded. Ingress of water can cause damage to the engine (water shock) or components.

Because dirt particles generally enter into the component with the water (e.g. starter motor, wiring harness), the components need to be thoroughly inspected.

Residual moisture in the components leads to corrosion (increased contact resistance in the component), which can lead to a component failure at a later time.

If water ingress into the electrical components cannot be ruled out, it is recommended to replace the component to ensure correct functioning through the vehicle lifetime.

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61 00 ... Information on removing, connecting and changing the battery

Observe safety informations for handling vehicle battery.

Disconnecting the battery

Before disconnecting battery:

Turn off the ignition and other electrical loads/consumers to prevent sparking when reconnecting.

Note:

If the ignition is not turned off when the battery is disconnected, fault memories may be set in some control units.

Important!

- There is a danger of mixing up battery cables: If the battery positive and negative leads are the same colour and you are in doubt, follow the polarity to the battery, then mark and cover the leads.
- The on-board computer and clock may lose your data.

General notes on disconnecting battery:

- Do not disconnect battery leads and leads from alternator and starter motor while engine is running.
- Disconnect terminal of battery earth lead from the battery. Cover battery negative terminal(s) and secure.
- Disconnect both battery earth leads in versions with an auxiliary battery. Cover battery negative terminal(s) and secure.
- When work is carried out on the electrical system, faults may be caused in the fault memories of some control units when the battery is connected.
- When installing battery terminal: Tightening torque 61 21 1AZ.

AGM battery only:

- On vehicles with IBS at negative battery terminal:
  Do not under any circumstances pull/lever off pole shoes by force.
  Do not under any circumstances release the hexagon socket screw of the IBS.

Connected battery

After connecting battery:

Important!

The scope of application of some systems may be restricted after an open circuit.

Personal Profiles may also be lost.

Settings or activations must be carried out, depending on the equipment specification.

For example:

- Activate slide/tilt sunroof, if necessary
- Activate power window, if necessary

Refer to the diagnosis system for further vehicle-specific information.

Battery replacement

A vehicle battery is constructed for the installation location and the individual power requirements of the particular vehicle. These individual power requirements depend on the motorisation and different types of equipment. The individually assigned vehicle battery is the ideal compromise between the power requirements of the vehicle

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electrical system and the weight and service life of the vehicle battery.

Vehicles with the automatic engine start-stop function or particular engine types and optional equipment are equipped with a special vehicle battery (AGM battery), since only this battery type can provide elevated power requirements over the extended service life. Installing a different vehicle battery can cause problems with vehicle electronics, can reduce functions or can cause leakage of battery acid.

In the event of an accident where the airbags are deployed in vehicles with a vehicle battery in the luggage compartment, the electrical connection between the vehicle battery and the trigger is automatically disconnected through pyrotechnics. This prevents possible short-circuiting.

Proper operation of all of these safety and convenience functions requires a battery that conforms with specifications and that is properly registered in vehicles with energy management systems (IBS, power module).

Vehicles with energy management systems (IBS, power module): Register battery replacement.

The vehicle electrical system is informed about the vehicle battery characteristic data, such as type, size, age and current power capacity. Therefore, there will always be only one work scope provided that is permitted by the current status of information.

If performance readiness drops below a defined minimum, a Check Control message will be generated to advise the driver that the battery must be replaced.

When installing a new vehicle battery, the battery must be registered and thus must also be registered with the vehicle electrical system.

Note:

Only this registration/logon will ensure that the corresponding Check Control message will go out again.

Diagnosis system:

Registering the battery replacement:

- Service functions
- Body
- Voltage supply
- Register battery replacement

When retrofitting, a more powerful battery may be used. Standard batteries may always be replaced by AGM batteries with the same specifications.

When installing a battery of a different size or a different battery type, this change in vehicle data must be programmed into the vehicle data in accordance with specifications.

Programming system:

- Battery retrofitting

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12 00 ... Instructions for removal and replacement of control units

Important!

- Disconnecting the vehicle battery will cancel the fault memories of control units. Consequently, before disconnecting the car's battery, always interrogate the fault memories. Investigate stored faults and, once any faults have been remedied, cancel the fault memory.
- Control unit plugs should only ever be connected and disconnected while the ignition is turned off.
- The removal and installation of components, relays, fuses etc. can cause faults to be stored in fault memories capable of self diagnosis. Always interrogate the fault memories after completing work on the electrical system.
- Investigate stored faults and, once any faults have been remedied, cancel the fault memory.
- If necessary, initialise power window regulator Initialise power window regulator

On replacement of the DME/DDE control unit note the following:

- In every case use the diagnosis system to read out the hardware/software version of the corresponding control unit.
  Comply with the diagnosis system instructions for the encoding and programming work operations.
  On vehicles with an electronic immobiliser, comply with the diagnosis system instructions.
- In every control unit certain mean values are stored that are the basic values. The control unit receives different input values according to the engine condition. The teachable system compares the input values against the stored basic values and then forms the associated control commands. The control commands are forwarded to the corresponding actuators.
- When the DME control unit is de-energized for a long period (over one hour), the teachable system then loses the stored values. When a deleted control unit is returned to service or a new control unit is installed, the teachable system itself must read in and store the input value of the associated engine as new basic values.
- This process may cause uneven idle and faults in coasting mode after starting. Depending on the engine characteristics, it may take some time until all values have been compared with the engine condition.
- Therefore, comply with the following procedure before replacement or reinstallation of a DME/ DDE control unit is carried out:
  1. If possible, bring the engine up to its operating temperature prior to replacement of the control unit.
  2. Change control units and drive the vehicle with changing engine speeds.

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61 00 ... Notes for disconnecting and connecting the vehicle battery

Observe safety informations for handling vehicle battery.

Before disconnecting vehicle battery:

Turn off the ignition and other electrical consumers/consumers to prevent sparking when reconnecting.

Note:

If the ignition is not switched off when the vehicle battery is disconnected, fault memories may be set in some control units.

Caution!

- There is a danger of mixing up battery cables: if the positive battery cable and battery earth lead are the same colour and you are in doubt, follow the polarity to the vehicle battery, then mark and cover the leads
- The on-board computer and clock may lose your data.

General notes on disconnecting the vehicle battery:

- Do not disconnect battery leads and leads from alternator and starter motor while engine is running.
- Disconnect terminal of battery earth lead from the battery. Cover battery negative terminal(s) and secure.
- Disconnect both battery earth leads in version with auxiliary battery. Cover battery negative terminal(s) and secure.
- When work is carried out on the electrical system, faults may be caused in the fault memories of some control units when the vehicle battery is connected.

Only lead AGM battery:

- On vehicles with IBS at negative battery terminal:
  Do not under any circumstances pull/lever off pole shoes by force.
  Do not under any circumstances release the hexagon socket screw of the IBS.

Note the following after having connected the vehicle battery:

Caution!

The scope of application of some systems may be restricted after an open circuit.

Personal Profiles may also be lost.

Settings or activations must be carried out, depending on the equipment specification.

For example:

- Activate slide/tilt sunroof, if necessary
- Activate power window, if necessary

Refer to the diagnosis system for further vehicle-specific information.

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61 00 ... Notes on handling wiring harnesses and cables



The following applies in general:

To avoid damage, observe the following notes:

- Avoid compressive and tensile loads
- To ensure professional repairs, perform repair work only with BMW-approved or recommended special tools and spare parts
- Make sure cables are laid without kinks or abrasions
- Ensure non-contacting routing at sharp-edged body components; use edge protection if necessary
- Secure additionally laid cables/leads with cable ties

The following additionally applies

Shielded lines

Interference radiation and interference resistance can lead to neutral zones at contact points in the shielding. Consequently, distinctions have to be drawn between the following types:

Coaxial cable

- Shielded coaxial cables RTK031 may only be repaired with a special crimping tool.
- For aerial lines only the bushing contact may be repaired.
- RG174 Lines and the bushing contact may not be repaired.

CVBS cables

- CVBS cables may not be repaired.
- CVBS cables must be replaced in their entirety.

HSD cables

- HSD cables may not be repaired.
- HSD cables must be replaced in their entirety.

Fibre-optic cables:

Note:
Fibre-optic cables are coloured differently as follows:

- Green = **MOST** (**M**edia **O**riented **S**ystems **T**ransport) optical fibres
- Yellow = **ISIS** (**I**ntelligent **S**afety and **I**ntegration **S**ystem) optical fibres
- Orange=repair fibre-optic cables

Caution!

- Optical fibres are permitted to show only one junction point (bridge). Replace optical fibres if necessary
- Smallest permissible bending radius is 25 mm
- Avoid effects of heat ≥ 85 °

Treating cables and optical fibres

FlexRay (twisted cables):

It is possible to repair the FlexRay. In the event of damage, the cables can be joined with conventional butt connectors and heat-shrink tubing.

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Note:

- FlexRay lines may only reveal one separation point (bride); renew complete line if necessary.
- If possible, maintain twisted cable after repair.
- After repairs, twist cables as close as possible to the connector/separation point.
- Twisting must be as symmetrical as possible.

Airbag lines:

Repairing airbag cables

Ribbon cables:

Repairing ribbon cables

Replacing wiring harnesses

Repair wiring harnesses mainly cover the full equipment of the vehicle. If certain optional equipment is not installed in the vehicle, note the following:

- If necessary, secure the remaining connectors.
- If necessary, seal the remaining connectors outside the vehicle interior, for example, with butyl tape in such a way that moisture ingress can be eliminated permanently.
- If necessary, repin the connector of the repair wiring harness.

Note:
Repair wiring harnesses can be equipped with an **additional socket housing** (30-pin, for example), **which was not provided on the previous vehicle-side wiring harness**. This socket housing also cannot be found in the wiring diagram.

Procedure

The separation point between the vehicle-side wiring harness and the repair wiring harness is located **in the vehicle interior** (in the footwell, for example):

- Cut the additional socket housing and connect the lines to the vehicle-side wiring harness using a butt connector.
- Alternatively, a suitable pin housing can be fitted on the vehicle-side wiring harness and connected to the additional socket housing.

  However, this is permitted only if the following conditions are met:

  - Carpets must not protrude visibly or become deformed due to the installation of the additional plug connection.
  - It must be possible to install the adjacent components (for example, trims, trim panels, etc.) correctly after installing the additional plug connection.
  - All the attachment points of the adjacent components (for example, trims, trim panels, etc.) must engage correctly.
  - There must be no rattling noise due to the installation of the additional plug connection.
  - The additional plug connection must not damage the adjacent components/wiring harnesses, etc..

The separation point between the vehicle-side wiring harness and the repair wiring harness is located **outside the vehicle interior** (in the wheel arch, for example):

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- Cut the additional socket housing and connect the lines to the vehicle-side wiring harness using a butt connector.
- **Using the additional socket housing is not permitted with a separation point outside the vehicle interior.**

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12 00 ... Notes/information on start assistance (jump starting)

Do not start the engine with help of starting sprays.

Preparation:

Conform with the following when starting the engine with a jump starting cable.

- Ensure that the jump starting cable wires are of appropriate cross-section size.
- Only use fuse-protected jump starting cables.
- Check whether the current-supplying battery has 12 V voltage.
- If the engine is started from the battery of another vehicle, ensure that there is no contact between the bodies of both vehicles.

Important!

Never touch electrically live ignition system components: high voltage - danger of injury!

If the battery in the vehicle supplying power is weak, start the engine of this vehicle and let it run at idling speed.

Operation:

It is essential to conform to the procedures so as to avoid injury to persons or damage to parts.

- Automatic transmission: select drive position ”P”, apply parking brake.
- Manual transmission: move gear lever to neutral position, apply parking brake.
- Ensure that the jump leads cannot get caught in rotating parts, e.g. fan.
- First connect both positive poles of the batteries with one jump starting cable (red).
- Use the battery positive terminal in the engine compartment for vehicles with the battery in the luggage compartment.
- Then use the second jump starting cable (black) to connect the negative post of the current-supplying battery with the earth/ground point (not the negative pole or the body) of the vehicle to be started.

Important!

Do not connect the second jump starting cable (black) with the negative pole of the battery in the vehicle to be started. Produced gas could be ignited by sparks.

Risk of explosion!

After the engine of the vehicle to be started has fired, first disconnect the jump starting cable between the negative pole and the earth/ground point. Then remove the starting cable from the positive poles.

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00 Safety information for working on vehicles with automatic engine start-stop function (MSA)

Warning!

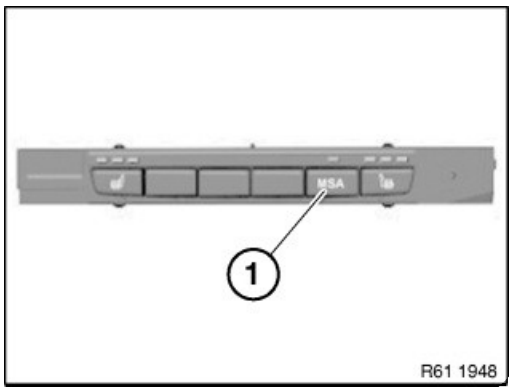
If the engine hood/bonnet contact is pulled upwards (workshop mode), the information "switch closed" is output. The automatic engine start-stop function is active.

An automatic engine start is possible.

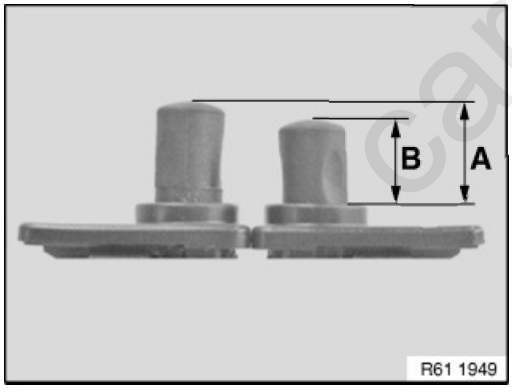
Observe safety precautions when working on MSA vehicles.

Before carrying out practical work on the engine, always ensure that the MSA functionality is deactivated so as to prevent automatic engine starting while work is being carried out in the engine compartment.

MSA function is deactivated by:



- Deactivate MSA by means of button (1) in passenger compartment
- Open seat belt buckle and driver's door



- Open engine bonnet/hood and ensure that engine hood/bonnet contact is not in workshop mode
  - Workshop mode

    A = 10 mm
  - Basic setting (engine hood/bonnet open)

    B = 7 mm

  To make sure that the engine hood/bonnet contact is at the basic setting, if necessary press the hood/bonnet contact up to the limit position before starting work and slowly release.

When working with diagnosis tools:

- Observe instructions in diagnosis tool

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Note:
For further information on automatic engine start-stop function (MSA):

- Refer to the Service Information (bulletin) (for manual transmissions) Service Information (bulletin) 61 01 07 335
- Refer to the Service Information (bulletin) (for automatic transmissions or twin-clutch gearboxes) Service Information (bulletin) 61 01 10 629

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61 00 ... Safety information on handling hybrid cars

Please observe the current version. Safety information for handling electric and hybrid vehicles

1. *Qualification:*
   All repair work on high-voltage components may **only be performed by specially trained personnel** (qualification: Work on high-voltage inherently save vehicles) must be performed by qualified technicians. Each hybrid car requires additional vehicle specific training with training achievement controls.
   Required training is offered by the BMW Training Academy.
2. *Identification:*
   Observe **warning notices** on high-voltage components. When replacing individual high-voltage components, check if warning stickers are present. Independently attaching warnings is only allowed on the locations provided for them. Use only approved and appropriately identified original new parts.
3. *Rules of conduct/protective measures:*
   - Note operating instructions for handling high-voltage battery units.
   - Do not under any circumstances touch open high-voltage cables and high-voltage components on damaged vehicle before shutting down the high-voltage electrical system.
   - In the event of damage (mechanical, thermal) transition metal oxides, carbon, electrolyte solvents and their products of decomposition may be released.
     Suitable acid-resistant protective clothing/equipment must therefore be used when handling the vehicle!
     - Hand protection: Gloves
     - Eye protection: Safety goggles

     Damaged high-voltage battery units must be stored in an acid-resistant pan in a location in the open that is protected against the weather (sun, rain) and secured against unauthorised access. Do not inhale escaping gasses.
   - Prevent escaping substances from entering drains, pits and the sewer system.
   - Collect any material that is discharged and have it disposed of according to the work instruction, wear acid-resistant protective clothing when doing so.
   - Notify the fire brigade if fire breaks out, clear the area immediately and make accident scene safe. Attempt to extinguish the fire without putting persons in danger (suitable extinguishant: water and water foam).
   - A cut 2nd emergency separation point must be repaired with a butt connector.
4. *Measures before starting work*:
   - Each job on the vehicle must be assigned by appropriately trained personnel. Before work is started, this electrician must place the vehicle in the operating condition required to perform the relevant activity. The qualified personnel's instructions and directions absolutely must be followed. **No work may be carried out without this qualified personnel** being consulted first.
   - It is **not** permitted to work on the high voltage system or on high voltage components while the engine is running.
   - The readiness to drive must be ended before shutting off the voltage of the high-voltage system. The readiness to drive is ended when the driver is absent only under the following prerequisites:
     1. seat belt buckle unlocked **and**
     2. the driver's door is open **and**
     3. no brake activated **and**
     4. the accelerator pedal is not activated **and**
     5. speed < 3 km/h (2 mph)
   - Work on live high-voltage components is expressly prohibited. Before each operation on the high-voltage system, the system must be isolated from the power supply by qualified personnel (high-voltage safety connector Off) and secured against unauthorised recommissioning (padlock).
   - After each deactivation of the high-voltage system, it is essential to observe a **waiting period** of at least **10 seconds** prior to further work.
   - Before beginning work, it is mandatory to check that the equipment is de-energised and is protected against being energised again!
     Work is only permitted to begin if:
     1. Corresponding display in the instrument cluster **High-voltage system deactivated** or

     When a high-voltage warning is active (indicator light, Check Control, etc.), it is essential to determine and eliminate the cause of this warning via the diagnosis system before continuing with any other work. **If it cannot be definitively established that the equipment is de-energised**, work is not permitted to begin. **Danger to life!** Before work begins, a qualified electrician (1000 V AC) must verify that the system is de-energised using appropriate measuring devices and procedures.

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=> In this case, Technical Support must be contacted!

- Do not perform any work on the vehicle while it is charging. Before starting work, disconnect the charging cable from the vehicle.
  Battery charging may result in heating of the high-voltage battery unit. This heating may lead to sporadic launches of the electric fan (switch-on request from the electric fan). Therefore, work in the vicinity of the electric fan during the charging procedure is prohibited. Ensure freedom of movement of the battery charge lines in the vicinity of the electric fan.

5. *Measures during/after activities:*
   - Identifiable mechanical damage to or tampering with high-voltage components must be reported immediately to the qualified personnel in charge.
   - When carrying out any work on the high-voltage system, it is prohibited to drive externally all the drivetrain components (wheels, gearbox, drive shafts, etc.).
   - *E72 only:* When the “Power Electronic Box Cover” is removed, the high-voltage system is not permitted to be activated. The high-voltage service disconnect must only be used when the "Power Electronics Box Cover" is completely installed.
   - High-voltage cables (orange coating) and their connectors and stop parts **may not** be repaired. If damaged, a cable must always be replaced completely.
   - When working in the vicinity of high-voltage components (identified accordingly with warning stickers and orange-coloured coating), protect these components against damage.
   - The specified work steps in the repair instructions must be adhered to exactly.
   - High-voltage components and their holders must be screwed/bolted to the defined tightening torque. Tightening torques and tightening specifications must be observed.
   - Connecting high-voltage components to body ground is crucial to safety for reasons of equipotential bonding. For this reason, it is prohibited to operate any high-voltage components without them being correctly connected to body ground. The measurements (insulation/potential equalisation measurement) are performed automatically by the vehicle. Manual measurement is not therefore necessary.
     For a correct earthing connection, the retaining elements of high-voltage components must not be painted. Follow further notes on paintwork.
   - Removed high-voltage battery units must be stored in a manner that protects them from misuse and damage.
   - Damaged or warning stickers that are no longer legible on high-voltage components must always be replaced.
6. *Equipotential bonding:*
   Equipotential bonding lines, high-voltage cables and the battery negative lead to the EME are fitted with safety screws!
   - Clean contact faces and have then checked by a second person.
   - Tighten down screws/bolts to specified torque.
   - Have tightening torque checked by a second person.
   - Both persons must document that the work has been carried out correctly in the vehicle records.

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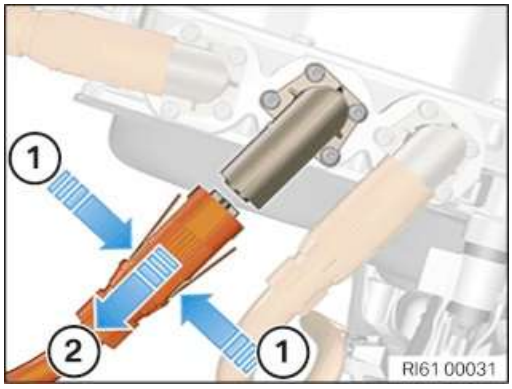
61 13 ... Unlocking and disconnecting various plug connections in electrical and hybrid vehicles



Attention!

Observe the following instructions for handling high-voltage plug connections:

- Damaged high-voltage plug connections must be replaced completely. Repair is not permitted.
- Dirt contamination must be removed before opening the plug connection.



Disconnect the Hirschmann high-voltage connector:

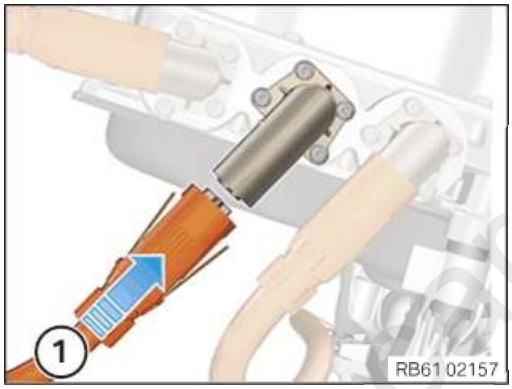
Press the lock (1) on the left and right on the connector in the direction of the arrow.

Pull off connector (2) in direction of arrow.

Attention!

Connector (2) is difficult to pull off.

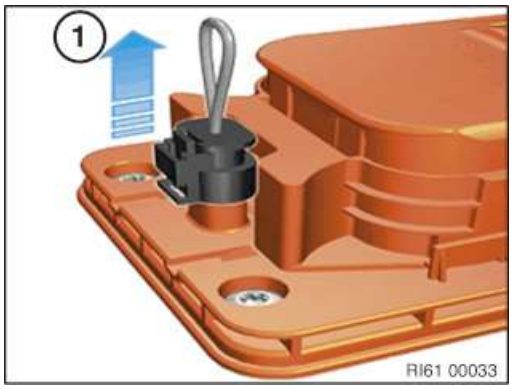
In the event of damage to high-voltage connector (2), the complete high-voltage cable must be replaced!



Connect the Hirschmann high-voltage connectors:

Slide the connector (1) on in the direction of the arrow.

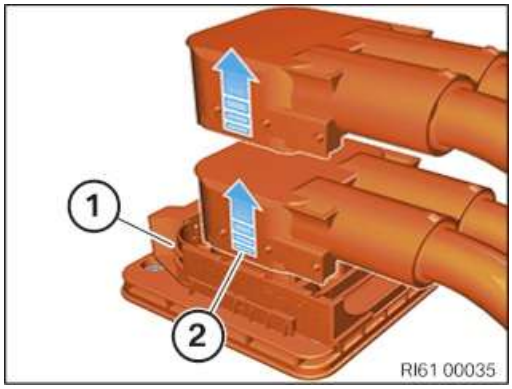
Note:
Connector (2) must lock audibly.



Disconnect the Kostal high-voltage connector:

Unlock and disconnect high-voltage interlock loop (1).

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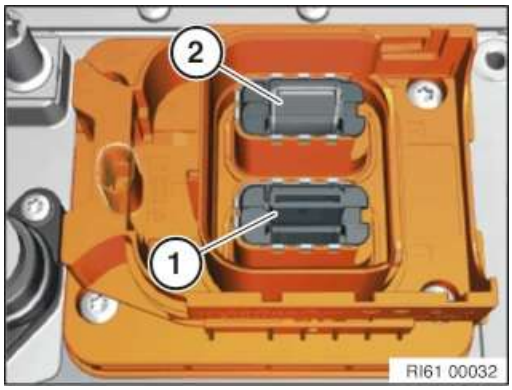
Push the lock (1) fully to the front.

Lift the connector (2) and remove it entirely.

Attention!

Plug connection (3) is difficult to pull off.

The connector (2) must be completely pulled off the opposite housing in one step. Damage may be caused to contact protection if connector is only partly pulled off and then closed again!



Check the Kostal high-voltage connector and connection for damage:

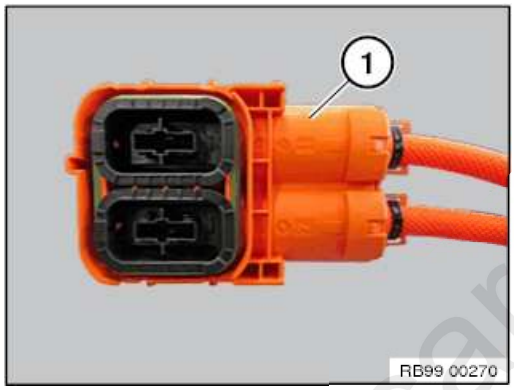
Check the touch protection for damage and correct positioning (1).

Warning!

Do not touch unprotected connector (2)!

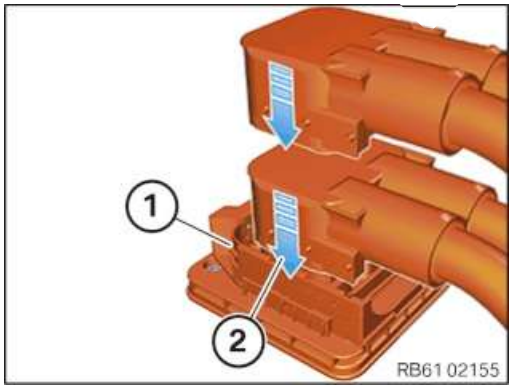
If the contact protection (1) has been pushed to the bottom (2), the high-voltage connector must be refitted.

If contact protection (1) remains in bottom position (2) after reinstallation, the contact protection is faulty and the component must be replaced!



Check the high-voltage connector (1) for damage.**Warning!**

In the event of damage to the high-voltage connector (1), the complete high-voltage cable must be replaced!



Connect the Kostal high-voltage connector:

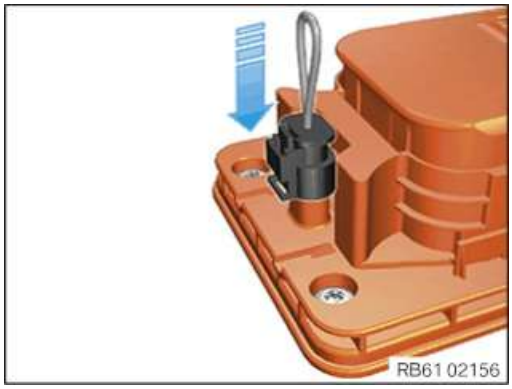
Connect the connector (2) in one single movement to the counter-housing.

Push the lock (1) fully to the rear.

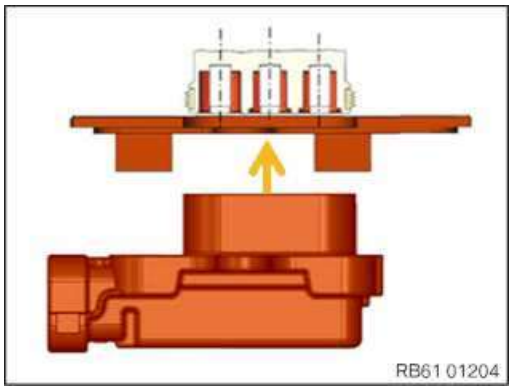
Attention!

Plug connection (3) must be correctly locked by lock (2), otherwise there is a risk of damage.

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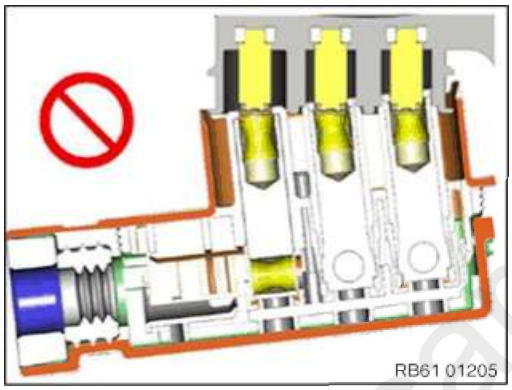


Connect the connector for the high-voltage interlock.



Three-phase high-voltage connector:

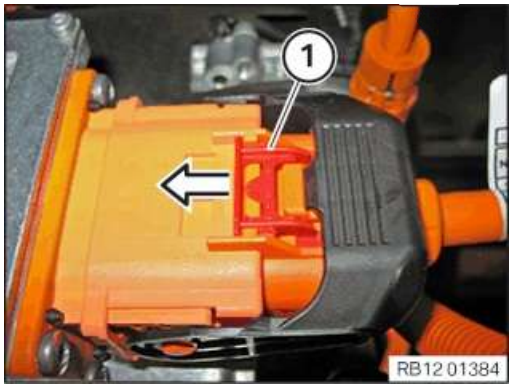
Connect and disconnect the connector straight.



Attention!

The system is designed to only offer limited protection against damage caused by connectors that are inserted at an angle.

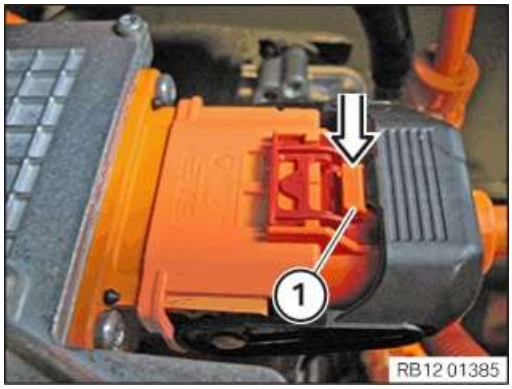
Increased tilted connections will increase the connecting force and the risk of danger.



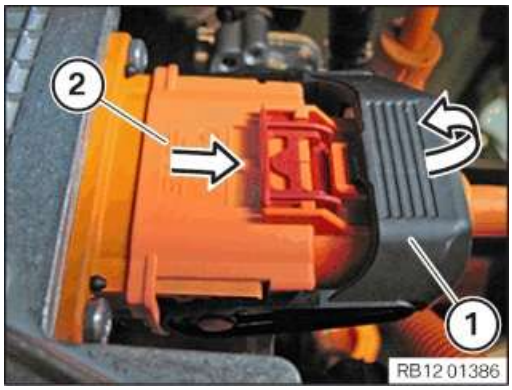
Disconnect the high-voltage connector from the high-voltage connection of the KLE:

Slide lock (1) in direction of arrow up to stop.

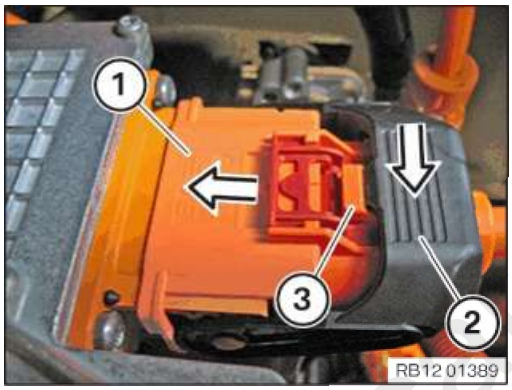
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Press lock (1).



Open the lock (1) completely and disconnect the connector (2).



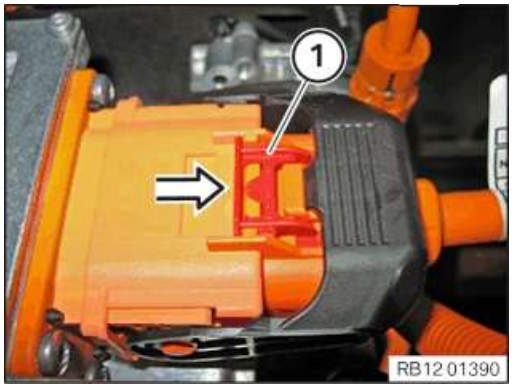
Connect the high-voltage connector to the high-voltage connection of the KLE:

Connect the connector (1) to the limit position and close the lock (2).

Attention!

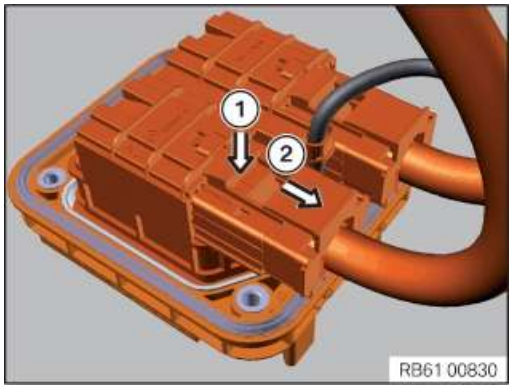
Lock (2) must snap audibly into place.

The retaining lug of the lock (2) must be positioned completely under the lock (2).



Slide the lock (1) on to the stop in the direction of the arrow.

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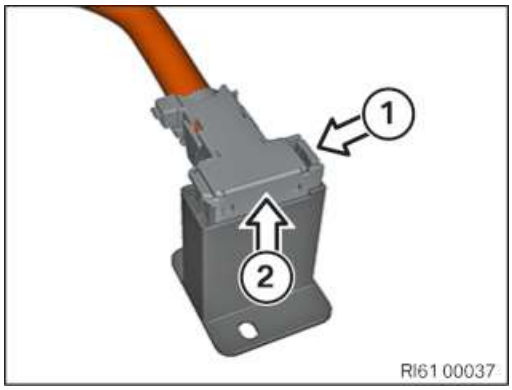
High-voltage connector on the high-voltage connection of the high-voltage battery unit:

Press down unlocking (1) in direction of arrow and pull off connector in direction of arrow (2).

Attention!

Contact protection is no longer provided in the event of a damaged connector housing.

In this case, contact technical support.



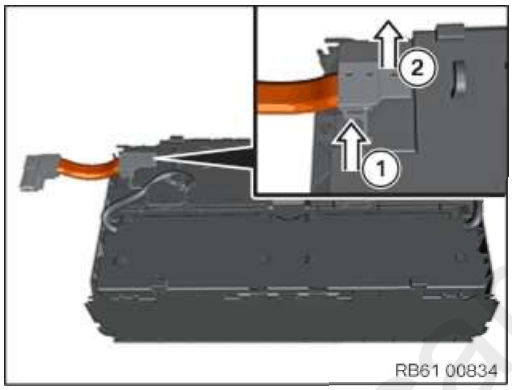
High-voltage connector on the cell module I01:

Press unlocking device (1) together and pull off connector upwards (2).

Attention!

Contact protection is no longer provided in the event of a damaged connector housing.

In this case, contact technical support.



High-voltage connector on the cell module (cell module connecting line):

Press unlocking (1) in direction of arrow and pull off connector in direction of arrow (2).

Attention!

Contact protection is no longer provided in the event of a damaged connector housing.

In this case, contact technical support.

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12 14 700 Encoding the control unit (DME/DDE)

Switch off ignition.



Connect diagnosis system.

Switch the ignition on.

Select "encoding" program.

Follow the instructions in the diagnosis system.

Adjust the following control units:

- EWS (electronic immobiliser)
- DME (Digital Motor Electronics) or
- DDE (Digital Diesel Electronics)

Follow Service Information "Diagnosis and Encoding" on the topic of encoding.

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12 14 705 Programming the control unit (DME/DDE)

Switch off ignition.



Connect diagnosis system.

Switch the ignition on.

Select "Programming".

Follow the instructions in the diagnosis system.

Adjust the following control units:

- EWS (electronic immobiliser)
- DME (Digital Motor Electronics) or
- DDE (Digital Diesel Electronics)

Follow Service Information "Diagnosis and Encoding" on the topic of programming.

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12 23 505 Replace all glow elements

PRELIMINARY WORK

1 – Removing the acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover/design cover.

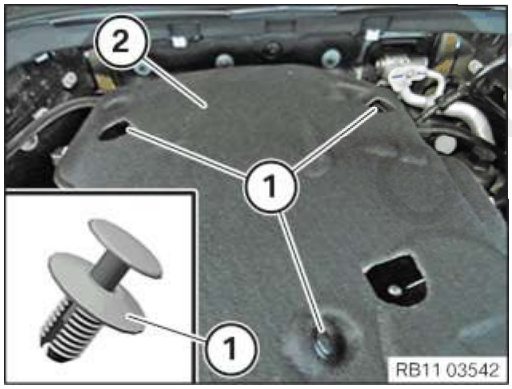
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover/design cover.

- Disassemble or mount the acoustic cover/design cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover/design cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the indicated area towards the top.

2 – Remove the acoustic cover for the injectors



- **If installed:** Release the expanding rivet (1).
- Guide the acoustic cover (2) out and remove.

3 – Partially releasing the wiring harness section

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

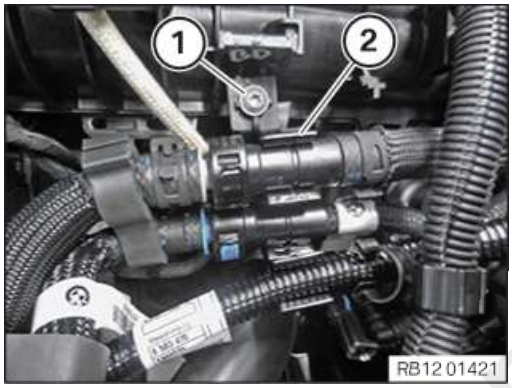
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 ... Notes for ESD protection (electrostatic discharge)

RISK OF DAMAGE

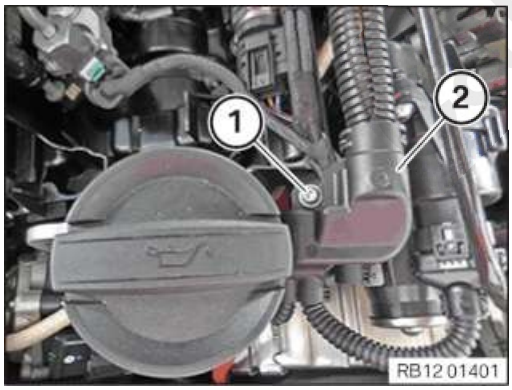
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

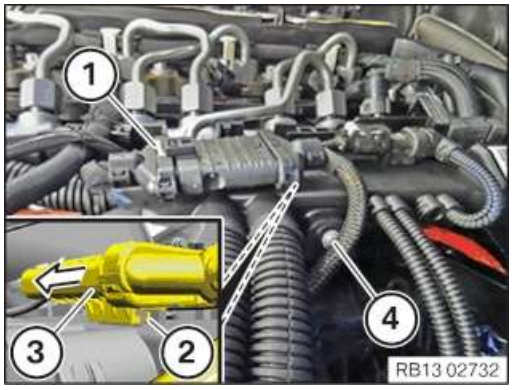
- Do not pull on the wires when disconnecting connectors and plug connections.



- Loosen screw (1).
- Thread out holder (2) and set aside.



- Loosen screw (1).
- Remove the wiring harness section (2) and put to one side.

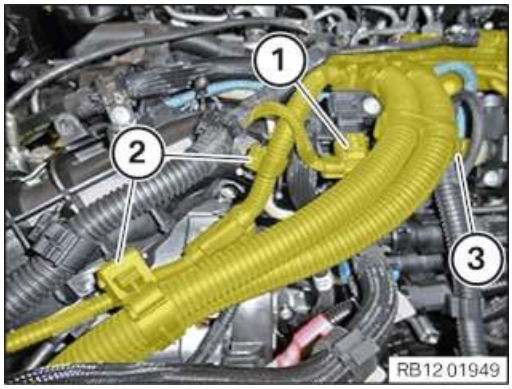


NOTICE

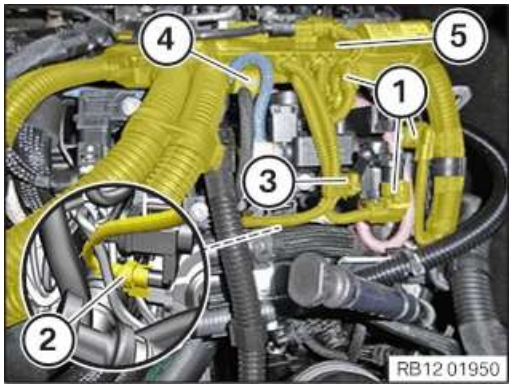
The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

- Unlock plug connection (1) and disconnect.
- Unlock the lock (2).
- Feed out the connector (3) in direction of arrow and remove.
- Loosen screw (4).

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- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Loosen clamp (3).



- Unlock and disconnect the plug connection (1).
- Unlock and disconnect the plug connection (2).
- Loosen clamp (3).
- Loosen screw (4).
- Guide out wiring harness section (5) as far as possible and set it aside.

MAIN WORK

4 – Remove all glow elements

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Damage to the glow elements.

Excessive force may damage the glow elements and they may then have to be renewed.

- Handle glow elements with care and do not drop.
- Do not rest the cylinder head on glow elements. Glow elements protrude from the sealing surface of the cylinder head.

RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 ... Notes for ESD protection (electrostatic discharge)

RISK OF DAMAGE

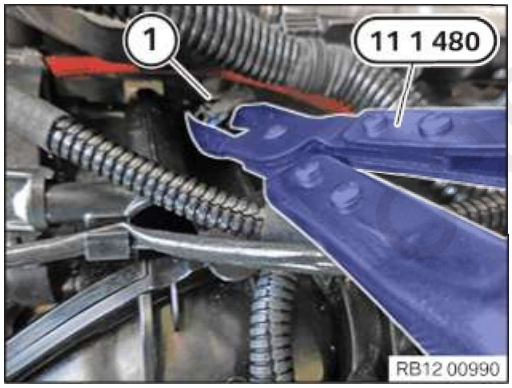
Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

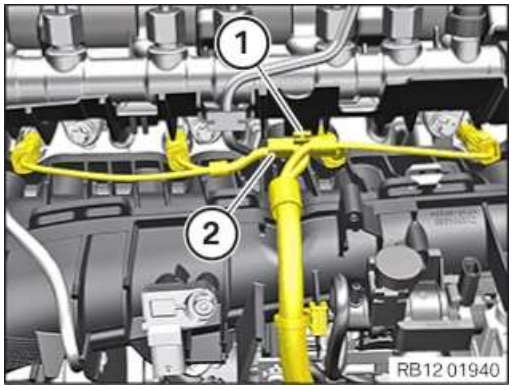
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

NOTICE

The description is for one component only. The procedure is identical for all further components.



- Unlock and release the connector (1) using special tool 0 490 796 (11 1 480).

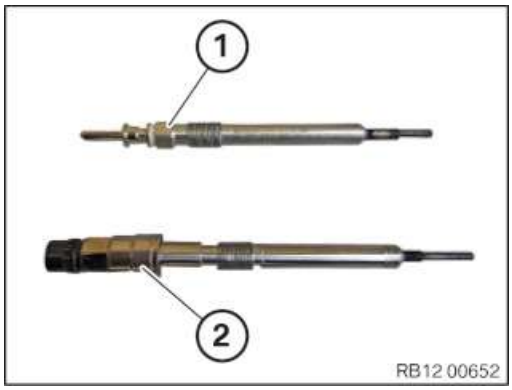


- Loosen clamp (1).
- Remove the wiring harness section (2) and put to one side.



- Unscrew the glow elements with the special tool or conventional tools.

5 – Install all glow elements



TECHNICAL INFORMATION

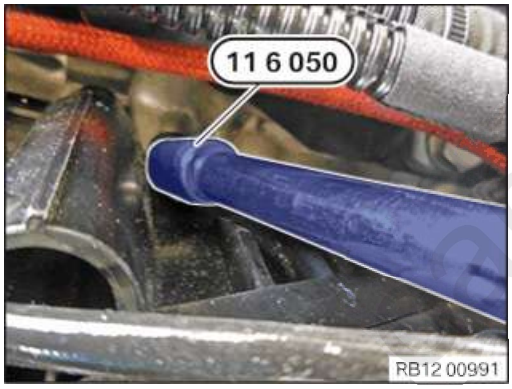
The combustion chamber pressure sensor can and is omitted from a technical point of view.

As an alternative to the combustion chamber pressure sensor, a normal glow element can be installed.

If a glow element is installed as an alternative, the appropriate wiring harness for the glow elements must also be installed.

For more information, see the Electronic Parts Catalogue and other information

- If installed: Install the glow element with **combustion chamber pressure sensor** (2), in the cylinder **2**.
- Install the glow elements (1) in the cylinders **1**, if necessary, **2**, **3** and **4**.



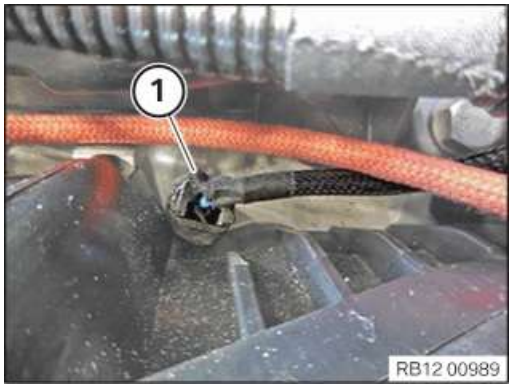
NOTICE

The description is for one component only. The procedure is identical for all further components.

- Screw in and tighten the glow elements with the special tool or conventional tools.

Glow elements to cylinder head

Glow element		Tightening torque	13 Nm

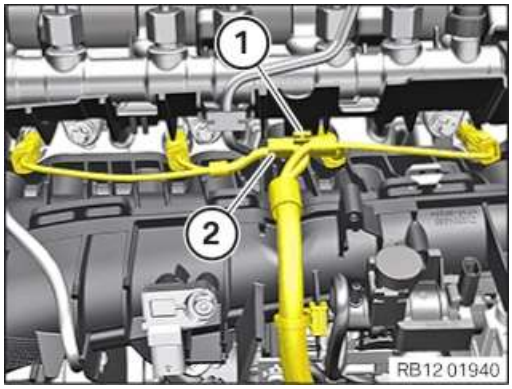


NOTICE

The description is for one component only. The procedure is identical for all further components.

- Connect and lock the connector (1).

  The connector (1) must engage audibly.



- Guide in the wiring harness section (2) and install.
- Secure clamps (1).

▸ When replacing the glow element: Teach in glow elements if necessary

- Teach in glow elements with the diagnosis system.

POSTPROCESSES

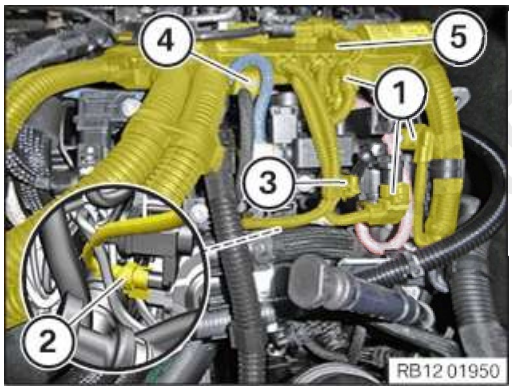
6 – Partially securing the wiring harness section

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



- Guide in the wiring harness section (5) and install.
- Tighten down screw (4).

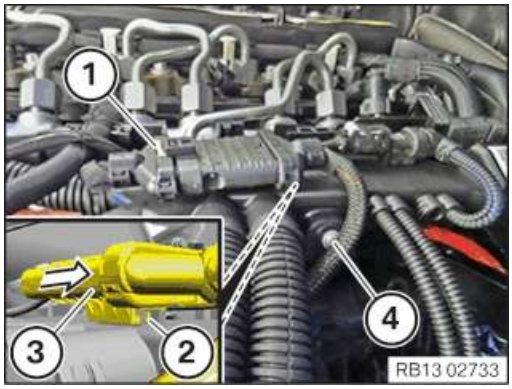
Wiring harness section to manifold

TS5x20		Tightening torque	3,6 Nm

- Secure clamps (3).
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.
- Connect connectors (1) and lock.

  The connectors (1) must engage audibly.



NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

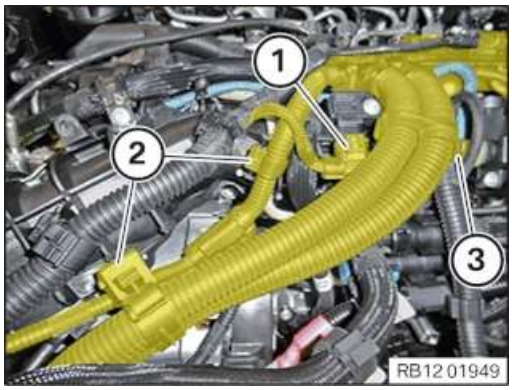
- Tighten down screw (4).

Wiring harness section to manifold

TS5x20		Tightening torque	3,6 Nm

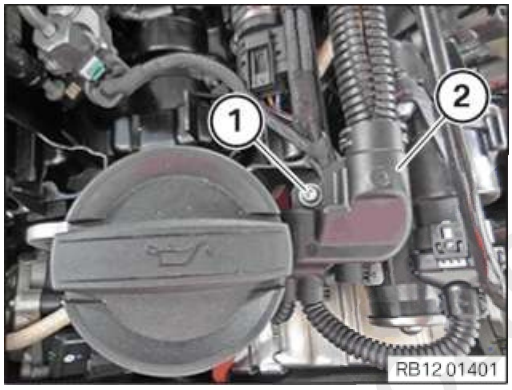
- Feed in and install the connector (3) in the direction of the arrow.
- Ensure that the lock engages audibly (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

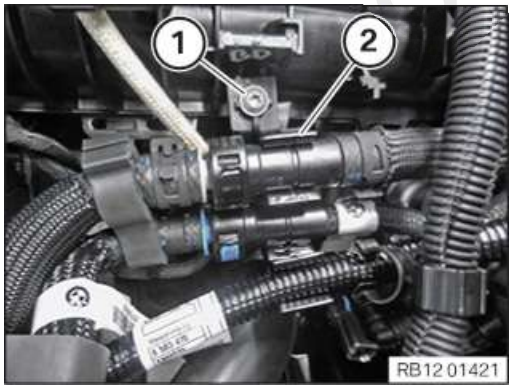
  The connector (1) must engage audibly.



- Guide in the wiring harness section (2) and install.
- Tighten down screw (1).

Wiring harness section to cylinder head cover

TS5x20		Tightening torque	3,6 Nm



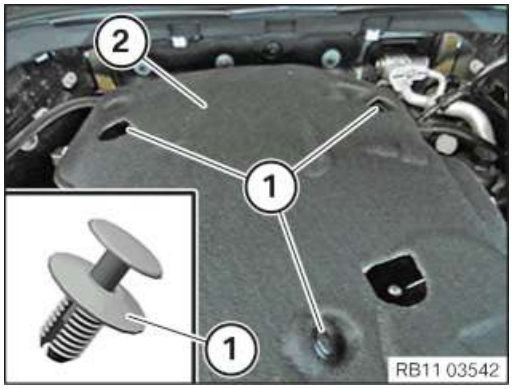
- Insert and install the holder (2).
- Tighten down screw (1).

Holder on intake plenum

TS6X20		Tightening torque	5 Nm

7 – Install the acoustic cover for the injectors

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- Feed the acoustic cover (2) in and install.
- **If installed:** Secure the acoustic cover (2) with the expanding rivets (1) .

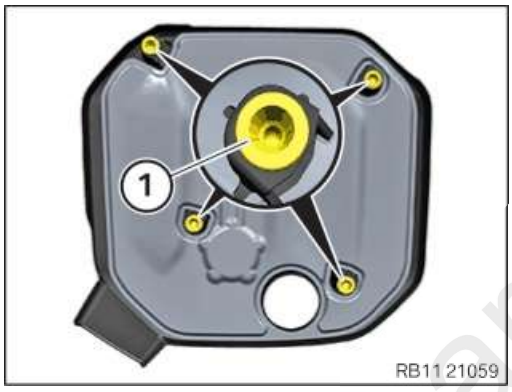
8 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover/design cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover/design cover.

- Disassemble or mount the acoustic cover/design cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover/design cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check the acoustic cover for correct fit of the rubber mounts (1).



- Clip in the acoustic cover (1) into the holders in the indicated areas.

Additional Information

Overview of Tightening Torques

Glow elements to cylinder head Used in step 5

Glow element		Tightening torque	13 Nm

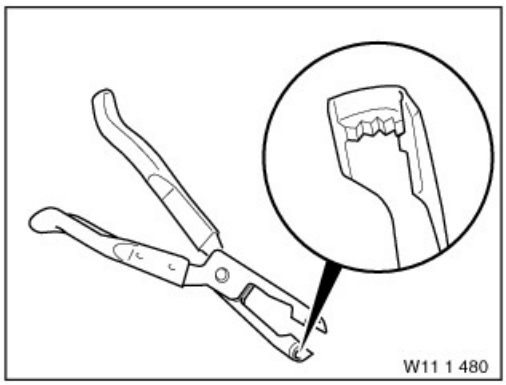
Wiring harness section to manifold			Used in step 6
TS5x20		Tightening torque	3,6 Nm

Wiring harness section to cylinder head cover			Used in step 6
TS5x20		Tightening torque	3,6 Nm

Holder on intake plenum			Used in step 6
TS6X20		Tightening torque	5 Nm

Overview of Special Tools

0 490 796 (11 1 480) Pliers



Common		Used in step 4
Usage	For removing valve stem seal	
Included in the tool or work		
Storage location	A10	
Replaced by		
In connection with		
SI-Number	01 01 93 (621)	

Links

Repair instructions	Used in step
61 35 ... Notes on ESD protection (Electro Static Discharge)	34
61 35 ... Notes on ESD protection (Electro Static Discharge)	34
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12 31 022 Removing and installing starter motor generator

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no charger** is connected to the jump start support point in the engine compartment.
- Detach battery earth lead from battery.
- With auxiliary batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

PRELIMINARY WORK

1 – Deactivating the 48 V electrical system

Prerequisite

Ignition is switched off.

WARNING

Deactivation of the 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no battery charger** is connected to the jump start terminal point in the engine compartment.

- For vehicles with additional electrical systems (48 V electrical system, high-voltage vehicle electrical system), it is mandatory to deactivate them **before** disconnecting the vehicle battery.

WARNING

Deactivation of the 48 V electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no charger** is connected to the jump start support point in the engine compartment.

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RISK OF DAMAGE

Damage to 48-V battery

If a 48-V battery that is disconnected from the electrical system is activated, the battery electronics will be damaged.

- Only carry out activation of the 48V electrical system with a completely connected 48-V battery.

TECHNICAL INFORMATION

Follow notes for 48-V battery. See further information 6120 ... Notes on 48-V battery.



- Deactivate the 48V electrical system by opening the bonnet.

  The deactivation takes place automatically.



Check

TECHNICAL INFORMATION

Zero voltage (48V electrical system is switched off) is displayed only in PAD mode.

- Press the START-STOP button quickly 3 times without stepping on the brake pedal to establish the PAD mode.
- Check isolation from the supply in the instrument cluster in PAD mode.

desired state

- The Check Control message "48V electrical system switched off." (1) is displayed.

Result

» **The absence of voltage** cannot be determined by means of the Check Control message "48V electrical system switched off:" (1). Work is not permitted to be started.

Measure

- Carry out the service function "48 V electrical system deactivation".
  - Vehicle management > Service functions > Voltage supply > Deactivate 48 V electrical system

Only when the Check Control message “48 V electrical system switched off.” (1) is displayed in the instrument cluster is it permitted to disconnect the 12 V battery.

If the absence of voltage is not indicated clearly, contact Technical Support.

Result

» The Check Control message signals that the 48V electrical system has been switched off.

Measure

- Exit PAD mode by pressing the START-STOP button once without depressing the brake pedal.

  The work “Disconnecting the negative battery cable of the 48-V battery” can be started.



- Unlock and disconnect plug connection (1) of the CAN bus.
- Release the clip (2).



- Loosen nut (1).
- Pull off negative battery cable (2) of the 48-V battery from the negative battery terminal, set it aside and secure it.



WARNING

Unprotected battery terminals.

Risk of short circuits! Risk of fire!

- Cover the vehicle battery.

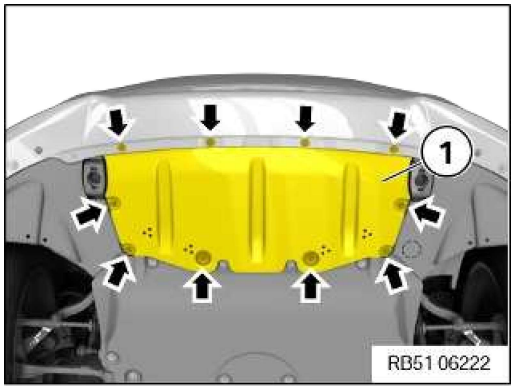
- Cover the vehicle battery with the special tool as shown.
- Position the battery earth lead (1) as shown.

2 – Disconnecting all battery earth leads



- See additional information.

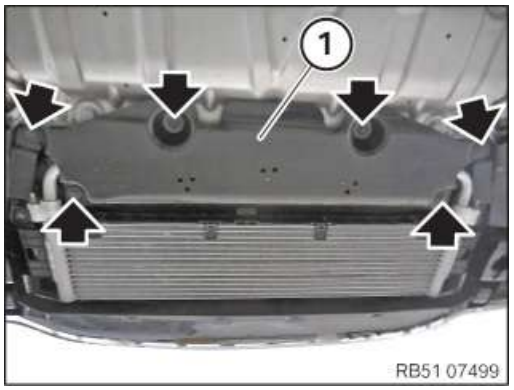
3 – Removing the front underbody protection



- **Version A:**

  Remove screws (arrows).

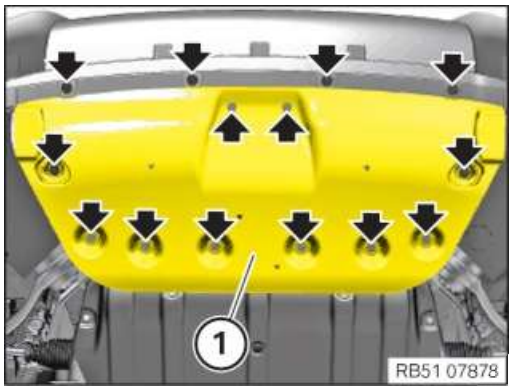
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version B:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

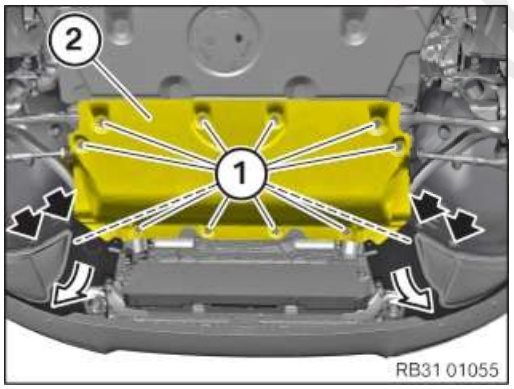


- **Version C:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

4 – Remove the underbody protection of the steering gear



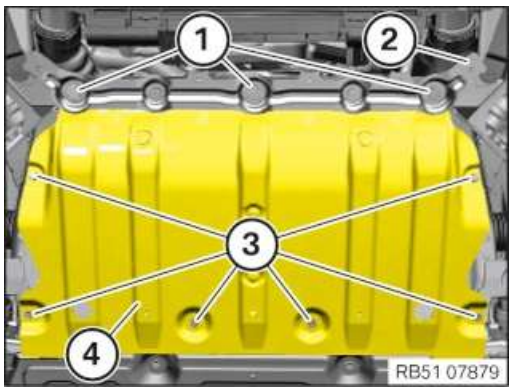
- **Version A:**

  Unscrew the screws (arrows) of the wheel arch cover on the wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove the underbody protection (2) of the steering gear.



- **Version B:**

  Loosen screws (1).

  Remove the holder (2) for the underride protection.

  Loosen screws (3).

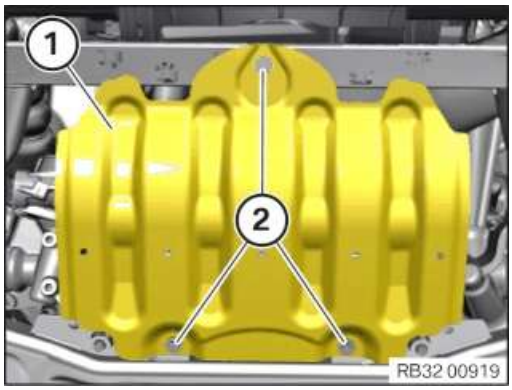
  Feed out and remove the underbody protection (4) of the steering gear.

5 – If installed: Removing the steering underbody protection

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Prerequisite

Front underbody protection has been removed.



- Loosen screws (2).
- Remove underbody protection (1).

6 – Removing the acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover/design cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover/design cover.

- Disassemble or mount the acoustic cover/design cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover/design cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the indicated area towards the top.

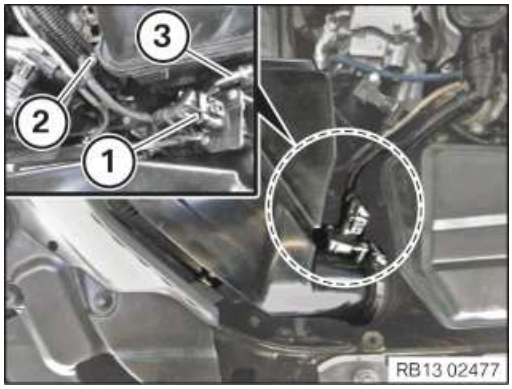
7 – Removing the clean air pipe with the resonator

WARNING

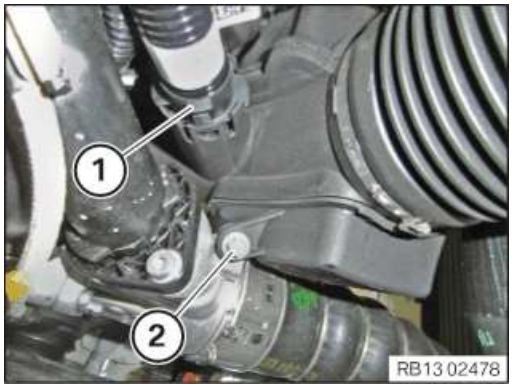
Hot surfaces.

Risk of burning!

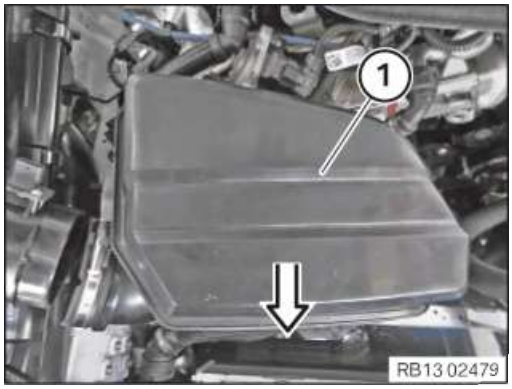
- Perform all work only on components that have cooled down.



- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Unlock engine ventilation line (1), disconnect it and place it aside.
- Loosen screw (2).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Unlock and loosen clamp (1).



- Feed out and remove clean air pipe with resonator (1) in the direction of the arrow.

8 – Draining the coolant from the high-temperature cooling system

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WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

CAUTION

Materials harmful to health.

Contact with fluids harmful to health!

- Note and follow safety information on containers.
- Conduct all work in appropriate personal protective equipment only.

TECHNICAL INFORMATION

Life-long fill of coolant!

Do not reuse used coolant.

When replacing and removing components which rely on the corrosion protection effect of the coolant, it is essential to change the coolant. The cooling system must therefore be emptied and refilled.

In the case of other removal work involving the draining of part quantities of coolant, the coolant level must be topped up with new coolant.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Loosen sealing cap (1).

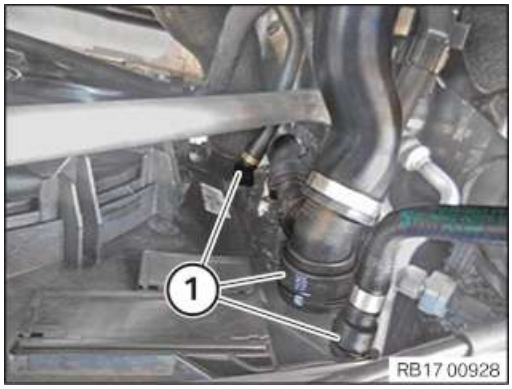
▸ **Avoiding damage to the starter generator due to escaping coolant**

RISK OF DAMAGE

Escaping coolant on the starter generator.

Damage and operating failure of the starter generator.

- Cover the starter generator with suitable, watertight auxiliary materials.
- Close off line connections with seal plugs.
- If necessary: Flush the leaked coolant from the starter generator with at least 1 l water.



NOTICE

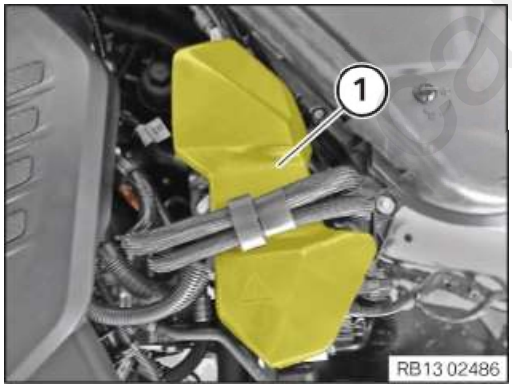
Schematic diagram is for example purposes. Some parts may differ in certain details.

- Unlock all coolant lines (1) and detach.
- Catch and dispose of escaping coolant.



- Unlock and loosen coolant line (1).
- Catch and dispose of escaping coolant.

9 – Remove the cover for the DDE control unit



- Pull off, guide out and remove cover (1) upwards.

10 – Remove DDE control unit

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 ... Notes for ESD protection (electrostatic discharge)

TECHNICAL INFORMATION

In a warranty case, you must always provide a fault memory printout with the defective part, even if the fault memory does not contain an entry.

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.

For additional information see: 12 00 ... Notes on removal and installation of control units

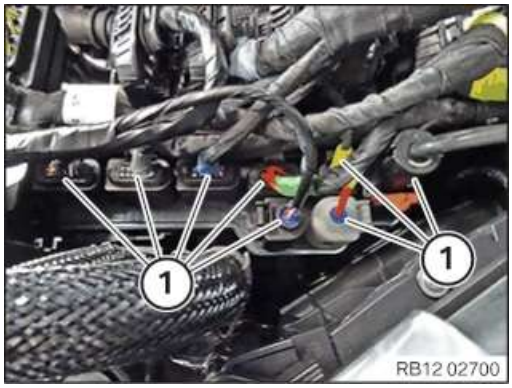
TECHNICAL INFORMATION

Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.

TECHNICAL INFORMATION

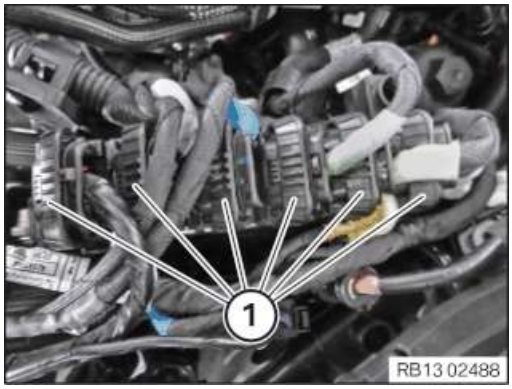
Control unit must be programmed after it is replaced.

For additional information see: 61 00 ... Programming/encoding control unit(s)

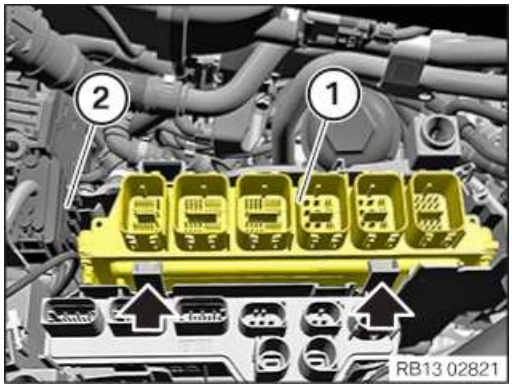


- Unlock plug connections (1) and disconnect.

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- Unlock and disconnect plug connections (1).



- Release the latch mechanisms (arrows).
- Ensure that the plug connection is (2) not damaged.
- Feed out the DDE control unit (1) **carefully** and remove.

11 – Removing the integrated supply module (PDM) partially

Prerequisite

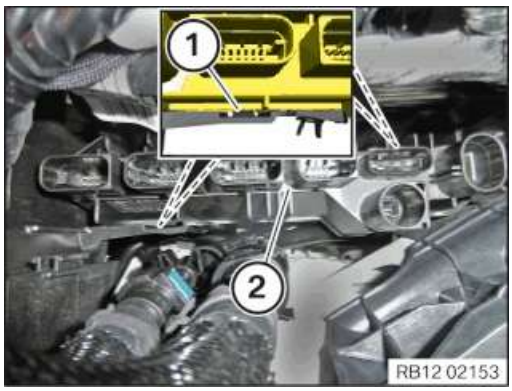
Engine control unit is removed.

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 ... Notes for ESD protection (electrostatic discharge)



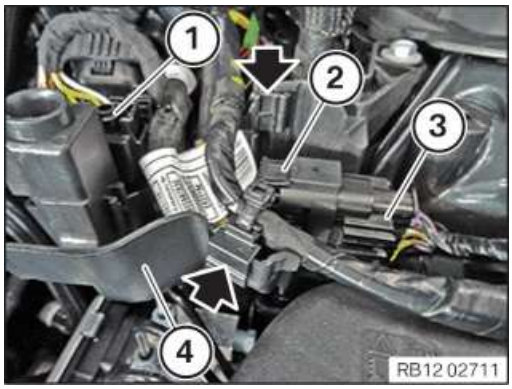
- Loosen the latch mechanisms (1).
- Feed out and remove the integrated supply module (PDM) (2) upwards.

12 – Removing the control unit holder

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TECHNICAL INFORMATION

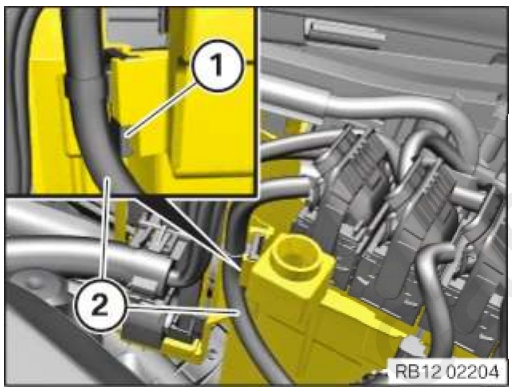
The number of connectors on the described component may vary depending on the equipment specification.
If necessary, unlock all other connectors and disconnect or connect and lock respectively.



- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Release the connector (3) and disconnect from the control unit holder (4).
- Release the clamps (arrows).



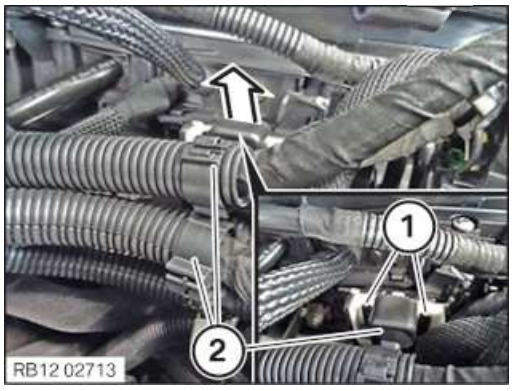
- Unlock plug connection (1) and disconnect.



- Unlock and loosen the cable clip (1).
- Remove the wiring harness section (2) and put to one side.

NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

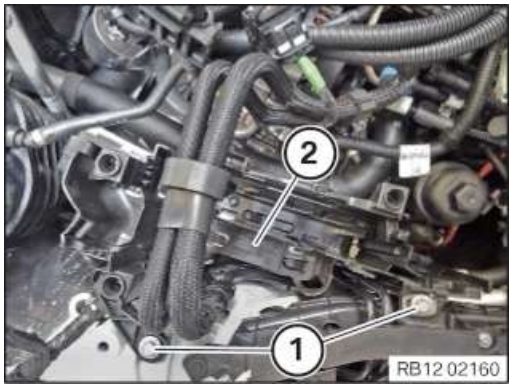


- Unlock the locks (1) .
- Guide out the cable clip (2) in the direction of arrow and set aside.

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- Unlock the lock (arrow).
- Feed out the cable clip (1) upwards and set it aside.



- Loosen screws (1).
- Guide out and remove the control unit holder (2).

13 – Releasing the wiring harness section with the starter generator lines partially

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

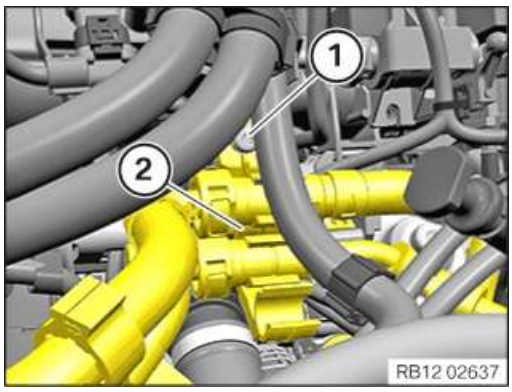
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 ... Notes for ESD protection (electrostatic discharge)

RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

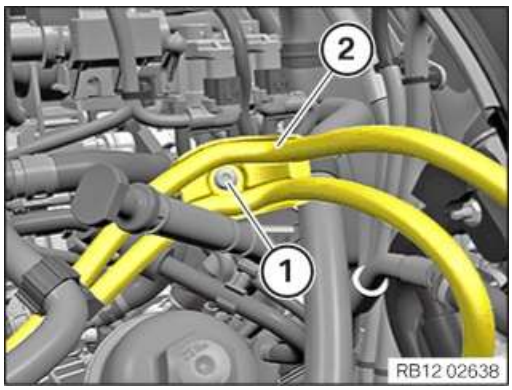


- Release the screw (1).
- Guide out fuel lines (2) and set them aside.

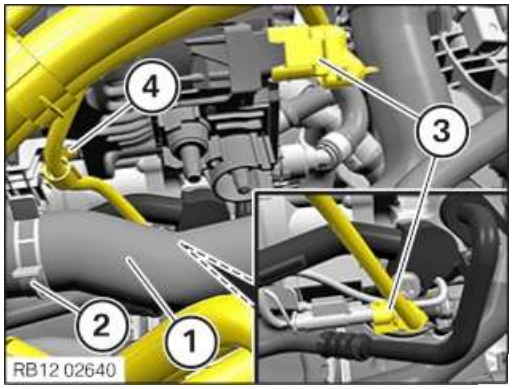
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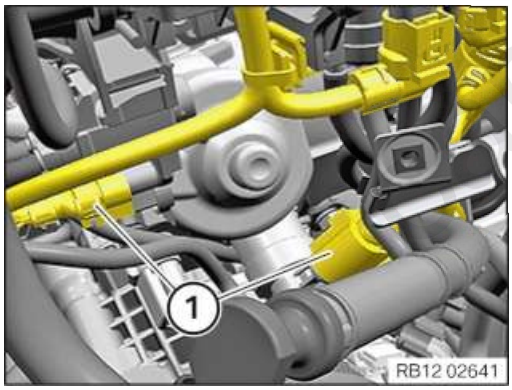
- Guide out and remove the lid (1).
- Release the nuts (2) and (3).
- Feed out positive battery cables (4) and place to one side.
- Loosen clamp (5).
- Thread out holder (2) and set aside.



- Release the screw (1).
- Guide out the positive battery cables (2) and set them aside.



- Release the coolant line (1) from the holder (2) .
- Unlock plug connections (3) and disconnect.
- Loosen clamp (4).



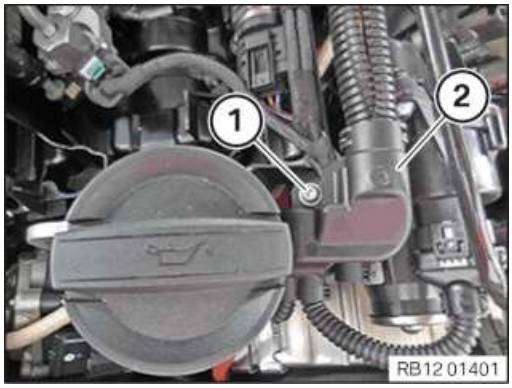
- Unlock and disconnect plug connections (1).



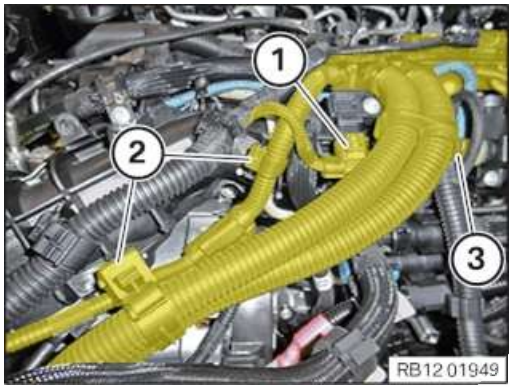
- Unlock and loosen connector (1).



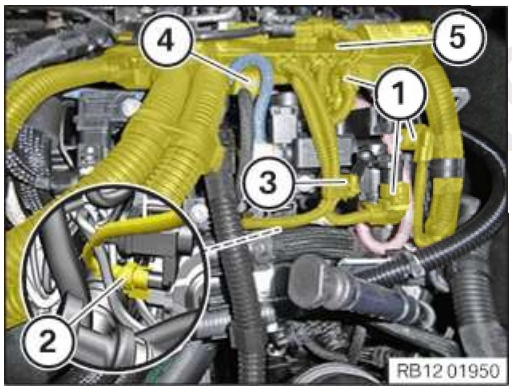
- Unlock plug connection (1) and disconnect.



- Loosen screw (1).
- Remove the wiring harness section (2) and put to one side.



- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Loosen clamp (3).



- Unlock and disconnect the plug connection (1).
- Unlock and disconnect the plug connection (2).
- Loosen clamp (3).
- Loosen screw (4).
- Guide out wiring harness section (5) as far as possible and set it aside.

14 – Removing the throttle body

WARNING

Hot surfaces.

Risk of burning!

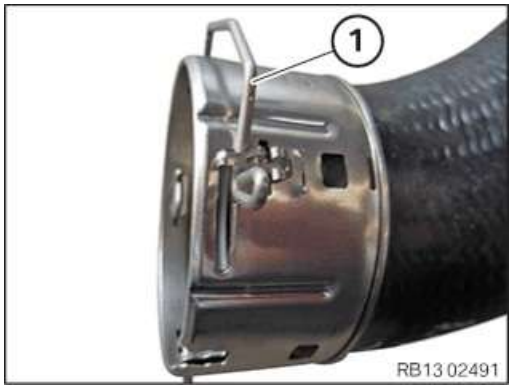
- Perform all work only on components that have cooled down.

RISK OF DAMAGE

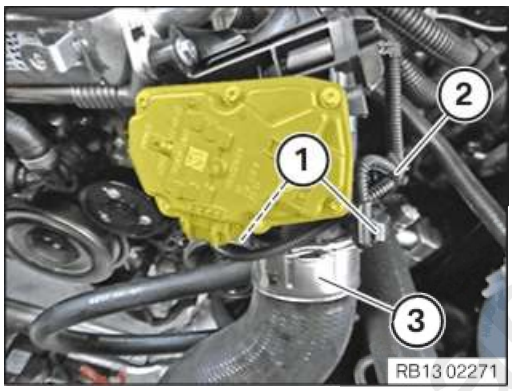
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 ... Notes for ESD protection (electrostatic discharge)



- Unlock clamp (1) and engage in this position.

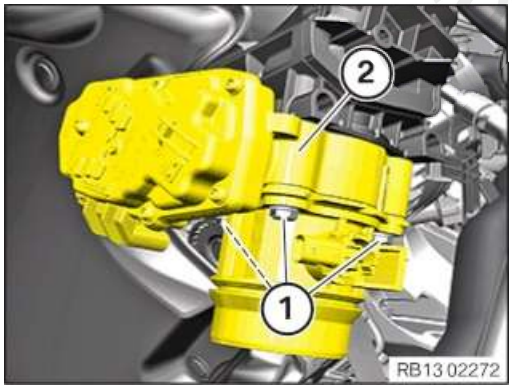


- Unlock and disconnect plug connections (1).

NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

- Loosen clamp (2).
- Unlock and disconnect the pressure pipe (3).



- Loosen screws (1).
- Remove throttle body (2).

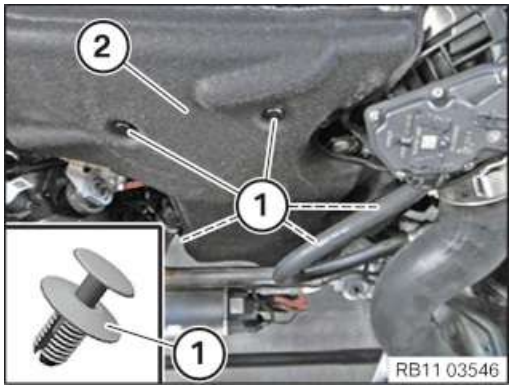
15 – Remove acoustic cover of the front engine

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.



- Release and remove expanding rivet (1).
- Guide the acoustic cover (2) out and remove.

16 – Removing the drive belt for the starter motor generator

CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

CAUTION

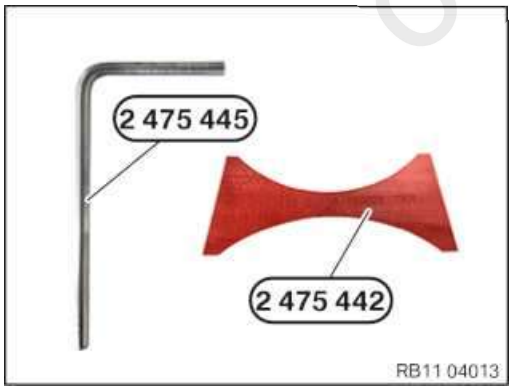
Component with preload.

Danger of injury!

- Reduce preload as far as possible before disassembly. Relieve component.

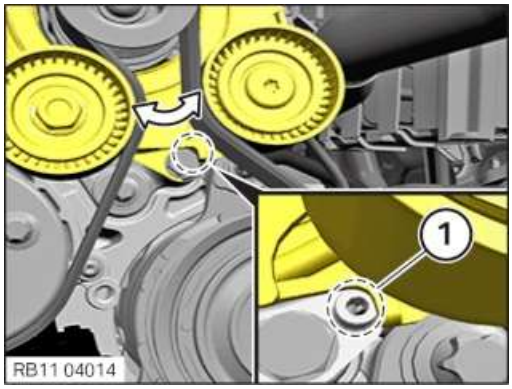
TECHNICAL INFORMATION

The drive belt must be replaced if contaminated with coolant- and oil residues.

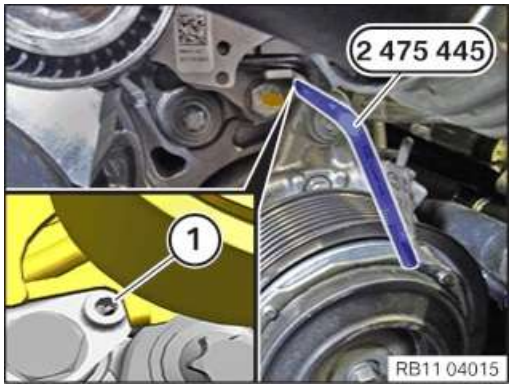


- Prepare the special tool 2 475 442 and the special tool 2 475 445.

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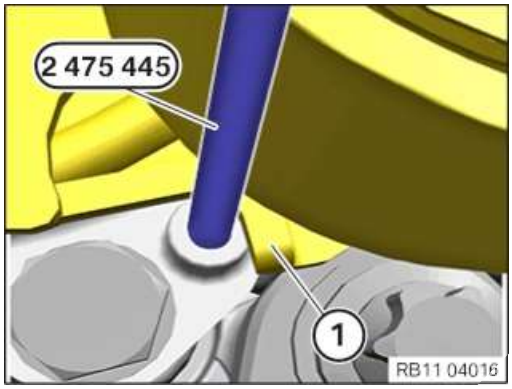


- Position the belt tensioner in the direction of the arrow so that the bore hole is visible in the area (1).

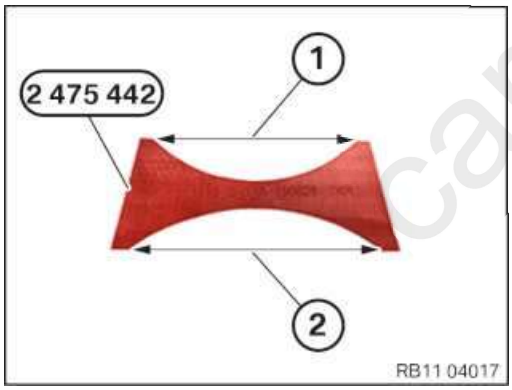


- Guide in the special tool 2 475 445 and install it in the bore hole (1).

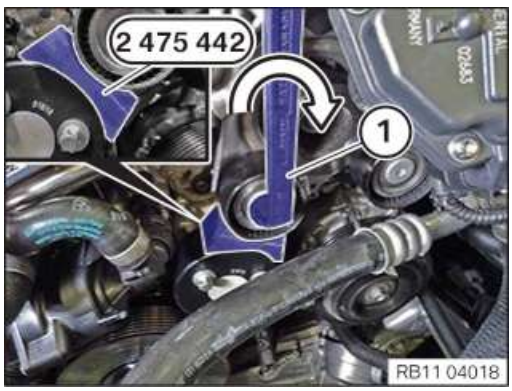
  The special tool 2 475 445 must rest against the starter motor generator.



- Ensure that the belt tensioner (1) is supported on the special tool 2 475 445.



- Ensure that the radius (1) of the special tool 2 475 442 supports the tensioning pulley of the belt tensioner.
- Ensure that the radius (2) of the special tool 2 475 442 is supported on the belt pulley of the coolant pump.

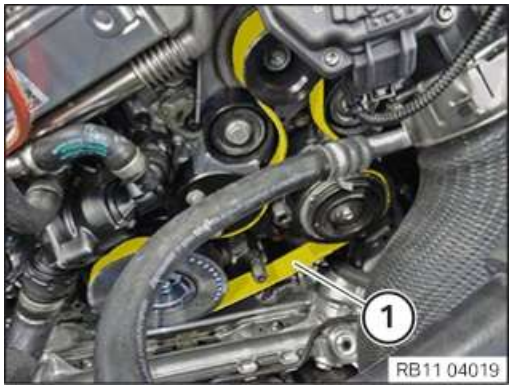


TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

- Twist the tensioning pulley (1) in the direction of the arrow.
- Guide in and install the special tool 2 475 442 between the belt pulley of the coolant pump and the tensioning pulley.

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TECHNICAL INFORMATION

If the drive belt is reused: Mark direction of travel and reinstall drive belt in same direction of travel.

- Guide out and remove the drive belt (1) for the starter motor generator.

MAIN WORK

17 – Removing the starter motor generator

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no charger** is connected to the jump start support point in the engine compartment.
- Detach battery earth lead from battery.
- With auxiliary batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 ... Notes for ESD protection (electrostatic discharge)

▸ **Avoiding damage to the starter generator due to escaping coolant**

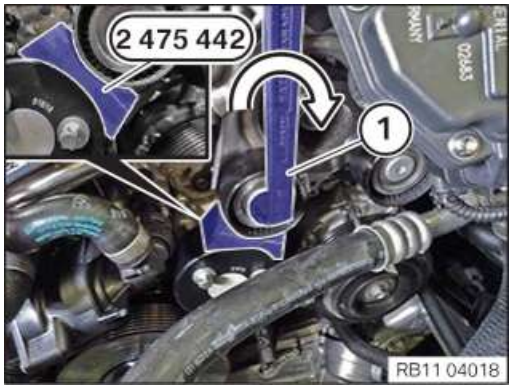
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RISK OF DAMAGE

Escaping coolant on the starter generator.

Damage and operating failure of the starter generator.

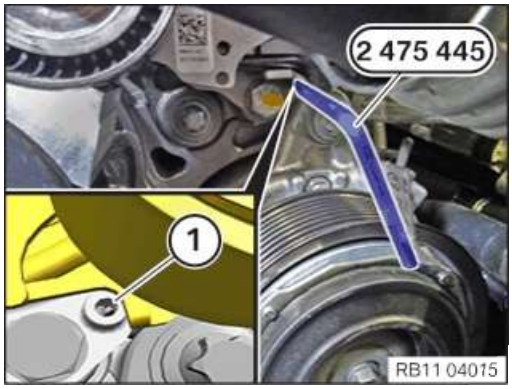
- Cover the starter generator with suitable, watertight auxiliary materials.
- Close off line connections with seal plugs.
- If necessary: Flush the leaked coolant from the starter generator with at least 1 l water.



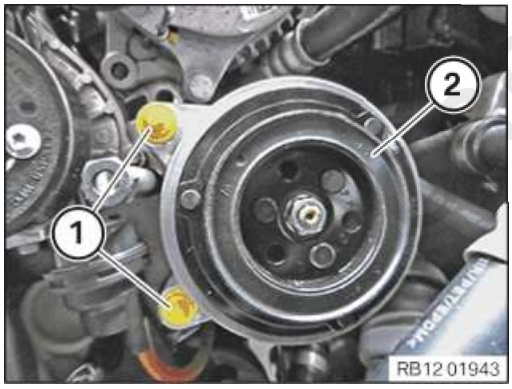
TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

- Twist the tensioning pulley (1) in the direction of the arrow.
- Feed out the special tool 2 475 442 between the belt pulley of the coolant pump and the tensioning pulley and remove it.



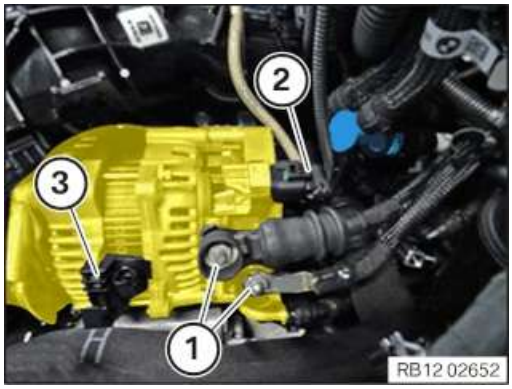
- Feed out the special tool 2 475 445 from the bore hole (1) and remove it.



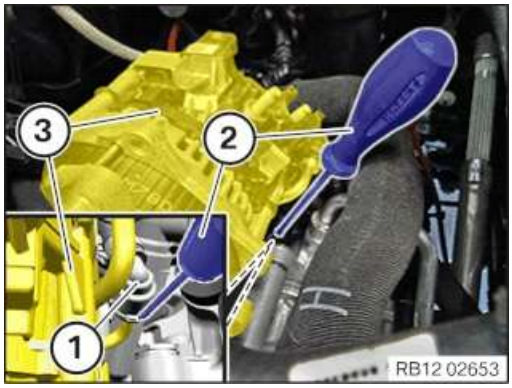
- Loosen screws (1).
- Slide the air conditioning compressor (2) out and set it aside.



- Guide out and remove the lid (1).



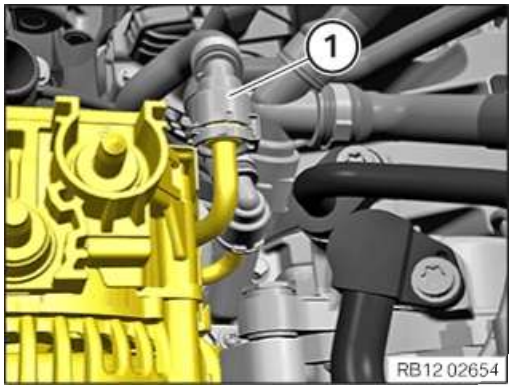
- Release nuts (1).
- Unlock plug connection (2) and disconnect.
- Loosen the holder (3).



TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

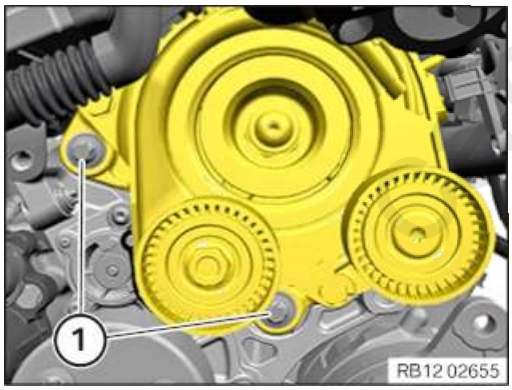
- Unlock and pull off the coolant line (1) with a screwdriver (2).
- Catch and dispose of escaping coolant.



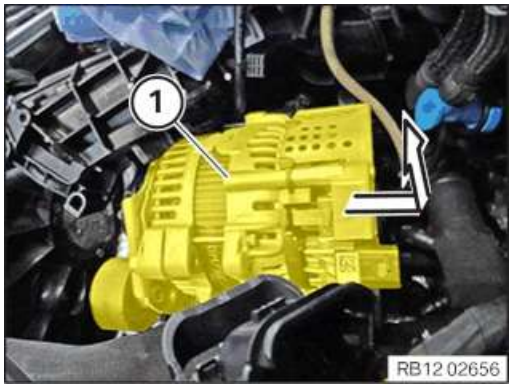
TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

- Unlock and remove the coolant line (1).
- Catch and dispose of escaping coolant.



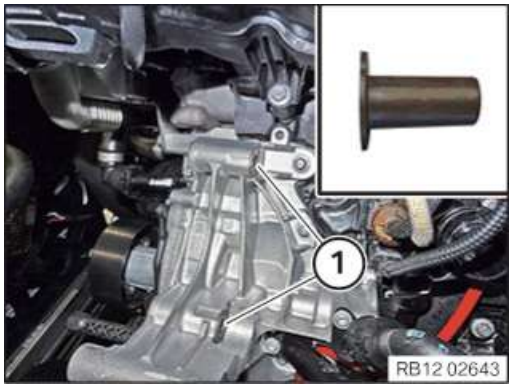
- Loosen screws (1).



- Feed out and remove the starter motor generator (1) in the direction of arrow.

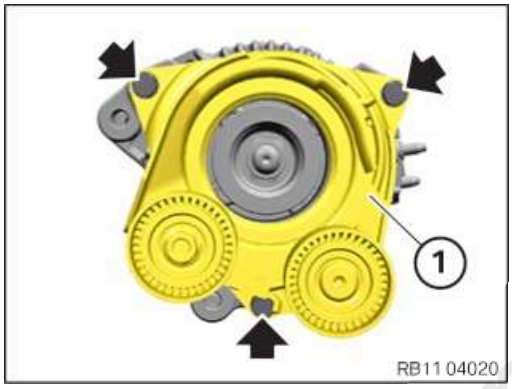


- Feed out and remove the bush (1).

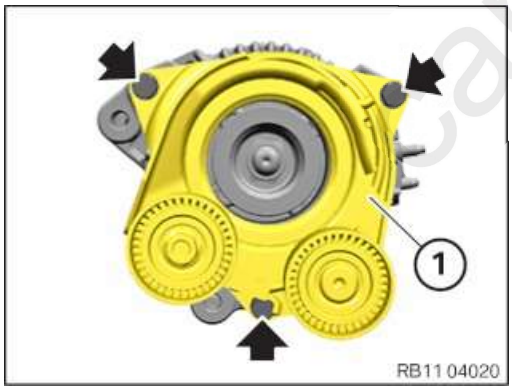


- Feed out and remove the bush (1).

18 – For starter generator replacement: Remounting the belt tensioner of the starter generator



- Remove screws (arrows).
- Feed out the belt tensioner (1) at the starter generator and remove.



- Feed in and install the belt tensioner (1) on the starter generator.
- Tighten screws (arrows).

Belt tensioner to alternator/starter generator

M8X30		Tightening torque	28 Nm

19 – Installing the starter motor generator

CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

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RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.

▸ **Avoiding damage to the starter generator due to escaping coolant**

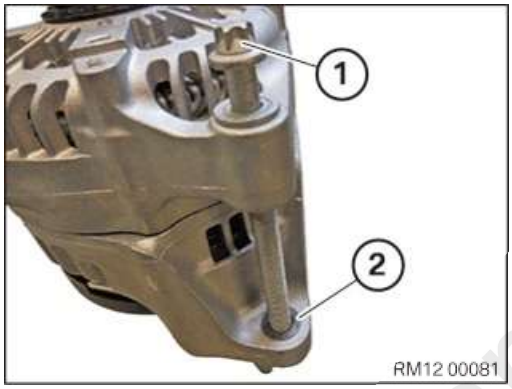
RISK OF DAMAGE

Escaping coolant on the starter generator.

Damage and operating failure of the starter generator.

- Cover the starter generator with suitable, watertight auxiliary materials.
- Close off line connections with seal plugs.
- If necessary: Flush the leaked coolant from the starter generator with at least 1 l water.

▸ **Prepare for the installation of the alternator**



- Screw the screw (1) into the threaded support sleeve (2).
- Slightly press back the threaded support sleeve (2) using the bolt (1).
- Once again unscrew the screw (1) from the threaded support sleeve (2).



- Renew the bushes (1).

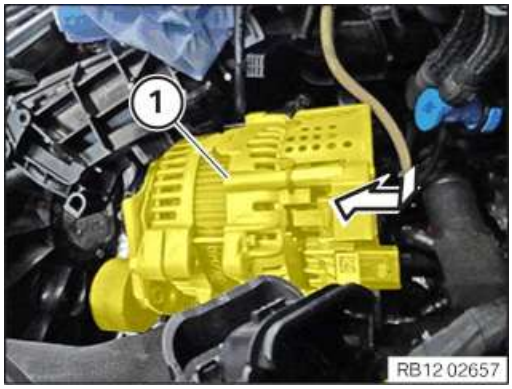
  Parts: Bushes
- Guide in and install the bushes (1).



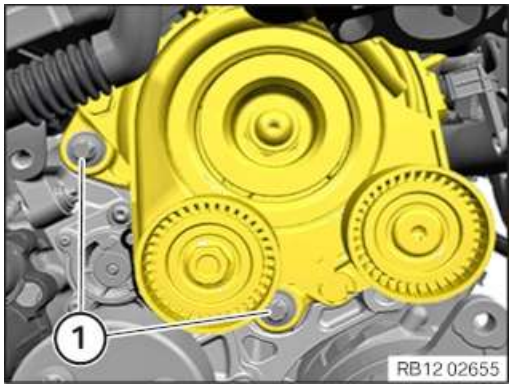
- Renew the bushes (1).

  Parts: Bushes
- Guide in and install the bushes (1).

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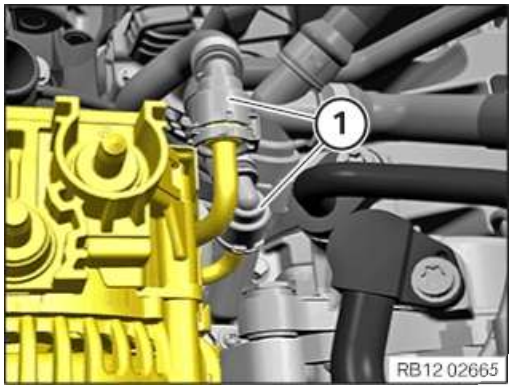
- Guide in and install the starter motor generator (1) in the direction of the arrow.



- Tighten the screws (1).

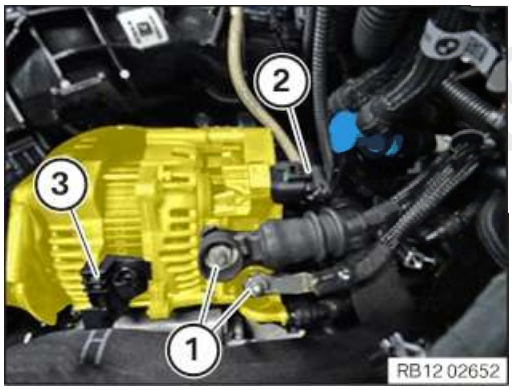
Alternator to component carrier

M10x75		Tightening torque	38 Nm
M10x125		Tightening torque	38 Nm
M10x90		Tightening torque	38 Nm



- Connect and lock the coolant lines (1).

  The coolant lines (1) must engage audibly.



- Fasten the holder (3).
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.
- Renew nuts (1).

  Parts: Nuts
- Tighten nuts (1).

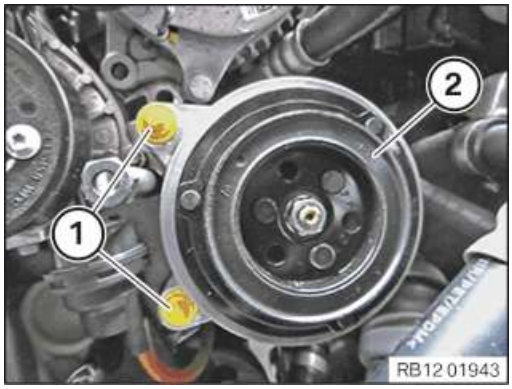
Battery positive lead on the starter motor generator

M8		Tightening torque	19 Nm



- Guide in and install the lid (1).

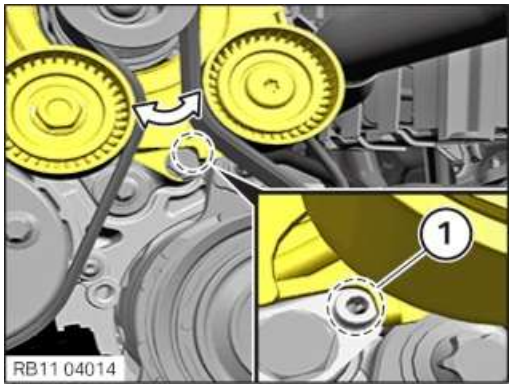
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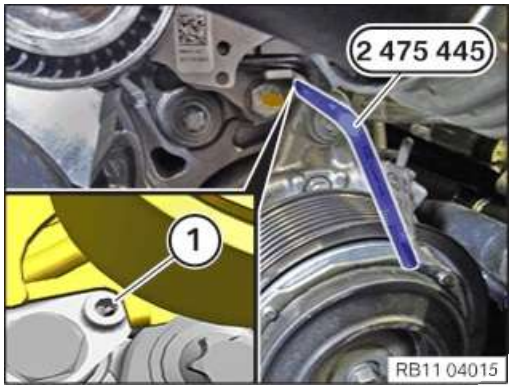
- Insert and install the air conditioning compressor (2).
- Tighten the screws (1).

Air conditioning compressor in component carrier

M10		Tightening torque	38 Nm



- Position the belt tensioner so that the bore hole is visible in the area (1).

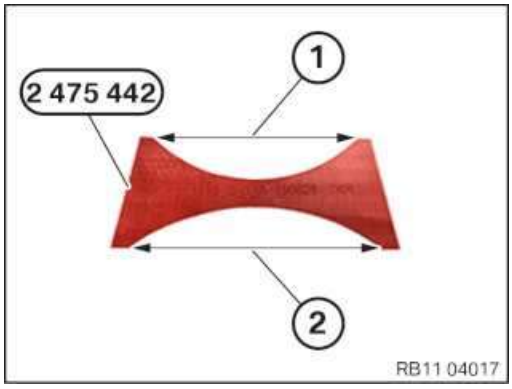


- Guide in the special tool 2 475 445 and install it in the bore hole (1).

  The special tool 2 475 445 must rest against the starter motor generator.

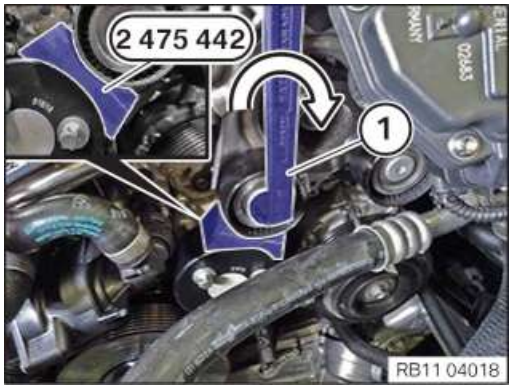


- The belt tensioner (1) must be supported on the special tool 2 475 445.



- The radius (1) of the special tool 2 475 442 supports the tensioning pulley of the belt tensioner.
- The radius (2) of the special tool 2 475 442 is supported on the belt pulley of the coolant pump.

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TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

- Twist the tensioning pulley (1) in the direction of the arrow.
- Guide in and install the special tool 2 475 442 between the belt pulley of the coolant pump and the tensioning pulley.

POSTPROCESSES

20 – Installing the drive belt for the starter motor generator

CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

CAUTION

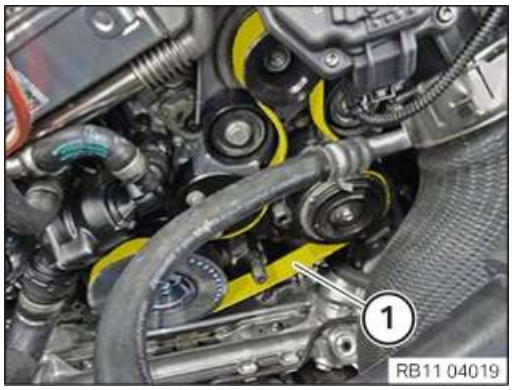
Component with preload.

Danger of injury!

- Reduce preload as far as possible before disassembly. Relieve component.

TECHNICAL INFORMATION

The drive belt must be replaced if contaminated with coolant- and oil residues.

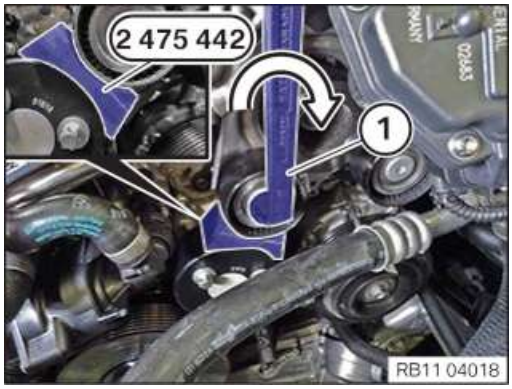


TECHNICAL INFORMATION

If the drive belt is reused: Mark direction of travel and reinstall drive belt in same direction of travel.

- Feed in and install the drive belt (1) for the starter motor generator.

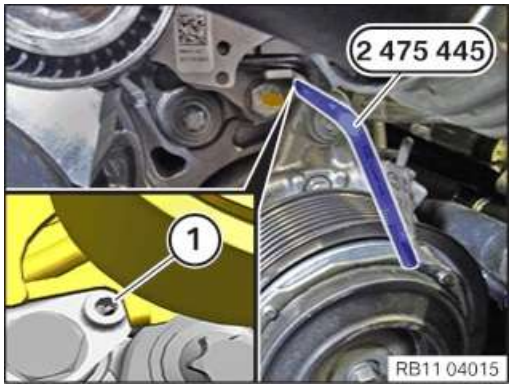
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TECHNICAL INFORMATION

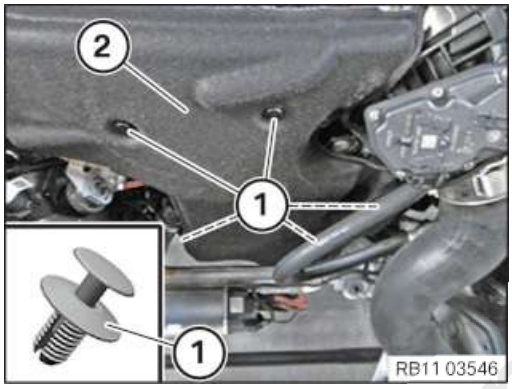
Conduct the following operation with the assistance of a second person.

- Turn the tensioning pulley in (1) in the direction of arrow.
- Feed out the special tool 2 475 442 between the belt pulley of the coolant pump and the tensioning pulley and remove it.



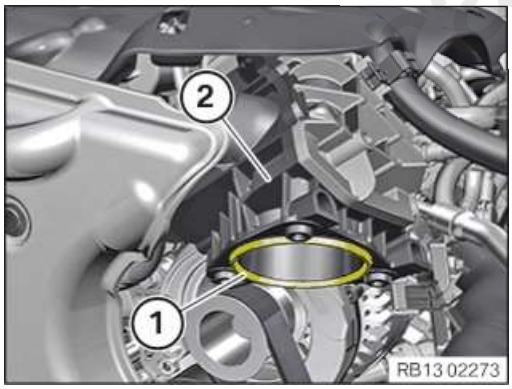
- Feed out the special tool 2 475 445 from the bore hole (1) and remove it.

21 – Install acoustic cover for the engine, front



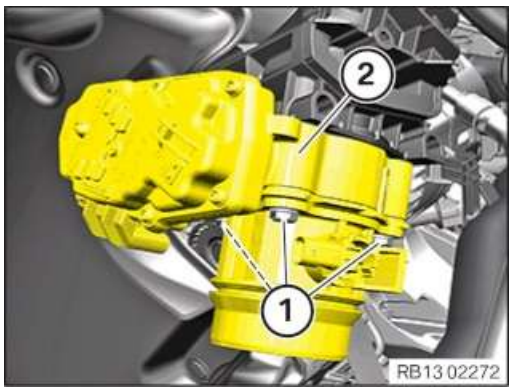
- Feed the acoustic cover (2) in and install.
- Secure the acoustic cover (2) with the expanding rivets (1).

22 – Installing the throttle body



- Renew the sealing ring (1) on the intake plenum .

  Parts: Sealing ring



- Feed in and install the throttle body (2).
- Tighten the screws (1).

Throttle body to intake plenum

6x50		Tightening torque	8 Nm

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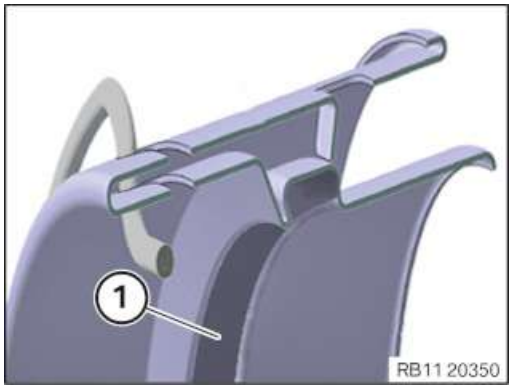


- Check the seal (1) for damage, renew if necessary.

▸ **Replacing damaged seal**

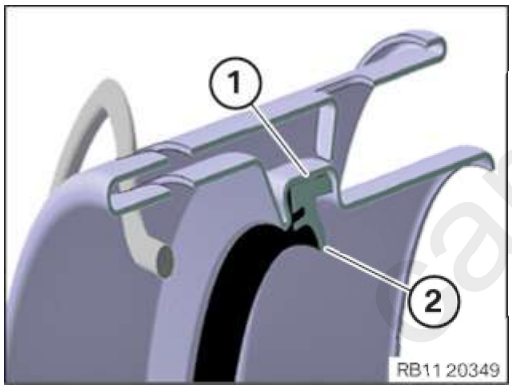
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



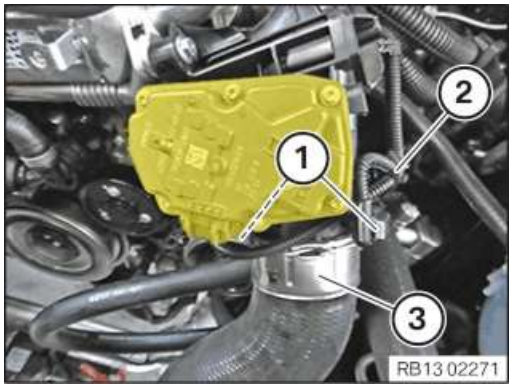
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is directed inwards as shown.



- Connect the pressure pipe (3) and lock.

  The pressure pipe (3) must engage audibly.

NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

- Secure clamps (2).
- Connect connectors (1) and lock.

  The connectors (1) must engage audibly.

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- Lock clamp (1).

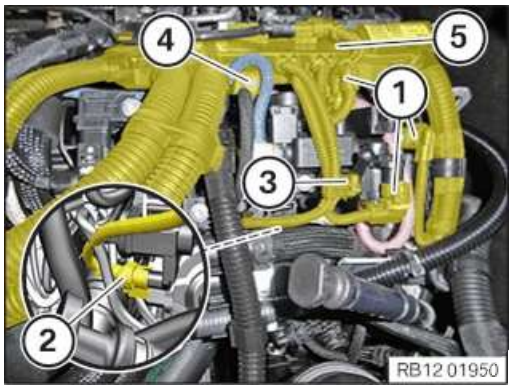
23 – Partially securing the wiring harness section with the starter generator cables

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



- Guide in the wiring harness section (5) and install.
- Tighten down screw (4).

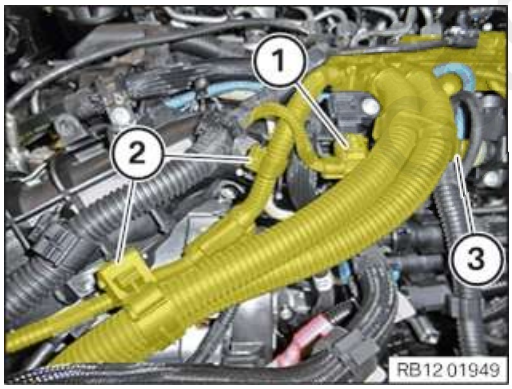
Wiring harness section to manifold

TS5x20		Tightening torque	3,6 Nm

- Secure clamps (3).
- Connect connectors (2) and lock.

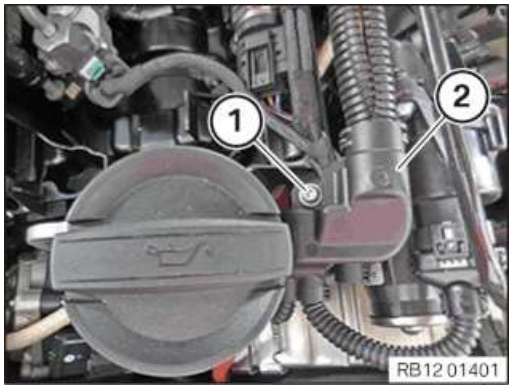
  The connector (2) must engage audibly.
- Connect connectors (1) and lock.

  The connectors (1) must engage audibly.



- Secure clamps (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Guide in the wiring harness section (2) and install.
- Tighten down screw (1).

Wiring harness section to cylinder head cover

TS5x20		Tightening torque	3,6 Nm

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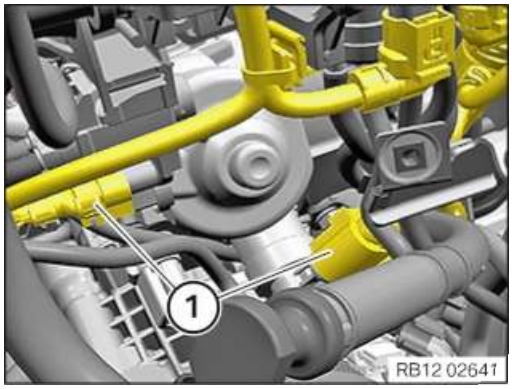
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



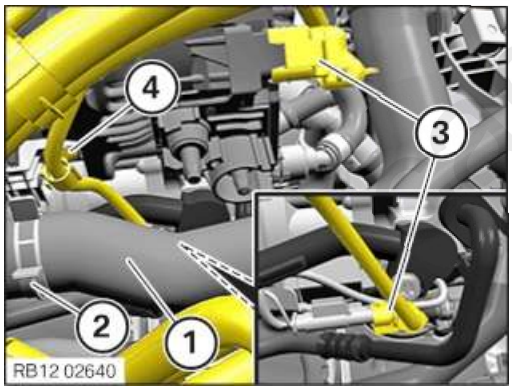
- Connect the connector (1) and lock it.

  The connector (1) must engage audibly.



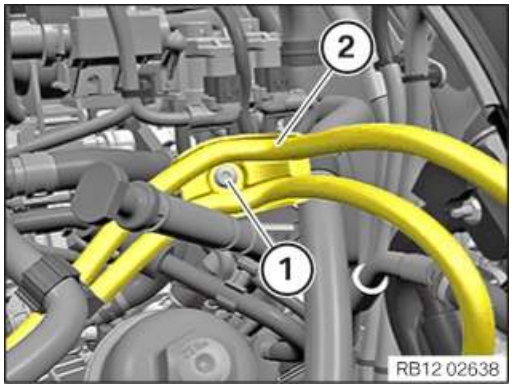
- Connect connectors (1) and lock.

  The connectors (1) must engage audibly.



- Secure the clamp (4).
- Connect connectors (3) and lock.

  The connectors (3) must engage audibly.
- Feed the coolant line (1) into the holder (2) and install it.



- Feed in and position the positive battery cables (2) .
- Tighten down screw (1).

Standard screw connection M6

M6		Tightening torque	8 Nm

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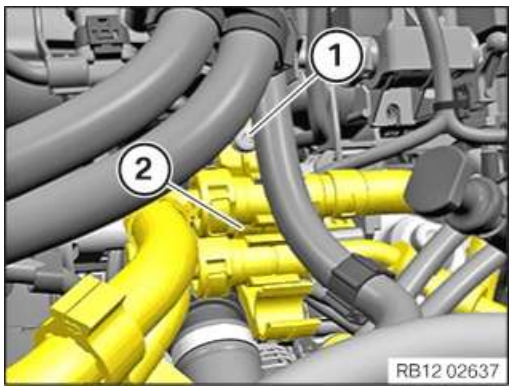


- Feed in and install the positive battery cable (4).
- Feed in and position the positive battery cables (4) .
- Renew the nuts (3) and (2).

  Parts: Nuts
- Tighten nuts (3) and (2).

Battery positive lead on the starter motor generator

M8		Tightening torque	19 Nm



- Guide in and install the lid (1).
- Insert and install the holder (2).
- Tighten down screw (1).

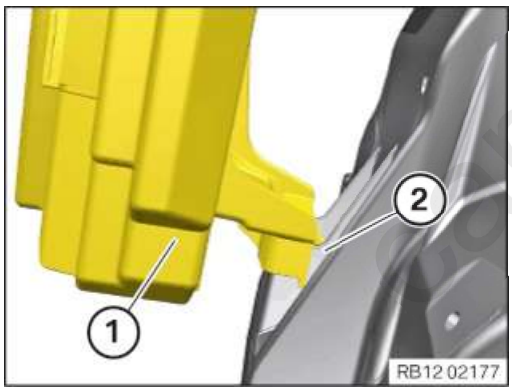
Holder on intake plenum

TS6X20		Tightening torque	5 Nm

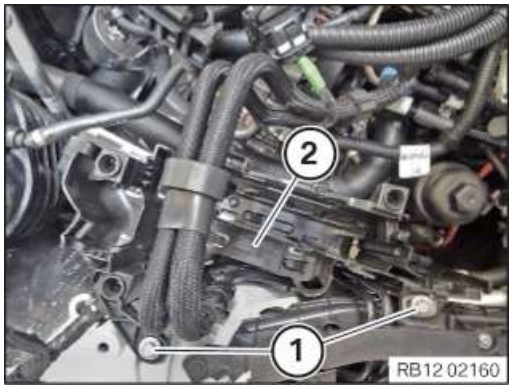
24 – Installing the control unit holder

TECHNICAL INFORMATION

The number of connectors on the described component may vary depending on the equipment specification.
If necessary, unlock all other connectors and disconnect or connect and lock respectively.



- Make sure the bottom control unit holder (1) is inserted correctly into the fixture (2).



- Guide in and install control unit holder (2).
- Tighten the screws (1).

Control unit holder

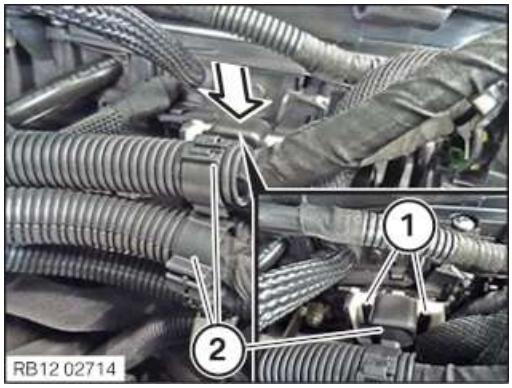
M6		Tightening torque	8 Nm

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- Feed in and install the cable clip (1).

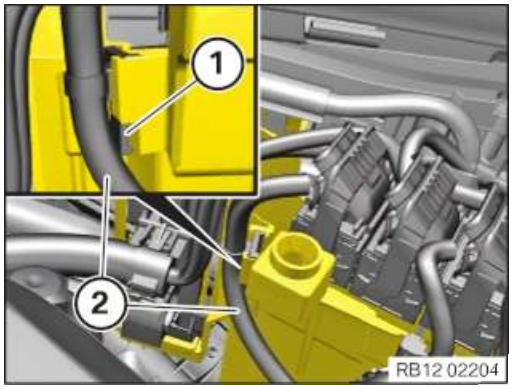
  Lock (arrow) must audibly engage.



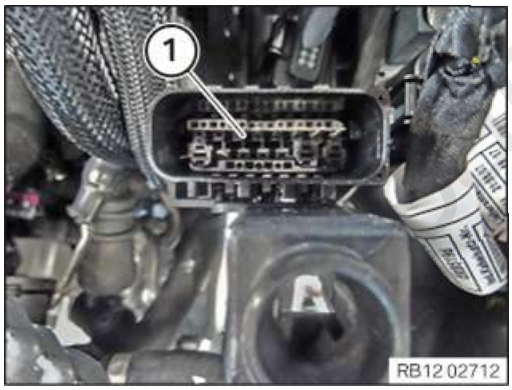
NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

- Guide in cable clip (2) in the direction of the arrow and install it.
- Ensure that the locks (1)engage audibly.

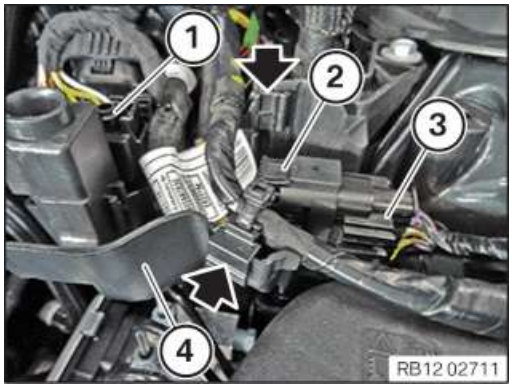


- Guide in the wiring harness section (2) and install.
- Connect and lock the cable clip (1).



- Feed in and install the connector (1).

  The connector (1) must engage audibly.



- Connect connector (3) to control unit holder (4) and lock it.

  The connector (3) must engage audibly.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.
- Connect connectors (1) and lock.

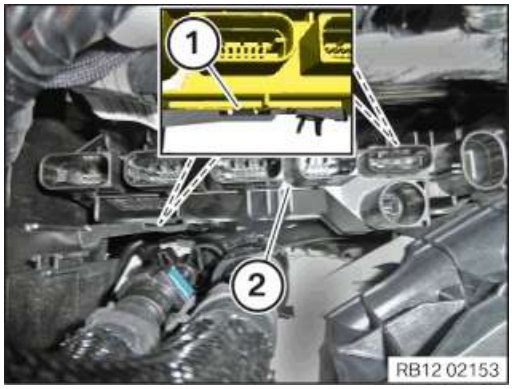
  The connector (1) must engage audibly.
- Secure the clamps (arrows).

25 – Installing the integrated supply module (PDM) partially

Prerequisite

Engine control unit has been removed.

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- Insert and install the integrated supply module (PDM) (2).

  The latch mechanisms (1) must engage audibly.

26 – Install DDE control unit

TECHNICAL INFORMATION

If the DDE control unit or an injector has been replaced, it will also be necessary to carry out injection quantity compensation. The adjustment value (7-position letter/number code) is engraved on each injector.

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.

For additional information see: 12 00 ... Notes on removal and installation of control units

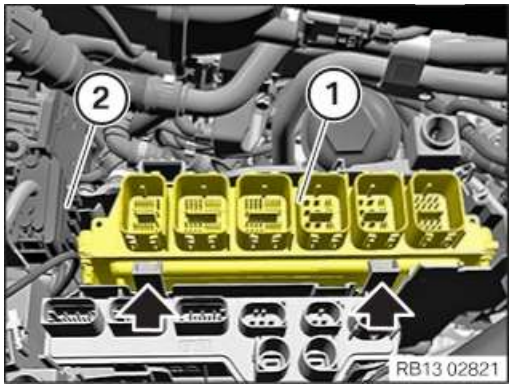
TECHNICAL INFORMATION

Control unit must be programmed after it is replaced.

For additional information see: 61 00 ... Programming/encoding control unit(s)

TECHNICAL INFORMATION

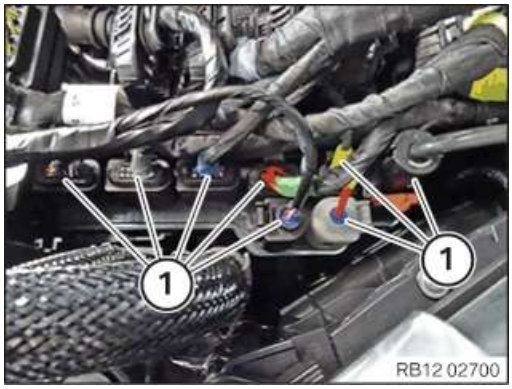
Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.



- Make sure that the plug connection (2) does not get damaged.
- Insert the DDE control unit (1) **carefully** and install it.

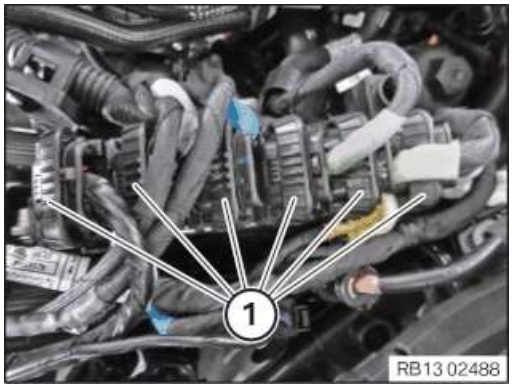
  The latch mechanisms (arrows) must engage audibly.

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- Connect connectors (1) and lock.

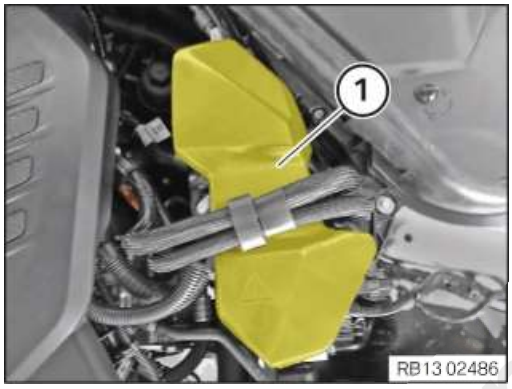
  The connectors (1) must engage audibly.



- Connect connectors (1) and lock.

  The connectors (1) must engage audibly.

27 – Install the cover for the DDE control unit

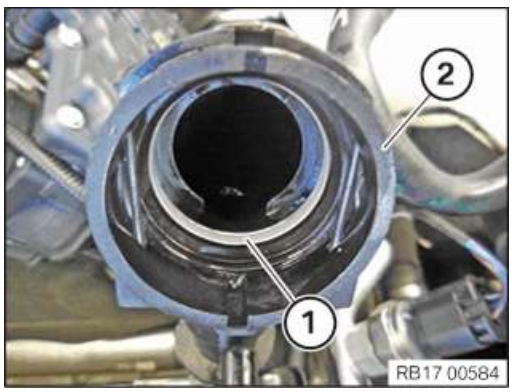


- Insert and install cover (1) into guides.

28 – Connecting the coolant lines

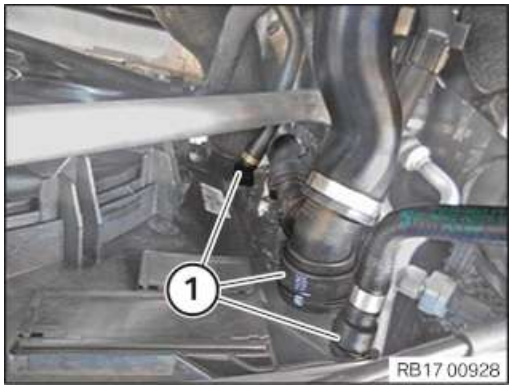
TECHNICAL INFORMATION

Make sure that the connections are locked correctly. The locks must engage audibly.



- Check the sealing ring (1) of the coolant line (2) for damage and renew where required.

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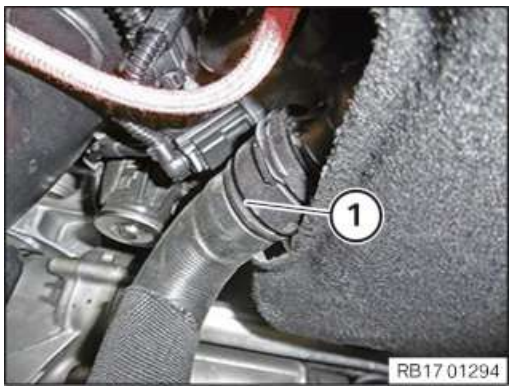


NOTICE

Schematic diagram is for example purposes. Some parts may differ in certain details.

- Connect and lock the coolant lines (1).

  The coolant lines (1) must engage audibly.



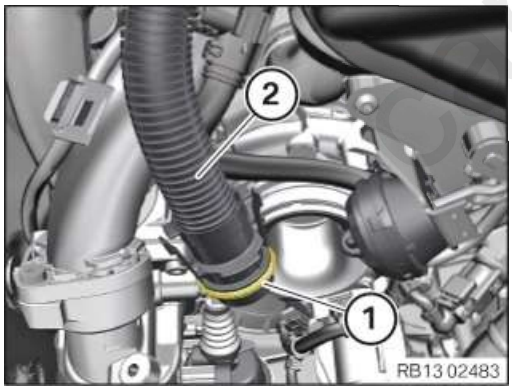
- Connect and lock coolant line (1).

  The coolant line (1) must audibly engage.

29 – Installing the clean air pipe with resonator



- Check the sealing ring (1) on the exhaust turbocharger for damage and renew if necessary.

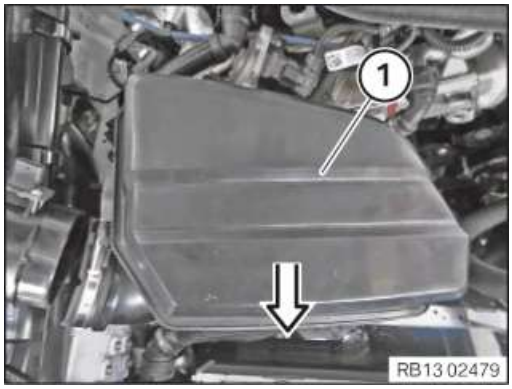


- Check the sealing ring (1) for the engine ventilation line (2) for damage and renew where required.



- Feed in and install clean air pipe with resonator (1) in the direction of the arrow.

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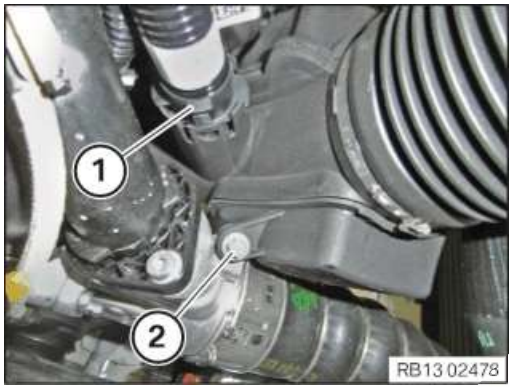


- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Attach and lock the clamp (1).

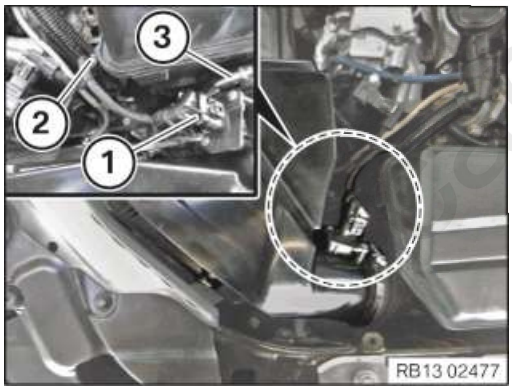
  The clamp (1) must engage audibly.



- Tighten down screw (2).

Clean air pipe to exhaust turbocharger

M6X20		Tightening torque	8 Nm



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

30 – Install acoustic cover

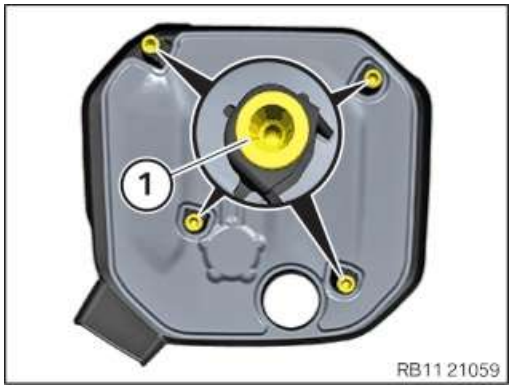
RISK OF DAMAGE

Damage to the acoustic cover/design cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover/design cover.

- Disassemble or mount the acoustic cover/design cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover/design cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.

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- Check the acoustic cover for correct fit of the rubber mounts (1).



- Clip in the acoustic cover (1) into the holders in the indicated areas.

31 – Connecting all battery earth leads



- See additional information.

32 – Activating the 48 V electrical system

Prerequisite

Ignition is switched off.

RISK OF DAMAGE

Damage to 48-V battery

If a 48-V battery that is disconnected from the electrical system is activated, the battery electronics will be damaged.

- Only carry out activation of the 48V electrical system with a completely connected 48-V battery.

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- Lift battery earth lead (1).
- Remove special tool .



- Release the negative battery cable (2) of the 48-V battery from the mounting.
- Position the negative battery cable (2) of the 48-V battery on the negative battery terminal.
- Tighten nut (1).

Negative battery cable to 48-V battery

Nut M8		Tightening torque	19 Nm



- Connect the connector (1) of the CAN bus and lock it.
- Clip in clip (2).



- Activate the 48V electrical system by closing the bonnet.
  The activation takes place automatically.

33 – Filling and bleed the high-temperature coolant circuit



TECHNICAL INFORMATION

It is **mandatory** to fill the cooling system before bleeding.
Fill **both** the circuits for high and low-temperature coolant circuits.

- See additional information.

34 – For starter generator replacement: Programming the starter generator to the latest I level or resetting the

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statistical data

TECHNICAL INFORMATION

Use the most recent software version to prevent faults during programming/encoding.
The battery voltage must not fall below 13.0 V during programming.
Use only chargers for a low volt-vehicle electrical system that are recommended by BMW.

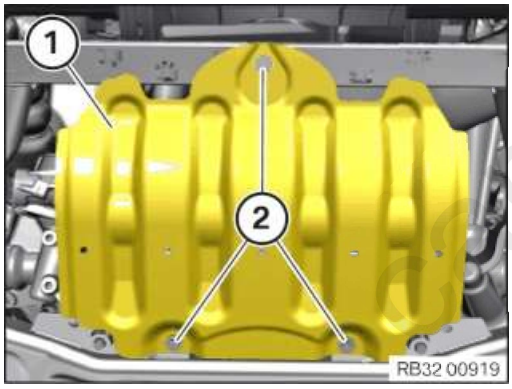


- Connect the battery charger to the vehicle.
- Connect the programming system with the vehicle.
- **Program the starter generator.**
  - Power train
  - Digital Diesel Electronics (DDE)
  - Power supply, vehicle electrical system
  - Starter motor generator 48 volts (SGR48)
  - Starter motor generator 48 volts (SGR48)
- **Reset starter generator statistics data.**
  - Power train
  - Digital Diesel Electronics (DDE)
  - Reset generator statistical data

35 – If installed: Install underbody protection of the steering

Prerequisite

Front underbody protection has been removed.



- Position underbody protection (1).
- Tighten the screws (2).

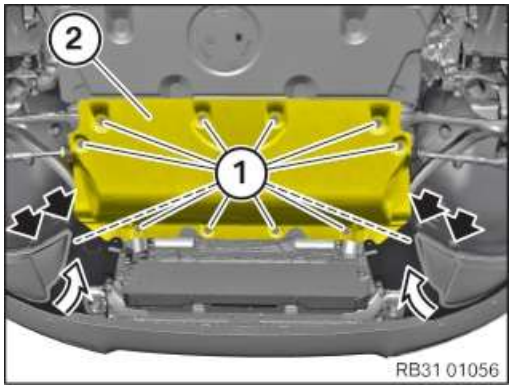
Underbody protection, steering, to front axle support

Multi-purpose boltM10		Tightening torque	56 Nm

Underbody protection, steering, to front axle support

Hexagon bolt M6		Tightening torque	8 Nm

36 – Install the underbody protection of the steering gear



- **Version A:**

  Position the underbody protection (2) of the steering gear.

  Tighten the screws (1).

Underbody protection of the steering gear

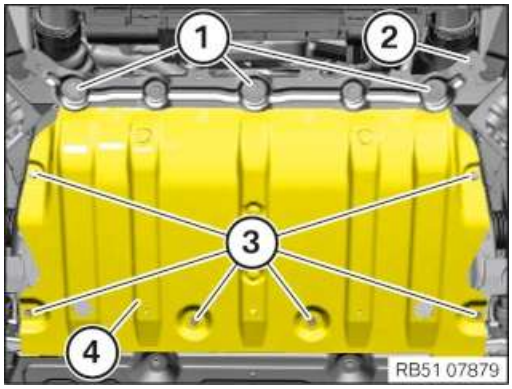
Hexagon screw for thermoplastic		Tightening torque	2.6 Nm
Hexagon bolt M6x20		Tightening torque	8 Nm

- Position the bottom wheel arch cover.

  Tighten the screws (arrows) of the lower wheel arch cover on the wheel arch cover.

Wheel arch trim panel, front

Thermoplastic hexagon screw		Tightening torque	2,6 Nm



- **Version B:**

  Feed in the underbody protection (4) of steering gear and install it.

  Tighten the screws (3).

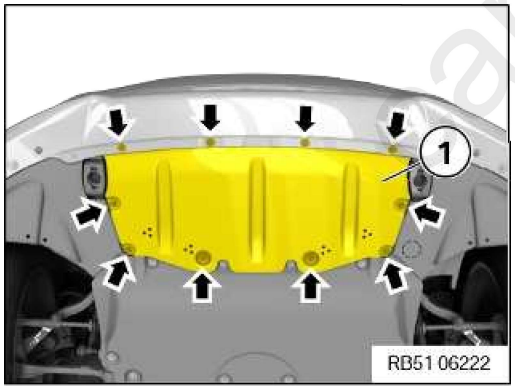
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	2.6 Nm
Hexagon bolt M6x20		Tightening torque	8 Nm

- Position the holder (2) for the underride protection.

  Tighten the screws (1).

37 – Installing the front underbody protection



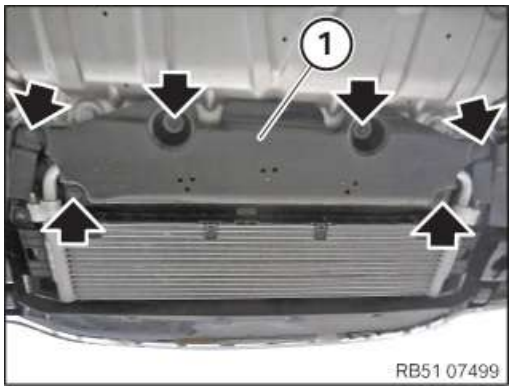
- **Version A:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version B:**

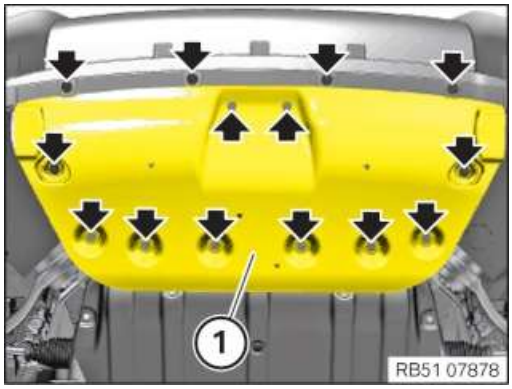
  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

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- **Version C:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Additional Information

Overview of Tightening Torques

Belt tensioner to alternator/starter generator — Used in step 18

M8X30		Tightening torque	28 Nm

Alternator to component carrier — Used in step 19

M10x75		Tightening torque	38 Nm
M10x125		Tightening torque	38 Nm
M10x90		Tightening torque	38 Nm

Battery positive lead on the starter motor generator — Used in step 1923

M8		Tightening torque	19 Nm

Air conditioning compressor in component carrier — Used in step 19

M10		Tightening torque	38 Nm

Throttle body to intake plenum — Used in step 22

6x50		Tightening torque	8 Nm

Wiring harness section to manifold — Used in step 23

TS5x20		Tightening torque	3,6 Nm

Wiring harness section to cylinder head cover — Used in step 23

TS5x20		Tightening torque	3,6 Nm

Standard screw connection M6 — Used in step 23

M6		Tightening torque	8 Nm

Holder on intake plenum — Used in step 23

TS6X20		Tightening torque	5 Nm

Control unit holder — Used in step 24

M6		Tightening torque	8 Nm

Clean air pipe to exhaust turbocharger — Used in step 29

M6X20		Tightening torque	8 Nm

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Clean air pipe to upper section of intake filter housing			Used in step 29
Clamp		Tightening torque	3 Nm

Negative battery cable to 48-V battery			Used in step 32
Nut M8		Tightening torque	19 Nm

Underbody protection, steering, to front axle support			Used in step 35
Multi-purpose boltM10		Tightening torque	56 Nm

Underbody protection, steering, to front axle support			Used in step 35
Hexagon bolt M6		Tightening torque	8 Nm

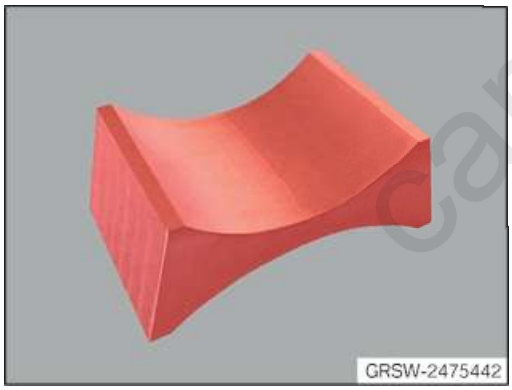
Underbody protection of the steering gear			Used in step 36
Hexagon screw for thermoplastic		Tightening torque	2.6 Nm
Hexagon bolt M6x20		Tightening torque	8 Nm

Wheel arch trim panel, front			Used in step 36
Thermoplastic hexagon screw		Tightening torque	2,6 Nm

Underbody protection front			Used in step 37
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Overview of Special Tools

2 475 442 Removal and installation tool



Common	Used in step 16171920
Usage	For removing and installing the drive belt of the ancillary components.
Included in the tool or work	
Storage location	A8
Replaced by	
In connection with	83302475445
SI-Number	01 19 19 (668)

2 475 445 Pin



Common	Used in step 16171920
Usage	Tool for drive belt of 48 V ancillary components
Included in the tool or work	
Storage location	A8
Replaced by	
In connection with	83302475442 83302475444
SI-Number	01 19 19 (668)

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Links

Repair instructions (PRE)	Used in step
Notes on 48-V battery	132

General repair instructions	Used in step
12 00 ... Instructions for removal and replacement of control units	1026

Repair instructions	Used in step
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	231
61 20 900 Disconnecting and connecting battery earth lead	231
61 20 900 Disconnecting and connecting battery earth lead	231
61 20 900 Disconnecting and connecting battery earth lead	231
61 20 900 Disconnecting and connecting battery earth lead	231
61 20 900 Disconnecting and connecting battery earth lead	231
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61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	231
61 20 900 Disconnecting and connecting battery earth lead	231
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	231
61 20 900 Disconnecting and connecting battery earth lead (Plug-in Hybrid Electric Vehicle)	231
61 20 900 Disconnecting and connecting battery earth lead	231
61 20 900 Disconnecting and connecting battery earth lead	231
61 20 900 Disconnecting and connecting battery earth lead	231
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61 20 900 Disconnecting and connecting battery earth lead 231
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12 31 020 Removing and installing/replacing alternator

PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Removing the acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover/design cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover/design cover.

- Disassemble or mount the acoustic cover/design cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover/design cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the indicated area towards the top.

3 – Removing the throttle body

WARNING

Hot surfaces.

Risk of burning!

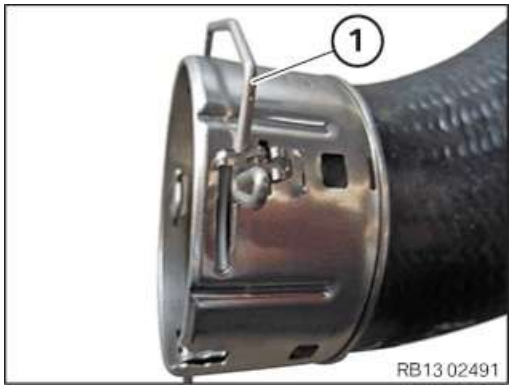
- Perform all work only on components that have cooled down.

RISK OF DAMAGE

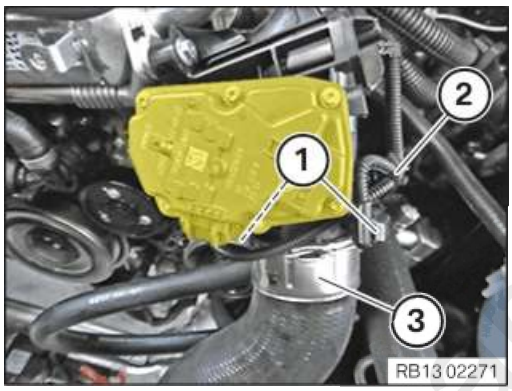
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 ... Notes for ESD protection (electrostatic discharge)



- Unlock clamp (1) and engage in this position.

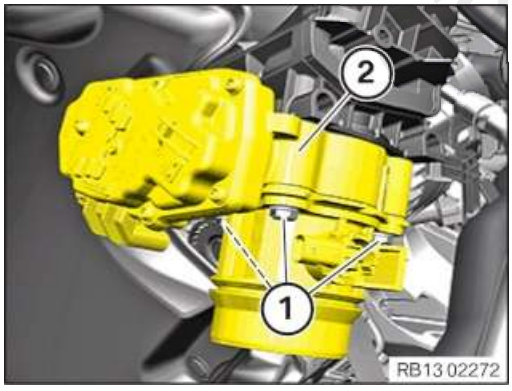


- Unlock and disconnect plug connections (1).

NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

- Loosen clamp (2).
- Unlock and disconnect the pressure pipe (3).



- Loosen screws (1).
- Remove throttle body (2).

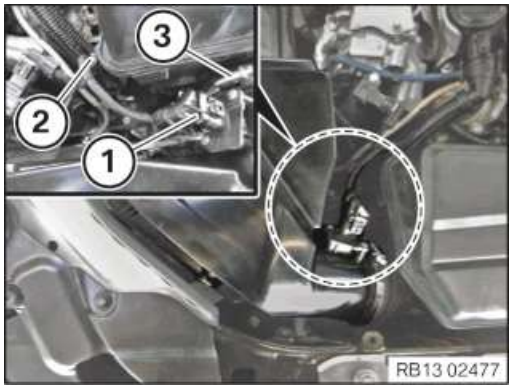
4 – Removing the clean air pipe with the resonator

WARNING

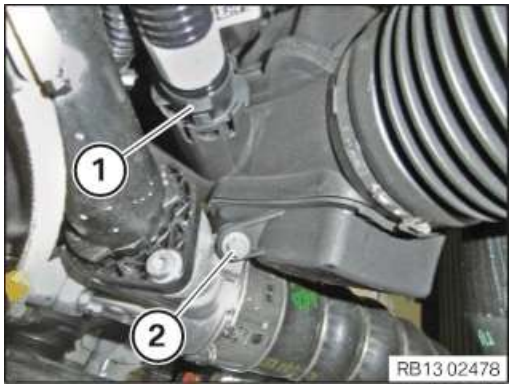
Hot surfaces.

Risk of burning!

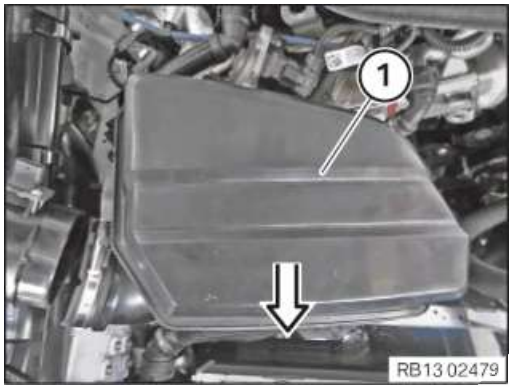
- Perform all work only on components that have cooled down.



- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.



- Unlock engine ventilation line (1), disconnect it and place it aside.
- Loosen screw (2).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Unlock and loosen clamp (1).



- Feed out and remove clean air pipe with resonator (1) in the direction of the arrow.

5 – Remove acoustic cover of the front engine

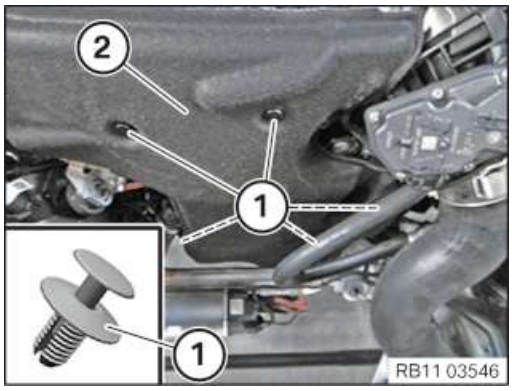
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WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.



- Release and remove expanding rivet (1).
- Guide the acoustic cover (2) out and remove.

6 – Removing the drive belt for alternator

CAUTION

Spring preload.

Danger of injury!

- The use of the specified special tool (tool) is mandatory.
- The described operation must be carried out properly.

CAUTION

Component with preload.

Danger of injury!

- Reduce preload as far as possible before disassembly. Relieve component.

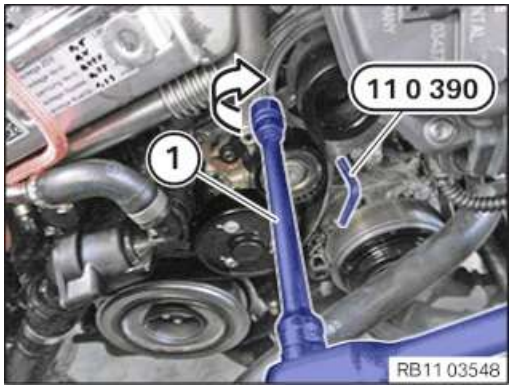
TECHNICAL INFORMATION

If the drive belt is reused: Mark direction of travel and reinstall drive belt in same direction of travel.

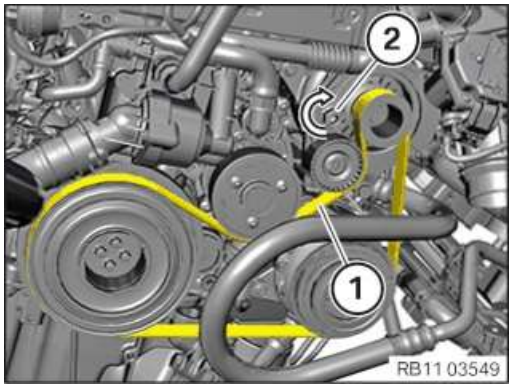
TECHNICAL INFORMATION

The drive belt must be replaced if contaminated with coolant- and oil residues.

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- If reusing the drive belt for alternator: Mark the direction of rotation.
- Relax the belt tensioner in the direction of the arrow using a standard tool (1).
- Fix the belt tensioner with the special tool 0 496 268 (11 0 390).



- Relieve belt tensioner at hexagon head (2) in direction of arrow up to limit position.
- Guide out and remove drive belt for alternator (1).

MAIN WORK

7 – Removing the alternator

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no charger** is connected to the jump start support point in the engine compartment.
- Detach battery earth lead from battery.
- With auxiliary batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

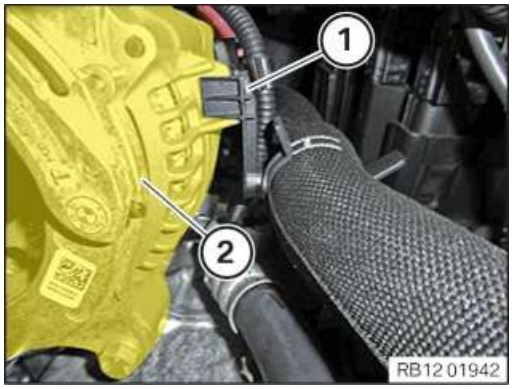
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RISK OF DAMAGE

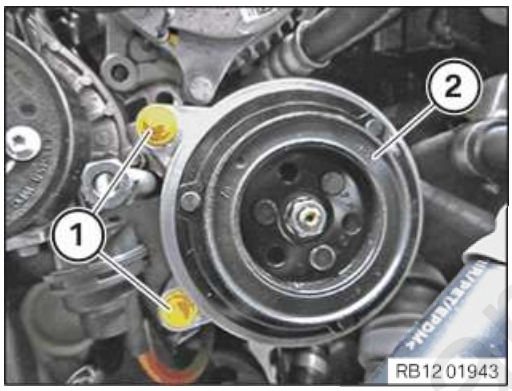
Electrostatic discharge.

Damage to or destruction of electrical components.

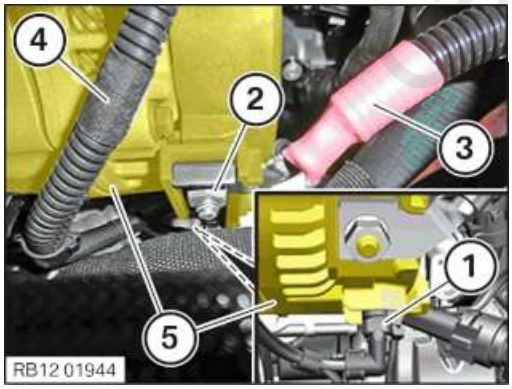
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 ... Notes for ESD protection (electrostatic discharge)



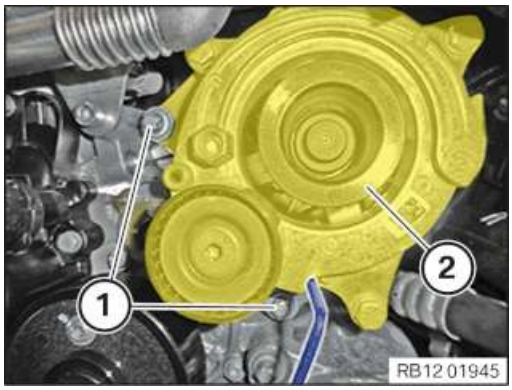
- Release the bracket (1) from the alternator (2).



- Loosen screws (1).
- Slide the air conditioning compressor (2) out and set it aside.



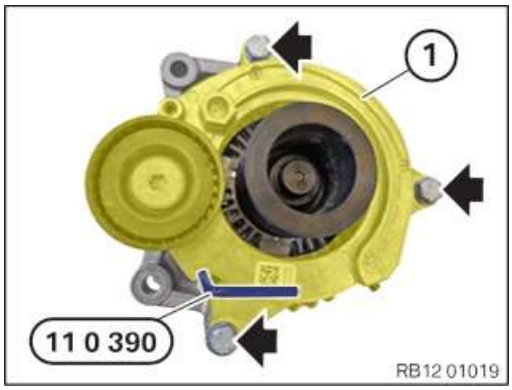
- Unlock the plug connection (1) and disconnect it from the alternator (5).
- Release the nut (2) on the alternator (5).
- Feed out positive battery cable (3) and put to one side.
- Remove the wiring harness section (4) and put to one side.



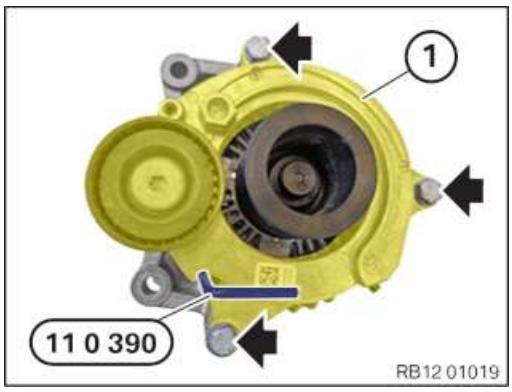
- Loosen screws (1).
- Guide out alternator (2) and remove.

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8 – When replacing the alternator: Remounting the belt tensioner of the alternator



- Remove screws (arrows).
- Feed out and remove the belt tensioner of the alternator (1).
- Make sure that the special tool 0 496 268 (11 0 390) is fitted correctly.



- Replace alternator.

  Parts: Alternator
- Feed in and install the belt tensioner of the alternator (1).
- Tighten screws (arrows).

Belt tensioner to alternator/starter generator

M8X30		Tightening torque	28 Nm

- Make sure that the special tool 0 496 268 (11 0 390) is fitted correctly.

9 – Installing the alternator

CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

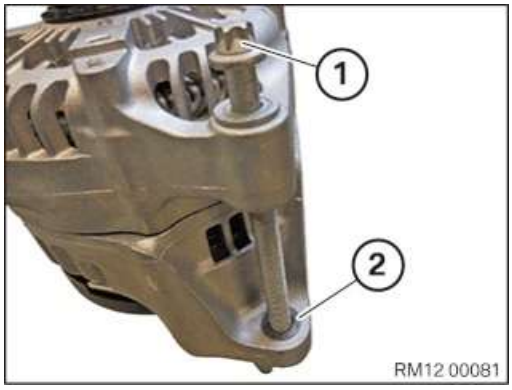
RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

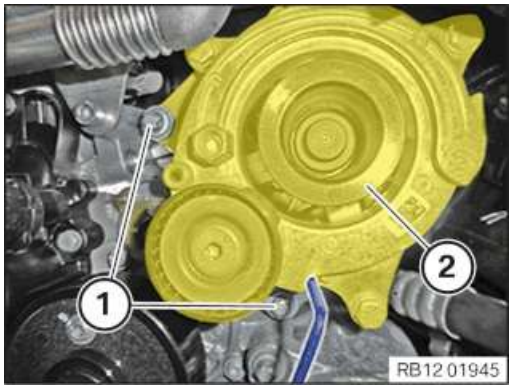
- Route all cables without abrasions, do not trap and crush.

▸ **Prepare for the installation of the alternator**



- Screw the screw (1) into the threaded support sleeve (2).
- Slightly press back the threaded support sleeve (2) using the bolt (1).
- Once again unscrew the screw (1) from the threaded support sleeve (2).

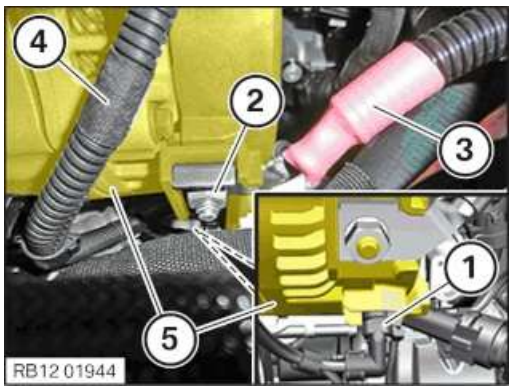
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- Insert and install the alternator (2).
- Tighten the screws (1).

Alternator to component carrier

M10x75		Tightening torque	38 Nm
M10x125		Tightening torque	38 Nm
M10x90		Tightening torque	38 Nm



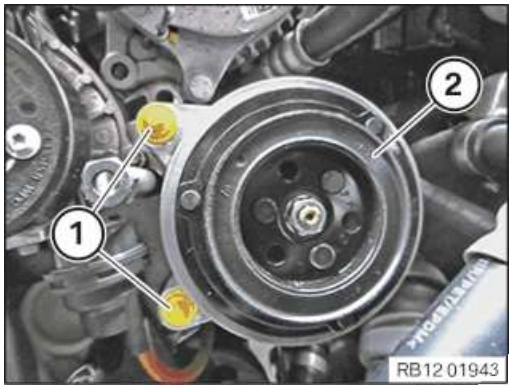
- Guide in the wiring harness section (4) and install.
- Insert and install the positive battery cable (3).
- Tighten the nut (2) on the alternator (5).

Positive battery cable to the alternator

M8		Tightening torque	19 Nm

- Connect the plug (1) with the alternator (5) and lock.

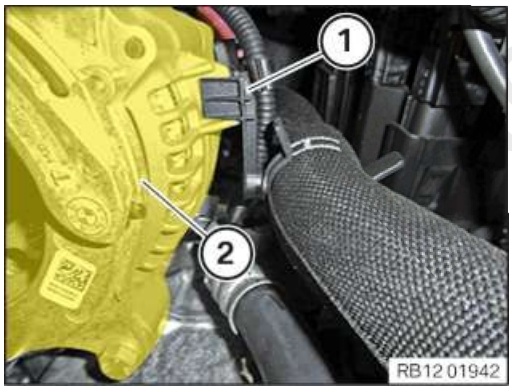
  The connector (1) must engage audibly.



- Insert and install the air conditioning compressor (2).
- Tighten the screws (1).

Air conditioning compressor in component carrier

M10		Tightening torque	38 Nm



- Secure holder (1) to alternator (2).

POSTPROCESSES

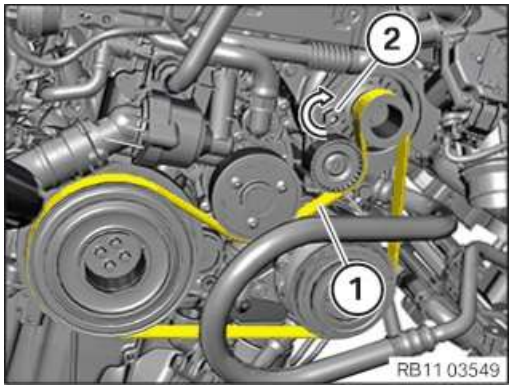
10 – Installing the drive belt for alternator

TECHNICAL INFORMATION

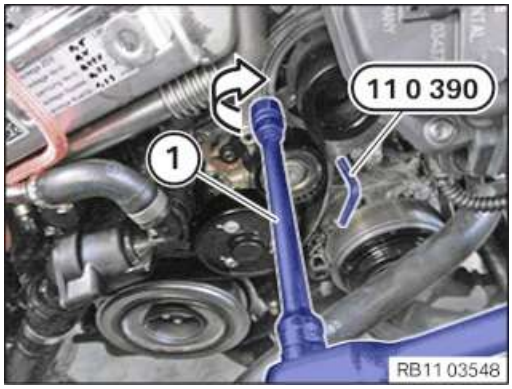
If the drive belt is reused: Mark direction of travel and reinstall drive belt in same direction of travel.

TECHNICAL INFORMATION

The drive belt must be replaced if contaminated with coolant- and oil residues.

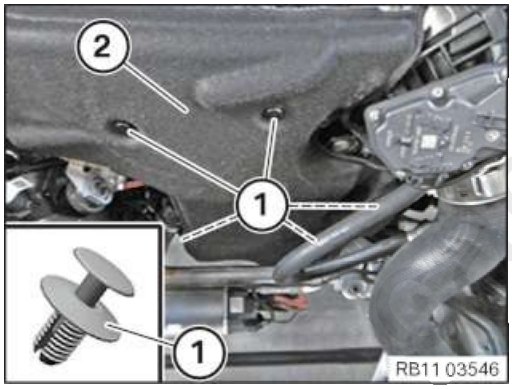


- Check drive belt for alternator (1) for coolant and oil residues and, if necessary, renew it.
- Relieve belt tensioner at hexagon head (2) up to limit position in direction of arrow.
- Install drive belt for alternator (1).



- Increase the preload of the belt tensioner using conventional tool (1) in the direction of arrow until the special tool 0 496 268 (11 0 390) can be removed.
- Remove special tool 0 496 268 (11 0 390).
- Stretch the drive belt for the alternator.

11 – Install acoustic cover for the engine, front

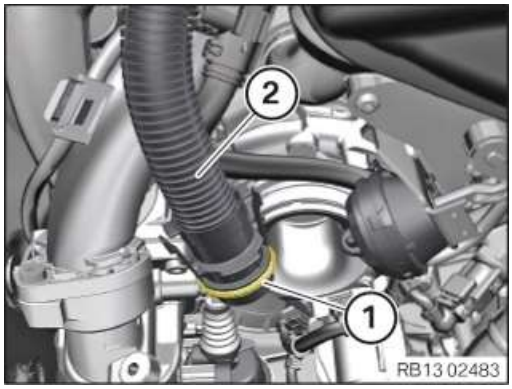


- Feed the acoustic cover (2) in and install.
- Secure the acoustic cover (2) with the expanding rivets (1).

12 – Installing the clean air pipe with resonator



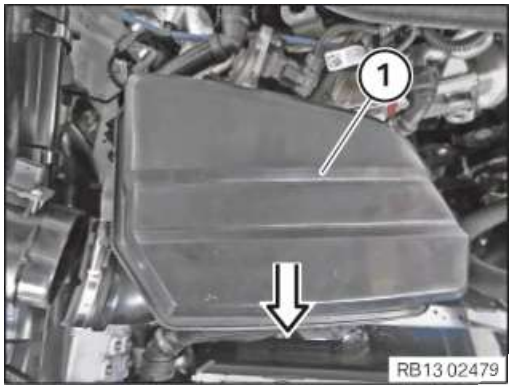
- Check the sealing ring (1) on the exhaust turbocharger for damage and renew if necessary.



- Check the sealing ring (1) for the engine ventilation line (2) for damage and renew where required.



- Feed in and install clean air pipe with resonator (1) in the direction of the arrow.

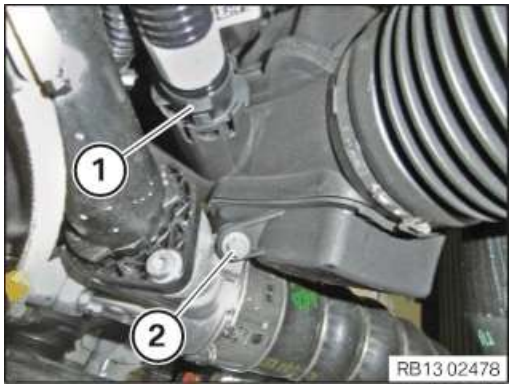


- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Attach and lock the clamp (1).

  The clamp (1) must engage audibly.

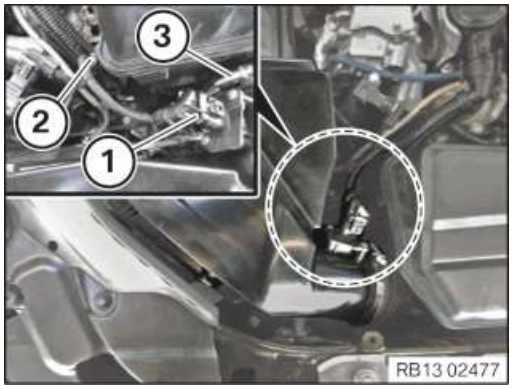


- Tighten down screw (2).

Clean air pipe to exhaust turbocharger

M6X20		Tightening torque	8 Nm

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- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

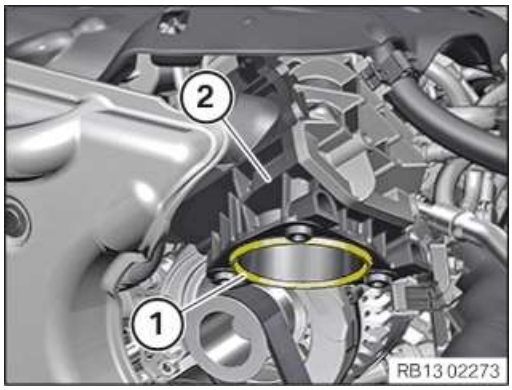
Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure clamps (2).
- Connect connectors (1) and lock.

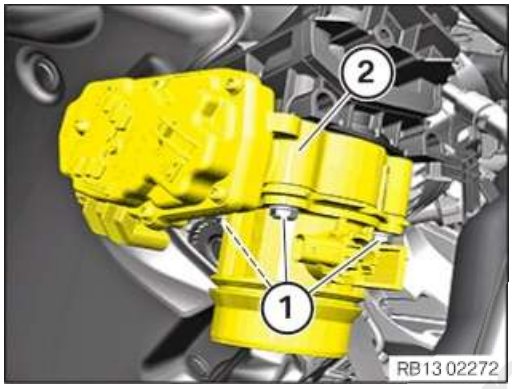
  The connector (1) must engage audibly.

13 – Installing the throttle body



- Renew the sealing ring (1) on the intake plenum .

  Parts: Sealing ring



- Feed in and install the throttle body (2).
- Tighten the screws (1).

Throttle body to intake plenum

6x50		Tightening torque	8 Nm

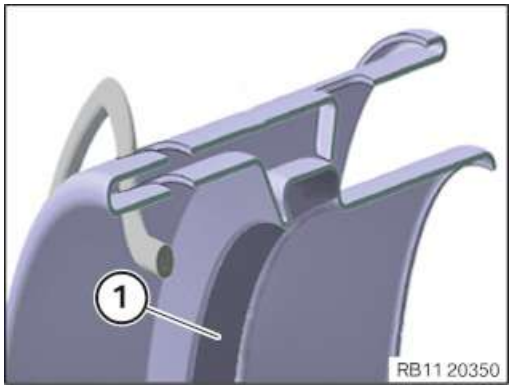


- Check the seal (1) for damage, renew if necessary.

▸ **Replacing damaged seal**

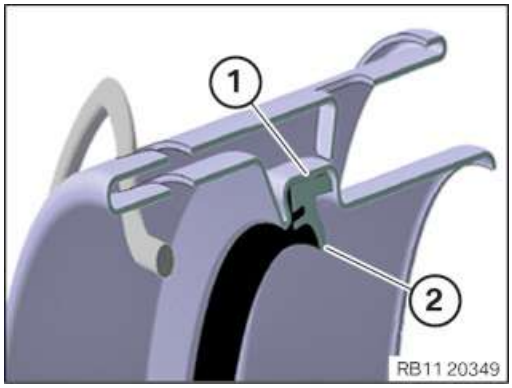
TECHNICAL INFORMATION

Do not use pointed or sharp-edged tools for the installation and/or removal.



- Remove damaged seal.
- Clean gasket groove (1) with a dry towel.

  The gasket groove (1) must be clean.



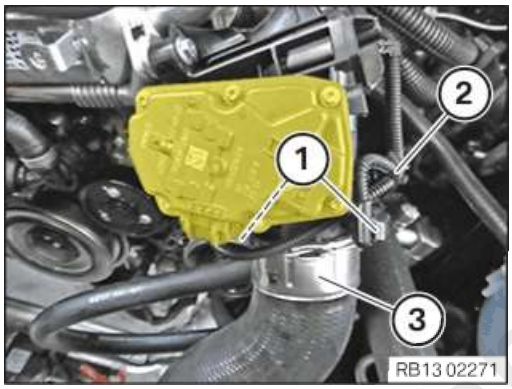
- Renew gasket.

  Parts: Gasket
- Install seal dry without lubricant or mounting agent.

TECHNICAL INFORMATION

Incorrect assembly is possible. Ensure correct installation position.

- Feed in and install the seal.
- Make sure the seal is correctly installed in the gasket groove (1).
- Make sure that the sealing lip (2) is directed inwards as shown.



- Connect the pressure pipe (3) and lock.

  The pressure pipe (3) must engage audibly.

NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

- Secure clamps (2).
- Connect connectors (1) and lock.

  The connectors (1) must engage audibly.



- Lock clamp (1).

14 – Install acoustic cover

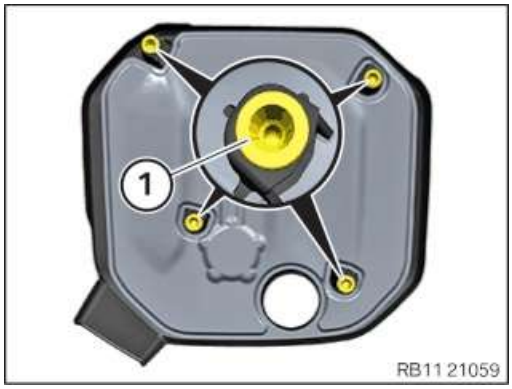
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RISK OF DAMAGE

Damage to the acoustic cover/design cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover/design cover.

- Disassemble or mount the acoustic cover/design cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover/design cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check the acoustic cover for correct fit of the rubber mounts (1).



- Clip in the acoustic cover (1) into the holders in the indicated areas.

15 – Connecting all battery earth leads



- See additional information.

16 – When replacing the alternator/alternator regulator: Reset generator statistical data



- Connect the battery charger to the vehicle.

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- **Reset starter generator statistics data.**
  - Power train
  - Digital Diesel Electronics/engine electronics
  - Reset generator statistical data

Additional Information

Overview of Tightening Torques

Belt tensioner to alternator/starter generator			Used in step 8
M8X30		Tightening torque	28 Nm

Alternator to component carrier			Used in step 9
M10x75		Tightening torque	38 Nm
M10x125		Tightening torque	38 Nm
M10x90		Tightening torque	38 Nm

Positive battery cable to the alternator			Used in step 9
M8		Tightening torque	19 Nm

Air conditioning compressor in component carrier			Used in step 9
M10		Tightening torque	38 Nm

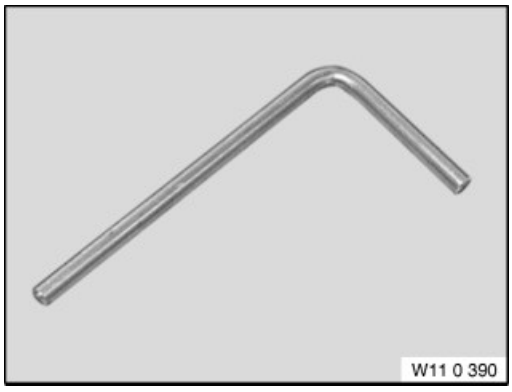
Clean air pipe to exhaust turbocharger			Used in step 12
M6X20		Tightening torque	8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 12
Clamp		Tightening torque	3 Nm

Throttle body to intake plenum			Used in step 13
6x50		Tightening torque	8 Nm

Overview of Special Tools

0 496 268 (11 0 390) Pin



Common	Used in step 6810
Usage	(roll pin) For securing new tensioning pulley (poly-V belt)
Included in the tool or work	
Storage location	B24
Replaced by	
In connection with	
SI-Number	01 15 07 (390)

Links

Repair instructions	**Used in step**
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	115

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61 20 900 Disconnecting and connecting battery earth lead	115
61 20 900 Disconnecting and connecting battery earth lead	115
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61 20 900 Disconnecting and connecting battery earth lead 115
61 20 900 Disconnecting and connecting battery earth lead 115
61 35 ... Notes on ESD protection (Electro Static Discharge) 37
61 35 ... Notes on ESD protection (Electro Static Discharge) 379

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61 00 ... Safety information on handling hybrid cars

Please observe the current version. Safety information for handling electric and hybrid vehicles

1. *Qualification:*
   All repair work on high-voltage components may **only be performed by specially trained personnel** (qualification: Work on high-voltage inherently save vehicles) must be performed by qualified technicians. Each hybrid car requires additional vehicle specific training with training achievement controls.
   Required training is offered by the BMW Training Academy.
2. *Identification:*
   Observe **warning notices** on high-voltage components. When replacing individual high-voltage components, check if warning stickers are present. Independently attaching warnings is only allowed on the locations provided for them. Use only approved and appropriately identified original new parts.
3. *Rules of conduct/protective measures:*
   - Note operating instructions for handling high-voltage battery units.
   - Do not under any circumstances touch open high-voltage cables and high-voltage components on damaged vehicle before shutting down the high-voltage electrical system.
   - In the event of damage (mechanical, thermal) transition metal oxides, carbon, electrolyte solvents and their products of decomposition may be released.
     Suitable acid-resistant protective clothing/equipment must therefore be used when handling the vehicle!
     - Hand protection: Gloves
     - Eye protection: Safety goggles

     Damaged high-voltage battery units must be stored in an acid-resistant pan in a location in the open that is protected against the weather (sun, rain) and secured against unauthorised access. Do not inhale escaping gasses.
   - Prevent escaping substances from entering drains, pits and the sewer system.
   - Collect any material that is discharged and have it disposed of according to the work instruction, wear acid-resistant protective clothing when doing so.
   - Notify the fire brigade if fire breaks out, clear the area immediately and make accident scene safe. Attempt to extinguish the fire without putting persons in danger (suitable extinguishant: water and water foam).
   - A cut 2nd emergency separation point must be repaired with a butt connector.
4. *Measures before starting work*:
   - Each job on the vehicle must be assigned by appropriately trained personnel. Before work is started, this electrician must place the vehicle in the operating condition required to perform the relevant activity. The qualified personnel's instructions and directions absolutely must be followed. **No work may be carried out without this qualified personnel** being consulted first.
   - It is **not** permitted to work on the high voltage system or on high voltage components while the engine is running.
   - The readiness to drive must be ended before shutting off the voltage of the high-voltage system. The readiness to drive is ended when the driver is absent only under the following prerequisites:
     1. seat belt buckle unlocked **and**
     2. the driver's door is open **and**
     3. no brake activated **and**
     4. the accelerator pedal is not activated **and**
     5. speed < 3 km/h (2 mph)
   - Work on live high-voltage components is expressly prohibited. Before each operation on the high-voltage system, the system must be isolated from the power supply by qualified personnel (high-voltage safety connector Off) and secured against unauthorised recommissioning (padlock).
   - After each deactivation of the high-voltage system, it is essential to observe a **waiting period** of at least **10 seconds** prior to further work.
   - Before beginning work, it is mandatory to check that the equipment is de-energised and is protected against being energised again!
     Work is only permitted to begin if:
     1. Corresponding display in the instrument cluster **High-voltage system deactivated** or

     When a high-voltage warning is active (indicator light, Check Control, etc.), it is essential to determine and eliminate the cause of this warning via the diagnosis system before continuing with any other work. **If it cannot be definitively established that the equipment is de-energised**, work is not permitted to begin. **Danger to life!** Before work begins, a qualified electrician (1000 V AC) must verify that the system is de-energised using appropriate measuring devices and procedures.

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=> In this case, Technical Support must be contacted!

- Do not perform any work on the vehicle while it is charging. Before starting work, disconnect the charging cable from the vehicle.
  Battery charging may result in heating of the high-voltage battery unit. This heating may lead to sporadic launches of the electric fan (switch-on request from the electric fan). Therefore, work in the vicinity of the electric fan during the charging procedure is prohibited. Ensure freedom of movement of the battery charge lines in the vicinity of the electric fan.

5. *Measures during/after activities:*
   - Identifiable mechanical damage to or tampering with high-voltage components must be reported immediately to the qualified personnel in charge.
   - When carrying out any work on the high-voltage system, it is prohibited to drive externally all the drivetrain components (wheels, gearbox, drive shafts, etc.).
   - *E72 only:* When the “Power Electronic Box Cover” is removed, the high-voltage system is not permitted to be activated. The high-voltage service disconnect must only be used when the "Power Electronics Box Cover" is completely installed.
   - High-voltage cables (orange coating) and their connectors and stop parts **may not** be repaired. If damaged, a cable must always be replaced completely.
   - When working in the vicinity of high-voltage components (identified accordingly with warning stickers and orange-coloured coating), protect these components against damage.
   - The specified work steps in the repair instructions must be adhered to exactly.
   - High-voltage components and their holders must be screwed/bolted to the defined tightening torque. Tightening torques and tightening specifications must be observed.
   - Connecting high-voltage components to body ground is crucial to safety for reasons of equipotential bonding. For this reason, it is prohibited to operate any high-voltage components without them being correctly connected to body ground. The measurements (insulation/potential equalisation measurement) are performed automatically by the vehicle. Manual measurement is not therefore necessary.
     For a correct earthing connection, the retaining elements of high-voltage components must not be painted. Follow further notes on paintwork.
   - Removed high-voltage battery units must be stored in a manner that protects them from misuse and damage.
   - Damaged or warning stickers that are no longer legible on high-voltage components must always be replaced.
6. *Equipotential bonding:*
   Equipotential bonding lines, high-voltage cables and the battery negative lead to the EME are fitted with safety screws!
   - Clean contact faces and have then checked by a second person.
   - Tighten down screws/bolts to specified torque.
   - Have tightening torque checked by a second person.
   - Both persons must document that the work has been carried out correctly in the vehicle records.

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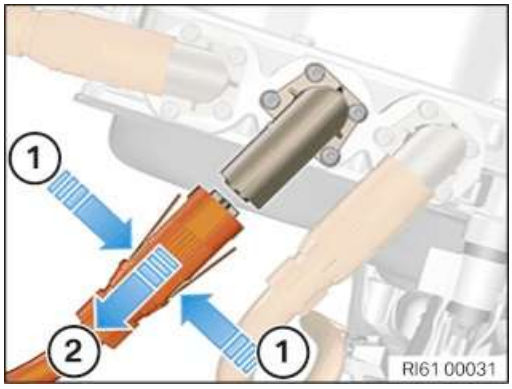
61 13 ... Unlocking and disconnecting various plug connections in electrical and hybrid vehicles



Attention!

Observe the following instructions for handling high-voltage plug connections:

- Damaged high-voltage plug connections must be replaced completely. Repair is not permitted.
- Dirt contamination must be removed before opening the plug connection.



Disconnect the Hirschmann high-voltage connector:

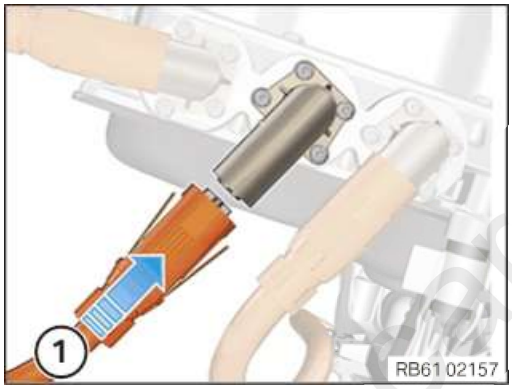
Press the lock (1) on the left and right on the connector in the direction of the arrow.

Pull off connector (2) in direction of arrow.

Attention!

Connector (2) is difficult to pull off.

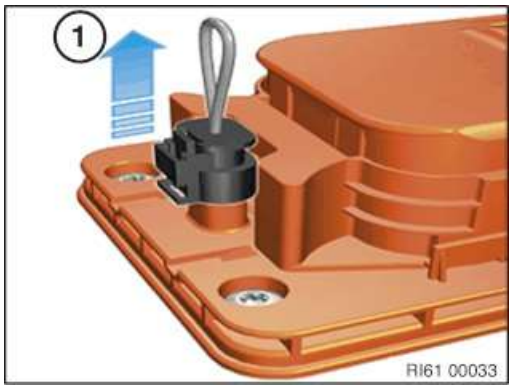
In the event of damage to high-voltage connector (2), the complete high-voltage cable must be replaced!



Connect the Hirschmann high-voltage connectors:

Slide the connector (1) on in the direction of the arrow.

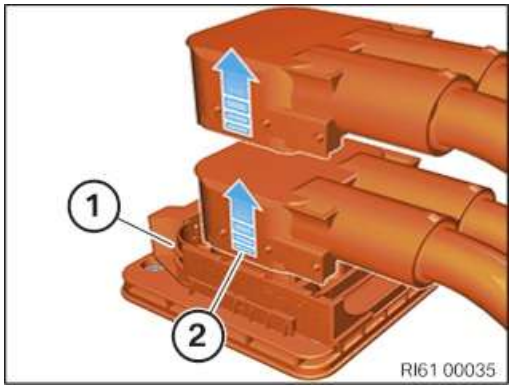
Note:
Connector (2) must lock audibly.



Disconnect the Kostal high-voltage connector:

Unlock and disconnect high-voltage interlock loop (1).

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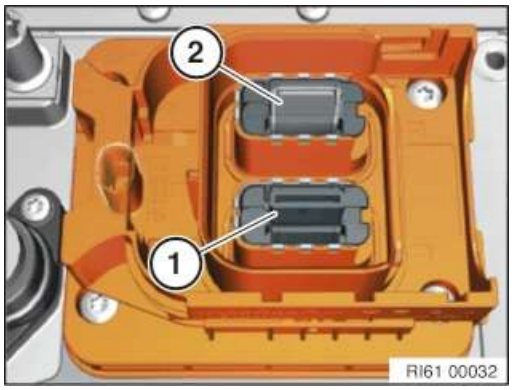
Push the lock (1) fully to the front.

Lift the connector (2) and remove it entirely.

Attention!

Plug connection (3) is difficult to pull off.

The connector (2) must be completely pulled off the opposite housing in one step. Damage may be caused to contact protection if connector is only partly pulled off and then closed again!



Check the Kostal high-voltage connector and connection for damage:

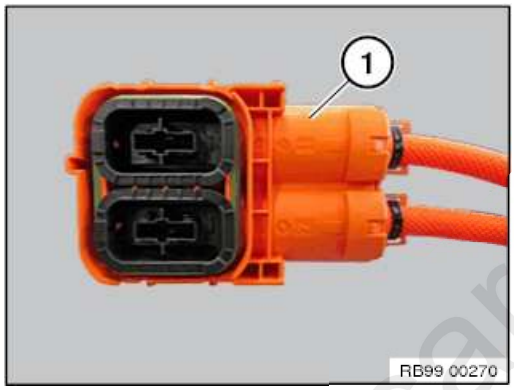
Check the touch protection for damage and correct positioning (1).

Warning!

Do not touch unprotected connector (2)!

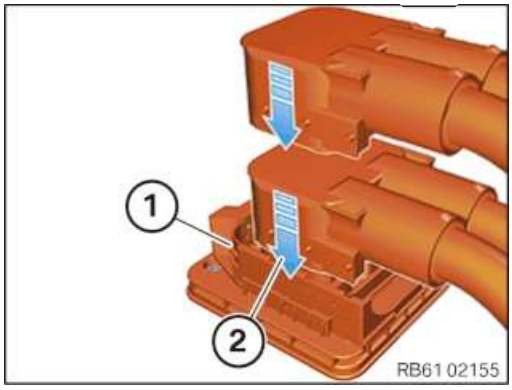
If the contact protection (1) has been pushed to the bottom (2), the high-voltage connector must be refitted.

If contact protection (1) remains in bottom position (2) after reinstallation, the contact protection is faulty and the component must be replaced!



Check the high-voltage connector (1) for damage.**Warning!**

In the event of damage to the high-voltage connector (1), the complete high-voltage cable must be replaced!



Connect the Kostal high-voltage connector:

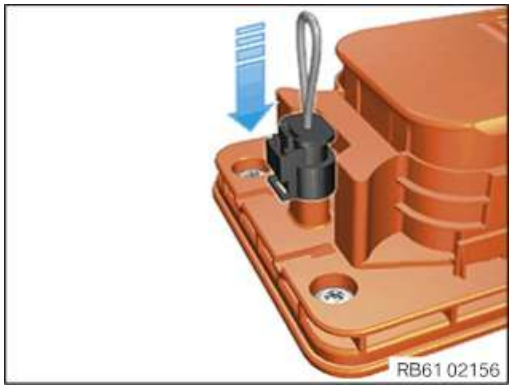
Connect the connector (2) in one single movement to the counter-housing.

Push the lock (1) fully to the rear.

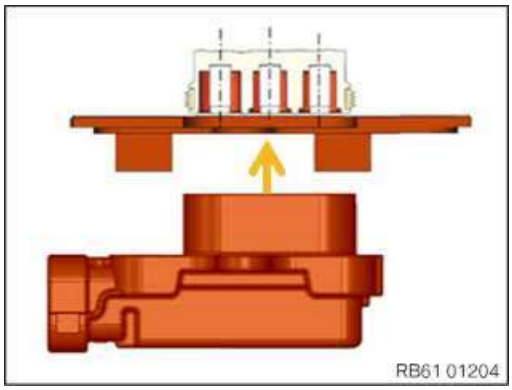
Attention!

Plug connection (3) must be correctly locked by lock (2), otherwise there is a risk of damage.

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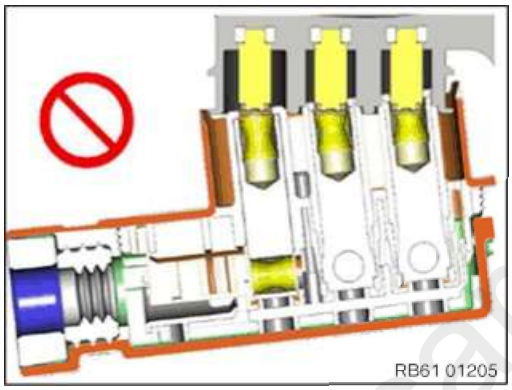


Connect the connector for the high-voltage interlock.



Three-phase high-voltage connector:

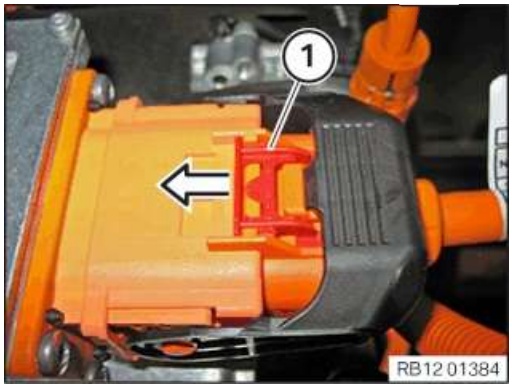
Connect and disconnect the connector straight.



Attention!

The system is designed to only offer limited protection against damage caused by connectors that are inserted at an angle.

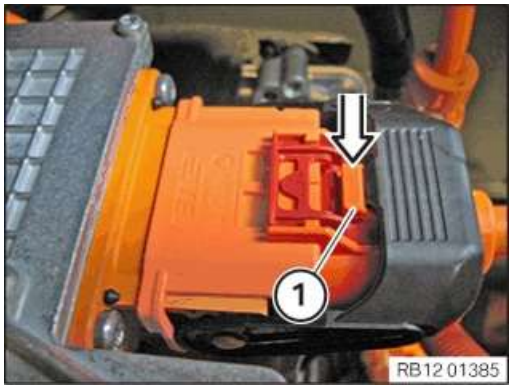
Increased tilted connections will increase the connecting force and the risk of danger.



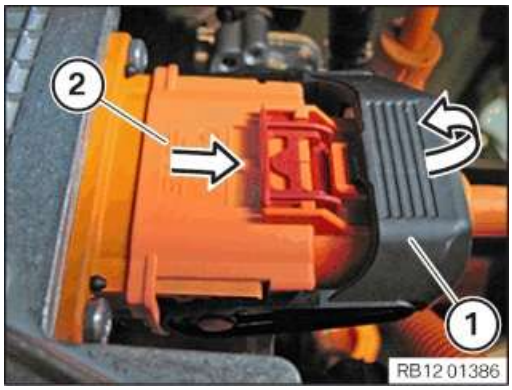
Disconnect the high-voltage connector from the high-voltage connection of the KLE:

Slide lock (1) in direction of arrow up to stop.

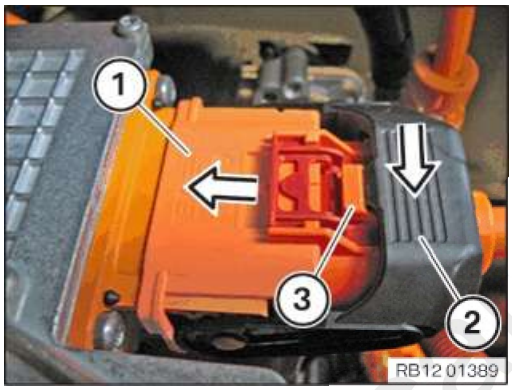
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Press lock (1).



Open the lock (1) completely and disconnect the connector (2).



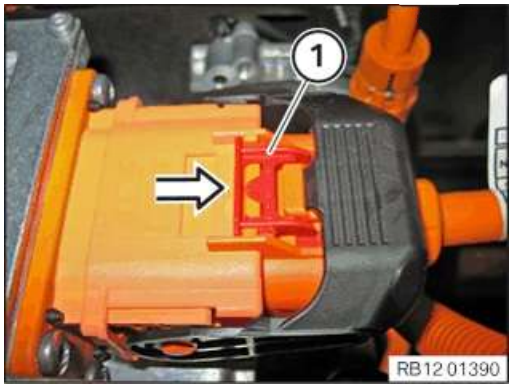
Connect the high-voltage connector to the high-voltage connection of the KLE:

Connect the connector (1) to the limit position and close the lock (2).

Attention!

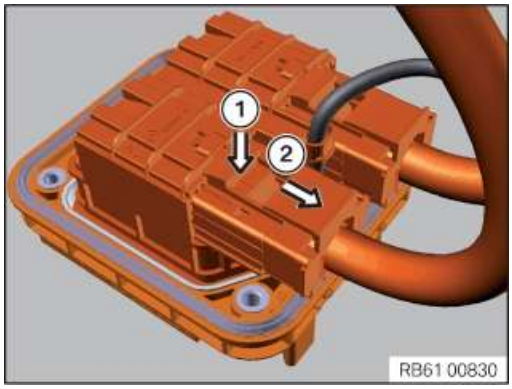
Lock (2) must snap audibly into place.

The retaining lug of the lock (2) must be positioned completely under the lock (2).



Slide the lock (1) on to the stop in the direction of the arrow.

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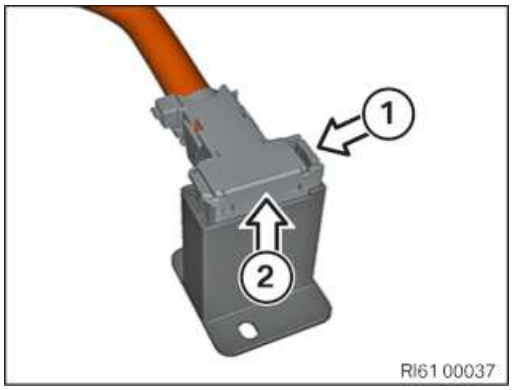
High-voltage connector on the high-voltage connection of the high-voltage battery unit:

Press down unlocking (1) in direction of arrow and pull off connector in direction of arrow (2).

Attention!

Contact protection is no longer provided in the event of a damaged connector housing.

In this case, contact technical support.



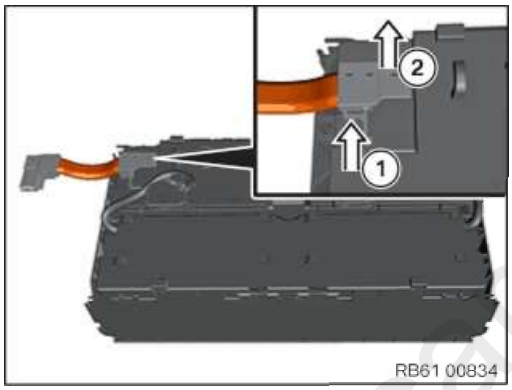
High-voltage connector on the cell module I01:

Press unlocking device (1) together and pull off connector upwards (2).

Attention!

Contact protection is no longer provided in the event of a damaged connector housing.

In this case, contact technical support.



High-voltage connector on the cell module (cell module connecting line):

Press unlocking (1) in direction of arrow and pull off connector in direction of arrow (2).

Attention!

Contact protection is no longer provided in the event of a damaged connector housing.

In this case, contact technical support.

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61 00 ... Safety information on handling hybrid cars

Please observe the current version. Safety information for handling electric and hybrid vehicles

1. *Qualification:*
   All repair work on high-voltage components may **only be performed by specially trained personnel** (qualification: Work on high-voltage inherently save vehicles) must be performed by qualified technicians. Each hybrid car requires additional vehicle specific training with training achievement controls.
   Required training is offered by the BMW Training Academy.
2. *Identification:*
   Observe **warning notices** on high-voltage components. When replacing individual high-voltage components, check if warning stickers are present. Independently attaching warnings is only allowed on the locations provided for them. Use only approved and appropriately identified original new parts.
3. *Rules of conduct/protective measures:*
   - Note operating instructions for handling high-voltage battery units.
   - Do not under any circumstances touch open high-voltage cables and high-voltage components on damaged vehicle before shutting down the high-voltage electrical system.
   - In the event of damage (mechanical, thermal) transition metal oxides, carbon, electrolyte solvents and their products of decomposition may be released.
     Suitable acid-resistant protective clothing/equipment must therefore be used when handling the vehicle!
     - Hand protection: Gloves
     - Eye protection: Safety goggles

     Damaged high-voltage battery units must be stored in an acid-resistant pan in a location in the open that is protected against the weather (sun, rain) and secured against unauthorised access. Do not inhale escaping gasses.
   - Prevent escaping substances from entering drains, pits and the sewer system.
   - Collect any material that is discharged and have it disposed of according to the work instruction, wear acid-resistant protective clothing when doing so.
   - Notify the fire brigade if fire breaks out, clear the area immediately and make accident scene safe. Attempt to extinguish the fire without putting persons in danger (suitable extinguishant: water and water foam).
   - A cut 2nd emergency separation point must be repaired with a butt connector.
4. *Measures before starting work*:
   - Each job on the vehicle must be assigned by appropriately trained personnel. Before work is started, this electrician must place the vehicle in the operating condition required to perform the relevant activity. The qualified personnel's instructions and directions absolutely must be followed. **No work may be carried out without this qualified personnel** being consulted first.
   - It is **not** permitted to work on the high voltage system or on high voltage components while the engine is running.
   - The readiness to drive must be ended before shutting off the voltage of the high-voltage system. The readiness to drive is ended when the driver is absent only under the following prerequisites:
     1. seat belt buckle unlocked **and**
     2. the driver's door is open **and**
     3. no brake activated **and**
     4. the accelerator pedal is not activated **and**
     5. speed < 3 km/h (2 mph)
   - Work on live high-voltage components is expressly prohibited. Before each operation on the high-voltage system, the system must be isolated from the power supply by qualified personnel (high-voltage safety connector Off) and secured against unauthorised recommissioning (padlock).
   - After each deactivation of the high-voltage system, it is essential to observe a **waiting period** of at least **10 seconds** prior to further work.
   - Before beginning work, it is mandatory to check that the equipment is de-energised and is protected against being energised again!
     Work is only permitted to begin if:
     1. Corresponding display in the instrument cluster **High-voltage system deactivated** or

     When a high-voltage warning is active (indicator light, Check Control, etc.), it is essential to determine and eliminate the cause of this warning via the diagnosis system before continuing with any other work. **If it cannot be definitively established that the equipment is de-energised**, work is not permitted to begin. **Danger to life!** Before work begins, a qualified electrician (1000 V AC) must verify that the system is de-energised using appropriate measuring devices and procedures.

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=> In this case, Technical Support must be contacted!

- Do not perform any work on the vehicle while it is charging. Before starting work, disconnect the charging cable from the vehicle.
  Battery charging may result in heating of the high-voltage battery unit. This heating may lead to sporadic launches of the electric fan (switch-on request from the electric fan). Therefore, work in the vicinity of the electric fan during the charging procedure is prohibited. Ensure freedom of movement of the battery charge lines in the vicinity of the electric fan.

5. *Measures during/after activities:*
   - Identifiable mechanical damage to or tampering with high-voltage components must be reported immediately to the qualified personnel in charge.
   - When carrying out any work on the high-voltage system, it is prohibited to drive externally all the drivetrain components (wheels, gearbox, drive shafts, etc.).
   - *E72 only:* When the “Power Electronic Box Cover” is removed, the high-voltage system is not permitted to be activated. The high-voltage service disconnect must only be used when the "Power Electronics Box Cover" is completely installed.
   - High-voltage cables (orange coating) and their connectors and stop parts **may not** be repaired. If damaged, a cable must always be replaced completely.
   - When working in the vicinity of high-voltage components (identified accordingly with warning stickers and orange-coloured coating), protect these components against damage.
   - The specified work steps in the repair instructions must be adhered to exactly.
   - High-voltage components and their holders must be screwed/bolted to the defined tightening torque. Tightening torques and tightening specifications must be observed.
   - Connecting high-voltage components to body ground is crucial to safety for reasons of equipotential bonding. For this reason, it is prohibited to operate any high-voltage components without them being correctly connected to body ground. The measurements (insulation/potential equalisation measurement) are performed automatically by the vehicle. Manual measurement is not therefore necessary.
     For a correct earthing connection, the retaining elements of high-voltage components must not be painted. Follow further notes on paintwork.
   - Removed high-voltage battery units must be stored in a manner that protects them from misuse and damage.
   - Damaged or warning stickers that are no longer legible on high-voltage components must always be replaced.
6. *Equipotential bonding:*
   Equipotential bonding lines, high-voltage cables and the battery negative lead to the EME are fitted with safety screws!
   - Clean contact faces and have then checked by a second person.
   - Tighten down screws/bolts to specified torque.
   - Have tightening torque checked by a second person.
   - Both persons must document that the work has been carried out correctly in the vehicle records.

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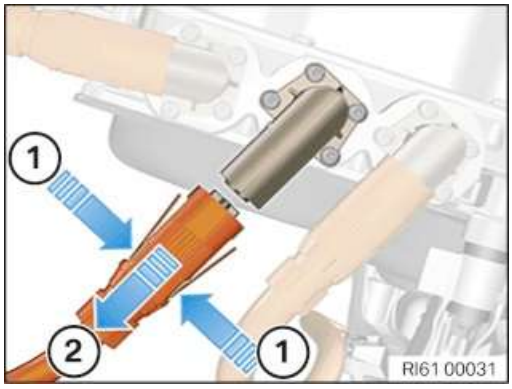
61 13 ... Unlocking and disconnecting various plug connections in electrical and hybrid vehicles



Attention!

Observe the following instructions for handling high-voltage plug connections:

- Damaged high-voltage plug connections must be replaced completely. Repair is not permitted.
- Dirt contamination must be removed before opening the plug connection.



Disconnect the Hirschmann high-voltage connector:

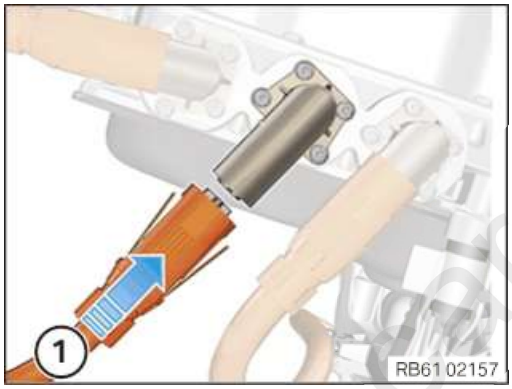
Press the lock (1) on the left and right on the connector in the direction of the arrow.

Pull off connector (2) in direction of arrow.

Attention!

Connector (2) is difficult to pull off.

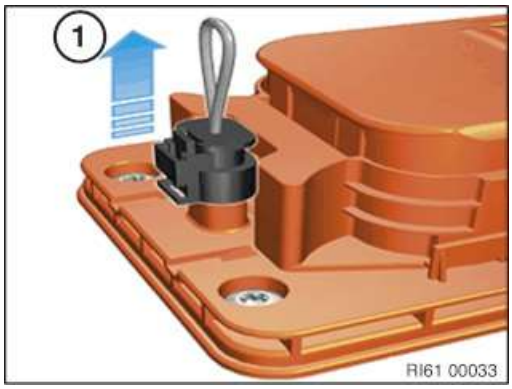
In the event of damage to high-voltage connector (2), the complete high-voltage cable must be replaced!



Connect the Hirschmann high-voltage connectors:

Slide the connector (1) on in the direction of the arrow.

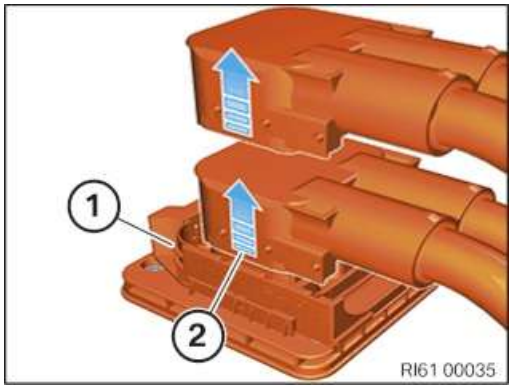
Note:
Connector (2) must lock audibly.



Disconnect the Kostal high-voltage connector:

Unlock and disconnect high-voltage interlock loop (1).

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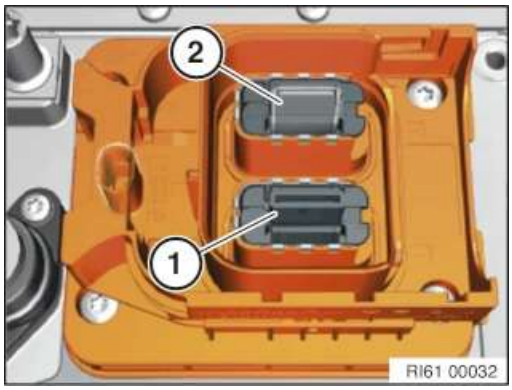
Push the lock (1) fully to the front.

Lift the connector (2) and remove it entirely.

Attention!

Plug connection (3) is difficult to pull off.

The connector (2) must be completely pulled off the opposite housing in one step. Damage may be caused to contact protection if connector is only partly pulled off and then closed again!



Check the Kostal high-voltage connector and connection for damage:

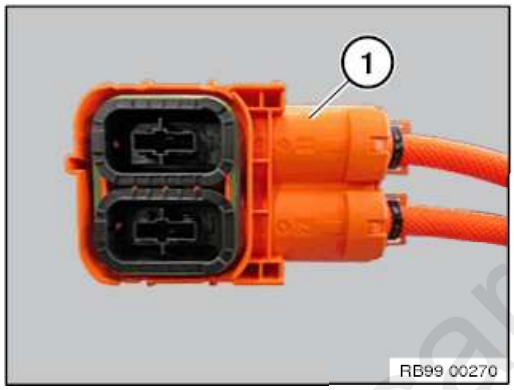
Check the touch protection for damage and correct positioning (1).

Warning!

Do not touch unprotected connector (2)!

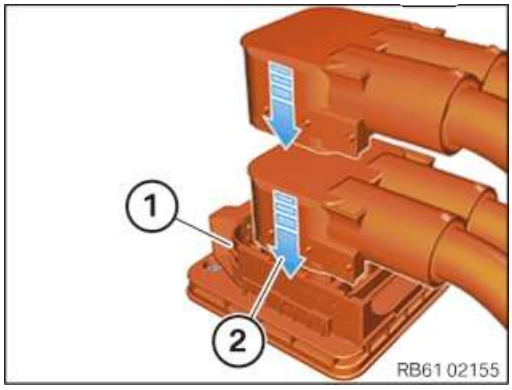
If the contact protection (1) has been pushed to the bottom (2), the high-voltage connector must be refitted.

If contact protection (1) remains in bottom position (2) after reinstallation, the contact protection is faulty and the component must be replaced!



Check the high-voltage connector (1) for damage.**Warning!**

In the event of damage to the high-voltage connector (1), the complete high-voltage cable must be replaced!



Connect the Kostal high-voltage connector:

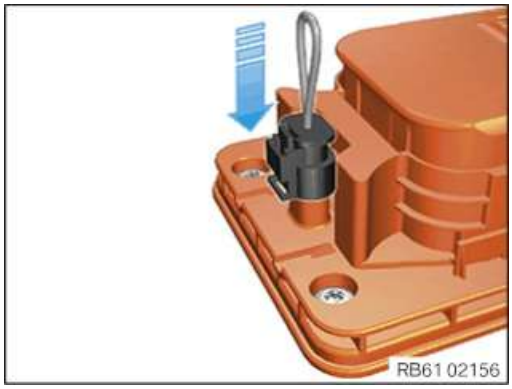
Connect the connector (2) in one single movement to the counter-housing.

Push the lock (1) fully to the rear.

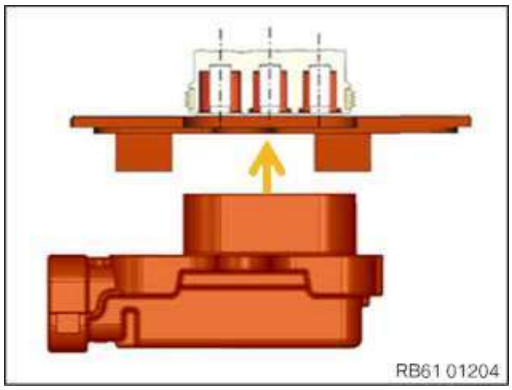
Attention!

Plug connection (3) must be correctly locked by lock (2), otherwise there is a risk of damage.

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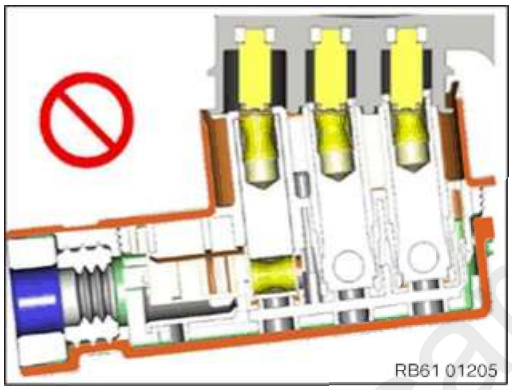


Connect the connector for the high-voltage interlock.



Three-phase high-voltage connector:

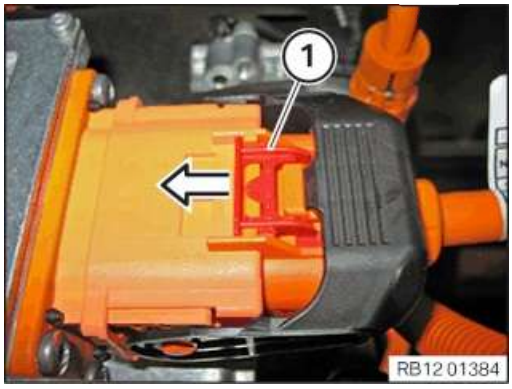
Connect and disconnect the connector straight.



Attention!

The system is designed to only offer limited protection against damage caused by connectors that are inserted at an angle.

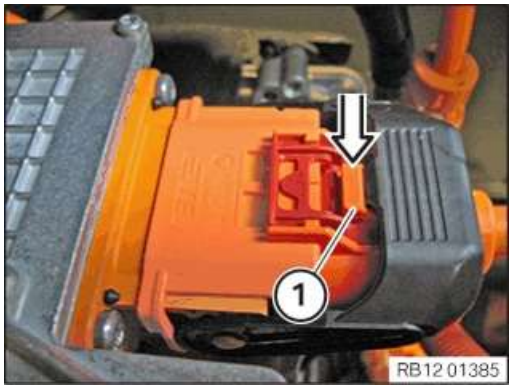
Increased tilted connections will increase the connecting force and the risk of danger.



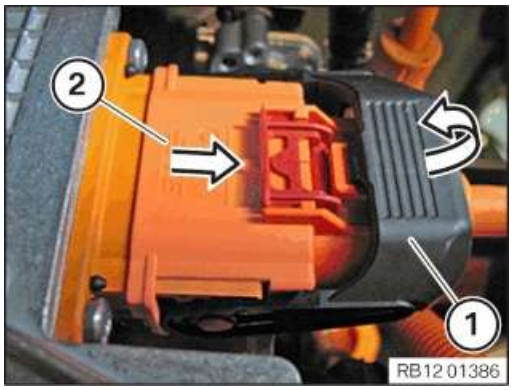
Disconnect the high-voltage connector from the high-voltage connection of the KLE:

Slide lock (1) in direction of arrow up to stop.

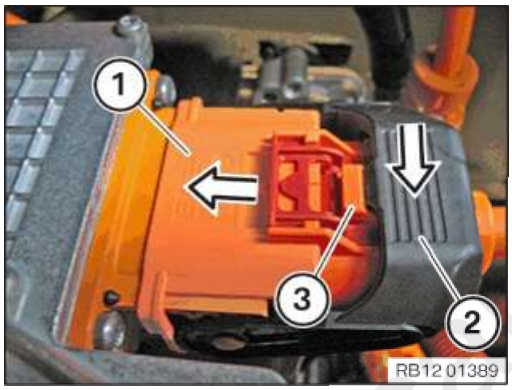
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Press lock (1).



Open the lock (1) completely and disconnect the connector (2).



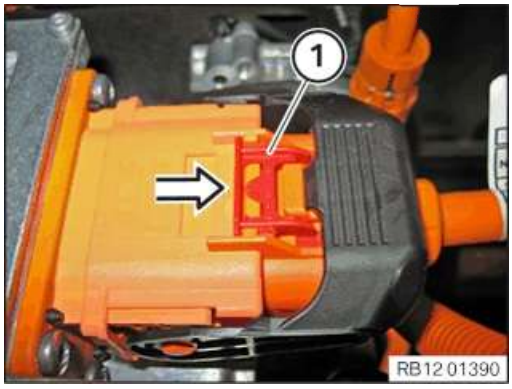
Connect the high-voltage connector to the high-voltage connection of the KLE:

Connect the connector (1) to the limit position and close the lock (2).

Attention!

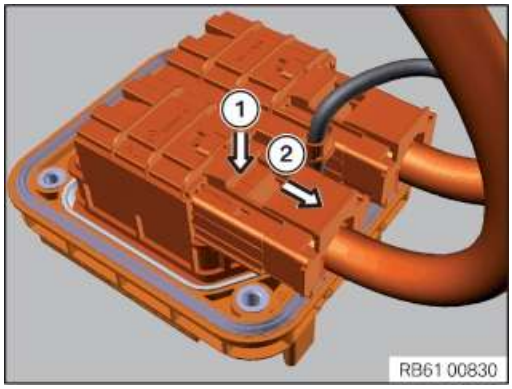
Lock (2) must snap audibly into place.

The retaining lug of the lock (2) must be positioned completely under the lock (2).



Slide the lock (1) on to the stop in the direction of the arrow.

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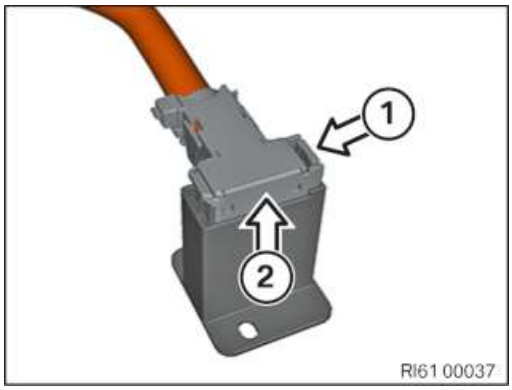
High-voltage connector on the high-voltage connection of the high-voltage battery unit:

Press down unlocking (1) in direction of arrow and pull off connector in direction of arrow (2).

Attention!

Contact protection is no longer provided in the event of a damaged connector housing.

In this case, contact technical support.



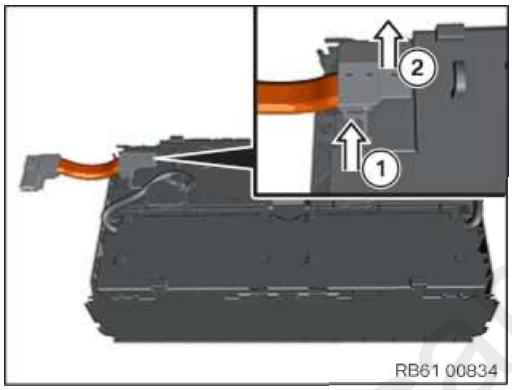
High-voltage connector on the cell module I01:

Press unlocking device (1) together and pull off connector upwards (2).

Attention!

Contact protection is no longer provided in the event of a damaged connector housing.

In this case, contact technical support.



High-voltage connector on the cell module (cell module connecting line):

Press unlocking (1) in direction of arrow and pull off connector in direction of arrow (2).

Attention!

Contact protection is no longer provided in the event of a damaged connector housing.

In this case, contact technical support.

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11 00 ... Handling components after flood damage

Flood damage can occur if the permissible fording depth of a vehicle is exceeded. Ingress of water can cause damage to the engine (water shock) or components.

Because dirt particles generally enter into the component with the water (e.g. starter motor, wiring harness), the components need to be thoroughly inspected.

Residual moisture in the components leads to corrosion (increased contact resistance in the component), which can lead to a component failure at a later time.

If water ingress into the electrical components cannot be ruled out, it is recommended to replace the component to ensure correct functioning through the vehicle lifetime.

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12 41 020 Removing and installing/replacing starter motor

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no charger** is connected to the jump start support point in the engine compartment.
- Detach battery earth lead from battery.
- With auxiliary batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

PRELIMINARY WORK

1 – Deactivating the 48 V electrical system

Prerequisite

Ignition is switched off.

WARNING

Deactivation of the 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no battery charger** is connected to the jump start terminal point in the engine compartment.
- For vehicles with additional electrical systems (48 V electrical system, high-voltage vehicle electrical system), it is mandatory to deactivate them **before** disconnecting the vehicle battery.

WARNING

Deactivation of the 48 V electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no charger** is connected to the jump start support point in the engine compartment.

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RISK OF DAMAGE

Damage to 48-V battery

If a 48-V battery that is disconnected from the electrical system is activated, the battery electronics will be damaged.

- Only carry out activation of the 48V electrical system with a completely connected 48-V battery.

TECHNICAL INFORMATION

Follow notes for 48-V battery. See further information 6120 ... Notes on 48-V battery.



- Deactivate the 48V electrical system by opening the bonnet.

  The deactivation takes place automatically.



Check

TECHNICAL INFORMATION

Zero voltage (48V electrical system is switched off) is displayed only in PAD mode.

- Press the START-STOP button quickly 3 times without stepping on the brake pedal to establish the PAD mode.
- Check isolation from the supply in the instrument cluster in PAD mode.

desired state

- The Check Control message "48V electrical system switched off." (1) is displayed.

Result

» **The absence of voltage** cannot be determined by means of the Check Control message "48V electrical system switched off:" (1). Work is not permitted to be started.

Measure

- Carry out the service function "48 V electrical system deactivation".
  - Vehicle management > Service functions > Voltage supply > Deactivate 48 V electrical system

Only when the Check Control message “48 V electrical system switched off.” (1) is displayed in the instrument cluster is it permitted to disconnect the 12 V battery.

If the absence of voltage is not indicated clearly, contact Technical Support.

Result

» The Check Control message signals that the 48V electrical system has been switched off.

Measure

- Exit PAD mode by pressing the START-STOP button once without depressing the brake pedal.

  The work “Disconnecting the negative battery cable of the 48-V battery” can be started.



- Unlock and disconnect plug connection (1) of the CAN bus.
- Release the clip (2).



- Loosen nut (1).
- Pull off negative battery cable (2) of the 48-V battery from the negative battery terminal, set it aside and secure it.



WARNING

Unprotected battery terminals.

Risk of short circuits! Risk of fire!

- Cover the vehicle battery.

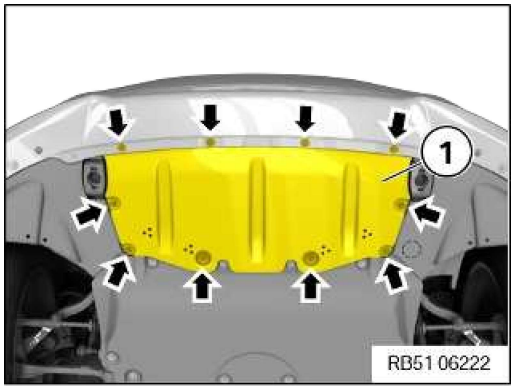
- Cover the vehicle battery with the special tool as shown.
- Position the battery earth lead (1) as shown.

2 – Disconnecting all battery earth leads



- See additional information.

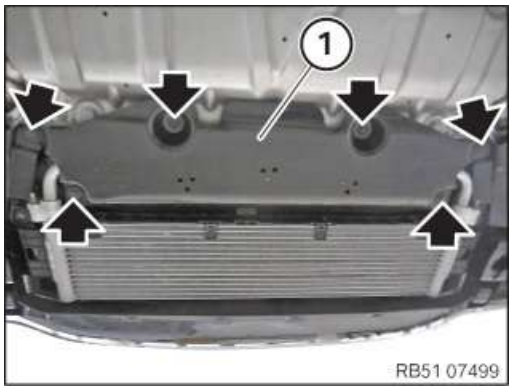
3 – Removing the front underbody protection



- **Version A:**

  Remove screws (arrows).

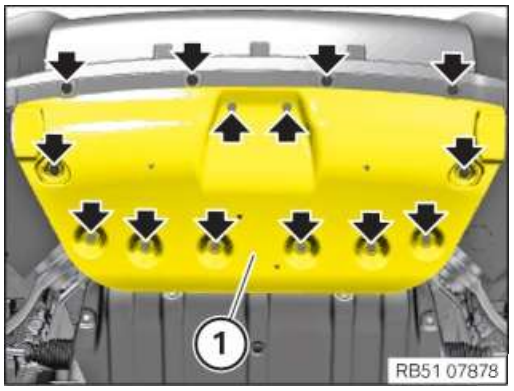
  Feed front underbody protection (1) backwards out of the bumper panel.



- **Version B:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

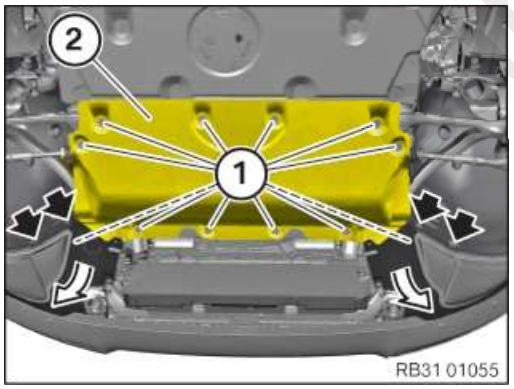


- **Version C:**

  Remove screws (arrows).

  Guide out front underbody protection (1) and remove it.

4 – Remove the underbody protection of the steering gear



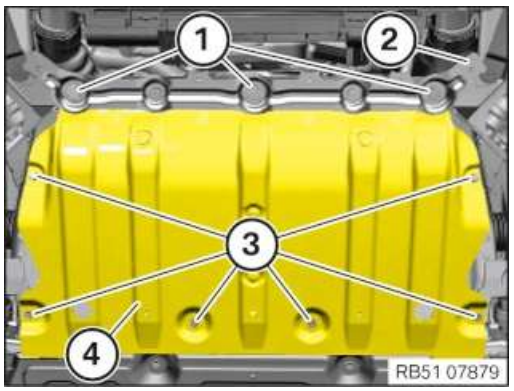
- **Version A:**

  Unscrew the screws (arrows) of the wheel arch cover on the wheel arch cover.

  Fold the bottom wheel arch cover to the side.

  Loosen screws (1).

  Remove the underbody protection (2) of the steering gear.



- **Version B:**

  Loosen screws (1).

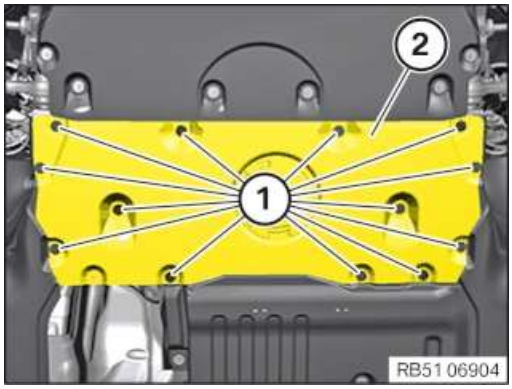
  Remove the holder (2) for the underride protection.

  Loosen screws (3).

  Feed out and remove the underbody protection (4) of the steering gear.

5 – Removing the centre underbody protection

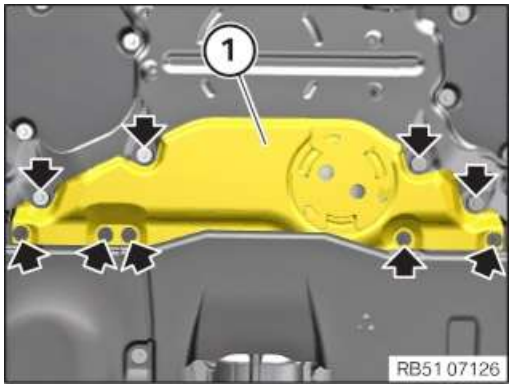
rdiagn.com



- **Variant with rear wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .



- **Version with all-wheel drive:**

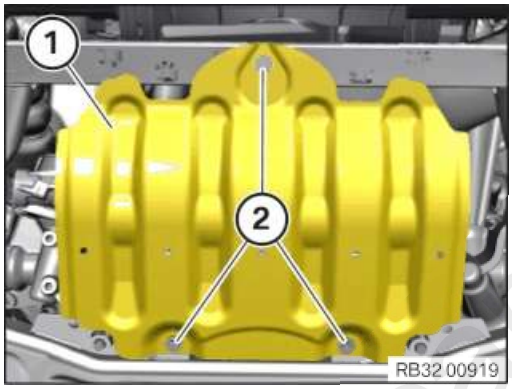
  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

6 – If installed: Removing the steering underbody protection

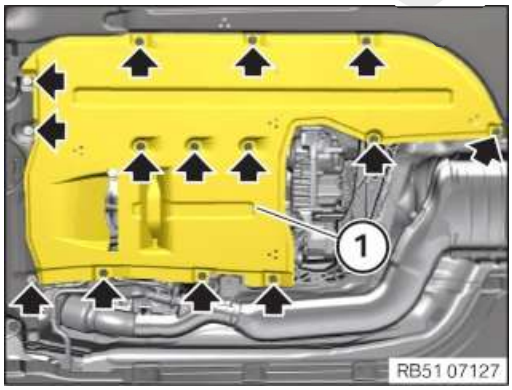
Prerequisite

Front underbody protection has been removed.



- Loosen screws (2).
- Remove underbody protection (1).

7 – Remove rear underbody protection

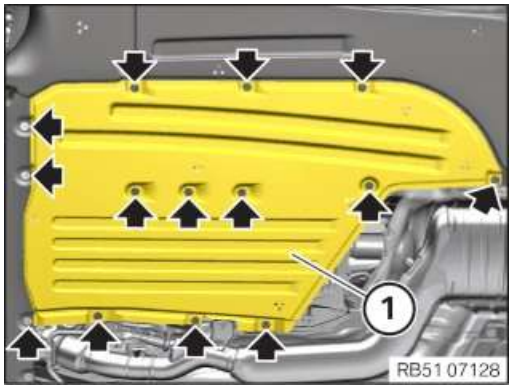


- **Version A:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).

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- **Version B:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

MAIN WORK

8 – Removing starter motor

Prerequisite

Battery earth leads are disconnected.

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

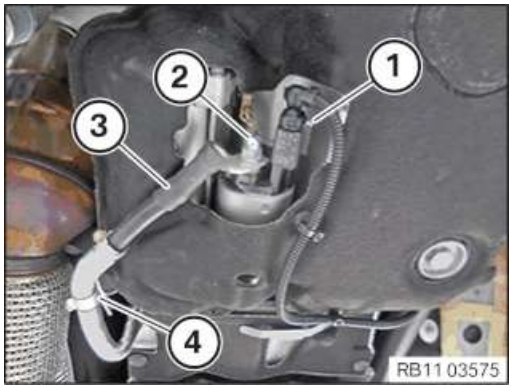
Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no charger** is connected to the jump start support point in the engine compartment.
- Detach battery earth lead from battery.
- With auxiliary batteries: Detach all battery earth leads from additional batteries.

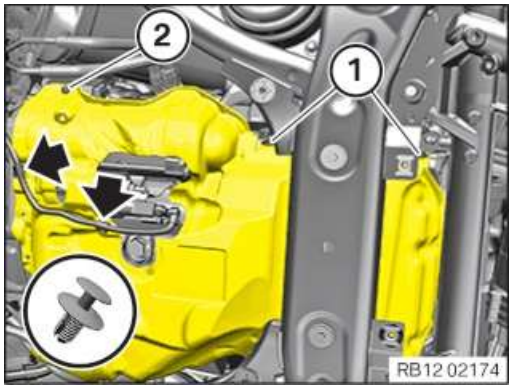
TECHNICAL INFORMATION

Make sure that the acoustic cover is **not** damaged while removing the starter motor.
A damaged lower acoustic cover can only be renewed when the front axle is lowered.

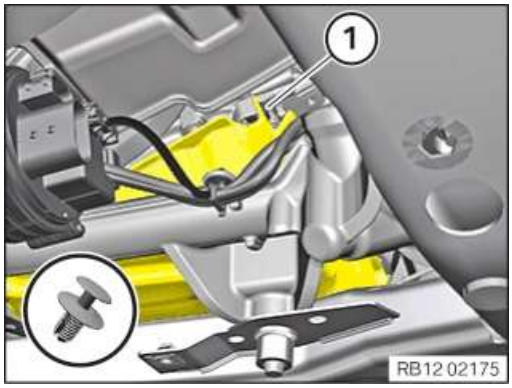


- Unlock plug connection (1) and disconnect.
- Release nut (2).
- Release positive battery cable (3) from holder (4).

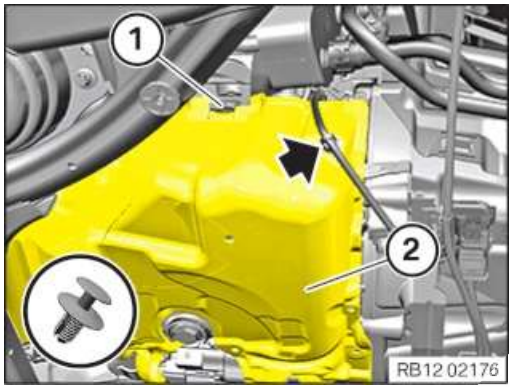
cardiagn.com



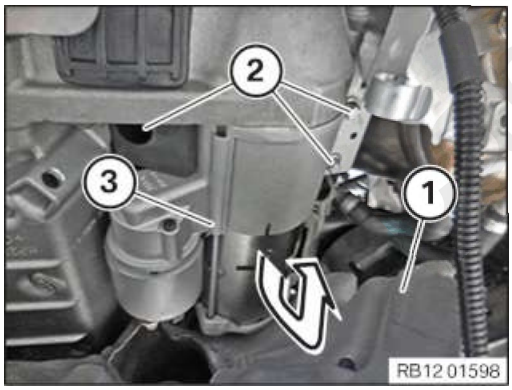
- Loosen the expanding rivet (1).
- Undo fir tree clip (2).
- Release the clamps (arrows).



- Loosen expanding rivet (1).
- Lower the acoustic cover of the oil sump.

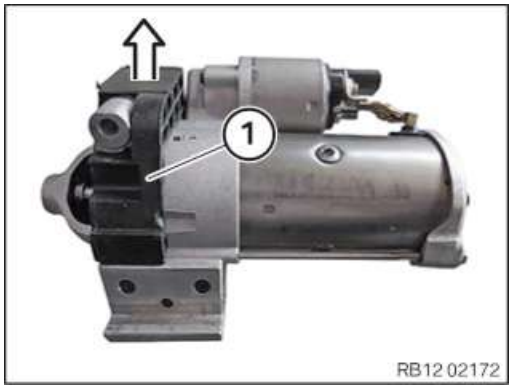


- Loosen expanding rivet (1).
- Loosen the clamp (arrow).
- Lower acoustic cover (2).

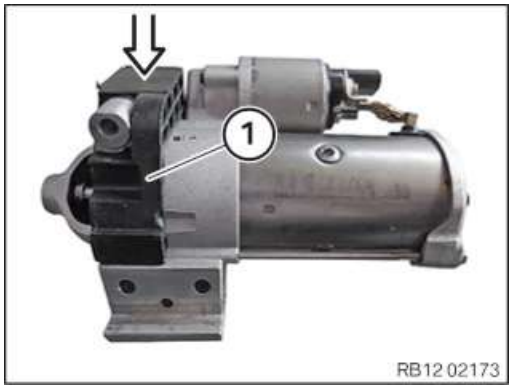


- Make sure that the acoustic cover (1) is not damaged.
- Carefully press acoustic cover (1) to one side.
- Loosen screws (2).
- Carefully guide out the starter motor (3) in direction of arrow and remove.

9 – Replace starter motor



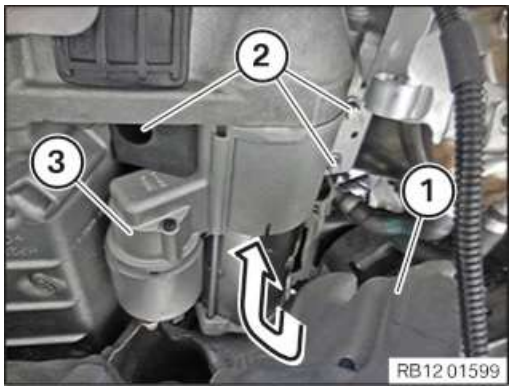
- Remove noise damping plug (1) in the direction of the arrow.



- Replace starter motor.

  Parts: Starter motor
- Fit noise damping plug (1) in the direction of the arrow.

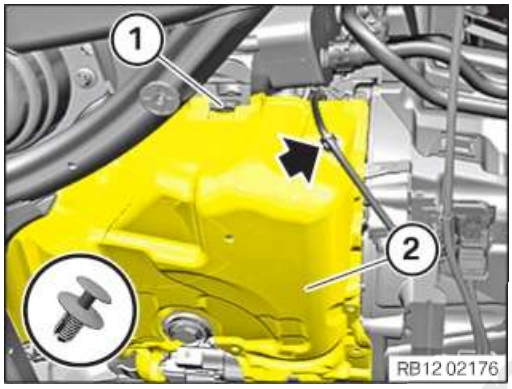
10 – Installing starter motor



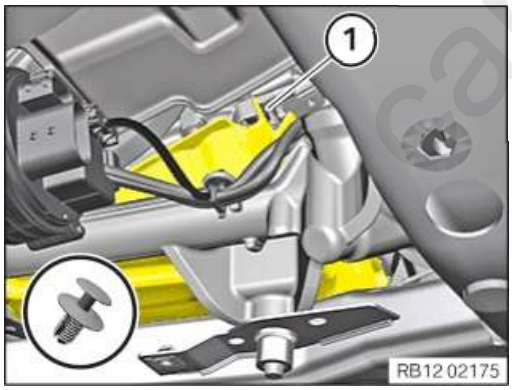
- Make sure that the acoustic cover (1) is not damaged.
- Carefully press the acoustic cover (1) to one side.
- Feed in and install the starter motor (3) in the direction of the arrow.
- Tighten the screws (2).

Starter motor to engine

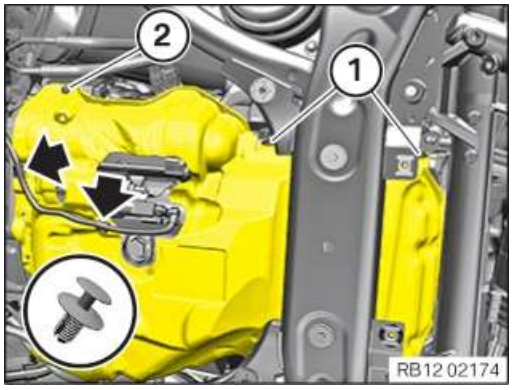
M8X60		Tightening torque	19 Nm



- Position the acoustic cover (2).
- Fasten expanding rivet (1).
- Secure clamp (arrow).

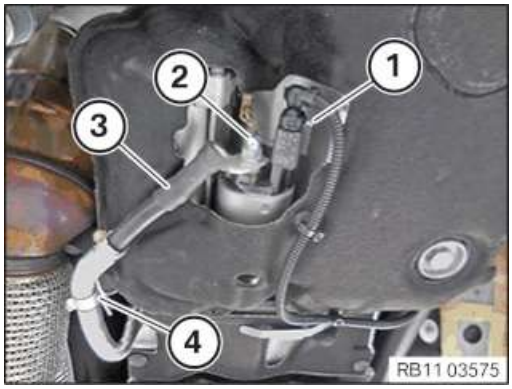


- Fasten expanding rivet (1).

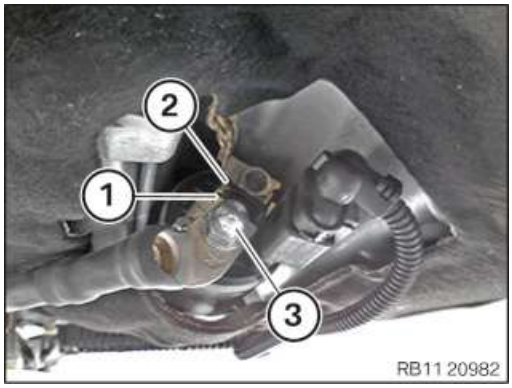


- Secure fir tree clip (2).
- Secure expanding rivet (1).
- Secure the clamps (arrows).

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- Fasten positive battery cable(3) in holder (4) and position it on the starter motor.
- Tighten the nut (2) hand-tight.
- Connect the connector (1) and audibly lock it.



CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.

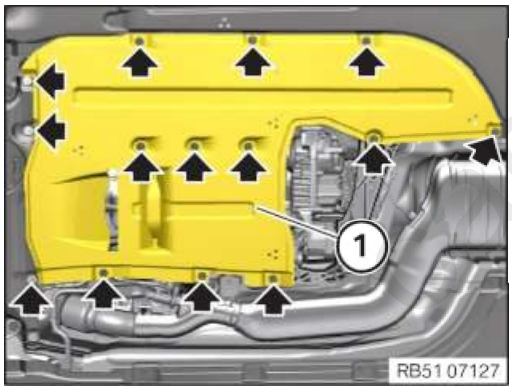
- Attach the positive battery cable (1) **correctly** to anti-twist lock (2).
- Tighten nut (3).

Battery positive lead to starter

M8		Tightening torque	13,5 Nm

POSTPROCESSES

11 – Installing underbody protection at rear



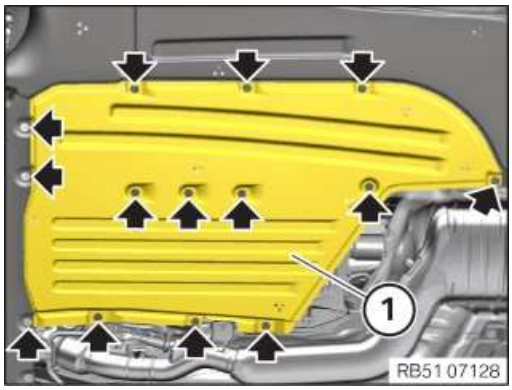
- **Version A:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version B:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

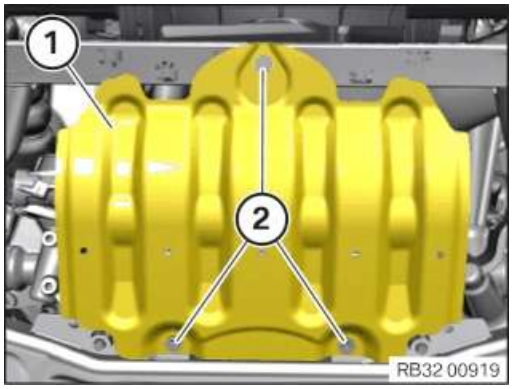
Underbody protection

Hexagon screw		Tightening torque	3 Nm

12 – If installed: Install underbody protection of the steering

Prerequisite

Front underbody protection has been removed.



- Position underbody protection (1).
- Tighten the screws (2).

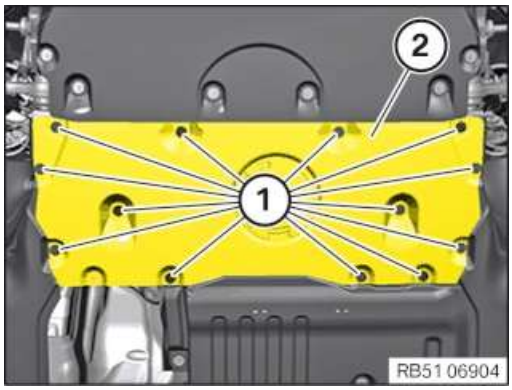
Underbody protection, steering, to front axle support

Multi-purpose boltM10		Tightening torque	56 Nm

Underbody protection, steering, to front axle support

Hexagon bolt M6		Tightening torque	8 Nm

13 – Installing the centre underbody protection



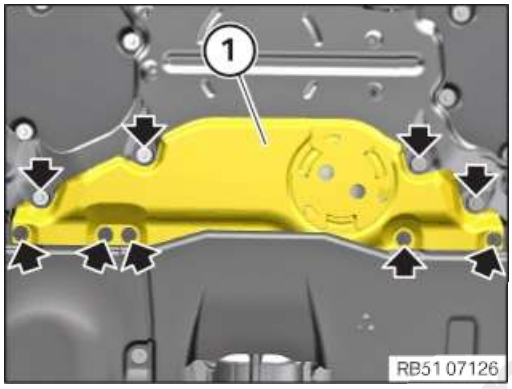
- **Variant with rear wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

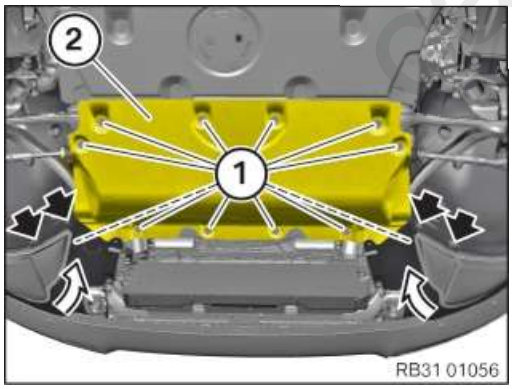
  Guide in centre underbody protection (1) and install.

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

14 – Install the underbody protection of the steering gear



- **Version A:**

  Position the underbody protection (2) of the steering gear.

  Tighten the screws (1).

Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	2.6 Nm
Hexagon bolt M6x20		Tightening torque	8 Nm

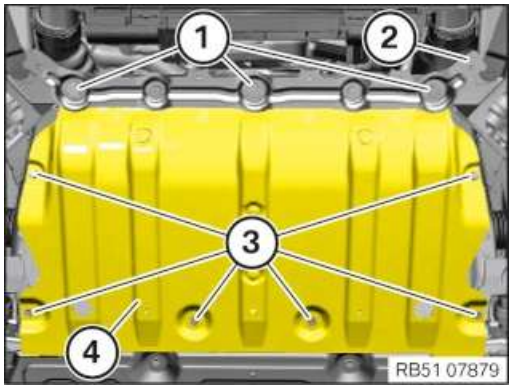
- Position the bottom wheel arch cover.

  Tighten the screws (arrows) of the lower wheel arch cover on the wheel arch cover.

Wheel arch trim panel, front

Thermoplastic hexagon screw		Tightening torque	2,6 Nm

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- **Version B:**

  Feed in the underbody protection (4) of steering gear and install it.

  Tighten the screws (3).

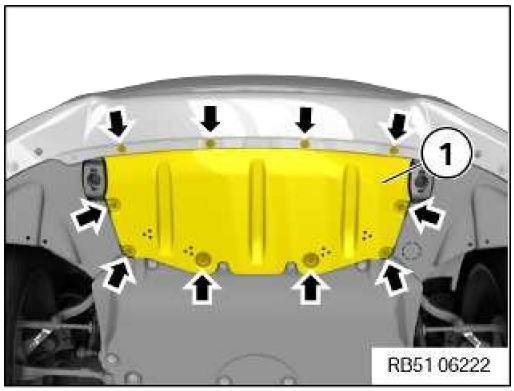
Underbody protection of the steering gear

Hexagon screw for thermoplastic		Tightening torque	2.6 Nm
Hexagon bolt M6x20		Tightening torque	8 Nm

- Position the holder (2) for the underride protection.

  Tighten the screws (1).

15 – Installing the front underbody protection



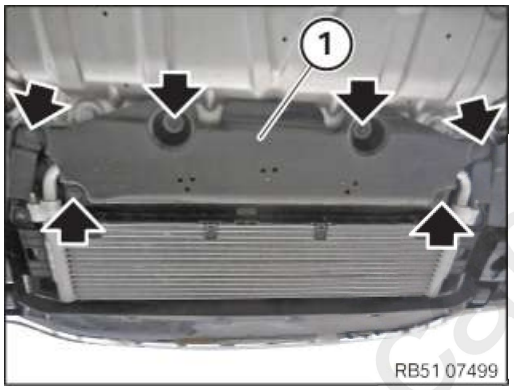
- **Version A:**

  Feed in the front underbody protection (1) towards the front under the bumper panel and position.

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



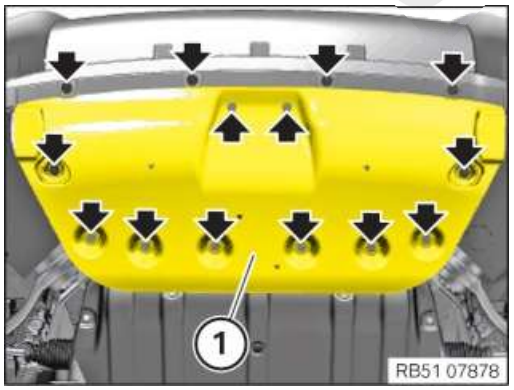
- **Version B:**

  Feed in and position the front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm



- **Version C:**

  Feed in and install front underbody protection (1).

  Tighten screws (arrows).

Underbody protection front

Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

16 – Connecting all battery earth leads

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- See additional information.

17 – Activating the 48 V electrical system

Prerequisite

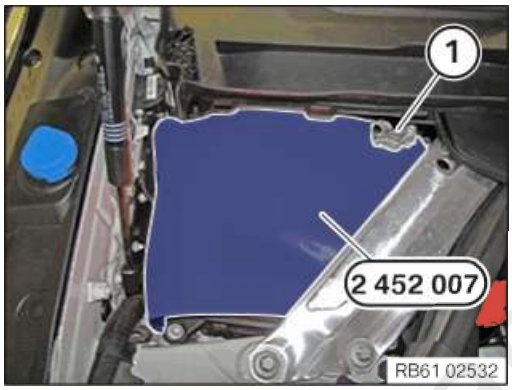
Ignition is switched off.

RISK OF DAMAGE

Damage to 48-V battery

If a 48-V battery that is disconnected from the electrical system is activated, the battery electronics will be damaged.

- Only carry out activation of the 48V electrical system with a completely connected 48-V battery.



- Lift battery earth lead (1).
- Remove special tool .



- Release the negative battery cable (2) of the 48-V battery from the mounting.
- Position the negative battery cable (2) of the 48-V battery on the negative battery terminal.
- Tighten nut (1).

Negative battery cable to 48-V battery

Nut M8		Tightening torque	19 Nm



- Connect the connector (1) of the CAN bus and lock it.
- Clip in clip (2).



- Activate the 48V electrical system by closing the bonnet.
  The activation takes place automatically.

Additional Information

Overview of Tightening Torques

Starter motor to engine			Used in step 10
M8X60		Tightening torque	19 Nm

Battery positive lead to starter			Used in step 10
M8		Tightening torque	13,5 Nm

Underbody protection			Used in step 1113
Hexagon screw		Tightening torque	3 Nm

Underbody protection, steering, to front axle support			Used in step 12
Multi-purpose boltM10		Tightening torque	56 Nm

Underbody protection, steering, to front axle support			Used in step 12
Hexagon bolt M6		Tightening torque	8 Nm

Underbody protection of the steering gear			Used in step 14
Hexagon screw for thermoplastic		Tightening torque	2.6 Nm
Hexagon bolt M6x20		Tightening torque	8 Nm

Wheel arch trim panel, front			Used in step 14
Thermoplastic hexagon screw		Tightening torque	2,6 Nm

Underbody protection front			Used in step 15
Hexagon screw for thermoplastic		Tightening torque	2,6 Nm
Hexagon screw M6x20		Tightening torque	8 Nm

Negative battery cable to 48-V battery			Used in step 17
Nut M8		Tightening torque	19 Nm

Overview of Special Tools

Links

Repair instructions (PRE)	Used in step

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Notes on 48-V battery	117

Repair instructions	Used in step
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	216
61 20 900 Disconnecting and connecting battery earth lead	216
61 20 900 Disconnecting and connecting battery earth lead	216
61 20 900 Disconnecting and connecting battery earth lead	216
61 20 900 Disconnecting and connecting battery earth lead	216
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61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	216
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	216
61 20 900 Disconnecting and connecting battery earth lead	216
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	216
61 20 900 Disconnecting and connecting battery earth lead (Plug-in Hybrid Electric Vehicle)	216
61 20 900 Disconnecting and connecting battery earth lead	216
61 20 900 Disconnecting and connecting battery earth lead	216
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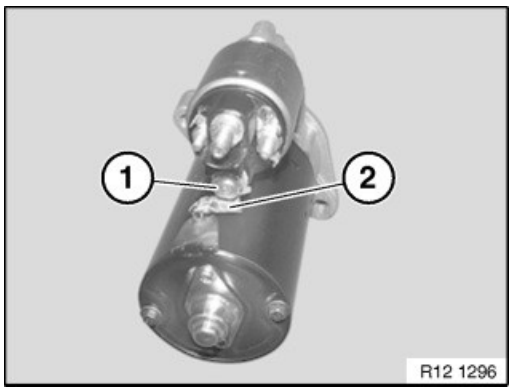
61 20 900 Disconnecting and connecting battery earth lead	216
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	216
61 20 900 Disconnecting and connecting battery earth lead	216
61 20 900 Disconnecting and connecting battery earth lead	216
61 20 900 Disconnecting and connecting battery earth lead	216

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12 41 041 Replacing the engagement solenoid switch

Necessary preliminary work:

- Switch off ignition.
- Remove starter motor.

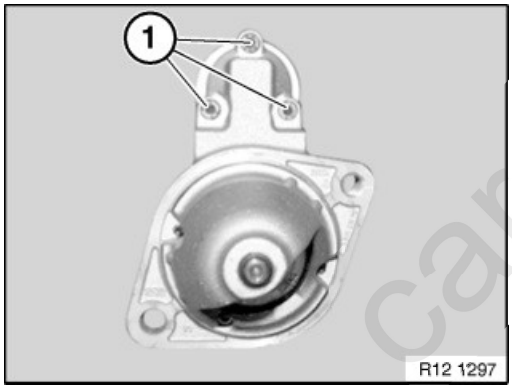


Slacken nut (1).

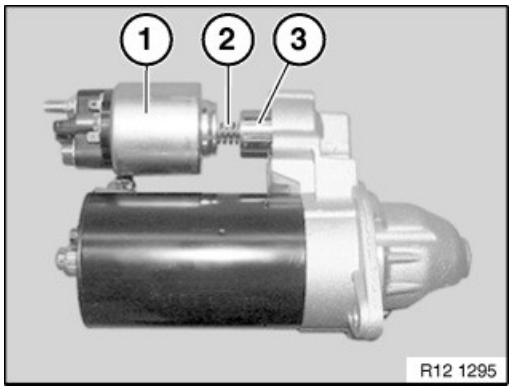
Remove the cable shoe (2).

Attention!
Do not twist the cable shoe (2) when tightening, risk of shorting to starter motor housing.

Tightening torque 12 41 1AZ.



Release screws (1).



Remove the solenoid switch (1) and the spring (2).

Detach the bolt (3).

Installation note:
Check the bolt (3) for wear and grease the bolt.

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12 42 651 Removing and installing/replacing the positive battery cable, remote positive terminal to alternator

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no charger** is connected to the jump start support point in the engine compartment.
- Detach battery earth lead from battery.
- With auxiliary batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Bring front compartment lid in the service position

Prerequisite

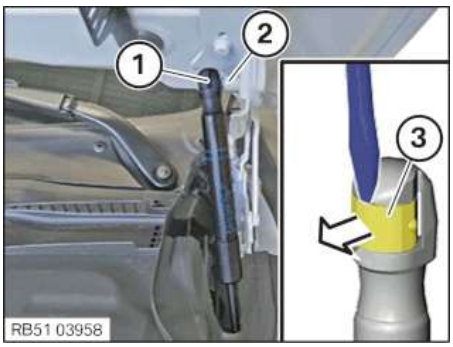
Engine compartment lid is open.

CAUTION

Shutting bonnet or tailgate.

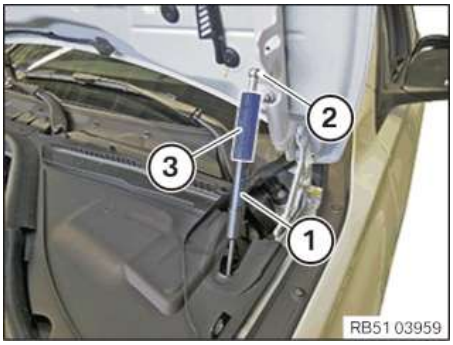
Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Lift clamp (3) slightly using a screwdriver, in the direction of the arrow.
- Lift off ball socket (1) from ball pin (2).
- Repeat the operation on the other side of vehicle.

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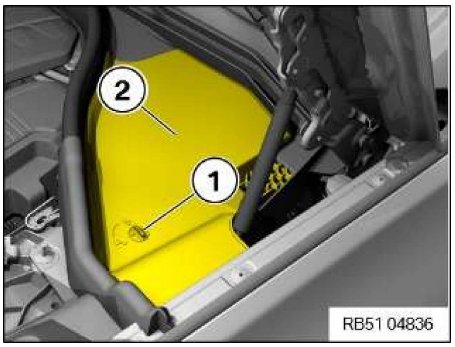


TECHNICAL INFORMATION

Conduct the following operation with the assistance of a second person.

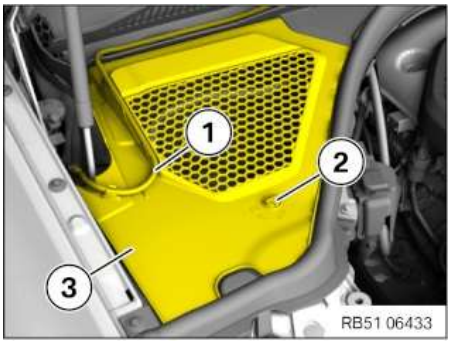
- Remove the bonnet support and open the bonnet further.
- Pull special tool or or (3) over gas pressure spring (1).
- Place special tool on the ball pin (2) and engage using force.
- Repeat the operation on the other side of vehicle.

3 – Remove the cover of the engine compartment at the rear left



- Loosen the lock (1).
- Remove the cover (2) of the rear left engine compartment.

4 – Remove the cover of the rear right engine compartment



- Release washer fluid hose (1) from the guides.
- Loosen the lock (2).
- Remove the cover (3) of the rear right engine compartment.

5 – Removing the wiper arm on the left and right

NOTICE

Description is for left component only. Procedure on the right side is identical.

▸ **Remove the wiper arm**

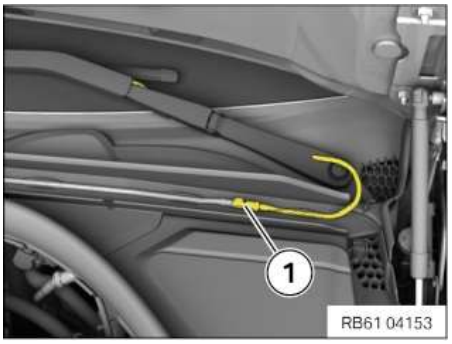
RISK OF DAMAGE

Damage to wiper console.

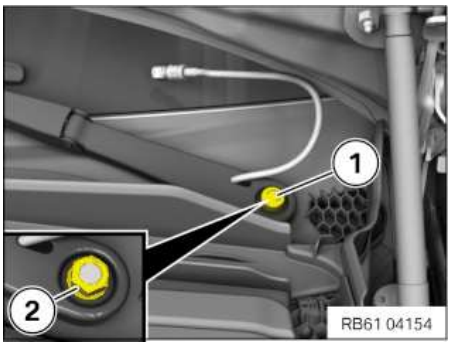
While removing the wiper arms without using special tool, the wiper console can break.

- Removing the wiper arms must be carried out only using the prescribed special tool.
- Do **not** lever off the wiper arm because otherwise the wiper console may break at the predetermined breaking point for active pedestrian protection.

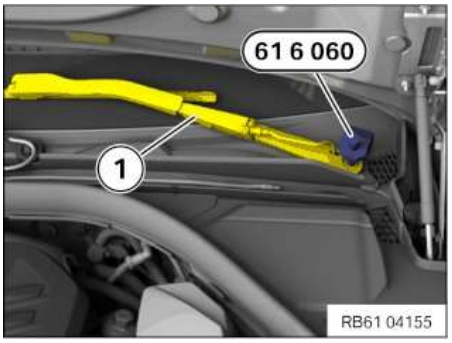
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- Disconnect the washer fluid hose (1) at the separation point and feed out from the cowl panel guide.

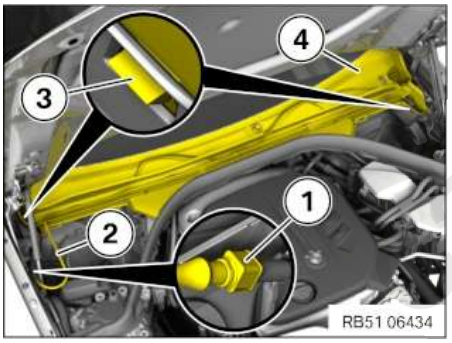


- Remove the protective cap (1).
- Loosen nut (2).

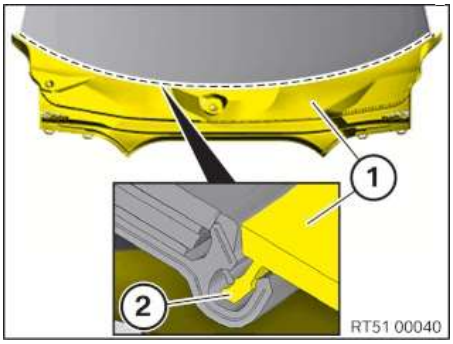


- Pull off the wiper arm (1) using special tool .

6 – Remove cowl panel cover



- Release snap fastener (1) of the washer fluid hose (2) and put the washer fluid hose (2) to one side.
- Unclip clips (3) on the cowl panel cover (4).



- Pull the cowl panel cover (1) upward out of the latch mechanism (2) beginning on the side.

7 – Remove the seal for the rear bonnet

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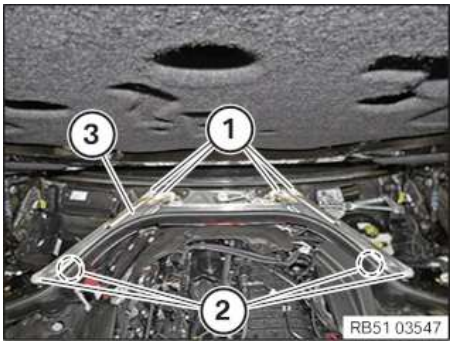


- Feed the cable (1) out of the brackets toward the front.
- Remove the rear bonnet seal (2) from the guide toward the inside.

8 – Removing the centre bulkhead upper part

TECHNICAL INFORMATION

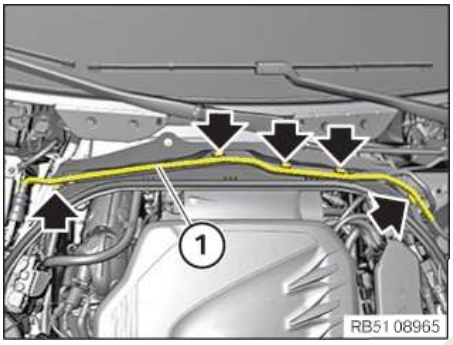
Driving without the strut brace/front-end strut or tension strut is not permitted.



NOTICE

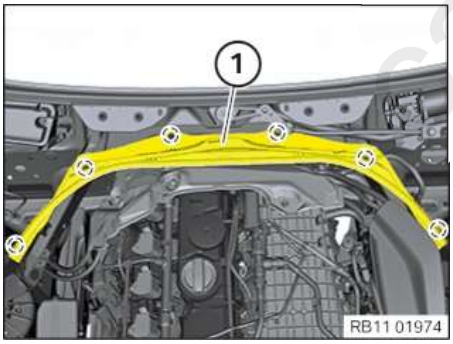
The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

- Loosen screws (1) and (2).
- Remove tension strut (3) in the spring strut dome upwards.



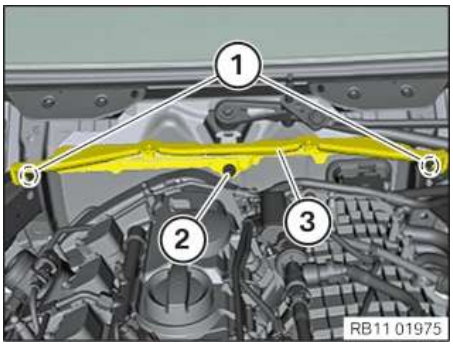
- **Version with mild hybrid technology:**

  Unclip the wire (1) at the holders (arrows).



- Unscrew the bolts in the marked areas.
- Remove the centre bulkhead upper part (1).

9 – Removing the centre bulkhead lower section



- Loosen screws (1).
- Loosen nut (2).
- Remove the centre bulkhead lower part (3).

10 – Removing the acoustic cover

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RISK OF DAMAGE

Damage to the acoustic cover/design cover.

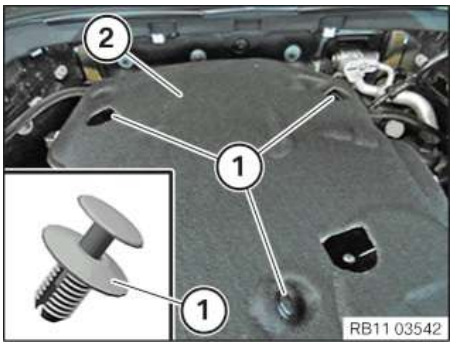
Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover/design cover.

- Disassemble or mount the acoustic cover/design cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover/design cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



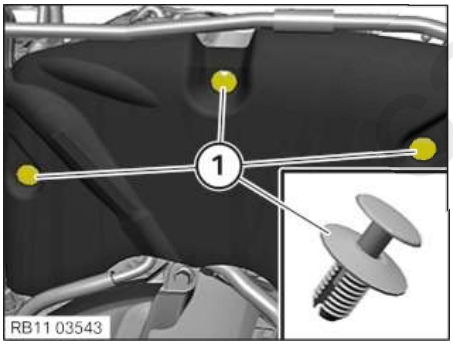
- Unclip the acoustic cover (1) from the holders in the indicated area towards the top.

11 – Remove the acoustic cover for the injectors

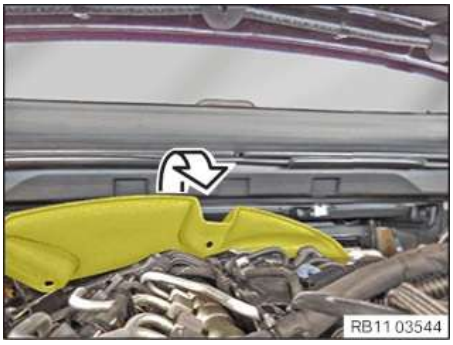


- **If installed:** Release the expanding rivet (1).
- Guide the acoustic cover (2) out and remove.

12 – Removing acoustic cover at rear



- Loosen the expanding rivet (1).



- Guide out and remove the acoustic cover in the direction of the arrow.

MAIN WORK

13 – Removing the positive battery cable from the alternator to the positive battery connection point

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WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no charger** is connected to the jump start support point in the engine compartment.
- Detach battery earth lead from battery.
- With auxiliary batteries: Detach all battery earth leads from additional batteries.

WARNING

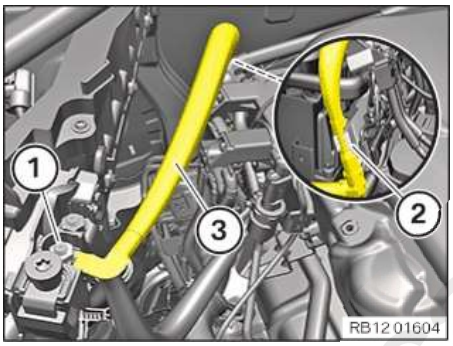
Hot surfaces.

Risk of burning!

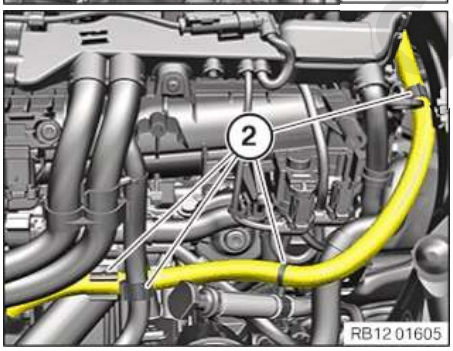
- Perform all work only on components that have cooled down.



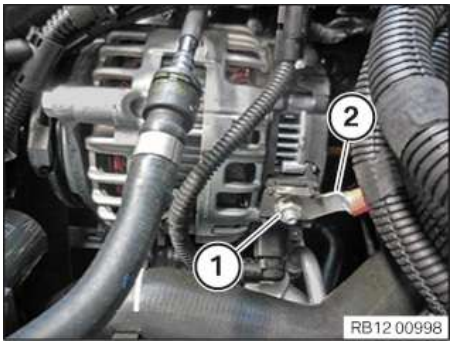
- Unlock the locks (1).
- Guide and remove cover (2) in direction of arrow.



- Unfasten nut (1).
- Loosen clamp (2).
- Feed out positive battery cable (3) and put to one side.



- Loosen clamps (2).



- Unfasten nut (1).
- Remove positive battery cable (2) and remove.

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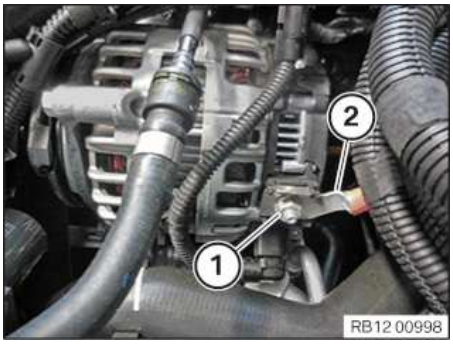
14 – Installing the positive battery cable from the alternator to the positive battery connection point

CAUTION

Improper routing of the positive battery cable.

Risk of short circuits!

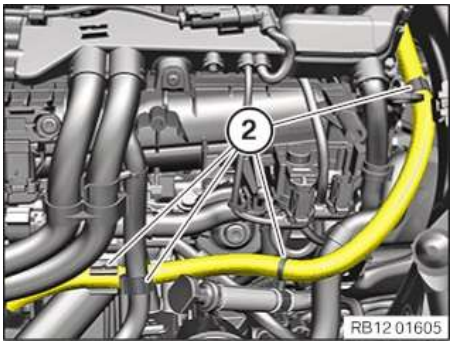
- Route the positive battery cable without abrasions and do not trap.



- Insert and install the positive battery cable (2) at the alternator.
- Tighten nut (1).

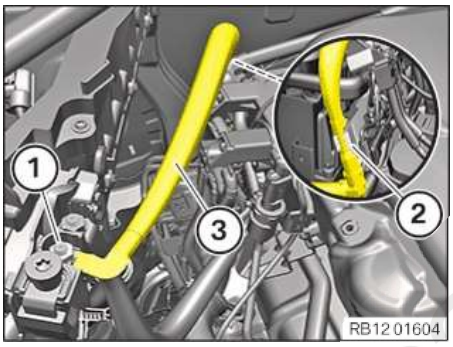
Positive battery cable to the alternator

M8		Tightening torque	19 Nm



- Secure clamps (2).

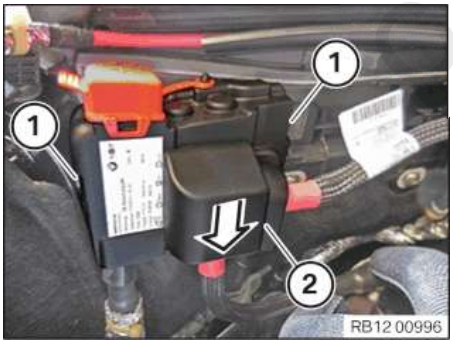
  The clamps (2) must engage audibly.



- Secure clamps (2).
- Insert and install the positive battery cable (3) at the positive battery connection point.
- Tighten nut (1).

Battery positive lead to battery positive terminal

M8		Tightening torque	19 Nm



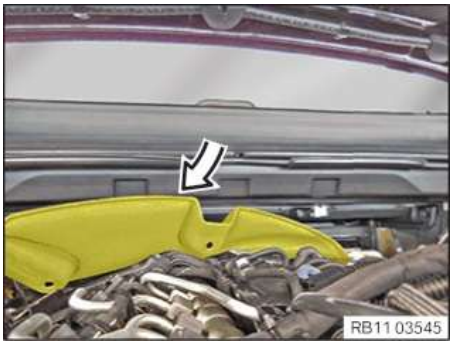
- Insert and install the cover (2) in the direction of the arrow.

  The locks (1) must engage audibly.

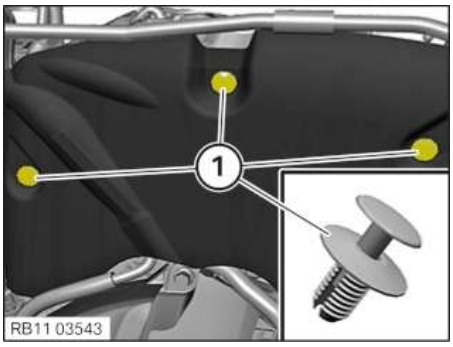
POSTPROCESSES

15 – Installing acoustic cover at rear

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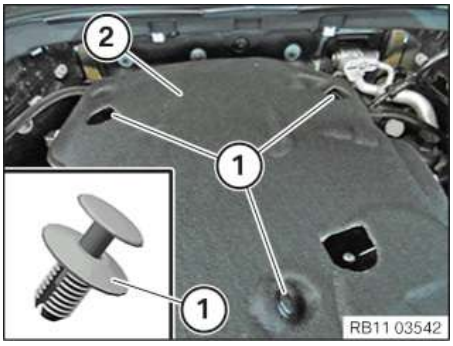


- Guide in the acoustic cover in the direction of the arrow and install it.



- Secure acoustic cover with the expanding rivets (1).

16 – Install the acoustic cover for the injectors



- Feed the acoustic cover (2) in and install.
- **If installed:** Secure the acoustic cover (2) with the expanding rivets (1) .

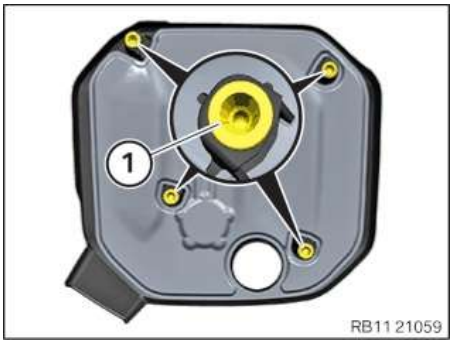
17 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover/design cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover/design cover.

- Disassemble or mount the acoustic cover/design cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover/design cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



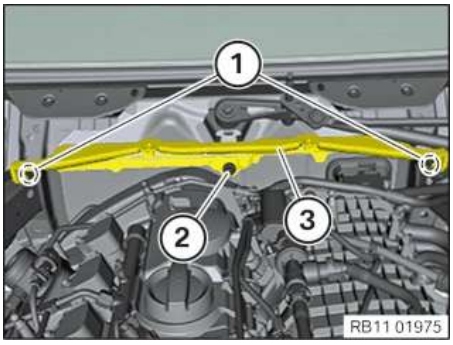
- Check the acoustic cover for correct fit of the rubber mounts (1).

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- Clip in the acoustic cover (1) into the holders in the indicated areas.

18 – Installing centre bulkhead lower section

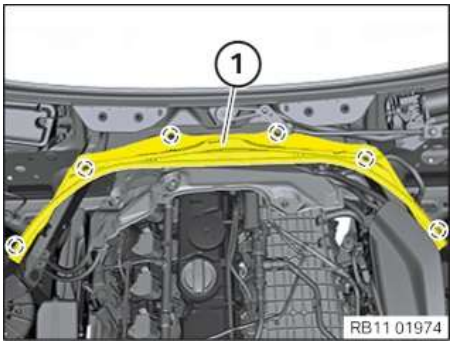


- Position the centre bulkhead lower part (3).
- Tighten nut (2) and screws (1).

Bulkhead lower part to body

Screw		Tightening torque	2,6 Nm
Plastic nut		Tightening torque	2,6 Nm

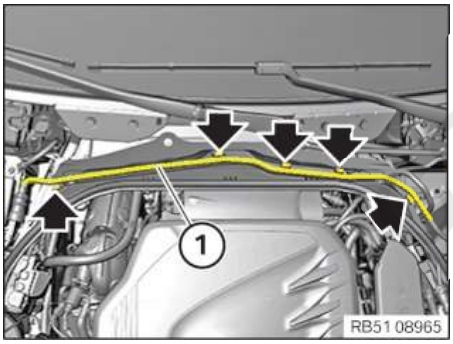
19 – Installing the centre bulkhead upper part



- Position the centre bulkhead upper part (1).
- Tighten the bolts in the marked areas.

Bulkhead upper part to bottom bulkhead

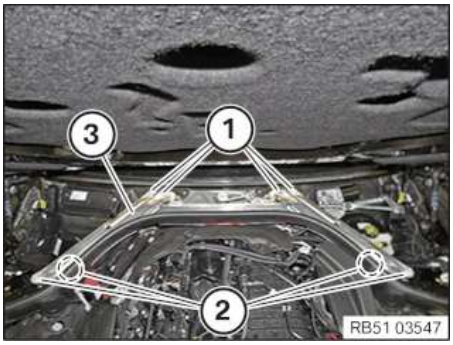
		Tightening torque	3 Nm



- **Version with mild hybrid technology:**

  Clip in the wire (1) into the holders (arrows).

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NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

- Install the tension strut (3) on the spring strut dome.
- Tighten the screws (1).

Tension strut on bulkhead

M10x25 screw		Tightening torque	56 Nm

- Renew screws (2).

  Parts: Screws
- Tighten the screws (2).

Tension strut to spring strut dome

Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

20 – Install the seal for the bonnet



- Press the rear bonnet seal (2) into the guide.
- Feed in cable (1) into the brackets.
- Check that the rear bonnet seal (2) and the cable (1) are seated correctly.

21 – Installing cowl panel cover

RISK OF DAMAGE

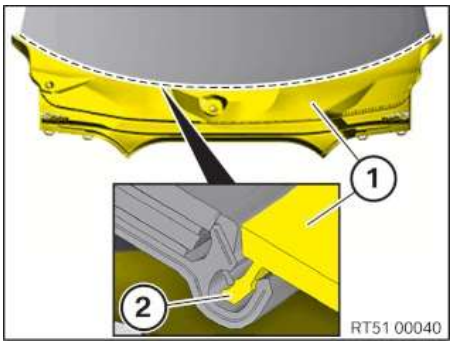
Damage caused by water ingress into the vehicle.

Water ingress into the vehicle may result in damage to components, malfunctions and corrosion.

- Ensure correct installation of the components.
- Only use undamaged components.

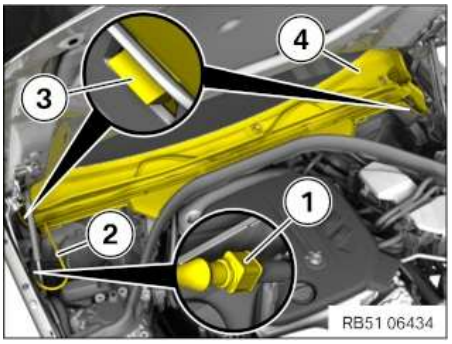
TECHNICAL INFORMATION

Before installing the cowl panel cover it is **mandatory** to check that the 48 V line is routed correctly and fitted tightly.
An incorrectly laid or attached 48 V line can be damaged by the wiper kinematics.



- Push the cowl panel cover (1) into the latch mechanism (2) beginning on the side.

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- Clip cowl panel cover (4)in by means of the latch mechanisms (3).
- Position windscreen wash hose (2) and connect windscreen wash hose (1)quick lock.

22 – Install left and right wiper arm

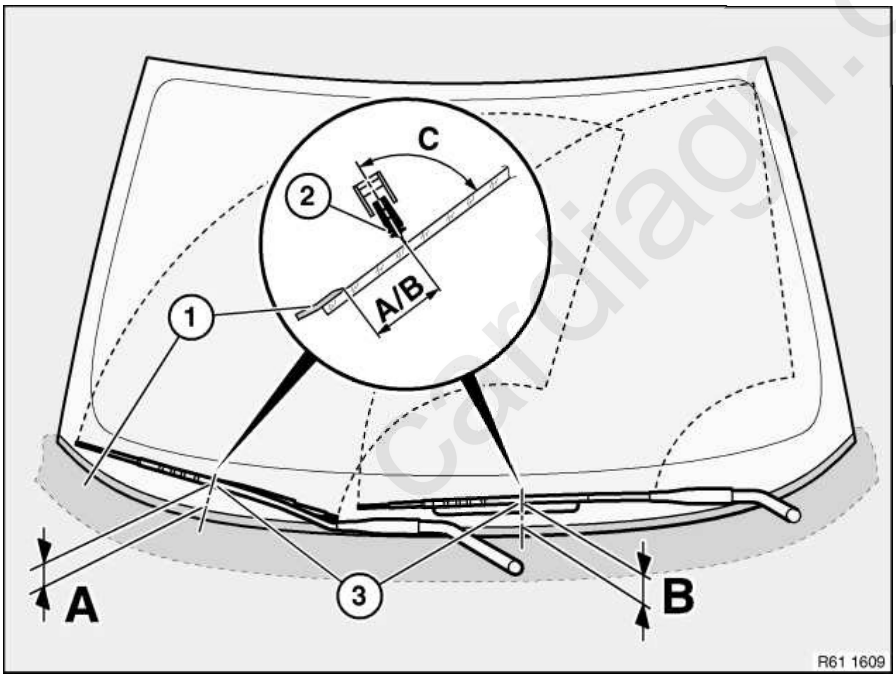
NOTICE

Description is for left component only. Procedure on the right side is identical.

▸ **Installing left and right wiper arm**

TECHNICAL INFORMATION

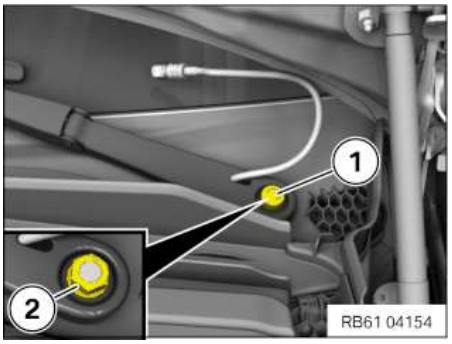
The wiper system must be in zero position.
After installing the cowl panel cover and before fitting the wiper arm:
Activate the wiper system once to ensure that it has the correct installation position.



- Connect the wiper arm (3).
- Correctly position the wiper arm (2) in relation to the window edge (1).

Distance from window pane edge to wiper blade

Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm



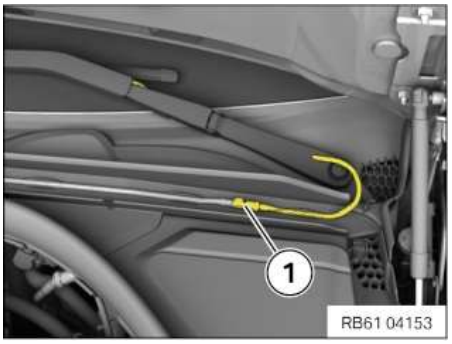
- Tighten nut (2).

Windscreen wiper arm

Combination hexagon nut		Tightening torque	35 Nm

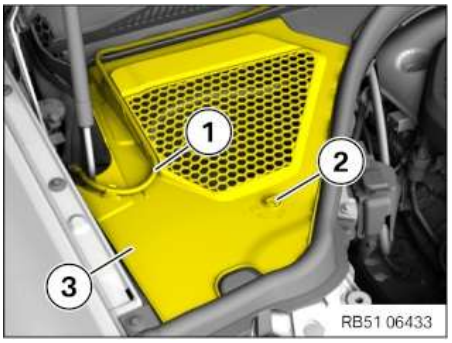
- Connect the protective cap (1).

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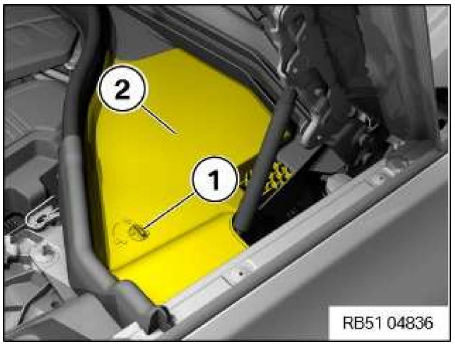
- Feed washer fluid hose (1) into the cowl panel guide and connect at the separation point.

23 – Install the rear right engine compartment cover



- Position the cover of the engine compartment on the rear right (3).
- Close lock (2).
- Insert washer fluid hose (1) into the guides.

24 – Install the cover of the engine compartment on the rear left



- Position the engine compartment cover at the rear left (2) .
- Close lock (1).

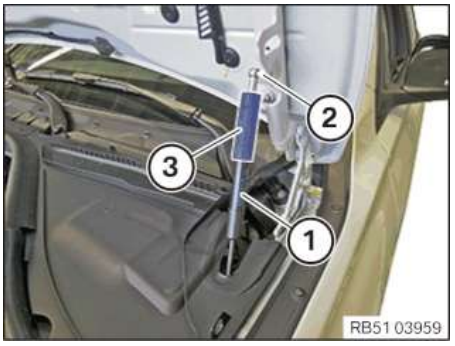
25 – Take bonnet out of the service position

CAUTION

Shutting bonnet or tailgate.

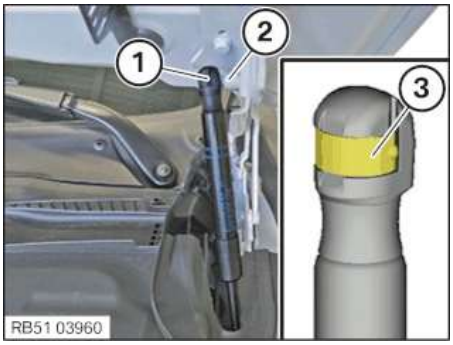
Danger of injury!

- Support bonnet/tailgate in fully open position with the aid of a suitable device.



- Support the bonnet by hand.
- Remove the special tool (3) from the ball pin (2).
- Pull off the special tool (3) from the gas pressure spring (1).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

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- Check the clamp (3) is fitted correctly.
- Connect ball socket (1) to ball pin (2).
- Continue to support the bonnet and repeat the operation on the other side of vehicle.

26 – Connecting all battery earth leads



- See additional information.

Additional Information

Overview of Tightening Torques

Positive battery cable to the alternator			Used in step 14
M8		Tightening torque	19 Nm

Battery positive lead to battery positive terminal			Used in step 14
M8		Tightening torque	19 Nm

Bulkhead lower part to body			Used in step 18
Screw		Tightening torque	2,6 Nm
Plastic nut		Tightening torque	2,6 Nm

Bulkhead upper part to bottom bulkhead			Used in step 19
		Tightening torque	3 Nm

Tension strut on bulkhead			Used in step 19
M10x25 screw		Tightening torque	56 Nm

Tension strut to spring strut dome			Used in step 19
Screw	Renew screws.	Jointing torque	56 Nm
		Angle of rotation	90 °

Windscreen wiper arm			Used in step 22
Combination hexagon nut		Tightening torque	35 Nm

Overview of Special Tools

Overview Technical Data

Distance from window pane edge to wiper blade	Used in step 22
Wiper arm right (A)	57,5 ± 5 mm
Wiper arm left (B)	63,3 ± 4 mm

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Links

Repair instructions	Used in step
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	126
61 20 900 Disconnecting and connecting battery earth lead	126
61 20 900 Disconnecting and connecting battery earth lead	126
61 20 900 Disconnecting and connecting battery earth lead	126
61 20 900 Disconnecting and connecting battery earth lead	126
61 20 900 Disconnecting and connecting battery earth lead	126
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61 20 900 Disconnecting and connecting battery earth lead	126
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	126
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	126
61 20 900 Disconnecting and connecting battery earth lead	126
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	126
61 20 900 Disconnecting and connecting battery earth lead (Plug-in Hybrid Electric Vehicle)	126
61 20 900 Disconnecting and connecting battery earth lead	126
61 20 900 Disconnecting and connecting battery earth lead	126
61 20 900 Disconnecting and connecting battery earth lead	126
61 20 900 Disconnecting and connecting battery earth lead	126
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61 20 900 Disconnecting and connecting battery earth lead	126
61 20 900 Disconnecting and connecting battery earth lead	126
61 20 900 Disconnecting and connecting battery earth lead	126

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12 42 652 Removing and installing/replacing the positive battery cable, remote positive terminal to starter motor

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no charger** is connected to the jump start support point in the engine compartment.
- Detach battery earth lead from battery.
- With auxiliary batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

PRELIMINARY WORK

1 – Deactivating the 48 V electrical system

Prerequisite

Ignition is switched off.

WARNING

Deactivation of the 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no battery charger** is connected to the jump start terminal point in the engine compartment.
- For vehicles with additional electrical systems (48 V electrical system, high-voltage vehicle electrical system), it is mandatory to deactivate them **before** disconnecting the vehicle battery.

WARNING

Deactivation of the 48 V electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no charger** is connected to the jump start support point in the engine compartment.

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RISK OF DAMAGE

Damage to 48-V battery

If a 48-V battery that is disconnected from the electrical system is activated, the battery electronics will be damaged.

- Only carry out activation of the 48V electrical system with a completely connected 48-V battery.

TECHNICAL INFORMATION

Follow notes for 48-V battery. See further information 6120 ... Notes on 48-V battery.



- Deactivate the 48V electrical system by opening the bonnet.

  The deactivation takes place automatically.



Check

TECHNICAL INFORMATION

Zero voltage (48V electrical system is switched off) is displayed only in PAD mode.

- Press the START-STOP button quickly 3 times without stepping on the brake pedal to establish the PAD mode.
- Check isolation from the supply in the instrument cluster in PAD mode.

desired state

- The Check Control message "48V electrical system switched off." (1) is displayed.

Result

» **The absence of voltage** cannot be determined by means of the Check Control message "48V electrical system switched off:" (1). Work is not permitted to be started.

Measure

- Carry out the service function "48 V electrical system deactivation".
  - Vehicle management > Service functions > Voltage supply > Deactivate 48 V electrical system

Only when the Check Control message “48 V electrical system switched off.” (1) is displayed in the instrument cluster is it permitted to disconnect the 12 V battery.

If the absence of voltage is not indicated clearly, contact Technical Support.

Result

» The Check Control message signals that the 48V electrical system has been switched off.

Measure

- Exit PAD mode by pressing the START-STOP button once without depressing the brake pedal.

  The work “Disconnecting the negative battery cable of the 48-V battery” can be started.



- Unlock and disconnect plug connection (1) of the CAN bus.
- Release the clip (2).



- Loosen nut (1).
- Pull off negative battery cable (2) of the 48-V battery from the negative battery terminal, set it aside and secure it.



WARNING

Unprotected battery terminals.

Risk of short circuits! Risk of fire!

- Cover the vehicle battery.

- Cover the vehicle battery with the special tool as shown.
- Position the battery earth lead (1) as shown.

2 – Disconnecting all battery earth leads

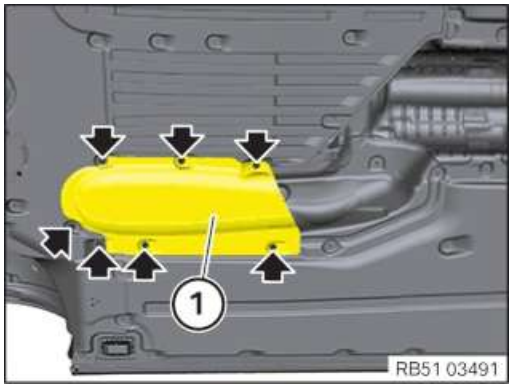


- See additional information.

3 – Remove the underbody panelling of the transmission on the side

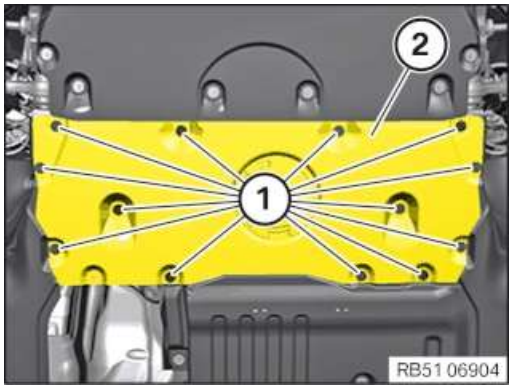
NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.



- Remove screws (arrows).
- Remove the underbody panelling (1).

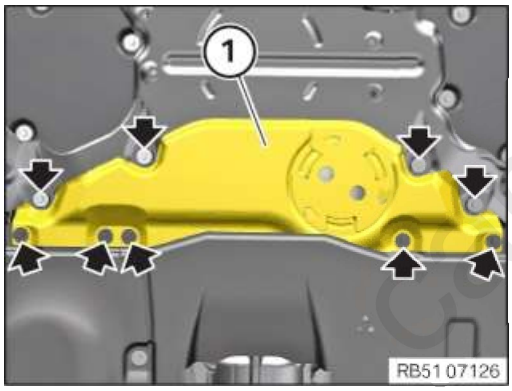
4 – Removing the centre underbody protection



- **Variant with rear wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .

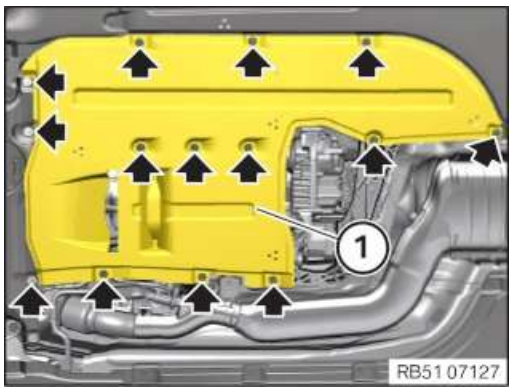


- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

5 – Remove rear underbody protection

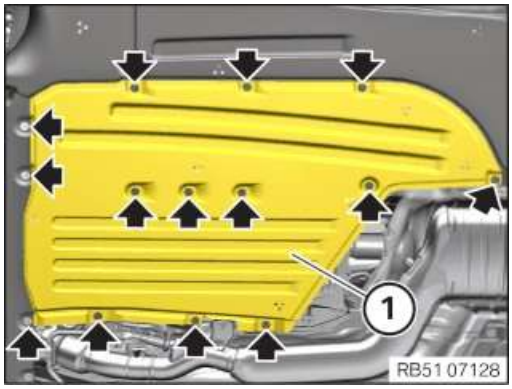


- **Version A:**

  Remove screws (arrows).

  Feed out the rear underbody protection (1).

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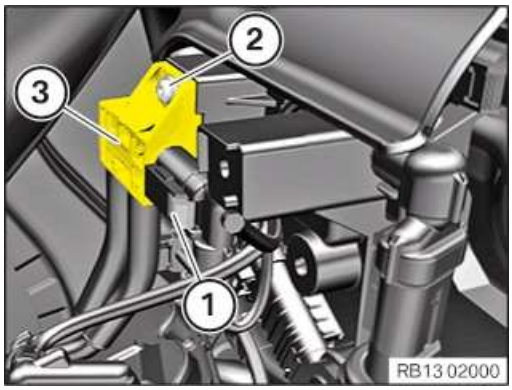


- **Version B:**

  Remove screws (arrows).

  Guide out rear underbody protection (1) and remove it.

6 – Releasing the differential pressure sensor for the diesel particulate filter



- Unlock plug connection (1) and disconnect.
- Loosen screw (2).
- Remove the differential pressure sensor (3) and put it to one side.

MAIN WORK

7 – Removing the positive battery cable from the starter motor to the positive battery connection point

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no charger** is connected to the jump start support point in the engine compartment.
- Detach battery earth lead from battery.
- With auxiliary batteries: Detach all battery earth leads from additional batteries.

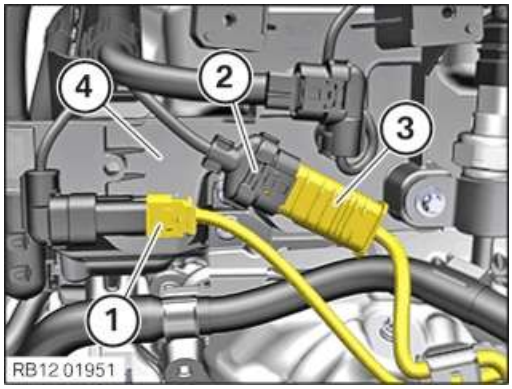
WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

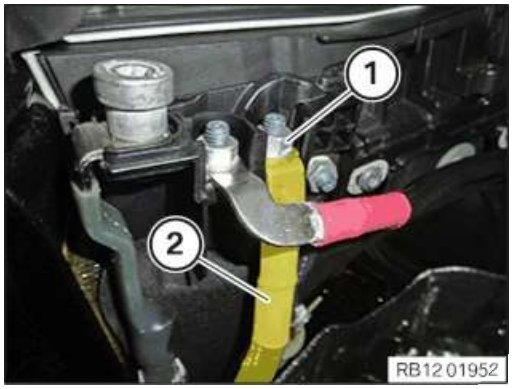
cardiagn.com



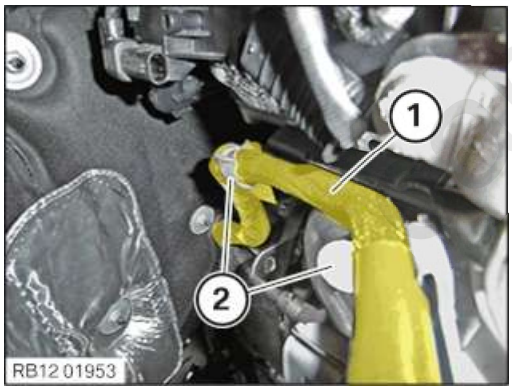
- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Unlock the connector (3) and disconnect from holder (4).



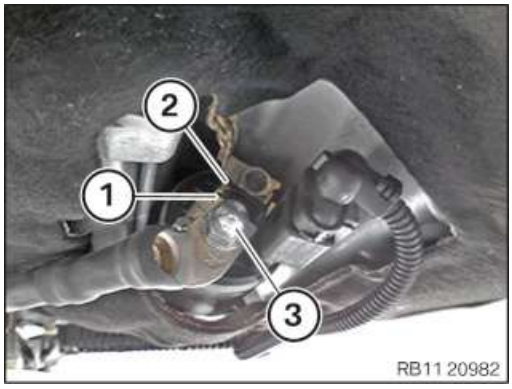
- Unlock the locks (1).
- Guide and remove cover (2) in direction of arrow.



- Unfasten nut (1).
- Thread out positive battery cable (2) and set it aside.

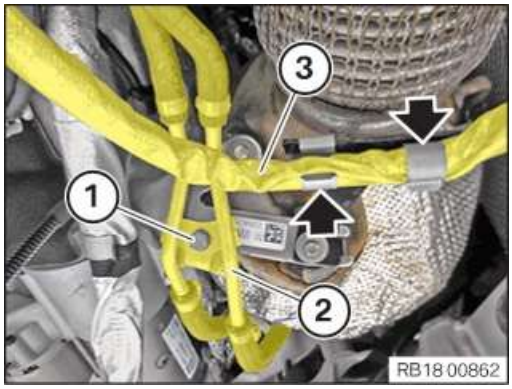


- Feed out the positive battery cable (1) from the clamps (2) and set it aside.

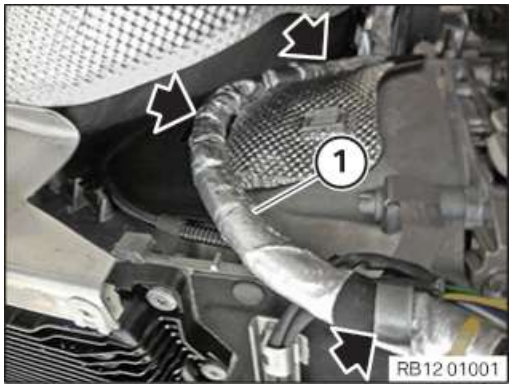


- Loosen nut (3).
- Thread out positive battery cable (1) and set it aside.

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- Loosen screw (1).
- Guide out coolant lines (1) from the SCR metering module and set them aside.
- Guide out SCR metering line (3) from the clamps (arrows) and set it aside.



- Disconnect the positive battery cable (1) (arrows).
- Remove positive battery cable (1) and remove.

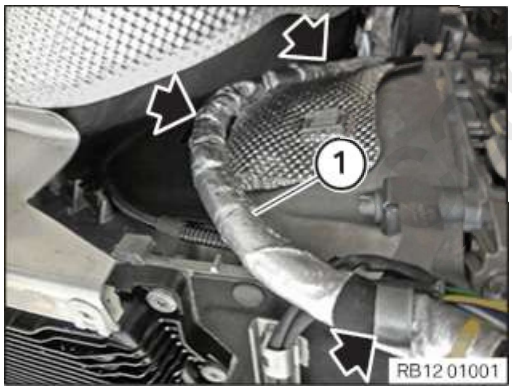
8 – Installing the positive battery cable from the starter motor to the positive battery connection point

CAUTION

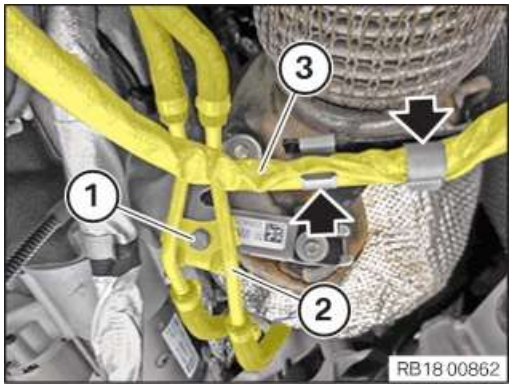
Improper routing of the positive battery cable.

Risk of short circuits!

- Route the positive battery cable without abrasions and do not trap.



- Insert and install the positive battery cable (1).
- Secure the positive battery cable (1) (arrows).

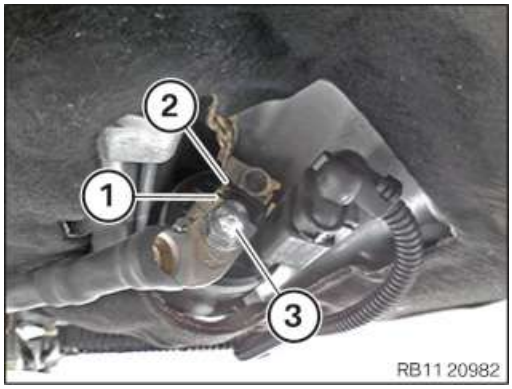


- Install the SCR metering line (3) and fasten on the clamps (arrows).
- Install the coolant lines (2) from the SCR metering module.
- Tighten down screw (1).

Coolant lines for SCR metering module

M6X16		Tightening torque	8 Nm

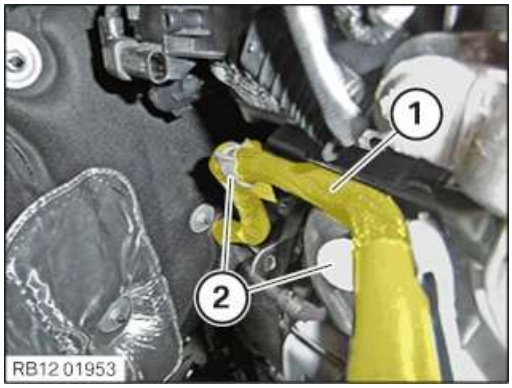
mdiagn.com



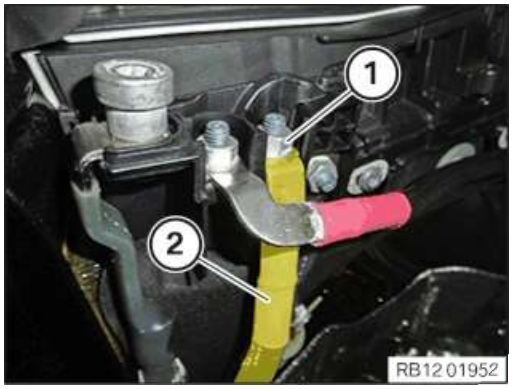
- Connect the positive battery cable (1) to the starter motor.
- Bring positive battery cable (1) on anti-twist lock (2) to the limit position.
- Tighten nut (3).

Battery positive lead to starter

M8		Tightening torque	13,5 Nm



- Feed the positive battery cable (1) into the holders (2) and install.



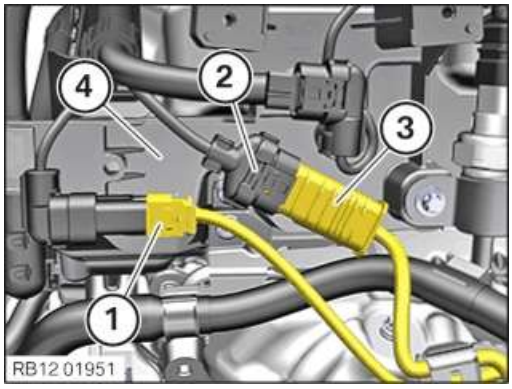
- Insert and install the positive battery cable (1).
- Tighten nut (1).

Battery positive lead to battery positive terminal

M8		Tightening torque	19 Nm



- Insert and install the cover (2) in the direction of the arrow.
  The locks (1) must engage audibly.

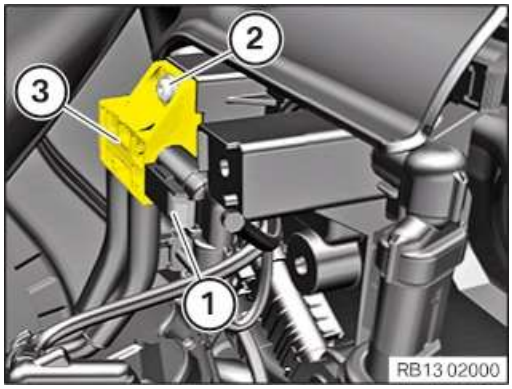


- Connect and lock connector (3) with holder (4).
  The connector (3) must engage audibly.
- Connect connectors (2) and lock.
  The connector (2) must engage audibly.
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.

POSTPROCESSES

9 – Securing the differential pressure sensor for the diesel particulate filter

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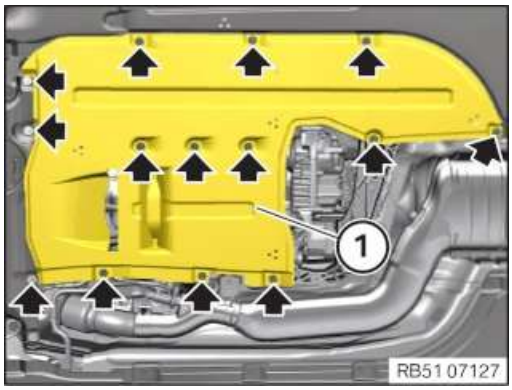
- Feed in and install the differential pressure sensor (3).
- Tighten down screw (2).

Differential pressure sensor of diesel particulate filter on cylinder head cover

TS5x20		Tightening torque	4 Nm

- Connect connectors (1) and lock.
- Make sure the connector (1) engages audibly.

10 – Installing underbody protection at rear



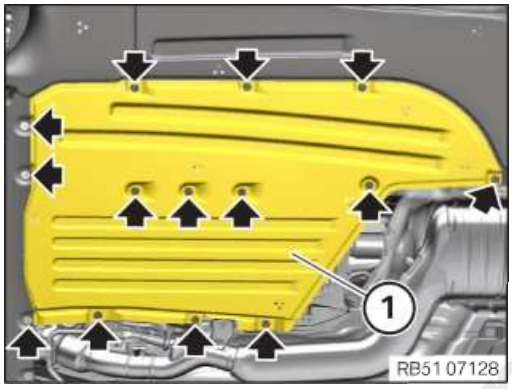
- **Version A:**

  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version B:**

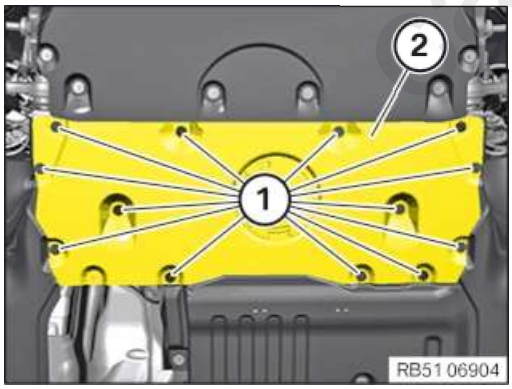
  Insert and install the rear underbody protection (1).

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

11 – Installing the centre underbody protection



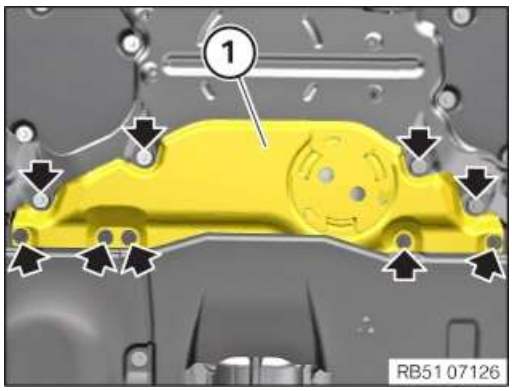
- **Variant with rear wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

  Guide in centre underbody protection (1) and install.

  Tighten screws (arrows).

Underbody protection

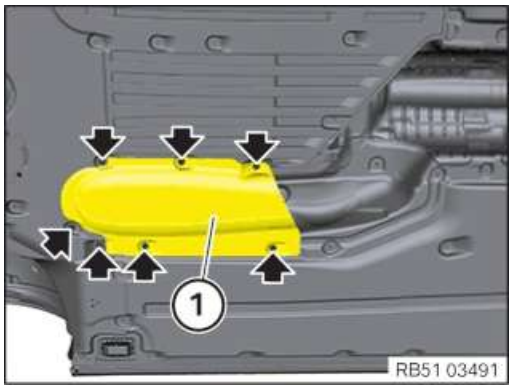
Hexagon screw		Tightening torque	3 Nm

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12 – Install the underbody panelling of the transmission on the side

NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.



- Insert the underbody panelling (1).
- Tighten screws (arrows).

Underbody panelling

Screw		Tightening torque	2,6 Nm
Plastic nut		Tightening torque	2,6 Nm

13 – Connecting all battery earth leads



- See additional information.

14 – Activating the 48 V electrical system

Prerequisite

Ignition is switched off.

RISK OF DAMAGE

Damage to 48-V battery

If a 48-V battery that is disconnected from the electrical system is activated, the battery electronics will be damaged.

- Only carry out activation of the 48V electrical system with a completely connected 48-V battery.



- Lift battery earth lead (1).
- Remove special tool .

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- Release the negative battery cable (2) of the 48-V battery from the mounting.
- Position the negative battery cable (2) of the 48-V battery on the negative battery terminal.
- Tighten nut (1).

Negative battery cable to 48-V battery

Nut M8		Tightening torque	19 Nm



- Connect the connector (1) of the CAN bus and lock it.
- Clip in clip (2).



- Activate the 48V electrical system by closing the bonnet.

  The activation takes place automatically.

Additional Information

Overview of Tightening Torques

Coolant lines for SCR metering module — Used in step 8

M6X16		Tightening torque	8 Nm

Battery positive lead to starter — Used in step 8

M8		Tightening torque	13,5 Nm

Battery positive lead to battery positive terminal — Used in step 8

M8		Tightening torque	19 Nm

Differential pressure sensor of diesel particulate filter on cylinder head cover — Used in step 9

TS5x20		Tightening torque	4 Nm

Underbody protection — Used in step 1011

Hexagon screw		Tightening torque	3 Nm

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Underbody panelling			Used in step 12
Screw		Tightening torque	2,6 Nm
Plastic nut		Tightening torque	2,6 Nm

Negative battery cable to 48-V battery			Used in step 14
Nut M8		Tightening torque	19 Nm

Overview of Special Tools

Links

Repair instructions (PRE)	Used in step
Notes on 48-V battery	114

Repair instructions	Used in step
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	213
61 20 900 Disconnecting and connecting battery earth lead	213
61 20 900 Disconnecting and connecting battery earth lead	213
61 20 900 Disconnecting and connecting battery earth lead	213
61 20 900 Disconnecting and connecting battery earth lead	213
61 20 900 Disconnecting and connecting battery earth lead	213
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61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	213
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	213
61 20 900 Disconnecting and connecting battery earth lead	213
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	213
61 20 900 Disconnecting and connecting battery earth lead (Plug-in Hybrid Electric Vehicle)	213
61 20 900 Disconnecting and connecting battery earth lead	213
61 20 900 Disconnecting and connecting battery earth lead	213
61 20 900 Disconnecting and connecting battery earth lead	213
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61 20 900 Disconnecting and connecting battery earth lead 213
61 20 900 Disconnecting and connecting battery earth lead 213
61 20 900 Disconnecting and connecting battery earth lead 213

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12 42 540 Replacing safety battery terminal (SBK)

Caution!
Observe safety regulations.

Investigate cause of triggering of safety battery terminal.

To do so, read out fault memory of airbag control unit. Note fault messages stored in memory. Rectify faults. Then clear fault memory.

Use of safety battery terminal:

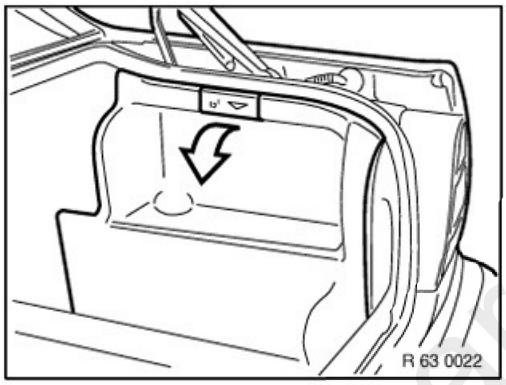
- From model year 1998 in Series E38, E39, E46
- From 4/99 in E36/Z3
- in each of following new Series

The different models have different installation locations:

Battery in engine compartment

Safety battery terminal is replaced with cable up to battery positive support point.

Safety battery terminal is omitted as from 03/2002 from all E46 LHD models with 4-cylinder engines.



Battery in luggage compartment behind side trim panel

Remove side trim panel.

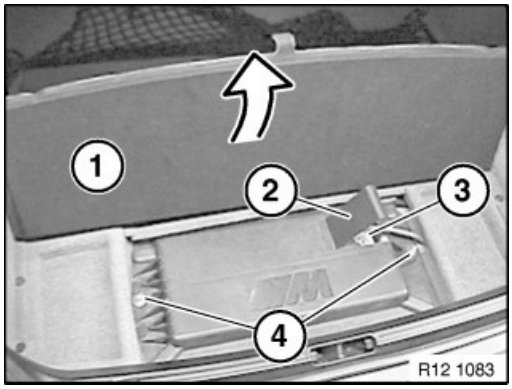
Follow instructions for disconnecting and connecting battery.

Disconnect and cover battery negative lead.



Release front side trim panel partly and fold forward.

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Battery in luggage compartment under floor trim panel

Follow instructions for disconnecting and connecting battery.

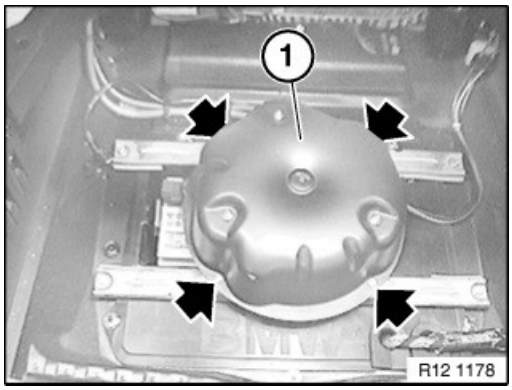
Fold back floor trim panel (1).

Lift cover (2) on battery negative lead.

Disconnect and cover battery negative lead (3).

Release nuts (4).

Remove battery cover.



Battery in luggage compartment under spare wheel

Remove spare wheel.

Release screws.

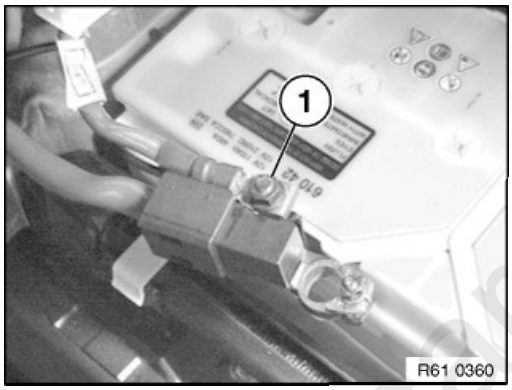
Caution!

Do not kink air pipes.

Set air supply system (1) to one side.

Follow instructions for disconnecting and connecting battery.

Disconnect battery negative lead.



Disconnect supply cable (1) for vehicle electrical system.**Installation:**

Remove faulty fuses and carry out troubleshooting.



Caution!

Pay attention to interface.

The repair cable is always a standard length.

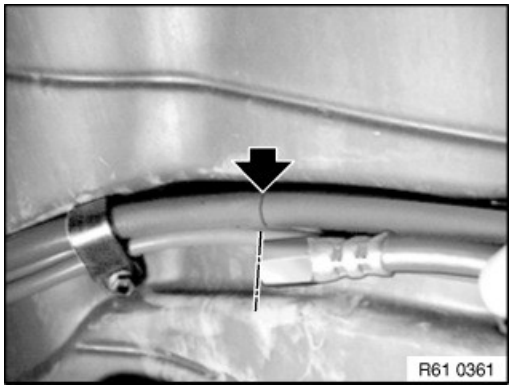
The heavy-current connector of the repair cable has a larger diameter than the battery positive lead.

In some Series (e.g. E46 touring), the heavy-current connector of the repair cable can lead to installation problems.

This is the case when the interface is in the area of the close-fitting trim panels.

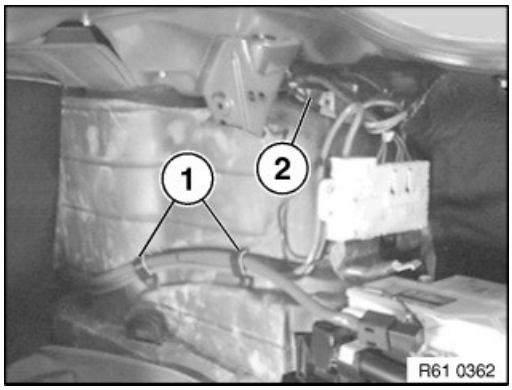
Find matching interface (e.g. approx. 10 cm behind rear seat backrest in E46 touring).

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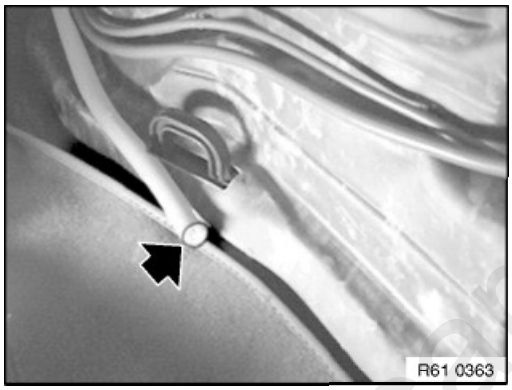
Lay repair cable parallel to battery positive lead.

Mark interface of battery positive lead at end of repair cable.



Release cable ties (1).

Disconnect plug connection (2).

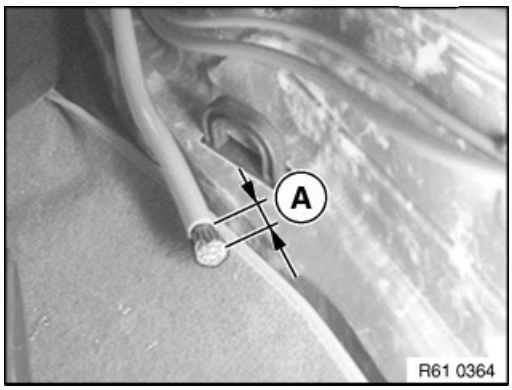


Caution!

Do not use bolt cutters or similar tools to cut through the cable.

A cable end that has been squashed flat will no longer fit into the clamping sleeve.

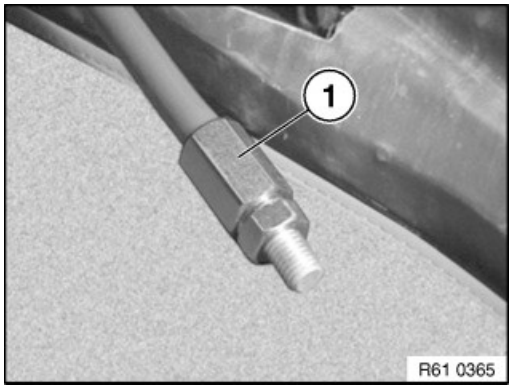
Saw through battery positive cable at marked point with an iron saw.



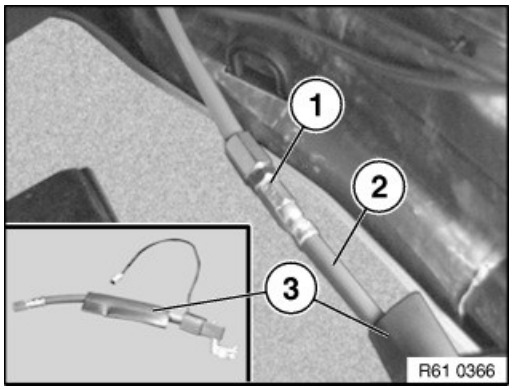
Strip insulation - length (A) - from cable end.

Distance (A) = 15 mm.

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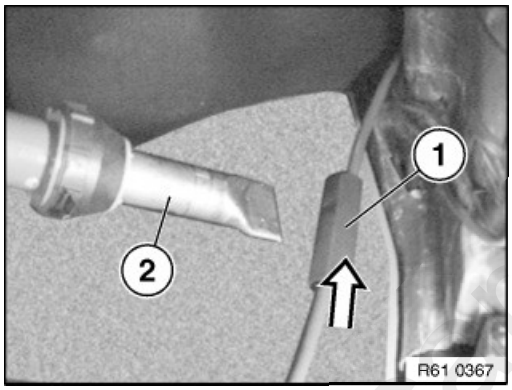


Push heavy-current connector (1) over stripped cable end and screw into position.

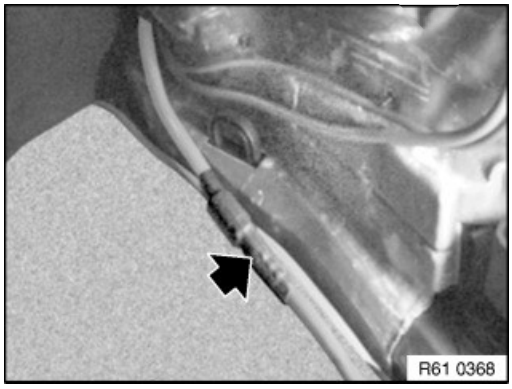


Push shrink-fit hose (3) over repair cable.

Screw threaded sleeve (1) of repair cable (2) to heavy-current connector.



Push shrink-fit hose (1) over connecting point and shrink on with a hot-air blower (2).



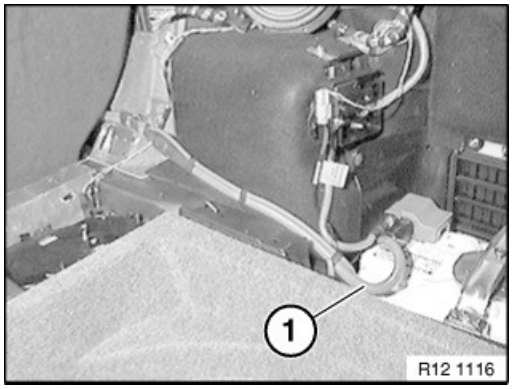
Note:

Heat up shrink-fit hose until it has settled completely around the connection point.

When laying the repaired battery positive cable, observe the following:

- The shrink-fit hose must not be scuffed during any movement.
- The repair cable must not cause any disturbing noises during driving operation.

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Note:

Offsetting cutting line by approx. 10 cm produces excess length of battery positive lead (1).

Lay battery positive lead (1) without kinks or abrasions.

(Shown on E46 touring.)

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12 51 200 Replacing wiring harness section for injectors

PRELIMINARY WORK

1 – Deactivating the 48 V electrical system

Prerequisite

Ignition is switched off.

WARNING

Deactivation of the 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no battery charger** is connected to the jump start terminal point in the engine compartment.
- For vehicles with additional electrical systems (48 V electrical system, high-voltage vehicle electrical system), it is mandatory to deactivate them **before** disconnecting the vehicle battery.

WARNING

Deactivation of the 48 V electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no charger** is connected to the jump start support point in the engine compartment.

RISK OF DAMAGE

Damage to 48-V battery

If a 48-V battery that is disconnected from the electrical system is activated, the battery electronics will be damaged.

- Only carry out activation of the 48V electrical system with a completely connected 48-V battery.

TECHNICAL INFORMATION

Follow notes for 48-V battery. See further information 6120 ... Notes on 48-V battery.



- Deactivate the 48V electrical system by opening the bonnet.

  The deactivation takes place automatically.

Check

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TECHNICAL INFORMATION

Zero voltage (48V electrical system is switched off) is displayed only in PAD mode.

- Press the START-STOP button quickly 3 times without stepping on the brake pedal to establish the PAD mode.
- Check isolation from the supply in the instrument cluster in PAD mode.

desired state

- The Check Control message "48V electrical system switched off." (1) is displayed.

Result

» **The absence of voltage** cannot be determined by means of the Check Control message "48V electrical system switched off:" (1). Work is not permitted to be started.

Measure

- Carry out the service function "48 V electrical system deactivation".
  - Vehicle management > Service functions > Voltage supply > Deactivate 48 V electrical system

  Only when the Check Control message “48 V electrical system switched off.” (1) is displayed in the instrument cluster is it permitted to disconnect the 12 V battery.

  If the absence of voltage is not indicated clearly, contact Technical Support.

Result

» The Check Control message signals that the 48V electrical system has been switched off.

Measure

- Exit PAD mode by pressing the START-STOP button once without depressing the brake pedal.

  The work “Disconnecting the negative battery cable of the 48-V battery” can be started.



- Unlock and disconnect plug connection (1) of the CAN bus.
- Release the clip (2).



- Loosen nut (1).
- Pull off negative battery cable (2) of the 48-V battery from the negative battery terminal, set it aside and secure it.



WARNING

Unprotected battery terminals.

Risk of short circuits! Risk of fire!

- Cover the vehicle battery.

- Cover the vehicle battery with the special tool as shown.
- Position the battery earth lead (1) as shown.

2 – Disconnecting all battery earth leads



- See additional information.

3 – Removing the acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover/design cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover/design cover.

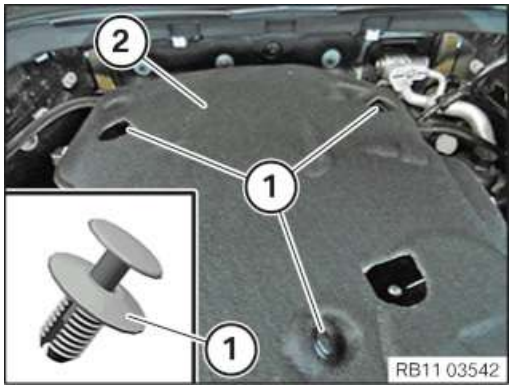
- Disassemble or mount the acoustic cover/design cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover/design cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the indicated area towards the top.

4 – Remove the acoustic cover for the injectors

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- **If installed:** Release the expanding rivet (1).
- Guide the acoustic cover (2) out and remove.

5 – Detaching the leakage oil line from the injectors

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

WARNING

Hot surfaces.

Risk of burning!

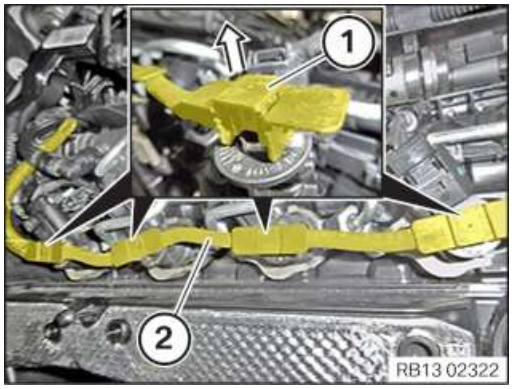
- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.



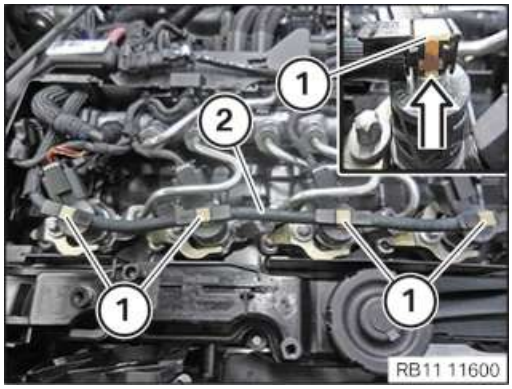
- **Version A:**

  Unlock the locks (1) in the direction of the arrow.

  Remove the leakage oil line (2) and put it to one side.

  Catch and dispose of escaping fuel.

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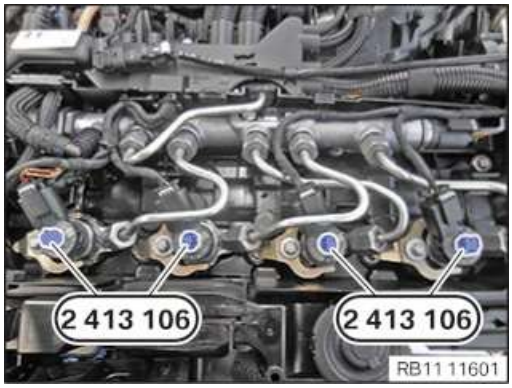


- **Version B:**

  Unlock the locks (1) in the direction of the arrow.

  Remove the leakage oil line (2) and put it to one side.

  Catch and dispose of escaping fuel.



- Seal open connections with special tools .

6 – Remove the high pressure lines between the injector and the rail

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

WARNING

Working on fuel system.

Risk of fire! Danger of explosion!

- When working on the fuel system, make sure that the workbay is sufficiently ventilated, e.g. using extraction unit.
- Tightly seal off open lines and connections; collect any escaping fuel directly at the point of exit.
- No fire, sparks, open flames or smoking.

CAUTION

On releasing high pressure line, fuel may emerge at high speed.

Danger of injury!

- Wear suitable personal protective equipment.
- Allow the cooling system to cool down to a temperature below 40°C before starting installation work.
- Note warnings on cylinder head cover.

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RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

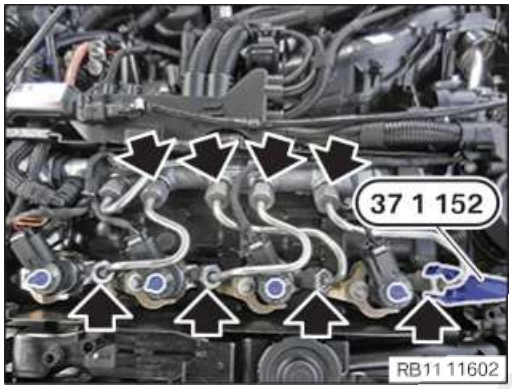
- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

TECHNICAL INFORMATION

If several high pressure lines are removed, ensure that each high pressure line is installed in its original location. Label high pressure lines.

TECHNICAL INFORMATION

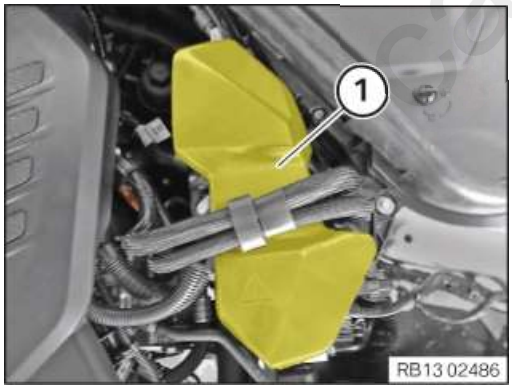
Reset special tool in early to avoid bending pressure lines.



- Release the high pressure lines (arrows) with the special tool .

  Reset the special tool early on to prevent bending of the high pressure line.
- Catch and dispose of escaping fuel.
- Feed out and remove the high pressure lines (arrows).
- Seal off all the open cable connections with the special tool .

7 – Remove the cover for the DDE control unit



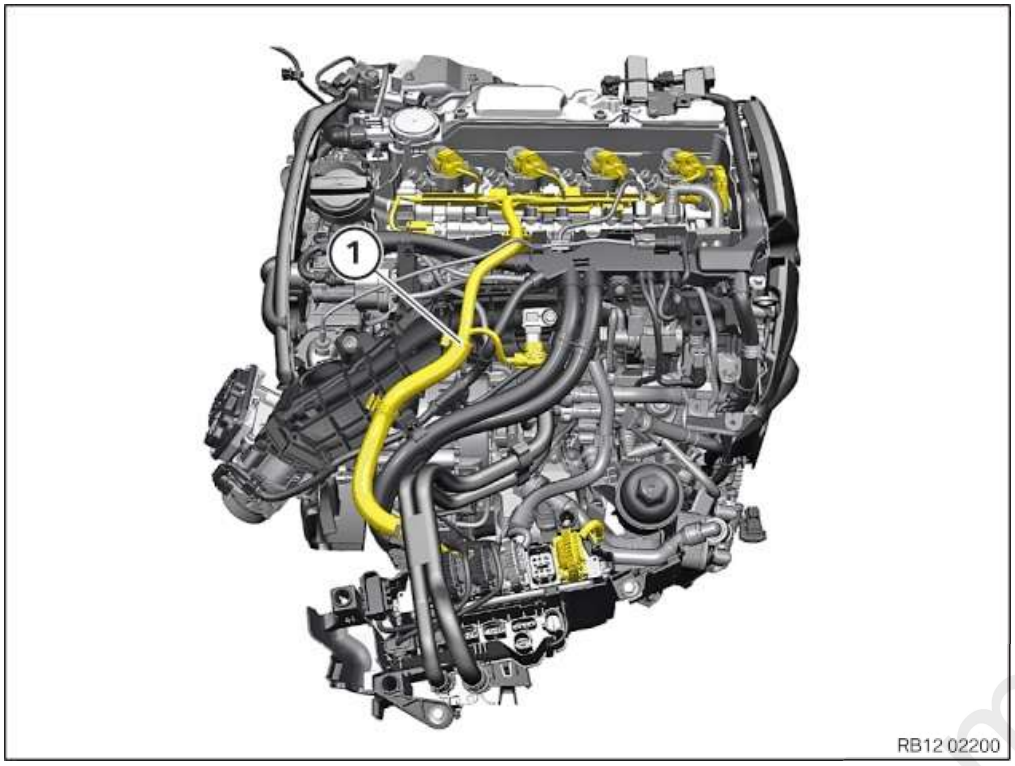
- Pull off, guide out and remove cover (1) upwards.

MAIN WORK

8 – Remove the wiring harness section for the injectors

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Wiring harness section for injectors



1 Wiring harness section for injectors

RISK OF DAMAGE

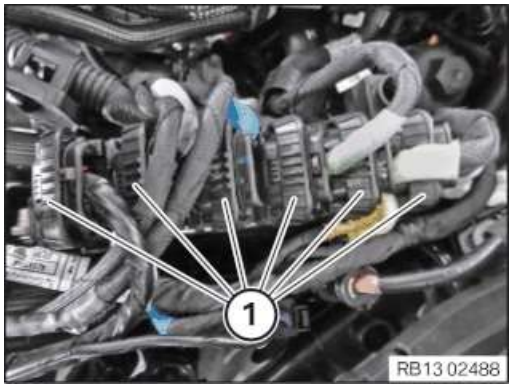
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 ... Notes for ESD protection (electrostatic discharge)

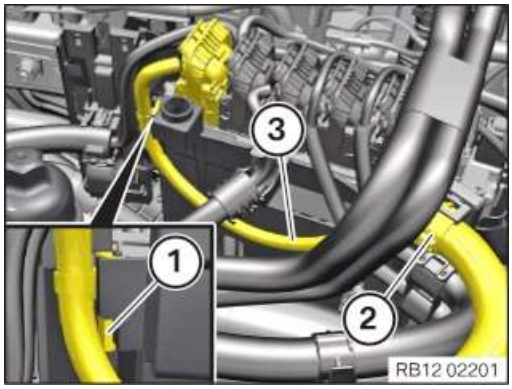
TECHNICAL INFORMATION

Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.

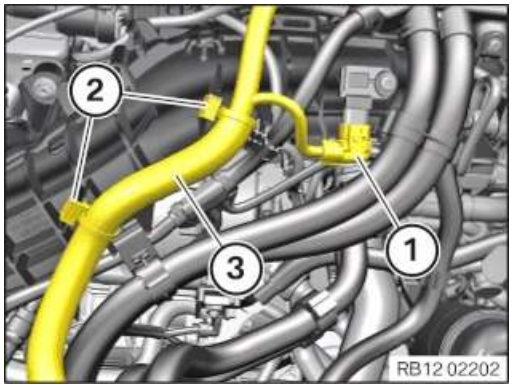


- Unlock and disconnect plug connections (1).

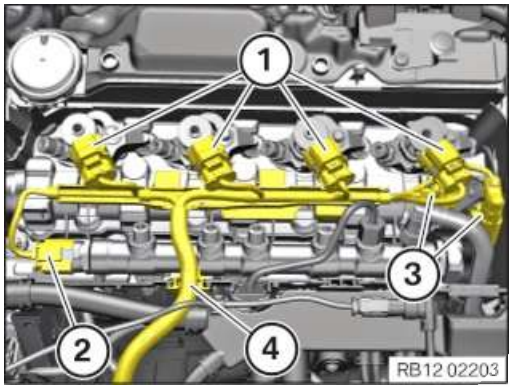
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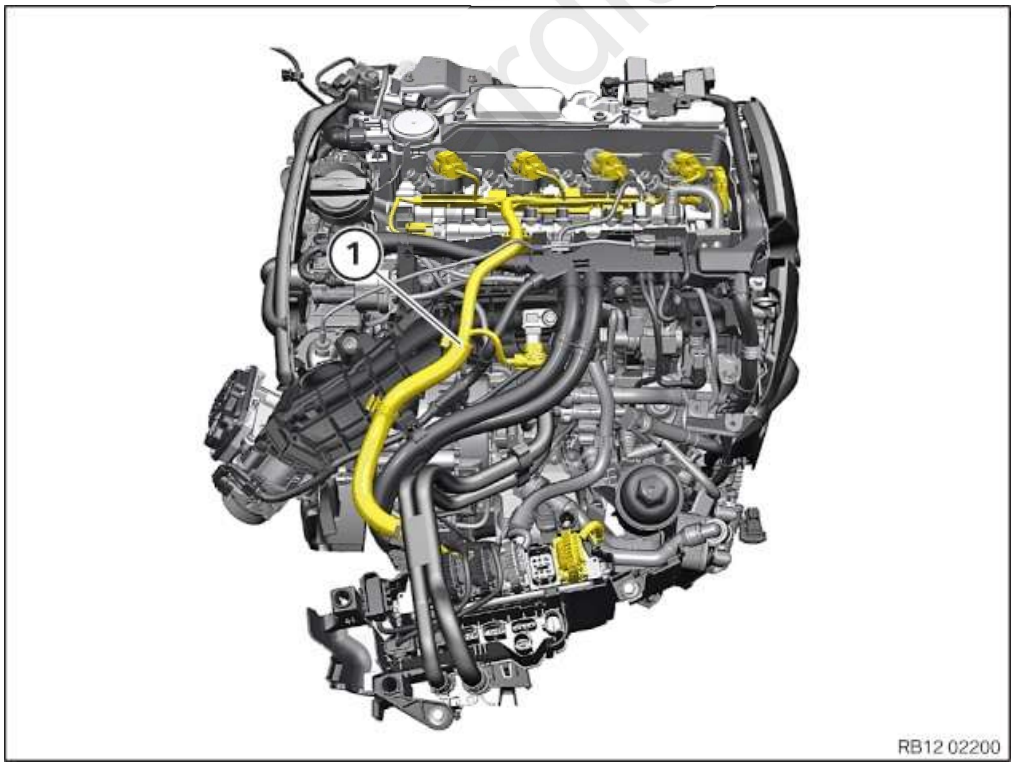
- Unlock and loosen the cable clip (1).
- Unlock and loosen the cable clip (2).
- Feed out the wiring harness section (3) for the injectors and set aside.



- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Feed out the wiring harness section (3) for the injectors and set aside.



- Unlock and disconnect plug connections (1).
- Unlock plug connection (2) and disconnect.
- Unlock and disconnect plug connections (3).
- Unlock and loosen the cable clip (4).

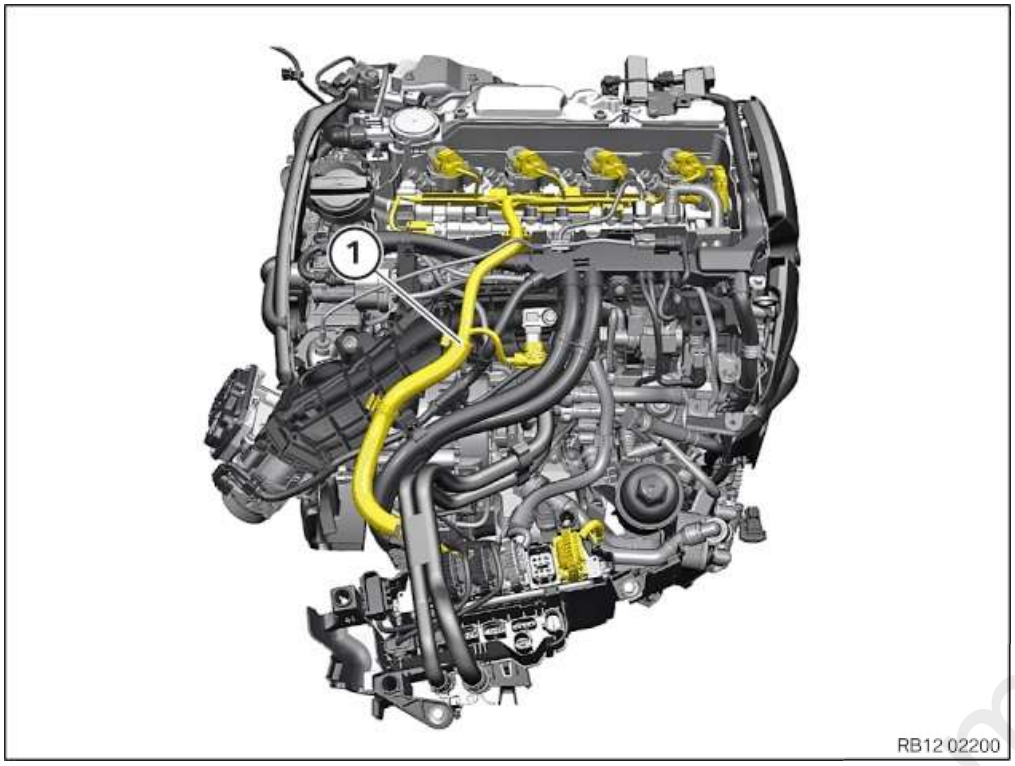


- Feed out and remove the wiring harness section (1) for the injectors.

9 – Install the wiring harness section for the injectors

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Wiring harness section for injectors



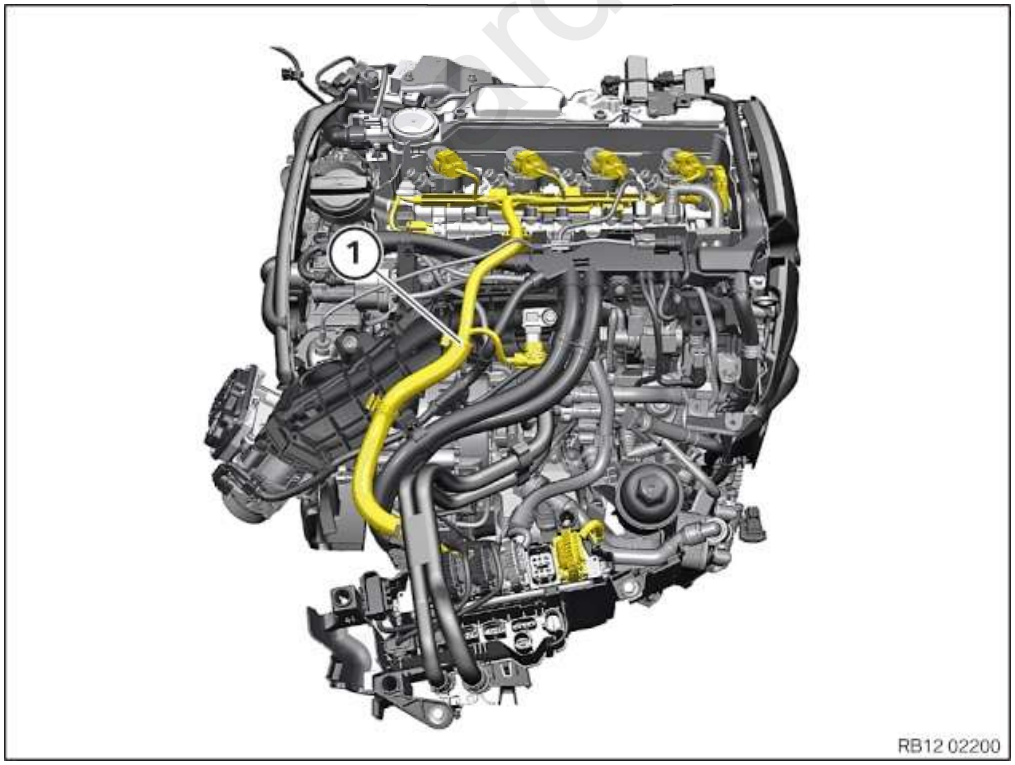
1 Wiring harness section for injectors

RISK OF DAMAGE

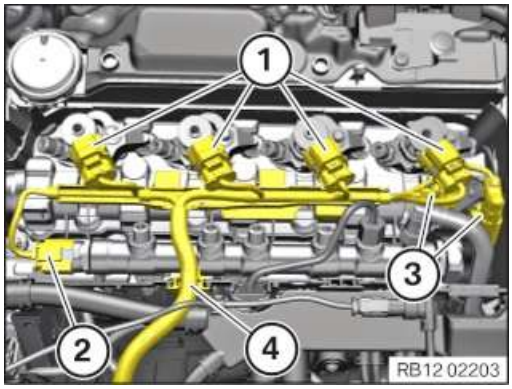
Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

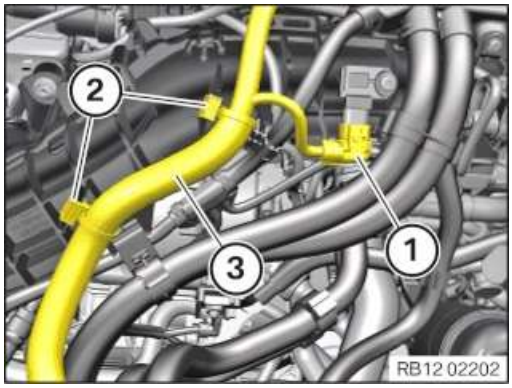
- Route all cables without abrasions, do not trap and crush.



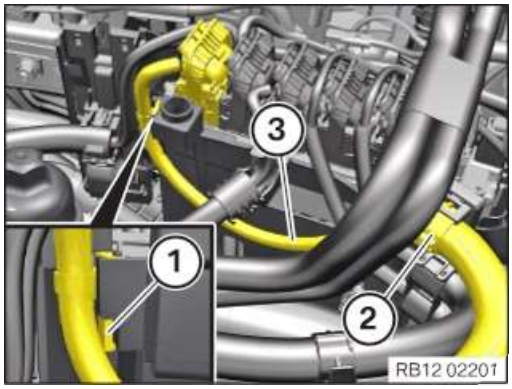
- Insert and install the wiring harness section (1) for the injectors.



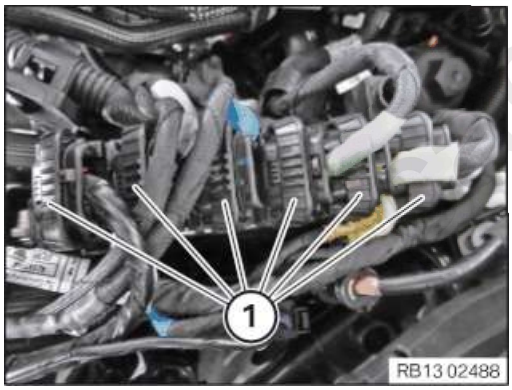
- Connect connectors (3) and lock.
  The connectors (3) must engage audibly.
- Connect connectors (2) and lock.
  The connectors (2) must engage audibly.
- Connect and lock the plug connections (1).
  The connector (1) must engage audibly.
- Connect and lock the cable clip (4).
  Cable clip (4) must engage audibly.



- Insert and install the wiring harness section (3) for the injectors.
- Secure clamps (2).
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.



- Insert and install the wiring harness section (3) for the injectors.
- Connect and lock the cable clip (2).
- Connect and lock the cable clip (1).

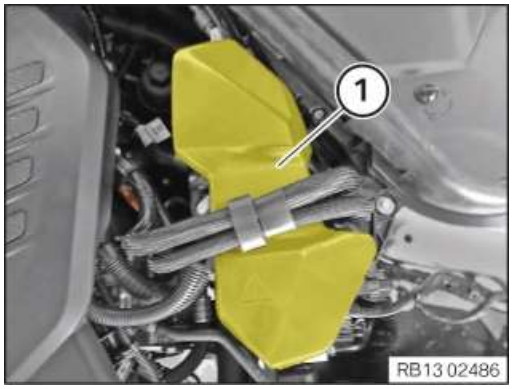


- Connect connectors (1) and lock.
  The connectors (1) must engage audibly.

POSTPROCESSES

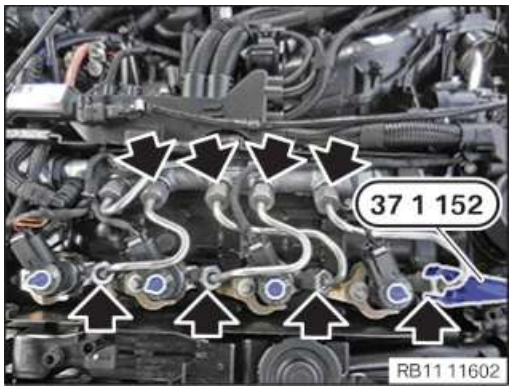
10 – Install the cover for the DDE control unit

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- Insert and install cover (1) into guides.

11 – Installing the high pressure lines between the injector and the rail



- Remove the special tool from all cable connections.
- Feed in and install the high pressure lines (arrows).
- Hand-tighten the high pressure lines (arrows).

TECHNICAL INFORMATION

Renew high pressure lines when the tightening torque exceeds the maximum of 30 Nm.

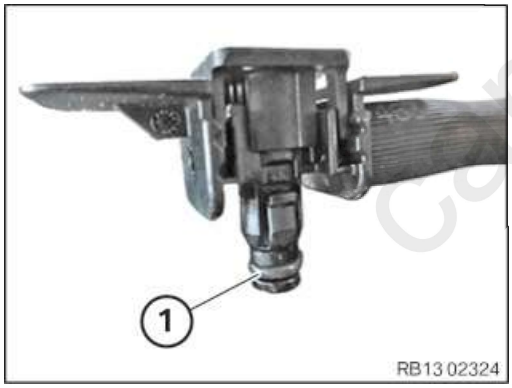
- Tighten the high pressure lines (arrows) with the special tool .

High pressure lines between injector and rail

High-pressure pipe		Tightening torque	24.5 Nm

- Check the high pressure lines (arrows) for tightness (**visual inspection**).

12 – Attach the leakage oil line on the injectors

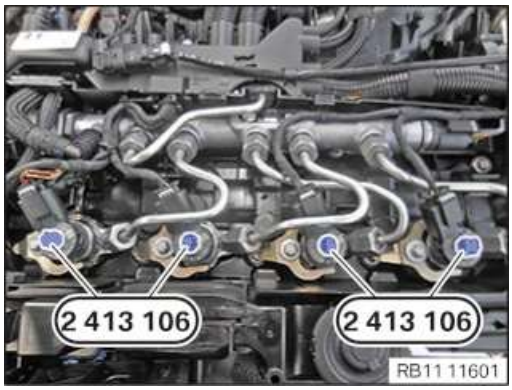


- **Version A:**

  Check sealing ring (1) for damage, renew leakage oil line if necessary.

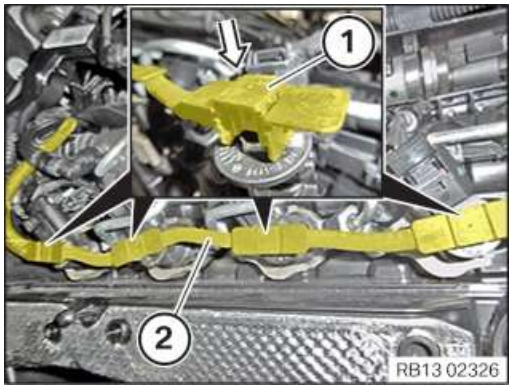
  Damaged sealing rings may cause malfunctions during fuel pressure build-up.

  Coat the sealing ring (1) with lubricant before connecting the leakage oil line to the injector.

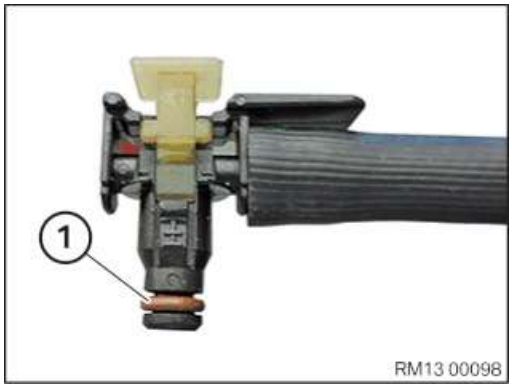


- Feed out the special tools and remove.

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- Feed in leakage oil line (2) and install.
- Lock the locks (1) in the direction of the arrow.
- Ensure that the locks (1) engage audibly.



- **Version B**:

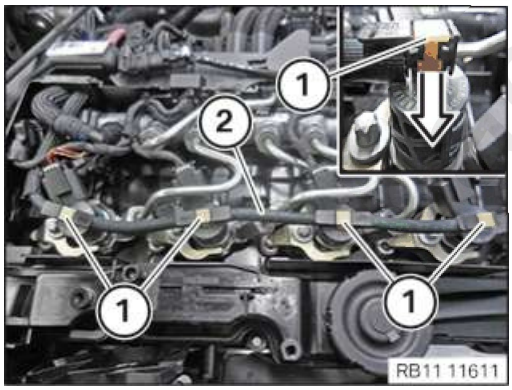
  Check sealing ring (1) for damage, renew leakage oil line if necessary.

  Damaged sealing rings may cause malfunctions during fuel pressure build-up.

  Coat the sealing ring (1) with lubricant before connecting the leakage oil line to the injector.

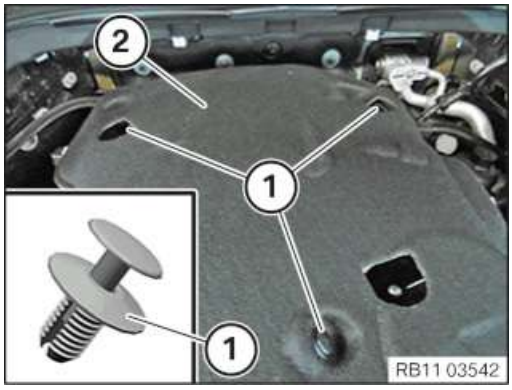


- Feed out the special tools and remove.



- Feed in leakage oil line (2) and install.
- Lock the locks (1) in the direction of the arrow.
- Ensure that the locks (1) engage audibly.

13 – Install the acoustic cover for the injectors



- Feed the acoustic cover (2) in and install.
- **If installed:** Secure the acoustic cover (2) with the expanding rivets (1) .

14 – Install acoustic cover

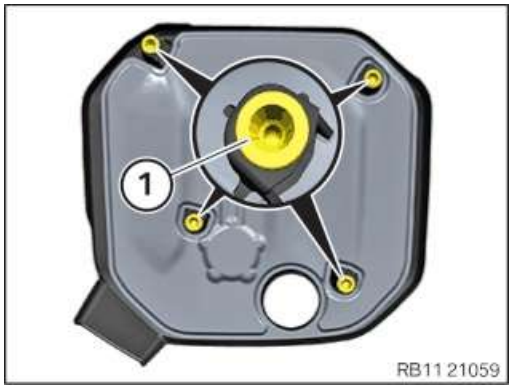
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RISK OF DAMAGE

Damage to the acoustic cover/design cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover/design cover.

- Disassemble or mount the acoustic cover/design cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover/design cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check the acoustic cover for correct fit of the rubber mounts (1).



- Clip in the acoustic cover (1) into the holders in the indicated areas.

15 – Connecting all battery earth leads



- See additional information.

16 – Activating the 48 V electrical system

Prerequisite

Ignition is switched off.

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RISK OF DAMAGE

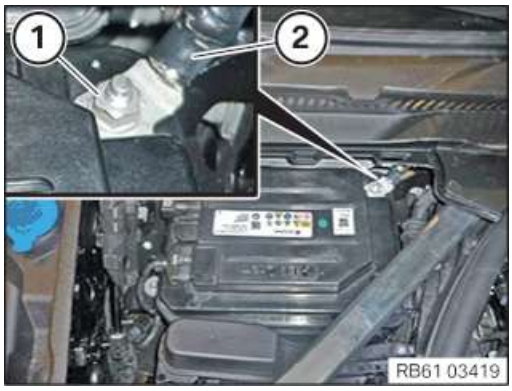
Damage to 48-V battery

If a 48-V battery that is disconnected from the electrical system is activated, the battery electronics will be damaged.

- Only carry out activation of the 48V electrical system with a completely connected 48-V battery.



- Lift battery earth lead (1).
- Remove special tool .



- Release the negative battery cable (2) of the 48-V battery from the mounting.
- Position the negative battery cable (2) of the 48-V battery on the negative battery terminal.
- Tighten nut (1).

Negative battery cable to 48-V battery

Nut M8		Tightening torque	19 Nm



- Connect the connector (1) of the CAN bus and lock it.
- Clip in clip (2).



- Activate the 48V electrical system by closing the bonnet.

  The activation takes place automatically.

Additional Information

Overview of Tightening Torques

High pressure lines between injector and rail			Used in step 11
High-pressure pipe		Tightening torque	24.5 Nm

Negative battery cable to 48-V battery			Used in step 16
Nut M8		Tightening torque	19 Nm

Overview of Special Tools

Links

Repair instructions (PRE)	Used in step
Notes on 48-V battery	116

Repair instructions	Used in step
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	215
61 20 900 Disconnecting and connecting battery earth lead	215
61 20 900 Disconnecting and connecting battery earth lead	215
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61 20 900 Disconnecting and connecting battery earth lead	215
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	215
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	215
61 20 900 Disconnecting and connecting battery earth lead	215
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	215
61 20 900 Disconnecting and connecting battery earth lead (Plug-in Hybrid Electric Vehicle)	215
61 20 900 Disconnecting and connecting battery earth lead	215
61 20 900 Disconnecting and connecting battery earth lead	215
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61 20 900 Disconnecting and connecting battery earth lead	215
61 20 900 Disconnecting and connecting battery earth lead	215
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12 51 010 Replacing wiring harness section for preheating system

PRELIMINARY WORK

1 – Deactivating the 48 V electrical system

Prerequisite

Ignition is switched off.

WARNING

Deactivation of the 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no battery charger** is connected to the jump start terminal point in the engine compartment.
- For vehicles with additional electrical systems (48 V electrical system, high-voltage vehicle electrical system), it is mandatory to deactivate them **before** disconnecting the vehicle battery.

WARNING

Deactivation of the 48 V electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no charger** is connected to the jump start support point in the engine compartment.

RISK OF DAMAGE

Damage to 48-V battery

If a 48-V battery that is disconnected from the electrical system is activated, the battery electronics will be damaged.

- Only carry out activation of the 48V electrical system with a completely connected 48-V battery.

TECHNICAL INFORMATION

Follow notes for 48-V battery. See further information 6120 ... Notes on 48-V battery.



- Deactivate the 48V electrical system by opening the bonnet.

  The deactivation takes place automatically.

Check

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TECHNICAL INFORMATION

Zero voltage (48V electrical system is switched off) is displayed only in PAD mode.

- Press the START-STOP button quickly 3 times without stepping on the brake pedal to establish the PAD mode.
- Check isolation from the supply in the instrument cluster in PAD mode.

desired state

- The Check Control message "48V electrical system switched off." (1) is displayed.

Result

» **The absence of voltage** cannot be determined by means of the Check Control message "48V electrical system switched off:" (1). Work is not permitted to be started.

Measure

- Carry out the service function "48 V electrical system deactivation".
  - Vehicle management > Service functions > Voltage supply > Deactivate 48 V electrical system

  Only when the Check Control message “48 V electrical system switched off.” (1) is displayed in the instrument cluster is it permitted to disconnect the 12 V battery.

  If the absence of voltage is not indicated clearly, contact Technical Support.

Result

» The Check Control message signals that the 48V electrical system has been switched off.

Measure

- Exit PAD mode by pressing the START-STOP button once without depressing the brake pedal.

  The work “Disconnecting the negative battery cable of the 48-V battery” can be started.



- Unlock and disconnect plug connection (1) of the CAN bus.
- Release the clip (2).



- Loosen nut (1).
- Pull off negative battery cable (2) of the 48-V battery from the negative battery terminal, set it aside and secure it.



WARNING

Unprotected battery terminals.

Risk of short circuits! Risk of fire!

- Cover the vehicle battery.

- Cover the vehicle battery with the special tool as shown.
- Position the battery earth lead (1) as shown.

2 – Disconnecting all battery earth leads



- See additional information.

3 – Removing the acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover/design cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover/design cover.

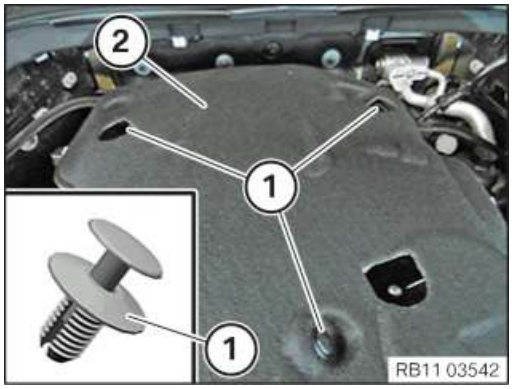
- Disassemble or mount the acoustic cover/design cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover/design cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the indicated area towards the top.

4 – Remove the acoustic cover for the injectors

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- **If installed:** Release the expanding rivet (1).
- Guide the acoustic cover (2) out and remove.

5 – Partially releasing the wiring harness section

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

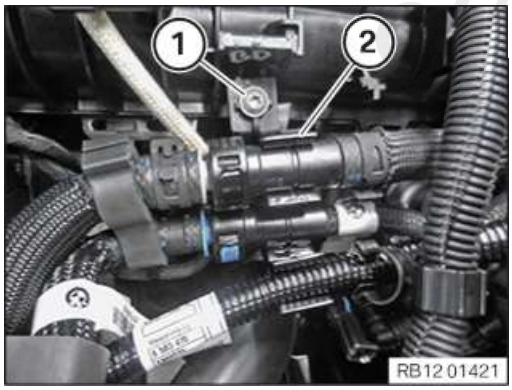
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 ... Notes for ESD protection (electrostatic discharge)

RISK OF DAMAGE

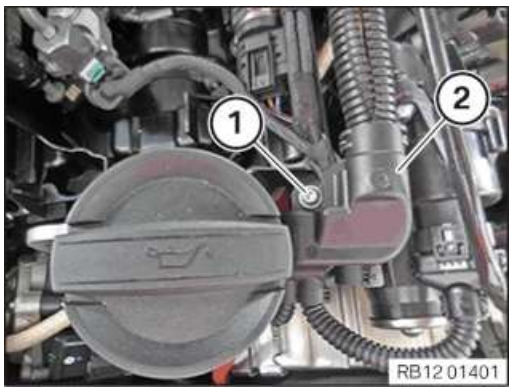
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

- Do not pull on the wires when disconnecting connectors and plug connections.

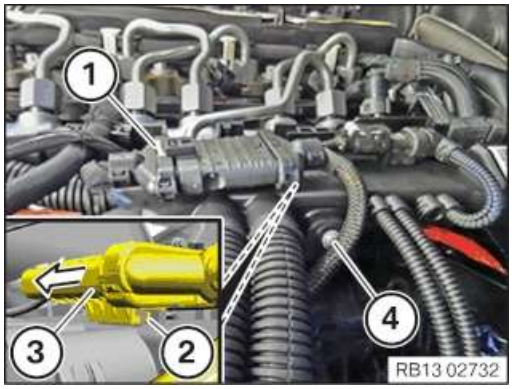


- Loosen screw (1).
- Thread out holder (2) and set aside.



- Loosen screw (1).
- Remove the wiring harness section (2) and put to one side.

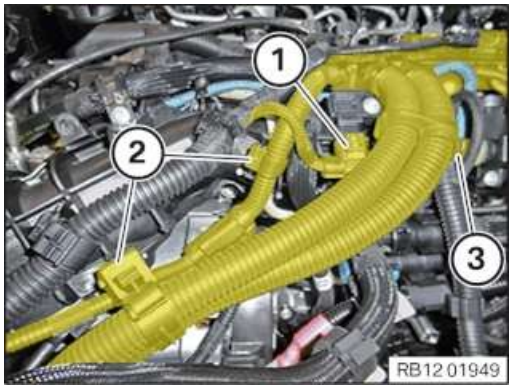
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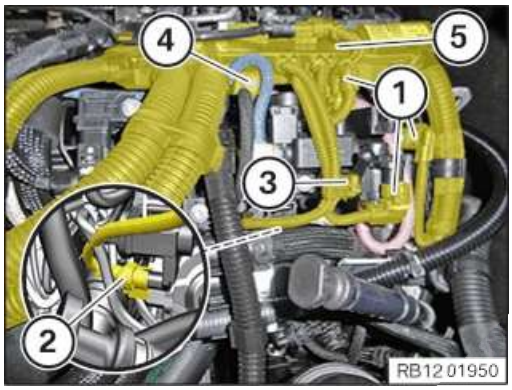
NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

- Unlock plug connection (1) and disconnect.
- Unlock the lock (2).
- Feed out the connector (3) in direction of arrow and remove.
- Loosen screw (4).

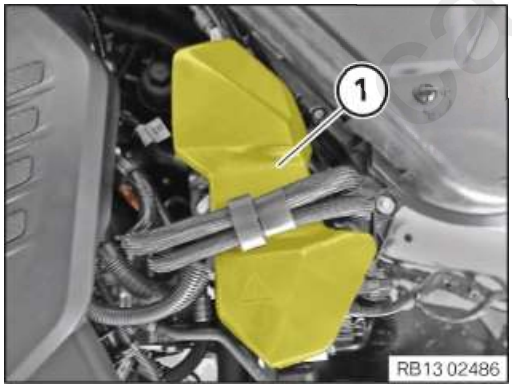


- Unlock plug connection (1) and disconnect.
- Loosen clamps (2).
- Loosen clamp (3).



- Unlock and disconnect the plug connection (1).
- Unlock and disconnect the plug connection (2).
- Loosen clamp (3).
- Loosen screw (4).
- Guide out wiring harness section (5) as far as possible and set it aside.

6 – Remove the cover for the DDE control unit



- Pull off, guide out and remove cover (1) upwards.

MAIN WORK

7 – Remove the wiring harness section for the preheating system

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RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 ... Notes for ESD protection (electrostatic discharge)

RISK OF DAMAGE

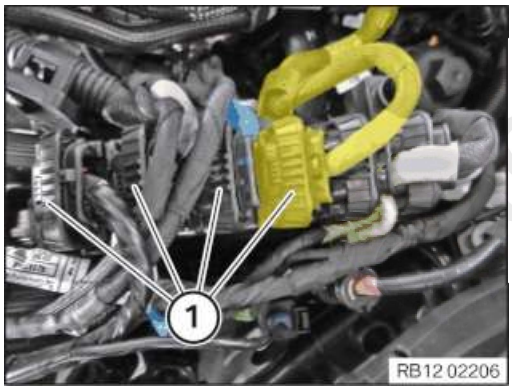
Damage to wires when disconnecting connectors and plug connections.

Sheared wires can cause a short circuit.

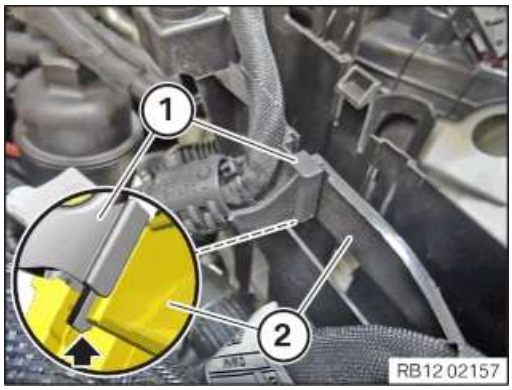
- Do not pull on the wires when disconnecting connectors and plug connections.

TECHNICAL INFORMATION

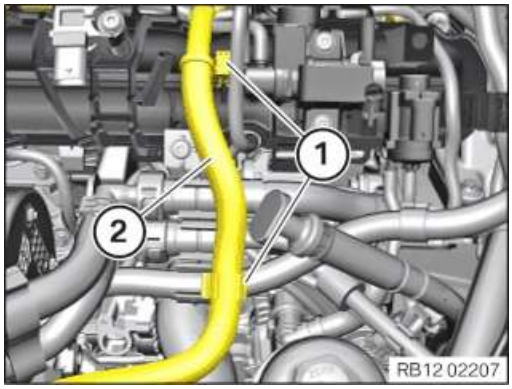
Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.



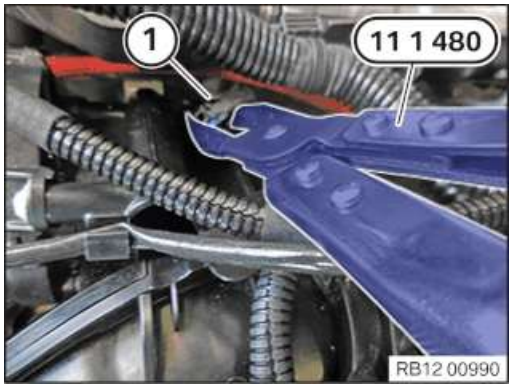
- Unlock and disconnect plug connections (1).



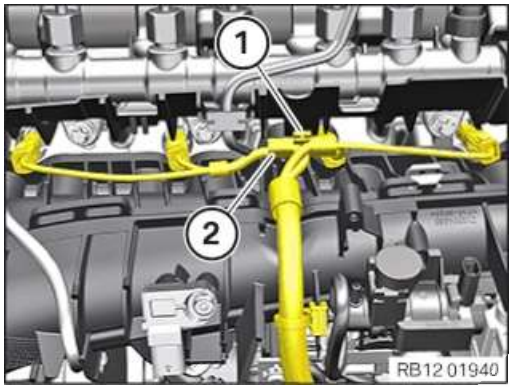
- Unlock the lock (arrow).
- Disconnect the cable plug (1) upwards from the control unit holder (2).



- Loosen clamps (1).
- Feed out the wiring harness section (2) for the preheating system and set it aside.



- Unlock and release the connector (1) using special tool 0 490 796 (11 1 480).



- Loosen clamp (1).
- Remove the wiring harness section (2).

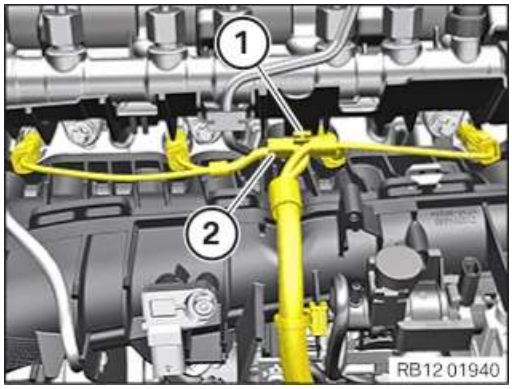
8 – Install the wiring harness section for the preheating system

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

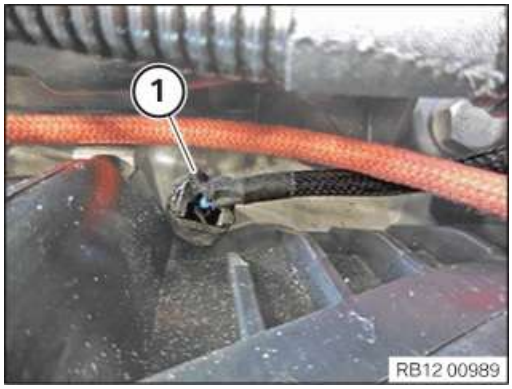
Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



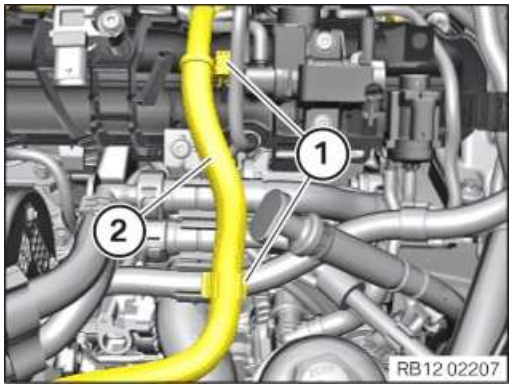
- Guide in the wiring harness section (2) and install.
- Secure clamps (1).

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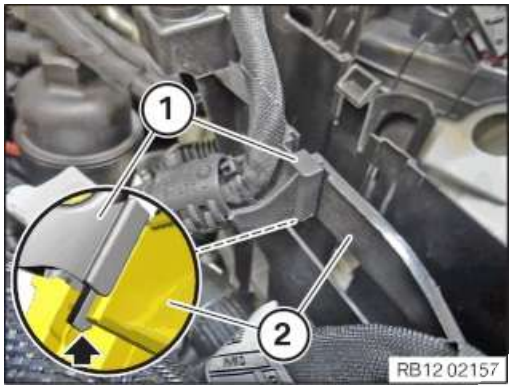


- Connect and lock the connector (1).

  The connector (1) must engage audibly.

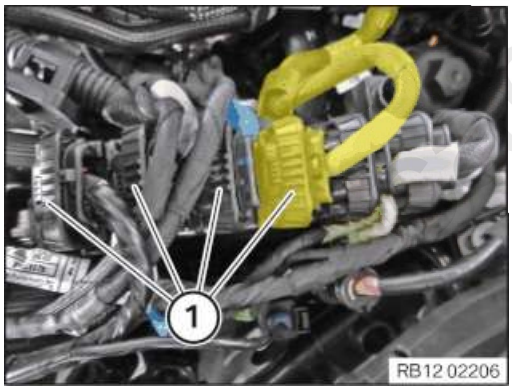


- Insert and install the wiring harness section (2) for the preheating system.
- Secure clamps (1).



- Connect the cable clip (1) with the control unit holder (2) and lock it.

  Lock (arrow) must audibly engage.

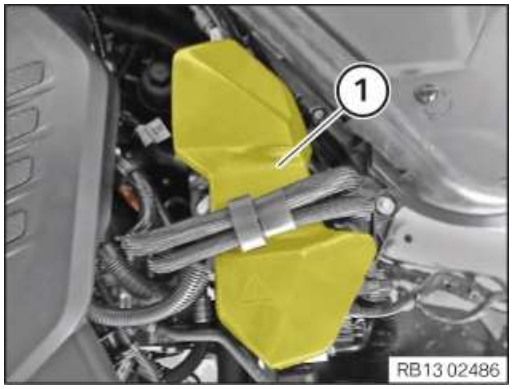


- Connect connectors (1) and lock.

  The connectors (1) must engage audibly.

POSTPROCESSES

9 – Install the cover for the DDE control unit



- Insert and install cover (1) into guides.

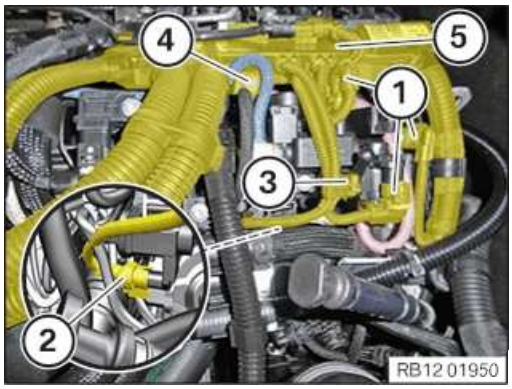
10 – Partially securing the wiring harness section

RISK OF DAMAGE

Improper routing of cables and wiring harnesses.

Trapped, crushed or damaged cables may cause short circuits and malfunctions.

- Route all cables without abrasions, do not trap and crush.



- Guide in the wiring harness section (5) and install.
- Tighten down screw (4).

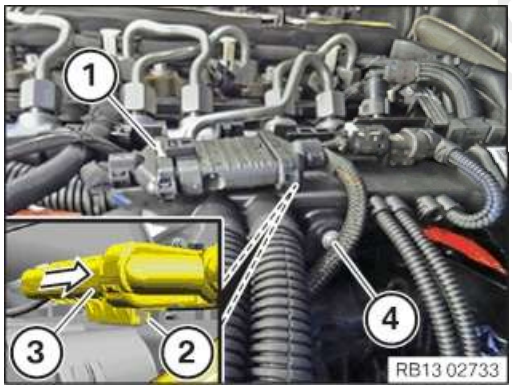
Wiring harness section to manifold

TS5x20		Tightening torque	3,6 Nm

- Secure clamps (3).
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.
- Connect connectors (1) and lock.

  The connectors (1) must engage audibly.



NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

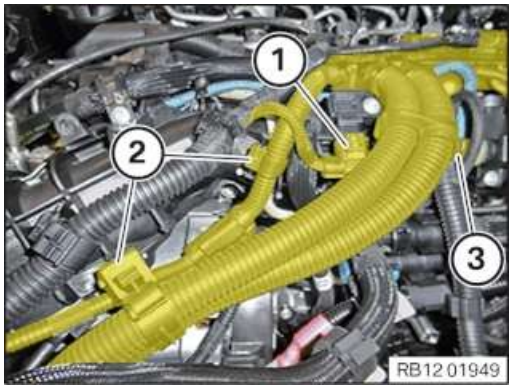
- Tighten down screw (4).

Wiring harness section to manifold

TS5x20		Tightening torque	3,6 Nm

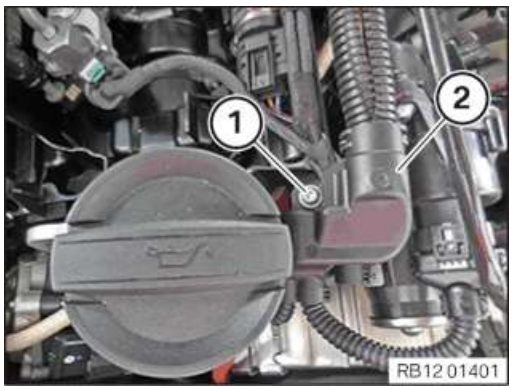
- Feed in and install the connector (3) in the direction of the arrow.
- Ensure that the lock engages audibly (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Secure clamps (3).
- Secure clamps (2).
- Connect connectors (1) and lock.

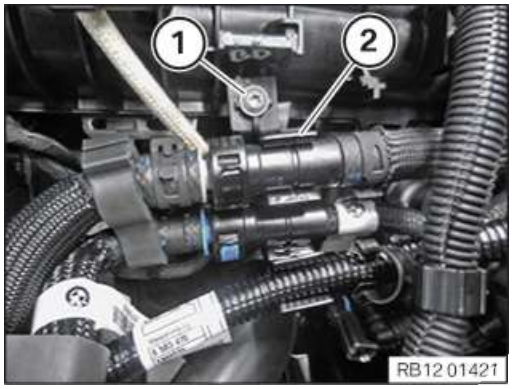
  The connector (1) must engage audibly.



- Guide in the wiring harness section (2) and install.
- Tighten down screw (1).

Wiring harness section to cylinder head cover

TS5x20		Tightening torque	3,6 Nm

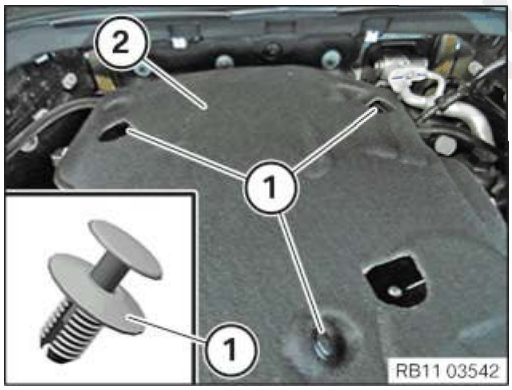


- Insert and install the holder (2).
- Tighten down screw (1).

Holder on intake plenum

TS6X20		Tightening torque	5 Nm

11 – Install the acoustic cover for the injectors



- Feed the acoustic cover (2) in and install.
- **If installed:** Secure the acoustic cover (2) with the expanding rivets (1) .

12 – Install acoustic cover

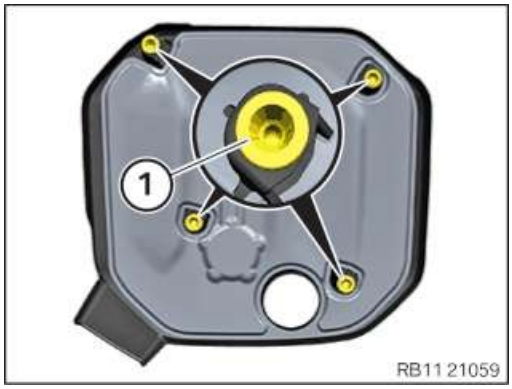
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RISK OF DAMAGE

Damage to the acoustic cover/design cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover/design cover.

- Disassemble or mount the acoustic cover/design cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover/design cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check the acoustic cover for correct fit of the rubber mounts (1).



- Clip in the acoustic cover (1) into the holders in the indicated areas.

13 – Connecting all battery earth leads



- See additional information.

14 – Activating the 48 V electrical system

Prerequisite

Ignition is switched off.

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RISK OF DAMAGE

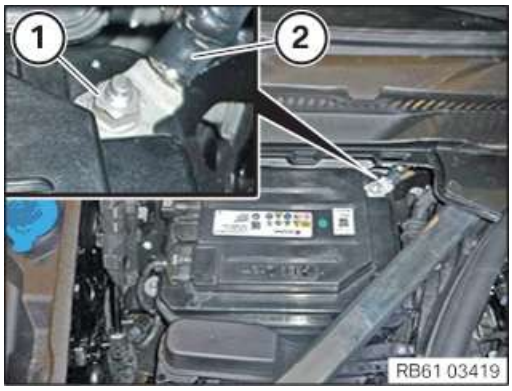
Damage to 48-V battery

If a 48-V battery that is disconnected from the electrical system is activated, the battery electronics will be damaged.

- Only carry out activation of the 48V electrical system with a completely connected 48-V battery.



- Lift battery earth lead (1).
- Remove special tool .



- Release the negative battery cable (2) of the 48-V battery from the mounting.
- Position the negative battery cable (2) of the 48-V battery on the negative battery terminal.
- Tighten nut (1).

Negative battery cable to 48-V battery

Nut M8		Tightening torque	19 Nm



- Connect the connector (1) of the CAN bus and lock it.
- Clip in clip (2).



- Activate the 48V electrical system by closing the bonnet.

  The activation takes place automatically.

Additional Information

Overview of Tightening Torques

Wiring harness section to manifold			Used in step 10
TS5x20		Tightening torque	3,6 Nm

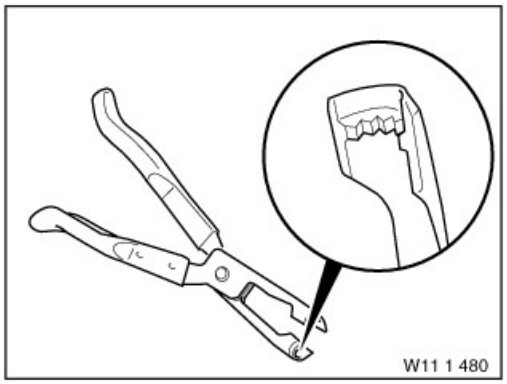
Wiring harness section to cylinder head cover			Used in step 10
TS5x20		Tightening torque	3,6 Nm

Holder on intake plenum			Used in step 10
TS6X20		Tightening torque	5 Nm

Negative battery cable to 48-V battery			Used in step 14
Nut M8		Tightening torque	19 Nm

Overview of Special Tools

0 490 796 (11 1 480) Pliers



Common	Used in step 7
Usage	For removing valve stem seal
Included in the tool or work	
Storage location	A10
Replaced by	
In connection with	
SI-Number	01 01 93 (621)

Links

Repair instructions (PRE)	Used in step
Notes on 48-V battery	114

Repair instructions	Used in step
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	213
61 20 900 Disconnecting and connecting battery earth lead	213
61 20 900 Disconnecting and connecting battery earth lead	213
61 20 900 Disconnecting and connecting battery earth lead	213
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61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads) 213
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads) 213
61 20 900 Disconnecting and connecting battery earth lead 213
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads) 213
61 20 900 Disconnecting and connecting battery earth lead (Plug-in Hybrid Electric Vehicle) 213
61 20 900 Disconnecting and connecting battery earth lead 213
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61 35 ... Notes on ESD protection (Electro Static Discharge) 57
61 35 ... Notes on ESD protection (Electro Static Discharge) 57

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61 00 ... Safety information on handling hybrid cars

Please observe the current version. Safety information for handling electric and hybrid vehicles

1. *Qualification:*
   All repair work on high-voltage components may **only be performed by specially trained personnel** (qualification: Work on high-voltage inherently save vehicles) must be performed by qualified technicians. Each hybrid car requires additional vehicle specific training with training achievement controls.
   Required training is offered by the BMW Training Academy.
2. *Identification:*
   Observe **warning notices** on high-voltage components. When replacing individual high-voltage components, check if warning stickers are present. Independently attaching warnings is only allowed on the locations provided for them. Use only approved and appropriately identified original new parts.
3. *Rules of conduct/protective measures:*
   - Note operating instructions for handling high-voltage battery units.
   - Do not under any circumstances touch open high-voltage cables and high-voltage components on damaged vehicle before shutting down the high-voltage electrical system.
   - In the event of damage (mechanical, thermal) transition metal oxides, carbon, electrolyte solvents and their products of decomposition may be released.
     Suitable acid-resistant protective clothing/equipment must therefore be used when handling the vehicle!
     - Hand protection: Gloves
     - Eye protection: Safety goggles

     Damaged high-voltage battery units must be stored in an acid-resistant pan in a location in the open that is protected against the weather (sun, rain) and secured against unauthorised access. Do not inhale escaping gasses.
   - Prevent escaping substances from entering drains, pits and the sewer system.
   - Collect any material that is discharged and have it disposed of according to the work instruction, wear acid-resistant protective clothing when doing so.
   - Notify the fire brigade if fire breaks out, clear the area immediately and make accident scene safe. Attempt to extinguish the fire without putting persons in danger (suitable extinguishant: water and water foam).
   - A cut 2nd emergency separation point must be repaired with a butt connector.
4. *Measures before starting work*:
   - Each job on the vehicle must be assigned by appropriately trained personnel. Before work is started, this electrician must place the vehicle in the operating condition required to perform the relevant activity. The qualified personnel's instructions and directions absolutely must be followed. **No work may be carried out without this qualified personnel** being consulted first.
   - It is **not** permitted to work on the high voltage system or on high voltage components while the engine is running.
   - The readiness to drive must be ended before shutting off the voltage of the high-voltage system. The readiness to drive is ended when the driver is absent only under the following prerequisites:
     1. seat belt buckle unlocked **and**
     2. the driver's door is open **and**
     3. no brake activated **and**
     4. the accelerator pedal is not activated **and**
     5. speed < 3 km/h (2 mph)
   - Work on live high-voltage components is expressly prohibited. Before each operation on the high-voltage system, the system must be isolated from the power supply by qualified personnel (high-voltage safety connector Off) and secured against unauthorised recommissioning (padlock).
   - After each deactivation of the high-voltage system, it is essential to observe a **waiting period** of at least **10 seconds** prior to further work.
   - Before beginning work, it is mandatory to check that the equipment is de-energised and is protected against being energised again!
     Work is only permitted to begin if:
     1. Corresponding display in the instrument cluster **High-voltage system deactivated** or

     When a high-voltage warning is active (indicator light, Check Control, etc.), it is essential to determine and eliminate the cause of this warning via the diagnosis system before continuing with any other work. **If it cannot be definitively established that the equipment is de-energised**, work is not permitted to begin. **Danger to life!** Before work begins, a qualified electrician (1000 V AC) must verify that the system is de-energised using appropriate measuring devices and procedures.

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=> In this case, Technical Support must be contacted!

- Do not perform any work on the vehicle while it is charging. Before starting work, disconnect the charging cable from the vehicle.
  Battery charging may result in heating of the high-voltage battery unit. This heating may lead to sporadic launches of the electric fan (switch-on request from the electric fan). Therefore, work in the vicinity of the electric fan during the charging procedure is prohibited. Ensure freedom of movement of the battery charge lines in the vicinity of the electric fan.

5. *Measures during/after activities:*
   - Identifiable mechanical damage to or tampering with high-voltage components must be reported immediately to the qualified personnel in charge.
   - When carrying out any work on the high-voltage system, it is prohibited to drive externally all the drivetrain components (wheels, gearbox, drive shafts, etc.).
   - *E72 only:* When the “Power Electronic Box Cover” is removed, the high-voltage system is not permitted to be activated. The high-voltage service disconnect must only be used when the "Power Electronics Box Cover" is completely installed.
   - High-voltage cables (orange coating) and their connectors and stop parts **may not** be repaired. If damaged, a cable must always be replaced completely.
   - When working in the vicinity of high-voltage components (identified accordingly with warning stickers and orange-coloured coating), protect these components against damage.
   - The specified work steps in the repair instructions must be adhered to exactly.
   - High-voltage components and their holders must be screwed/bolted to the defined tightening torque. Tightening torques and tightening specifications must be observed.
   - Connecting high-voltage components to body ground is crucial to safety for reasons of equipotential bonding. For this reason, it is prohibited to operate any high-voltage components without them being correctly connected to body ground. The measurements (insulation/potential equalisation measurement) are performed automatically by the vehicle. Manual measurement is not therefore necessary.
     For a correct earthing connection, the retaining elements of high-voltage components must not be painted. Follow further notes on paintwork.
   - Removed high-voltage battery units must be stored in a manner that protects them from misuse and damage.
   - Damaged or warning stickers that are no longer legible on high-voltage components must always be replaced.
6. *Equipotential bonding:*
   Equipotential bonding lines, high-voltage cables and the battery negative lead to the EME are fitted with safety screws!
   - Clean contact faces and have then checked by a second person.
   - Tighten down screws/bolts to specified torque.
   - Have tightening torque checked by a second person.
   - Both persons must document that the work has been carried out correctly in the vehicle records.

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12 61 280 Removing and installing/replacing oil pressure switch

PRELIMINARY WORK

1 – Removing the acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover/design cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover/design cover.

- Disassemble or mount the acoustic cover/design cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover/design cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Unclip the acoustic cover (1) from the holders in the indicated area towards the top.

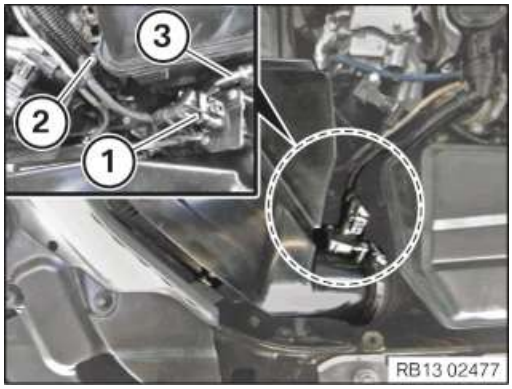
2 – Removing the clean air pipe with the resonator

WARNING

Hot surfaces.

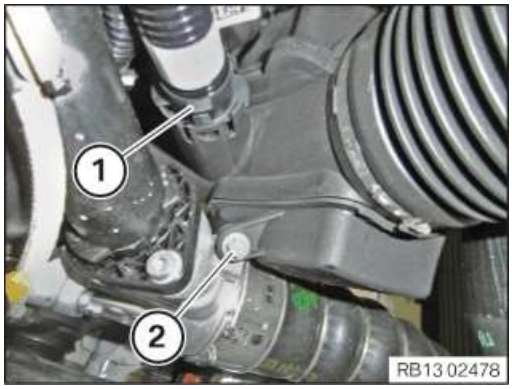
Risk of burning!

- Perform all work only on components that have cooled down.

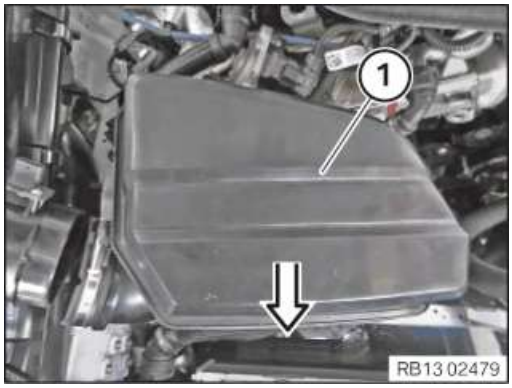


- Unlock plug connection (1) and disconnect.
- Loosen clamp (2).
- Unfasten clamp (3).
- Separate the clean air pipe with resonator from the intake filter housing.

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- Unlock engine ventilation line (1), disconnect it and place it aside.
- Loosen screw (2).



- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Unlock and loosen clamp (1).



- Feed out and remove clean air pipe with resonator (1) in the direction of the arrow.

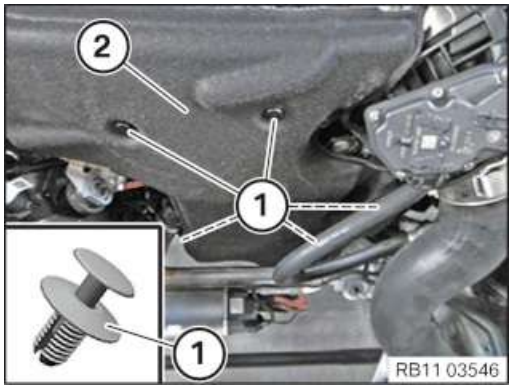
3 – Remove acoustic cover of the front engine

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.



- Release and remove expanding rivet (1).
- Guide the acoustic cover (2) out and remove.

MAIN WORK

4 – Removing the oil pressure switch

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

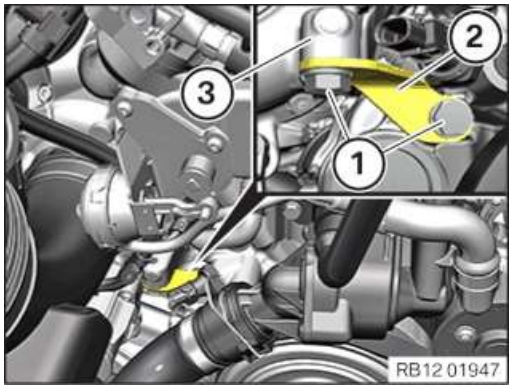
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 ... Notes for ESD protection (electrostatic discharge)

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.



- Unlock plug connection (1) and disconnect.



- Loosen screws (1).
- Thread out holder (2) on the exhaust turbocharger (3) downward and remove.



- Release the oil pressure switch (1) with the special tool .
- Feed out and remove the oil pressure switch (1).
- Catch and dispose of emerging engine oil.

5 – Installing the oil pressure switch

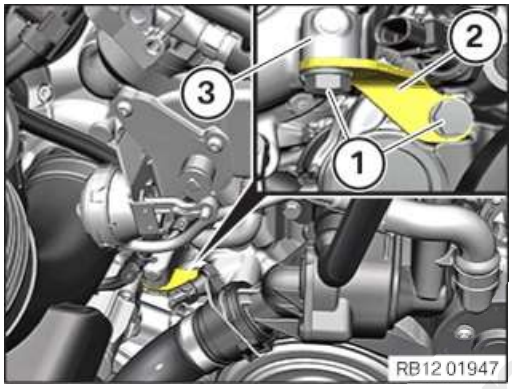


- Replace oil pressure switch.

  Parts: Oil pressure switch
- Guide in and install oil pressure switch (1).
- Tighten oil pressure switch (1) with the special tool .

Oil pressure switch to crankcase

Sensor	Replace oil pressure switch.	Tightening torque	22 Nm



- Thread in holder (2) on the exhaust turbocharger (3) downward and install.
- Tighten the screws (1).

Exhaust turbocharger to panel holder for support to crankcase

Hexagon screw M8x16		Tightening torque	22 Nm

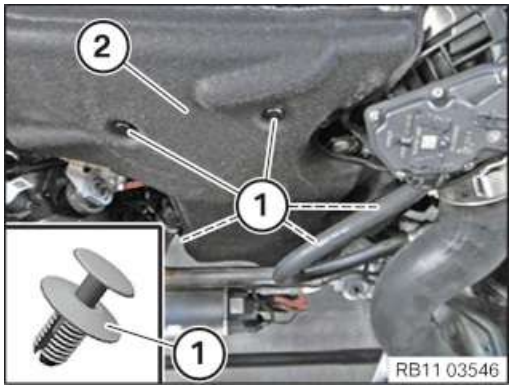


- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

POSTPROCESSES

6 – Install acoustic cover for the engine, front

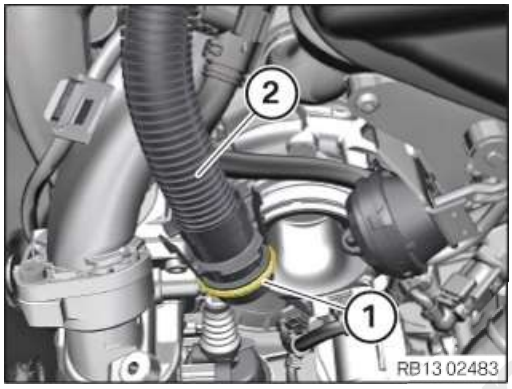


- Feed the acoustic cover (2) in and install.
- Secure the acoustic cover (2) with the expanding rivets (1).

7 – Installing the clean air pipe with resonator



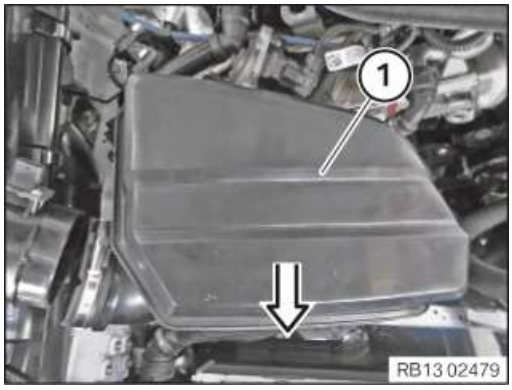
- Check the sealing ring (1) on the exhaust turbocharger for damage and renew if necessary.



- Check the sealing ring (1) for the engine ventilation line (2) for damage and renew where required.



- Feed in and install clean air pipe with resonator (1) in the direction of the arrow.

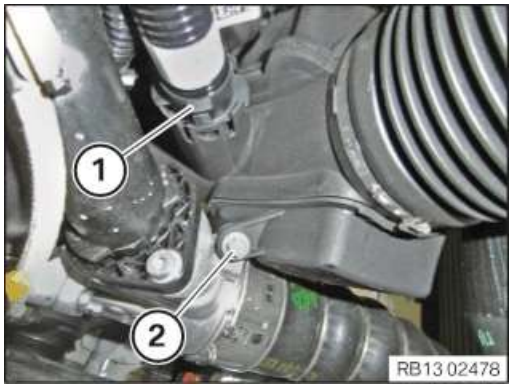


- Press and hold clean air pipe with resonator (1) in the direction of the arrow.



- Attach and lock the clamp (1).

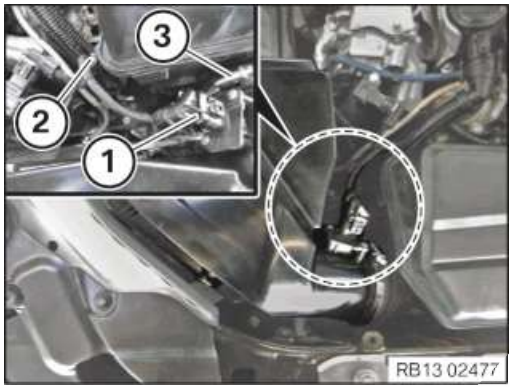
  The clamp (1) must engage audibly.



- Tighten down screw (2).

Clean air pipe to exhaust turbocharger

M6X20		Tightening torque	8 Nm



- Connect the clean air pipe with resonator to the intake filter housing.
- Tighten clamp (3).

Clean air pipe to upper section of intake filter housing

Clamp		Tightening torque	3 Nm

- Secure clamps (2).
- Connect connectors (1) and lock.

  The connector (1) must engage audibly.

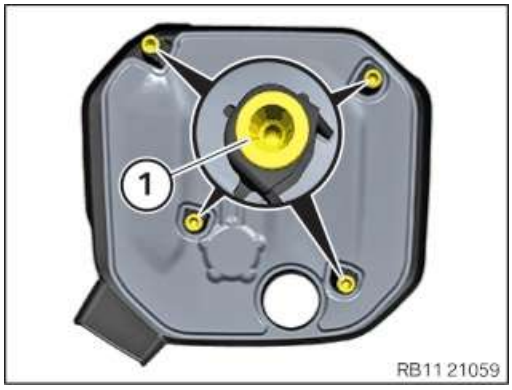
8 – Install acoustic cover

RISK OF DAMAGE

Damage to the acoustic cover/design cover.

Jerky movements during disassembly and excessive application of force during installation may result in breakage of the acoustic cover/design cover.

- Disassemble or mount the acoustic cover/design cover carefully.
- Disassemble or mount snap-lock couplings of the ball pivots one after the other.
- Disassemble or mount acoustic cover/design cover only at temperatures >20 °C.
- Use only distilled water as an auxiliary material during installation, no lubricants.



- Check the acoustic cover for correct fit of the rubber mounts (1).

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- Clip in the acoustic cover (1) into the holders in the indicated areas.

9 – Check engine oil level

Prerequisite

Vehicle is in a horizontal position.

TECHNICAL INFORMATION

Please comply with instructions in Owner's Handbook.

- Carry out an electronic oil measurement.
- Top up engine oil if necessary.

▸ **Check engine oil level**

TECHNICAL INFORMATION

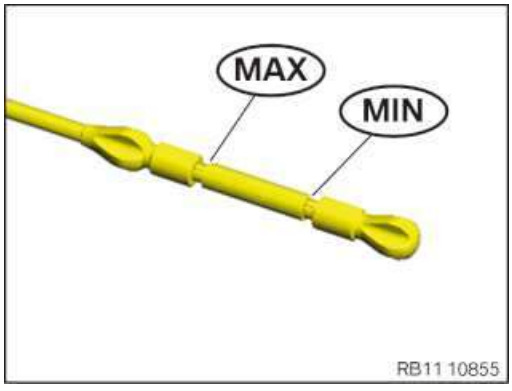
Always check the engine oil level when the engine is at operating temperature (engine oil temperature > 70°C).

- Park vehicle on a horizontal surface.
- Stop the engine and wait for 5 minutes.
- Pull out the oil dipstick and wipe off using a lint-free cloth.

TECHNICAL INFORMATION

Do not pull out or insert the oil dipstick into the guide tube too quickly or slowly.

- Push the oil dipstick into the guide tube up to the limit position and pull it out again.



TECHNICAL INFORMATION

The engine oil level must be between the minimum mark and the maximum mark of the oil dipstick.

- Read the engine oil level on the oil dipstick.
- Top up engine oil if necessary.

Oil quantity between the two markings MIN and MAX of the oil dipstick

1.0 l

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Additional Information

Overview of Tightening Torques

Oil pressure switch to crankcase			Used in step 5
Sensor	Replace oil pressure switch.	Tightening torque	22 Nm

Exhaust turbocharger to panel holder for support to crankcase			Used in step 5
Hexagon screw M8x16		Tightening torque	22 Nm

Clean air pipe to exhaust turbocharger			Used in step 7
M6X20		Tightening torque	8 Nm

Clean air pipe to upper section of intake filter housing			Used in step 7
Clamp		Tightening torque	3 Nm

Overview of Special Tools

Overview Technical Data

Oil quantity between the two markings MIN and MAX of the oil dipstick	Used in step 9
	1.0 l

Links

Repair instructions	Used in step
61 35 ... Notes on ESD protection (Electro Static Discharge)	4
61 35 ... Notes on ESD protection (Electro Static Discharge)	4

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12 61 285 Replacing engine oil level sensor

WARNING

Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

RISK OF DAMAGE

Contaminant or foreign body.

Contamination can result in malfunctions, operating failure or leaks.

- Adhere to the utmost cleanliness.
- Protect components from contamination e.g. by covering.
- Close off line connections with seal plugs.

RISK OF DAMAGE

Engine damage caused by excessively filling the engine with engine oil.

Filling an excessive quantity of engine oil may cause engine damage.

- Observe the exact engine oil filling capacity.
- Allow engine oil to drip off when draining.

TECHNICAL INFORMATION

Make sure the vehicle is at operating temperature for engine oil service (engine oil temperature > 70 °C).

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

PRELIMINARY WORK

1 – Removing the oil filler cap

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- Open oil filler cap (1).

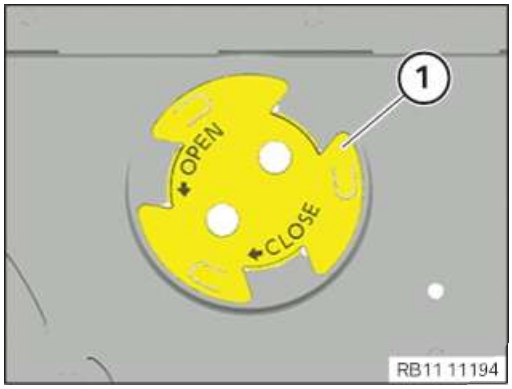
2 – Releasing the oil drain plug

WARNING

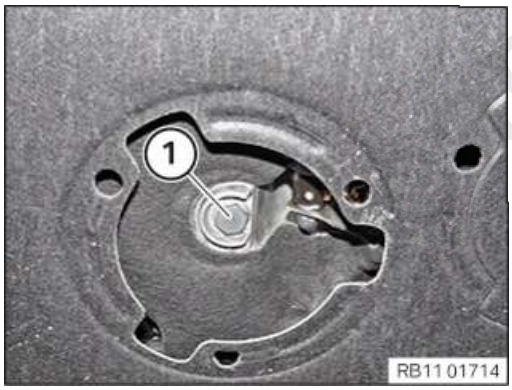
Hot fluids.

Risk of scalding!

- Conduct all work in the vehicle wearing appropriate personal protective equipment only.



- Turn and remove service cap (1).



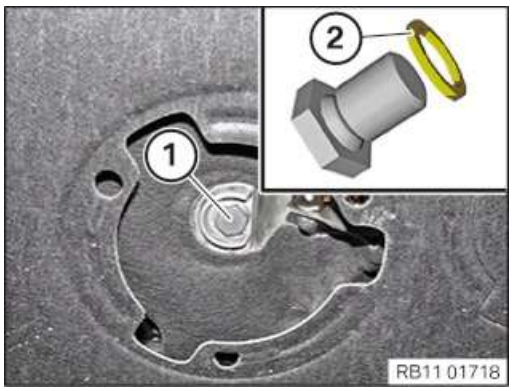
- Open oil drain plug (1) from the oil sump.

TECHNICAL INFORMATION

Collect and dispose of emerging fluids. Observe country-specific waste disposal regulations.

- Allow the engine oil to drain out fully.

3 – Tightening the oil drain plug



- Renew sealing ring (2).

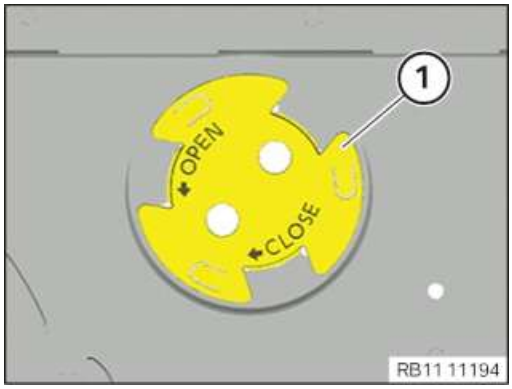
  Parts: Sealing ring

- Position oil drain plug (1) on the oil sump and tighten.

Oil drain plug

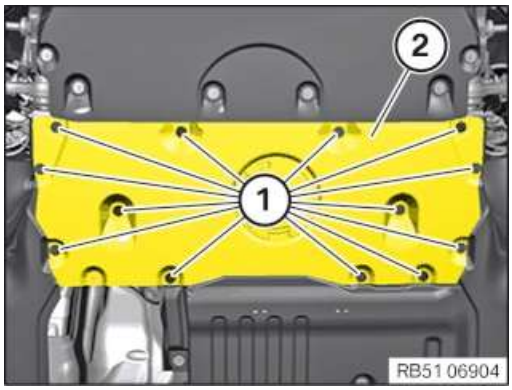
M12x16	Renew the sealing ring.	Tightening torque	25 Nm

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- Install service cap (1).

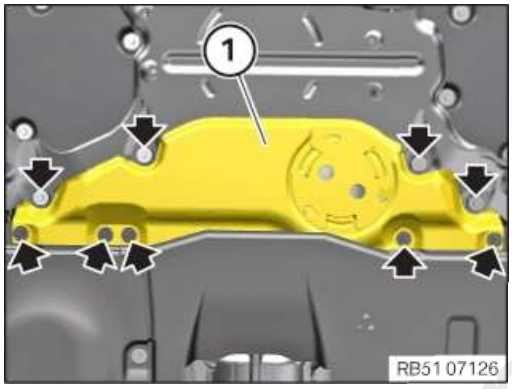
4 – Removing the centre underbody protection



- **Variant with rear wheel drive:**

  Loosen screws (1).

  Remove centre underbody protection (2) .



- **Version with all-wheel drive:**

  Remove screws (arrows).

  Feed out and remove the centre underbody protection (1).

MAIN WORK

5 – Removing the oil-level sensor

WARNING

Hot surfaces.

Risk of burning!

- Perform all work only on components that have cooled down.

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RISK OF DAMAGE

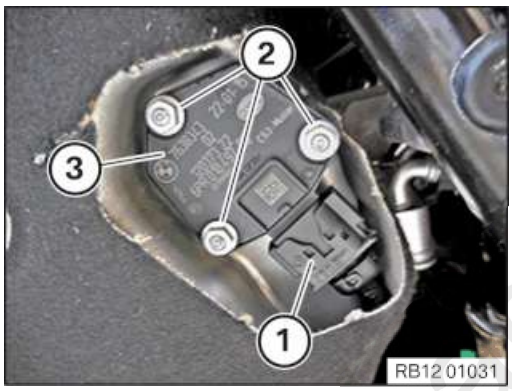
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 ... Notes for ESD protection (electrostatic discharge)



- Loosen cover (1).



- Unlock plug connection (1) and disconnect.
- Release nuts (2).
- Remove oil-level sensor (3).

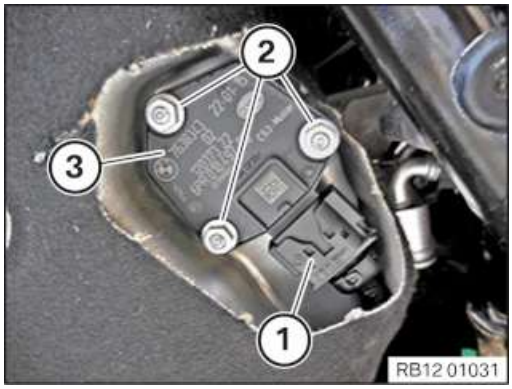
6 – Installing the oil-level sensor



- Renew sealing ring (1).

  Parts: Sealing ring

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- Install the oil-level sensor (3).
- Tighten nuts (2).

Oil level sensor to oil sump

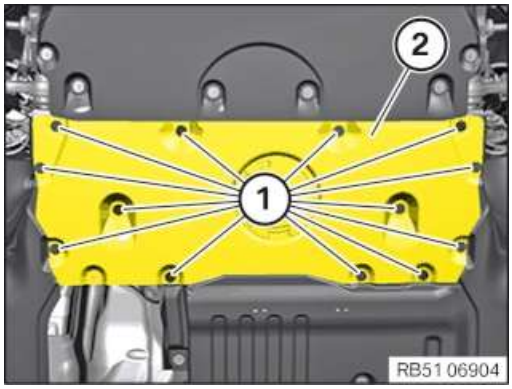
M6 hexagon nut		Jointing torque	2 Nm
		Tightening torque	8,5 Nm

- Connect connectors (1) and lock.

  The connector (1) must engage audibly.
- Check the oil-level sensor (3) for tightness.

POSTPROCESSES

7 – Installing the centre underbody protection



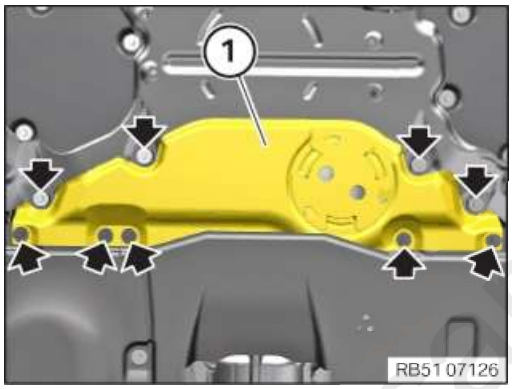
- **Variant with rear wheel drive:**

  Position central underbody protection (2).

  Tighten the screws (1).

Underbody protection

Hexagon screw		Tightening torque	3 Nm



- **Version with all-wheel drive:**

  Guide in centre underbody protection (1) and install.

  Tighten screws (arrows).

Underbody protection

Hexagon screw		Tightening torque	3 Nm

8 – Topping up the engine oil

RISK OF DAMAGE

Engine damage caused by excessively filling the engine with engine oil.

Filling an excessive quantity of engine oil may cause engine damage.

- Observe the exact engine oil filling capacity.
- Allow engine oil to drip off when draining.

- Pour in engine oil.

Engine oil B47D20U1 / B47D20O1 / B47D20T1

Filling capacity, engine oil change with oil filter element	5,5 l

Engine oil: Technically suitable engine oils for BMW Group engines

9 – Installing the oil filler cap

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- Close oil filler cap (1).

10 – Check engine oil level

Prerequisite

Vehicle is in a horizontal position.

TECHNICAL INFORMATION

Please comply with instructions in Owner's Handbook.

- Carry out an electronic oil measurement.
- Top up engine oil if necessary.

▸ **Check engine oil level**

TECHNICAL INFORMATION

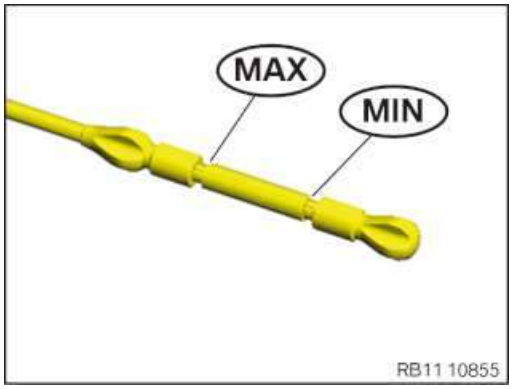
Always check the engine oil level when the engine is at operating temperature (engine oil temperature > 70°C).

- Park vehicle on a horizontal surface.
- Stop the engine and wait for 5 minutes.
- Pull out the oil dipstick and wipe off using a lint-free cloth.

TECHNICAL INFORMATION

Do not pull out or insert the oil dipstick into the guide tube too quickly or slowly.

- Push the oil dipstick into the guide tube up to the limit position and pull it out again.



TECHNICAL INFORMATION

The engine oil level must be between the minimum mark and the maximum mark of the oil dipstick.

- Read the engine oil level on the oil dipstick.
- Top up engine oil if necessary.

Oil quantity between the two markings MIN and MAX of the oil dipstick

1.0 l

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Additional Information

Overview of Tightening Torques

Oil drain plug			Used in step 3
M12x16	Renew the sealing ring.	Tightening torque	25 Nm

Oil level sensor to oil sump			Used in step 6
M6 hexagon nut		Jointing torque	2 Nm
		Tightening torque	8,5 Nm

Underbody protection			Used in step 7
Hexagon screw		Tightening torque	3 Nm

Overview Technical Data

Engine oil B47D20U1 / B47D20O1 / B47D20T1	Used in step 8
Filling capacity, engine oil change with oil filter element	5,5 l
Engine oil: Technically suitable engine oils for BMW Group engines	

Oil quantity between the two markings MIN and MAX of the oil dipstick	Used in step 10
	1.0 l

Links

Repair instructions	Used in step
61 35 ... Notes on ESD protection (Electro Static Discharge)	5
61 35 ... Notes on ESD protection (Electro Static Discharge)	5

Operating materials	Used in step
3.0 Technically appropriate engine oils for BMW Group engines	8

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12 63 586 Replacing power distribution box

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no charger** is connected to the jump start support point in the engine compartment.
- Detach battery earth lead from battery.
- With auxiliary batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

PRELIMINARY WORK

1 – Deactivating the 48 V electrical system

Prerequisite

Ignition is switched off.

WARNING

Deactivation of the 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no battery charger** is connected to the jump start terminal point in the engine compartment.
- For vehicles with additional electrical systems (48 V electrical system, high-voltage vehicle electrical system), it is mandatory to deactivate them **before** disconnecting the vehicle battery.

WARNING

Deactivation of the 48 V electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no charger** is connected to the jump start support point in the engine compartment.

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RISK OF DAMAGE

Damage to 48-V battery

If a 48-V battery that is disconnected from the electrical system is activated, the battery electronics will be damaged.

- Only carry out activation of the 48V electrical system with a completely connected 48-V battery.

TECHNICAL INFORMATION

Follow notes for 48-V battery. See further information 6120 ... Notes on 48-V battery.



- Deactivate the 48V electrical system by opening the bonnet.

  The deactivation takes place automatically.



Check

TECHNICAL INFORMATION

Zero voltage (48V electrical system is switched off) is displayed only in PAD mode.

- Press the START-STOP button quickly 3 times without stepping on the brake pedal to establish the PAD mode.
- Check isolation from the supply in the instrument cluster in PAD mode.

desired state

- The Check Control message "48V electrical system switched off." (1) is displayed.

Result

» **The absence of voltage** cannot be determined by means of the Check Control message "48V electrical system switched off:" (1). Work is not permitted to be started.

Measure

- Carry out the service function "48 V electrical system deactivation".
  - Vehicle management > Service functions > Voltage supply > Deactivate 48 V electrical system

Only when the Check Control message “48 V electrical system switched off.” (1) is displayed in the instrument cluster is it permitted to disconnect the 12 V battery.

If the absence of voltage is not indicated clearly, contact Technical Support.

Result

» The Check Control message signals that the 48V electrical system has been switched off.

Measure

- Exit PAD mode by pressing the START-STOP button once without depressing the brake pedal.

  The work “Disconnecting the negative battery cable of the 48-V battery” can be started.



- Unlock and disconnect plug connection (1) of the CAN bus.
- Release the clip (2).



- Loosen nut (1).
- Pull off negative battery cable (2) of the 48-V battery from the negative battery terminal, set it aside and secure it.



WARNING

Unprotected battery terminals.

Risk of short circuits! Risk of fire!

- Cover the vehicle battery.

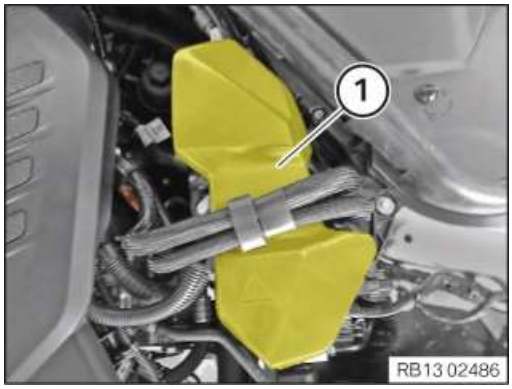
- Cover the vehicle battery with the special tool as shown.
- Position the battery earth lead (1) as shown.

2 – Disconnecting all battery earth leads



- See additional information.

3 – Remove the cover for the DDE control unit



- Pull off, guide out and remove cover (1) upwards.

MAIN WORK

4 – Removing integrated supply module (PDM)

RISK OF DAMAGE

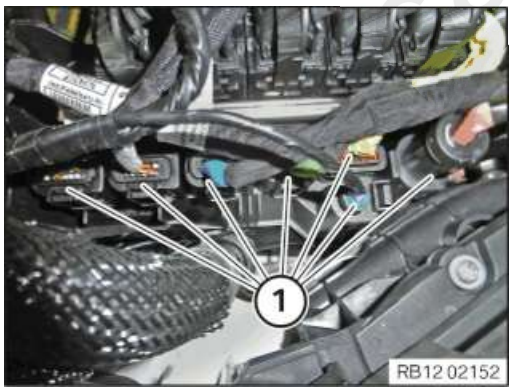
Electrostatic discharge.

Damage to or destruction of electrical components.

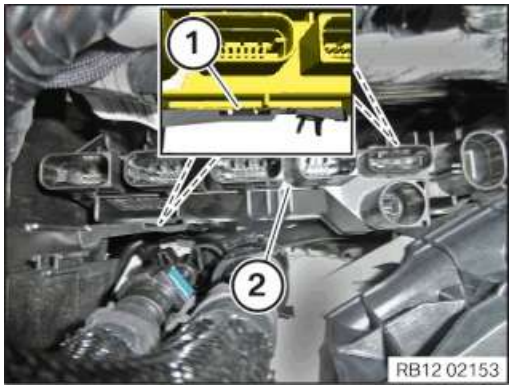
- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 ... Notes for ESD protection (electrostatic discharge)

TECHNICAL INFORMATION

The number of connectors on the described component may vary depending on the equipment specification.
If necessary, unlock all other connectors and disconnect or connect and lock respectively.



- Unlock and disconnect plug connections (1).

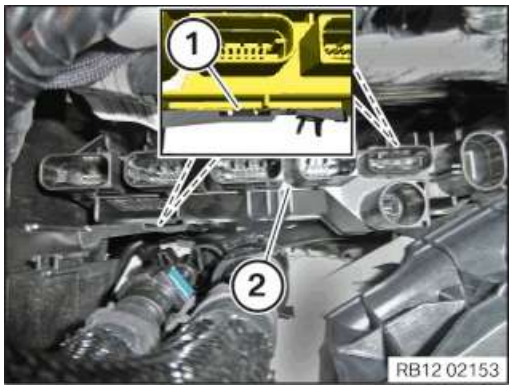


- Loosen the latch mechanisms (1).
- Feed out and remove the integrated supply module (PDM) (2) upwards.

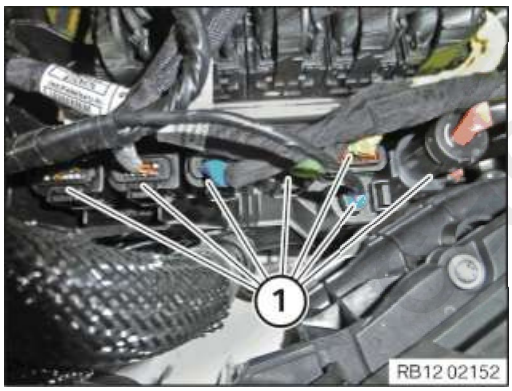
5 – Installing the integrated supply module (PDM)

TECHNICAL INFORMATION

The number of connectors on the described component may vary depending on the equipment specification.
If necessary, unlock all other connectors and disconnect or connect and lock respectively.



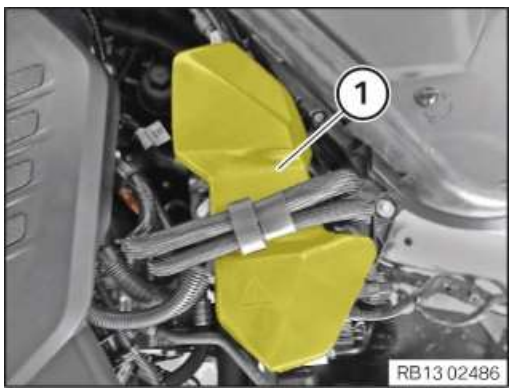
- Insert and install the integrated supply module (PDM) (2).
  The latch mechanisms (1) must engage audibly.



- Connect connectors (1) and lock.
  The connectors (1) must engage audibly.

POSTPROCESSES

6 – Install the cover for the DDE control unit



- Insert and install cover (1) into guides.

7 – Connecting all battery earth leads



- See additional information.

8 – Activating the 48 V electrical system

Prerequisite

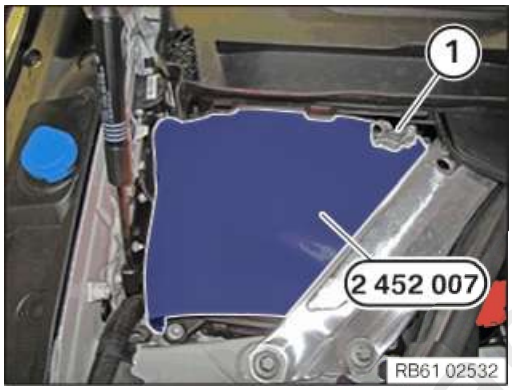
Ignition is switched off.

RISK OF DAMAGE

Damage to 48-V battery

If a 48-V battery that is disconnected from the electrical system is activated, the battery electronics will be damaged.

- Only carry out activation of the 48V electrical system with a completely connected 48-V battery.



- Lift battery earth lead (1).
- Remove special tool .



- Release the negative battery cable (2) of the 48-V battery from the mounting.
- Position the negative battery cable (2) of the 48-V battery on the negative battery terminal.
- Tighten nut (1).

Negative battery cable to 48-V battery

Nut M8		Tightening torque	19 Nm



- Connect the connector (1) of the CAN bus and lock it.
- Clip in clip (2).



- Activate the 48V electrical system by closing the bonnet.
  The activation takes place automatically.

Additional Information

Overview of Tightening Torques

Negative battery cable to 48-V battery			Used in step 8
Nut M8		Tightening torque	19 Nm

Overview of Special Tools

Links

Repair instructions (PRE)	Used in step
Notes on 48-V battery	18

Repair instructions	Used in step
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	27
61 20 900 Disconnecting and connecting battery earth lead	27
61 20 900 Disconnecting and connecting battery earth lead	27
61 20 900 Disconnecting and connecting battery earth lead	27
61 20 900 Disconnecting and connecting battery earth lead	27
61 20 900 Disconnecting and connecting battery earth lead	27
61 20 900 Disconnecting and connecting battery earth lead	27
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	27
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	27
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61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	27
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61 20 900 Disconnecting and connecting battery earth lead	27
61 20 900 Disconnecting and connecting battery earth lead	27
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	27

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61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	27
61 20 900 Disconnecting and connecting battery earth lead	27
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	27
61 20 900 Disconnecting and connecting battery earth lead (Plug-in Hybrid Electric Vehicle)	27
61 20 900 Disconnecting and connecting battery earth lead	27
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61 20 900 Disconnecting and connecting battery earth lead	27
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	27
61 20 900 Disconnecting and connecting battery earth lead	27
61 20 900 Disconnecting and connecting battery earth lead	27
61 20 900 Disconnecting and connecting battery earth lead	27
61 35 ... Notes on ESD protection (Electro Static Discharge)	4
61 35 ... Notes on ESD protection (Electro Static Discharge)	4

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12 90 120 Removing and installing/replacing control unit holder

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no charger** is connected to the jump start support point in the engine compartment.
- Detach battery earth lead from battery.
- With auxiliary batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

PRELIMINARY WORK

1 – Disconnecting all battery earth leads



- See additional information.

2 – Remove DDE control unit

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 ... Notes for ESD protection (electrostatic discharge)

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TECHNICAL INFORMATION

In a warranty case, you must always provide a fault memory printout with the defective part, even if the fault memory does not contain an entry.

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.

For additional information see: 12 00 ... Notes on removal and installation of control units

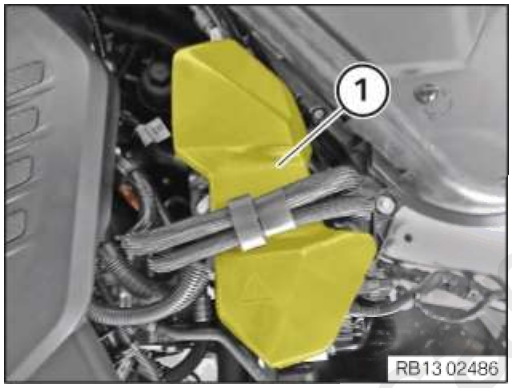
TECHNICAL INFORMATION

Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.

TECHNICAL INFORMATION

Control unit must be programmed after it is replaced.

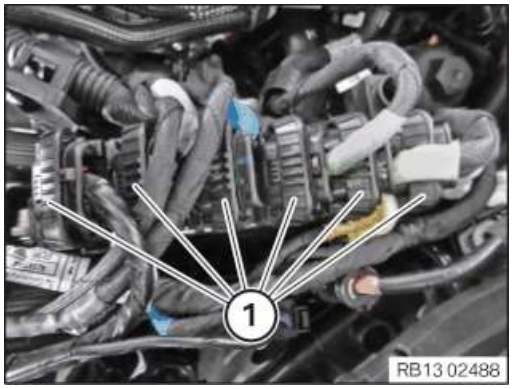
For additional information see: 61 00 ... Programming/encoding control unit(s)



- Pull off cover (1) upwards, feed out and remove.



- Unlock plug connection (1) and disconnect.



- Unlock and disconnect plug connections (1).



- Release the latch mechanisms (arrows).
- Thread out and remove DDE control unit (1).

3 – Removing integrated supply module (PDM)

RISK OF DAMAGE

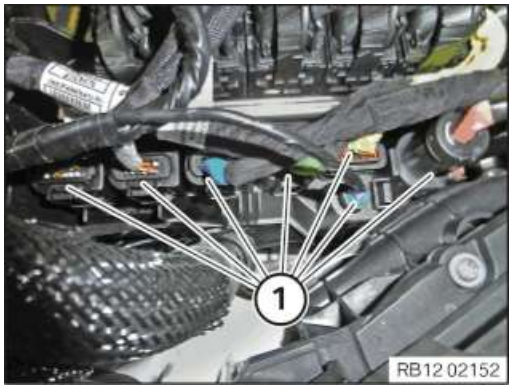
Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 ... Notes for ESD protection (electrostatic discharge)

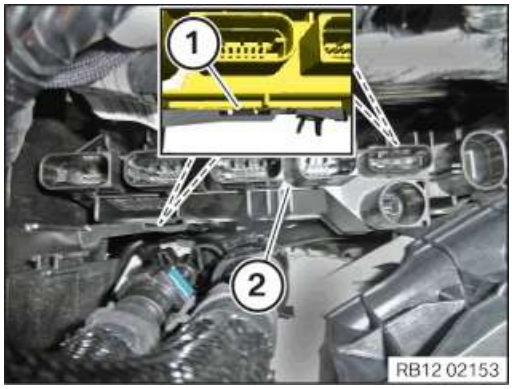
TECHNICAL INFORMATION

The number of connectors on the described component may vary depending on the equipment specification.
If necessary, unlock all other connectors and disconnect or connect and lock respectively.



- Unlock and disconnect plug connections (1).

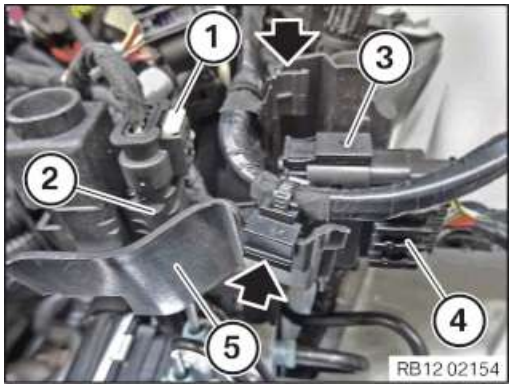
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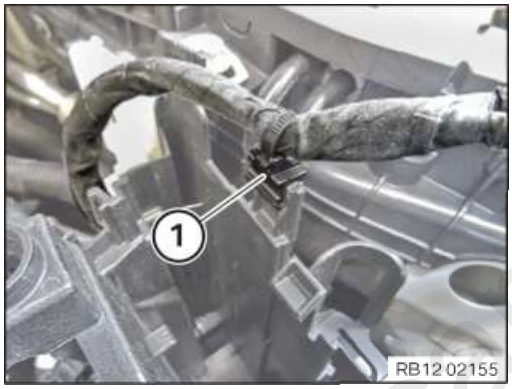
- Loosen the latch mechanisms (1).
- Feed out and remove the integrated supply module (PDM) (2) upwards.

MAIN WORK

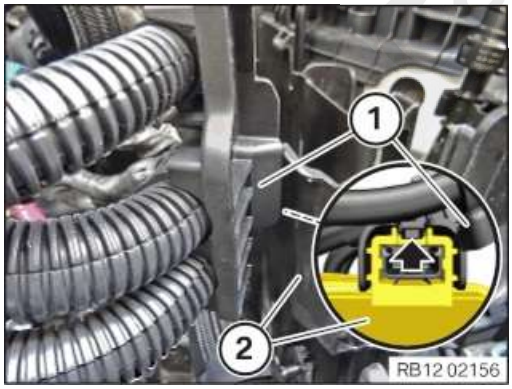
4 – Removing the control unit holder



- Unlock plug connection (1) and disconnect.
- Unlock connector (2) and disconnect from the control unit holder (5).
- Unlock plug connection (3) and disconnect.
- Unlock connector (4) and disconnect from the control unit holder (5).
- Release the clamps (arrows).

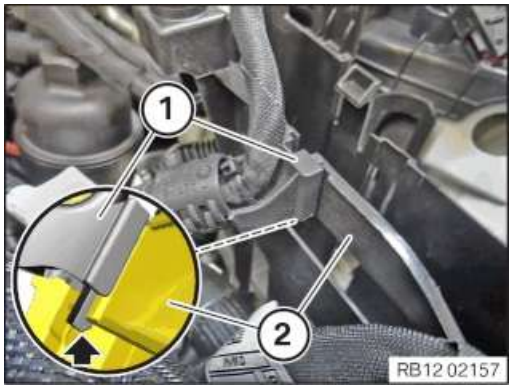


- Loosen clamp (1).

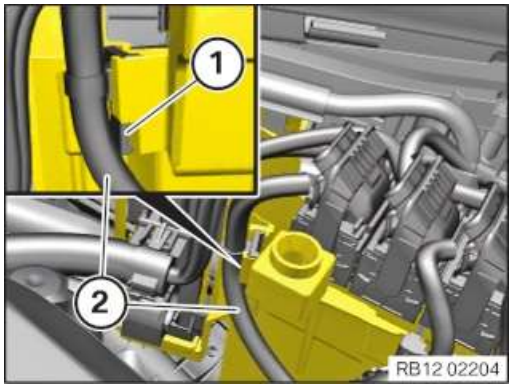


- Unlock the lock (arrow).
- Disconnect cable clip (1) from the control unit holder (2) to the top.

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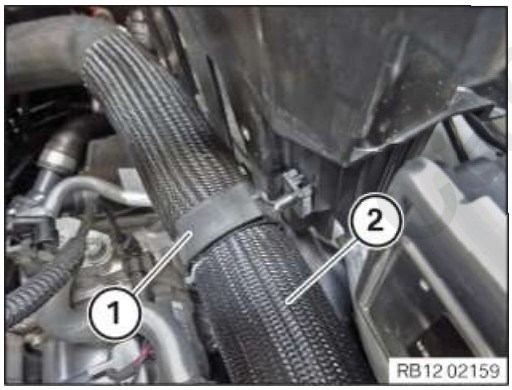
- Unlock the lock (arrow).
- Disconnect cable clip (1) from the control unit holder (2) to the top.



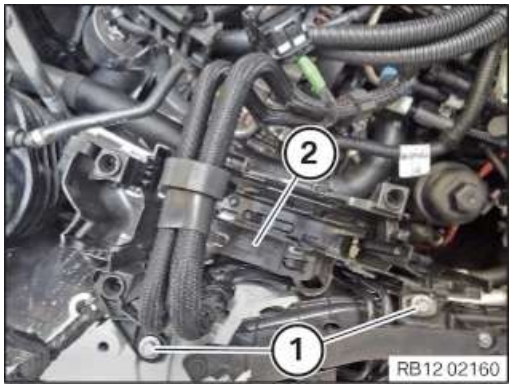
- Unlock and loosen the cable clip (1).
- Remove the wiring harness section (2) and put to one side.



- Unlock the lock (arrow).
- Feed out the cable clip (1) to the top and set it aside.



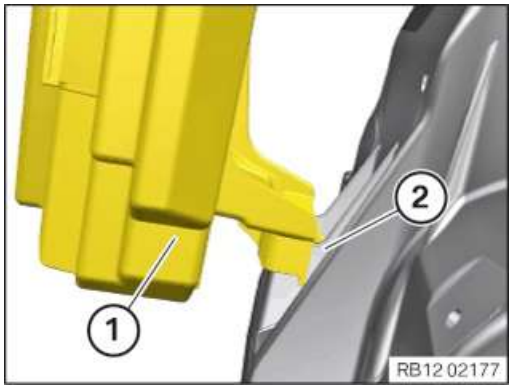
- Unlock holder (1), feed out coolant line (2) and place to one side.



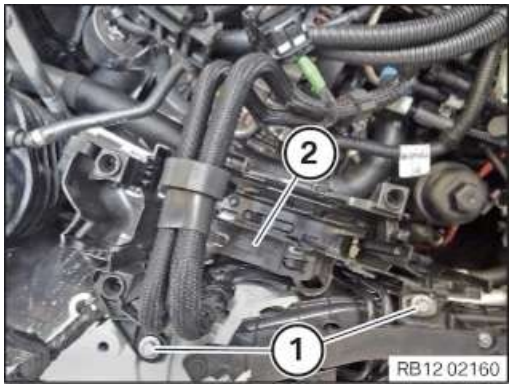
- Loosen screws (1).
- Guide out and remove the control unit holder (2).

5 – Installing the control unit holder

.com



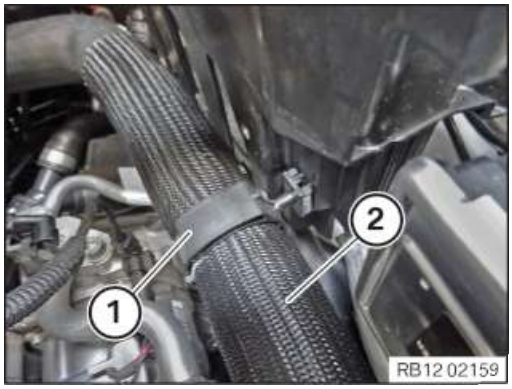
- Make sure the bottom control unit holder (1) is inserted correctly into the fixture (2).



- Guide in and install control unit holder (2).
- Tighten the screws (1).

Control unit holder

M6		Tightening torque	8 Nm



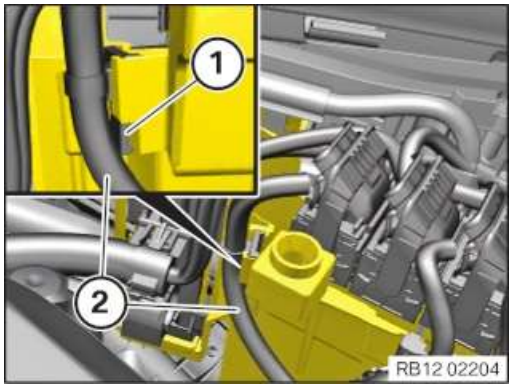
- Feed in and install coolant line (2).
- Lock holder (1).

  The holder (1) must engage audibly.



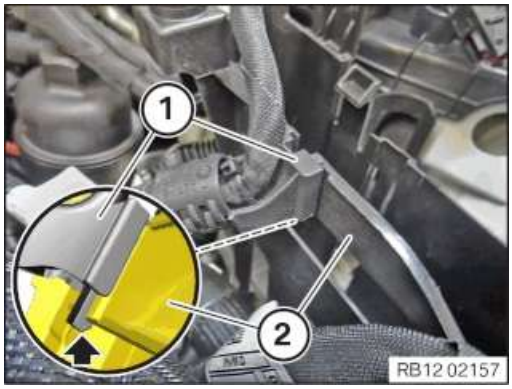
- Feed in and install the cable clip (1).

  Lock (arrow) must audibly engage.

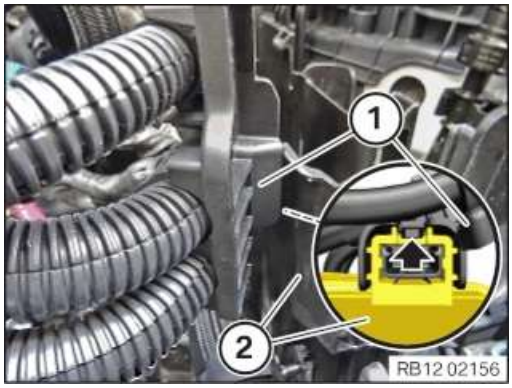


- Guide in the wiring harness section (2) and install.
- Connect and lock the cable clip (1).

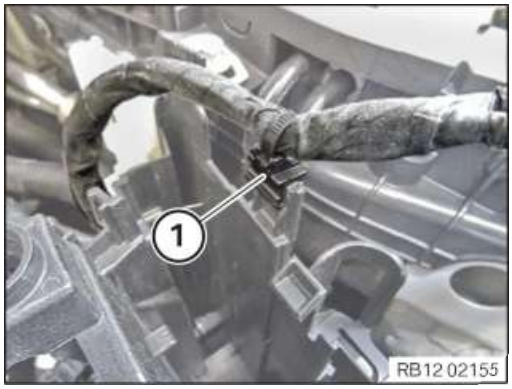
rdiagn.com



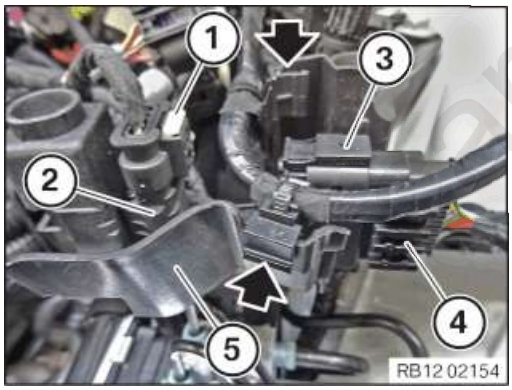
- Connect the cable clip (1) with the control unit holder (2) and lock.
  Lock (arrow) must audibly engage.



- Connect the cable clip (1) with the control unit holder (2) and lock.
  Lock (arrow) must audibly engage.



- Secure clamps (1).



- Connect and lock the connector (4) with the control unit holder (5).
  The connector (4) must engage audibly.
- Connect connectors (3) and lock.
  The connector (3) must engage audibly.
- Connect and lock the connector (2) with the control unit holder (5).
  The connector (2) must engage audibly.
- Connect connectors (1) and lock.
  The connector (1) must engage audibly.
- Secure the clamps (arrows).

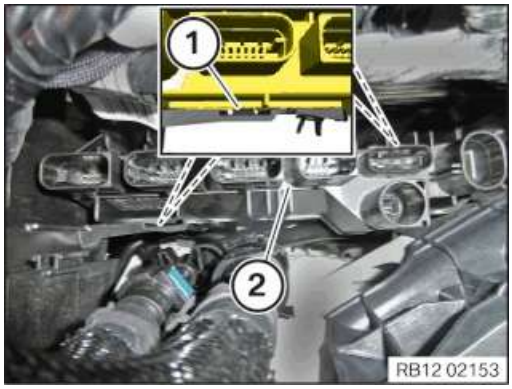
POSTPROCESSES

6 – Installing the integrated supply module (PDM)

TECHNICAL INFORMATION

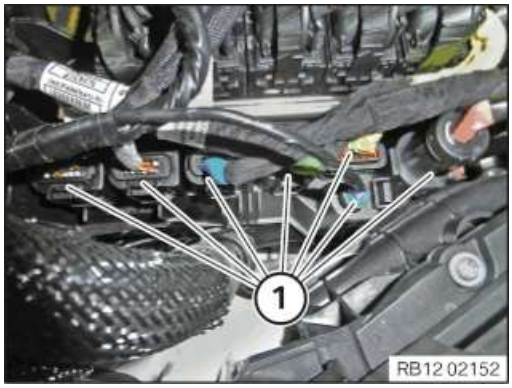
The number of connectors on the described component may vary depending on the equipment specification.
If necessary, unlock all other connectors and disconnect or connect and lock respectively.

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- Insert and install the integrated supply module (PDM) (2).

  The latch mechanisms (1) must engage audibly.



- Connect connectors (1) and lock.

  The connectors (1) must engage audibly.

7 – Install DDE control unit

TECHNICAL INFORMATION

If the DDE control unit or an injector has been replaced, it will also be necessary to carry out injection quantity compensation. The adjustment value (7-position letter/number code) is engraved on each injector.

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.

For additional information see: 12 00 ... Notes on removal and installation of control units

TECHNICAL INFORMATION

Control unit must be programmed after it is replaced.

For additional information see: 61 00 ... Programming/encoding control unit(s)

TECHNICAL INFORMATION

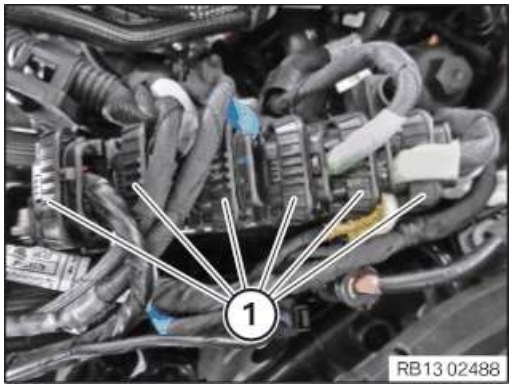
Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.

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- Install DDE control unit(1).

  The latch mechanisms (arrows) must engage audibly.



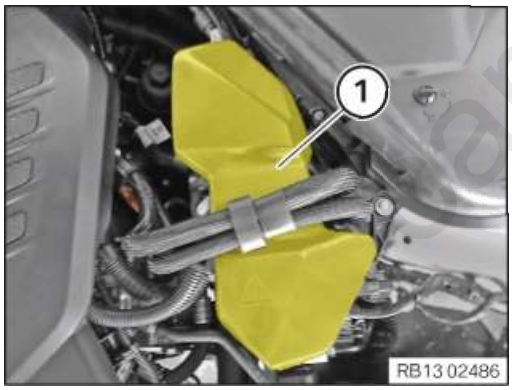
- Connect connectors (1) and lock.

  The connectors (1) must engage audibly.



- Connect connectors (1) and lock.

  The connector (1) must engage audibly.



- Insert and install cover (1) into guides.

8 – Connecting all battery earth leads



- See additional information.

Additional Information

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Overview of Tightening Torques

Control unit holder			Used in step 5
M6		Tightening torque	8 Nm

Links

General repair instructions	Used in step
12 00 ... Instructions for removal and replacement of control units	27

Repair instructions	Used in step
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	18
61 20 900 Disconnecting and connecting battery earth lead	18
61 20 900 Disconnecting and connecting battery earth lead	18
61 20 900 Disconnecting and connecting battery earth lead	18
61 20 900 Disconnecting and connecting battery earth lead	18
61 20 900 Disconnecting and connecting battery earth lead	18
61 20 900 Disconnecting and connecting battery earth lead	18
61 20 900 Disconnecting and connecting the battery earth lead (all battery earth leads)	18
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12 90 120 Removing and installing/replacing control unit holder

WARNING

Working on 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no charger** is connected to the jump start support point in the engine compartment.
- Detach battery earth lead from battery.
- With auxiliary batteries: Detach all battery earth leads from additional batteries.

RISK OF DAMAGE

Damage to battery terminal, the safety battery terminal or the intelligent battery sensor (IBS).

Damaged battery terminals can lead to malfunctions or vehicle electrical system faults.

- Pull off battery terminal from battery pole by carefully moving to and fro. Do not pry off using a tool.

PRELIMINARY WORK

1 – Deactivating the 48 V electrical system

Prerequisite

Ignition is switched off.

WARNING

Deactivation of the 12 V vehicle electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no battery charger** is connected to the jump start terminal point in the engine compartment.
- For vehicles with additional electrical systems (48 V electrical system, high-voltage vehicle electrical system), it is mandatory to deactivate them **before** disconnecting the vehicle battery.

WARNING

Deactivation of the 48 V electrical system.

Risk of short circuits! Risk of fire!

- Make sure that **no charger** is connected to the jump start support point in the engine compartment.

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RISK OF DAMAGE

Damage to 48-V battery

If a 48-V battery that is disconnected from the electrical system is activated, the battery electronics will be damaged.

- Only carry out activation of the 48V electrical system with a completely connected 48-V battery.

TECHNICAL INFORMATION

Follow notes for 48-V battery. See further information 6120 ... Notes on 48-V battery.



- Deactivate the 48V electrical system by opening the bonnet.

  The deactivation takes place automatically.



Check

TECHNICAL INFORMATION

Zero voltage (48V electrical system is switched off) is displayed only in PAD mode.

- Press the START-STOP button quickly 3 times without stepping on the brake pedal to establish the PAD mode.
- Check isolation from the supply in the instrument cluster in PAD mode.

desired state

- The Check Control message "48V electrical system switched off." (1) is displayed.

Result

» **The absence of voltage** cannot be determined by means of the Check Control message "48V electrical system switched off:" (1). Work is not permitted to be started.

Measure

- Carry out the service function "48 V electrical system deactivation".
  - Vehicle management > Service functions > Voltage supply > Deactivate 48 V electrical system

Only when the Check Control message “48 V electrical system switched off.” (1) is displayed in the instrument cluster is it permitted to disconnect the 12 V battery.

If the absence of voltage is not indicated clearly, contact Technical Support.

Result

» The Check Control message signals that the 48V electrical system has been switched off.

Measure

- Exit PAD mode by pressing the START-STOP button once without depressing the brake pedal.

  The work “Disconnecting the negative battery cable of the 48-V battery” can be started.



- Unlock and disconnect plug connection (1) of the CAN bus.
- Release the clip (2).



- Loosen nut (1).
- Pull off negative battery cable (2) of the 48-V battery from the negative battery terminal, set it aside and secure it.



WARNING

Unprotected battery terminals.

Risk of short circuits! Risk of fire!

- Cover the vehicle battery.

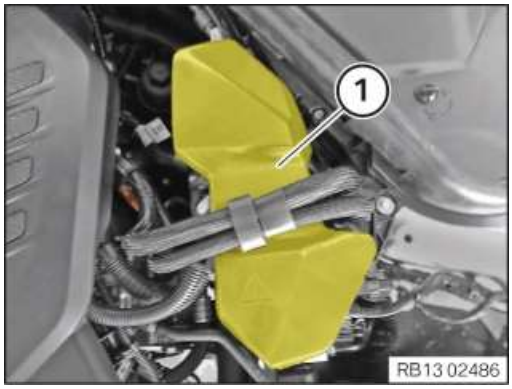
- Cover the vehicle battery with the special tool as shown.
- Position the battery earth lead (1) as shown.

2 – Disconnecting all battery earth leads



- See additional information.

3 – Remove the cover for the DDE control unit



- Pull off, guide out and remove cover (1) upwards.

4 – Remove DDE control unit

RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 ... Notes for ESD protection (electrostatic discharge)

TECHNICAL INFORMATION

In a warranty case, you must always provide a fault memory printout with the defective part, even if the fault memory does not contain an entry.

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.

For additional information see: 12 00 ... Notes on removal and installation of control units

TECHNICAL INFORMATION

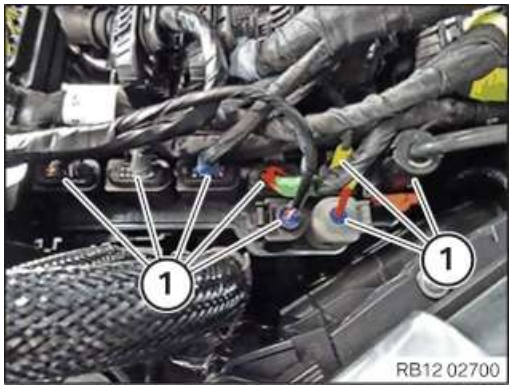
Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.

TECHNICAL INFORMATION

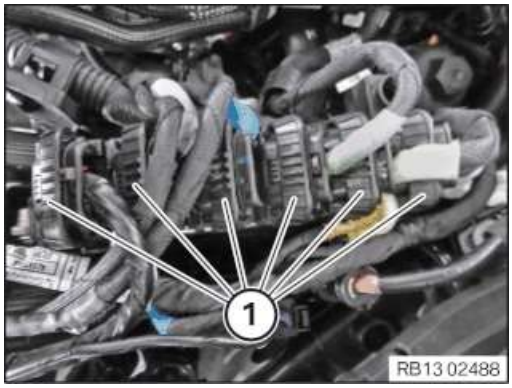
Control unit must be programmed after it is replaced.

For additional information see: 61 00 ... Programming/encoding control unit(s)

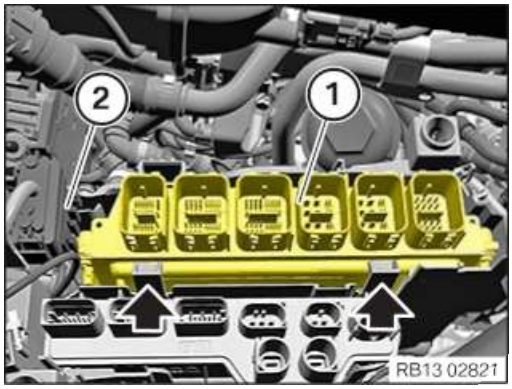
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- Unlock plug connections (1) and disconnect.



- Unlock and disconnect plug connections (1).



- Release the latch mechanisms (arrows).
- Ensure that the plug connection is (2) not damaged.
- Feed out the DDE control unit (1) **carefully** and remove.

5 – Removing the integrated supply module (PDM) partially

Prerequisite

Engine control unit is removed.

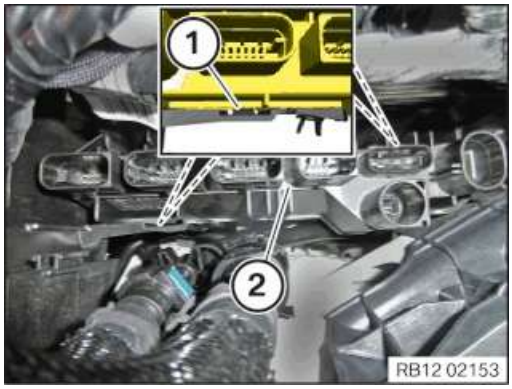
RISK OF DAMAGE

Electrostatic discharge.

Damage to or destruction of electrical components.

- Leave electrical components in original packaging until just before they are installed. Use the original packaging only for any return shipments. Always package removed components straight away.
- Read and comply with user information on using the associated special tool 12 7 060.
- Only touch the housings of electrical components. Do not touch pins or multi-pin connectors directly.
- Wear electrically conductive clothing and antistatic shoes (with ESD symbol).
- For additional information see: 61 35 ... Notes for ESD protection (electrostatic discharge)

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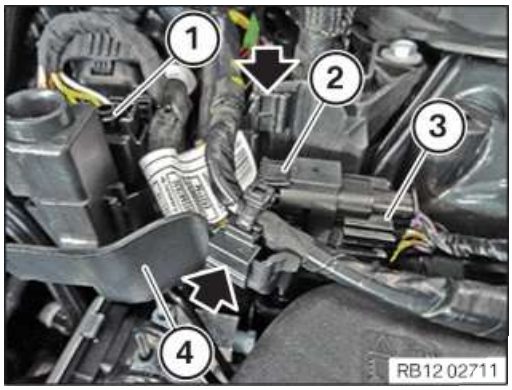
- Loosen the latch mechanisms (1).
- Feed out and remove the integrated supply module (PDM) (2) upwards.

MAIN WORK

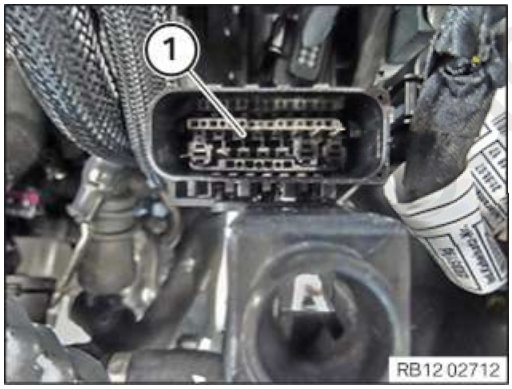
6 – Removing the control unit holder

TECHNICAL INFORMATION

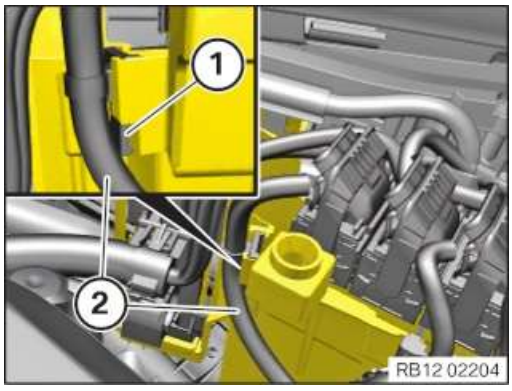
The number of connectors on the described component may vary depending on the equipment specification.
If necessary, unlock all other connectors and disconnect or connect and lock respectively.



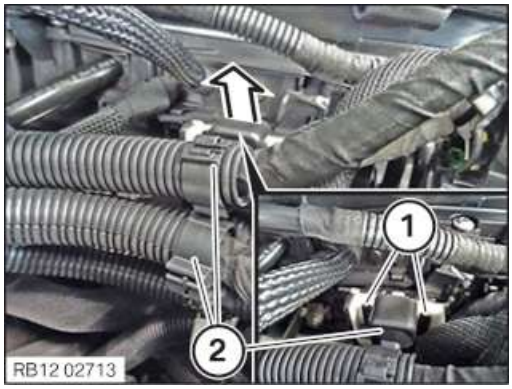
- Unlock plug connection (1) and disconnect.
- Unlock plug connection (2) and disconnect.
- Release the connector (3) and disconnect from the control unit holder (4).
- Release the clamps (arrows).



- Unlock plug connection (1) and disconnect.



- Unlock and loosen the cable clip (1).
- Remove the wiring harness section (2) and put to one side.



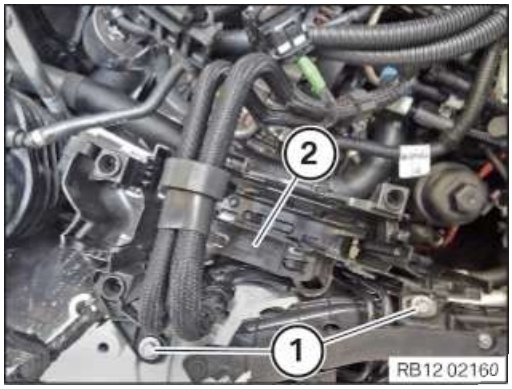
NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

- Unlock the locks (1) .
- Guide out the cable clip (2) in the direction of arrow and set aside.



- Unlock the lock (arrow).
- Feed out the cable clip (1) upwards and set it aside.

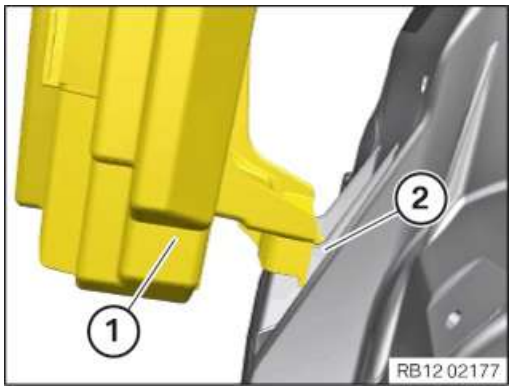


- Loosen screws (1).
- Guide out and remove the control unit holder (2).

7 – Installing the control unit holder

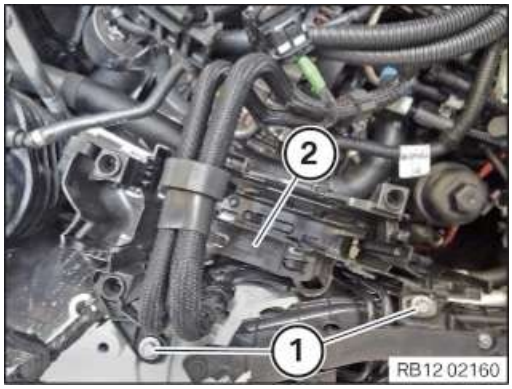
TECHNICAL INFORMATION

The number of connectors on the described component may vary depending on the equipment specification.
If necessary, unlock all other connectors and disconnect or connect and lock respectively.



- Make sure the bottom control unit holder (1) is inserted correctly into the fixture (2).

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- Guide in and install control unit holder (2).
- Tighten the screws (1).

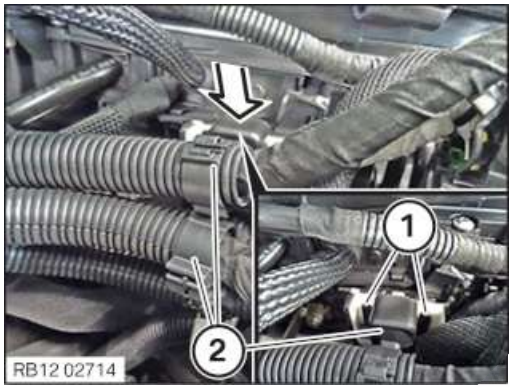
Control unit holder

M6		Tightening torque	8 Nm



- Feed in and install the cable clip (1).

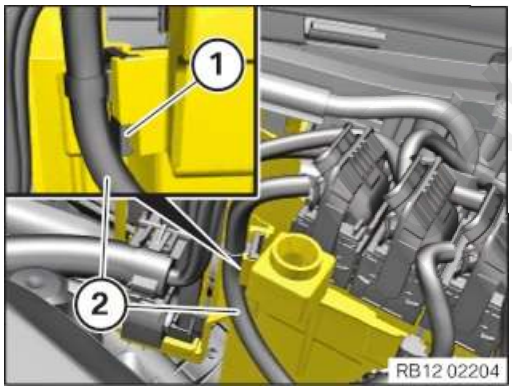
  Lock (arrow) must audibly engage.



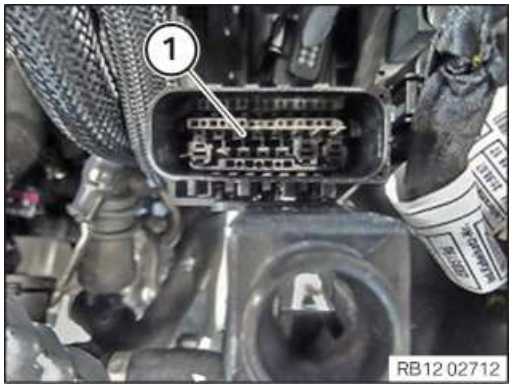
NOTICE

The following work step(s) is / are to be carried out if the specified component(s) is/are fitted.

- Guide in cable clip (2) in the direction of the arrow and install it.
- Ensure that the locks (1)engage audibly.

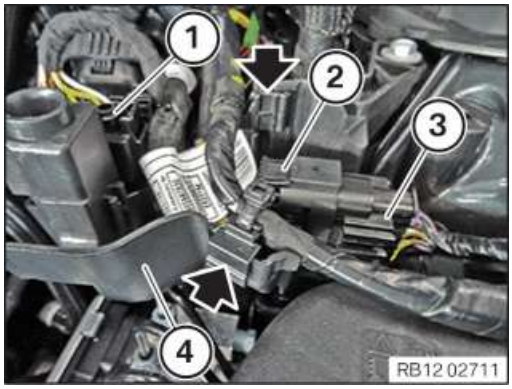


- Guide in the wiring harness section (2) and install.
- Connect and lock the cable clip (1).



- Feed in and install the connector (1).

  The connector (1) must engage audibly.



- Connect connector (3) to control unit holder (4) and lock it.

  The connector (3) must engage audibly.
- Connect connectors (2) and lock.

  The connector (2) must engage audibly.
- Connect connectors (1) and lock.

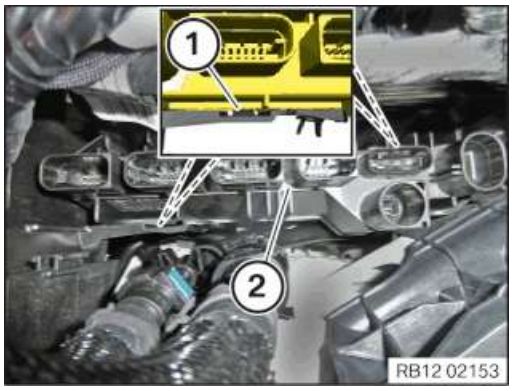
  The connector (1) must engage audibly.
- Secure the clamps (arrows).

POSTPROCESSES

8 – Installing the integrated supply module (PDM) partially

Prerequisite

Engine control unit has been removed.



- Insert and install the integrated supply module (PDM) (2).

  The latch mechanisms (1) must engage audibly.

9 – Install DDE control unit

TECHNICAL INFORMATION

If the DDE control unit or an injector has been replaced, it will also be necessary to carry out injection quantity compensation. The adjustment value (7-position letter/number code) is engraved on each injector.

TECHNICAL INFORMATION

Follow instructions for removing and installing control units.

For additional information see: 12 00 ... Notes on removal and installation of control units

TECHNICAL INFORMATION

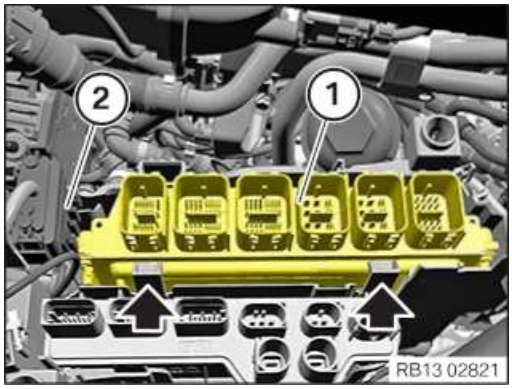
Control unit must be programmed after it is replaced.

For additional information see: 61 00 ... Programming/encoding control unit(s)

TECHNICAL INFORMATION

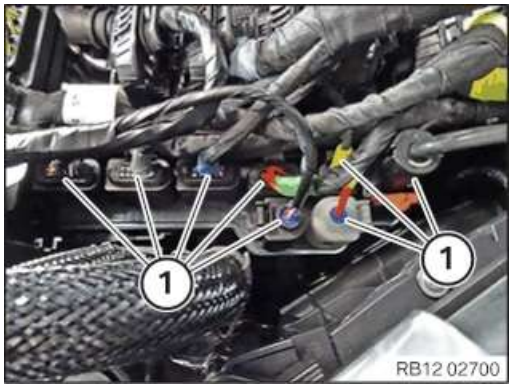
Disconnecting control units may cause fault code entries and functional limitations. Fault code entries must be read out and deleted if necessary.

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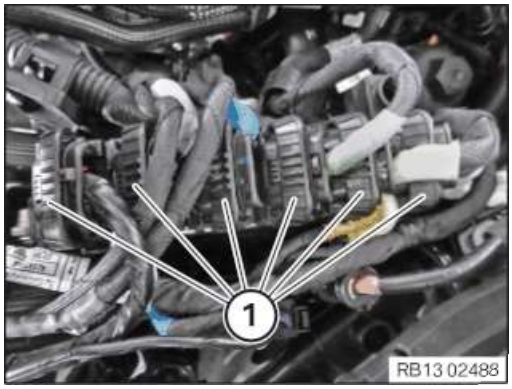
- Make sure that the plug connection (2) does not get damaged.
- Insert the DDE control unit (1) **carefully** and install it.

  The latch mechanisms (arrows) must engage audibly.



- Connect connectors (1) and lock.

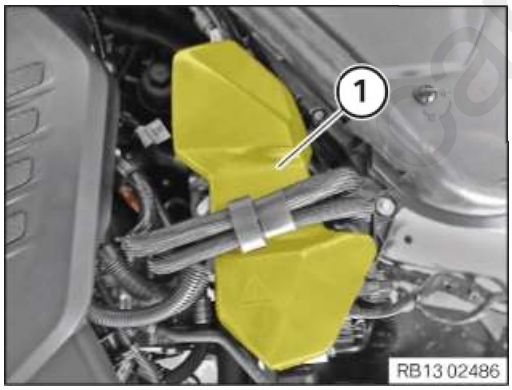
  The connectors (1) must engage audibly.



- Connect connectors (1) and lock.

  The connectors (1) must engage audibly.

10 – Install the cover for the DDE control unit



- Insert and install cover (1) into guides.

11 – Connecting all battery earth leads



- See additional information.

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12 – Activating the 48 V electrical system

Prerequisite

Ignition is switched off.

RISK OF DAMAGE

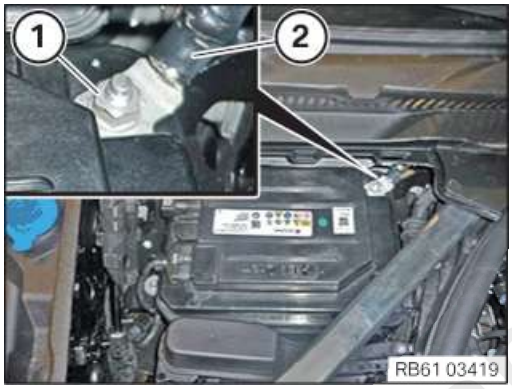
Damage to 48-V battery

If a 48-V battery that is disconnected from the electrical system is activated, the battery electronics will be damaged.

- Only carry out activation of the 48V electrical system with a completely connected 48-V battery.



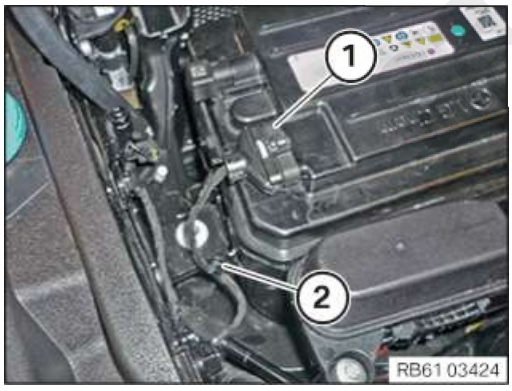
- Lift battery earth lead (1).
- Remove special tool .



- Release the negative battery cable (2) of the 48-V battery from the mounting.
- Position the negative battery cable (2) of the 48-V battery on the negative battery terminal.
- Tighten nut (1).

Negative battery cable to 48-V battery

Nut M8		Tightening torque	19 Nm



- Connect the connector (1) of the CAN bus and lock it.
- Clip in clip (2).



- Activate the 48V electrical system by closing the bonnet.

  The activation takes place automatically.

Additional Information

Overview of Tightening Torques

Control unit holder			Used in step 7
M6		Tightening torque	8 Nm

Negative battery cable to 48-V battery			Used in step 12
Nut M8		Tightening torque	19 Nm

Overview of Special Tools

Links

Repair instructions (PRE)	Used in step
Notes on 48-V battery	112

General repair instructions	Used in step
12 00 ... Instructions for removal and replacement of control units	49

Repair instructions	Used in step
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61 00 ... Parking-residing-driving

Vehicles of the G series feature a new type of terminal control:

Functional description of the parking-residing-driving terminal control

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