

4.11 Electrical wires

Validities

BMW passenger car, BMW i, MINI passenger car

Official method according to EG PTI:

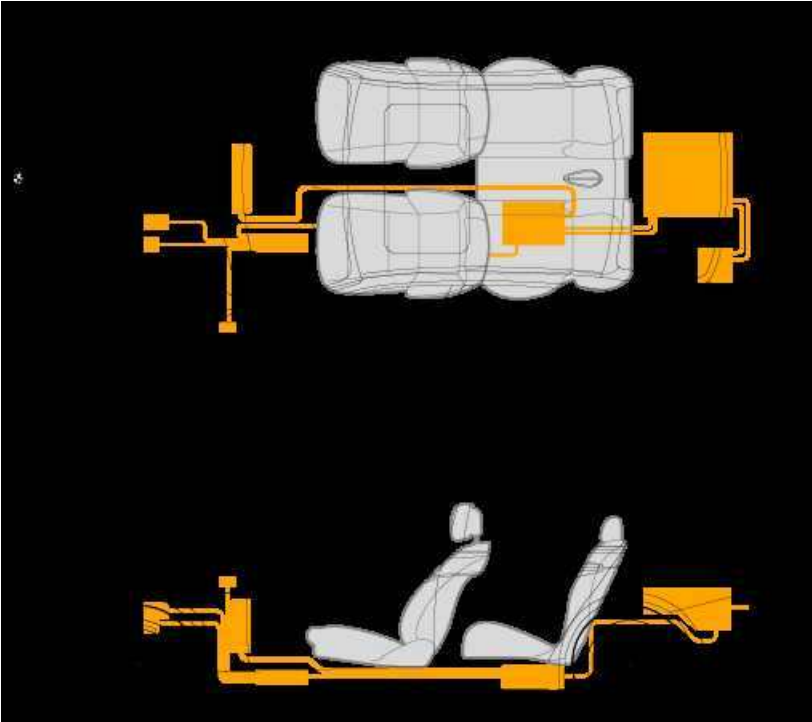
Visual inspection, including the engine compartment in some cases, while the vehicle is situated over an inspection pit or on a vehicle lift

Fault determination according to EG PTI:

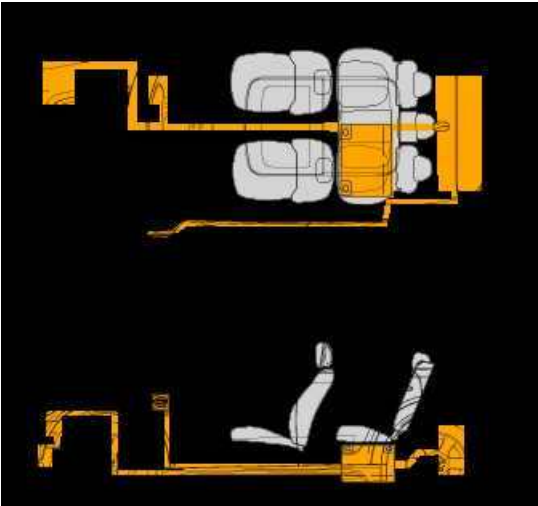
a)	Lines unsafe or insufficiently secured, brackets loose, in contact with sharp edges, connections may release, lines may come into contact with hot parts, rotating parts or the floor; connections have been released (important parts for braking and steering).
b)	Lines with minor damage, lines with major damage, lights with extreme damage (important parts for braking and steering)
c)	Insulation damaged or faulty, danger of short circuit, imminent risk of fire, sparking

Visual inspection, including the engine compartment in some cases, while the vehicle is situated over an inspection pit or on a vehicle lift

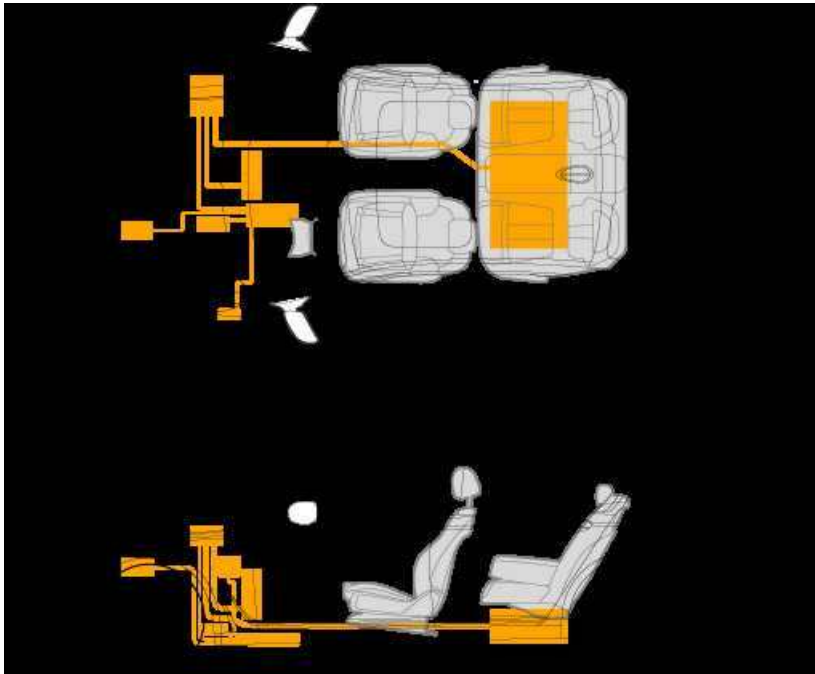
Methods according to vehicle manufacturer:



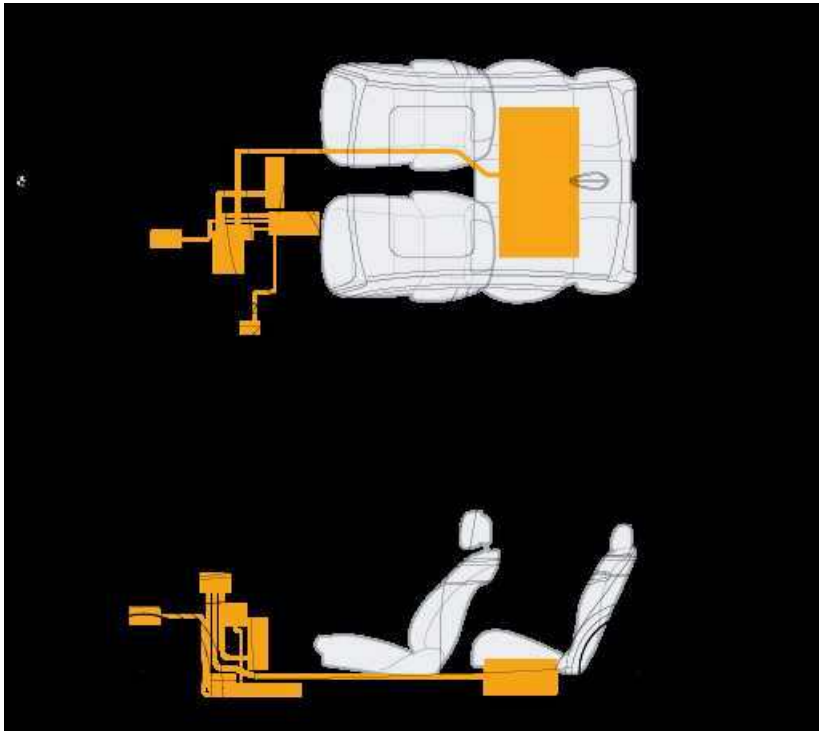
F30 PHEV
BMW 3 Series



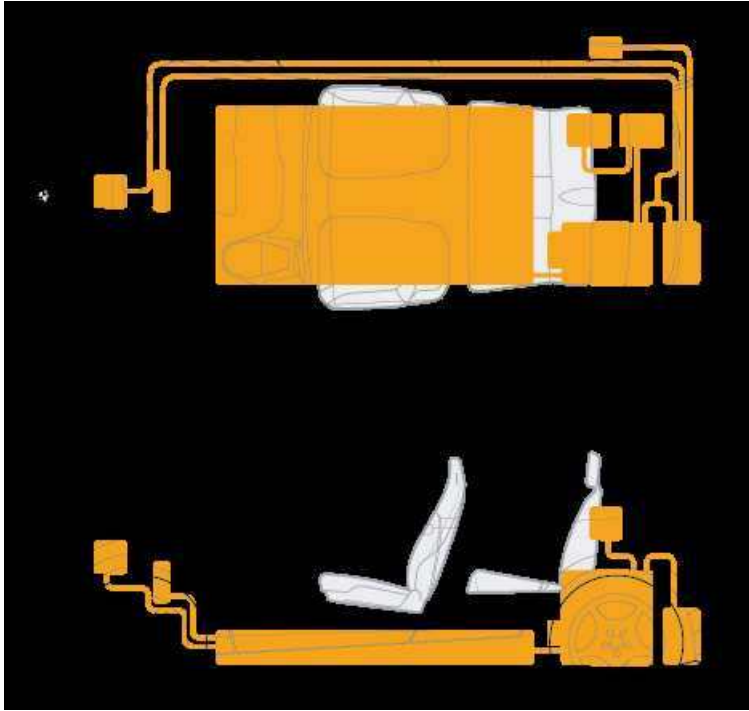
F60 PHEV
MINI Countryman



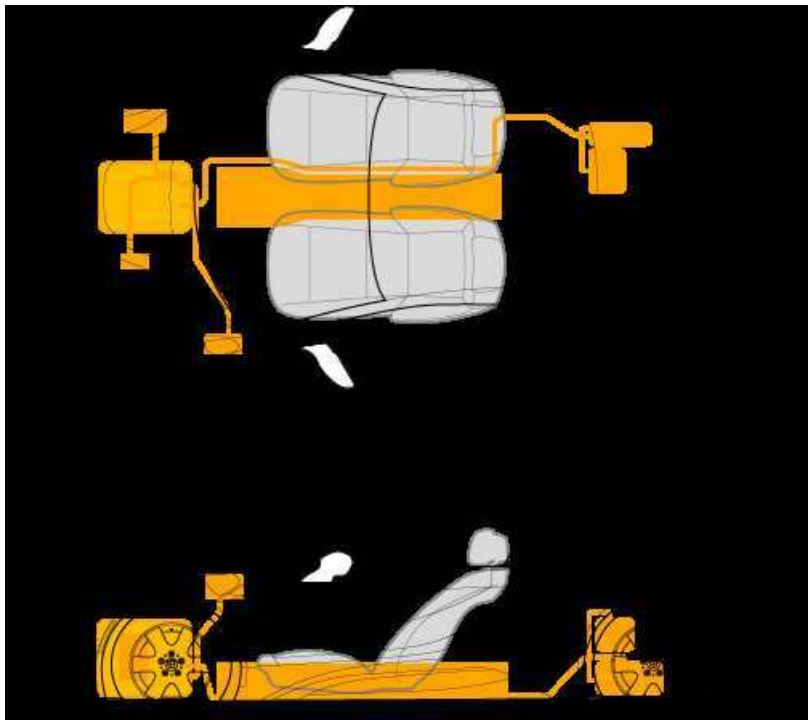
G11/G12 PHEV
BMW 7 Series



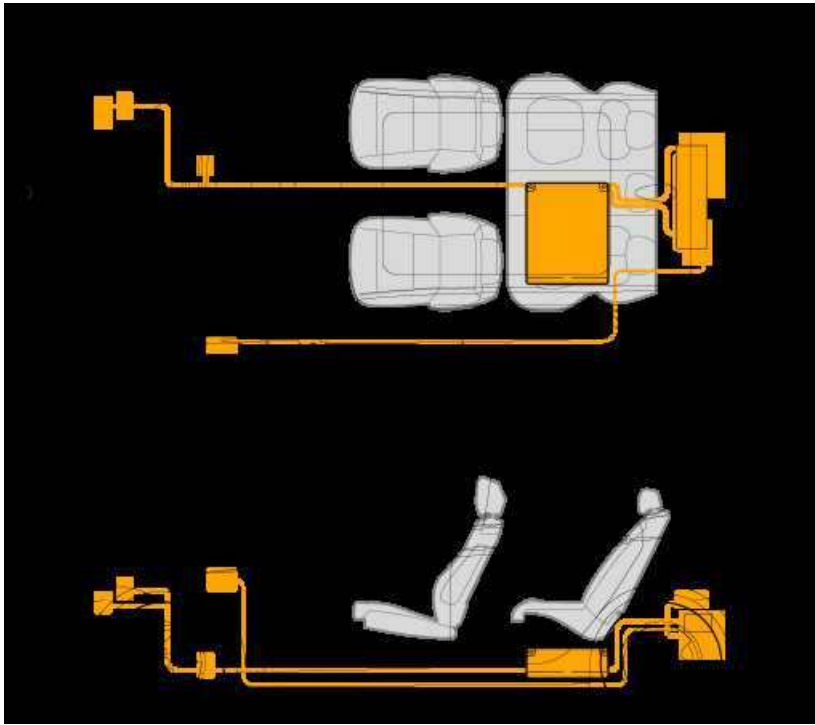
G30 PHEV
BMW 5 Series



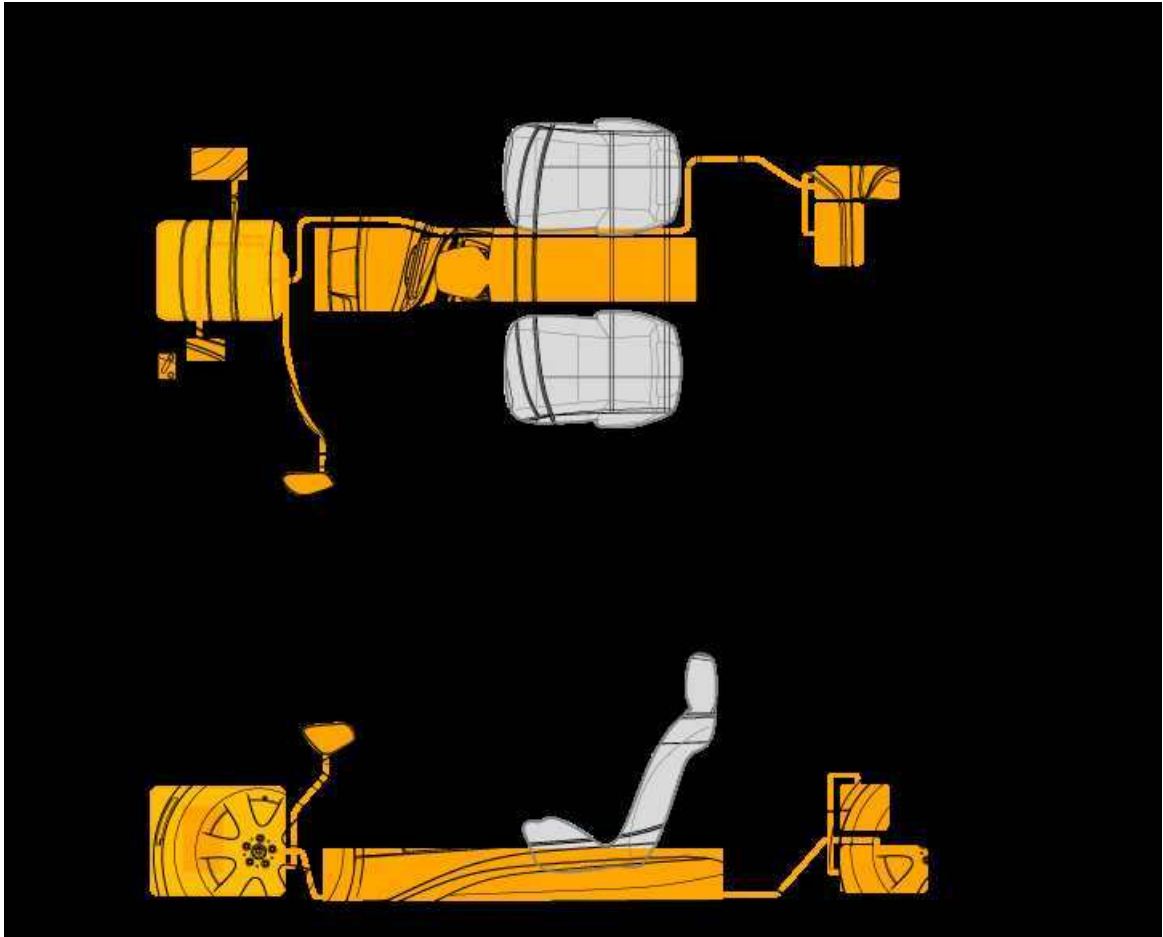
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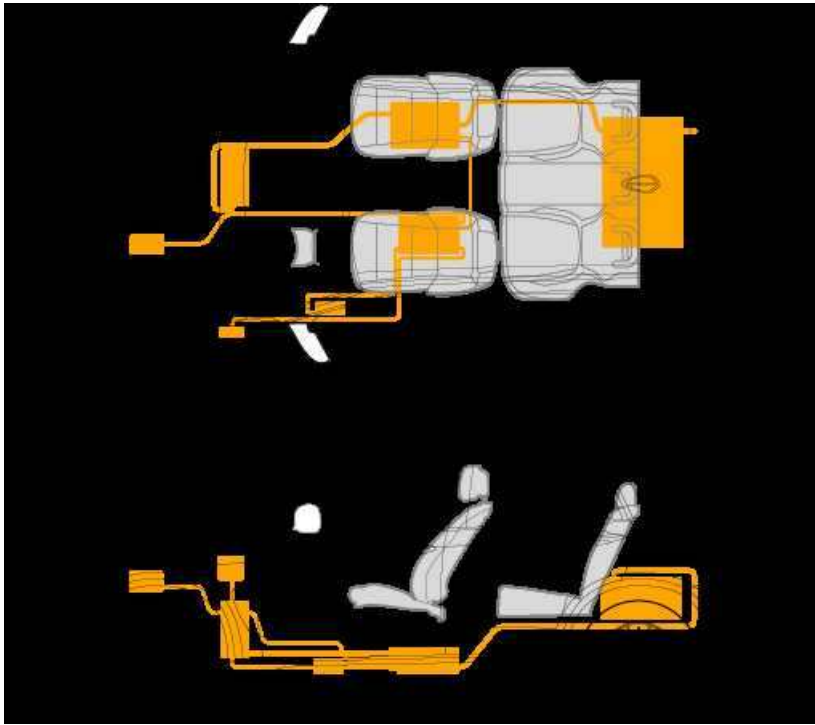


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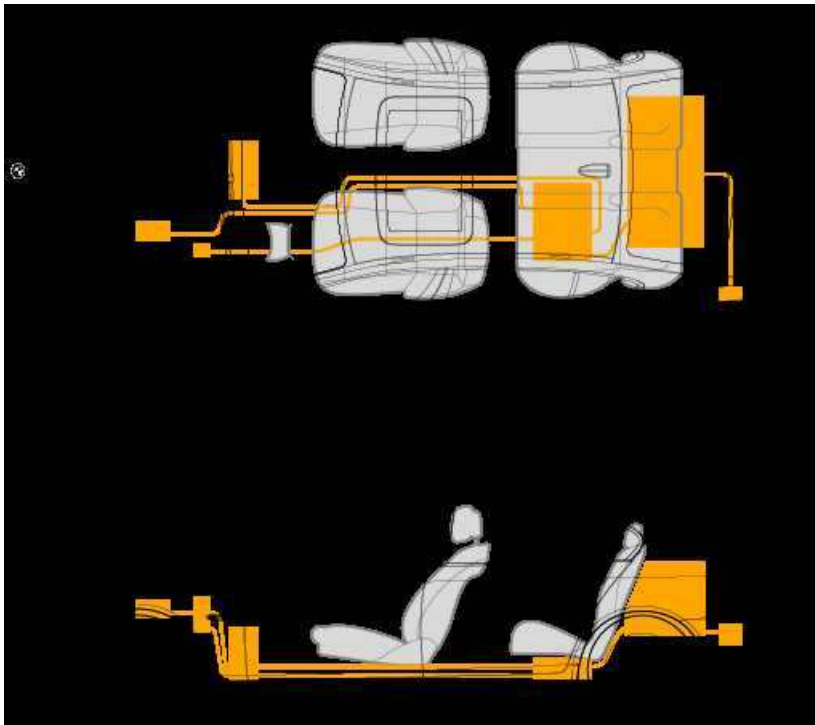


F45 PHEV

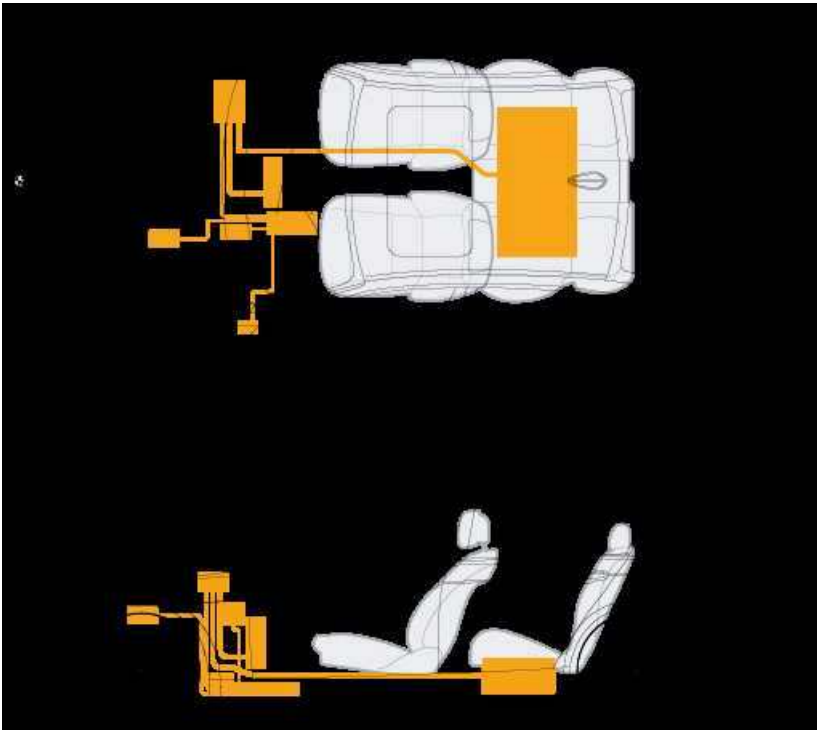




F15 PHEV



F18 PHEV



G38 PHEV

Battery exchange in vehicles with a high-voltage system

Faulty 12 V battery or vehicle electrical system unresponsive

If the vehicle electrical system for electrified vehicles is no longer responsive due to a faulty 12 V battery, proceed as follows:

- Connect the vehicle to an external battery booster or a jumper cable
- Unlock high-voltage safety connector
- Check for voltage disconnection display in the KOMBI
- Switch off the ignition
- Remove battery booster or jumper cable
- Change 12 V battery
- Check if vehicle electrical system is active again
- Register battery via service function

If the vehicle electrical system cannot be activated with an external battery booster or jumper cable, a BMW qualified electrician is required to determine voltage disconnection.

However, an accurate energy diagnosis is required before replacing the 12 V battery.

Battery replacement information

Battery replacement information

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

If the vehicle electrical system of electric vehicles is not accessible due to a faulty 12 V battery, proceed as follows:

- See additional information

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.

The correct function of all of these comfort and safety functions requires a battery which conforms to the specifications and is correctly logged on to the vehicle.

Register battery exchange

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 CC message is generated to indicate to the driver that battery exchange is necessary.

When installing a new vehicle battery, the battery must be registered and thus must also be registered with the vehicle electrical system. Only this registration/logon will ensure that the corresponding CC message will go out again.

Register battery exchange via the following path:

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

Retrofitting a more powerful battery

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

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 via the following path as per the specification:

- Service functions
- Body
- Voltage supply
- Battery retrofitting

Additional Information

Links

Repair instructions (PRE)

Battery exchange in vehicles with a high-voltage system

Instructions for 12 V dual storage system

Instructions for 12 V dual storage system

Introduction

A 12 V dual storage system featuring 12 V lithium ion battery will be installed in the G05 and G15 for the first time from 07/2018. Model series 35 is then enabled for UP.

The constantly increasing energy demand of modern vehicle electrical systems calls for ever more powerful battery solutions.

A modern luxury-class vehicle has some 100 actuator motors that have to be fed with electrical current. Added to these are safety, environmental and comfort elements which are increasingly becoming standard features, such as Antilock Brake System (ABS), Dynamic Stability Control (DSC), electrical steering assistance, MSA, air conditioning and navigation system. Current consumption is considerable even when the vehicle is not in use.

In a **direct parallel circuit of (dual storage system) 12 V lithium ion battery and AGM battery** it is possible to benefit from the advantages of both systems in the event of a suitable equipment specification:

(Reduced) AGM battery:

- Guarantees starting capability and
- provides the required energy content in a cost-efficient manner.

Performance-oriented (dual storage system) 12 V lithium ion battery:

- Covers the largest proportion of cycle load during driving (up to 90 %)
- Enables efficient energy recovery (high to complete vehicle electrical system compensation)
- Charges and discharges the AGM battery even after having finished driving (passive system)

Consequently:

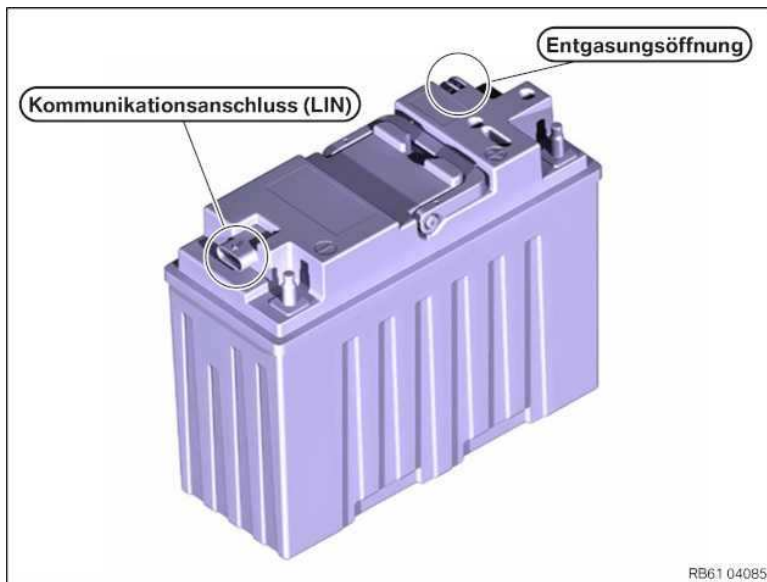
- The AGM battery state of charge is sustainably increased (availability improved and breakdowns reduced or prevented)
- The cycle load of this component is significantly reduced (quality, total cost of ownership)
- Fuel consumption and carbon dioxide pollutant emission are reduced.

Brief component description (dual storage system) of the 12 V lithium ion battery:

The (dual storage system) lithium ion battery can be identified by the following characteristics:



- Notes on the label



- Component size and weight
- LIN bus connection inside of the lid
- Large degassification connection in the lid
- M8 power interfaces in comparison to lead terminals
- "Magic Eye" is not available.
- (Dual storage system) lithium ion battery features a black housing like the AGM battery.

An electronics system that has been integrated into the (dual storage system) 12 V lithium ion battery is used instead of the IBS at the negative terminal of the AGM battery which is responsible for similar elements.

- In addition an electronic disconnect switch (ETS) has been integrated into the (dual storage system) 12 V lithium ion battery.



Notes for Service department:

- **Caution! When handling the (dual storage system) 12 V lithium ion battery it is necessary to observe some special characteristics pertaining to battery exchange and charging:**

Load:

Existing devices can be used to charge (dual storage system) 12 V lithium ion battery. Default settings for lead chargers can be used (charging voltage 14.8V).

Warning!

- Do not exceed the maximum charging voltage of 15.6V when charging the (ISPI Dealer Self Support) 12 V lithium-ion battery.
- Do not use rapid-charging programs!
- The battery must be charged using the remote positive terminal only.

Caution!

- An excessive charging voltage may lead to the electronic disconnect switch (ETS) of the (dual storage system) 12 V lithium ion battery opening in exceptional cases. This does not damage the (dual storage system) 12 V lithium ion battery. The electronic disconnect switch (ETS) re-closes once a charging voltage of <15.5 V applies at the battery terminals.
- The (dual storage system) 12 V lithium ion battery must be charged at a battery temperature of > 5 °C only.
- Do not set a current limitation at the charger for this battery.

Electronic disconnect switch (ETS):

The (dual storage system) 12 V lithium ion battery features an electronic disconnect switch (ETS) that can switch off the battery to protect it. The voltage at the battery terminals cannot be measured when switched off.

- Consequently the (dual storage system) 12 V lithium ion battery is not necessarily faulty if it is no longer possible to measure voltage at the battery terminals.
- If the electronic disconnect switch (ETS) has activated, it is necessary to diagnose the (dual storage system) 12 V lithium ion battery using the diagnosis system.

The following table describes the response of the ETS in situations involving faults:

Fault situation	Condition for reactivation
Overvoltage (U>18V)	Overvoltage is no longer applied. Voltage at the battery terminals <17.4V
Undervoltage (protection from total discharge) U<7.8V.	Applying a voltage of > 13.6V for a period of > 30s at the battery terminal, e.g. with a charger.
Operation in high temperatures (T>75°C)	Operating temperature T<=70°C
Short circuit	Rectify short-circuit.

If it is necessary to apply a voltage at the battery terminals to reactivate the electronic disconnect switch (ETS) as per the aforementioned table, this can be carried out using a charger with a suitable voltage setting or by jump-starting with a running donor vehicle. As a result of the insufficient voltage output it is not possible to reactivate the electronic disconnect switch (ETS) using a second battery.

When using a charger it must feature a mode for deep-discharged batteries or manual starting of the charging procedure (so that U>13.6V) as otherwise the battery is not detected and the charging procedure is not started.

Housing:



Note for Service:

- Do not open lithium ion batteries!

Disposal/transport:

Assess the transport suitability before transporting the (dual storage system) 12 V lithium ion battery!

- See additional information.

It is also possible to permanently store the battery on its side. It is permitted to store it upside down for 6 weeks.

Note regarding the battery electronics ((dual storage system) 12 V lithium ion battery)

The basic function of the 12 V lithium ion battery electronics correspond with that of the intelligent battery sensor (IBS) of an AGM battery.

In contrast to the IBS, the electronics are a fixed component of the battery. In the event of a defect, the entire 12 V lithium ion battery must therefore be replaced.

Additionally, the electronics regulate the battery management that is required for lithium ion batteries, such as the adjustment of cell voltage or activation of the electronic disconnect switch (ETS).

Note!

Do not connect the trickle charger to the 12 V charging socket!

The 12 V charging socket is supplied with voltage by the rear power distribution box via relay. Charge the battery using the remote positive terminal only. Only then can the voltage supply be registered by the vehicle.

Caution!

Danger of destruction in event of mechanical strain!

Do not modify the ground cable. The ground cable also serves for heat dissipation.

Do not use force when disconnecting the pole shoe from the battery terminal:

- Do not pull on the ground cable.
- Do not place any tools under the terminal clip to lever off the pole shoe.
- The nut has been integrated into the cable shoe.

Use a torque wrench and set tightening torque in accordance with repair instructions.

Use the battery size (capacity) installed as standard when replacing the battery.

Register battery replacement via Service functions in diagnosis system.

Delete fault code entries in the Digital Engine Electronics (DME) associated with battery replacement.

Always proceed in accordance with the repair instructions.

Note:

The battery can be drained in spite of trouble-free battery electronics!

A (dual storage system) 12 V lithium ion battery can be drained (e.g. as a result of the lights or radio having been switched on) even when the battery electronics operate correctly in conjunction with power management.

However the DSS maintains an energy reserve to guarantee one-time emergency starting capability.

In the event of a corresponding message from the energy diagnosis test module, replace the (dual storage system) 12 V lithium ion battery!

- If a (dual storage system) 12 V lithium ion battery malfunction occurs, the (MSA) automatic engine start-stop function may consequently be restricted.

Additional Information

Links

General repair instructions

61 25 ... Assessment of the transportability of the 12 V lithium ion starter battery in service workshops

Assessing the transport capability of high-voltage battery units in service workshops

Introduction

For analysis and disposal purposes, it is necessary to transport the already used high-voltage battery unit. This lithium-ion based high-voltage battery is to be classified as hazardous material according to UN 38.3, and may only be transported under particular prerequisites.

Obtaining the certified transportability between the assessment and delivery of the high-voltage battery unit to the disposal / transportation company is the responsibility of a qualified person. For shipping one also needs to take into account the influence of the storage requirements and other possible occurring events for the determined transportability. If there is a possibility that previously certified transportability is no longer valid, it must be reassessed using the guideline.

The transport in the sense of the hazardous goods legislation is organised in three areas:

- Assessment of the transportability
- Transport preparation
- Performing the transport

This document contains all the necessary information in order to assess the transportability of a used high-voltage battery unit. The transport preparation and execution is not an element of this document.

Further information on this can be found in the product information in the Aftersales Assistance Portal.

It will be explained which measures are necessary in order to assess the transportability. How these measures are to be performed individually depends on the particular situation at the location and is not an element of this document. These procedures are to be defined according to the local regulations / laws and recorded as valid local work instructions.

Prerequisites from a security perspective

The analysis and assessment of the high-voltage battery unit is to be performed by an "expert for working on HV intrinsically safe vehicles with high-voltage battery certification".

The certificate of the transportability is the responsibility of the qualified person.

In addition, the specifications for occupational health and safety must be observed for the storage of high-voltage battery units and cell modules.

This information can be found in the product information in the Aftersales Assistance Portal.



NOTICE

This document must be printed out and archived with the vehicle data.

Assessment of high-voltage battery unit

NAME	Date	Serial no.	Vehicle identification number

Signature

The electrical assessment of the high-voltage battery unit takes place via the diagnosis and test module.

The de-energised state of the high-voltage battery unit is to be determined before it is removed from the vehicle.

Electrical assessment

The electrical assessment of the high-voltage battery unit takes place via the diagnosis and test module.Â

De-energise the high-voltage system.

	Yes	No
No de-energised state could be established (if a de-energised state was established, then No must be ticked)		
Intrinsic safety not present according to diagnosis or test module		

The presence of voltage can be determined using the end-of-service tester when the high-voltage battery was already removed from the vehicle.

Visual assessment:

	Yes	No
Smoke		
Evidence of fire damage		
Heat development		
Crack or opening on the housing		
Dents in the housing, deformations, modifications (scratches up to 0.5 mm deep or 5 cm long are permitted)		
Corrosion weakened parts/components		
Loose connections, loose or damaged		
Serial number/label safety information cannot be read		
Suspected water damage		

Result

	Yes	No
High-voltage battery unit, transport capable		

The serial number must be clearly legible. If the type plate can no longer be read, the housing of the high-voltage battery unit must be clearly marked with the serial number.

The label of the safety information must be replaced if it is illegible.

The electrical and visual assessment must be set down in writing!

If one or more points is/are answered with **yes** the following procedure must be clarified with technical support!

Furthermore, the high-voltage battery unit that has been removed must be marked with a sign and blocked off with high-voltage barrier tape.

If the high-voltage battery unit is still in the vehicle, the vehicle must be made inaccessible, marked and blocked off.

Form for equipotential bonding screw connections

Form for equipotential bonding screw connection



DANGER

Equipotential bonding in high-voltage system.

Danger to life if the equipotential bonding screw connection is not correct!

- Observe the safety requirements for the equipotential bonding screw connection.
- Clean contact faces and have then checked by a second person.
- Tighten the screws for equipotential bonding to the specified torque; have a second person check the torque.
- Correct execution of these tasks must be documented in the vehicle records by both persons.

This form must be completed in full and enclosed with the vehicle records!

Vehicle data:

Vehicle identification number	Order number	Order date	Kilometre reading

Equipotential bonding screw connections:

Screw application	Torque	Mechanic	Signature	Tester	Signature

By signing, the mechanic and tester assume liability for the correctness of the screw connection!

Notes for opening and closing cable straps

Preconditions

The following procedure must be followed without exception to loosen cable straps on electric and hybrid cars and in the high-voltage battery unit!

Do not use pointed or sharp-edged tools.

The following tools are permitted: combination pliers and coolant pump pliers

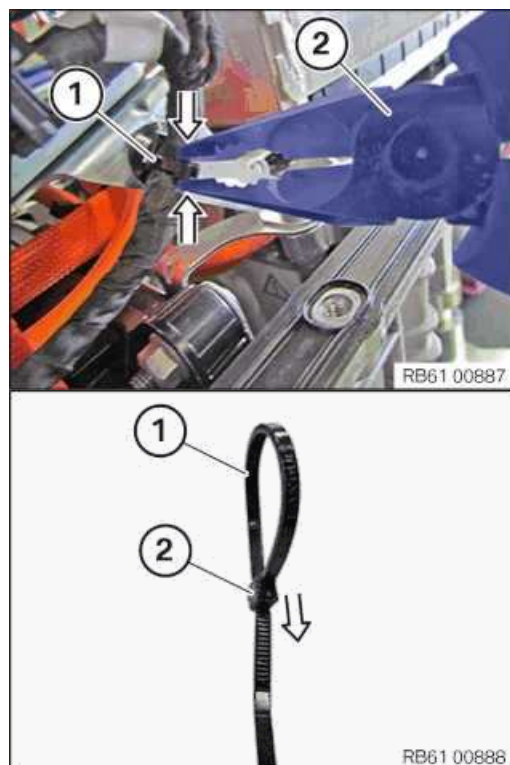
Technical support must be contacted in case of damaged high-voltage cables.

Remove the protruding end of the cable strap using the relevant special tool.

Sourcing reference:

See Aftersales Assistance Portal (ASAP) - Service/Technical - Workshop Equipment (Start BMW) - Shop Workshop Equipment Catalogue or at www.bmwgroup.com

Option 1



Grip and compress the cable strap (1) (as shown in the graphic) using the combination pliers or coolant pump pliers (2).

The cable strap (1) is opened at the closure (2) by pulling in the direction of arrow.

Option 2



DANGER



Damaged high-voltage cables, high-voltage connectors and high-voltage components.

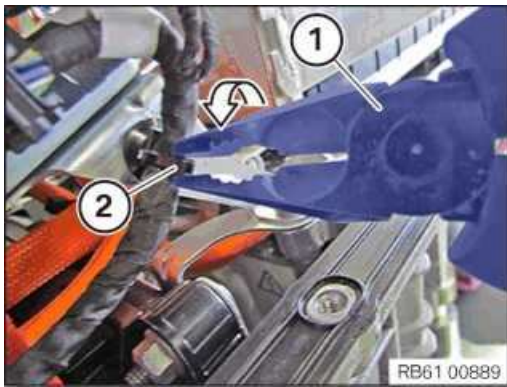
Danger to life through electric shock!

- Do not repair but always replace damaged high-voltage cables, high-voltage connectors and high-voltage components completely.
- Contact Technical Support immediately if high-voltage cables, high-voltage connectors and high-voltage components are damaged so that the touch protection is no longer intact.



TECHNICAL INFORMATION

If the closure does not open, the cable strap closure can also be twisted off.



Grab the closure (2) with the combination pliers or coolant pump pliers (1) and twist off in direction of arrow.

Closing cable straps



Setting the starting power above the rotary knob (1)

- Slide stop (2) in direction of arrow
- Hold stop (2) in position and rotate rotary knob (1) in the desired position.
- Release stop (2) again and let it be engaged.

Settings	0	1	2	3	4	5	6	7	8
Tensile force in N	20	38	51	68	85	104	125	143	165



Preload cable strap (1) by hand so that one stroke is enough for tightening and cutting-off.

Tighten cable strap (1) with special tool **2 359 966** until the protruding end of the cable strap is cut off.

For cable straps on high-voltage cables in the high-voltage battery unit special tool **2 359 966** must be adjusted to **stage 4**.

For cable straps on 12 V cables in the high-voltage battery unit special tool **2 359 966** must be adjusted to **stage 3**.

Additional Information

Overview of Special Tools

2 359 966 Pliers



Common

Usage For tightening and cleanly cutting off plastic cable straps in high-voltage battery units.

Included in the tool or work

Storage location Individual

Replaced by

In connection with

SI-Number 02 05 14 (104)

Notes on earth bonding screw connections

Equipotential bonding

Connecting high-voltage components to GND 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 GND.

For a correct ground connection, the retaining elements of high-voltage components must not be painted. Follow further painting notes.

Potential compensation wires, high-voltage cables and the battery earth lead of the electrical machine electronics have a safety screw connection! The following procedure must be adopted without fail:

- 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.
- Correct execution of these tasks must be documented in the vehicle records by both persons.

The additional information contains a prepared form for printing.

Additional Information

Links

Repair instructions (PRE)

Form for equipotential bonding screw connections

Notes on repair of high-voltage battery unit

Prerequisite

Various organisational prerequisites need to be fulfilled before the repair of a high-voltage battery unit is permitted and can be carried out in an expedient way. These prerequisites concern both, the commercial company and the service employee.

The repair of a high-voltage battery unit is intended to be carried out exclusively by commercial companies featuring the service format BMW i Service Extended Battery or BMW i Service Full.

A commercial company featuring the service format BMW i Service Basic is able to remove and install a high-voltage battery unit but cannot perform any repair work on or in the high-voltage battery unit. If a repair is required according to the test schedule in the diagnosis system, the vehicle or the high-voltage battery unit must be transported to a commercial company featuring the service format BMW i Service Extended Battery or BMW i Service Full. The repair is to be carried out in such a workshop.

The commercial company must make available the required special tools and a suitable workbay for the repair.

The most important special tools are the following:

- Mobile lift table MHT 1200 + set of adapters to remove and install the high-voltage battery unit.
- Charger for cell blocks of high-voltage battery unit.
- EoS tester for the repaired high-voltage battery unit.
- Lifting tool to remove and install cell blocks.
- Panel wedges made of plastic to remove clips within the high-voltage battery unit.
- Lifting traverse for the complete high-voltage battery unit.
- High-voltage barrier tape.
- Yellow cones relating to high-voltage recommended.

Sourcing reference:

See Aftersales Assistance Portal (ASAP) - Service/Technical - Workshop Equipment (StartÂ BMW) - Shop Workshop Equipment or at www.bmwgroup.com

Only service employees being qualified for the repair of the high-voltage battery unit may carry out this procedure.

This includes a training as "Qualified technicians for work on high-voltage intrinsically safe vehicles".

Before removing and opening the high-voltage battery unit, troubleshooting is to be carried out by means of the relative diagnosis system. Only if determined by the test plan and if the prerequisite "no mechanical damage on the outside" is satisfied, may the high-voltage battery unit be opened and the faulty component identified by the test plan exchanged. No other repair work relating to the high-voltage battery unit than the replacement of faulty components is planned.

It is essential to observe the operational steps specified in the repair instructions very precisely in order to carry out the replacement of a faulty component. The use of the special tools listed therein is absolutely essential as well.

Safety rules

The first step after opening the housing cover to repair the high-voltage battery unit is a visual inspection for mechanical damage.

A thorough visual inspection of the components inside the working area is required during and/or before and after every operation. When removing one component, all other involved components being accessible need to be checked for damages. If the housing or other internal high-voltage components are damaged, a qualified electrician or Technical Support must be contacted. All repair works relating to the high-voltage battery unit must be stopped immediately for safety reasons.

Check the correct latch mechanism of the connector of the insulation monitoring line at the control unit of the high-voltage battery unit. If this is not fully locked, an isolation fault may not have been detected.

The separation of the high-voltage cable between the cell modules mounted on the inside of the housing (across from the connection side of the high-voltage battery unit) is to be carried out before working on the opened high-voltage battery unit. This procedure ensures the interrupt of the series connection (additional safety).

The workbay required for the repair of the high-voltage battery unit must be clean (free of grease, dirt and swarf), dry (no leaking fluid) and free of flying sparks. Therefore, avoid close vicinity to areas intended for cleaning of vehicles and to workbays intended for repair work relating to the body. Use movable walls for separation, if needed.

High-voltage barrier tape is required to secure the workbay against unauthorised access (insufficient qualification, customers, visitors, etc.). It is also required in case the high-voltage intrinsic safety is not established or the status is not determined yet. Placing yellow cones with lightning bolt to indicate high-voltage when leaving the working area is recommended.

Do not use tools or other objects with pointed and sharp blades/edges when working on high-voltage components or high-voltage cables and/or in their close vicinity. Diagonal cutting pliers, knives etc. are prohibited. Cable straps inside the low-voltage wiring harness may be opened by means of diagonal cutting pliers.

Allowed: **Plastic wedges** e.g. special tool **2 298 505**

Cable straps relating to high-voltage cables or 12V lines may not be cut open. Damaged clips remain on the high-voltage cable or 12V line. The remaining, damaged clip must be pushed to a position on the high-voltage line where the clip can not rub. A new clip must then be installed.

Defective or damaged high-voltage cables must be made unusable to ensure they are not reused.

No tools must be forgotten inside the high-voltage battery unit. Visually inspect the high-voltage battery unit before closing the housing cover.

Check the tools in the tool trolley are complete.

It is absolutely essential to remove all small parts/screws that fell into the high-voltage battery unit. The use of magnetized screws is generally recommended in order not to lose any screws in the high-voltage battery unit during the repair.

When interruptions of work occur: Secure housing cover against unintended opening by screwing in several screws. Enclose the working area by means of high-voltage barrier tape.

Due to the very slim construction of the radiator, the risk of damage during disassembly and installation is high. Careful handling is absolutely necessary as the cooling of the cell blocks may not be guaranteed when the radiator is damaged (bent, dented). The consequence is a major loss of the electrical range and of the power of the vehicle. In extreme cases, even a breakdown may occur.

Very careful handling is necessary when disconnecting and connecting the insulation monitoring line at the control unit of the high-voltage battery unit (safety box coming) since high-voltage is present in the thin orange lines. Do not pull on the lines (e.g. to unplug the connector etc.)! The connector must be locked securely when plugged in.

Make sure the plastic lids of the modules are not loosened when working on the cell modules (loosening screws, raising and lifting, etc.). The live cell contacting system is located thereunder. Continuing to work with the lid being removed is not permitted. A qualified electrician or Technical Support must be contacted.

A schematic diagram with limiting sample examples in the training is necessary to get to know the limits. This shows from when continuing work for "Qualified technicians for high-voltage inherently safe vehicles" is no longer possible due to lack of intrinsic safety. Contact technical support or a qualified electrician.

Remove residual moisture and coarse contamination around the lid of the high-voltage battery unit before beginning the disassembly.

Clean gaskets and sealing surfaces (venting unit, high-voltage connector, signal connector, radiator connection) with a specified cleaning agent before reassembly.

If contamination is present in the high-voltage battery unit, check the cause and carefully clean the affected areas.

Approved cleaning agent:

- Spirit
- Windscreen cleaner
- Glass cleaner
- Distilled water
- Vacuum cleaner with plastic top

Cleaning with compressed air from the high-voltage battery unit is **not** permitted. This is because dirt particles and swarf could get to the high-voltage components.

Visual inspection for contamination and damage of housing as well as of connections and degassing unit when installed (underfloor). A damaged diaphragm within the venting unit may indicate damaged storage cells. In this case, special carefulness is required when checking and opening the high-voltage battery unit.

Electrolyte

The majority of the electrolyte is a mixture of lithium-nickel-manganese-cobalt oxide in bound state. The quantity of free electrolyte in the high-voltage battery unit is very small. It is a noxious and irritant fluid. Absolutely avoid direct contact of skin with leaking fluid as acid burns may occur. In case of contact with eyes or skin, flush with

plenty of clear water and consult a doctor immediately. Burning or evaporating electrolyte is also hazardous. Careful, do not inhale! Ensure sufficient fresh air supply. If breathing ceases, apply artificial respiration and immediately consult a doctor. Notify fire brigade in case of fire. Clear the area immediately and make accident scene safe. Attempt to extinguish the fire without putting persons in danger and use suitable extinguishant, e.g. water.

Repairing removed high-voltage battery units

The high-voltage battery unit is a component of large dimensions and heavy weight. Only the combination of the housing and the cell blocks mounted therein provides the high-voltage battery unit with complete stability (rigidity), as required for driving. Therefore, it is necessary to ensure that the housing is positioned on the relative mounting/adaptor of the lifting table during replacement and fixation of cell blocks. This prevents the housing from jamming and the high-voltage battery unit from being installed in the vehicle in this condition.

It is extremely important to enter the serial numbers and the installation positions of the replaced components in the SME via the EoS tester, as well as transfer the data to the diagnosis system. Otherwise, the new installation position will be assigned automatically by the SME. The consequence is an incorrect location data, as the SME does not set correct installation positions. For a renewed repair of the high-voltage battery unit, the diagnosed faults for the incorrect installation position will be displayed. The consequence is that replacement is done at the wrong location.

In diagnosis, it is not possible to enter the serial numbers of the cell supervision circuits. The serial numbers are transmitted from the cell supervision circuit to the SME using the CAN bus. The SME then assigns corresponding location data. This assignment is not always fault-free. That is why the serial number and installation position of the exchanged cell supervision circuit must be checked in the diagnosis after completed repair. If the installation positions do not match, a position change can be performed with diagnosis. A new serial number of a cell supervision circuit is not entered.

Important: Do not use powered wrenches as the screws/threads located in the high-voltage battery unit may break due to the low torques!

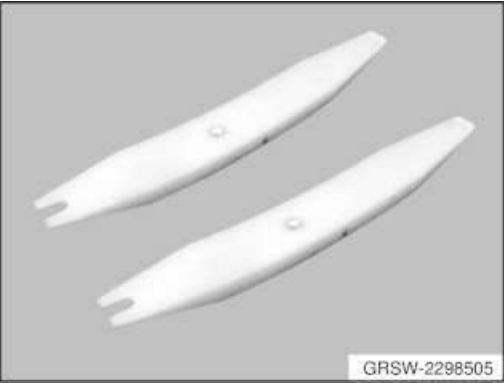
The seal must be renewed every time the housing cover is removed to guarantee tightness of the high-voltage battery unit.

The screws are thread-tapping, so pre-insert them manually before tightening them with a tool. Otherwise, the threads of the lower housing section may be damaged!

Additional Information

Overview of Special Tools

2 298 505 Wedge



Common	
Usage	Set (delivery of 2 pieces)
Included in the tool or work	
Storage location	C34
Replaced by	
In connection with	
SI-Number	01 03 12 (792)

Overview of high-voltage battery unit cooling

Cooling types of the high-voltage battery unit

List of cooling types of high-voltage batteries installed in BMW, BMWi and MINI

BMW

Vehicle	Coolant cooling	Refrigerant cooling
E72		x
F01 Hybrid		x
F10 Hybrid		x
F30 Hybrid		x
F15PHEV		x
F30PHEV		x
F45PHEV		x
G11PHEV		x
G12PHEV		x
G30PHEV		x

BMW i

Vehicle	Coolant cooling	Refrigerant cooling
I01		x
I12		x
I15		x

MINI

Vehicle	Coolant cooling	Refrigerant cooling
F60PHEV		x

Safety information for handling electric and hybrid vehicles

Qualification

All repair work on high-voltage components may **only be performed by specially trained personnel** (qualification: Work on high-voltage inherently safe 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.

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.

Rules of conduct/protective measures:

Note operating instructions for handling high-voltage battery units.

Visually inspect the high-voltage components to be worked on before commencing work.

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.

A cut 2nd emergency separation point must be repaired with a butt connector.

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.**

Required training is offered by the BMW Training Academy. 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 conditions:

- seat belt buckle unlocked **and**
- the driver's door is open **and**
- no brake activated **and**
- the accelerator pedal is not activated **and**
- 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:

Display in the KOMBI **High-voltage system deactivated.**

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! A qualified electrician must verify that the system is de-energised 1000 V AC with suitable measuring devices/measuring procedures before work can commence.

=> 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 may cause the electric fan to start running (switch-on request of 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.

Measures during/after work

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: It is not permitted to activate the high-voltage system when the "Power electronic box cover" has been removed. The high-voltage service disconnect must be used with a mounted "Power electronic box cover" only.

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/equipotential bonding measurement) are performed by the vehicle automatically and for this reason, manual measurement is not required.

For a correct earthing connection, the retaining elements of high-voltage components must not be painted. Refer to the following REP for further information: **Painting notes**.

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.

Equipotential bonding

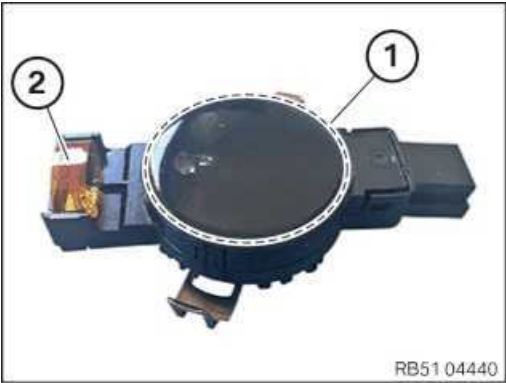
Potential compensation wires, high-voltage cables and the battery earth lead on the electrical machine electronics have a safety screw connection!

- 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.

Replace the gel pad for rain-light-solar-condensation sensors

Not valid for sensors with 35 mm diameter.
Rain-light-solar-condensation sensor removed

1 – Replacing the gel pad



RISK OF DAMAGE

Damage to the surface.

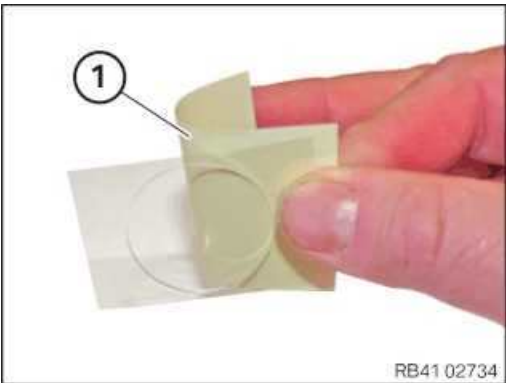
The use of sharp-edged tools may damage the surface.

- Use only microfibre cloths.

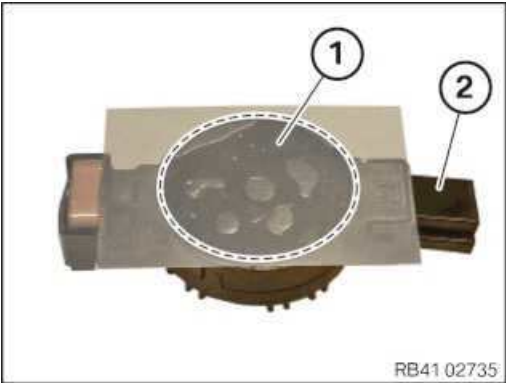
- Remove the gel pad (1) by hand.
Do not touch or damage the printed circuit (2).
- If necessary, remove any gel residue using a microfibre cloth.
- Clean the surface of the rain-light-solar-fogging sensor using a microfibre cloth R2 soaked in cleaning agent.

Expendable materials

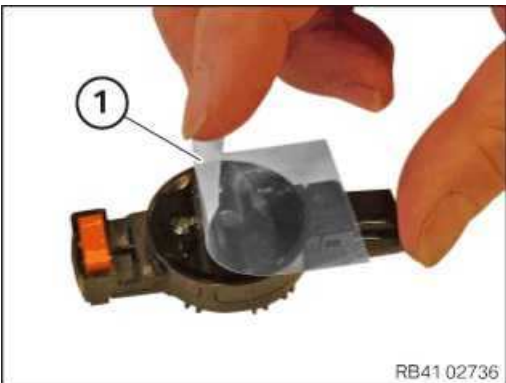
Cleaning agent R2	500 ml	83190417324
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- Remove the yellow protective film (1).



- Place the gel pad (1) in the centre of the surface of the rain-light-solar-fogging sensor (2).
Do not eliminate existing air bubbles.
Air pockets disappear within 30 min after mounting the sensor on the windscreen.



- Remove transparent protective film (1).