64 51 Heating and air-conditioning unit (evaporator), switching elements

Resistance as a function of temperature	°C/kΩ	-5/11.4 ... 11.9 0/8.8 ... 9.2 5/6.8 ... 7.2 10/5.3 ... 5.6 15/4.2 ... 4.5 20/3.3 ... 3.6 25/2.6 ... 2.9 30/2.1 ... 2.3 35/1.7 ... 1.9

cardiagn.com

64 51 Heating and air-conditioning unit (expansion valve), switching elements

Inlet pressure (excess pressure)	bar	14
Outlet pressure (excess pressure)	bar	1.8
Leak test with detector at excess pressure	bar	1 ... 2

cardiagn.com

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!

cardiagn.com

5.1.1 Axles

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

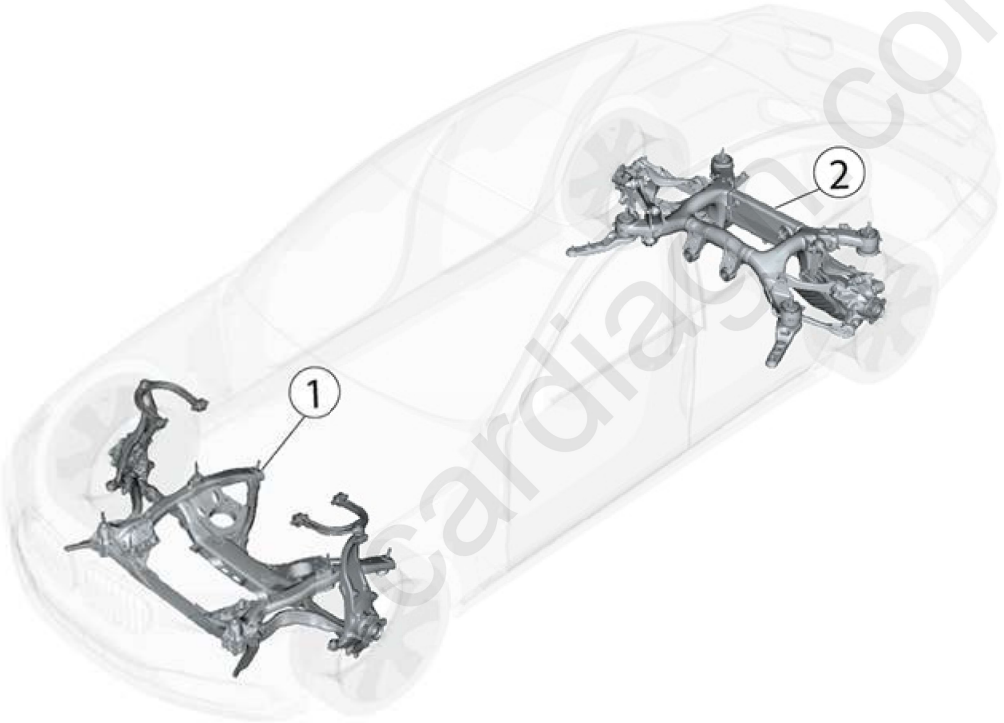
Visual inspection while the vehicle is positioned over an inspection pit or on a vehicle lift. Using wheel play detectors is permitted and recommended for vehicles with a maximum weight of over 3.5 metric tons.

Fault determination according to EG PTI:

a)	Axle fractured or deformed.
b)	Unsafe mounting on the vehicle. Stability impaired, operability impaired; excessive play at the attachment points.
c)	Modification relevant to safety. Stability and operability impaired, insufficient distance to other vehicle components or insufficient ground clearance.

Methods according to vehicle manufacturer

Axles



1 Front Axle

2 Rear Axle

Only 2 axles are installed in BMW, BMW i, MINI and Rolls-Royce vehicles.

7.1.1 Installation safety of the seat belts/seat belt buckles

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Visual inspection

Fault determination according to EG PTI:

a)	Attachment point severely damaged. Stability impaired.
b)	Mounting loose.

Methods according to vehicle manufacturer

Seats with three-point seat belt



A seat with three-point seat belt including seat belt buckle and mountings is illustrated

1 Seat belt guide loop attachment point

2 Belt retraction system attachment point

3 Seat belt buckle attachment point

As a rule, BMW installs seats with three-point seat belts!

Methods according to vehicle manufacturer

Seats with three-point seat belt



A seat with three-point seat belt including seat belt buckle and mountings is illustrated

1 Belt retraction system attachment point

2 Seat belt buckle attachment point

As a rule, BMW installs seats with three-point seat belts!

cardiagn.com

7.1.2 Status of the seat belts/seat belt buckles

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Visual inspection and operation.

Fault determination according to EG PTI:

a)	The specified belt is missing or has not been mounted.
b)	Belt damaged. Cut or signs of overstretching.
c)	Seat belt not as per regulations.
d)	Seat belt buckle damaged or not operating correctly.
e)	Retractor damaged or not operating correctly.

Methods according to vehicle manufacturer:

Three-point seat belt

Exclusively three-point seat belts have been illustrated.

1	Seat belt guide loop attachment point
2	Belt retraction system attachment point
3	Seat belt buckle attachment point



carbagnol.com

Three-point seat belt

Exclusively three-point seat belts have been illustrated.

1	Belt retraction system attachment point
2	Seat belt buckle attachment point



Reversible electromotive reel (REMA) on the left and right

The REMA system involves the following functions:

- Removal of the belt slack after buckling up so that the seat belt lies optimally against the driver's resp. front passenger's body.
- Stabilisation of the seat position in a critical driving situation by pretensioning the seat belt for optimising the restraint system.

The REMA motor essentially consists of the following parts:

- e-motor.
- Control electronics.
- Gear with clutch (the clutch connects to the automatic reel).
- Automatic reel (mechanical function).

.

Functional description

The "Minimise belt slack" function only uses the signal of the seat belt buckle switch and the driving speed. From an encodable driving speed (currently 10 km/h) the control electronics activates the motor once for a certain time. With the help of the electric motor, the seat belt strap is rolled up, thus removing the belt slack. In critical driving situations or in the event of a potential accident, the control electronics also activates the motor. The duration is set in such a way that the motor is activated by the control unit until the end of a critical driving situation.

cardiagn.com

7.1.3 Belt force limiter

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Visual inspection and/or use of electronic vehicle interface.

Fault determination according to EG PTI:

a)	Force limiter evidently missing or unsuitable for the vehicle.
b)	System outputs an error via the electronic vehicle interface.

Methods according to vehicle manufacturer

For electronic testing via the diagnostic interface (OBD socket), the read-out routines necessary for the EU testing organisation will be provided.

cardiagn.com

7.1.4 Seat belt tensioner

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Visual inspection and/or use of electronic vehicle interface.

Fault determination according to EG PTI:

a)	Seat belt tensioner evidently missing or unsuitable for the vehicle.
b)	System outputs an error via the electronic vehicle interface.

Methods according to vehicle manufacturer

For electronic testing via the diagnostic interface (OBD socket), the read-out routines necessary for the EU testing organisation will be provided.

cardiagn.com

7.1.5 Airbag

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

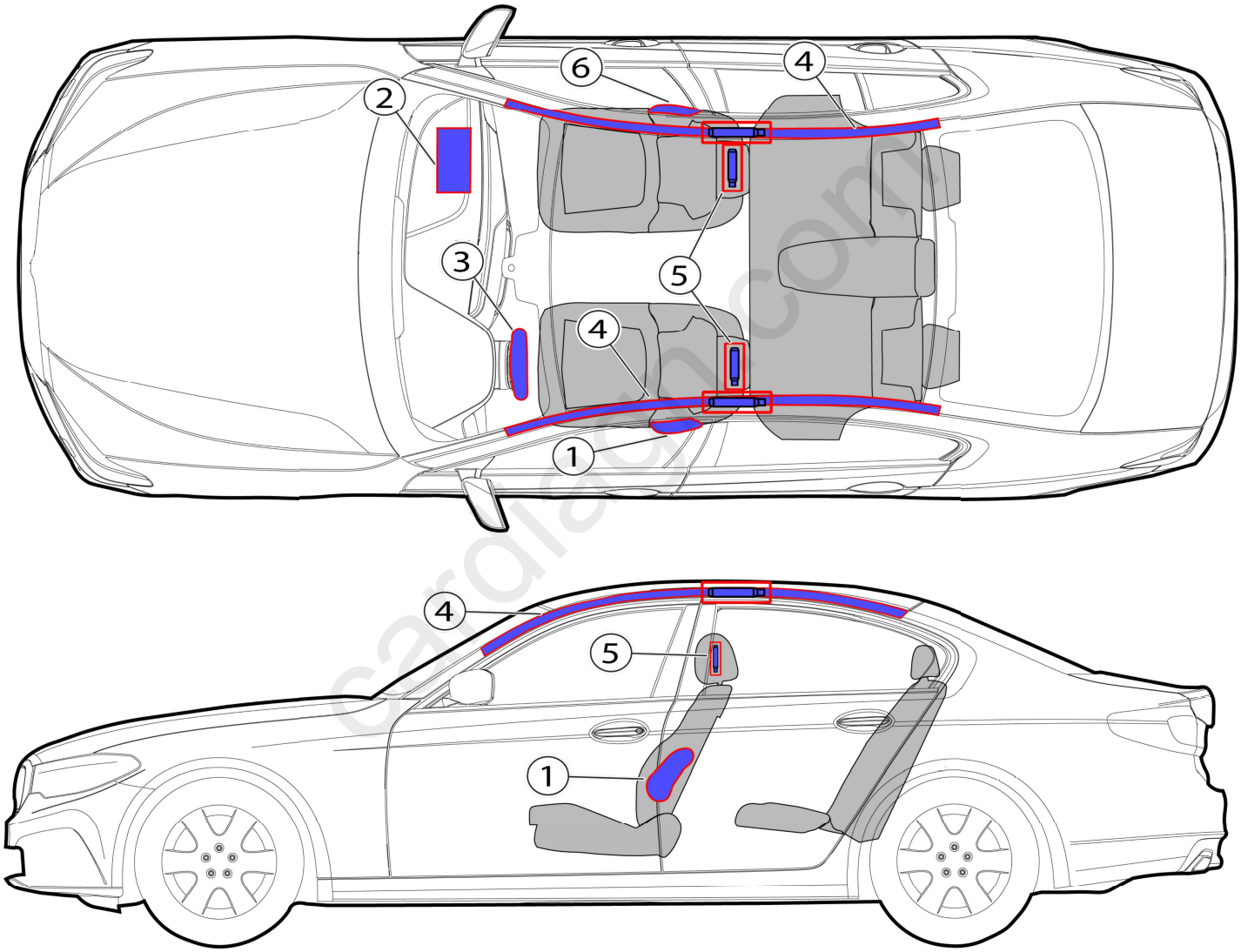
Visual inspection and/or use of electronic vehicle interface.

Fault determination according to EG PTI:

a)	Airbag control light does not go out after ignition
b)	Airbag evidently missing or unsuitable for the vehicle
c)	System indicates an error via the electronic vehicle interface
d)	Airbag evidently not operational

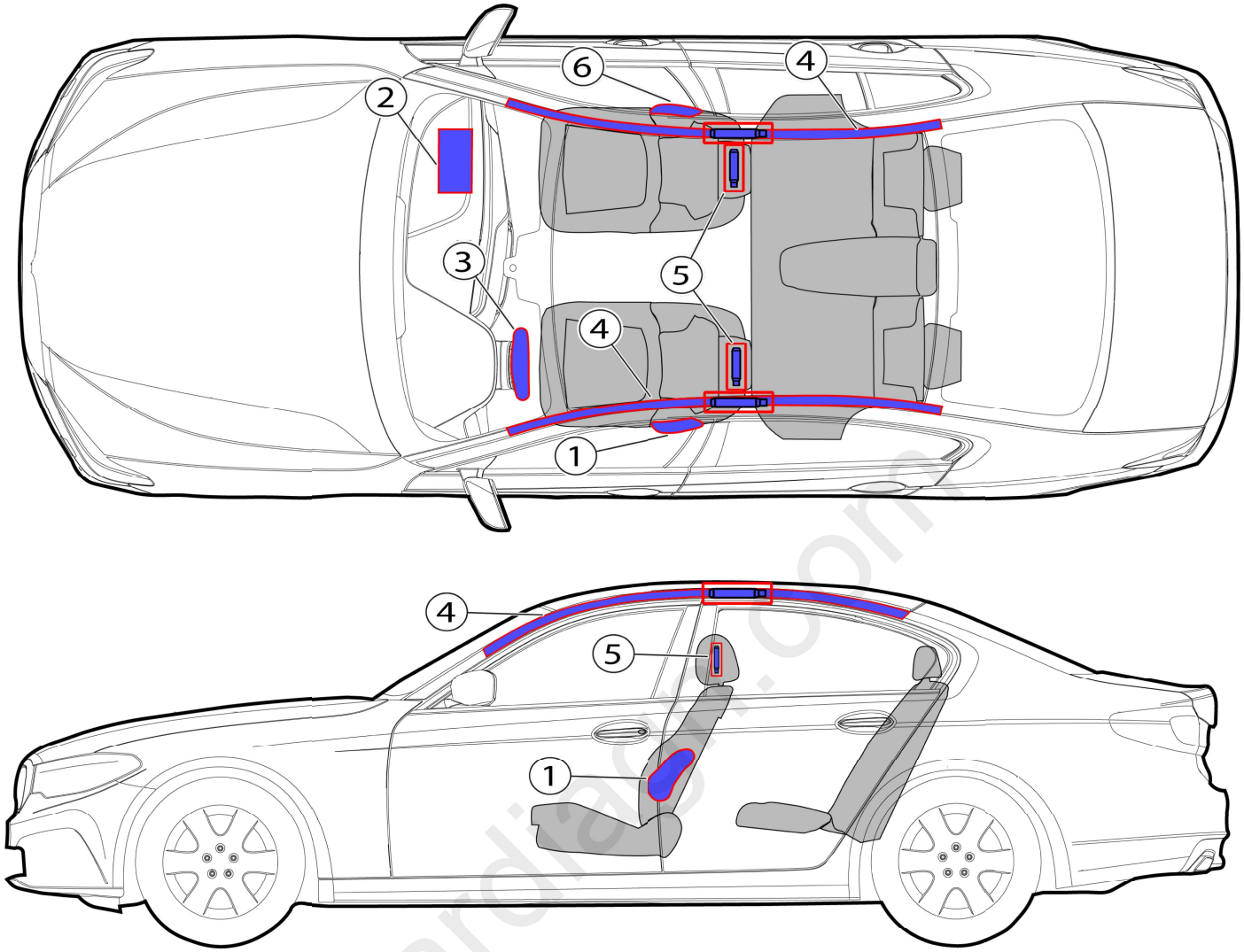
Methods according to vehicle manufacturer

Airbag systems



1. Side airbag (B-pillar or seat)
2. Front passenger airbag
3. Driver's airbag
4. Head airbag
5. Head restraint airbag

The exact position of the airbag has been highlighted with "SRS" or "Airbag" labelling.



cardiagn.com

7.1.6 Supplementary restraint systems (SRS)

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Visual inspection of the airbag control light and/or use of electronic vehicle interface.

Fault determination according to EG PTI:

a)	Airbag control light indicates errors in the system (does not go out)
b)	System displays an error message via the electronic vehicle interface

Methods according to vehicle manufacturer

For electronic testing via the diagnostic interface (OBD socket), the read-out routines necessary for the EU testing organisation will be provided.

cardiagn.com

7.11 Odometer (if present)

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Visual inspection and/or use of electronic vehicle interface.

Fault determination according to EG PTI:

a)	Evident tampering (fraud) to reduce a vehicle's odometer reading or show an incorrect value.
b)	Evidently not operational.

Methods according to vehicle manufacturer

The information is integrated into the Aftersales Information Research system.

cardiagn.com

7.12 Driving dynamics control (Electronic Stability Program, ESP) (if installed/required)

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Visual inspection and/or use of electronic vehicle interface.

Fault determination according to EG PTI:

a)	Wheel speed sensors missing or damaged.
b)	Cable damaged.
c)	Other components missing or damaged.
d)	Switch damaged or not operating correctly.
e)	DSC malfunction indicator lamp (MIL) indicates a fault in the system.
f)	System outputs a fault message via the electronic vehicle interface.

Methods according to vehicle manufacturer

For electronic testing via the diagnostic interface (OBD socket), the read-out routines necessary for the EU testing organisation will be provided.

cardiagn.com

Repair notes to renew the cylinder head

RISK OF DAMAGE

Engine damage due to lack of engine oil.

Lack of engine oil after the cylinder head or the engine has been renewed may cause damage to the valve gear.

- Do not start the engine after renewing the cylinder head or the engine without following the repair notes.
- The repair notes on renewing the cylinder head or the engine must be followed.
- For additional information, see: Repair notes on renewing the cylinder head or the engine

Problem

After replacing the cylinder head, a loud rattling noise occurs in the area of the cylinder head or cylinder head cover after starting the engine.

One or more roller cam followers can pop out.

Cause

The new part cylinder head does not contain any engine oil.

The oil supply to the valve clearance compensating elements on the exhaust side and in the area of the exhaust valve stems is not optimal at the first engine start.

Solution

TECHNICAL INFORMATION

- Observe the sign in the engine compartment! Only pour in approved engine oil with the correct SAE viscosity classification.

Before installing the cylinder head cover, the valve stems of all exhaust valves must be moistened with engine oil.

Engine oil

Technically suitable engine oils for BMW Group engines	

3.0 Technically appropriate engine oils for BMW Group engines

Before the first engine start, the engine only needs to be turned with the starter (without combustion) for a few seconds.. The maximum permissible uninterrupted operating period must not be exceeded.

Maximum permissible uninterrupted operating period of the starter motor

15 s

cardiagn.com

To guarantee this, the electrical connections of all injectors must be disconnected.

Alternatively, the wiring harness for injection and ignition must be unplugged from the Digital Motor Electronics (DME).

For additional information, see: Repair instructions "11 00 039 Check compression of all cylinders", but without removing ignition coils and spark plugs. "Compression pressure test" service function.

Turning the engine with the starter (without combustion) ensures that the valve train has a sufficient oil supply to start the engine regularly afterwards.

Then reconnect the injectors or the wiring harness for injection and ignition to the Digital Motor Electronics (DME).

Delete the fault memory.

Start engine.

Additional Information

Overview Technical Data

Maximum permissible uninterrupted operating period of the starter motor
15 s

Links

Operating materials
3.0 Technically appropriate engine oils for BMW Group engines

cardiagn.com

Repair notes to renew the engine

RISK OF DAMAGE

Engine damage due to lack of engine oil.

Lack of engine oil after the cylinder head or the engine has been renewed may cause damage to the valve gear.

- Do not start the engine after renewing the cylinder head or the engine without following the repair notes.
- The repair notes on renewing the cylinder head or the engine must be followed.
- For additional information, see: Repair notes on renewing the cylinder head or the engine

Problem

After renewing the engine, a loud rattling noise occurs in the area of the cylinder head or cylinder head cover after engine start.

One or more roller cam followers can pop out.

Cause

The engine new part has a long storage time or transport time.

Engine oil flows out of the cylinder head and back into the oil sump.

The oil supply to the valve clearance compensating elements on the exhaust side and in the area of the exhaust valve stems is not optimal at the first engine start.

Solution

Before the first engine start, the engine only needs to be turned with the starter (without combustion) for a few seconds.. The maximum permissible uninterrupted operating period must not be exceeded.

Maximum permissible uninterrupted operating period of the starter motor

15 s

To guarantee this, the electrical connections of all injectors must be disconnected.

Alternatively, the wiring harness for injection and ignition must be unplugged from the Digital Motor Electronics (DME).

For additional information, see: Repair instructions "11 00 039 Check compression of all cylinders", but without removing ignition coils and spark plugs. "Compression pressure test" service function.

Turning the engine with the starter (without combustion) ensures that the valve train has a sufficient oil supply to start the engine regularly afterwards.

Then reconnect the injectors or the wiring harness for injection and ignition to the Digital Motor Electronics (DME).

Delete the fault memory.

Start engine.

Additional Information

Overview Technical Data

Maximum permissible uninterrupted operating period of the starter motor

15 s

cardiagn.com

6.1.9 Engine performance

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Visual inspection and/or use of electronic vehicle interface.

Fault determination according to EG PTI:

a)	Emissions warning light does not go out
b)	Fault entry present
a)	Control changed, consequently impaired safety and/or environmental response
b)	Engine changed, consequently impaired safety and/or environmental response

Methods according to vehicle manufacturer

For electronic testing via the diagnostic interface (OBD socket), the read-out routines necessary for the EU testing organisation will be provided.

cardiagn.com

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!

cardiagn.com

8.2.1.1 Emission control systems

Validities

BMW i, BMW passenger cars, MINI passenger cars, Rolls-Royce passenger cars

Official method according to EG PTI:

Visual inspection

Fault determination according to EG PTI:

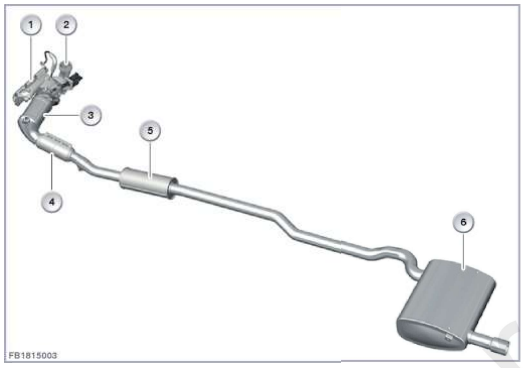
a)	The exhaust gas aftertreatment system installed by the manufacturer is missing, has been changed or it has evidently been damaged
b)	Leakages influencing emission measurement

Methods according to vehicle manufacturer:

System description

The engines form part of the so-called modular engines. Depending on the motorisation, different versions of the exhaust emission system are used. Apart from the exhaust manifolds and the exhaust turbochargers, the exhaust system has been designed very similarly for each modular engine. The exhaust emission systems essentially only differ in their varied volume and the number of exhaust tailpipes.

Exhaust emission system



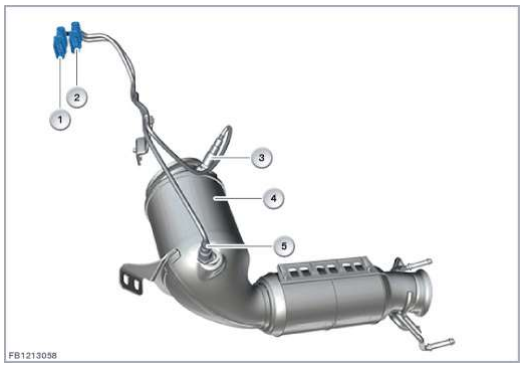
Index	Explanation
1	Exhaust manifold
2	Exhaust turbocharger
3	Catalytic converter
4	Decoupling element
5	Centre silencer
6	Rear silencer

The 3-cylinder petrol engine is equipped with a water-cooled exhaust manifold made of aluminium. The 4-cylinder petrol engine and the 6-cylinder petrol engine feature an exhaust manifold made of cast steel. The 3, 4 and 6-cylinder petrol engines feature one bank each. In all engines, the exhaust manifold and the exhaust turbocharger housing have been designed as one cast part and for this reason, they cannot be renewed individually. Both the 8-cylinder petrol engine and the 12-cylinder engine have 2 cylinder banks. As a result, the engine features 2 exhaust turbochargers which have not been integrated into the exhaust manifold.

Apart from the 3-cylinder petrol engine, the exhaust turbochargers have been designed as twin-scroll exhaust turbochargers to enable a quicker and more direct response. The engines feature one oxidation catalytic converter near the engine per bank. The charging pressure per exhaust turbocharger is controlled using an electrical wastegate valve.

Oxygen sensors

cardiagn.com

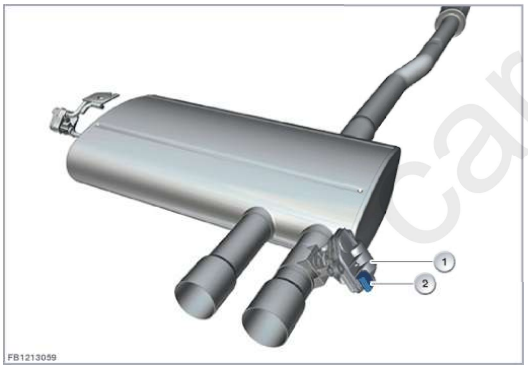


Index	Explanation
1	five-pin plug connection
2	five-pin plug connection
3	Oxygen sensor before catalytic converter
4	Catalytic-converter mounted close to the engine
5	Oxygen sensor after catalytic converter

The oxygen sensor consists of a ceramic coating made of zirconium dioxide (laminated). The heating element that has been inserted into the laminate quickly generates the required operating temperature of at minimum 750 °C. The oxygen sensor contains 2 cells, a measuring cell and a reference cell. The two cells are coated with electrode made of platinum.

It is possible to gradually measure an air/fuel ratio of between 0.65 and 2.5 using the oxygen sensor (constant characteristic curve). This oxygen sensor works with a lower heater output than a conventional oxygen sensor. In addition, this oxygen sensor is ready for operation more quickly. Current is applied at the measuring cell. Consequently O2 is pumped into the reference cell until a voltage of 450 mV has been established between the reference cell electrodes. The applied current at the measuring cell is the measured variable for the fuel-air ratio. This enables the oxygen sensor emissions control to set any desired air/fuel ratio in the combustion chamber.

Electrical exhaust flap (model-specific)



Index	Explanation
1	Electrical exhaust flap
2	five-pin plug connection

The exhaust control flap is driven via an axially arranged electric motor with integrated gearing and integrated electronics. The exhaust control flap is activated by the Digital Engine Electronics (pulse-width modulation). Input variables are:

- Engine speed
- Load
- Driving speed

The exhaust flap is integrated within the rear silencer. The exhaust flap reduces the noise level when the engine is idle and when the engine speed is close to idle. The exhaust flap guarantees active noise control and reduces the output by approximately 8 dB.

The electric exhaust control flap is connected via 4-pin plug connection. The drive for the electric exhaust control flap is supplied with terminal 15N.

The exhaust flap can be opened (10 % pulse width modulation) and closed (90 % pulse width modulation). The end positions are mechanical limit stops. Intermediate positions are not provided. The preferred position with a detected fault (for example failure of pulse-width modulated signal) or after having switched off the combustion engine is the open position.

TECHNICAL INFORMATION

The oxygen sensor requires ambient air within its interior in order to operate. The ambient air enters the interior via the plug connection through the cable. For this reason it is important to guard the plug connection against contamination from substances such as wax and sealants. When malfunctions occur in the lambda closed-loop control system the oxygen sensor's plug connection should always be checked. If necessary, the plug connection must be cleaned. Avoid all contact between the plug connection and contact spray, cleaning agents and solvents, as these substances could destroy the oxygen sensor.

TECHNICAL INFORMATION

If the exhaust flap is defective the exhaust system will emit a hissing noise a high engine speeds when it is closed. If the exhaust flap is defective and partially open a humming noise will be generated at idle.

Petrol particulate filter

In the EURO 6c exhaust emissions legislation, the limit values of the particle mass (PM) and the particle number (PN) are even more strictly limited. The reason for this is that, in modern petrol engines with direct injection, the most homogeneous fuel-air mixture is created with intake pipe fuel injection. This means that more particles are created during combustion. In order to comply with the limit values, a petrol particulate filter is installed, among other things.



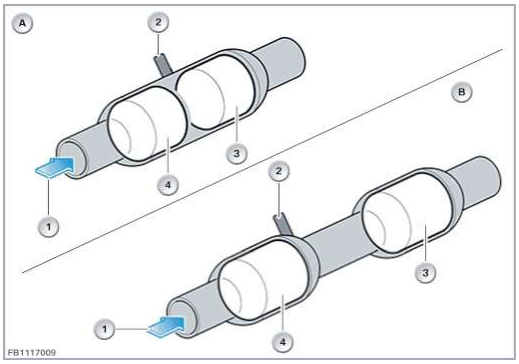
Overview:

Index	Explanation
1	Petrol particulate filter

The petrol particulate filter is installed behind the catalytic converter instead of the centre silencer. In future vehicles, it will also be possible install the petrol particulate filter near the engine together in one housing with the catalytic converter.

cardiagn.com

Mounting orientation:



Index	Explanation
A	Petrol particulate filter near the engine in the catalytic converter
B	Petrol particulate filter near the engine instead of the centre silencer
1	Exhaust mass flow
2	Exhaust gas pressure sensor connection
3	Petrol particulate filter
4	Catalytic converter

The mounting orientation of the exhaust gas pressure sensor must be checked for unique identification. If the exhaust gas pressure sensor is at the output of the catalytic converter, then the petrol particulate filter is installed far from the engine in the vehicle underbody instead of the centre silencer. If the exhaust gas pressure sensor is located in the centre of the catalytic converter housing, then the petrol particulate filter is installed close to the engine.

A mounting orientation of the petrol particulate filter near the engine benefits regeneration (erosion of soot) since it is easier to reach the necessary exhaust temperatures.

Exhaust gas pressure sensor:



Index	Explanation
1	Exhaust gas pressure sensor
2	Ambient pressure measuring connection
3	Measuring connection before petrol particulate filter
4	three-pin plug connection

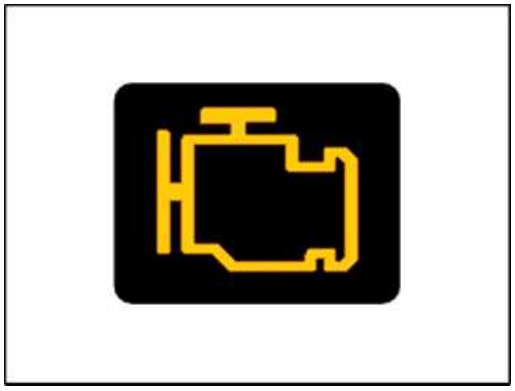
cardiagn.com

Unlike in diesel engines the differential pressure in petrol engines *is not measured upstream* and downstream of the microfilter. Instead, with petrol engines, the exhaust gas pressure sensor measures the exhaust gas pressure before the petrol particulate filter as well as the ambient pressure.

The Digital Motor Electronics (DME) calculates the exhaust mass flow using the signals of the exhaust gas pressure sensor and other signals such as the air mass. A value for the exhaust gas pressure after the petrol particulate filter is determined using the calculation of the exhaust mass flow in combination with the measured ambient pressure. The calculated differential pressure before and after the petrol particulate filter gives information on the load status of the petrol particulate filter. The Digital Motor Electronics (DME) activates regeneration when the permitted load status is exceeded.

Malfunction indicator lamp

The malfunction indicator lamp is also called as "Check engine light" in some countries.



Activation in fault states

The malfunction indicator lamp is activated if an exhaust-related fault is detected in two consecutive driving cycles. The associated BMW fault code then receives the fault detail "fault is currently activating a warning light". If a fault disappears again, the fault memory remains stored for 40 driving cycles. The malfunction indicator lamp is deactivated again if the fault does not occur for three successive driving cycles. In this case, the fault detail for the associated BMW fault code changes back to "fault does not currently activate any warning light".

Activation without fault status

In the conditions listed below, the malfunction indicator lamp is also active. These conditions do not represent a fault status, however. Troubleshooting is therefore not necessary in these conditions.

- During the pre-drive check, i.e. for some seconds directly after activating driving readiness.
- If exclusively terminal 15 is switched on without driving readiness *and/or* without having started the engine.

cardiagn.com

8.2.1.2 Gaseous emissions

Validities

BMW i, BMW passenger cars, MINI passenger cars, Rolls-Royce passenger cars

Official method according to EG PTI:

— In vehicles up to emission categories Euro 5 and Euro V (7): Measurement with the help of one of the exhaust gas analysis unit 1 conforming to the regulations or reading out the on-board diagnosis system. The exhaust-gas test is basically performed using the exhaust emissions. The member states may allow the use of the on-board diagnosis system based on a equivalence assessment and in consideration of the relevant type approval regulations, in which the recommendations of the vehicle manufacturer and other requirements must be observed.

— In vehicles from emission categories Euro 6 and Euro VI (8): measure using an emission analysis device1 that meets the specifications or read out the on-board diagnosis system while taking into account the manufacturer's recommendations and other requirements1. No measurements are carried out in two-stroke engines.

Fault determination according to EG PTI:

a)	Exhaust gas exceeds the specific values as per manufacturer specifications
b)	Or (if there is no corresponding data available) the carbon monoxide emissions exceed i) — 4.5 % or — 3.5 % in vehicles without modern exhaust gas aftertreatment system, depending on the first registration or initial operation date as per specifications1; ii) in vehicles with modern exhaust gas aftertreatment system — when the engine is idling: 0.5 %, — at increased idle speed: 0.3 % or — when the engine is idling: 0.3 % (7), — at increased idle speed: 0.2 %, depending on the first registration or initial operation date as per specifications1.
c)	Oxygen sensor coefficient outside the range 1 ± 0.03 or not in compliance with manufacturer specifications
d)	On-board diagnosis system (OBD) shows significant fault.

cardiagn.com

8.2.2.1 Emission control devices

Validities

BMW i, BMW passenger cars, MINI passenger cars, Rolls-Royce passenger cars

Official method according to EG PTI:

Visual inspection

Fault determination according to EG PTI:

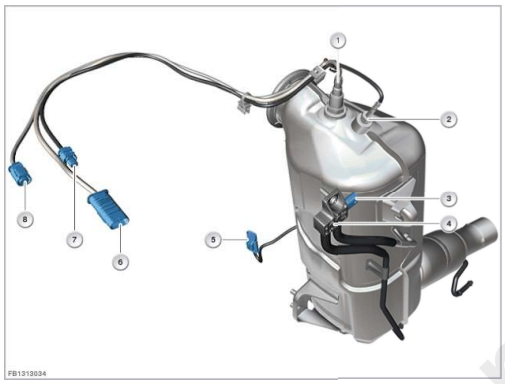
a)	The exhaust gas aftertreatment system installed by the manufacturer is missing or it has evidently been damaged.
b)	Leakages influencing emission measurement

Methods according to vehicle manufacturer:

Diesel particulate filter

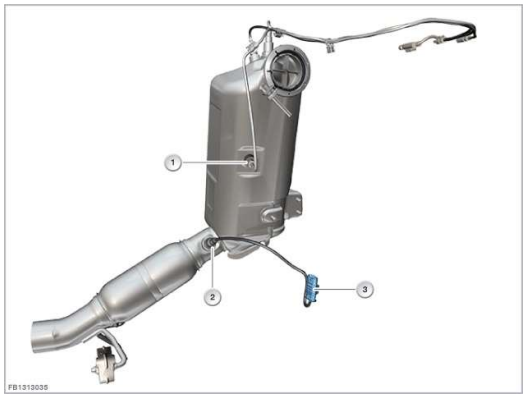
In order to comply with required particle emissions as per EURO5 and EURO6 exhaust emissions legislation all BMW diesel vehicles have been equipped with a diesel particulate filter.

The filter housing of the filter contains the oxidation catalytic converter and the actual diesel particulate filter. The oxidation catalytic converter is mounted upstream of the diesel particulate filter.



Index	Explanation
1	Oxygen sensor before catalytic converter
2	Exhaust temperature sensor upstream of catalytic converter
3	three-pin plug connection
4	Differential pressure sensor microfilter
5	two-pin plug connection
6	two-pin plug connection
7	two-pin plug connection
8	two-pin plug connection

cardiagn.com

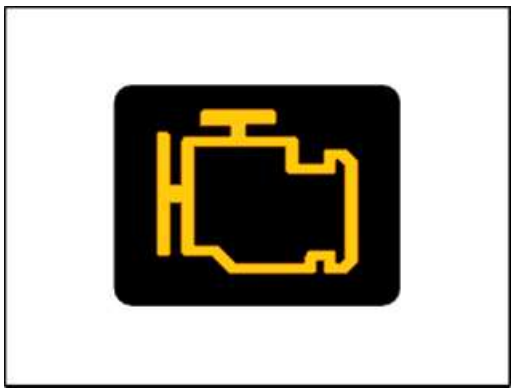


Index	Explanation
1	Exhaust-gas temperature sensor after catalytic converter
2	Oxygen sensor after catalytic converter
3	five-pin plug connection

cardiagn.com

Malfunction indicator lamp

The malfunction indicator lamp is also called as "Check engine light" in some countries.



Activation in fault states

The malfunction indicator lamp is activated if an exhaust-related fault is detected in two consecutive driving cycles. The associated BMW fault code then receives the fault detail "fault is currently activating a warning light". If a fault disappears again, the fault memory remains stored for 40 driving cycles. The malfunction indicator lamp is deactivated again if the fault does not occur for three successive driving cycles. In this case, the fault detail for the associated BMW fault code changes back to "fault does not currently activate any warning light".

Activation without fault status

In the conditions listed below, the malfunction indicator lamp is also active. These conditions do not represent a fault status, however. Troubleshooting is therefore not necessary in these conditions.

- During the pre-drive check, i.e. for some seconds directly after activating driving readiness.
- If exclusively terminal 15 is switched on without driving readiness and/or without having started the engine.

cardiagn.com

8.2.2.2 Exhaust gas opacity vehicles, vehicles registered or in operation prior to 01.01.1980 are excluded

Validities

BMW i, BMW passenger cars, MINI passenger cars, Rolls-Royce passenger cars

Official method according to EG PTI:

— In vehicles up to emission categories Euro 5 and Euro V (7): measurement of the exhaust gas opacity during acceleration (without load) from idle to cutoff speed, whereby the gear selector lever must be in neutral interval stage and the clutch must not be pressed, or read out OBD. As a rule, the exhaust-gas test is carried out by checking the exhaust gases. Member states may permit the use of OBD on the basis of an equal assessment. However, recommendations by the vehicle manufacturer must be taken into account.

— In vehicles from emission categories Euro 6 and Euro VI (8): measurement of the exhaust gas opacity during acceleration (without load) from idle to cutoff speed, whereby the gear selector lever must be in neutral interval stage and the clutch must not be pressed, or read out OBD while taking into account the manufacturer recommendations and other requirements1

Vehicle preheating/precooling: 1. Vehicles can be checked without preheating/precooling. However, for reasons of safety the engine must be at operating temperature and in correct mechanical condition2. Preheating/precooling requirements: i) The engine has fully reached operating temperature, i.e. an engine oil temperature of at minimum 80°C or the usual operating temperature (if this value is lower) is measured using a measuring tube sensor or the engine block temperature measured using an infrared radiation sensor has reached at minimum this value. If the value cannot be measured in this way as a result of the vehicle configuration, the normal engine operating temperature can be determined using a different method, e.g. by starting up the engine fan. ii) The exhaust emission system is flushed after a minimum of three non-loaded acceleration cycles from idle speed to cutoff speed or with an equivalent procedure.

Checking process: 1. The engine and a potentially installed exhaust turbocharger must have reached idle speed prior to starting the non-loaded acceleration cycle. With heavy diesel engines it is necessary to wait for a minimum of 10 seconds after having released the accelerator pedal for this purpose. 2. In order to initiate the non-loaded acceleration cycle it is necessary to quickly and constantly press the accelerator pedal (within less than one second), yet it must not be forcefully pressed fully down so the injection pump reaches the maximum delivery rate. 3. During each non-loaded acceleration cycle the engine must reach the cutoff speed or in vehicles with automatic transmission the speed specified by the manufacturer or, if this data is not available, two thirds of the cutoff speed before the accelerator pedal is released. For instance, this can be checked by monitoring the engine speed or by pressing the accelerator pedal for long enough, i.e. in M 2, M 3, N 2 and N 3 class vehicles the period of time from having initially pressed the accelerator pedal to releasing it must be at minimum two seconds. 4. The check must exclusively be assessed as a fail if the arithmetic mean of at minimum three non-loaded acceleration cycles exceeds the limit value. When calculating this value, measurements that significantly deviate from the average measured value or the result of other statistical calculations that take into account the spread of measurements can be ignored. Member states can limit the number of test cycles to be carried out. 5. Member states can assess vehicle checks as fails where measured values significantly exceed the limit values after fewer than three non-loaded acceleration cycles or after the flushing cycles to avoid unnecessary checks. Member states can also assess vehicle checks as passes where measured values are significantly below the limit values after fewer than three non-loaded acceleration cycles or after the flushing cycles to avoid unnecessary checks.

Fault determination according to EG PTI:

a)	In vehicles that are initially registered or put into operation after the date specified in the regulations1: exhaust gas opacity exceeds the value stated on the manufacturer label on the vehicle
b)	If this information is not available or the use of reference values has not been specified in the regulations1: — Naturally aspirated engines: 2.5 m–1, — Engines with turbocharger: 3.0 m–1, — In vehicles specified as per relevant regulations1 or initially registered or put into operation after the date stated in said regulations: 1.5 m–1 (9) or 0.7 m–1 (10)

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!

cardiagn.com

Assessment of the rubber mounts on axle components

Evaluation criteria of rubber mounts

General information:

- Rubber mounts are generally not a safety component
- Tether is constructionally secured
- Separation of the adhesion and cracks are generally permitted
- Fluid loss and grease loss in hydraulic mounts is permitted

Specific test criteria:

- Tight fit of the ball bearing must be ensured
- Excessive play while jolting the component is not permitted (check with a loaded axle)
- Grinding marks and metallic noises while jolting the component are not permitted

cardiagn.com

2.6 Electronic hydraulic steering (EPS)

Validities

BMW passenger cars, BMW i, MINI passenger cars, Rolls-Royce passenger cars

Official method according to EG PTI:

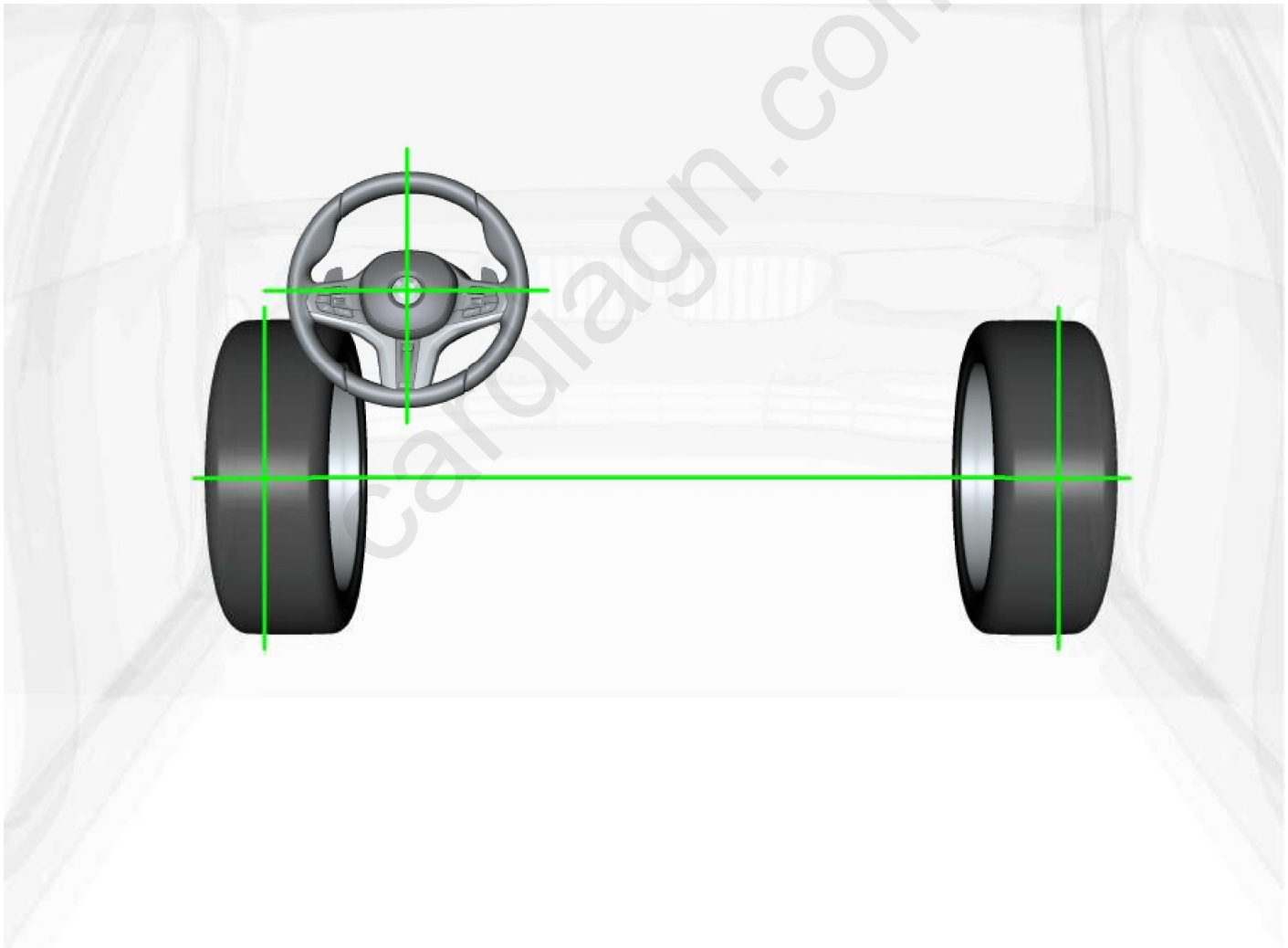
Visual inspection and checking whether the steering wheel angle and the wheels correspond when switching the engine on/off and/or using the electronic vehicle interface

Fault determination according to EG PTI:

a)	EPS malfunction indicator lamp (MIL) indicates a fault in the system.
b)	Discrepancy between the steering wheel angle and the wheel angle, steering impaired.
c)	Hydraulic steering not working.
d)	System outputs an error via the electronic vehicle interface.

Methods according to vehicle manufacturer:

Visual inspection: The wheels and steering wheel must be straight.





1	Indicator light and Check Control symbol

In the event of failure of the electromechanical power steering (EPS), a Check Control symbol appears in the LCD. Simultaneously, the fixed indicator lamp comes on in the instrument cluster.

carglagn.com

Assessment of the rubber mounts on axle components

Evaluation criteria of rubber mounts

General information:

- Rubber mounts are generally not a safety component
- Tether is constructionally secured
- Separation of the adhesion and cracks are generally permitted
- Fluid loss and grease loss in hydraulic mounts is permitted

Specific test criteria:

- Tight fit of the ball bearing must be ensured
- Excessive play while jolting the component is not permitted (check with a loaded axle)
- Grinding marks and metallic noises while jolting the component are not permitted

cardiagn.com

Assessment of the rubber mounts on axle components

Evaluation criteria of rubber mounts

General information:

- Rubber mounts are generally not a safety component
- Tether is constructionally secured
- Separation of the adhesion and cracks are generally permitted
- Fluid loss and grease loss in hydraulic mounts is permitted

Specific test criteria:

- Tight fit of the ball bearing must be ensured
- Excessive play while jolting the component is not permitted (check with a loaded axle)
- Grinding marks and metallic noises while jolting the component are not permitted

cardiagn.com

1.2.1 Service brake: Effect

Validities

BMW i, BMW passenger cars, MINI passenger cars, Rolls-Royce passenger cars

Official method according to EG PTI:

Operate the brakes on a brake test stand or, if this is not possible, during a road test gradually increasing up to the maximum brake force.

Fault determination according to EG PTI:

a)	Insufficient brake force at one or more wheels or no brake force at one or more wheels.
b)	Brake force at one wheel less than **70%** of the maximum brake force applicable at the other wheel of the same axle. Or, in the event of a road test, excessive deviation of the vehicle from straight-ahead running. Brake force at one wheel of steered axles less than **50%** of the maximum brake force applicable at the other wheel of the same axle.
c)	Brake force is not gradual (grabbing).
d)	Response time of the brake at one of the wheels too long.
e)	Heavy fluctuation of the brake force during every full wheel rotation.

Methods according to vehicle manufacturer

Braking on the test stand

TECHNICAL INFORMATION

With all-wheel drive vehicles, the test stand is detected automatically.

TECHNICAL INFORMATION

Only brake test stands with test speeds between 2.5 km/h and 6 km/h may be used.

cardiagn.com

Necessary preliminary work:

- Check tyres for damage.
- Check tyre tread.
- Check the tyre pressure.
- The brakes must be at normal operating temperature. To that end, warm up and dry off the brake discs by braking the vehicle a few times.

Front brakes:

- Drive the front axle of the vehicle onto the brake test stand.
- Place the selector lever in selector lever position (N).
- Start brake test stand.
- Press service brake pedal.
- Read off maximum brake force on the left / right.

Rear brakes:

- Drive the front axle of the vehicle onto the brake test stand.
- Place the selector lever in selector lever position (N).
- Start brake test stand.
- Press service brake pedal.
- Read off maximum brake force on the left / right.

Braking on the test stand with F25 F26

Prerequisite

- Check tyres for damage.
- Check tyre tread.
- Check the tyre pressure.

cardiagn.com

TECHNICAL INFORMATION

- Make sure the Hill Descent Control (HDC) is not active before driving on to the brake test rig!
  - The Hill Descent Control (HDC) indicator light must not be on!
  - Only brake test stands with test speeds between 2.5 km/h and 6 km/h may be used.
  - Max. bedding-in time 2 minutes.
  - You must follow without fail the regulation contained in the operating instructions of the relevant test stand manufacturer.

Attention!

The brakes must be at normal operating temperature. To do so, gently warm up the brake discs and brake drums while dry by braking the vehicle several times.

- **Failure to do so may result in damage to the vehicle and the system and also personal injury.**

Front axle on brake test rig: Attention!

- No gear or drive range must be engaged! Selector lever position "Neutral" on automatic transmission vehicles.
- Do not press accelerator!
- Disregard of these instructions will result in the transfer box engaging, forcing the vehicle off the brake test stand!

Drive vehicle on to brake test rig and carry out brake test.

Rear axle on brake test rig: Attention!

- No gear or drive range must be engaged! Selector lever position "Neutral" on automatic transmission vehicles.
- Do not press accelerator!
- Disregard of these instructions will result in the transfer box engaging, forcing the vehicle off the brake test stand!

Drive vehicle onto brake test stand

TECHNICAL INFORMATION

- The vehicle utilises a plausibility check (wheel speed comparison) to detect the brake test rig within a few seconds and switches to brake test rig mode.
  - The parking brake indicator light flashes slowly when brake test stand mode is activated and EMF actuators are released.

Following indicator lights are permanently on:

- Parking brake.
- Brake system.
- Dynamic Stability Control (DSC).
- Antilock Brake System (ABS).
- Press parking brake button according to the application of the brake pads.

TECHNICAL INFORMATION

The parking brake indicator light flashes quickly when brake test stand mode is activated and EMF actuators are partially locked.

cardiagn.com

- Press parking brake button = test force 1.
- Press parking brake button = test force 2.
- Press parking brake button = test force 3.
- The parking brake is released again when the button is actuated in the Release direction.

TECHNICAL INFORMATION

- The parking brake indicator light is permanently activated when brake test stand mode is not detected and EMF actuators are fully locked.
  - Brake test stand mode is automatically terminated when the vehicle is driven off the brake test stand.
  - Brake test stand mode is automatically terminated when the vehicle is driven off the brake test stand.
  - All indicator lights go out automatically!

Braking at test stand i01 i12

TECHNICAL INFORMATION

- Only brake test stands with test speeds between 2.5 km/h and 6 km/h may be used.
  - Before using the brake test stand with the rear axle, roller operation must be activated on the instrument cluster (see the following instructions).
  - It is not possible to check the electromechanical parking brake on a plate test stand!
  - **i01**: It is not permissible to use the brake test stand with the rear axle if roller operation has not been activated!
  - When roller operation is activated, hold steering wheel in straight-ahead position, steering wheel movements deactivate roller operation!

Necessary preliminary work:

- Check tyres for damage.
- Check tyre tread.
- Check the tyre pressure.
- The brakes must be at normal operating temperature. To that end, warm up and dry off the brake discs by braking the vehicle a few times.



TECHNICAL INFORMATION

Before using the brake test stand with the rear axle, roller operation must be activated on the instrument cluster (see the following instructions).

Figure :I01

cardiagn.com



Figure :I12

- Roller operation is activated using the kilometre reset button (1). Keep pressing reset button until the main menu is displayed in the centre of the instrument cluster.
- In main menu, select the "03 Start roller" menu item using the reset button.
- Quit the "03 Roller Operation" menu item by pressing the reset button.
- Roller operation is shown in the display with the message "Start ESC OFF". Press the reset button to start roller operation.
- The warning light and the message "Test operation ends during start of the journey" light up on the display. The brake test can now be performed.

Front brakes:

- Drive the front axle of the vehicle onto the brake test stand.
- Place the selector lever in selector lever position (N).
- Start brake test stand.
- Press service brake pedal.
- Read off maximum brake force on the left / right.

Rear brakes:

- Drive the rear axle of the vehicle onto the brake test stand.
- Place the selector lever in selector lever position (N).
- Start brake test stand.
- Press service brake pedal.
- Read off maximum brake force on the left / right.

cardiagn.com

1.3.1 Auxiliary brake (emergency braking): Effect

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Apply the test procedure described in 1.2.1 for an auxiliary brake system that is separate from the service brake system.

Fault determination according to EG PTI:

a)	Insufficient or no brake force at one or more wheels.
b)	Brake force at one wheel less than 70% of the maximum brake force applicable at the other wheel of the same axle. Or, in the event of a road test, excessive deviation of the vehicle from straight-ahead running. Brake force at one wheel of steered axles less than 50% of the maximum brake force applicable at the other wheel of the same axle.
c)	Brake force is not gradual (grabbing).

Methods according to vehicle manufacturer

Refer to chapter 1.1.6 on the parking brake (electronic and mechanical), a separate system is not installed for BMW.

cardiagn.com

1.1.6 Duo-servo parking brake

Validities

BMW passenger cars, MINI passenger cars, ROLLS-ROYCE

Official method according to EG PTI:

Visual inspection of the components when operating the brake system.

Fault determination according to EG PTI:

a)	Ratchet does not lock properly.
b)	Wear on lever bearing or ratchet mechanism.
c)	Excessive lever travel due to incorrect setting.
d)	Actuating device missing, damaged or inoperative.
e)	Faulty function, indicator light displays malfunction.

Required preliminary work for the test stand

TECHNICAL INFORMATION

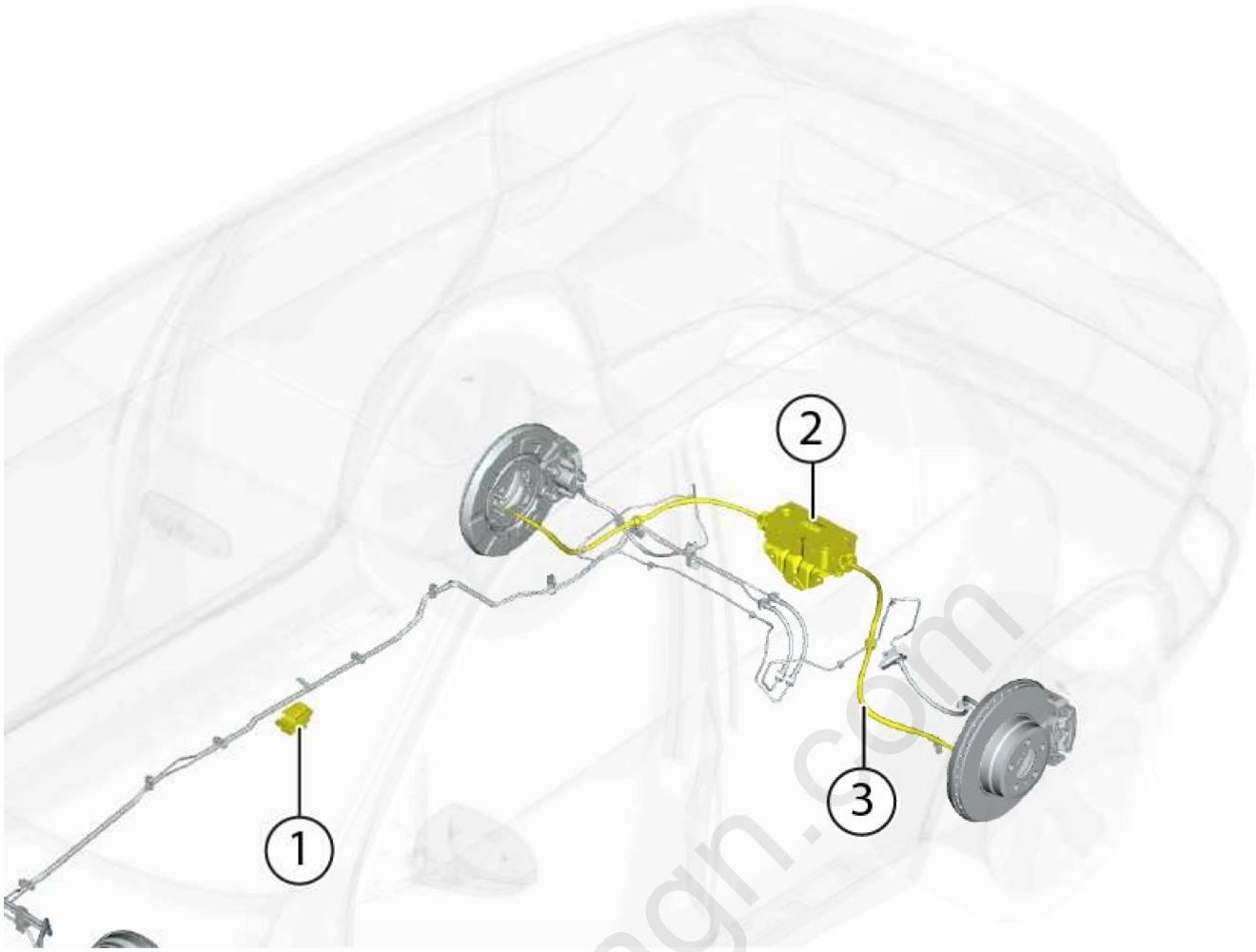
Only brake test stands with test speeds between 2.5 km/h and 6 km/h may be used.

- Check tyres for damage
- Check tyre treads
- Checking tyre pressure
- The brakes must be at normal operating temperature. To that end, warm up and dry off the brake discs by braking the vehicle a few times.

Methods according to vehicle manufacturer

cardiagn.com

Duo-servo parking brake



1 Electromechanical parking brake button

2 Servomotor

3 Cable

TECHNICAL INFORMATION

The check may only be carried out when the engine is switched off, the selector lever is in selector lever position (N) and the ignition is switched on.

TECHNICAL INFORMATION

It is not possible to check the electromechanical parking brake on a plate test stand!

Brake test on test stand:

Parking brake

- Drive the rear axle of the vehicle onto the brake test stand.
- Place the selector lever in selector lever position (N).
- Stop engine.

cardiagn.com

TECHNICAL INFORMATION

When the engine is running, additional braking effect will otherwise be exerted by the DSC system on all the wheels.

- Otherwise the DSC system generates an additional braking effect on all wheels.
- Switch on the ignition.
- Start brake test stand.

Activate the parking brake, for this purpose pull the button.

TECHNICAL INFORMATION

- Electromechanical holding brake indicator light lights up red on the display.
- Duo-servo parking brake (servomotor) is applied.
- Brake test stand switches off after wheels lock up (slip) or vehicle is pushed off the brake test stand.

- Read off maximum brake power on left / right
- Deactivate parking brake: - Press the button and simultaneously press the service brake pedal (*note*: duo-servo parking brake (servomotor) is released.)

cardiagn.com

1.1.6 Electronic parking brake

Validities

BMW i, BMW passenger cars, MINI passenger cars, Rolls-Royce passenger cars

Official method according to EG PTI:

Visual inspection of the components when operating the brake system.

Fault determination according to EG PTI:

a)	Ratchet does not lock properly.
b)	Wear on lever bearing or ratchet mechanism.
c)	Excessive lever travel due to incorrect setting.
d)	Actuating device missing, damaged or inoperative.
e)	Faulty function, indicator light displays malfunction.

Methods according to vehicle manufacturer:

Electromechanical parking brake



1 Parking brake operation switch

2 Brake calliper

Prerequisite

- Check tyres for damage.
- Check tyre tread.
- Check the tyre pressure.
- The brakes must be at normal operating temperature.
- To that end, warm up and dry off the brake discs by braking the vehicle a few times.

TECHNICAL INFORMATION

Only brake test stands with test speeds between 2.5 km/h and 6 km/h may be used.

Check without brake test stand

- Switch the ignition on. In this process, ensure that no gear is engaged!
- Visual inspection whether indicator lights and warning lights light up in the instrument cluster.
- Indicator lights must go out after a maximum of 5 seconds.
- A fault has occurred if the indicator and warning lights do not light up upon switching on the ignition or if they fail to go out after approximately 2-3 seconds.

Description of the parking brake

TECHNICAL INFORMATION

Follow notes for Brake testing for test stand.

The parking brake test must be carried out on the dynamic brake test stand as follows.

- Release position (engine off/ignition on).
- Wheel circumferential force on the right/left ≤ 300 N.

Press the parking brake button (engine off/ignition on):

- Vehicle must be evenly pulled from the brake test stand and/or the motor of the brake test stand is switched off on both sides.

Parking brake functional check

- Drive vehicle onto brake test stand
- The electromechanical parking brake control unit detects the brake test stand within a few seconds with a plausibility check (comparison of wheel speeds) and it activates brake test stand mode.
- The parking brake indicator light flashes slowly when brake test stand mode is activated and EMF actuators are released.
- Press parking brake button according to the application of the brake pads.
- The parking brake indicator light flashes quickly when brake test stand mode is activated and EMF actuators are partially locked.
- Press parking brake button = test force 1.
- Press parking brake button = test force 2.
- Press parking brake button = test force 3.
- The parking brake is released again when the button is actuated in the Release direction.
- The parking brake indicator light is permanently activated when brake test stand mode is not detected and EMF actuators are fully locked.
- The brake test stand mode is automatically terminated when the vehicle is driven off the brake test stand.

F85, F86 parking brake description

cardiagn.com

TECHNICAL INFORMATION

Only brake test stands with test speeds between 2.5 km/h and 6 km/h may be used.

Perform brake test on test stand

Necessary preliminary work:

- Check tyres for damage.
- Check tyre tread.
- Check the tyre pressure.
- The brakes must be at normal operating temperature. To that end, warm up and dry off the brake discs by braking the vehicle a few times.

TECHNICAL INFORMATION

The check may only be carried out when the engine is switched off, the selector lever is in selector lever position (N) and the ignition is switched on.

TECHNICAL INFORMATION

It is not possible to check the electromechanical parking brake on a plate test stand!

Parking brake:

- Drive the rear axle of the vehicle onto the brake test stand.
- Position the selector lever in selector lever position (N).
- Stop engine.

TECHNICAL INFORMATION

When the engine is running, additional braking effect will otherwise be exerted by the DSC system on all the wheels.

- Switch on the ignition.
- Start brake test stand.
- Activate the parking brake, for this purpose pull the button.

TECHNICAL INFORMATION

- Parking brake indicator light lights up red on the display.
- Duo-servo parking brake (servomotor) is applied.
- Brake test stand switches off after wheels lock up (slip) or vehicle is pushed off the brake test stand.

- Read off maximum brake force on the left / right.
- Deactivate parking brake: Press the button and simultaneously press the service brake pedal.

cardiagn.com

TECHNICAL INFORMATION

Duo-servo parking brake (servomotor) is released.

Description of the parking brake

The parking brake test must be carried out on the dynamic brake test stand as follows:

- Release position (engine off/ignition on).
- Wheel circumferential force, right/left ≤ 300 N.

Press the parking brake button (engine off/ignition on):

- Vehicle must be evenly pulled from the brake test stand and/or the motor of the brake test stand is switched off on both sides.

Parking brake functional check

- Drive the rear axle of the vehicle onto the brake test stand.
- Place the selector lever in selector lever position (N).
- The electromechanical parking brake control unit detects the brake test stand within a few seconds with a plausibility check (comparison of wheel speeds) and it activates brake test stand mode.
- The parking brake indicator light flashes slowly when brake test stand mode is activated and EMF actuators are released. Start brake test stand.
- Press parking brake button according to the application of the brake pads.
- The parking brake indicator light flashes quickly when brake test stand mode is activated and EMF actuators are partially locked.
- Press parking brake button = test force 1.
- Press parking brake button = test force 2.
- Press parking brake button = test force 3.
- Read off maximum brake force on the left / right.
- The parking brake is released again when the button is actuated in the Release direction.
- The brake test stand mode is automatically terminated when the vehicle is driven off the brake test stand.

Description of the parking brake

cardiagn.com

- Position the vehicle with its rear axle on the brake test stand.
- Position the selector lever in selector lever position N (neutral).
- **Run engine at idle speed.**
- The brake test stand starts automatically.
- The control unit runs a plausibility check (comparison of wheel speed) to identify within a few seconds that a vehicle is on the brake test stand and changes to brake test stand mode.
- If brake test stand mode has been activated and the EMF actuators are open, the indicator light for the electromechanical parking brake flashes slowly.
- Press the parking brake button: application of brake pads; when brake test stand mode is active and the EMF actuators have been partly applied, the indicator light for the electromechanical parking brake flashes quickly.
- Press the parking brake button: brake test with test force 1
- Press the parking brake button: brake test with test force 2
- Press the parking brake button: brake test with test force 3
- Read the maximum brake forces on the left and right.
- Release parking brake button 1. This releases the parking brake.
- Move the vehicle from the brake test stand. Brake test stand mode is automatically quit upon driving off the brake test stand.
- **After having completed the brake tests: Perform terminal change.**
- All indicator lights go out after having completed the terminal change.

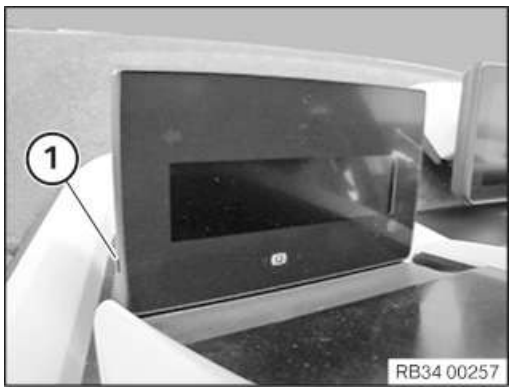
Description of the parking brake

TECHNICAL INFORMATION

- It is not possible to check the electromechanical parking brake on a plate test stand!
  - i01: It is not permissible to use the brake test stand with the rear axle if roller operation has not been activated!
  - When roller operation is activated, hold steering wheel in straight-ahead position, steering wheel movements deactivate roller operation!

Necessary preliminary work:

- Check tyres for damage
- Check tyre treads
- Checking tyre pressure
- The brakes must be at normal operating temperature. To that end, warm up and dry off the brake discs by braking the vehicle a few times.



TECHNICAL INFORMATION

Before using the brake test stand with the rear axle, roller operation must be activated on the instrument cluster (see the following instructions).

Figure :I01

cardiagn.com



Figure :I12

- Roller operation is activated using the kilometre reset button (1). Keep pressing reset button until the main menu is displayed in the centre of the instrument cluster.
- In main menu, select the "03 Start roller" menu item using the reset button.
- Quit the "03 Roller Operation" menu item by pressing the reset button.
- Roller operation is shown in the display with the message "Start ESC OFF". Press the reset button to start roller operation.
- The warning light and the message "Test mode ends during start of the journey" lights up on the display. The brake test can now be performed.

Parking brake:

- Drive the rear wheels of the vehicle onto the brake tester
- Place the selector lever in selector lever position (N)
- Start the brake test stand
- Wait until the parking brake indicator light flashes slowly
- Press parking brake button according to the application of the brake pads.
- The parking brake indicator light flashes quickly when brake test stand mode is activated and EMF actuators are partially locked.
- Press parking brake button = test force 1.
- Press parking brake button = test force 2.
- Press parking brake button = test force 3.
- The parking brake is released again when the button is actuated in the Release direction.

TECHNICAL INFORMATION

Roller operation is automatically deactivated after a terminal change!

cardiagn.com

1.1.6 Parking brake, operating lever, reversible ratchet

Validities

BMW i, BMW passenger cars, MINI passenger cars, Rolls-Royce passenger cars

Official method according to EG PTI:

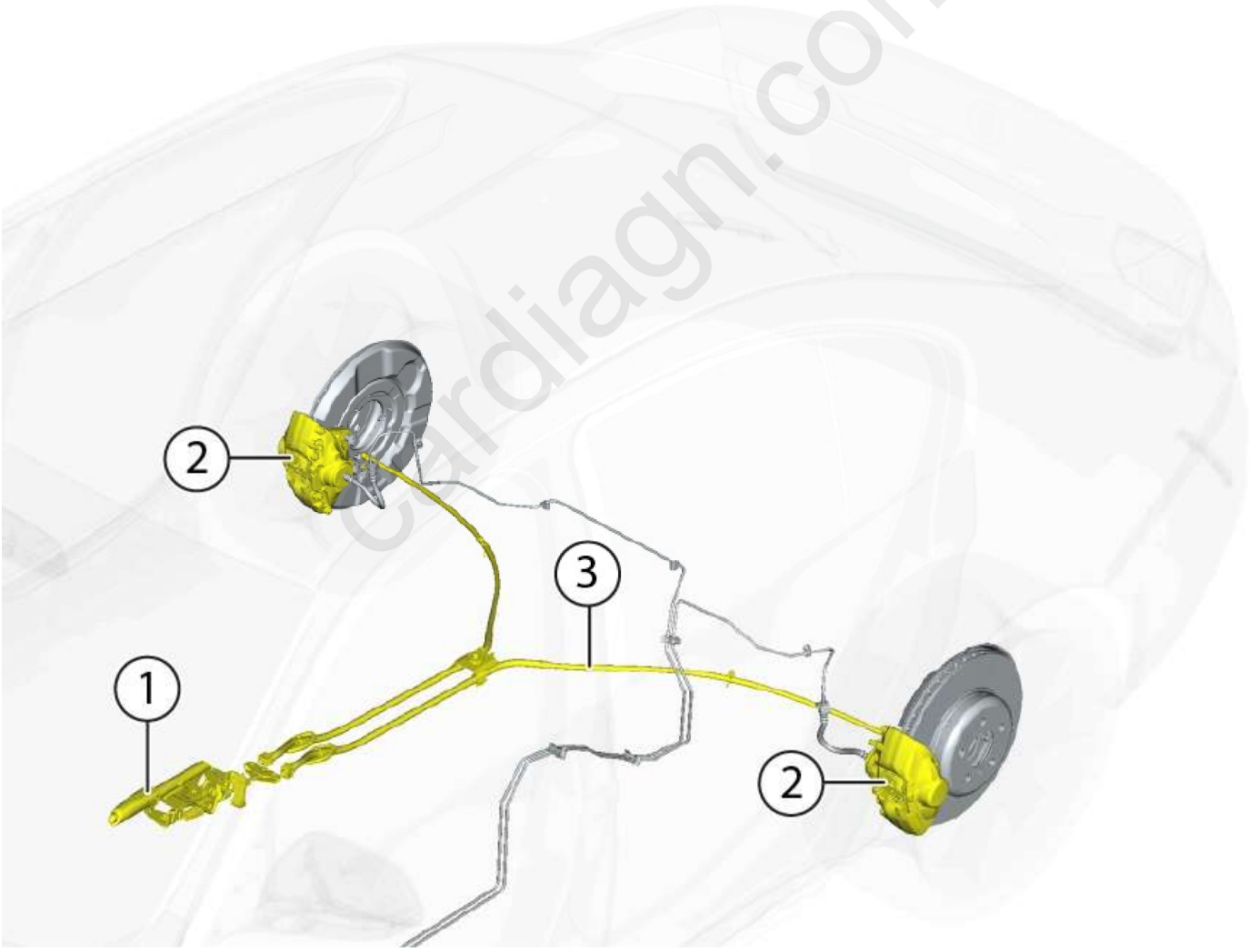
Visual inspection of the components when operating the brake system.

Fault determination according to EG PTI:

a)	Ratchet does not lock properly.
b)	Wear on lever bearing or ratchet mechanism.
c)	Excessive lever travel due to incorrect setting.
d)	Actuating device missing, damaged or inoperative.
e)	Faulty function, indicator light displays malfunction.

Methods according to vehicle manufacturer:

Mechanical parking brake



1 Parking brake lever

2 Brake calliper

3 Brake line

cardiagn.com

Preconditions

Switch the ignition on. In this process, ensure that no gear is engaged!

Parking brake that directly acts upon the service brake pads or also separate brake shoes in separate brake drums via a cable using variable force applied by hand or with the foot which can be operated while the vehicle is moving.

Check by hand:

- When 1st ratchet is engaged, no braking force should be exerted.
- Braking with locked wheels must be possible with the parking brake.
- The parking brake must be readjusted if the operating travel at the parking brake lever is greater than ten teeth.

Check on the test stand:

1. Carry out the following conditioning prior to testing the actual effect:

- Pull the parking brake lever up to at maximum the 8th tooth three times.
- Drive the vehicle onto the brake test stand, apply the parking brake lever on the running test stand rollers until a wheel circumferential force of approximately 700 N applies (per wheel).
- Once again release the parking brake lever after 1 minute and carry out the actual brake force measurement.

2. Brake force measurement:

- Completely apply the parking brake lever.

3. Brake force assessment: The following applies to these parking brake designs:

- Minimum braking 16% of the permissible total weight or blocking limit.
- Permissible right/left deviation at maximum 50% of the corresponding, higher value.



Testing instructions for systems:

- Visual inspection whether indicator lights and warning lights light up in the instrument cluster.
- Indicator lights must go out after a maximum of 5 seconds.
- A fault has occurred if the indicator and warning lights do not light up upon switching on the ignition or if they fail to go out after approximately 2-3 seconds.

Examples of potential faults in the braking and stabilising system:

- (1) = Drive-off assistant failed (also lights up when the parking brake has been applied).
- (2) = Insufficient brake fluid quantity.
- (3) = Driving dynamics system including ABS failed.
- (4) = DSC (Dynamic Stability Control) suspension control systems failed.

Description of the parking brake

TECHNICAL INFORMATION

Follow notes for Brake testing for test stand.

TECHNICAL INFORMATION

If deviations are identified during the following check, the parking brake must be adjusted:

The parking brake test must be carried out on the dynamic brake test stand as follows:

- Release position (engine off/ignition on).
- Wheel circumferential force, right/left 300 N.

Press the parking brake button (engine off/ignition on):

- Vehicle must be evenly pulled from the brake test stand and/or the motor of the brake test stand is switched off on both sides.

Parking brake functional check

Drive vehicle onto brake test stand

Warm up the parking brake by applying it several times until the wheels block.

Check the parking brake:

- Vehicles with manual transmission: Gearshift lever in idle position.
- Vehicles with automatic transmission: Selector lever in selector lever position (N).
- Gradually apply the parking brake lever.
- Significantly measurable braking must be recorded from the 5th tooth.
- Keep applying the parking brake lever until the wheels block.
- Read the brake forces of the left and right rear wheel.

Assessment: The total of both wheel brake forces must be at minimum 16 % of the permissible total weight of the vehicle.

The maximum permitted brake force differential between right/left must not exceed 50 % (in relation to the greater brake value).

cardiagn.com

1.4.1 Parking brake: Effect

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Brake actuation during the check on a brake test stand.

Fault determination according to EG PTI:

Brake without effect on one side or in the event of a road test, excessive deviation of the vehicle from straight-ahead running.

Methods according to vehicle manufacturer

Refer to chapter 1.1.6 on the parking brake (electronic and mechanical), a separate system is not installed for BMW.

cardiagn.com

1.6 Antilock Brake System (ABS)

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Visual inspection and check the warning device and/or use electronic vehicle interface.

Fault determination according to EG PTI:

a)	Warning device damaged.
b)	Warning device shows system malfunction.
c)	Wheel speed sensors missing or damaged.
d)	Cable damaged.
e)	Other components missing or damaged.
f)	System outputs an errors via the electronic vehicle interface.

Methods according to vehicle manufacturer



If the indicator light flashes yellow, the ABS is switched off due to a fault. The normal braking effect is present without restrictions. If the ignition is started in the vehicle, a PRE vehicle check is automatically run.

Assessment: Serious fault (e-motor)

- The indicator light in the instrument cluster goes out shortly after starting the engine.
- The indicator light lights up permanently: DSC is switched off via the button. Switch on DSC through button. Light goes out.
- The indicator light and the brake warning light glow permanently: DSC, fault code and Dynamic Brake Control are disturbed.

Assessment: Serious fault (e-motor)

cardiagn.com

1.7 Electronic brake system (EBS)

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Visual inspection and check the warning device and/or use electronic vehicle interface.

Fault determination according to EG PTI:

a)	Warning device damaged.
b)	Warning device shows system malfunction.
c)	System outputs an error via the electronic vehicle interface.

Methods according to vehicle manufacturer:

Status 01.01.2018: not relevant to BMW Group vehicles.

cardiagn.com

1.1.13 Brake pads

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Visual inspection

Fault determination according to EG PTI:

a)	Brake pad excessively worn (minimum thickness indicator reached).
b)	Brake pad dirty (oil, grease, etc.), impaired braking effect.
c)	Brake pad missing or incorrectly mounted.

Methods according to vehicle manufacturer



The wear indicator indicates an existing defect at the brake pads.

Exception: with series F56 it may be that no wear sensor has been installed. In this case carry out a visual inspection.

cardiagn.com

1.1.14 Brake drums, brake discs

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Visual inspection

Fault determination according to EG PTI:

a)	Brake drum or brake disc worn or severely worn, with excessive formation of grooves, component cracked, unsafe or fractured.
b)	Brake drum or brake disc dirty (oil, grease, etc.). Impaired braking effect.
c)	Brake drum or brake disc missing.
d)	Armature plate unsafe.

Methods according to vehicle manufacturer:

Minimum brake disc thickness

Test specification § 29 limit value for brake disc thickness:

- BMW, MINI and Rolls-Royce vehicles: **Nominal dimension minus** 2.4 mm
- BMW M GmbH vehicles (perforated brake disc): **Nominal dimension minus** 1.6 mm. This limit dimensions is also applicable to perforated brake discs which are fitted on BMW AG vehicles as optional accessories! This limit value does not apply to carbon ceramic brakes.
- **Minimum thickness of brake pads:** 3 mm**.** This corresponds to when the brake pad wear indicator initially lights up and applies to all BMW Group vehicles.

Falling below the aforementioned limit value must be assessed as 'significant damage' ("EM")!

Brake disc dimensions with 08.6 mm thickness

- 280x8.6

Brake disc dimensions with 10 mm thickness

- 259x10
- 280x10
- 296X10

Brake disc dimensions with 11 mm thickness

- 290X11

Brake disc dimensions with 14 mm thickness

- 312x14

Brake disc dimensions with 19 mm thickness

- 330x19

Brake disc dimensions with 20 mm thickness

cardiagn.com

- 280x20
- 300X20
- 320x20
- 324x20
- 330X20

Brake disc dimensions with 22 mm thickness

- 200x22
- 280x22
- 282X22
- 284X22
- 294x22
- 300X22

Brake disc dimensions with 24 mm thickness

- 300x24
- 307x24
- 312x24
- 330x24
- 345x24
- 370X24
- 385x24
- 396X24

Brake disc dimensions with 26 mm thickness

- 396x26

Brake disc dimensions with 28 mm thickness

- 328x28
- 380X28
- 398x28

Brake disc dimensions with 29 mm thickness

- 340x29

Brake disc dimensions with 30 mm thickness

- 332x30
- 335X30
- 340x30
- 348x30
- 370x30
- 380X30
- 402x30

Brake disc dimensions with 36 mm thickness

cardiagn.com

- 348x36
- 365x36
- 374x36
- 385x36
- 395x36
- 400X36
- 410X36

Brake disc dimensions with 38 mm thickness

- 400X38
- 400x38
- 410x38

Possible brake disc defects:



Figure shows faulty brake discs due to scoring.

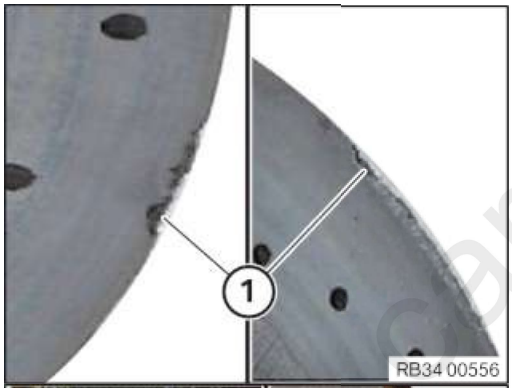
Figure shows faulty brake discs due to corrosion.





Figure shows faulty brake discs due to corrosion.

Potential carbon ceramic brake faults:



Sample image for flaking that is OK.



Sample image for flaking that is not OK (1)

Example fault patterns of edge flaking on the outer friction ring diameter due to improper handling = not OK → renew component!

cardiagn.com

5.2.2 Wheels

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Visual inspection of both sides of each wheel while the vehicle is positioned over an inspection pit or on a vehicle lift.

Fault determination according to EG PTI:

a)	Fracture or faulty weld.
b)	Rim rings mounted incorrectly. Danger of releasing!
c)	Wheel severely deformed or worn. Secure mounting on the wheel hub impaired; secure mounting of the tyre impaired.
d)	Wheel size, design, or wheel type not as per regulations or not compatible so that road safety is impaired.

Methods according to vehicle manufacturer

The corresponding PDF files are on the AOS portal **https://aos.bmwgroup.com/start**.

The files have been saved in **Application** - **AIR** - **START** - **Wheel/tyre+combinations (view document)**.

Now click the corresponding series (left-hand side). Available documents appear on the right-hand side.

cardiagn.com

Cosmetic repairs on wheel rims

Cost-effectiveness of the repairs has been checked.

Arrangement of wheel rims

Type	Repair options
Cast aluminium wheel	see Point 2
Cast aluminium wheel (machine-polished)	see Point 3
Carbon-fibre wheel rim	see Point 4

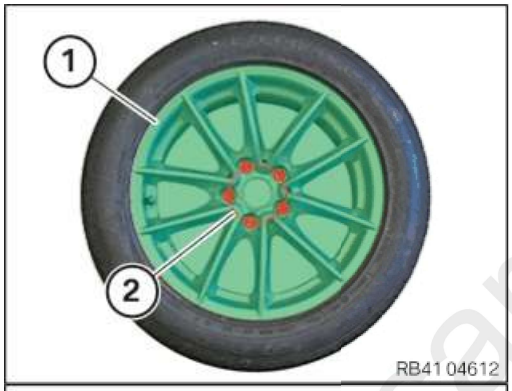
Cast aluminium rim

The rim must be replaced if damaged:

- All types of deformations
- All types of cracks
- All damage deeper than 1 mm of aluminium
- All damages on the inner surface of the wheel rim and in the rim base
- The radial runout and lateral runout prior to preparation exceed the production tolerance of 0.3 mm

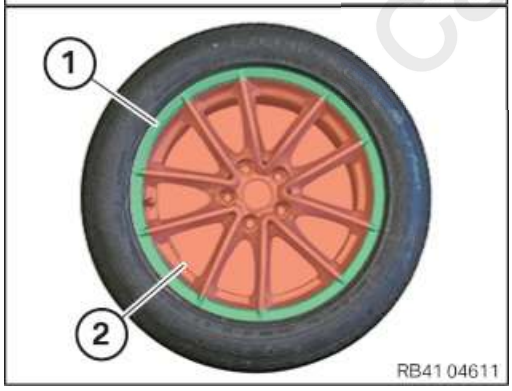
It is possible to repair the following damage:

- Maximum depth of damage to aluminium 1 mm
- The distance of the damage from the outer rim edge must not exceed 30 mm



Paintwork damage in area (1) can be repaired with paintwork.

Paintwork is not permitted in area (2).



In area (1) a repair to the aluminium up to a depth of 1 mm is allowed.

The wheel rim must be replaced if there is damage to the aluminium in area (2).

Repair procedure for cast aluminium wheel rim

1 – Preparing the wheel rim

cardiagn.com

- Dismount tyres.
- Clean the aluminium rim with a steam-jet cleaner.
- Dry the aluminium rim.
- Pre-grind the aluminium rim (break sharp edges with a grain P180 grinding wheel).
- Blow off the aluminium rim.
- Clean damaged areas extensively with silicone remover.

General information:



CAUTION

Materials harmful to health.

Health risks in the event of contact with substances that are harmful to health!

- Observe and comply with the Safety Information on the containers and the notes on the manufacturer's safety data sheet.
- Conduct all work in appropriate personal protective equipment only.

Putty S1

Processing time 20 °C	90 min
Processing time 30 °C	60 min
Age-hardening duration 60 °C	60 min
Storage	15 °C ... 25 °C
Durability (note the expiration date on the cartridge)	12 Monate

The barrel can be squeezed out with a commercially available cartridge press. Only use cartridge presses with a piston rod.

2 – Repairing the wheel rim

2 – Prepare surface for application of body filler

- Grind surface to a metallic bright-finish.

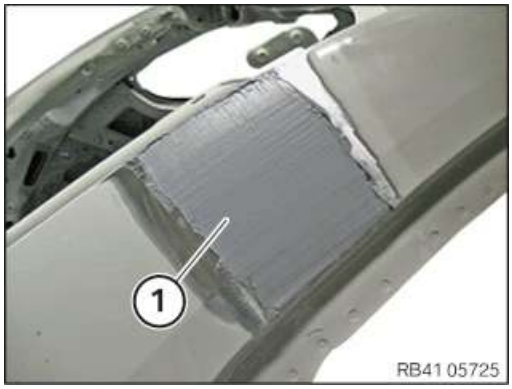
  For steel sheet, use grain 80.

  With aluminium sheet use grain 180.

  The surface must be clean, dry and free from grease.
- Clean surface with solvent cleaner R2 and leave to dry for 5 minutes.
- Clean surface with solvent cleaner R1 and leave to dry for 2-3 minutes.

2 – Apply body filler

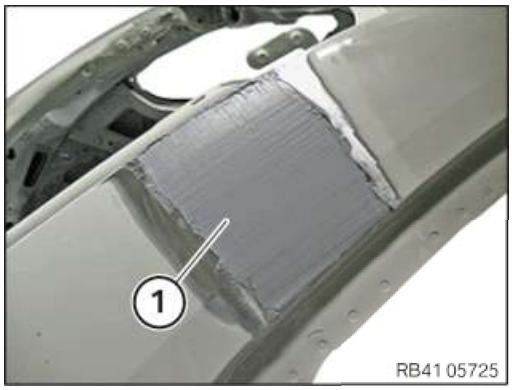
cardiagn.com



- Fill area (1) with body filler S1.

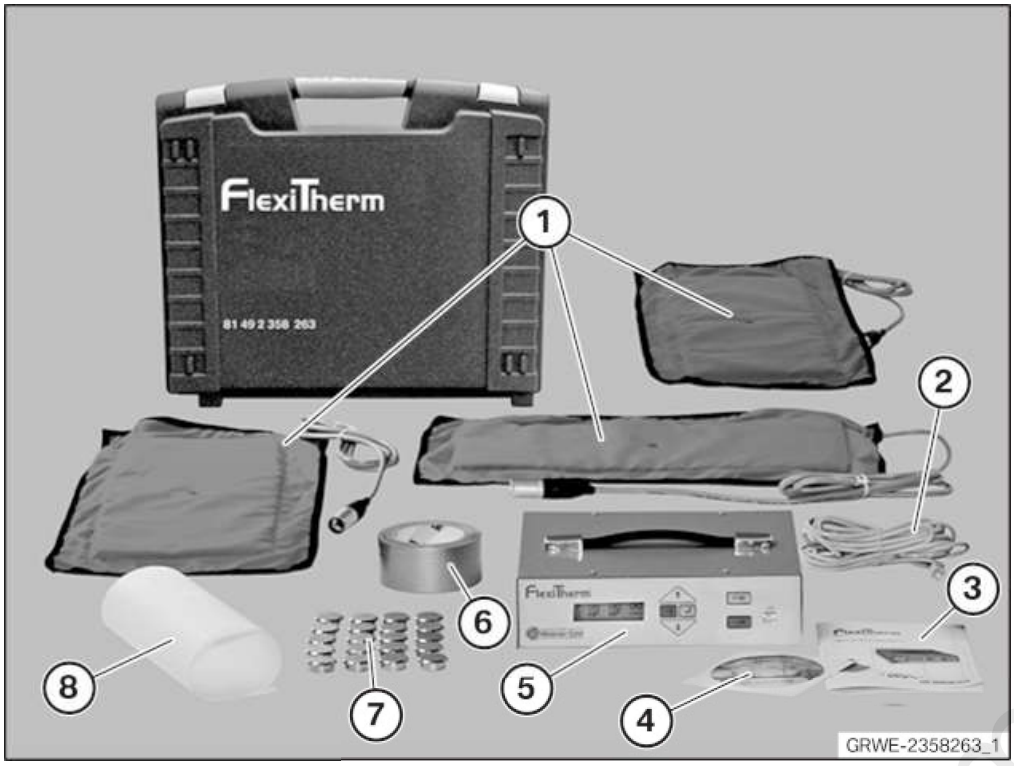
  Apply excess body filler S1.
- If possible, apply body filler S1 in one go to avoid air bubbles.

2 – Cure body filler



- Cure body filler S1.

cardiagn.com



TECHNICAL

Optionally, various devices can be used.

- Cure body filler S1 with “FlexiTherm” heater pad system.
- Please comply with instructions in Owner's Handbook.

  Select program in the control unit (5).

  The control unit autonomously controls and regulates the temperature of each individual heating mat (1).

  These are separately activated. The temperature sensor is located on the inside (red side).

  The heating mats may only be used in connection with the anti-adhesive paper (8).

  For trouble-free temperature measurements, the sensor must always be on the body filler (separated by anti-adhesive paper).

- Cure body filler S1 with infra-red heater.

RISK OF

Damage due to overheating

When using temperature-controlled infrared radiators, damage to adhesive bonds, paint and vehicle components

cardiagn.com



can occur when drying spatula and filler. The thermometers integrated in the infrared radiator only function reliably on large, even surfaces. On small surfaces such as C-pillars or sills, often only a colder, adjacent area is measured. This leads to actual surface temperatures of up to 130 °C, although only 70 °C is set on the infrared radiator. When the rear side walls are partially replaced by bonding and riveting, these high temperatures can lead to a visible pattern in the area of the joint.

- Check the surface temperatures on small component surfaces during the drying process with an external thermometer. The general rule is: The surface temperatures must not exceed 85°C.

- When the infrared heater is used for the first time, the correct distances for the desired temperatures must be determined.

cardiagn.com

Switch the infra-red heater on and change the distance until the surface temperature of the body filler no longer changes for a period of 2 min.

Measure temperature using an optical thermometer.

If optical thermometers are used (Epsilon value 0.92-0.95), the heater must be switched off briefly during the measurement.

Record the measurement

- Standard optical thermometers can be used to measure surface temperatures.



2 – Work body filler

CAUTION

Grinding dust when grinding components.

Hazardous to health!

- Directly draw off the grinding dust.
- Ensure adequate ventilation.
- Conduct all work in appropriate personal protective equipment only.

- Wear a fine dust mask with protection class P2-P3.
- Sand body filler S1 using a machine after cooling to 25 °C.

  Maximum permissible layer thickness after sanding is 5 mm.

  For steel sheet, use grain 80.

  With aluminium sheet use grain 180.
- Pores and faulty spots that become visible after grinding the surface must be closed with polyester filler (BMW Colour system).

  Use a drill bit with Ø40.2 mm. Turn the drill by hand to expand the pores in v shape. by t Fill cavities with polyester filler.
- Clean surface with solvent cleaner R2 and leave to dry for 5 minutes.
- Clean surface with solvent cleaner R1 and leave to dry for 2-3 minutes.

3 – Painting the wheel rim

- Pre-grind to apply filler (grain P220 grinding wheel or superfine soft pad).
- Blow off the aluminium rim.
- Clean the aluminium rim with silicone remover.
- Mask the aluminium rim, rim base and contact surface of the hub.
- Mask the rear side of the rim flange.
- Apply the filler.
- Dry the filler.
- Grind the filler (grain P400 grinding wheel).
- Blow off the aluminium rim.
- Clean the aluminium rim with hydro cleaner.
- Mask the screw holes.
- Clean the aluminium rim before applying the base coat.
- Apply the base coat.
- Dry the base coat.
- Apply the clear coat.
- Dry the clear coat.

cardiagn.com

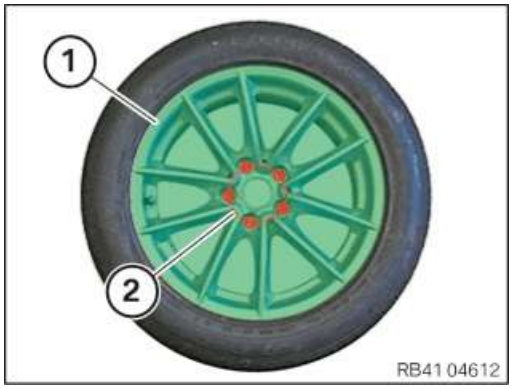
Cast aluminium wheel rim (machine-polished)

The rim must be replaced if damaged:

- All types of deformations
- All types of cracks
- All damage deeper than 1 mm of aluminium
- All damages on the inner surface of the wheel rim and in the rim base
- The radial runout and lateral runout prior to preparation exceed the production tolerance of 0.3 mm

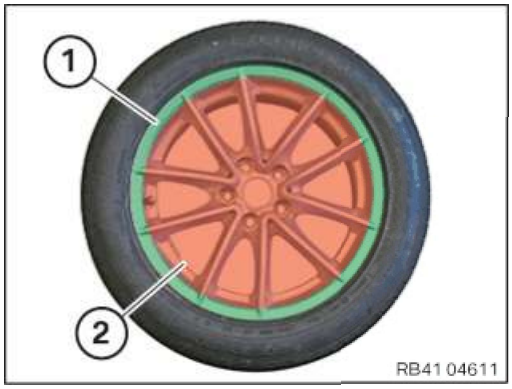
No cosmetic repairs to aluminium are allowed.

Only the clear coating may be repaired on the entire front side of the wheel rim of diamond polished cast aluminium wheels.



Paintwork damage in area (1) can be repaired with paintwork.

Paintwork is not permitted in area (2).



In area (1) damage to aluminium up to a depth of 1 mm is permissible.

For technical reasons, the rim must not be replaced.

The wheel rim must be replaced if there is damage to the aluminium in area (2).

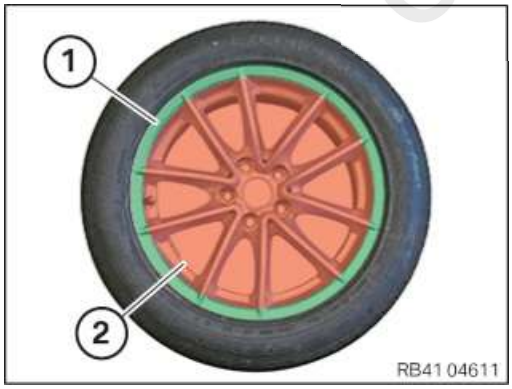
Carbon fibre wheel rims

No cosmetic repairs on carbon fibre wheel rims are permitted.

Assessment of damage to carbon fibre wheel rim

The wheel rim must be replaced in the event of the following damage:

- All types of deformations
- All types of cracks
- All damages greater than 1 mm depth
- The radial run-out and lateral run-out exceed the production tolerance of 0.3 mm

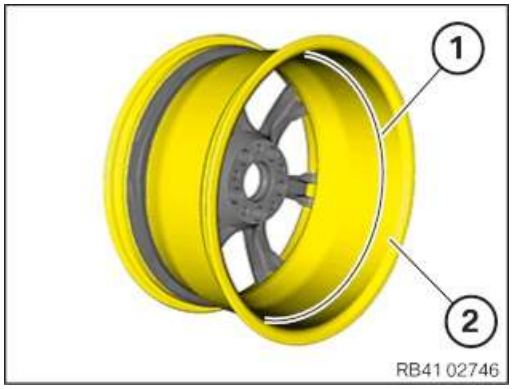


In area (1) damage up to a depth of 1 mm is permissible.

The wheel rim must not be replaced for technical reasons.

The rim will need to be replaced if there is damage in area (2).

cardiagn.com



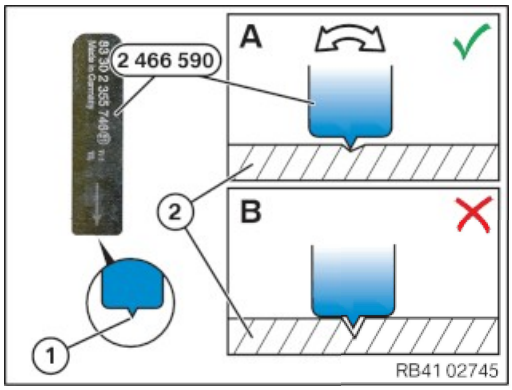
Radial scratches (1) on the interior (2) of the rim are permissible up to a depth of 0.4 mm.

The wheel rim must not be replaced for technical reasons.

The interior of the rim (2) can be coated with temperature-resistant matt paint.

The rim will need replacing if the depth of the scratches exceeds 0.4 mm.

4 – Determining depth of scratch



- Gauge has a test probe (1) with a height of 0.4 mm.
- If the test probe sits up at the deepest point of the scratch (figure A), it can be moved to the left and right. The scratch is less than 0.4 mm deep.
- If the test probe dips so deeply into the scratch that the gauge sits flat (figure B), the scratch is deeper than 0.4 mm and the part is damaged.

Additional Information

Overview of Special Tools

Overview Technical Data

Putty S1

Processing time 20 °C	90 min
Processing time 30 °C	60 min
Age-hardening duration 60 °C	60 min
Storage	15 °C ... 25 °C
Durability (note the expiration date on the cartridge)	12 Monate

cardiagn.com

5.2.3 Tyres

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Visual inspection of the entire tyre either while rotating the wheel when it has been lifted from the floor and the vehicle has been positioned over an inspection pit or on a vehicle lift, or when rolling the vehicle forwards and backwards over an inspection pit.

Fault determination according to EG PTI:

a)	Tyre size, load-carrying capacity, approval symbol or speed category not as per regulationsß1, so that road safety is impaired. Insufficient load-carrying capacity or speed category for the actual use, tyre touches other immovable vehicle components, which affects the driving safety.
b)	Differently sized tyres on the same axle or used as twin tyres.
c)	Tyres with different design (radial/diagonal tyres) installed on the same axle.
d)	Tyre severely damaged or cut, cord visible or damaged.
e)	Tread depth of the tyres: wear indicator becomes visible, tyre tread depth not as per regulationsß1.
f)	Tyre chafing on other components (flexible splash guards). Tyres rub on other components (driving safety not affected).
g)	Recut tyres not as per regulationsß1, cord protective layer impaired.
h)	Tyre pressure monitoring system faulty or obviously insufficient tyre pressure, evidently not suitable for operation.

Methods according to vehicle manufacturer

In principle, every BMW AG vehicle is equipped with tyre pressure control as standard.

The corresponding PDF files can be found on the **AOS portal** https://aos.bmwgroup.com/start.

cardiagn.com

Cosmetic repairs on wheel rims

Cost-effectiveness of the repairs has been checked.

Arrangement of wheel rims

Type	Repair options
Cast aluminium wheel	see Point 2
Cast aluminium wheel (machine-polished)	see Point 3
Carbon-fibre wheel rim	see Point 4

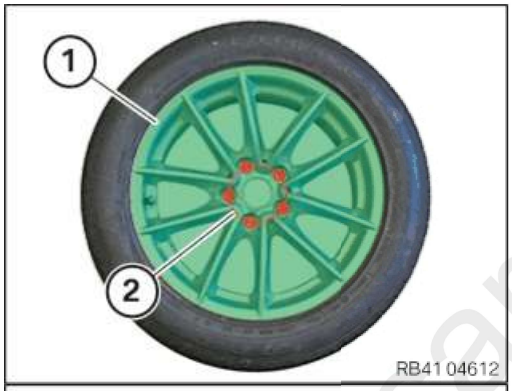
Cast aluminium rim

The rim must be replaced if damaged:

- All types of deformations
- All types of cracks
- All damage deeper than 1 mm of aluminium
- All damages on the inner surface of the wheel rim and in the rim base
- The radial runout and lateral runout prior to preparation exceed the production tolerance of 0.3 mm

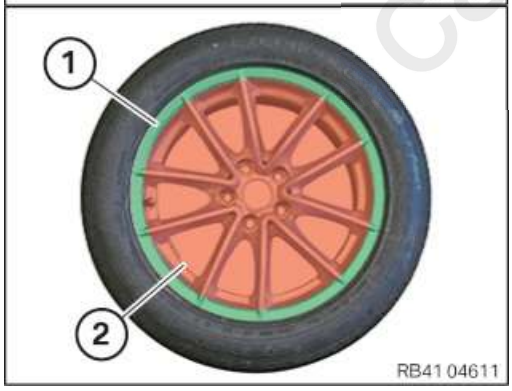
It is possible to repair the following damage:

- Maximum depth of damage to aluminium 1 mm
- The distance of the damage from the outer rim edge must not exceed 30 mm



Paintwork damage in area (1) can be repaired with paintwork.

Paintwork is not permitted in area (2).



In area (1) a repair to the aluminium up to a depth of 1 mm is allowed.

The wheel rim must be replaced if there is damage to the aluminium in area (2).

Repair procedure for cast aluminium wheel rim

1 – Preparing the wheel rim

cardiagn.com

- Dismount tyres.
- Clean the aluminium rim with a steam-jet cleaner.
- Dry the aluminium rim.
- Pre-grind the aluminium rim (break sharp edges with a grain P180 grinding wheel).
- Blow off the aluminium rim.
- Clean damaged areas extensively with silicone remover.

General information:



CAUTION

Materials harmful to health.

Health risks in the event of contact with substances that are harmful to health!

- Observe and comply with the Safety Information on the containers and the notes on the manufacturer's safety data sheet.
- Conduct all work in appropriate personal protective equipment only.

Putty S1

Processing time 20 °C	90 min
Processing time 30 °C	60 min
Age-hardening duration 60 °C	60 min
Storage	15 °C ... 25 °C
Durability (note the expiration date on the cartridge)	12 Monate

The barrel can be squeezed out with a commercially available cartridge press. Only use cartridge presses with a piston rod.

2 – Repairing the wheel rim

2 – Prepare surface for application of body filler

- Grind surface to a metallic bright-finish.

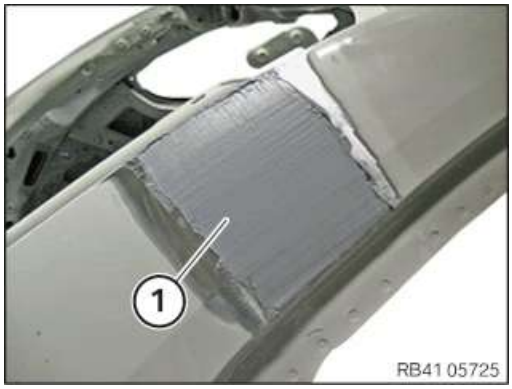
  For steel sheet, use grain 80.

  With aluminium sheet use grain 180.

  The surface must be clean, dry and free from grease.
- Clean surface with solvent cleaner R2 and leave to dry for 5 minutes.
- Clean surface with solvent cleaner R1 and leave to dry for 2-3 minutes.

2 – Apply body filler

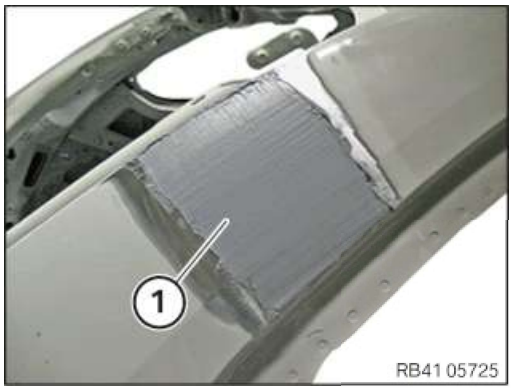
cardiagn.com



- Fill area (1) with body filler S1.

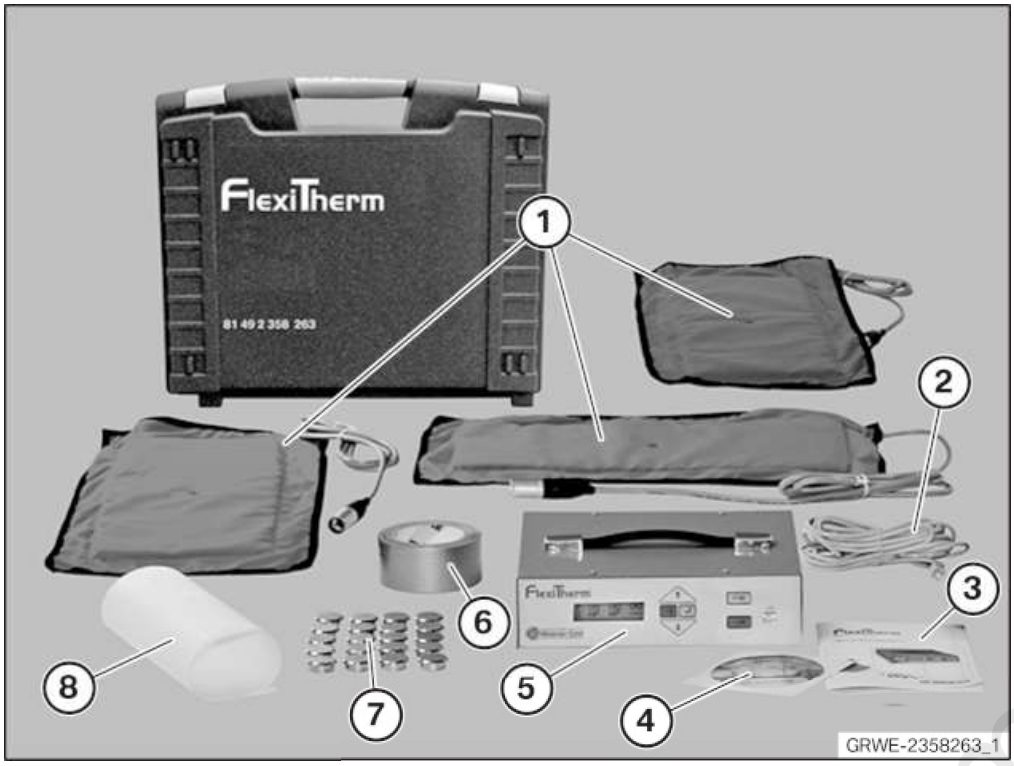
  Apply excess body filler S1.
- If possible, apply body filler S1 in one go to avoid air bubbles.

2 – Cure body filler



- Cure body filler S1.

cardiagn.com



TECHNICAL

Optionally, various devices can be used.

- Cure body filler S1 with “FlexiTherm” heater pad system.
- Please comply with instructions in Owner's Handbook.

  Select program in the control unit (5).

  The control unit autonomously controls and regulates the temperature of each individual heating mat (1).

  These are separately activated. The temperature sensor is located on the inside (red side).

  The heating mats may only be used in connection with the anti-adhesive paper (8).

  For trouble-free temperature measurements, the sensor must always be on the body filler (separated by anti-adhesive paper).

- Cure body filler S1 with infra-red heater.

RISK OF

Damage due to overheating

When using temperature-controlled infrared radiators, damage to adhesive bonds, paint and vehicle components

cardiagn.com



can occur when drying spatula and filler. The thermometers integrated in the infrared radiator only function reliably on large, even surfaces. On small surfaces such as C-pillars or sills, often only a colder, adjacent area is measured. This leads to actual surface temperatures of up to 130 °C, although only 70 °C is set on the infrared radiator. When the rear side walls are partially replaced by bonding and riveting, these high temperatures can lead to a visible pattern in the area of the joint.

- Check the surface temperatures on small component surfaces during the drying process with an external thermometer. The general rule is: The surface temperatures must not exceed 85°C.

- When the infrared heater is used for the first time, the correct distances for the desired temperatures must be determined.

cardiagn.com

Switch the infra-red heater on and change the distance until the surface temperature of the body filler no longer changes for a period of 2 min.

Measure temperature using an optical thermometer.

If optical thermometers are used (Epsilon value 0.92-0.95), the heater must be switched off briefly during the measurement.

Record the measurement

- Standard optical thermometers can be used to measure surface temperatures.



2 – Work body filler

CAUTION

Grinding dust when grinding components.

Hazardous to health!

- Directly draw off the grinding dust.
- Ensure adequate ventilation.
- Conduct all work in appropriate personal protective equipment only.

- Wear a fine dust mask with protection class P2-P3.
- Sand body filler S1 using a machine after cooling to 25 °C.

  Maximum permissible layer thickness after sanding is 5 mm.

  For steel sheet, use grain 80.

  With aluminium sheet use grain 180.
- Pores and faulty spots that become visible after grinding the surface must be closed with polyester filler (BMW Colour system).

  Use a drill bit with Ø40.2 mm. Turn the drill by hand to expand the pores in v shape. by t Fill cavities with polyester filler.
- Clean surface with solvent cleaner R2 and leave to dry for 5 minutes.
- Clean surface with solvent cleaner R1 and leave to dry for 2-3 minutes.

3 – Painting the wheel rim

- Pre-grind to apply filler (grain P220 grinding wheel or superfine soft pad).
- Blow off the aluminium rim.
- Clean the aluminium rim with silicone remover.
- Mask the aluminium rim, rim base and contact surface of the hub.
- Mask the rear side of the rim flange.
- Apply the filler.
- Dry the filler.
- Grind the filler (grain P400 grinding wheel).
- Blow off the aluminium rim.
- Clean the aluminium rim with hydro cleaner.
- Mask the screw holes.
- Clean the aluminium rim before applying the base coat.
- Apply the base coat.
- Dry the base coat.
- Apply the clear coat.
- Dry the clear coat.

cardiagn.com

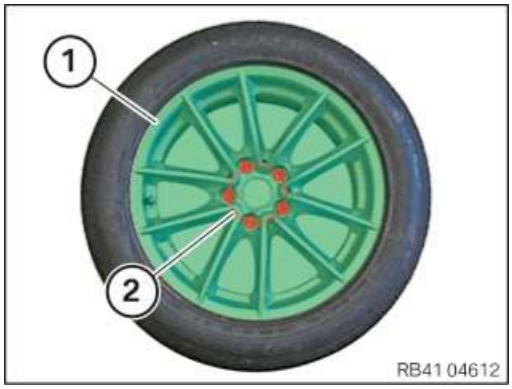
Cast aluminium wheel rim (machine-polished)

The rim must be replaced if damaged:

- All types of deformations
- All types of cracks
- All damage deeper than 1 mm of aluminium
- All damages on the inner surface of the wheel rim and in the rim base
- The radial runout and lateral runout prior to preparation exceed the production tolerance of 0.3 mm

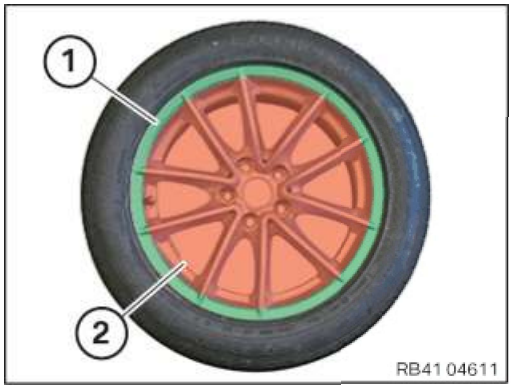
No cosmetic repairs to aluminium are allowed.

Only the clear coating may be repaired on the entire front side of the wheel rim of diamond polished cast aluminium wheels.



Paintwork damage in area (1) can be repaired with paintwork.

Paintwork is not permitted in area (2).



In area (1) damage to aluminium up to a depth of 1 mm is permissible.

For technical reasons, the rim must not be replaced.

The wheel rim must be replaced if there is damage to the aluminium in area (2).

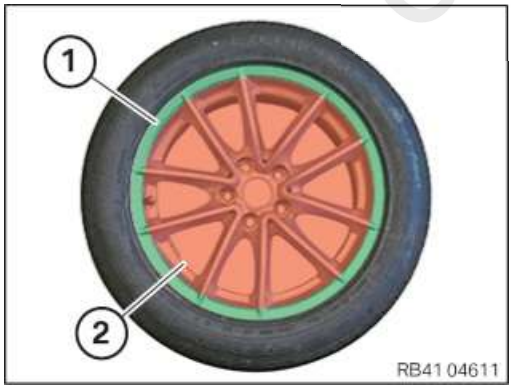
Carbon fibre wheel rims

No cosmetic repairs on carbon fibre wheel rims are permitted.

Assessment of damage to carbon fibre wheel rim

The wheel rim must be replaced in the event of the following damage:

- All types of deformations
- All types of cracks
- All damages greater than 1 mm depth
- The radial run-out and lateral run-out exceed the production tolerance of 0.3 mm

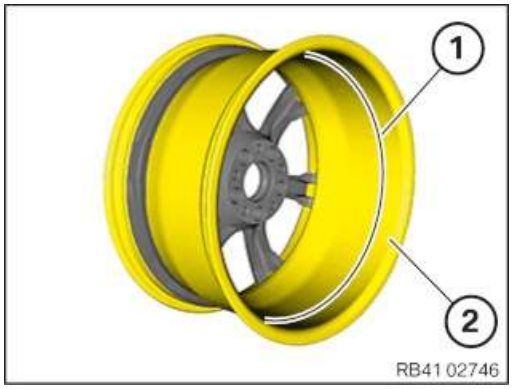


In area (1) damage up to a depth of 1 mm is permissible.

The wheel rim must not be replaced for technical reasons.

The rim will need to be replaced if there is damage in area (2).

cardiagn.com



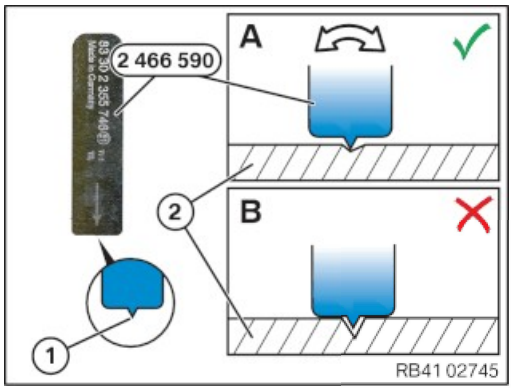
Radial scratches (1) on the interior (2) of the rim are permissible up to a depth of 0.4 mm.

The wheel rim must not be replaced for technical reasons.

The interior of the rim (2) can be coated with temperature-resistant matt paint.

The rim will need replacing if the depth of the scratches exceeds 0.4 mm.

4 – Determining depth of scratch



- Gauge has a test probe (1) with a height of 0.4 mm.
- If the test probe sits up at the deepest point of the scratch (figure A), it can be moved to the left and right. The scratch is less than 0.4 mm deep.
- If the test probe dips so deeply into the scratch that the gauge sits flat (figure B), the scratch is deeper than 0.4 mm and the part is damaged.

Additional Information

Overview of Special Tools

Overview Technical Data

Putty S1

Processing time 20 °C	90 min
Processing time 30 °C	60 min
Age-hardening duration 60 °C	60 min
Storage	15 °C ... 25 °C
Durability (note the expiration date on the cartridge)	12 Monate

cardiagn.com

Notes on vehicle tilt (2-axle air suspension)

System-related causes (no faults)

- Control tolerance when "Ignition on" and "Engine off: ± 20 mm to nominal ride-level height (attention: at the front axle, the control variable is the mean value of the right and left ride height).
- Control tolerance when "Ignition on" and "Engine on: +/- 9 mm relative to nominal ride-level height (attention: at the front axle, the mean value of the right and left ride height applies).
- When the doors are open, an automatic level correction does not take place (an active control procedure is aborted). Level changes that are requested with buttons will not be carried out when the doors are open (level changes in progress will be interrupted).
- If the vehicle was located on a vehicle hoist and the vehicle level no longer self-corrects, move the vehicle for t > 5 s with v > 6 km/h
- Vehicle inclination can only be checked on level and horizontal ground. For technical reasons, it is not possible to adjust all wheel stations to the nominal ride-level height on uneven surfaces. For example, if the one wheel of the vehicle is on the kerb, the resulting inclination is not corrected.
- Active wheel relief mode: To relieve a depressurised tyre, the vehicle is inclined using the air suspension. This mode is linked to the tyre pressure control and is not closed until the tyre pressure control no longer detects a tyre pressure loss.

Temperature influence

The air in the spring struts is warmed by the engine heat and damper work and expands. This raises the vehicle. During the journey, ride height changes due to temperature changes in the air suspension struts are corrected. When the vehicle is stationary and switched off, these temperature effects may lead to ride height changes and inclinations that are not corrected. When the engine is hot, an after-heating effect occurs after the vehicle is stopped that causes the vehicle to first be raised slightly within the first hour and be lowered again during the cooling-down period. In extreme cases, the temperature effect on the front axle may cause the vehicle to be lowered up to 50 mm. After the vehicle is parked, the self-levelling suspension performs up to six control procedures within the first 48 h during which, depending on the system availability, an attempt is made to reduce possible inclinations by raising or lowering the vehicle to a horizontal level. The self-levelling suspension may hereby lower the vehicle to up to 40 mm below the normal level. For technical reasons, inclinations in vehicles that have been parked for lengthy periods cannot be avoided in air suspension systems. Workshops are not able to check the control functions in parked vehicles due to the system complexity.

Checking the ride height adjustment

- Adjust the vehicle to the normal level
- Read out the front left, front right, rear left and rear right ride heights via the diagnosis system
- Measure the ride height of the vehicle
- Compare the measured ride height with the nominal value
- Ride height = measured value – nominal value
- In the event of deviations > of 3 mm from the setpoint value, adjust the ride height with the diagnosis system

Possible causes of mechanical faults

- Sensor linkage reversed (sensor arms must always face outward, rear axle: connector faces inward). Refer to Repair intructions
- Sensor bracket twisted (holder in centring bore? Holder must be flush with rear axle support)
- Sensor linkage torn or bent
- Leakage (test, see below)

Possible causes of electrical faults

- Water in the connector (corroded contacts) -> exchange the sensor and connector. Sensor signal is corrupted by voltage drop. Gradual process
- Short circuit (detected by control unit and Check Control message displayed)

Check for leaks

Larger leaks can be found using the following procedure. The determination for small leaks is significantly more extensive and lengthy to exclude effects from temperature changes and axle strain. According to the specifications, the leak may reach up to 2 mm per day (constant temperature, vehicle is parked on skid-proof plates -> no axle strain).

- Park the vehicle approximately 10 - 12 H in a room with largely constant temperature (+/- 3 °C) and adjust it to the normal level. **Do not set the parking brake!**
- If the vehicle ride-level height deviates from the nominal ride-level height by more than +/- 10 mm, adjust the vehicle to the normal level again (ignition on, door open –> all doors closed, adjust level, ignition off; let the engine run in emergencies only and only for a very brief time. Do not get into the vehicle).
- Place the EHC control unit into production mode via the diagnosis and information system (deactivated level controller)
- Measure and note down the ride heights
- Leave the vehicle parked for another 10 - 12 h (constant temperature, do not move the vehicle, do not get in or out or make any other load changes)
- Measure and note down the ride heights
- If the ride heights are lower than the initial measurement by more than 10 mm at one or more wheel stations, it can be concluded that there is a leak. Leaks may occur at the air lines, the pneumatic connecting elements and the spring strut.
- After completion of the leakage test, deactivate production mode again.

cardiagn.com

6.1.3 Fuel tank and fuel lines (including heater fuel tank and lines)

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Visual inspection while the vehicle is positioned over an inspection pit or on a vehicle lift, in case of CNG systems using a leak detector.

Fault determination according to EG PTI:

Visual inspection, while the vehicle stands over a test pit or on a vehicle lift, in case of compressed natural gas systems using leakage detector.

a)	Fuel tank or lines unsafe, consequently there is a particularly high risk of fire.
b)	Escaping fuel or missing or leaking fuel filler cap: risk of fire; excessive amount of escaping hazardous fluids.
c)	Lines chafing: Lines damaged.
d)	Fuel shut-off valve (if mandatory) not operating correctly.
e)	Risk of fire from:— escaping fuel/— poorly shielded fuel tank or exhaust system/— condition of the engine compartment.
f)	CNG or hydrogen system not according to regulations. Part of the system faulty.

Methods according to vehicle manufacturer:

Exemplary overview of fuel tank sizes of BMW passenger cars, BMWi, MINI and Rolls-Royce

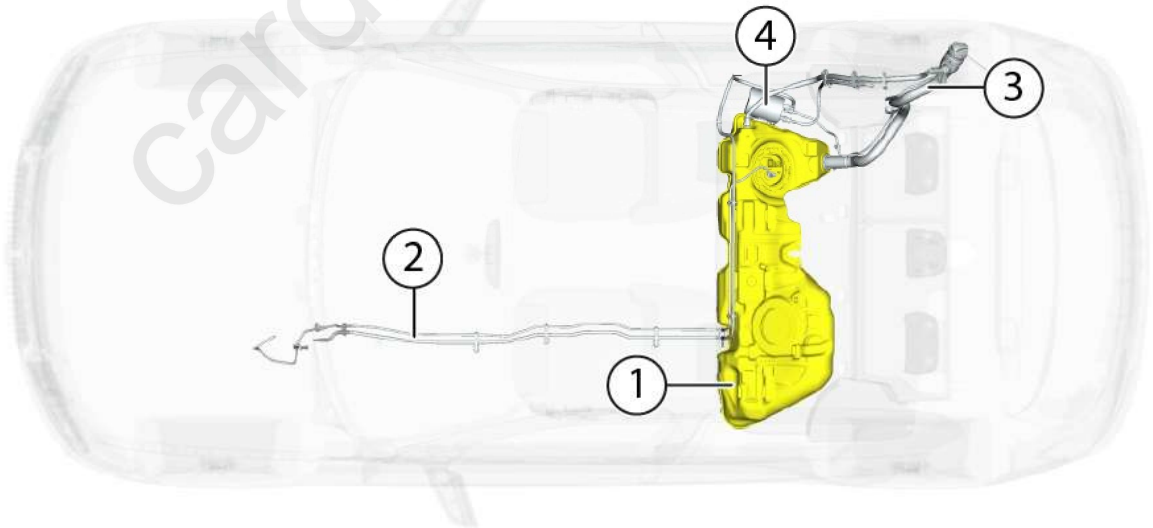
1-Series, 2-Series

1) Fuel tank

2) Fuel line

3) Fuel filler pipe

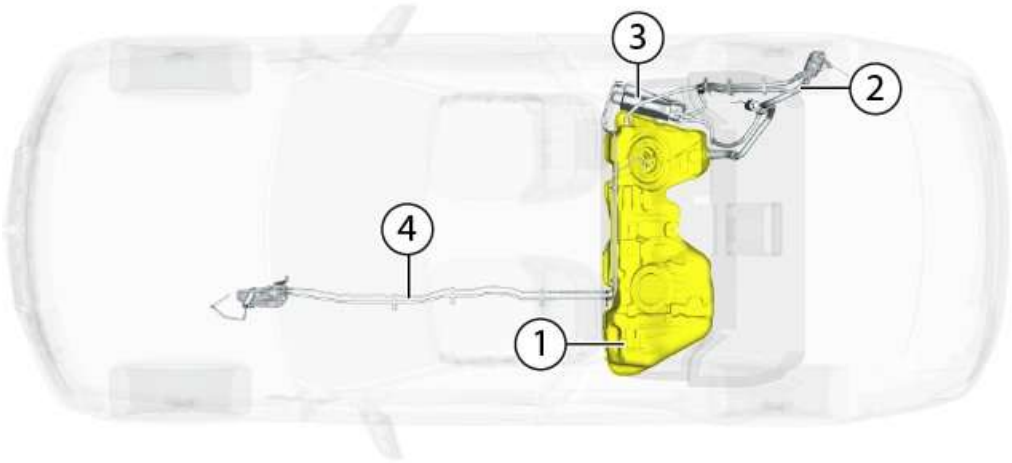
4) Carbon canister



cardiagn.com

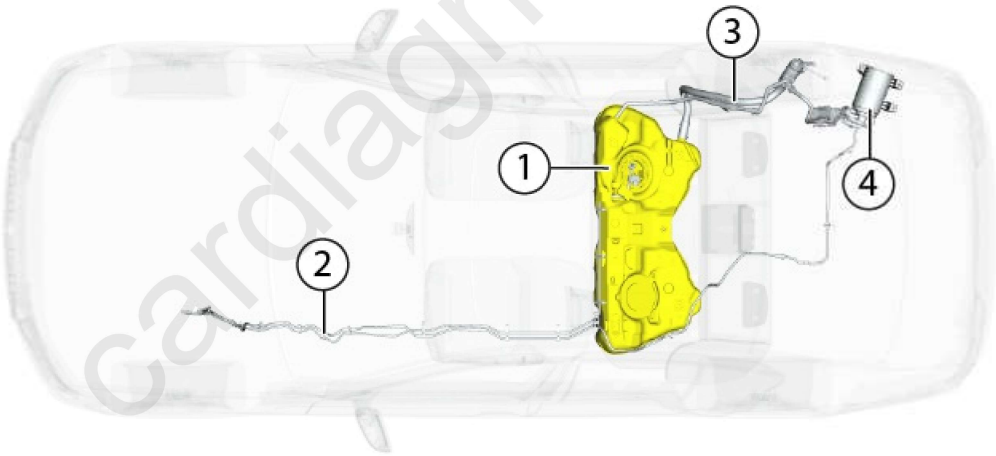
3-Series, 4-Series

1) Fuel tank
2) Fuel filler pipe
3) Carbon canister
4) Fuel line



5-Series, 6-Series

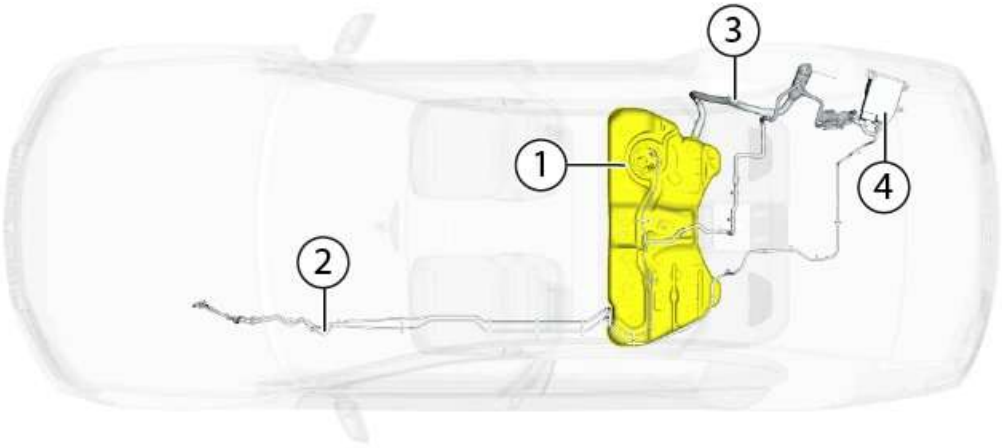
1) Fuel tank
2) Fuel line
3) Fuel filler pipe
4) Carbon canister



cardiagn.com

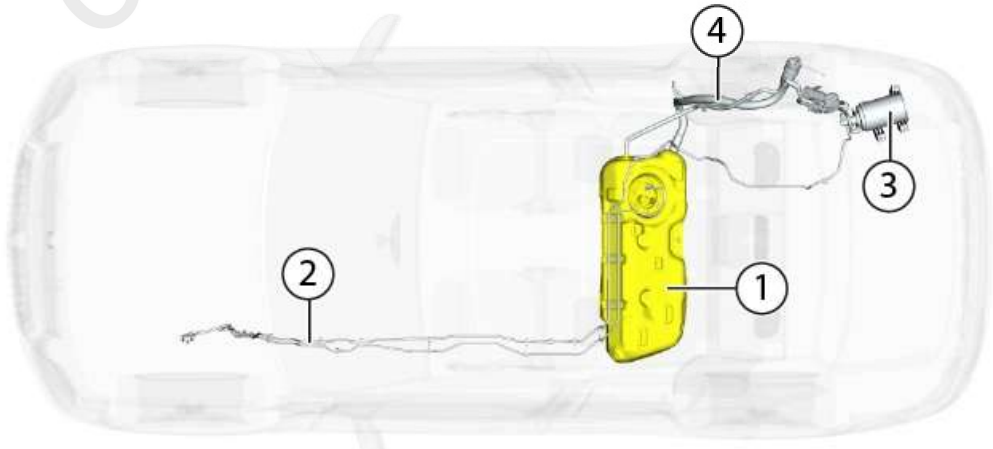
7-Series, 8-Series

1) Fuel tank
2) Fuel line
3) Fuel filler pipe
4) Carbon canister



X3/X4

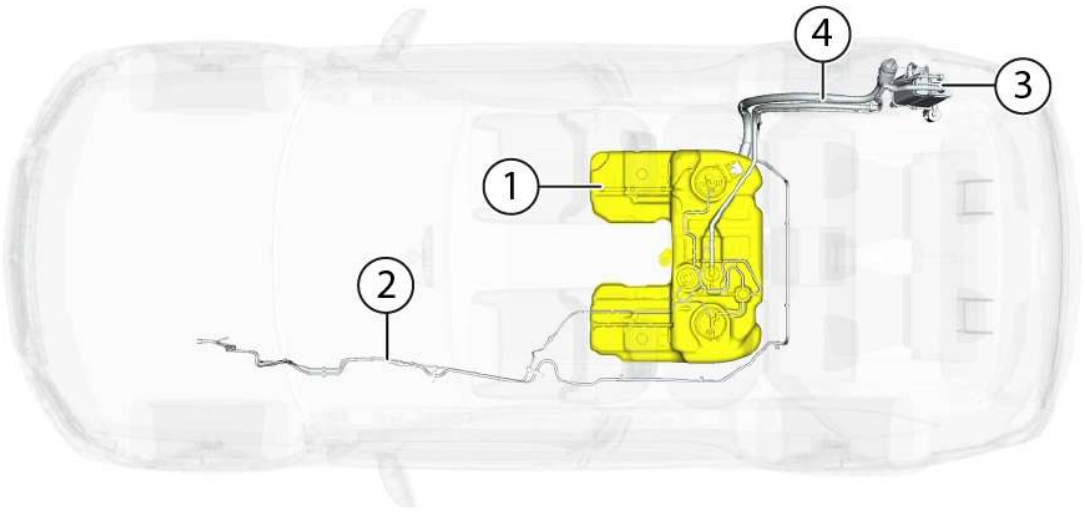
1) Fuel tank
2) Fuel line
3) Carbon canister
4) Fuel filler pipe



cardiagn.com

X5 / X6 /X7

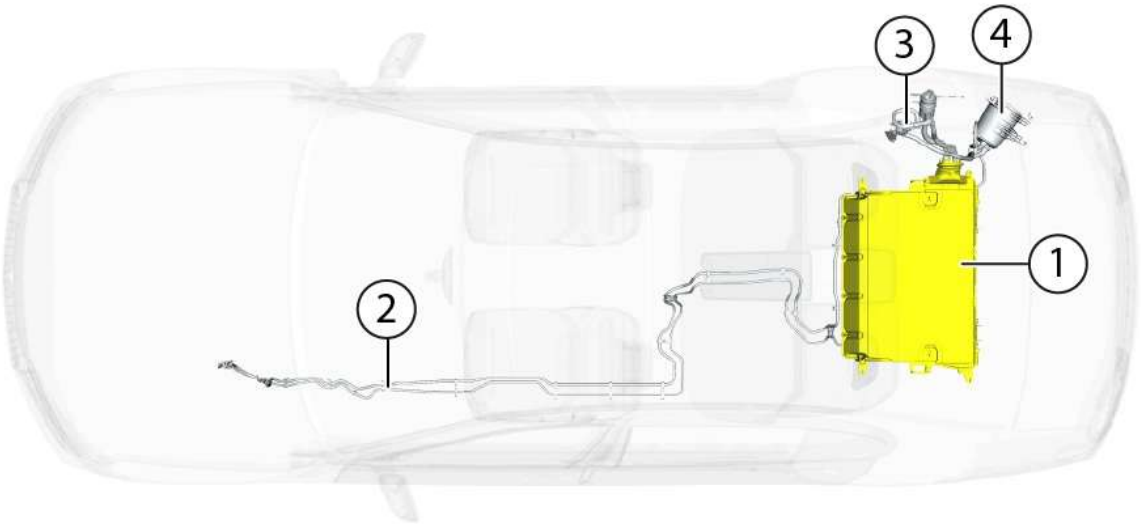
1) Fuel tank
2) Fuel line
3) Carbon canister
4) Fuel filler pipe



cardiagn.com

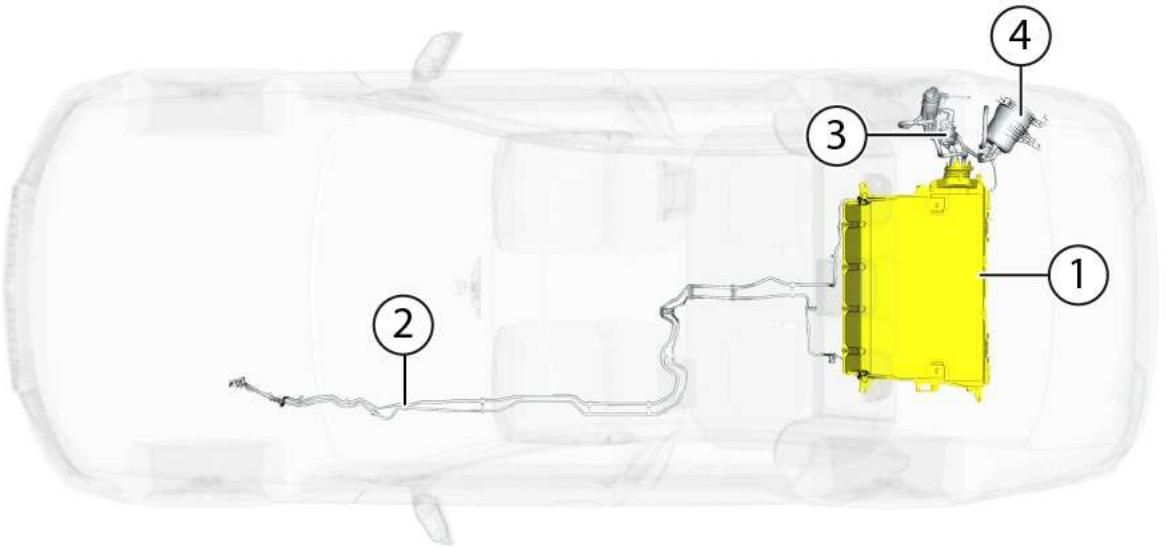
7 Series PHEV

1) Fuel tank
2) Fuel line
3) Fuel filler pipe
4) Carbon canister



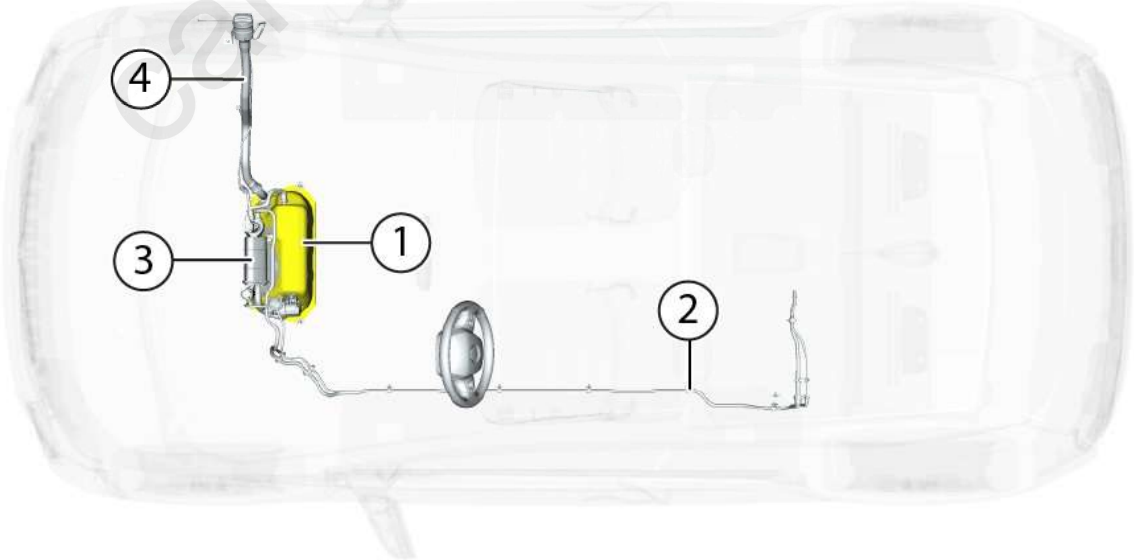
5 Series PHEV

1) Fuel tank
2) Fuel line
3) Fuel filler pipe
4) Carbon canister



I01

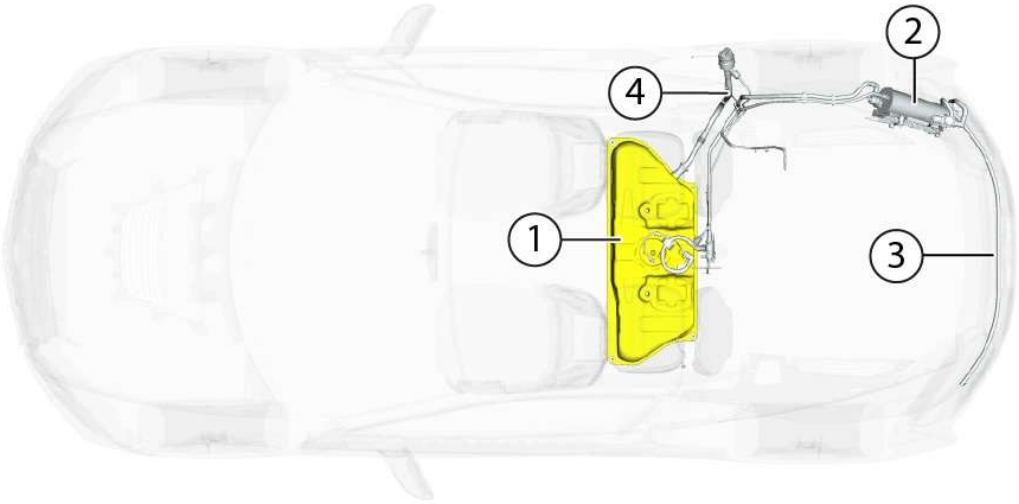
1) Fuel tank
2) Fuel line
3) Carbon canister
4) Fuel filler pipe



cardiagn.com

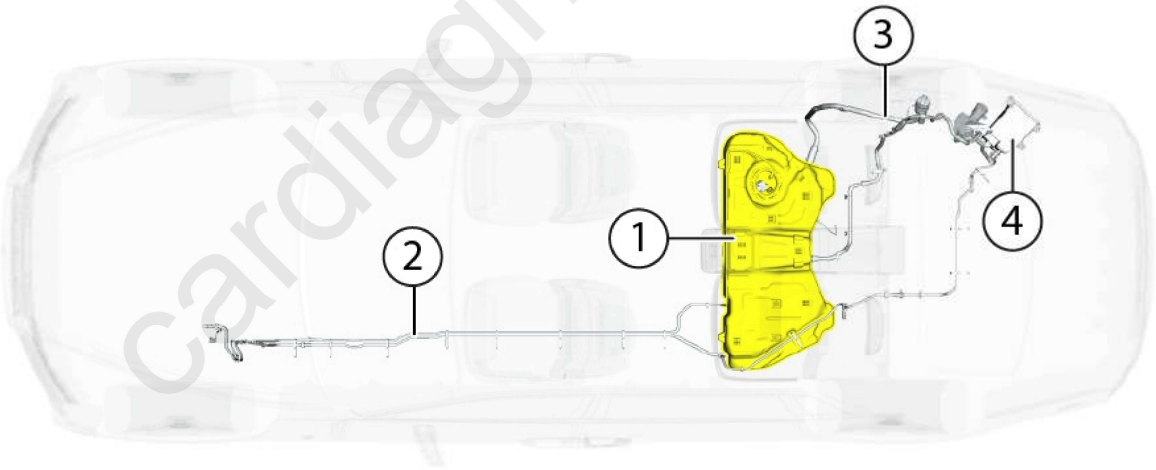
i8

1) Fuel tank
2) Carbon canister
3) Tank ventilation line
4) Fuel filler pipe



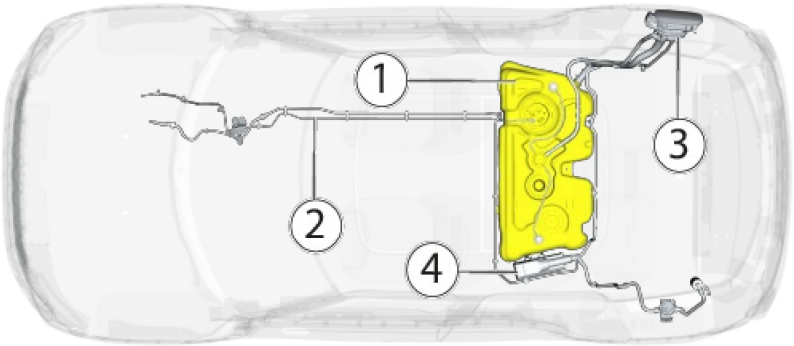
Rolls-Royce

1) Fuel tank
2) Fuel line
3) Fuel filler pipe
4) Carbon canister



MINI , X1, X2

1) Fuel tank
2) Fuel line
3) Fuel filler pipe
4) Carbon canister



cardiagn.com

Cosmetic repairs on wheel rims

Cost-effectiveness of the repairs has been checked.

Arrangement of wheel rims

Type	Repair options
Cast aluminium wheel	see Point 2
Cast aluminium wheel (machine-polished)	see Point 3
Carbon-fibre wheel rim	see Point 4

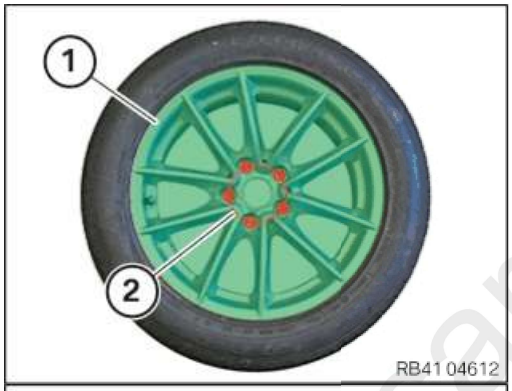
Cast aluminium rim

The rim must be replaced if damaged:

- All types of deformations
- All types of cracks
- All damage deeper than 1 mm of aluminium
- All damages on the inner surface of the wheel rim and in the rim base
- The radial runout and lateral runout prior to preparation exceed the production tolerance of 0.3 mm

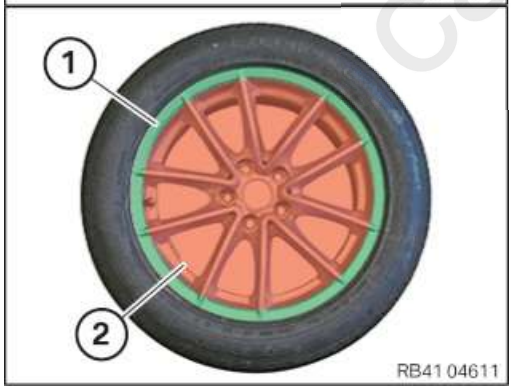
It is possible to repair the following damage:

- Maximum depth of damage to aluminium 1 mm
- The distance of the damage from the outer rim edge must not exceed 30 mm



Paintwork damage in area (1) can be repaired with paintwork.

Paintwork is not permitted in area (2).



In area (1) a repair to the aluminium up to a depth of 1 mm is allowed.

The wheel rim must be replaced if there is damage to the aluminium in area (2).

Repair procedure for cast aluminium wheel rim

1 – Preparing the wheel rim

cardiagn.com

- Dismount tyres.
- Clean the aluminium rim with a steam-jet cleaner.
- Dry the aluminium rim.
- Pre-grind the aluminium rim (break sharp edges with a grain P180 grinding wheel).
- Blow off the aluminium rim.
- Clean damaged areas extensively with silicone remover.

General information:



CAUTION

Materials harmful to health.

Health risks in the event of contact with substances that are harmful to health!

- Observe and comply with the Safety Information on the containers and the notes on the manufacturer's safety data sheet.
- Conduct all work in appropriate personal protective equipment only.

Putty S1

Processing time 20 °C	90 min
Processing time 30 °C	60 min
Age-hardening duration 60 °C	60 min
Storage	15 °C ... 25 °C
Durability (note the expiration date on the cartridge)	12 Monate

The barrel can be squeezed out with a commercially available cartridge press. Only use cartridge presses with a piston rod.

2 – Repairing the wheel rim

2 – Prepare surface for application of body filler

- Grind surface to a metallic bright-finish.

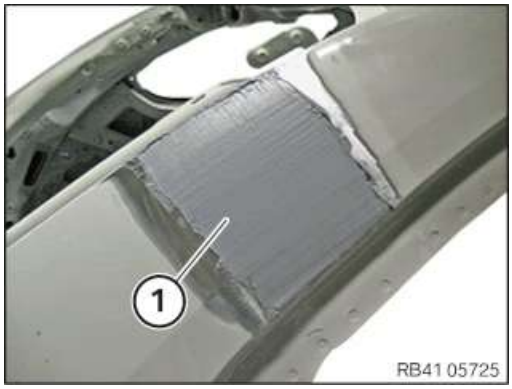
  For steel sheet, use grain 80.

  With aluminium sheet use grain 180.

  The surface must be clean, dry and free from grease.
- Clean surface with solvent cleaner R2 and leave to dry for 5 minutes.
- Clean surface with solvent cleaner R1 and leave to dry for 2-3 minutes.

2 – Apply body filler

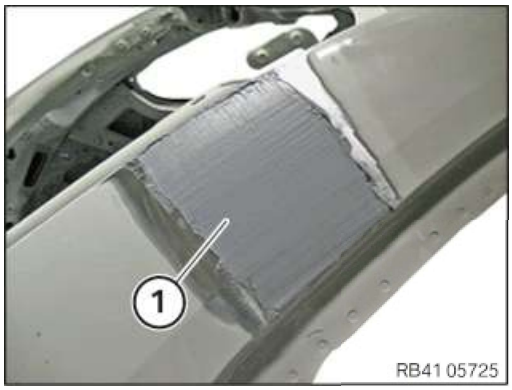
cardiagn.com



- Fill area (1) with body filler S1.

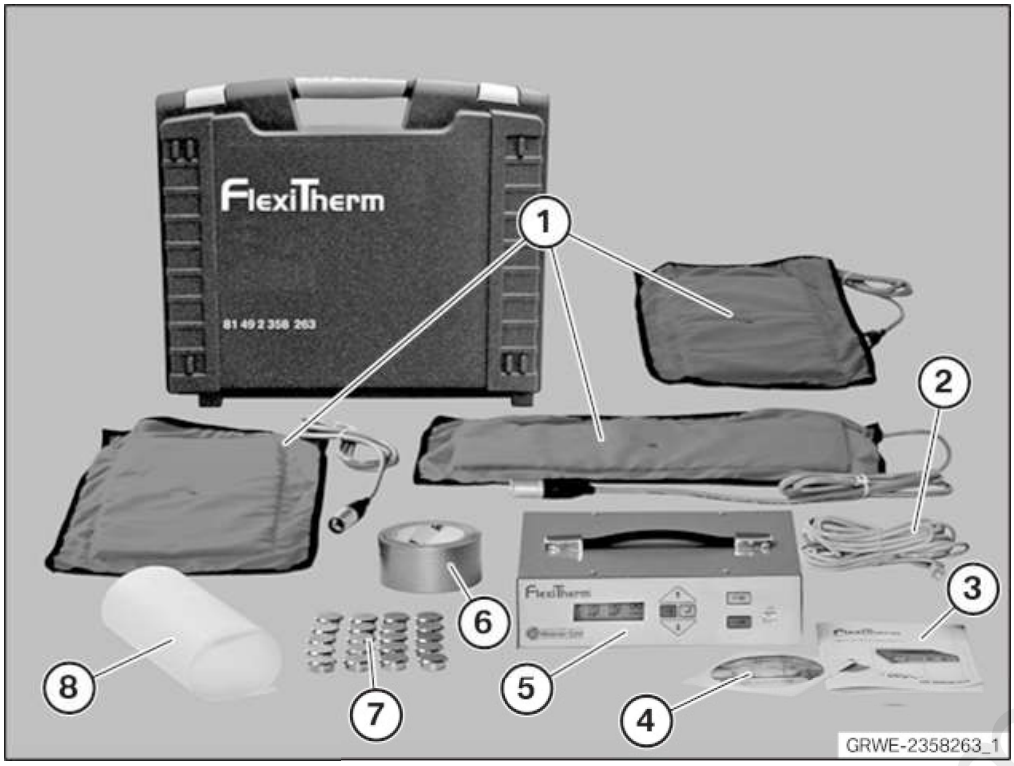
  Apply excess body filler S1.
- If possible, apply body filler S1 in one go to avoid air bubbles.

2 – Cure body filler



- Cure body filler S1.

cardiagn.com



TECHNICAL

Optionally, various devices can be used.

- Cure body filler S1 with “FlexiTherm” heater pad system.
- Please comply with instructions in Owner's Handbook.

  Select program in the control unit (5).

  The control unit autonomously controls and regulates the temperature of each individual heating mat (1).

  These are separately activated. The temperature sensor is located on the inside (red side).

  The heating mats may only be used in connection with the anti-adhesive paper (8).

  For trouble-free temperature measurements, the sensor must always be on the body filler (separated by anti-adhesive paper).

- Cure body filler S1 with infra-red heater.

RISK OF

Damage due to overheating

When using temperature-controlled infrared radiators, damage to adhesive bonds, paint and vehicle components

cardiagn.com



can occur when drying spatula and filler. The thermometers integrated in the infrared radiator only function reliably on large, even surfaces. On small surfaces such as C-pillars or sills, often only a colder, adjacent area is measured. This leads to actual surface temperatures of up to 130 °C, although only 70 °C is set on the infrared radiator. When the rear side walls are partially replaced by bonding and riveting, these high temperatures can lead to a visible pattern in the area of the joint.

- Check the surface temperatures on small component surfaces during the drying process with an external thermometer. The general rule is: The surface temperatures must not exceed 85°C.

- When the infrared heater is used for the first time, the correct distances for the desired temperatures must be determined.

cardiagn.com

Switch the infra-red heater on and change the distance until the surface temperature of the body filler no longer changes for a period of 2 min.

Measure temperature using an optical thermometer.

If optical thermometers are used (Epsilon value 0.92-0.95), the heater must be switched off briefly during the measurement.

Record the measurement

- Standard optical thermometers can be used to measure surface temperatures.



2 – Work body filler

CAUTION

Grinding dust when grinding components.

Hazardous to health!

- Directly draw off the grinding dust.
- Ensure adequate ventilation.
- Conduct all work in appropriate personal protective equipment only.

- Wear a fine dust mask with protection class P2-P3.
- Sand body filler S1 using a machine after cooling to 25 °C.

  Maximum permissible layer thickness after sanding is 5 mm.

  For steel sheet, use grain 80.

  With aluminium sheet use grain 180.
- Pores and faulty spots that become visible after grinding the surface must be closed with polyester filler (BMW Colour system).

  Use a drill bit with Ø40.2 mm. Turn the drill by hand to expand the pores in v shape. by t Fill cavities with polyester filler.
- Clean surface with solvent cleaner R2 and leave to dry for 5 minutes.
- Clean surface with solvent cleaner R1 and leave to dry for 2-3 minutes.

3 – Painting the wheel rim

- Pre-grind to apply filler (grain P220 grinding wheel or superfine soft pad).
- Blow off the aluminium rim.
- Clean the aluminium rim with silicone remover.
- Mask the aluminium rim, rim base and contact surface of the hub.
- Mask the rear side of the rim flange.
- Apply the filler.
- Dry the filler.
- Grind the filler (grain P400 grinding wheel).
- Blow off the aluminium rim.
- Clean the aluminium rim with hydro cleaner.
- Mask the screw holes.
- Clean the aluminium rim before applying the base coat.
- Apply the base coat.
- Dry the base coat.
- Apply the clear coat.
- Dry the clear coat.

cardiagn.com

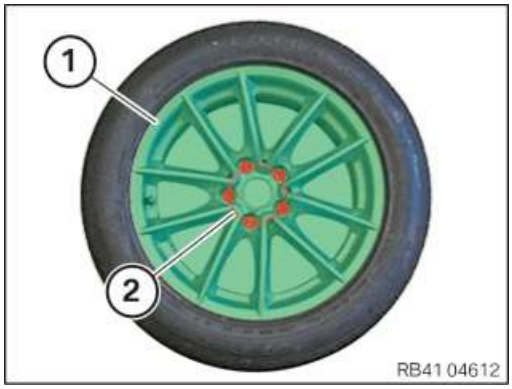
Cast aluminium wheel rim (machine-polished)

The rim must be replaced if damaged:

- All types of deformations
- All types of cracks
- All damage deeper than 1 mm of aluminium
- All damages on the inner surface of the wheel rim and in the rim base
- The radial runout and lateral runout prior to preparation exceed the production tolerance of 0.3 mm

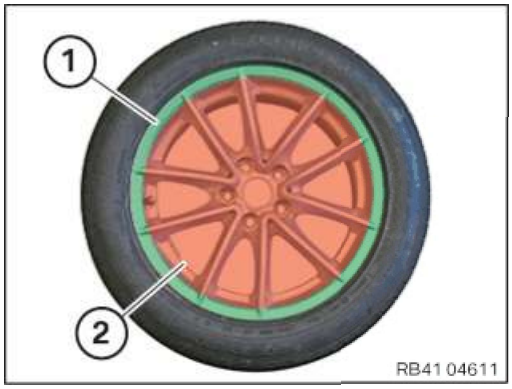
No cosmetic repairs to aluminium are allowed.

Only the clear coating may be repaired on the entire front side of the wheel rim of diamond polished cast aluminium wheels.



Paintwork damage in area (1) can be repaired with paintwork.

Paintwork is not permitted in area (2).



In area (1) damage to aluminium up to a depth of 1 mm is permissible.

For technical reasons, the rim must not be replaced.

The wheel rim must be replaced if there is damage to the aluminium in area (2).

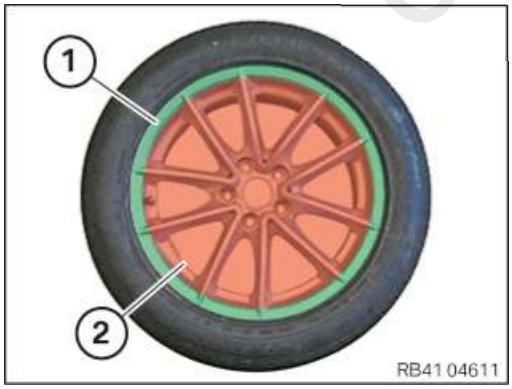
Carbon fibre wheel rims

No cosmetic repairs on carbon fibre wheel rims are permitted.

Assessment of damage to carbon fibre wheel rim

The wheel rim must be replaced in the event of the following damage:

- All types of deformations
- All types of cracks
- All damages greater than 1 mm depth
- The radial run-out and lateral run-out exceed the production tolerance of 0.3 mm

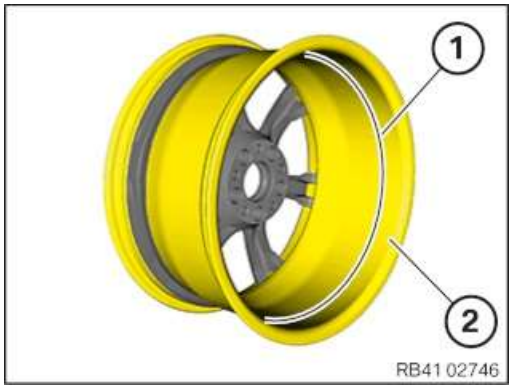


In area (1) damage up to a depth of 1 mm is permissible.

The wheel rim must not be replaced for technical reasons.

The rim will need to be replaced if there is damage in area (2).

cardiagn.com



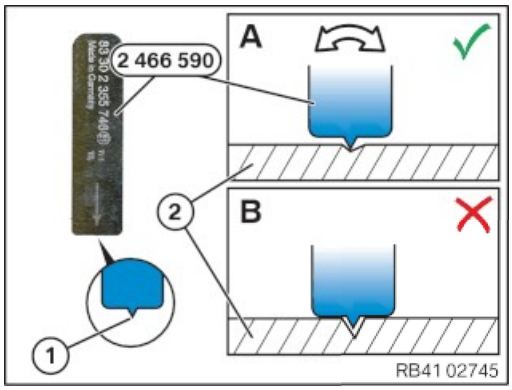
Radial scratches (1) on the interior (2) of the rim are permissible up to a depth of 0.4 mm.

The wheel rim must not be replaced for technical reasons.

The interior of the rim (2) can be coated with temperature-resistant matt paint.

The rim will need replacing if the depth of the scratches exceeds 0.4 mm.

4 – Determining depth of scratch



- Gauge has a test probe (1) with a height of 0.4 mm.
- If the test probe sits up at the deepest point of the scratch (figure A), it can be moved to the left and right. The scratch is less than 0.4 mm deep.
- If the test probe dips so deeply into the scratch that the gauge sits flat (figure B), the scratch is deeper than 0.4 mm and the part is damaged.

Additional Information

Overview of Special Tools

Overview Technical Data

Putty S1

Processing time 20 °C	90 min
Processing time 30 °C	60 min
Age-hardening duration 60 °C	60 min
Storage	15 °C ... 25 °C
Durability (note the expiration date on the cartridge)	12 Monate

cardiagn.com

EMC screws, general information

General notes for EMC screws

EMC screws (EMC = electromagnetic compatibility) are used with the bonding/riveting technology repair method to restore the ground connection between the individual components.

The EMC screws are responsible for the same task as the standard connections, that guarantee the ground connection between the individual components in standard production.

The punch or blind rivets used in the repair do not guarantee a permanent ground connection between the individual components.

The EMC screws ensure the operational reliability and safety of the electrical or electronic components following repairs!

Install the number of EMC screws specified in the vehicle-specific repair instructions.

1 â€“ Install the EMC screw (EMC = electromagnetic compatibility)

- After adhesive has fully hardened: Drill a hole with a diameter of 4.2 mm.
- Screw in the EMC screw.
- Seal the EMC screw with the sealant D1 .

Expendable materials

Sealant D1 (seam sealing)	310 ml	83422409985

cardiagn.com

Filler S1

Universal filler compound for body and wheel repairs.

Body: irregularities in surface and edges
Wheel repairs: see instructions

General information:



CAUTION

Materials harmful to health.

Health risks in the event of contact with substances that are harmful to health!

- Observe and comply with the Safety Information on the containers and the notes on the manufacturer's safety data sheet.
- Conduct all work in appropriate personal protective equipment only.

Putty S1

Processing time 20 °C	90 min
Processing time 30 °C	60 min
Age-hardening duration 60 °C	60 min
Storage	15 °C ... 25 °C
Durability (note the expiration date on the cartridge)	12 Monate

The barrel can be squeezed out with a commercially available cartridge press. Only use cartridge presses with a piston rod.

Applying the filling compound S1

1 – Prepare surface for application of body filler

- Grind surface to a metallic bright-finish.

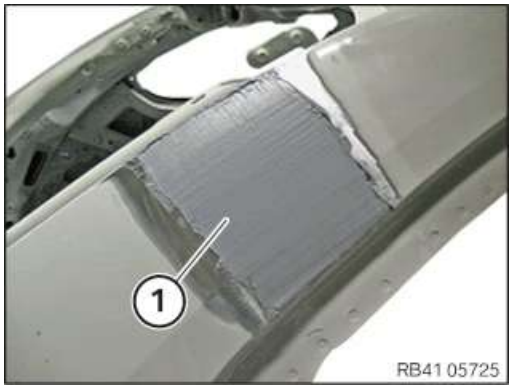
  For steel sheet, use grain 80.

  With aluminium sheet use grain 180.

  The surface must be clean, dry and free from grease.
- Clean surface with solvent cleaner R2 and leave to dry for 5 minutes.
- Clean surface with solvent cleaner R1 and leave to dry for 2-3 minutes.

2 – Apply body filler

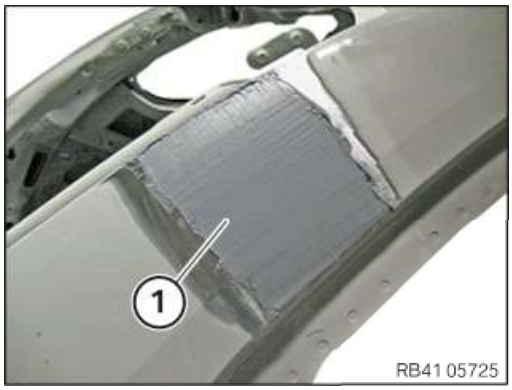
cardiagn.com



- Fill area (1) with body filler S1.

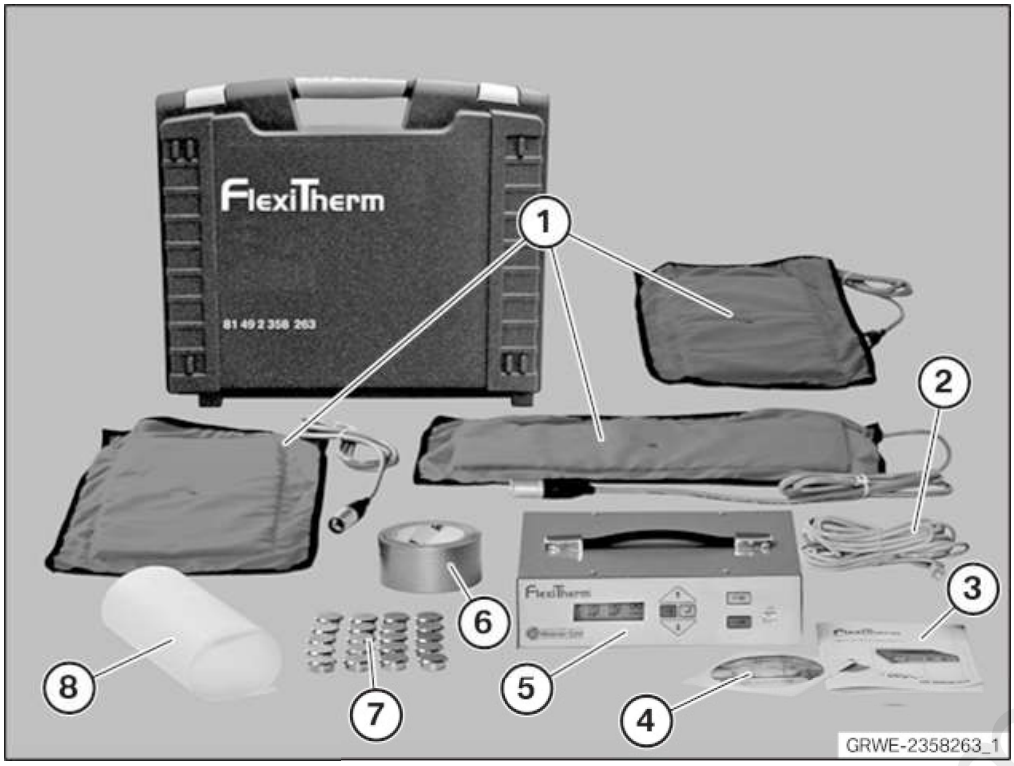
  Apply excess body filler S1.
- If possible, apply body filler S1 in one go to avoid air bubbles.

3 – Cure body filler



- Cure body filler S1.

cardiagn.com



TECHNICAL

Optionally, various devices can be used.

- Cure body filler S1 with “FlexiTherm” heater pad system.
- Please comply with instructions in Owner's Handbook.

  Select program in the control unit (5).

  The control unit autonomously controls and regulates the temperature of each individual heating mat (1).

  These are separately activated. The temperature sensor is located on the inside (red side).

  The heating mats may only be used in connection with the anti-adhesive paper (8).

  For trouble-free temperature measurements, the sensor must always be on the body filler (separated by anti-adhesive paper).

- Cure body filler S1 with infra-red heater.

RISK OF

Damage due to overheating

When using temperature-controlled infrared radiators, damage to adhesive bonds, paint and vehicle components

cardiagn.com



can occur when drying spatula and filler. The thermometers integrated in the infrared radiator only function reliably on large, even surfaces. On small surfaces such as C-pillars or sills, often only a colder, adjacent area is measured. This leads to actual surface temperatures of up to 130 °C, although only 70 °C is set on the infrared radiator. When the rear side walls are partially replaced by bonding and riveting, these high temperatures can lead to a visible pattern in the area of the joint.

- Check the surface temperatures on small component surfaces during the drying process with an external thermometer. The general rule is: The surface temperatures must not exceed 85°C.

- When the infrared heater is used for the first time, the correct distances for the desired temperatures must be determined.

cardiagn.com

Switch the infra-red heater on and change the distance until the surface temperature of the body filler no longer changes for a period of 2 min.

Measure temperature using an optical thermometer.

If optical thermometers are used (Epsilon value 0.92-0.95), the heater must be switched off briefly during the measurement.

Record the measurement

- Standard optical thermometers can be used to measure surface temperatures.



4 – Work body filler

CAUTION

Grinding dust when grinding components.

Hazardous to health!

- Directly draw off the grinding dust.
- Ensure adequate ventilation.
- Conduct all work in appropriate personal protective equipment only.

- Wear a fine dust mask with protection class P2-P3.
- Sand body filler S1 using a machine after cooling to 25 °C.

  Maximum permissible layer thickness after sanding is 5 mm.

  For steel sheet, use grain 80.

  With aluminium sheet use grain 180.
- Pores and faulty spots that become visible after grinding the surface must be closed with polyester filler (BMW Colour system).

  Use a drill bit with Ø40.2 mm. Turn the drill by hand to expand the pores in v shape. by t Fill cavities with polyester filler.
- Clean surface with solvent cleaner R2 and leave to dry for 5 minutes.
- Clean surface with solvent cleaner R1 and leave to dry for 2-3 minutes.

Coat surface

Perform paintwork according to the specifications in the painting handbook.

Additional Information

Overview Technical Data

Putty S1

Processing time 20 °C	90 min
Processing time 30 °C	60 min
Age-hardening duration 60 °C	60 min
Storage	15 °C ... 25 °C
Durability (note the expiration date on the cartridge)	12 Monate

cardiagn.com

Transferring hole pattern

Transferring hole pattern

When renewing a body component, the existing hole pattern must be transferred from the body to the new part.

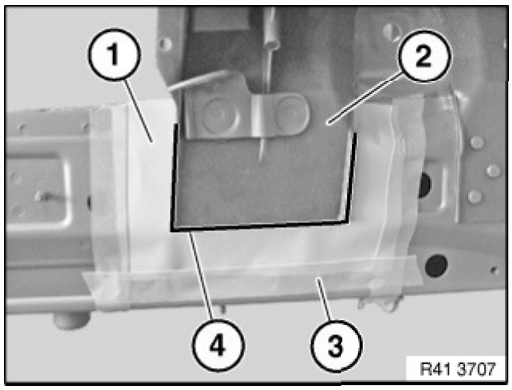
1 â€“ Transferring hole pattern

Prerequisite

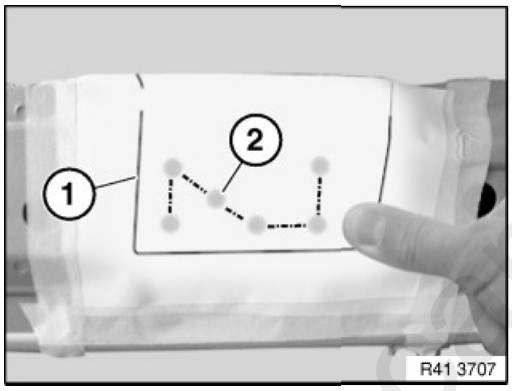
New part is adjusted.

NOTICE

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



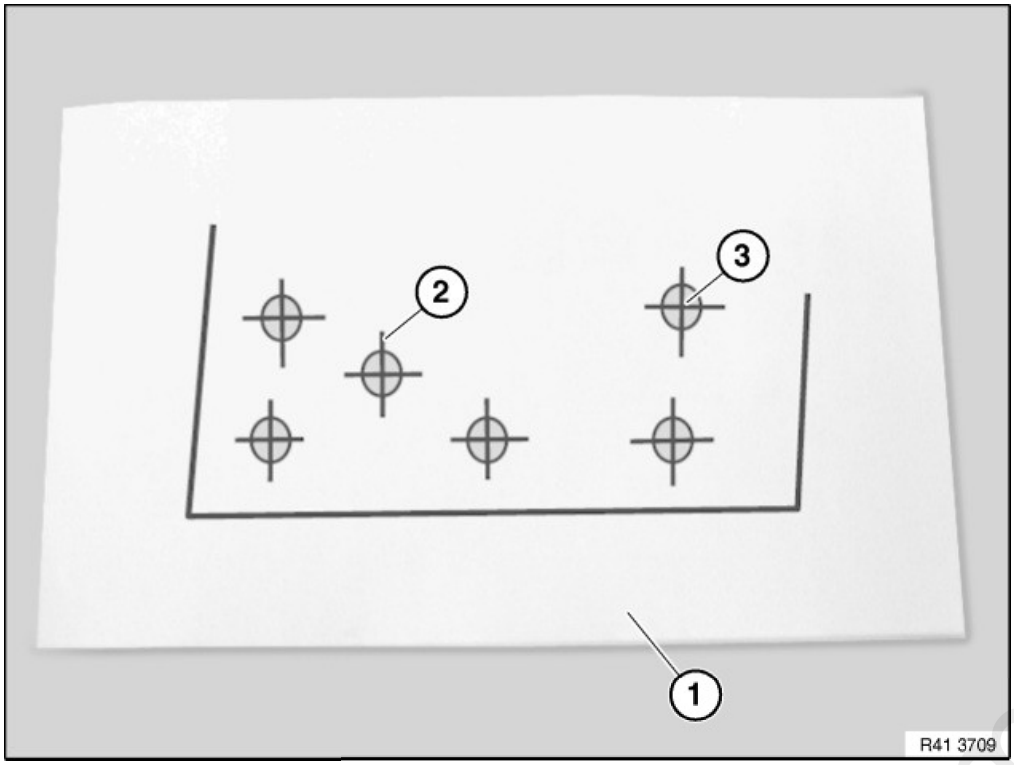
- Insert a template (paper template) (1) between the new part (2) and the body and secure it with adhesive tape (3).
- Transfer the outline (4) of the new part to the template.
- Remove the new part (2).



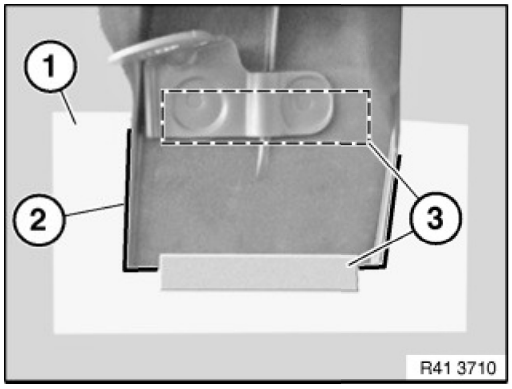
- Use your thumbs to press down on the positions of the bore holes (2) to transfer them to the template.

  The outline of the new part (1) provides better orientation.
- Remove the template.

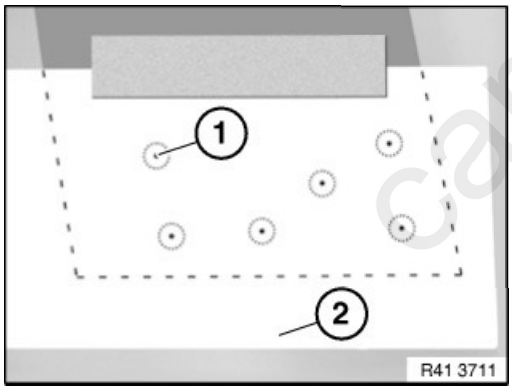
carldiag.com



- Place the template (1) onto a flat surface.
- Mark the centre points of the bore holes with X (2).
- Use a sharp object to punch through the paper to transfer the centre points (3) of the bore holes.



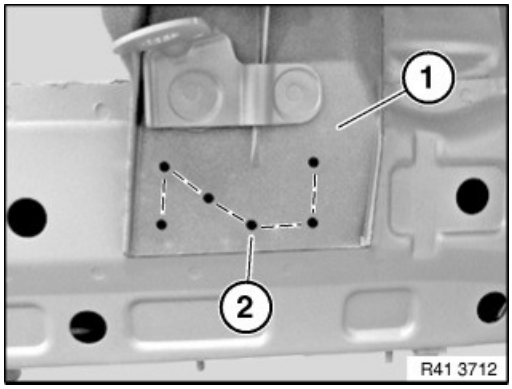
- Align the template (1) according to the outlines (2) on the inside of the new part.
- Secure the template (1) with adhesive tapes (3).



- Turn the new part around.

Note: The X marks must not be visible from this view.

- Set punch marks at the pressed through centre points (1). Provide counter support directly below the punch marks for punching.
- Remove the template (2).
- At the punch marks (1), drill out holes with an approximate diameter of 3 mm.



- Position the new part (1) on the vehicle.
- Drill out holes (2) to 6.8 mm diameter.

cardiagn.com

Vehicle identification number, general

General information for vehicle identification numbers

Observe national/country-specific regulations.

In the factory, the vehicle identification number is engraved in the designated area and in accordance with the series is equipped with a foil to protect it from corrosion.

In the case of a repair, the vehicle identification number is generally incorporated in the substitute area. The substitute area is usually situated below the Vehicle identification number. The factory used BMW emblem is replaced with a + at the beginning and end to clearly differentiate the vehicle identification number.

The IGEF number is dropped when replacing the component.

General information for embossed vehicle identification numbers

This procedure is used for all vehicles on which the vehicle identification number can not be punched.

If replacing the carrier support or the body, new parts can normally be ordered via BMW Group Parts with an embossed vehicle identification number. If this is not possible, observe country-specific regulations.

If an additional second vehicle identification number is embossed into the substitute area, the existing vehicle identification number must be crossed out. Only use the designated product range from the needle embossing machine. Tape off the invalid vehicle identification number with a foil.

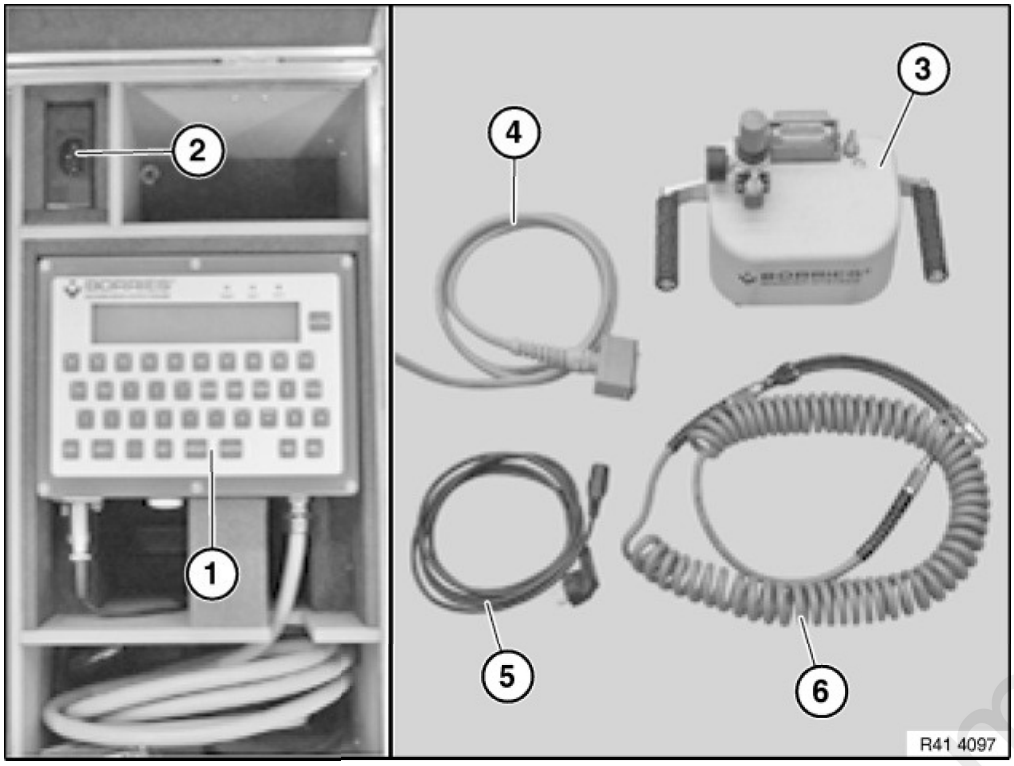
Paint the area around the vehicle identification number according to the BMW painting handbook. Ensure that layer thicknesses are small.

After painting, a new foil must be bonded on the vehicle identification number, if a foil was installed for the series as standard.

1 – Emboss the VIN

cardiagn.com

Overview of needle embossing device



1 Display

2 Mains connection

3 Needle embossing device

4 Connecting cable

5 Mains lead

6 Compressed air hose A compressed air connection is required (approximately 6 bar, use only dry oil-free compressed air)

Sourcing reference: Request detailed information about the order process under specialtools@bmwgroup.com.

General information for punched vehicle identification numbers

In the case of a repair, the vehicle identification number is engraved with a special tool before painting the new part.

Refer to the special tool number and the vehicle-specific repair instructions for the correct procedure.

If an additional second vehicle identification number is punched into the substitute area, the existing vehicle identification number must be crossed out. To do so, punch the letter I from the punch numbers lengthways through the existing vehicle identification number. Tape off the invalid vehicle identification number with a foil.

Paint the area around the vehicle identification number according to the BMW painting handbook. Ensure that layer thicknesses are small.

After painting, bond a new foil on the vehicle identification number, if a foil was installed for the series as standard.

Bonding the foil for the vehicle identification number

2 – Apply the foil (straight) for the VIN

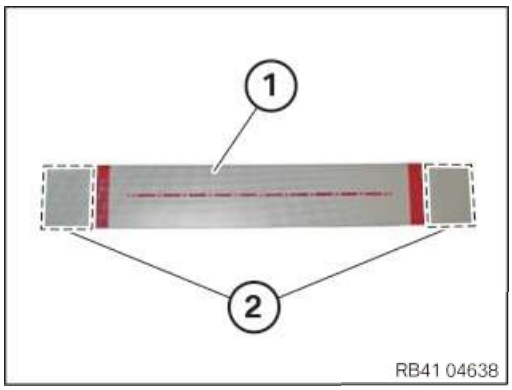
cardiagn.com



- Clean the surface in area (1) with cleaning agent R2 and allow to dry.

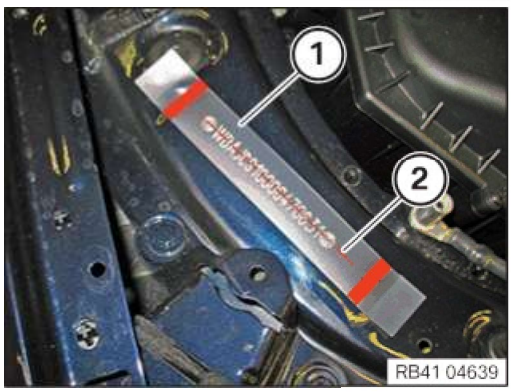
Expendable materials

Cleaning agent R2	500 ml	83190417324



- Pull off the protective film beginning at an edge.

  Touch the foil (1) only in the areas (2).



- Position the foil (1) with the line (2) in the centre above the VIN and press it on.



- Pull off the backing film (1) beginning on one side.

  If applicable, rub air bubbles out toward the edge.

3 – Apply the foil (bent) for the VIN

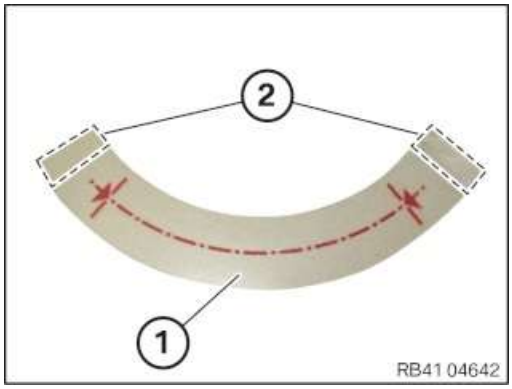


- Clean the surface in area (1) with cleaning agent R2 and allow to dry.

Expendable materials

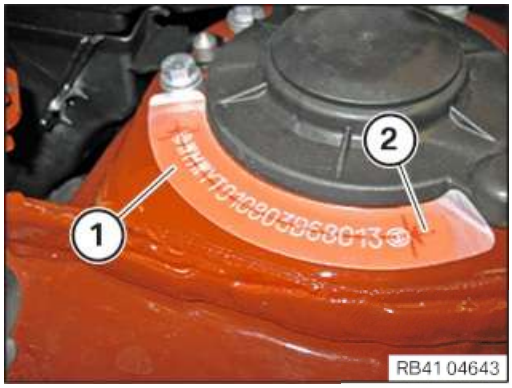
Cleaning agent R2	500 ml	83190417324

rdiagn.com

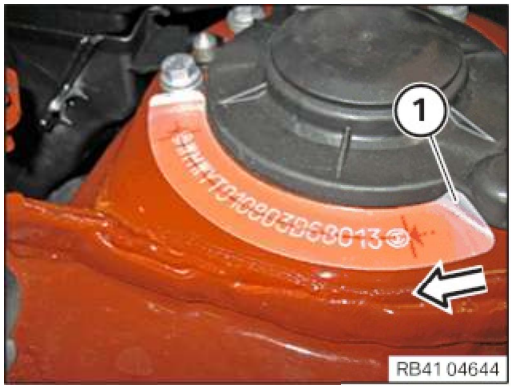


- Pull off the protective film beginning at an edge.

  Touch the foil (1) only in the areas (2).



- Position the foil (1) with the line (2) in the centre above the VIN and press it on.



- Pull off the backing film (1) beginning on one side.

  If applicable, rub air bubbles out toward the edge.

cardiagn.com

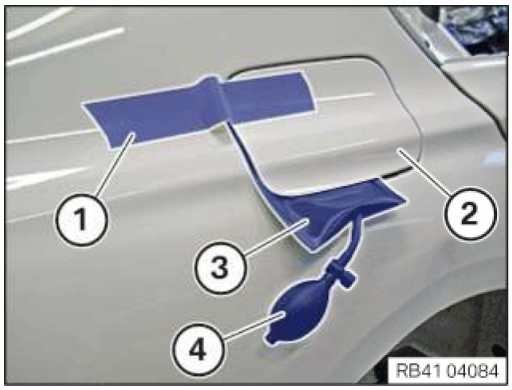
Fuel filler flap emergency release

If the servomotor is faulty, the fuel filler flap must be emergency-released if there is no cable.

1 Fuel filler flap emergency release



- Slide the special tool into the gap between the fuel filler flap (1) and the side panel.



- Bond the adhesive tape (1) to the side panel and the fuel filler cap (2) with a loop.

Expendable materials

Yellow plastic adhesive tape	83199410979

- Inflate the air cushion (3) with the hand pump (4), until the fuel filler cap (2) pops open.
- Pull off the adhesive tape (1).
- Repair the vehicle.

Additional Information

Overview of Special Tools

cardiagn.com

Assessment of damaged vehicle

Introduction

Damaged vehicles need to be evaluated in order to continue the treatment. This evaluation must be carried out within 24 hours after the arrival of the vehicle. The period of time between the determination of the intrinsic safety of the electric vehicle and the evaluation of the high-voltage battery unit should not exceed 4 weeks. After this period, the check must be carried out once again. Complying with these deadlines and keeping up the intrinsic safety of the electric vehicle during this period is the responsibility of a qualified person.

This document contains all the necessary information to determine the intrinsic safety of damaged vehicles. 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 vehicle is to be performed by an "expert for working on high-voltage intrinsically safe vehicles".

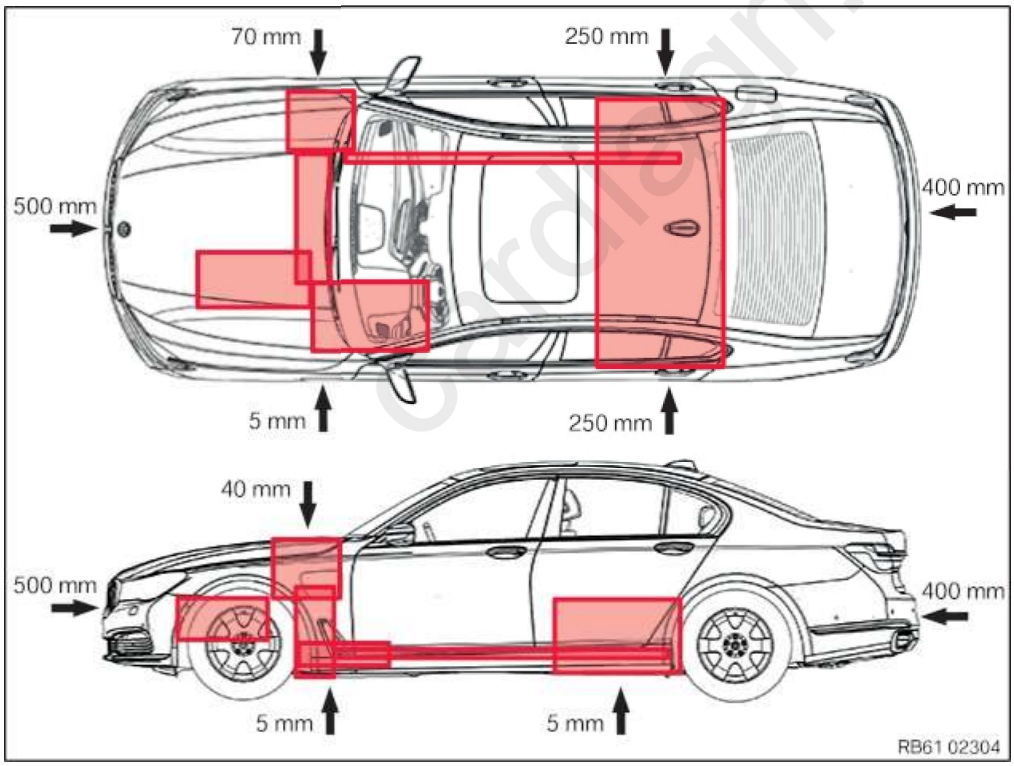
The certificate of the intrinsic safety is the responsibility of the qualified person.

In order to better follow up on this document, please print and archive it with the vehicle records.

Name:	First name:	Date:	Vehicle identification number
-			

Mechanical assessment

Penetration depths



	Yes	No
Is smoke formation visible?		
Does the vehicle show any evidence of fire damage?		
Suspected water damage incl. extinguishing water (vehicle and high-voltage battery unit)		
Does the vehicle show any mechanical damage within the areas marked in red? (see figure above)		
Crack or opening on the housing of the high-voltage battery unit		
Dents in the housing, deformations, changes (scratches up to 0.5 mm in depth or 5 cm in length are permitted) to the high-voltage battery unit		
Connections of high-voltage battery unit loose or damaged		
High-voltage cables hang loosely out of the vehicle		

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 vehicle must be made inaccessible and blocked off by means of high-voltage barrier tape and parked at a suitable location for vehicles that have been involved in an accident.

If all points have been answered with **no**, the vehicle is in an intrinsically safe condition. In this case, the vehicle can be added to a usual workshop process for intrinsically safe vehicles.

Place, date	NAME	Signature
-		

carbuyer.com

Removing and installing/replacing the protective cap on the door handle

1 – Removing the protective cap on the door handle



- Pull and hold door handle (1) up to the limit position.
- Grab the protective cap (2) with thumb and index finger.
- Press the spring (3) outward with the index finger and pull off the protective cap (2) toward the rear.

2 – Installing the protective cap on the door handle



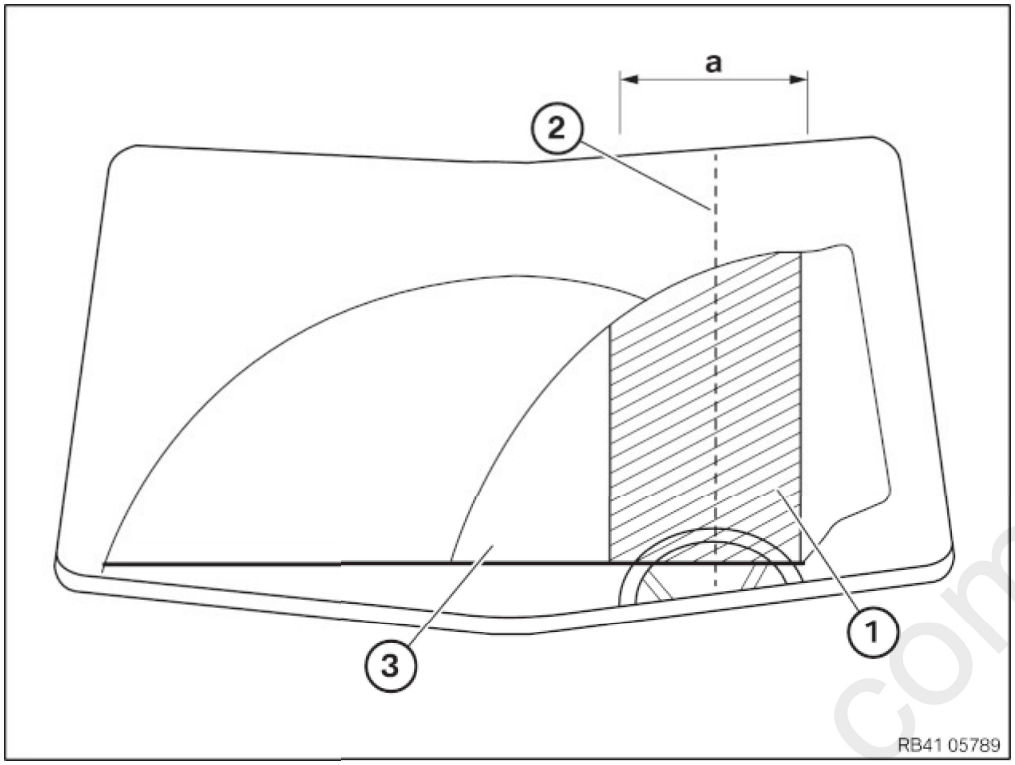
- Pull and hold door handle (1) up to the limit position.
- Position and push the protective cap (2) onto the door handle (1).

cardiagn.com

Repair of damage caused by stone chips on the windshied

General notes on repair of damage caused by stone chips

Definition of field of vision



1 Field of vision The field of vision is an approx. 30 cm wide strip (dimension a) centered above the steering wheel. The field of vision is bordered on the top and bottom by the wiper range.

2 Vertical line through the centre of the steering wheel

3 Wiper range

The repair of damage caused by stone chips is only permissible under the following conditions:

The conditions detailed below for repairing laminated safety glass conform to the legal regulations in Germany.

In other countries, the relevant regulations must be observed.

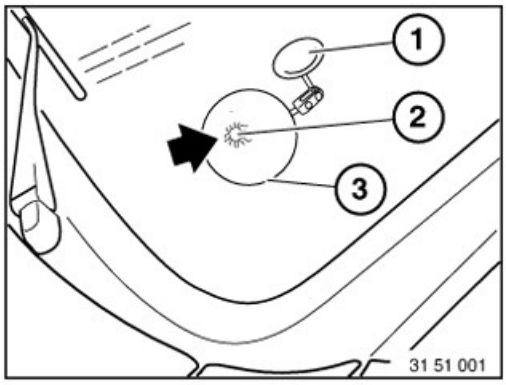
- The point of damage is located outside of the field of vision
- The point of damage is located outside of the contact surfaces of sensors and cameras
- Only the outer area of the windscreen was damaged
- The inner surface of the windscreen and the plastic film in between were not damaged
- The point of damage is free of moisture, dirt or similar
- The diameter of the point of damage is smaller than 5 mm
- Radial cracks originating from the point of damage are not longer than 50 mm
- Cracks do not reach to the outer edge of the windscreen
- Visibility through the repaired surface must be clear, transparent and with minimum distortion

1 – Repair of damage caused by stone chips on the windscreen

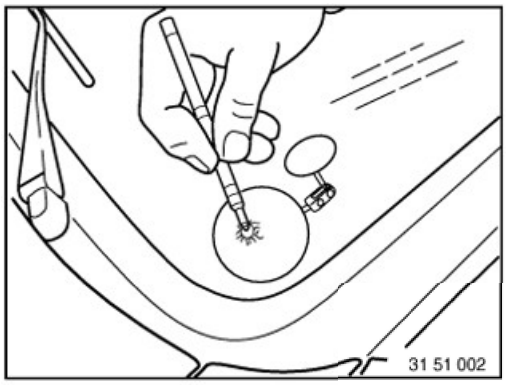
Prerequisite

Windscreen temperature greater than 20 °C. If necessary, heat the windscreen from the inside.

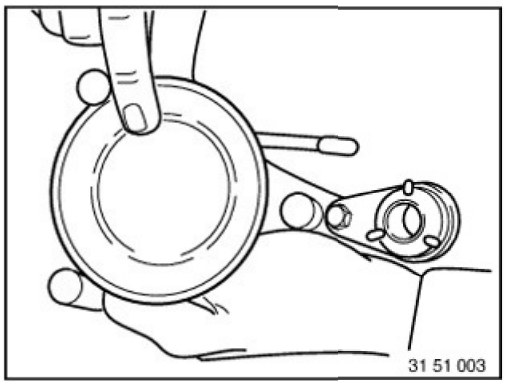
cardiagn.com



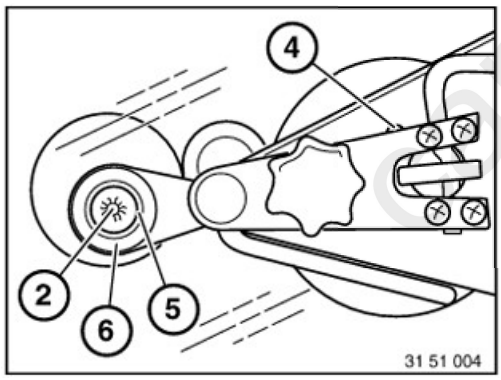
- Thinly coat the suction cup (1) of the concave mirror using the gel.
- Position the suction cup (1) on the windscreen from the inside so that the damaged area (2) can be viewed in the concave mirror (3) from the outside.



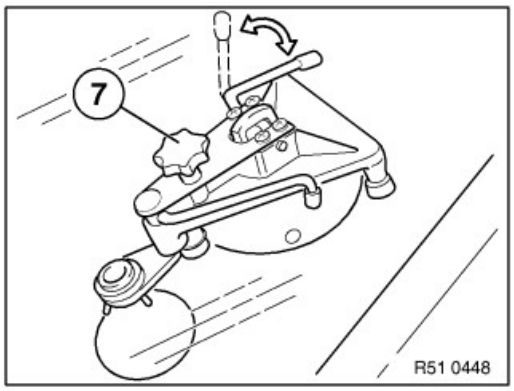
- Remove all glass shards from the damaged area using a scriber without enlarging the damaged area.



- Thinly coat the suction cup of the tool holder with the gel.

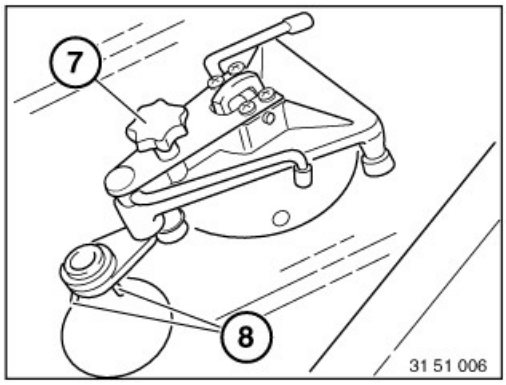


- Position the tool holder (4) on the windscreen from the outside so that the opening (5) of the head (6) is positioned exactly over the damaged area (2).

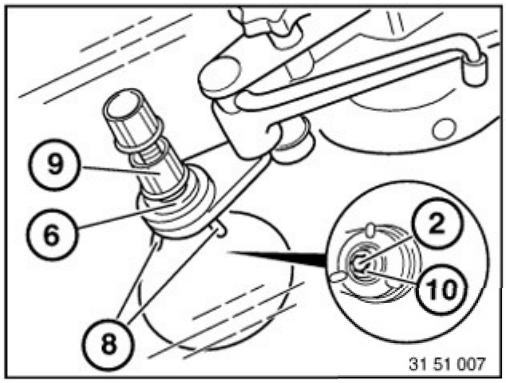


- Unscrew knurled screw (7).
- Move the stop lever towards the front and rear once until the suction cup has been secured to the windscreen.

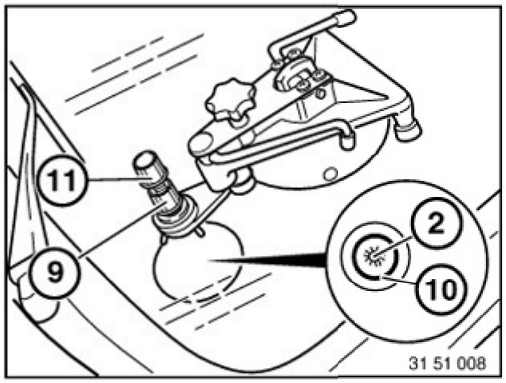
cardiagn.com



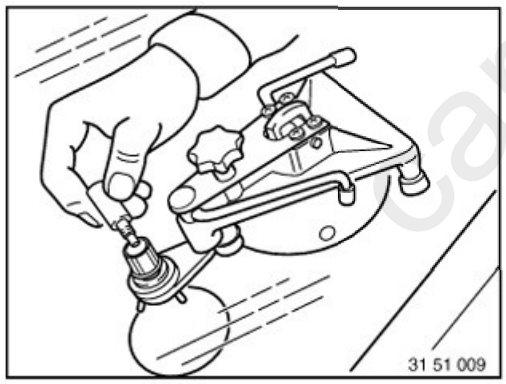
- Screw in the knurled screw (7) until the feet (8) are positioned straight and securely on the windscreen.



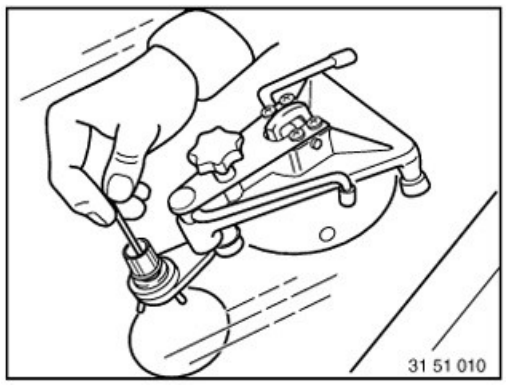
- Screw in the cylinder (9) into the head(6) until the rubber seal (10) firmly surrounds the damaged area (2) on the windscreen and the feet (8) just about lift slightly.



- Unscrew the injector (11) from the cylinder (9).
- Look into the cylinder (9) from the top and check whether the rubber seal (10) is centrally over the damaged area (2).
- Correct the position if necessary.

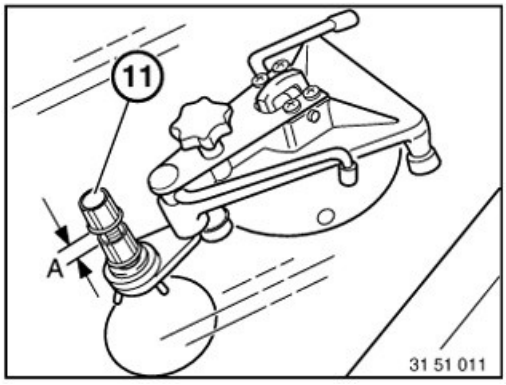


- Open the bottle of resin and fill approximately 1/3 of its contents into the cylinder.
- Once again close the bottle of resin.



- Stir out any potentially available air bubbles in the filled resin using a wooden stick.

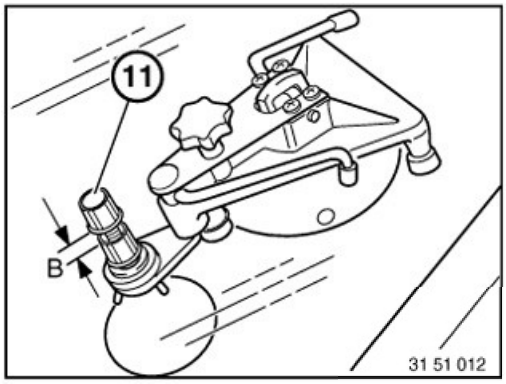
cardiagn.com



- Screw the injector (11) into the cylinder up to dimension (A) (slightly perceptible resistance) and let it rest for approximately 5 minutes.

  Dimension (A) = 5 mm

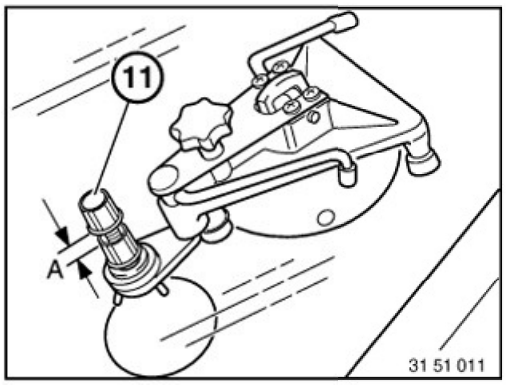
Note: In this position there is a pressure of approximately 16 bar. When monitoring the impact spot it is possible to see that the air trapped in the damaged area slowly escapes (noticeable as black shadows).



- Quickly unscrew the injector (11) to dimension (B).

  Dimension (B) = 12 mm

Note: In this position a vacuum now takes effect and extracts the remaining air from the damaged area.

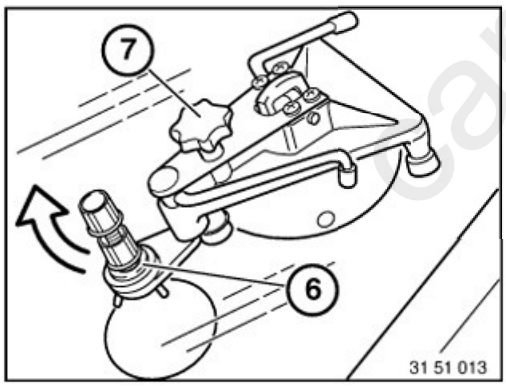


- Once again screw the injector (11) into the cylinder to dimension (A) (slightly perceptible resistance) and once again leave everything to rest for a few minutes.

  Dimension (A) = 5 mm

- Repeat the process of alternating between pressure and vacuum multiple times and then let the injector (11) rest in an intermediate setting between dimension (A) and dimension (B) for a few minutes.

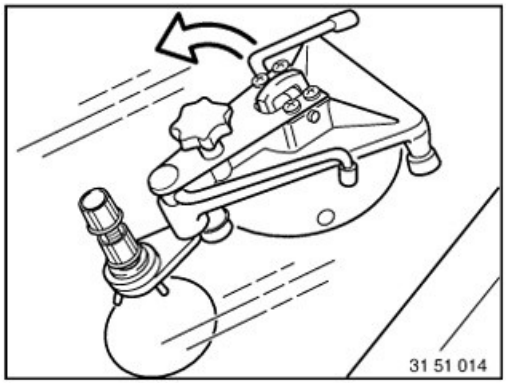
Note: If not all air has escaped yet, preheat the windscreen from the inside for a few seconds using a lighter during the pressure process.



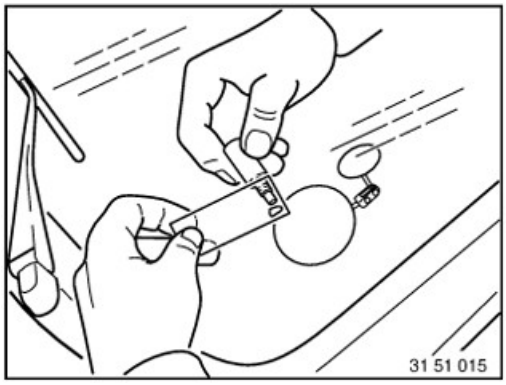
- Slacken the knurled screw (7).
- Swivel the head (6) to the side.
- Check the repair area from the top and in the concave mirror from different angles of view.

  There should no longer be visible air pockets.

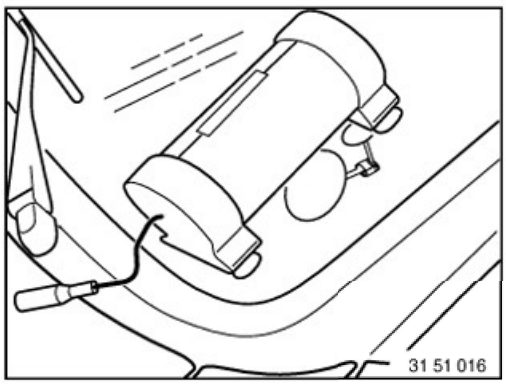
- If air pockets are still visible, swivel the head (6) back over the damaged area and screw in the knurled screw (7) as far as was previously the case.
- Repeat operations starting with pressure/vacuum process.



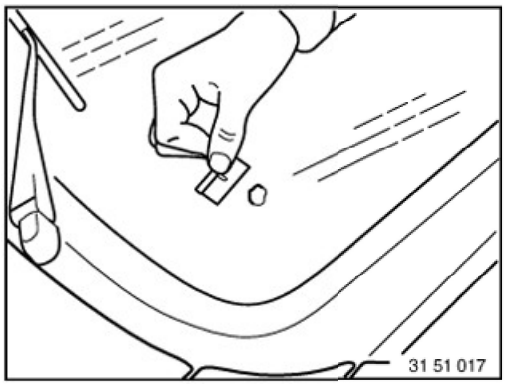
- Swivel the stop lever towards the front and remove the tool holder from the windscreen.



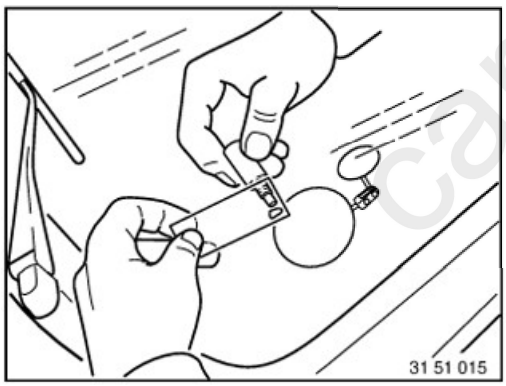
- Apply a drop of resin to the damaged area and cover with plastic film without applying pressure.



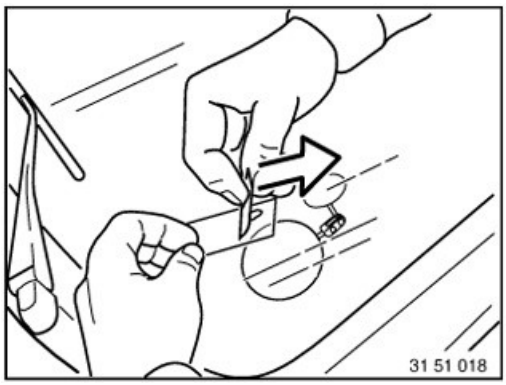
- Position the ultraviolet lamp over the repair area and severely press on the suction cups.
- Connect the ultraviolet lamp and allow the resin to harden for approximately 10 minutes.



- Remove the ultraviolet lamp.
- Pull off the plastic film.
- Scrape off protruding resin using a razor blade.

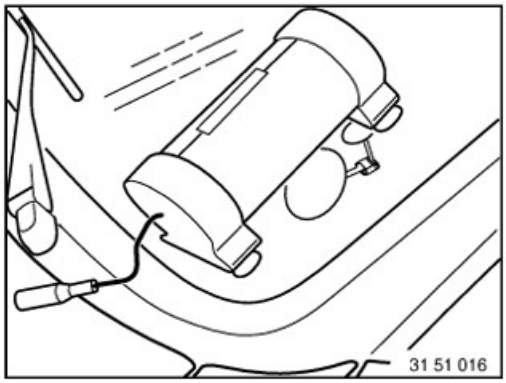


- Once again apply a drop of resin to the damaged area.
- Cover the area using a new sheet of plastic film.

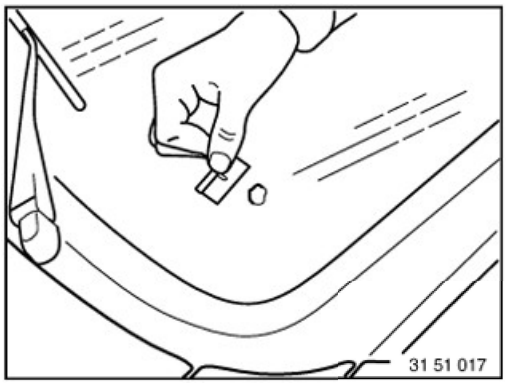


- Carefully rub over the plastic film with the razor blade so excess resin escapes at the sides.

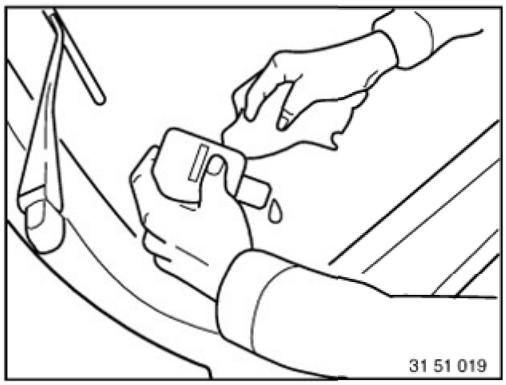
cardiagn.com



- Position the ultraviolet lamp over the repair area and severely press on the suction cups.
- Connect the ultraviolet lamp and allow the resin to harden for approximately 10 minutes.



- Remove the ultraviolet lamp.
- Pull off the plastic film.
- Scrape off protruding resin around the damaged area with the razor blade.



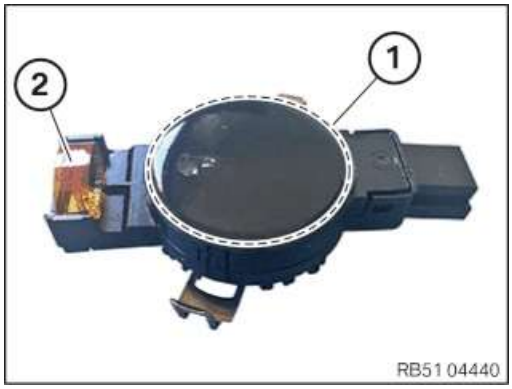
- Polish the repair area using a lint-free cloth and polish until the surface is clean and smooth.

cardiagn.com

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.

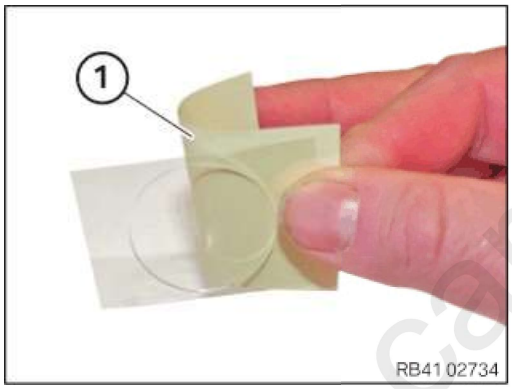
- Remove the gel pad (1) by hand.

  Do not touch or damage the printed circuit (2).

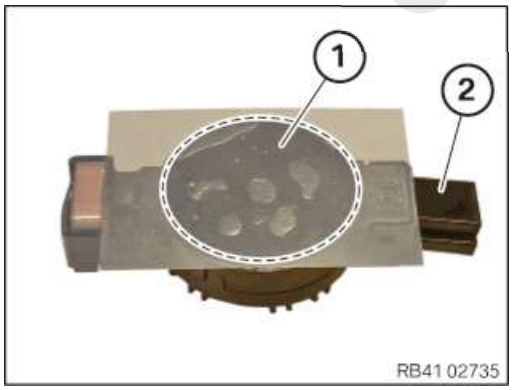
- If necessary, remove any gel residue using a microfibre cloth.
- Clean the surface of the rain-light-solar-fogging sensor using a microfibre cloth R2 soaked in cleaning agent.

Expendable materials

Cleaning agent R2	500 ml	83190417324



- Remove the yellow protective film (1).

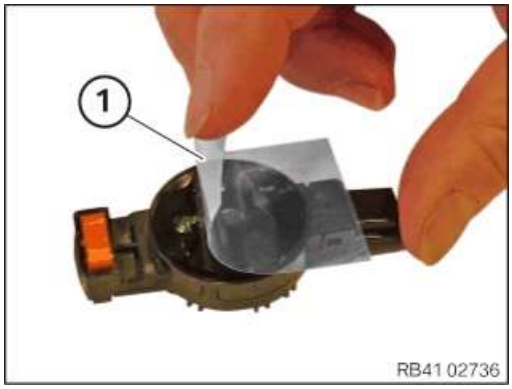


- Place the gel pad (1) in the centre of the surface of the rain-light-solar-fogging sensor (2).

  Do not eliminate existing air bubbles.

  Air pockets disappear within 30 min after mounting the sensor on the windscreen.

cardiagn.com



- Remove transparent protective film (1).

cardiagn.com

6.2.6 Other seats

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Visual inspection

Fault determination according to EG PTI:

a)	Seats faulty or unsafe (secondary parts): Seats faulty or unsafe (primary parts)
b)	Seats not installed as specified: permissible number of seats exceeded; arrangements of seats not according to approval

Methods according to vehicle manufacturer:

The number of seats installed can be found on the registration certificate.

cardiagn.com

4.11 Electrical wires

Validities

BMW passenger car, BMW i, MINI passenger car

Official method according to EG PTI:

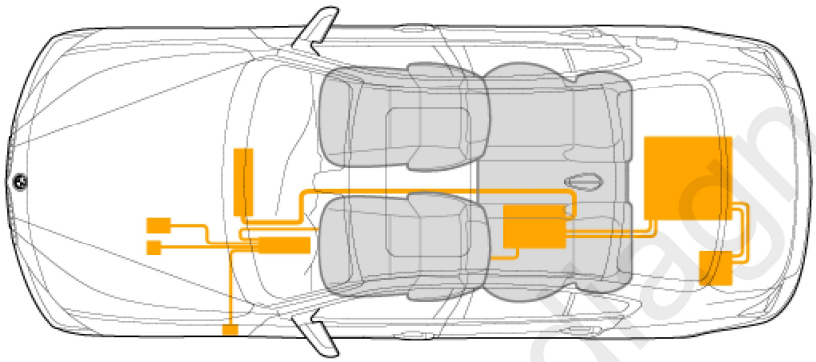
Visual inspection, including the engine compartment in some cases, while the vehicle is situated over an inspection pit or on a vehicle lift

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

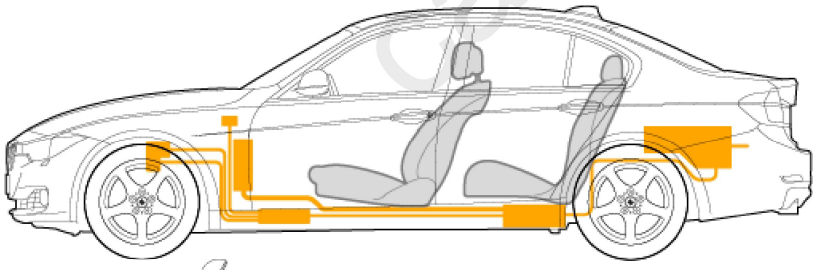
Visual inspection, including the engine compartment in some cases, while the vehicle is situated over an inspection pit or on a vehicle lift

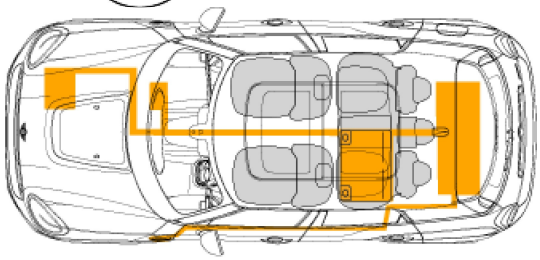
Methods according to vehicle manufacturer:



F30 PHEV

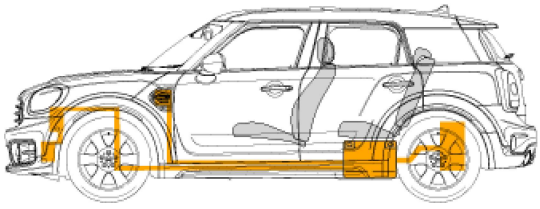
BMW 3 Series



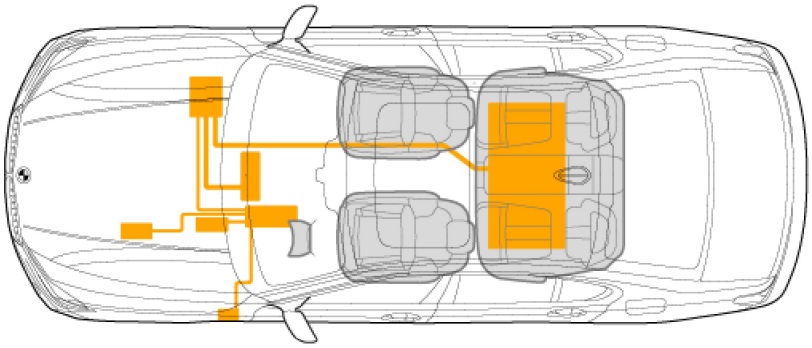


F60 PHEV

MINI Countryman

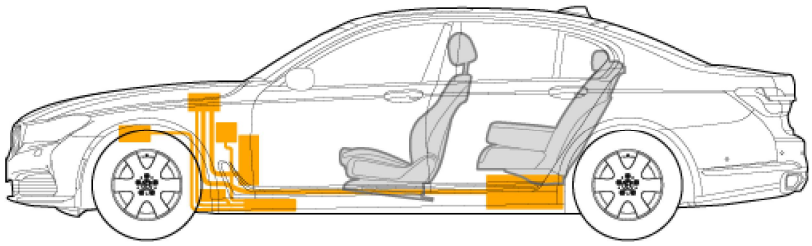


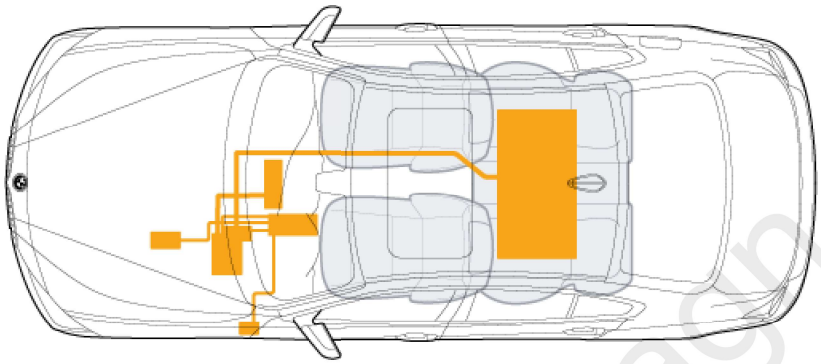
cardiagn.com



G11/G12 PHEV

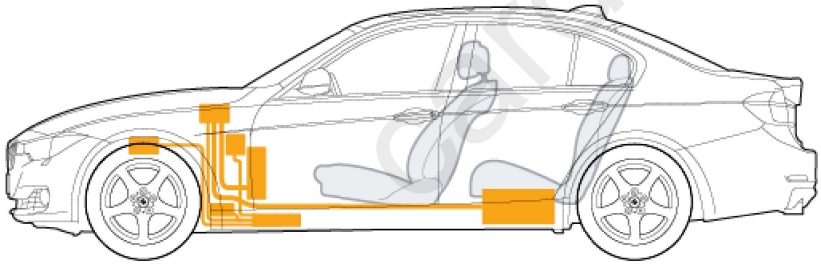
BMW 7 Series





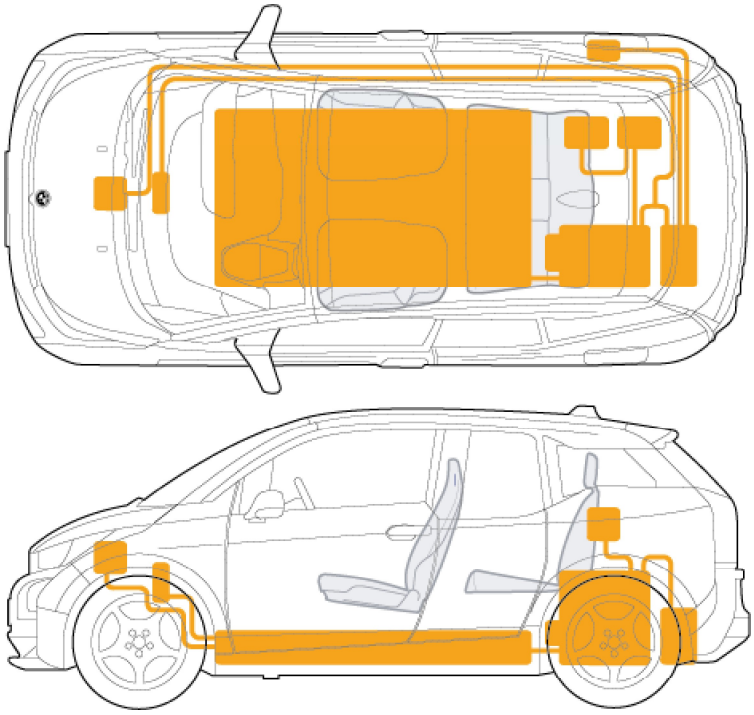
G30 PHEV

BMW 5 Series

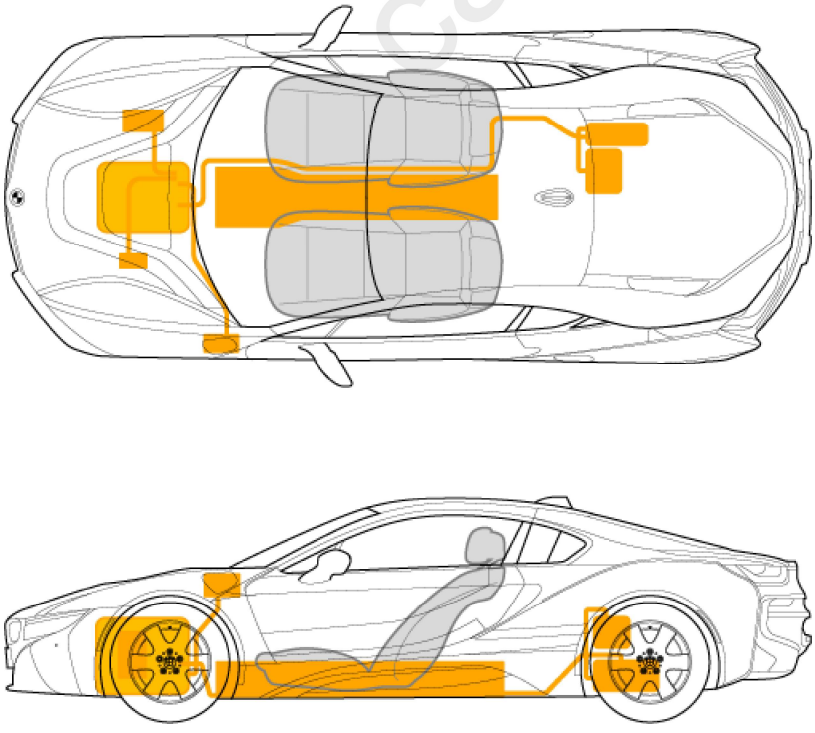


cardiagn.com

I3

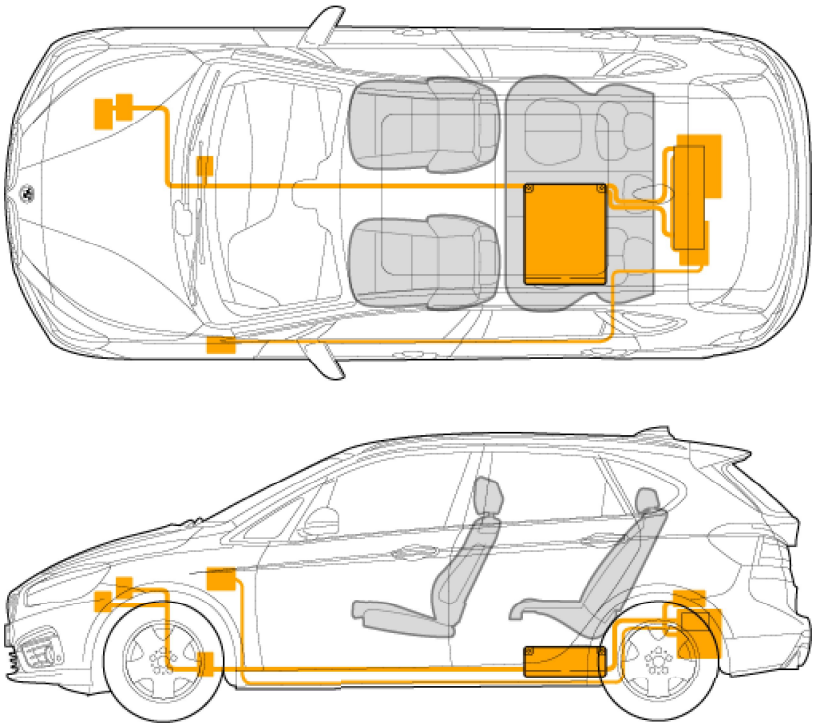


I8

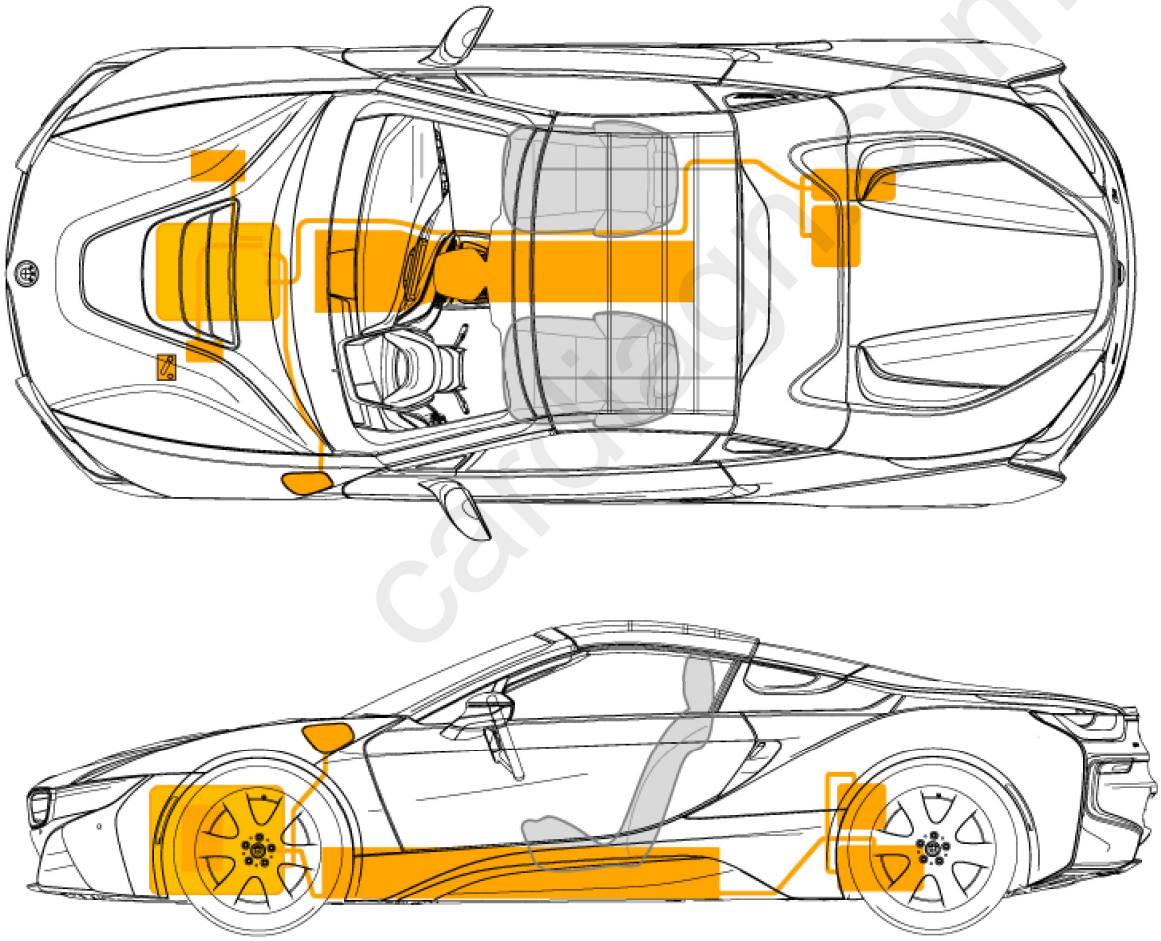


cardiagn.com

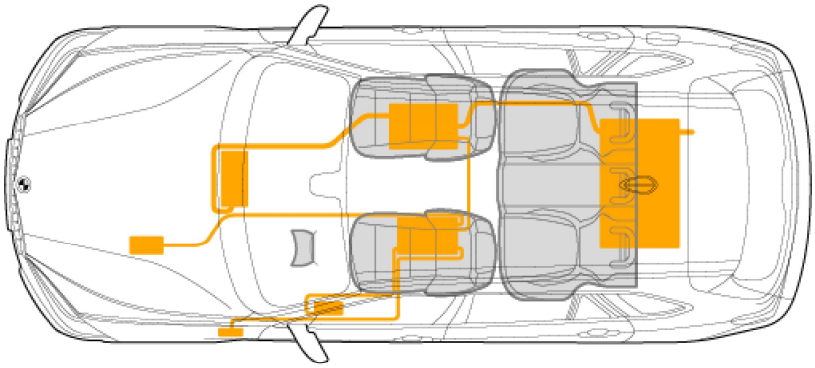
F45 PHEV



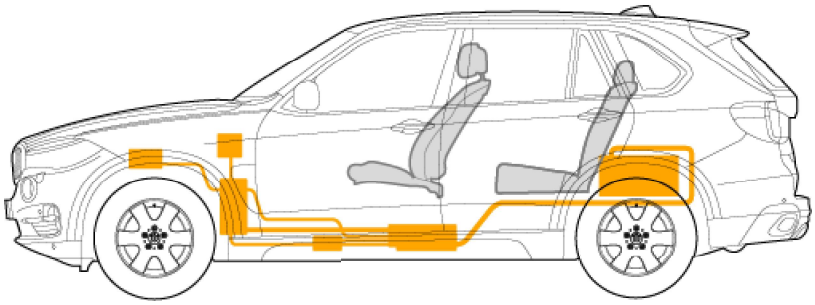
I15

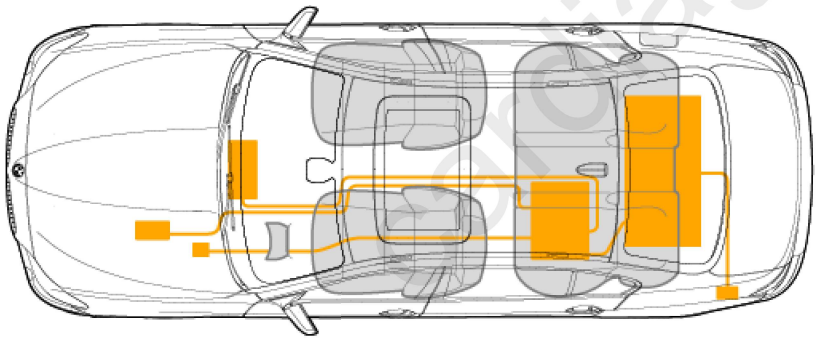


carmanuals.com

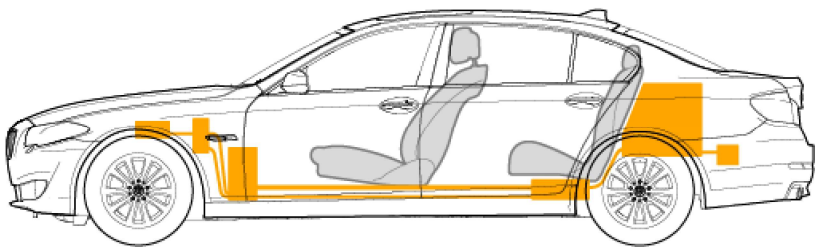


F15 PHEV

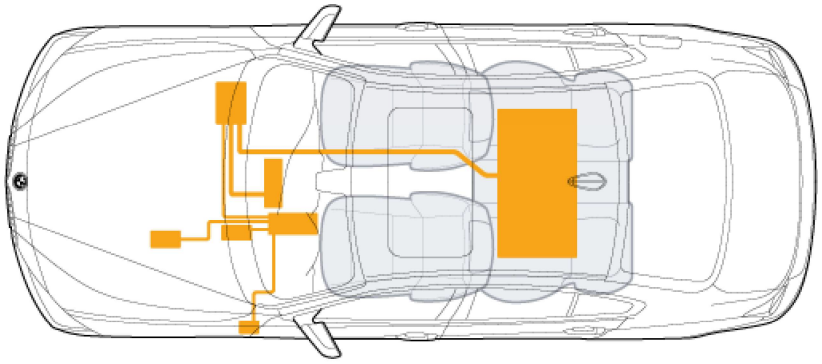




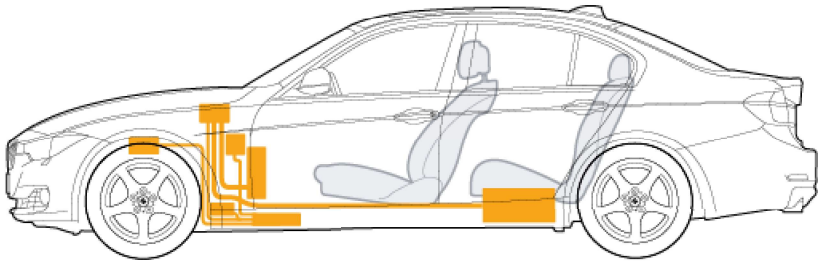
F18 PHEV



cardiagn.com



G38 PHEV



cardiagn.com

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.

cardiagn.com

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

cardiagn.com

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:

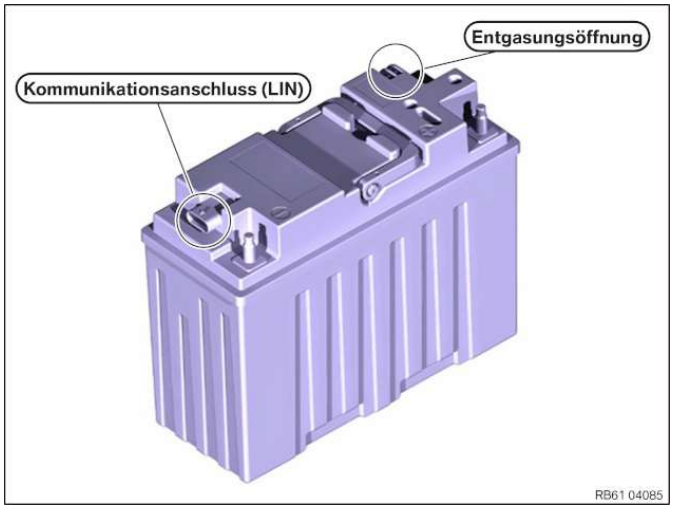
- The AGM battery state of charge is sustainably increased (availability improved and breakdowns reduced or prevented)
- The cycle load of this component is significantly reduced (quality, total cost of ownership)
- Fuel consumption and carbon dioxide pollutant emission are reduced.

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.

Cardiagn.com

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.

carlogn.com

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

carmagn.com

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 assesment 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

cardiag.com

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.

cardiagn.com

Assessment of damaged vehicle

Introduction

Damaged vehicles need to be evaluated in order to continue the treatment. This evaluation must be carried out within 24 hours after the arrival of the vehicle. The period of time between the determination of the intrinsic safety of the electric vehicle and the evaluation of the high-voltage battery unit should not exceed 4 weeks. After this period, the check must be carried out once again. Complying with these deadlines and keeping up the intrinsic safety of the electric vehicle during this period is the responsibility of a qualified person.

This document contains all the necessary information to determine the intrinsic safety of damaged vehicles. 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 vehicle is to be performed by an "expert for working on high-voltage intrinsically safe vehicles".

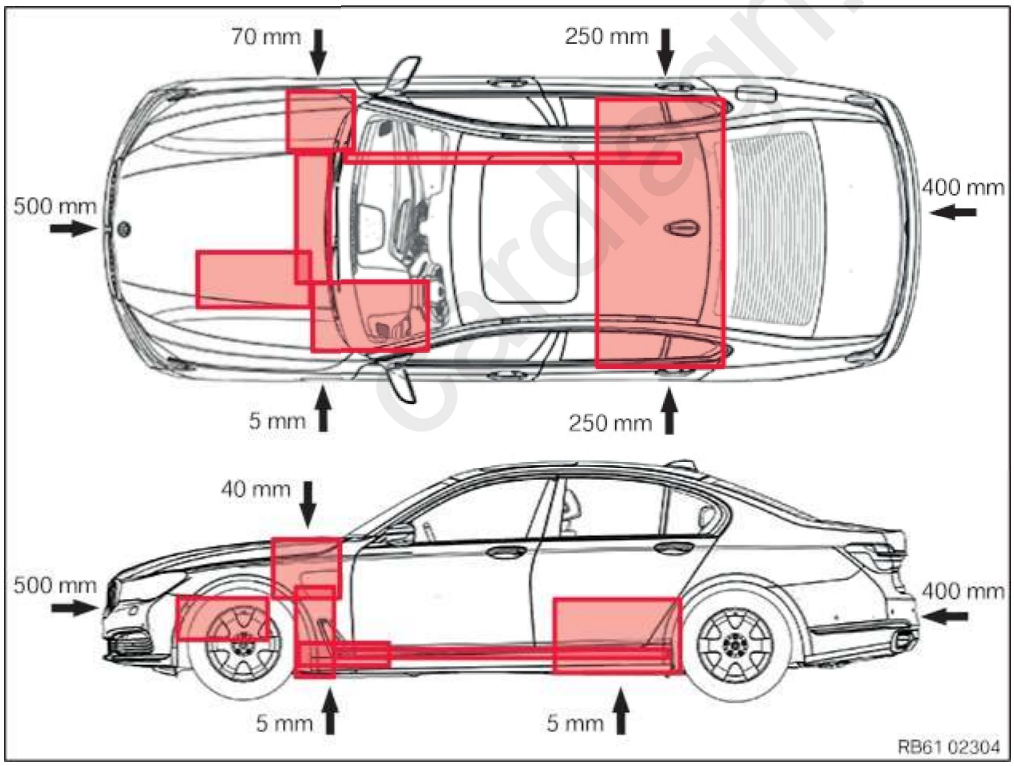
The certificate of the intrinsic safety is the responsibility of the qualified person.

In order to better follow up on this document, please print and archive it with the vehicle records.

Name:	First name:	Date:	Vehicle identification number
-			

Mechanical assessment

Penetration depths



	Yes	No
Is smoke formation visible?		
Does the vehicle show any evidence of fire damage?		
Suspected water damage incl. extinguishing water (vehicle and high-voltage battery unit)		
Does the vehicle show any mechanical damage within the areas marked in red? (see figure above)		
Crack or opening on the housing of the high-voltage battery unit		
Dents in the housing, deformations, changes (scratches up to 0.5 mm in depth or 5 cm in length are permitted) to the high-voltage battery unit		
Connections of high-voltage battery unit loose or damaged		
High-voltage cables hang loosely out of the vehicle		

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 vehicle must be made inaccessible and blocked off by means of high-voltage barrier tape and parked at a suitable location for vehicles that have been involved in an accident.

If all points have been answered with **no**, the vehicle is in an intrinsically safe condition. In this case, the vehicle can be added to a usual workshop process for intrinsically safe vehicles.

Place, date	NAME	Signature
-		

carbuyer.com

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!

cardiagn.com

Instructions for handling cell blocks

The following points must be observed when handling cell blocks:

After opening the packaging, a visual inspection for damage to the cell block must be carried out.

Only remove the cell module from the original packaging directly before the installation or to adapt the state of charge.

Put cell block down only on a clean workplace.

The cell block must be protected so that it cannot fall down. Use anti-slip and tilt-proof surface.

Do not lift up cell block by the leads.

The special tool intended for this purpose must be used to lift as well as remove and install the module.

A cell block that has been dropped must no longer be used.

Before shipping a cell module, the **Assessment of the transport capability of cell modules in service workshops** must be performed.

Technical Support must be contacted if there is visible damage to a cell block!

The following points must be observed before installation:

Before installing a new cell block, its voltage must be adapted to that of the other installed cell blocks.

Refer to diagnosis for the corresponding cell block voltage.

Use module chargers approved by BMW only.

cardiagn.com

Notes for lifting high-voltage battery unit

Preconditions

To safely lift the high-voltage battery unit from the packaging or from the lifting table, the special tool 2 456 428 is to be used!

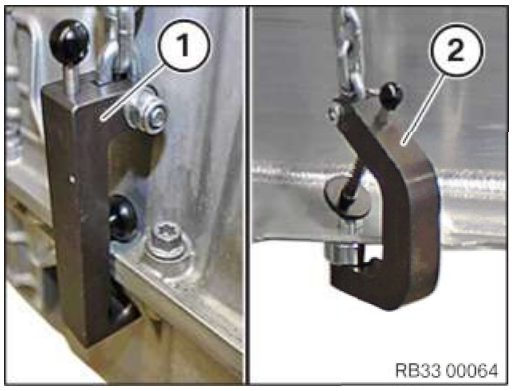
The following section describes the use of the special tool 2 456 428 with the different high-voltage battery units.

The position of the adjustment arms, pivot bearings and chain have been numbered or labelled on the special tool 2 456 428.

Settings are described individually for each high-voltage battery unit in the tables listed below.

Defined fixtures to attach multifunction hooks have been installed on the high-voltage battery unit housing!

Once special tool 2 456 428 has been correctly positioned and set, the bag hooks are located precisely at the fixtures of the high-voltage battery unit.



Bag hooks (1)

C-hooks (2)

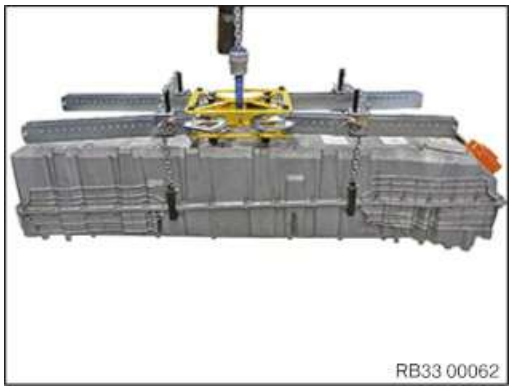
Special tool setting



Equip special tool 2 456 428 with the C-hooks.

Adjusting arm	Pivot bearing position	Chain position
1	I	1
2	I	1
3	H	2
4	H	2

Special tool setting



Equip special tool 2 456 428 with the multifunction hooks.

Adjusting arm	Pivot bearing position	Chain position
1	D	12
2	D	18
3	D	18
4	D	12

Special tool setting

cardiagn.com



Equip special tool 2 456 428 with the multifunction hooks.

Adjusting arm	Pivot bearing position	Chain position
1	T	6
2	S	6
3	S	9
4	T	9

Special tool setting



Equip special tool 2 456 428 with the C-hooks.

Adjusting arm	Pivot bearing position	Chain position
1	R	5
2	X	5
3	X	6
4	R	8

Special tool setting



Equip special tool 2 456 428 with the C-hooks.

Adjusting arm	Pivot bearing position	Chain position	Chain links up to the mounting hook
1	q	8	5
2	G	5	4
3	G	5	2
4	q	6	3

Special tool setting



Equip special tool 2 456 428 with the C-hooks.

Adjusting arm	Pivot bearing position	Chain position	Chain links up to the mounting hook
1	M	11	8
2	T	14	7
3	N	11	18
4	H	9	13

Special tool setting

carjiagn.com



Equip special tool 2 456 428 with the multifunction hooks.

Adjusting arm	Pivot bearing position	Chain position	Chain links up to the mounting hook
1	W	16	3
2	W	16	3
3	F	2	8
4	F	2	8

Special tool setting



Equip special tool 2 456 428 with the C-hooks.

Adjusting arm	Pivot bearing position	Chain position
1	q	1
2	q	1
3	q	1
4	q	1

Additional Information

Overview of Special Tools

2 456 428 Lifting gear



Common	
Usage	From 2018, this lifting gear replaces SWZ 2 360 081. During the course of the changeover from BMWi to iPerformance, a tool changeover also takes place from warehouse to campaign. The previous SWZ 83 30 2 360 081 can continue to be used as specified in the repair instructions.
Included in the tool or work	
Storage location	
Replaced by	
In connection with	
SI-Number	

cardiagn.com

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

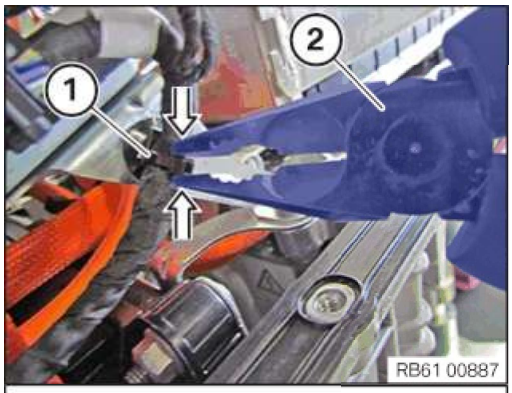
Technical support must be contacted in case of damaged high-voltage cables.

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

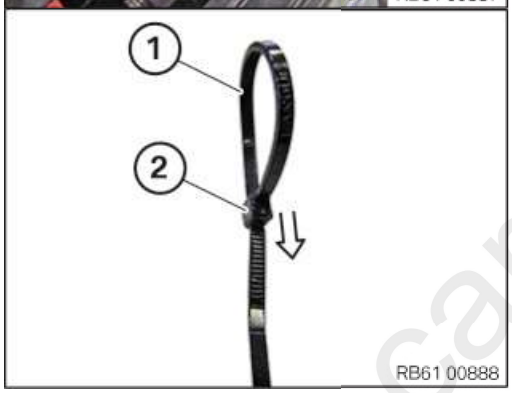
Sourcing reference:

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

cardiagn.com

DANGER



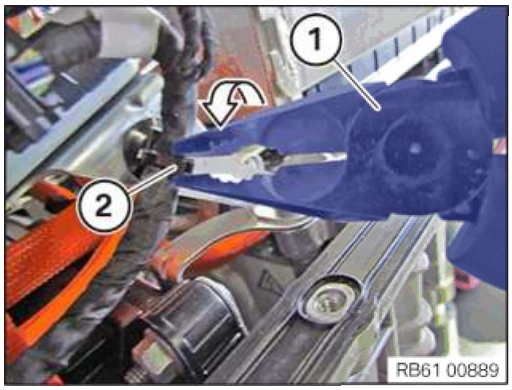
Damaged high-voltage cables, high-voltage connectors and high-voltage components.

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.

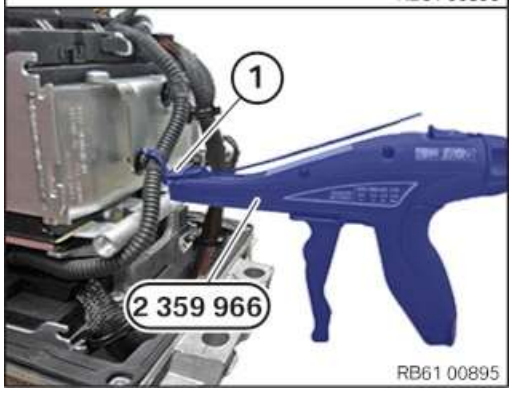
Closing cable straps



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

cardiagn.com

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)

cardiagn.com

Notes for use of adapter cable 24-pin

Use of a 24-pin adapter cable



If instructed by the EoS tester, the high-voltage battery unit must be connected to the vehicle with the adapter cable 2 448 805.

The 24-pin adapter cable is used to connect the removed high-voltage battery unit to the vehicle for further guided troubleshooting.

Procedure:

If the EoS test was not passed and the high-voltage battery unit has no faults that are relevant for safety, the high-voltage battery unit must be connected to the vehicle with an adapter cable.

The diagnosis via ISTA cannot start until this connection has been established.

If necessary, the 12 V battery must be reconnected for the diagnosis.

The activation of the high-voltage system is prohibited.

Additional Information

Overview of Special Tools

2 448 805 Adapter cable



Common	
Usage	24-pin I-adapter cable to connect the disassembled high-voltage connector and the vehicle for guided troubleshooting. During the course of the changeover from BMWi to iPerformance, a tool changeover also takes place from warehouse to campaign.
Included in the tool or work	
Storage location	R205
Replaced by	
In connection with	
SI-Number	02 18 16 (408)

cardiagn.com

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

cardiagn.com

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

cardiagn.com

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 (loosing 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/adapter 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!

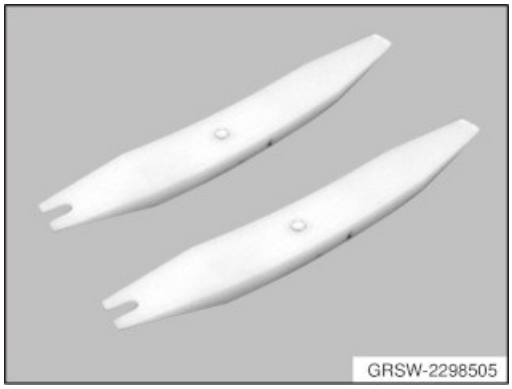
The seal must be renewed every time the housing cover is removed to guarantee tightness of the high-voltage battery unit.

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)

cardiagn.com

Notes on the identification of the high-voltage system

TECHNICAL INFORMATION

The warning stickers can be found as an attachment under further information. They can be printed out there in the respective national language.

High voltage identification

NOTICE

The warning stickers are only available in the standard BMW languages. If other national languages are required due to legal requirements, request them from the respective National Sales Company or Retailer Organisation.

These warning stickers are meant for easier and uniform identification of live vehicles in BMW Retailer Organisations.

The warning stickers are meant to uniquely identify the individual states of the high-voltage system of a vehicle for every person immediately.

These warning stickers are also meant to be part of the health and safety briefing so that all employees know their meaning and can judge the dangers associated with them correctly.

- Fill up the warning sticker fully so that the person responsible for work for that particular vehicle can be identified.
- The warning sticker must be affixed such that this can be seen immediately by everybody.

Warning sticker 4



The warning sticker 4 is to be affixed when the high-voltage system is de-energised.

For better follow up, the warning sticker must be filled up completely.

The de-energising must be performed by a qualified person with training as a high-voltage technician or as a high-voltage expert.

The procedure for de-energising may be taken from the respective repair instructions.

- The high-voltage service disconnect is disconnected and secured with the U-lock.
- No external voltage supply connected to the vehicle (e.g. charger)
- Check in instrument cluster that system is de-energised.

Covering the vehicle with high-voltage barrier tape is not necessary.

Identification of the vehicle by an identification block is also not required.

Warning sticker 5

carmagn.com



Warning sticker 5 is to be affixed for the following jobs.

- If diagnostic jobs are to be performed on the high-voltage system.
- If a high-voltage battery unit is opened and repaired.
- At the recommissioning after a repair of the high-voltage system.

The recommissioning of the high-voltage system may only take place after all components have been correctly installed.

Exception: The high-voltage battery unit is connected to the vehicle through the adapter cable 2 448 805.

For better follow up, the warning sticker must be filled up completely.

These jobs may only be carried out by trained persons with a qualification as a high-voltage technician or a high-voltage expert.

The vehicle may be covered by means of high-voltage barrier tape.

An open high-voltage battery unit must always be covered.

The vehicle may be identified through an identification block.

Warning sticker 6



Warning sticker 6 is to be affixed when the vehicle is not found to be de-energised.

Only high-voltage experts or Technical Support are permitted to work on the vehicle.

For better follow up, the warning sticker must be filled up completely.

These jobs may only be carried out by trained personnel with qualification as high-voltage experts or by a qualified electrician.

The vehicle must be covered by high-voltage barrier tape.

The vehicle must be identified by means of an identification block.

Additional Information

Overview of Special Tools

carsagn.com

2 448 805 Adapter cable



Common	
Usage	24-pin I-adapter cable to connect the disassembled high-voltage connector and the vehicle for guided troubleshooting. During the course of the changeover from BMWi to iPerformance, a tool changeover also takes place from warehouse to campaign.
Included in the tool or work	
Storage location	R205
Replaced by	
In connection with	
SI-Number	02 18 16 (408)

cardiagn.com

Links

Appendices
Warning stickers

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

cardiagn.com

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 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.

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

cardiagn.com

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

cardiagn.com

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-boltage 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.

cardiagn.com

Unlocking and disconnecting various plug connections in electrical and hybrid vehicles

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.

Hirschmann high-voltage connectors

Handling Hirschmann high-voltage connectors

1 – Disconnecting Hirschmann high-voltage connectors

DANGER

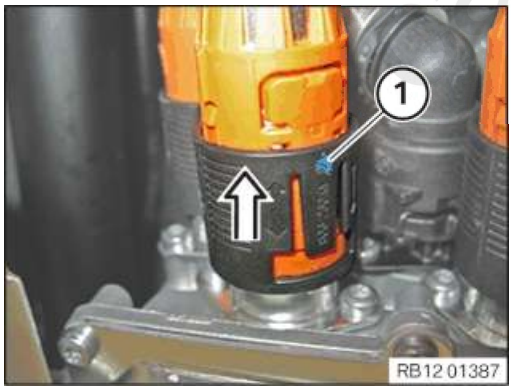


Damaged high-voltage cables, high-voltage connectors and high-voltage components.

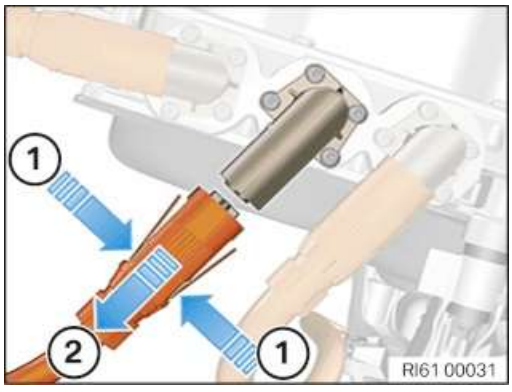
Danger to life through electric shock!

- 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.

1 – Convenience charging electronics (KLE): Unlock circlip

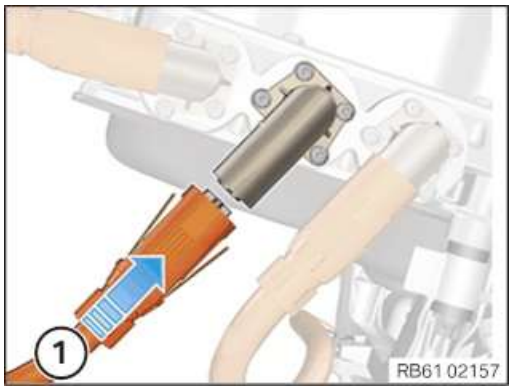


- Push back the circlip (1) to the limit position in the direction of the arrow.



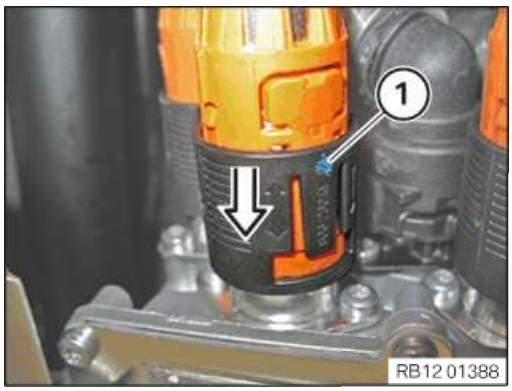
- Press the lock (1) on the left and right on the connector in the direction of the arrow.
- Pull off the connector (2) in the direction of the arrow.
- Connector (2) is difficult to pull off.

2 – Connecting Hirschmann high-voltage connectors



- Pull off the connector (1) in the direction of the arrow.
- While connecting, the connector (1) must engage audibly.

2 – Convenience charging electronics (KLE): Lock circlip



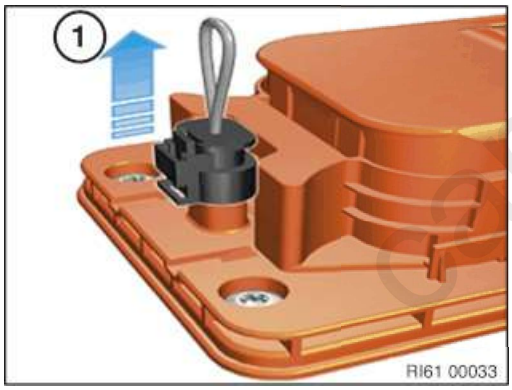
- Slide the circlip (1) in the direction of the arrow to the limit position.

  The circlip (1) must engage audibly.

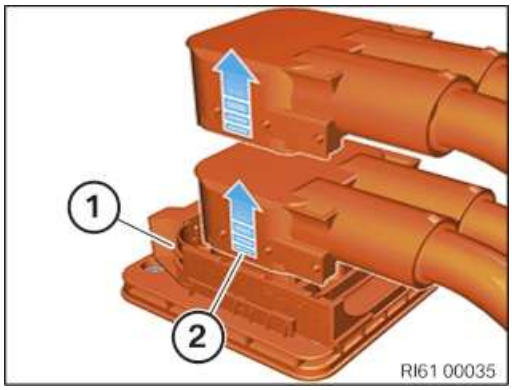
Kostal high-voltage connector

Handling Kostal high-voltage connector and high-voltage connection

3 – Disconnecting Kostal high-voltage connector



- Unlock and disconnect the connector (1) for the high-voltage interlock.



- Push the lock (1) fully to the front.
- Lift connector (2) and remove entirely.
- Pull off connector (2) in one single movement from the counter-housing.

» Damage may be caused to contact protection if connector is only partly pulled off and then closed again.

4 – Checking the Kostal high-voltage connection

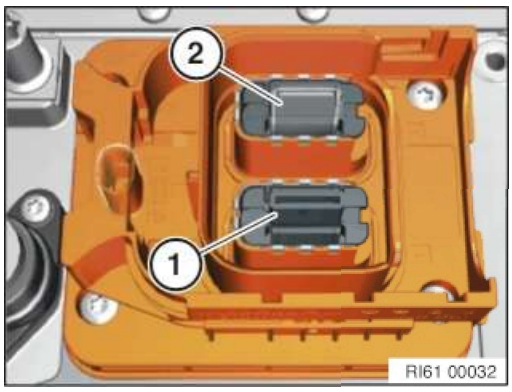
carldiagn.com

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.



Check

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

Result

» Touch protection is fixed in the lower position (2).

Measure

- Reconnect the high-voltage connector and carry out the test again.

  Renew the damaged high-voltage connector.

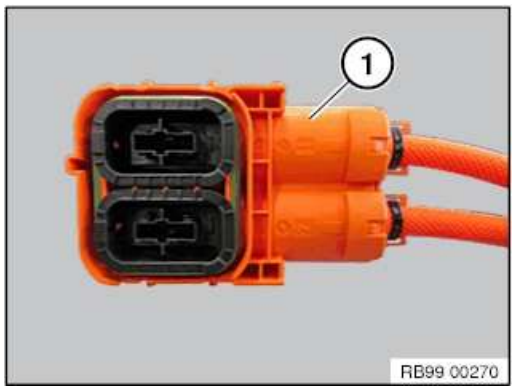
5 – Checking Kostal high-voltage connector

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.



Check

- Check high-voltage connector for damage.

cardiagn.com

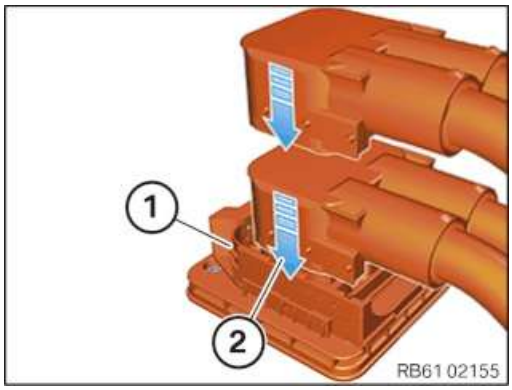
Result

» Damage to high-voltage connector housing

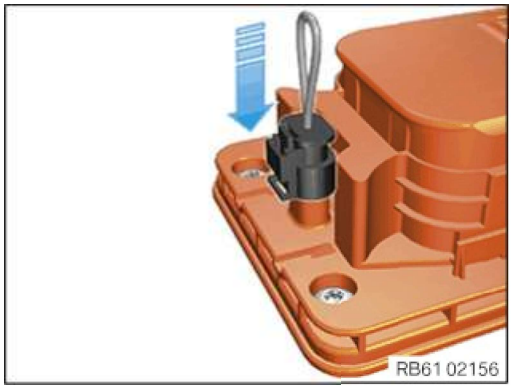
Measure

- Replace damaged high-voltage cable.

6 – Connecting Kostal high-voltage connector



- Connect connector (2) in one single movement to the counter-housing.
- Push the lock (1) fully to the rear.



- Connect the connector of the high-voltage interlock (1).

High-voltage connector to high-voltage connection

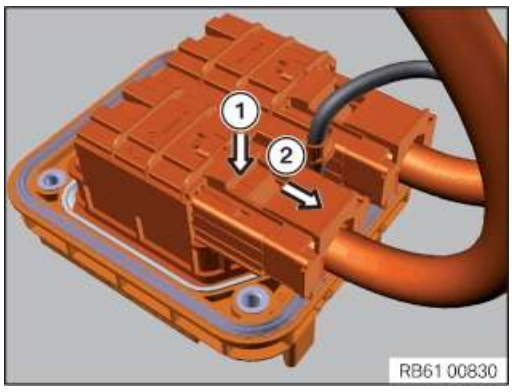
DANGER



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.



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

Pull off the connector (2) in the direction of the arrow.

High-voltage connector on cell module

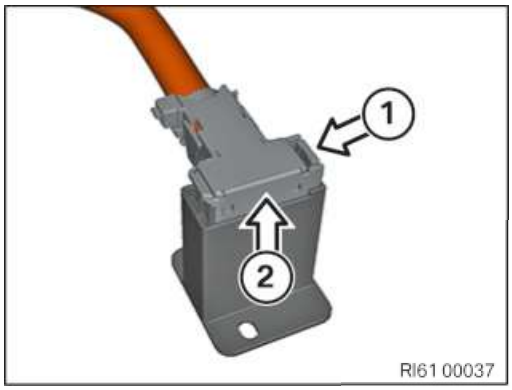
cardiagn.com

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.



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

Pull off the connector (2) in the direction of the arrow.

While connecting, the connector (2) must engage audibly.

In the case of damage to high-voltage connector (2), the entire cell module must be replaced.

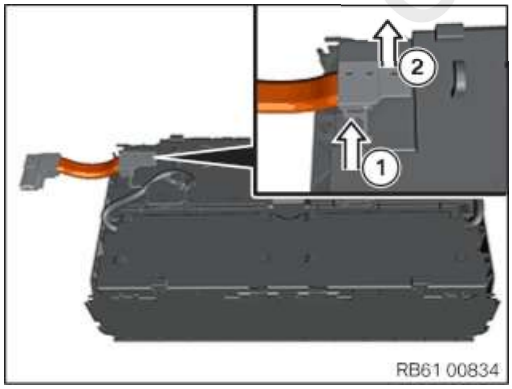
Cell module connecting cable

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.



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

Pull off the connector (2) in the direction of the arrow.

While connecting, the connector (2) must engage audibly.

In the case of damage to the cell module high-voltage connector (2), the entire cell module must be replaced.

UVW connector

Handling UVW connector.

7 – Disconnecting UVW connector

cardiagn.com

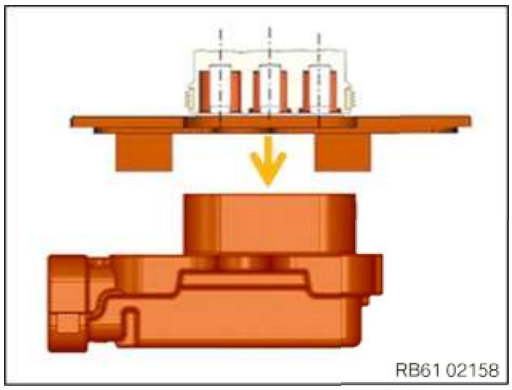
DANGER



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

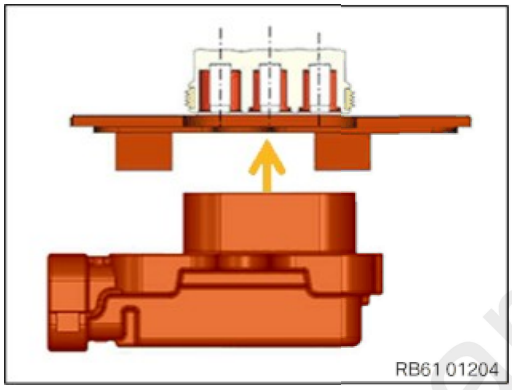
Danger to life through electric shock!

- 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.

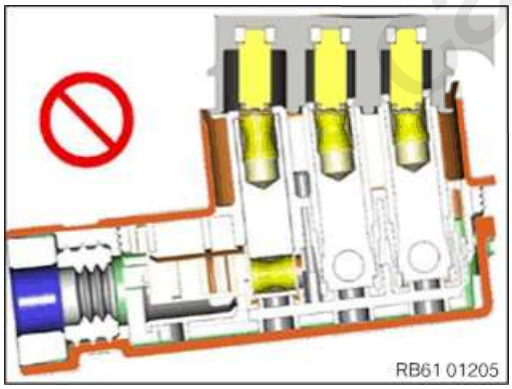


- Pull off UVW connector straight.

8 – Connecting UVW connector



- Connect UVW connector straight, until it is in parked position.



- The system is designed to only offer limited protection against damage caused by connectors inserted at an angle.
- As the angle of connection increases, so too does the risk of damage and insertion force.

carldiagn.com

Visual check of the high-voltage battery unit following an accident

Cost sheet

Working times incurred can be invoiced through the flat rate unit number 61 25 001.

Please note the further information before beginning work

The following points must be strictly observed prior to starting work (see further information):

- Assessment of damaged vehicle
- Observe safety information for working with electric vehicles.
- Disconnect high-voltage system from power

If the message **High-voltage system deactivated** is not displayed in the instrument cluster, work must be stopped. If the high-voltage battery unit is still in the vehicle, the vehicle must be made inaccessible and blocked off. Furthermore, the high-voltage battery unit that has been removed must be blocked off with high-voltage barrier tape.

Preconditions

It is mandatory to stop repair work and contact technical support when there is an unclear situation, strong deformation, strong heating as well as escape of fluid from the high-voltage battery unit.

Accident vehicle should be parked outdoors on a place for vehicles affected by accident.

If the high-voltage battery unit is still in the vehicle, then the vehicle must be made inaccessible and locked. Furthermore, the removed high-voltage battery unit must be blocked off with high-voltage barrier tape and technical support must be contacted.

An airbag that has been deployed or safety battery terminal

If at minimum one of the airbags or the safety battery terminal have been activated, the high-voltage battery unit must be removed and the safety box, housing tray and distributor block must be replaced. The remaining components may be reused, providing they are not damaged.

If the vehicle is severely deformed in the area of high-voltage battery unit without an airbag or the safety battery terminal having activated, the safety box must be replaced.

If the vehicle apparently had a serious accident when stopped (parked, in charging), and the airbag or safety battery terminal were not activated, then the safety box must also be replaced.

Checked	Comment
-	

Damage at attachment points



The high-voltage battery unit is screwed to the vehicle at the housing.

If the vehicle bolting points are torn off, bent or deformed, contact technical support!

In the case of cracks in the housing, contact technical support.

If damage that has not been described is detected or if there are ambiguities in the type of damage/cause of damage, then technical support must be contacted.

Checked	Comment
-	

Damage to electrical interfaces

carmanuals.com



The high-voltage battery unit is connected to the vehicle through the following interfaces on the housing:

- Signal line interface
- High-voltage cable interface
- High-voltage interlock interface

If these interfaces are damaged, contact technical support!

The following types of damage are considered to be relevant:

- bent plug-in contacts
- destroyed connector housing
- connectors that are torn off the housing
- loss of ability to connect the mating plug

If the message **High-voltage system deactivated** is not displayed in the instrument cluster, work must be stopped. If the high-voltage battery unit is still in the vehicle, the vehicle must be made inaccessible and blocked off. Furthermore, the high-voltage battery unit that has been removed must be blocked off with high-voltage barrier tape.

Technical support must be contacted when one or more of these points applies.

Checked	Comment
-	

Damage to venting unit/refrigerant connection



Visually check the following interface on the housing:

- Degassing unit

If this interface is damaged, the venting unit must be replaced.

If the diaphragm is damaged, technical support must be contacted!

Visually check the following interfaces on the housing:

- Refrigerant connections

If this interface is damaged, the radiator must be replaced. The following types of damage are considered to be relevant:

- Faulty threads (1) on the refrigerant connection/expansion valve
- Deformation (e.g. refrigerant lines can no longer be installed)
- Leak between the refrigerant connection and housing
- loss of ability to connect the mating plug

Checked	Comment
-	

Damage to the rest of the housing

ofrdiagn.com



Visually check the housing:

Relevant damage for the replacement of the high-voltage battery unit:

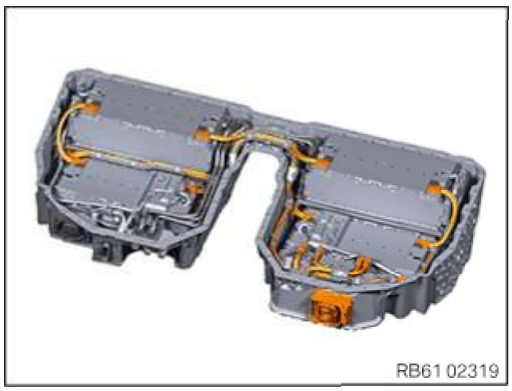
- Cracks, holes and other leaks on the housing
- Dents and deformation on the housing, especially on large-area housing sections

Scratch marks are not classed as critical. This type of damage does not require replacements.

If damage that has not been described is detected or if there are ambiguities in the type of damage/cause of damage, then technical support must be contacted.

Checked	Comment
-	

Visual inspection



If the lid the safety box is opened for replacement, a visual inspection for identifiable damages is to be immediately performed after opening the lid.

If damage that has not been described is detected or if there are ambiguities in the type of damage/cause of damage, then technical support must be contacted.

Checked	Comment
-	

Recycling



Pay attention to the recycling instructions in the information bulletin for the high-voltage battery unit.

Documentation

In order to better follow up on this document, please print and archive it with the vehicle records.

Vehicle identification number	Serial number of the high-voltage battery unit
_____	_____

Order number	Kilometre reading
_____	_____

NAME	First name	Date	Signature
_____	_____	_____	_____

Additional Information

Links

Repair instructions (PRE)
Safety information for handling electric and hybrid vehicles
Assessment of damaged vehicle

cardiagn.com

Assessment of damaged vehicle

Repair instructions

61 25 900 Disconnect high-voltage system from power

61 27 500 Replace the lid for the high-voltage battery unit (high-voltage battery unit removed)

61 27 501 Removing and installing lid for high-voltage battery unit (high-voltage battery unit removed)

61 27 671 Replacing the distributor block for the high-voltage battery unit (high-voltage battery unit removed)

61 27 581 Replacing the high-voltage battery unit housing well (high-voltage battery unit removed)

cardiagn.com

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

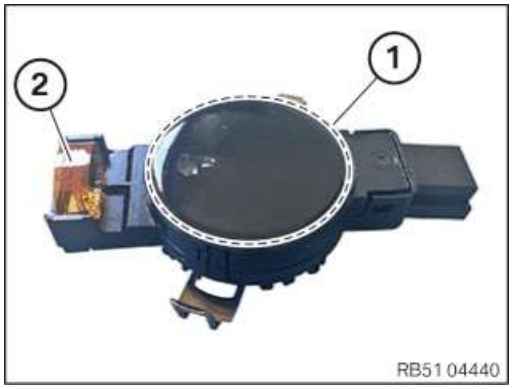
By signing, the mechanic and tester assume liability for the correctness of the screw connection!

cardiagn.com

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.

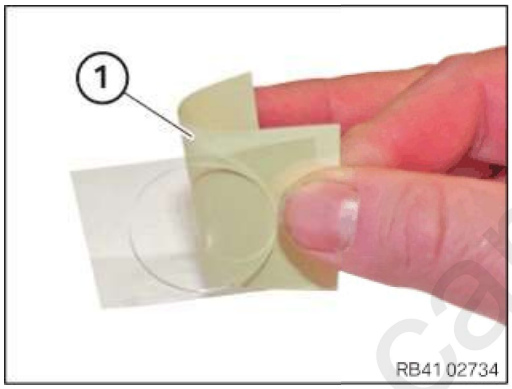
- Remove the gel pad (1) by hand.

  Do not touch or damage the printed circuit (2).

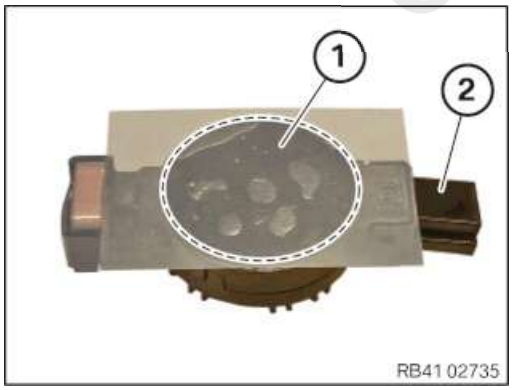
- If necessary, remove any gel residue using a microfibre cloth.
- Clean the surface of the rain-light-solar-fogging sensor using a microfibre cloth R2 soaked in cleaning agent.

Expendable materials

Cleaning agent R2	500 ml	83190417324



- Remove the yellow protective film (1).

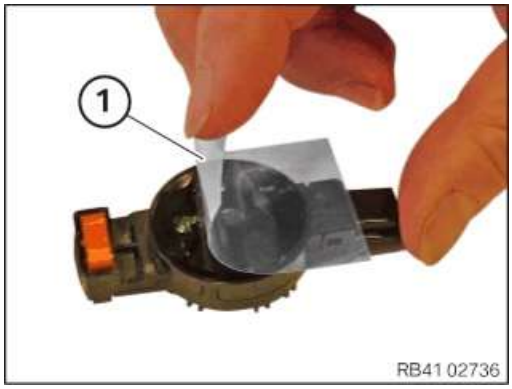


- Place the gel pad (1) in the centre of the surface of the rain-light-solar-fogging sensor (2).

  Do not eliminate existing air bubbles.

  Air pockets disappear within 30 min after mounting the sensor on the windscreen.

cardiagn.com



- Remove transparent protective film (1).

cardiagn.com

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!

cardiagn.com

4.1.2 Headlight alignment

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

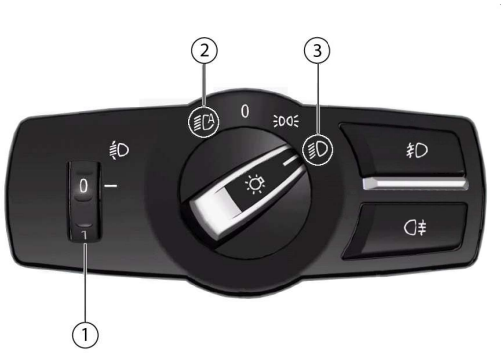
Use a headlight adjustment device to determine the horizontal setting of each headlight for the low-beam headlight or use the electronic vehicle interface.

Fault determination according to EG PTI:

a)	Headlight adjustment not within the prescribed limits.
b)	System outputs an error via the electronic vehicle interface.

Methods according to vehicle manufacturer:

Refer to document 4.1.3 for a description on how to activate the headlights.



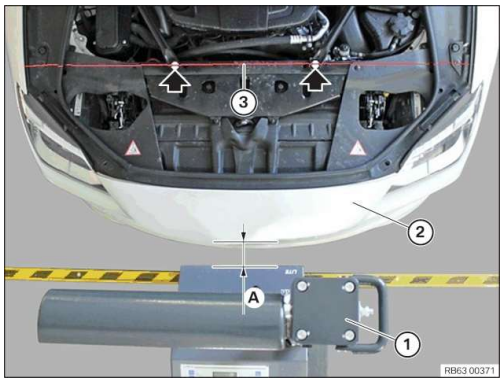
Test specifications:

- Park the vehicle on an even surface with the wheels in straight-ahead position.
- Faulty lenses and mirrors as well as light bulbs that have been tinted black are not permitted.
- Check tyre pressure and correct if necessary.
- Subject the driver's seat to the load of one person (approx. 75 kg).
- Vehicle with full fuel tank or appropriate additional weight in luggage compartment.

Carry out the test as instructed:

- Switch the ignition on.
- Manual headlight beam throw adjustment: Move handwheel to neutral position (1).
- The light switch must be in the low-beam headlight or driving light position (3).
- Do not run headlight adjustment in 'automatic driving lights control' (2) light switch position.
- Version with Xenon or LED (automatic headlight beam throw adjustment): Wait 80 s after having switched on the light. During this time, do not move the vehicle and avoid vibrations.

cardiagn.com



TECHNICAL INFORMATION

- Correct measurement/adjustment requires exact positioning of the headlight adjustment device (1)!
- The headlight adjusting device (1) must stand vertically to the vehicle longitudinal axis!
- This applies to all headlights!

TECHNICAL INFORMATION

- Points must be vehicle proof!
- Points must be separated as wide as possible!
- Trim panels are not suitable!

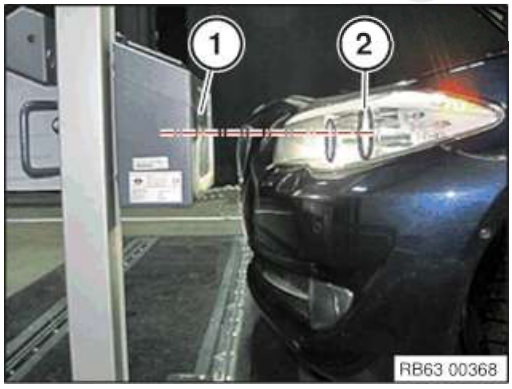
Position the headlight adjustment device (1) in the centre in front of the motor vehicle (2) at a distance (A) = 10 cm .

Align the headlight adjustment device (1) with the laser beam (3). The laser beam (3) must meet two suitable spots, e.g. highlighted by arrows.

.

cardiagn.com

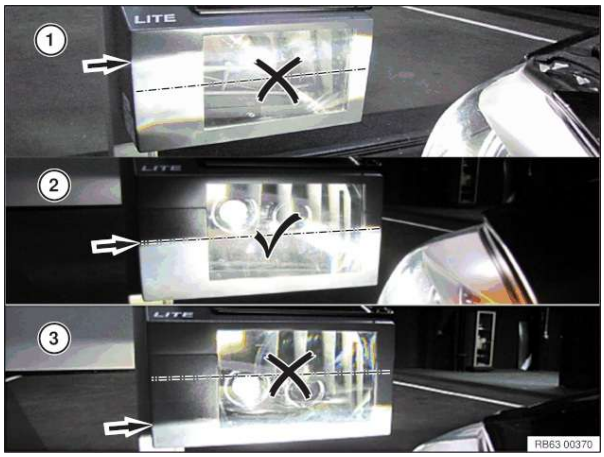
If the headlight adjusting device (1) does not have a laser beam (3), complete the alignment analogous with the line in the mirror.



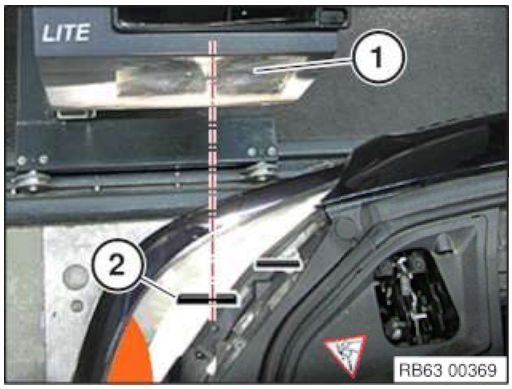
TECHNICAL INFORMATION

Always perform positioning of the headlight adjusting device (1) at the outer headlight (2)!

The centre of the collecting lens (1) must match the centre of headlight (2) horizontally. Corrections are made by raising or lowering the headlight adjusting device.



When positioned correctly, the light/dark boundary of the headlight (marked with arrow) must hit the collecting lens of the adjusting device in the centre: 1. Headlight adjustment device too far down. 2. Headlight adjustment device positioned correctly. 3. Headlight adjustment device too far at the top.



The centre of the collecting lens (1) must match the centre of headlight (2) vertically. Corrections are made by sliding the side of the headlight adjusting device to the left or right.

Light/dark boundary of headlights in headlight adjusting device

Setting dimension, headlights:

The value is indicated in % on the headlight housing.



The following value applies to saloons **1.0 %**: 1.0 % = -10 cm/10 m = - 1.0 % at the headlight adjustment device



The following value applies to Sports Utility Vehicles **1.1 %**: 1.1 % = -11 cm/10 m = - 1.1 % at the headlight adjustment device

cardiagn.com

4.1.1 Headlamps status and function

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Visual inspection and operation

Fault determination according to EG PTI:

a)	Headlight/light source faulty or missing (multiple headlight/multiple light sources; for LED up to 1/3 not operational). Individual headlights/light sources; for LED visibility severely impaired.
b)	Projection system (reflector and lens and/or headlight lens or end lens) with minor damage, projection system (reflector and lens and/or headlight lens or end lens) severely damaged or not available.
c)	Light not attached safely.

Methods according to vehicle manufacturer:

In general, four different lighting systems are installed at BMW, which may vary based on the vehicle equipment.

The front headlight consist of two headlights with a low-beam headlight and high beam each. All installed bulbs and/or LEDs of this system must be fully functional.

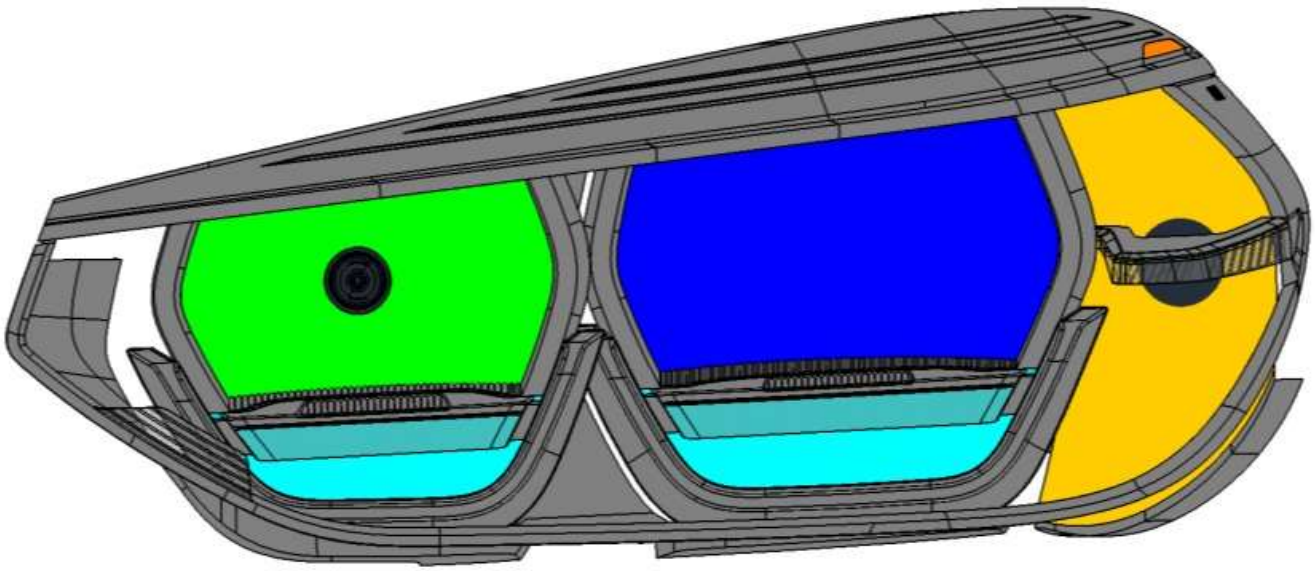
Following systems are installed:

The following descriptions come from examples of different models and may deviate in individual cases.

Halogen (H7) headlights

Manual headlight beam throw adjustment





	- The low-beam headlight (1) has been illustrated in dark blue.	1
	- The high beam (2) has been illustrated in green.	2
	- The daytime driving light (3) has been illustrated in light blue.	3
	- The turn indicator (4) has been illustrated in yellow/orange.	4

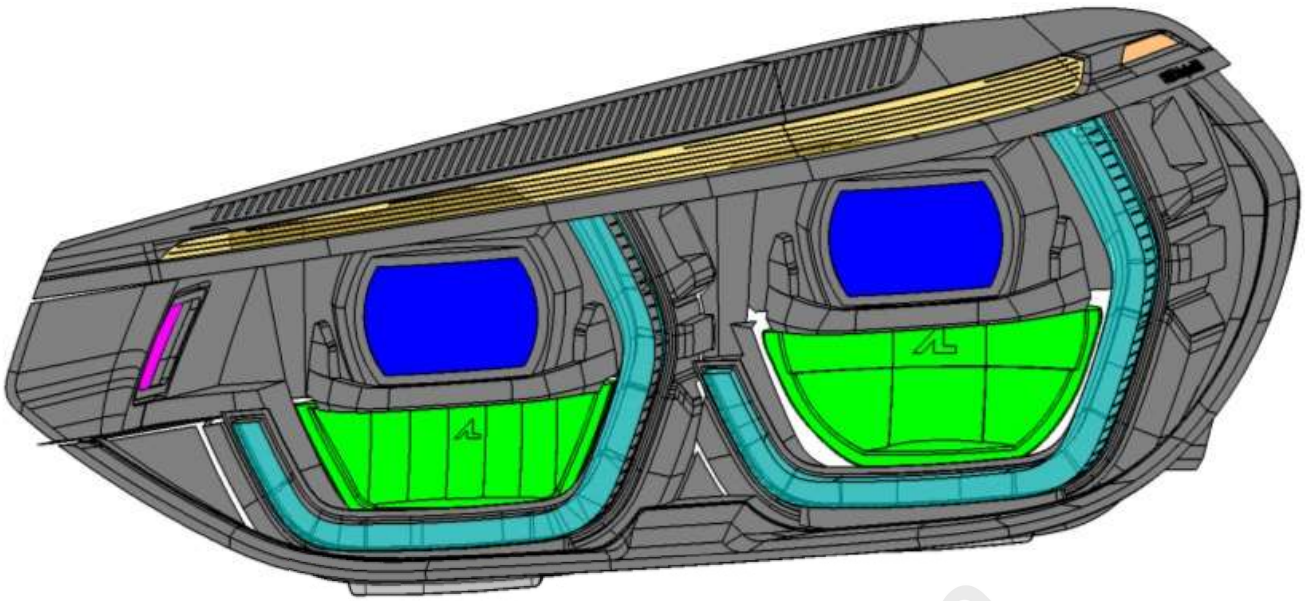
cardiagn.com



Xenon headlights

Automatic headlight beam throw adjustment (legally prescribed as per regulation by the ECE).

For example G01 front light combination OE 552 symbol light



	- The cornering light (1) has been illustrated in purple.	1
	- The turn indicator (2) has been illustrated in orange or yellow.	2
	- The low-beam headlight (3) has been illustrated in dark blue.	3
	- The high beam (4) has been illustrated in green.	4
	- The daytime driving light (5) has been illustrated in light blue.	5



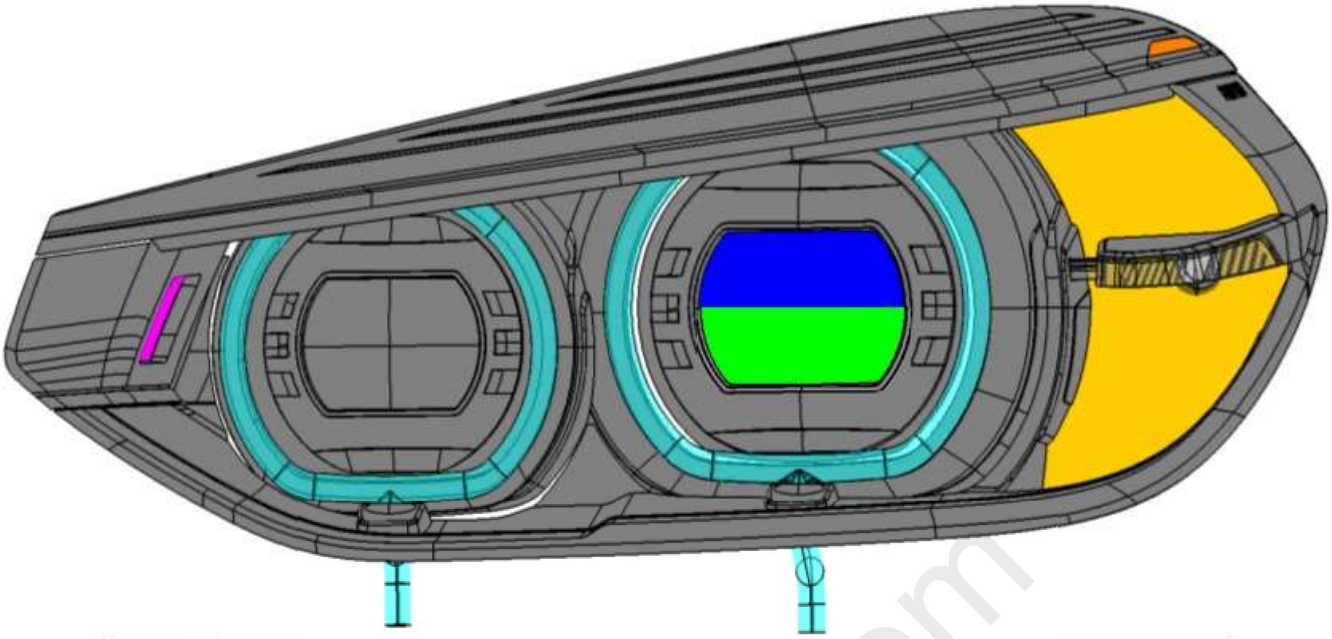
LED headlight

Low-beam headlight, high beam, daytime driving lights, front parking light.

Automatic driving light (automatic driving lights control).

Automatic headlight beam throw adjustment (legally prescribed as per regulation by the ECE).

Example G01 - front light combination (optional equipment 5A4) BiLED AHL



	- The cornering light (1) has been illustrated in purple.	1
	- The low-beam headlight (2) has been illustrated in dark blue.	2
	- The high beam (3) has been illustrated in green.	3
	- The daytime driving light (4) has been illustrated in light blue.	4
	- The turn indicator (5) has been illustrated in yellow.	5

cardiagn.com



Laser light

Automatically switches on and irrelevant for the statutory vehicle inspection.

Operations

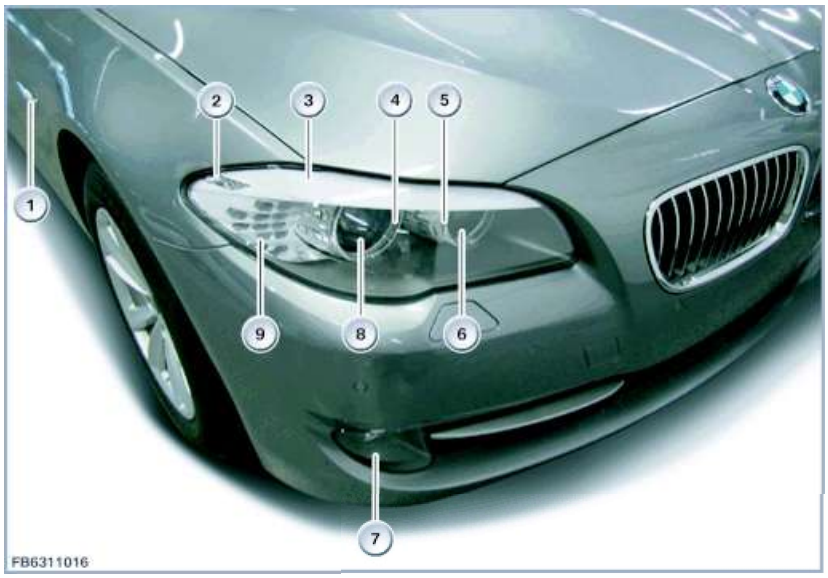
See Chapter 4.1.3.



cardiagn.com

Headlight overview

Front headlights



1 Side panel turn indicator

2 Side marker light

3 Accent light

4 Lighting ring for side lights and daytime driving lights in the low-beam headlight

5 Lighting ring for side lights and daytime driving lights in the high-beam headlight

6 High beam headlights

7 Fog lights

8 Bi-xenon headlight for low-beam headlight

9 LED turn indicator light

Headlight condensation

NOTICE

Certain weather conditions can lead to fogging on the inside of the headlight lens.
This is not necessarily a fault that requires replacement of the headlight.

cardiagn.com

Top row (A): Permissible fogging. **Headlight need not be replaced!**

Bottom row (B): Impermissible fogging. Replace the headlight.



cardiagn.com

4.1.6 Headlight cleaning system (if required)

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Visual inspection and operation (if possible).

Fault determination according to EG PTI:

Device not working with gas discharge bulb (xenon headlights) and LED headlight.

Methods according to vehicle manufacturer:

As legally prescribed, BMW installs a headlight cleaning system for xenon and LED headlights as well as laser light. With halogen headlights it depends on the equipment specification of the corresponding vehicle type.

The position of the operating levers for the corresponding vehicle type has been described in Chapter **'6.2.7 Activation units'** of the EG PTI documentation!

The headlight cleaning system is always linked to the window washer system at BMW.

Upon having operated the window washer system five times the headlight cleaning system is automatically started once.



Installing headlight repair kit

1 – Remove the cover for the centre engine compartment



- Release all expanding rivets (arrows).
- Remove the cover (1).

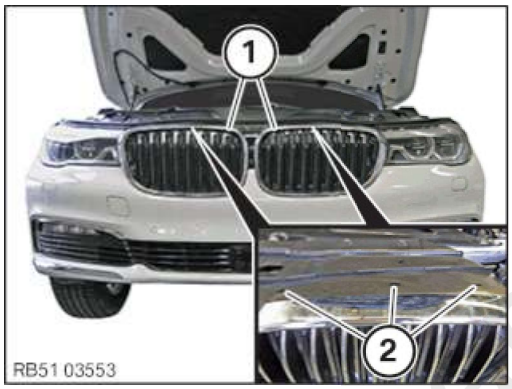
2 – Remove front ornamental grille

Prerequisite

Engine compartment lid is open.

NOTICE

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



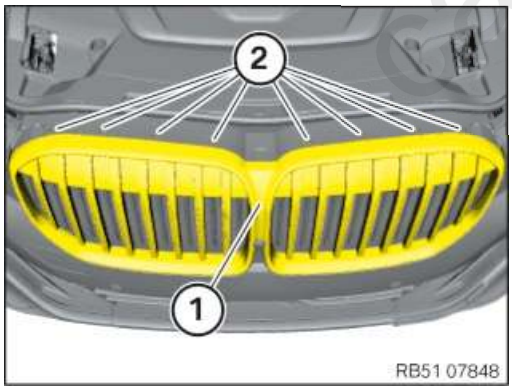
- **For G11/G12 versions up to 03.19 or G30/G31/G38/F90 any version:**

  Grip the lower part of the front ornamental grille (1) **and** clip it out.

  Swivel the upper latch mechanisms (2) upwards to unclip them.

  Avoid contact between front ornamental grille (1) and bumper panel!

  Pull off front ornamental grille (1) to the front.



- **For G11/G12 versions from 03.19**:

  Remove front ornamental grille (1) from the latch mechanisms (2).

  Pull off front ornamental grille (1) from the rest of the latch mechanisms to the front.

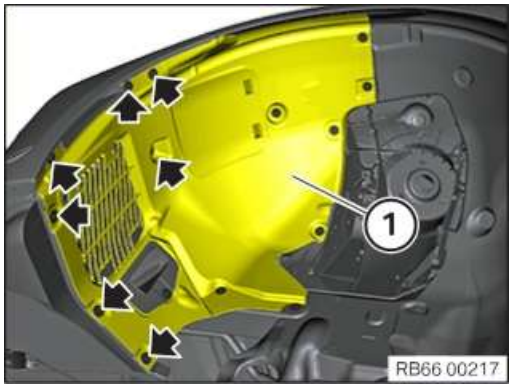
3 – Partially remove the front section of the front wheel arch cover

NOTICE

To provide a better overview: Schematic diagram with partially hidden components.

NOTICE

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

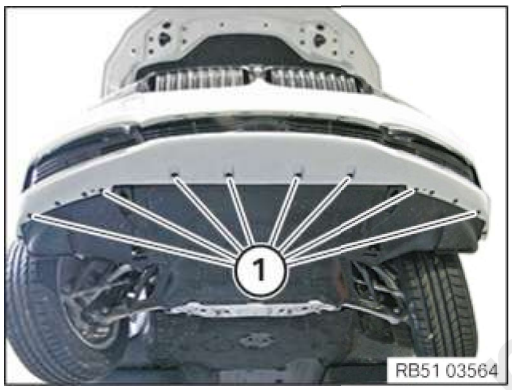


- Remove screws (arrows).
- Fold the wheel arch cover (1) to the side.

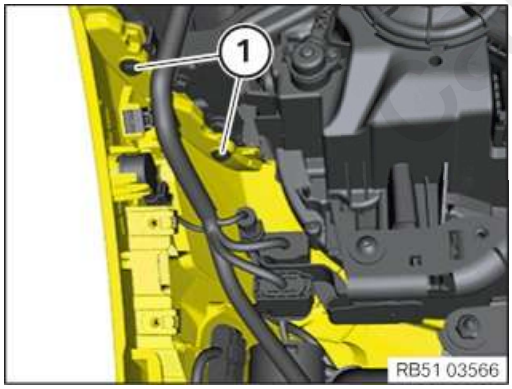
4 – Remove front bumper panel

NOTICE

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



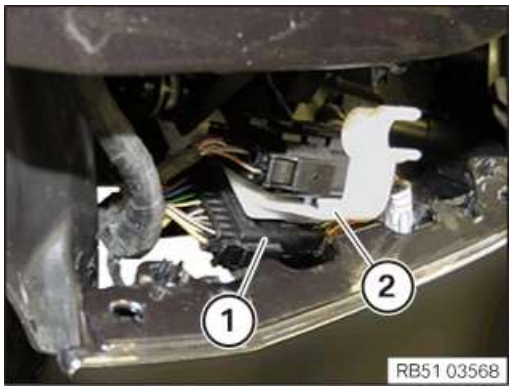
- Loosen screws (1).



NOTICE

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

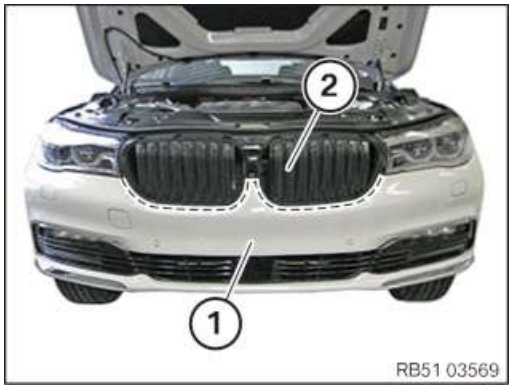
- Loosen screws (1).



- Unlock plug connection (1) on the right and disconnect.
- Detach the plug (1) from holder (2).
- Unlock and disconnect the hose for the headlight cleaning system.
- Place the hose to the top and fix.

  This will prevent washer fluid from exiting.

cardiagn.com



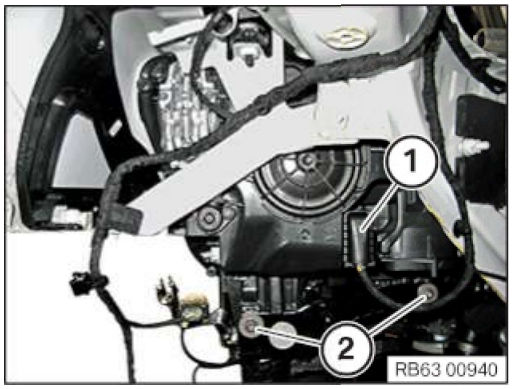
- Undo the bumper panel (1) in the area of the active air-flap control (2) from the mountings.
- Pull the bumper panel (1) slightly forward and disconnect any other plug connections as needed.
- Remove bumper panel (1) towards front.

5 – Removing both headlights

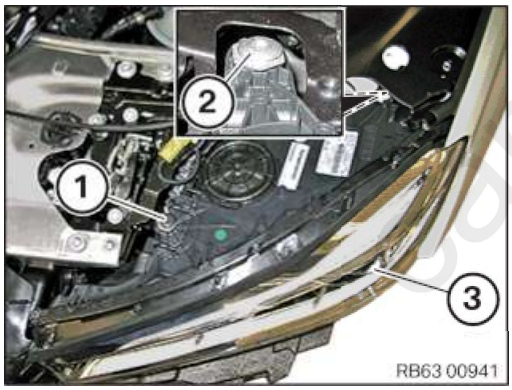
NOTICE

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

5 – Remove headlight

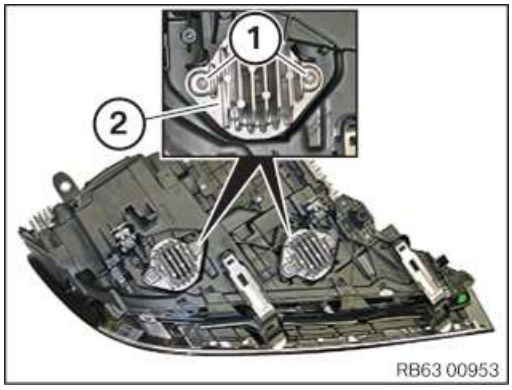


- Unlock and disconnect connector (1).
- Loosen screws (2).



- Loosen screw (1).
- Loosen screw (2).
- Lift headlight (3) slightly, feed out to the front and remove.

6 – Remove the LED module for the daytime driving lights



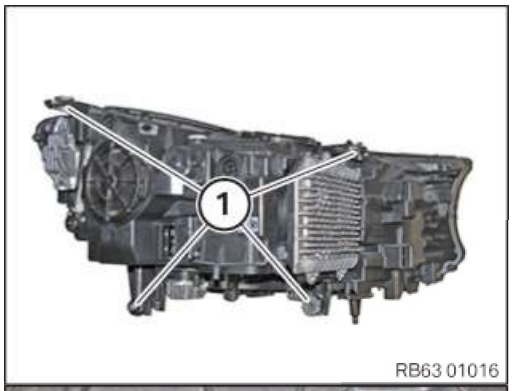
- Loosen screws (1).
- Pull LED module (2) out of headlight.

cardiagn.com



- Unlock connector (1) at LED module (2) and disconnect it.

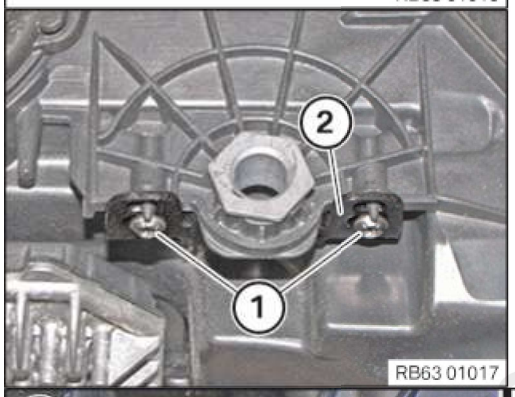
Installing headlight repair kit



TECHNICAL INFORMATION

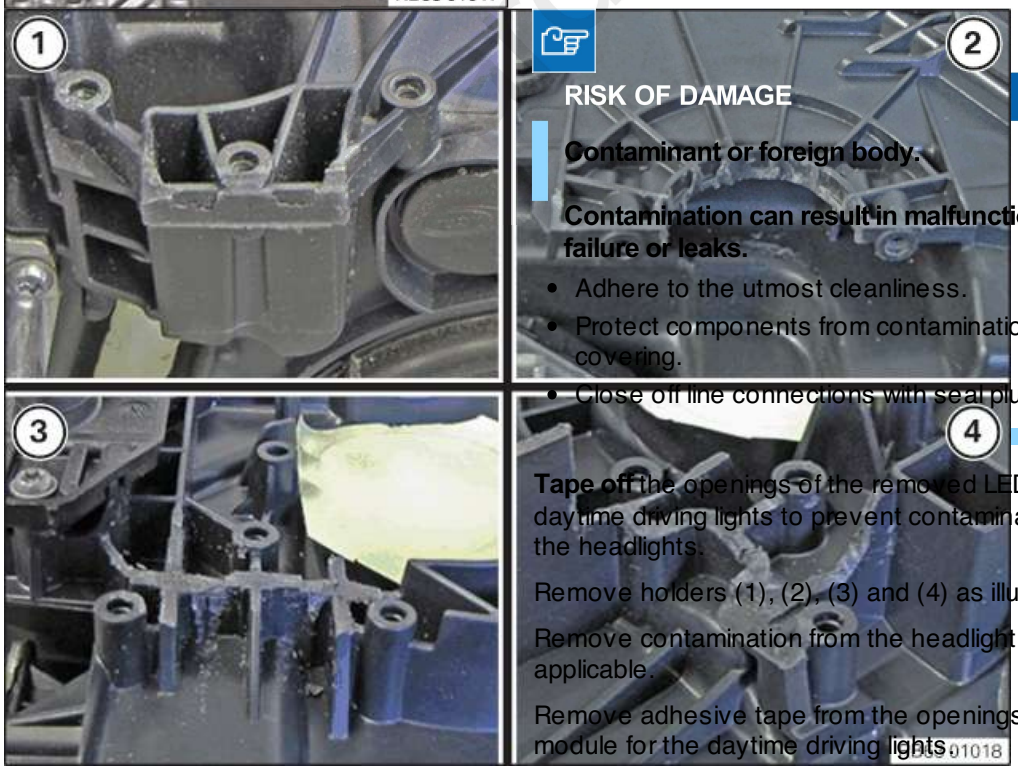
Damaged holders can be replaced with the repair kit.
The replacement of the headlight is **not required.**

The holders (1) can be renewed.



Loosen screws (1).

Remove adapter (2) (will not be used anymore).



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.

Tape off the openings of the removed LED modules for the daytime driving lights to prevent contamination from entering the headlights.

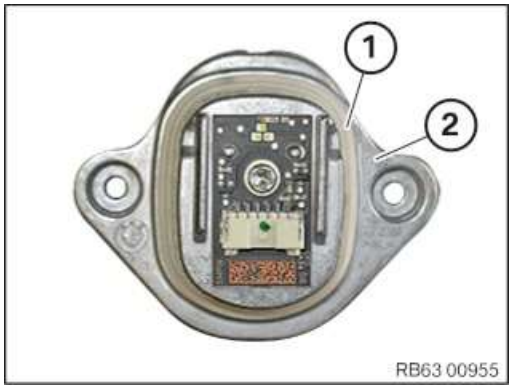
Remove holders (1), (2), (3) and (4) as illustrated.

Remove contamination from the headlight housing, if applicable.

Remove adhesive tape from the openings for the LED module for the daytime driving lights.

7 – Install the LED module for the daytime driving lights

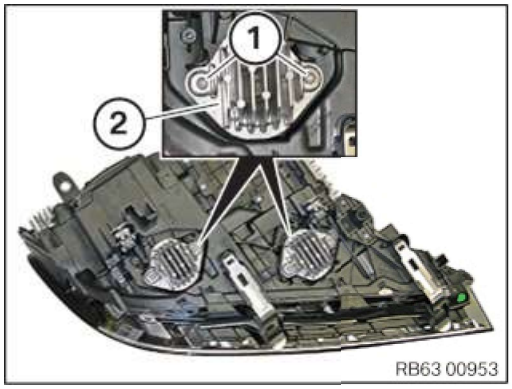
diagn.com



- Check the seal (1) on the LED module (2) for damage and replace as needed.



- Connect connector (1) to LED module (2).

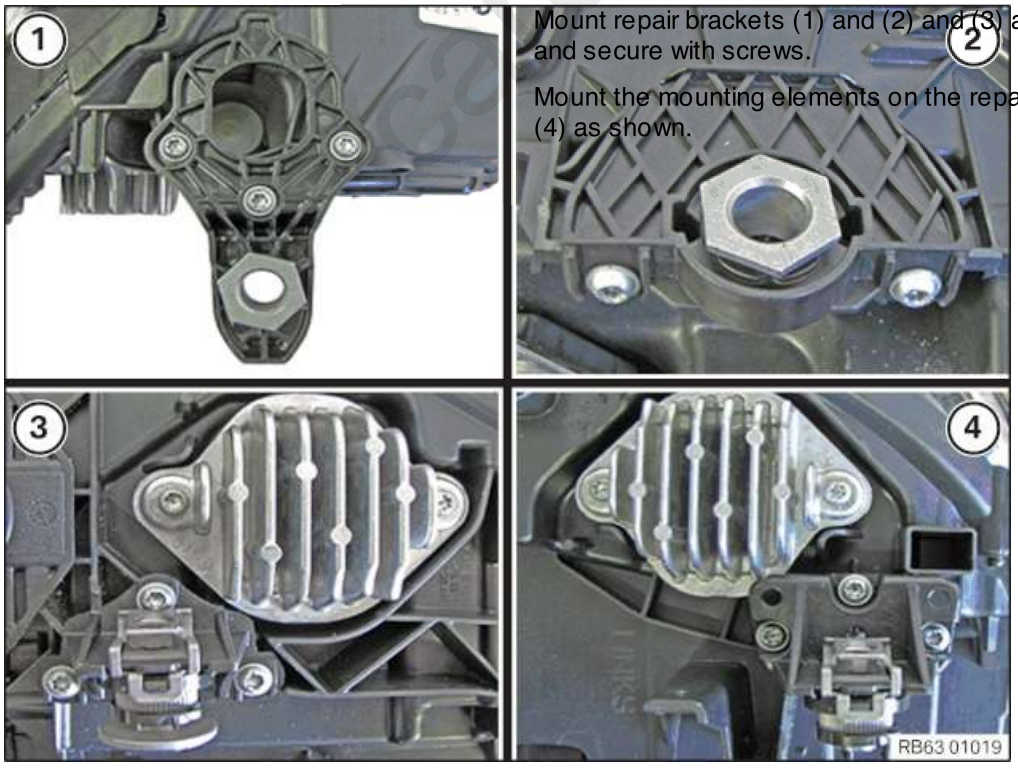


- Position the LED module (2) in the headlight.
- Tighten the screws (1).

LED module, daytime driving lights

Screw		Tightening torque	1,5 Nm

Secure the repair bracket



Mount repair brackets (1) and (2) and (3) and (4) as shown and secure with screws.

Mount the mounting elements on the repair bracket (3) and (4) as shown.

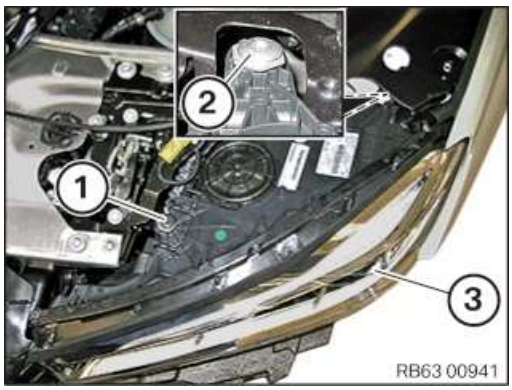
8 – Installing both headlights

cardiagn.com

NOTICE

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

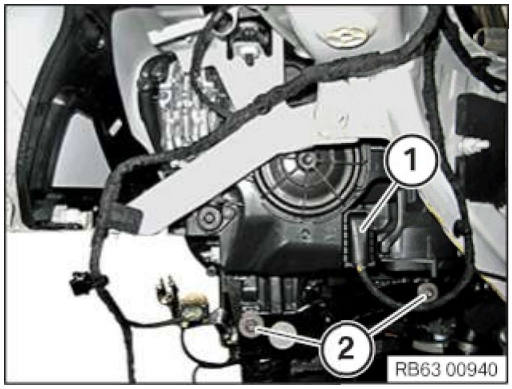
8 – Install headlight



- Feed in headlight (3) and position correctly.
- Tighten down screws (1) and (2).

Front light combination, top

Screw		8 Nm



- Tighten down screws (2).

Front light combination, bottom

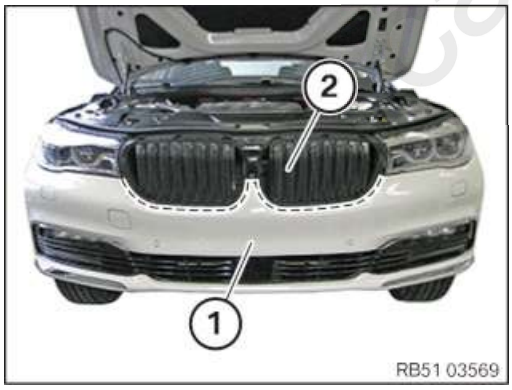
Screw		5 Nm

- Connect connector (1).

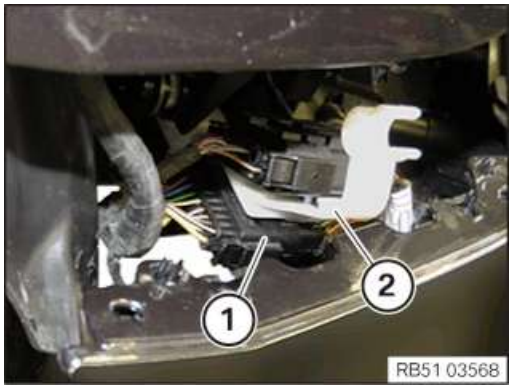
9 – Install bumper panel, front

NOTICE

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

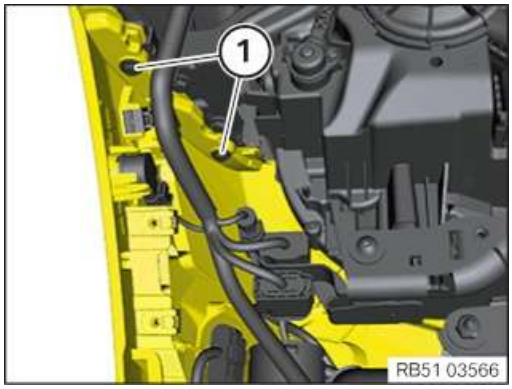


- Install the bumper panel (1).
- Engage the bumper panel (1) in the area of the upper active air-flap control (2) in the mountings.



- Connect the connector (1) on the right side.
- Attach plug connection (1) in holder (2).
- Connect the hose for the headlight cleaning system.

cardiagn.com



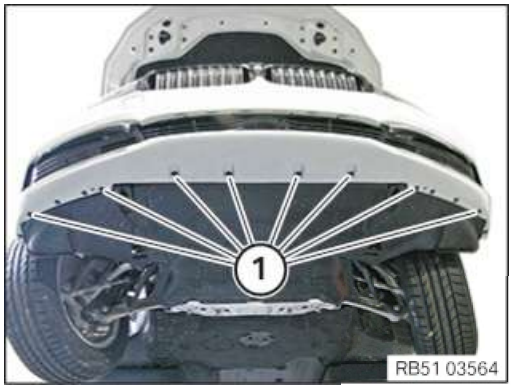
NOTICE

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

- Tighten the screws (1).

Front bumper panel on side wall

		3 Nm



- Tighten the screws (1).

Underbody protection

Screw		Tightening torque	3 Nm

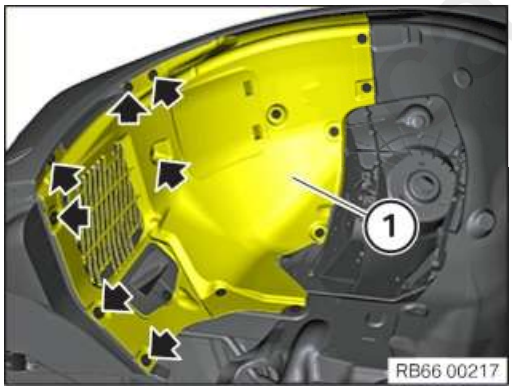
10 – Partially install the front section of the front wheel arch cover

NOTICE

To provide a better overview: Schematic diagram with partially hidden components.

NOTICE

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



- Mount the wheel arch cover (1).
- Tighten screws (arrows).

Wheel arch cover

Screw		3 Nm
Plastic nut		2,6 Nm

11 – Install front ornamental grille

Prerequisite

Engine compartment lid is open.

NOTICE

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



- **For G11/G12 version up to 03.19 or up to G30/G31/G38/F90 independent of the version:**
- Check all latch mechanisms for damage.
- If latch mechanisms are damaged, renew front ornamental grille (1).
- Position front ornamental grille (1) at the upper three latch mechanisms.

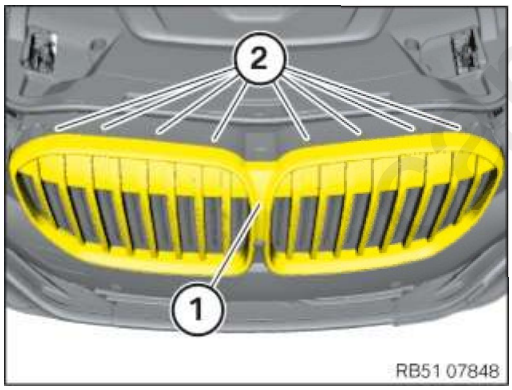
  Latch mechanisms **not yet** locked.



- Press the front ornamental grille (1) in the area of the headlight support down until lower latch mechanisms engage audibly.



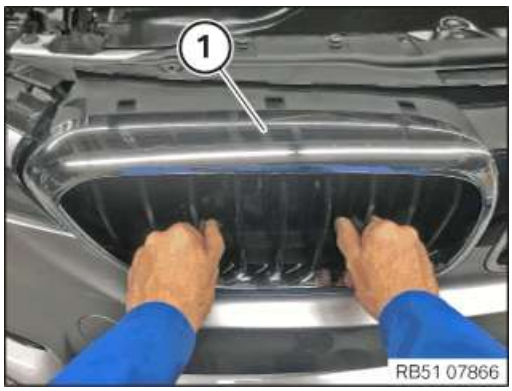
- Press on all locking positions of the front ornamental grille (1) until all latch mechanisms are audibly engaged.



- **For G11/G12 with version as of 03.19**:
- Check all latch mechanisms (2) for damage.
- If latch mechanisms are damaged, renew (2) the front ornamental grille (1).
- Position front ornamental grille (1) at the upper latch mechanisms (2).

  Latch mechanisms (2) **not yet** locked.
- Position front ornamental grille (1) at the lower latch mechanisms.

  Latch mechanisms **not yet** locked.
- Press on all locking positions of the front ornamental grille (1) until all latch mechanisms are audibly engaged.



- Carry out a tensile test after the installation of the front ornamental grille (1).
- Using both hands, grip each of the kidney grille fin as shown and pull on it to test the tight fit of the front ornamental grille (1).
- If required, press on the front ornamental grille (1) at all latch mechanisms once again.

12 – Install the cover of the engine compartment centre

12 – Install the cover of the engine compartment centre

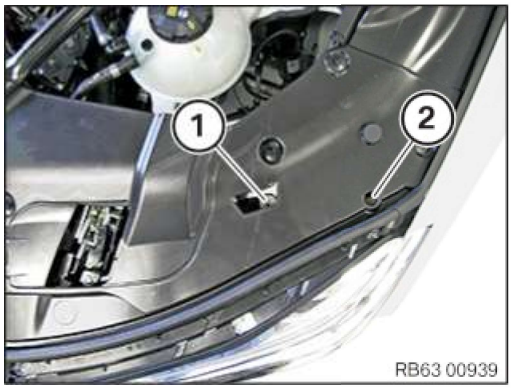


- Install the cover (1).
- Install all expanding rivets (arrows).

13 – Adjusting headlights

NOTICE

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



- Remove the cover above adjusting screws for the headlight adjustment.
- Adjust the height at the adjusting screw (1).
- **US version:** Set the lateral adjustment only if the plug on the adjusting screw for lateral adjustment is missing or damaged.

  Remove damaged plug if necessary (refer to additional information).
- Turn adjusting screw (2) for a correct lateral adjustment.
- **US version:** If the lateral adjustment has been checked or corrected: Renew plugs and push into the adjusting screw for the lateral adjustment **without damaging it** (see additional information).
- Install the cover above the adjusting screws for the headlight adjustment.

Additional Information

Overview of Tightening Torques

LED module, daytime driving lights

Screw		Tightening torque	1,5 Nm

Front light combination, top

Screw		8 Nm

Front light combination, bottom

Screw		5 Nm

Front bumper panel on side wall

		3 Nm

Underbody protection

Screw		Tightening torque	3 Nm

Wheel arch cover

Screw		3 Nm
Plastic nut		2,6 Nm

Links

General repair instructions

63 12 ... US version: Setting the horizontal blocking when headlamp is set	13
63 12 ... US version: Remove the horizontal blocking before adjusting the headlamp	13

cardiagn.com

4.1.5 Self-levelling suspension devices (if required)

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Visual inspection and operation (if possible) or use of electronic vehicle interface.

Fault determination according to EG PTI:

a)	Device inoperative.
b)	Manual device cannot be operated from the driver's seat.
c)	System outputs an error via the electronic vehicle interface.

Methods according to vehicle manufacturer:

The overview graphic illustrates the operation of manual self-levelling suspension. There is no knurled wheel (6) available if the vehicle features automatic self-levelling suspension.

TECHNICAL INFORMATION

Note:
There is no way of switching the control through the electronic interface.

Self-levelling suspension equipment

cardiagn.com

Light operating unit



1 Button for rear fog lamp

2 Fog light button

3 Rotary switch for side lights and low-beam headlights

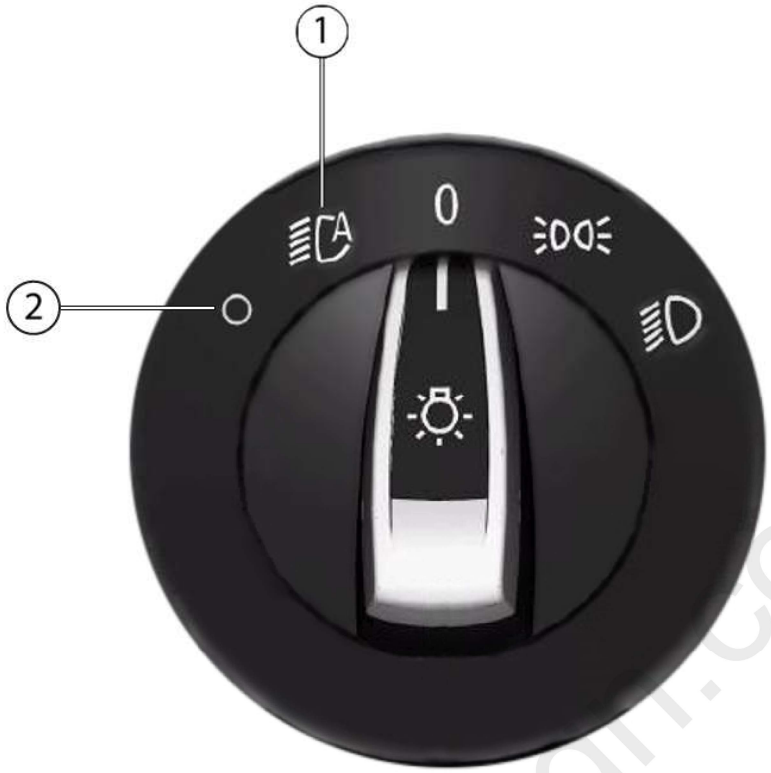
4 Knurled wheel for manual headlight beam throw adjustment

5 Knurled wheel for instrument lighting

cardiagn.com

Rotary switch for side light and low-beam headlight:

Index	Explanation
1	Switch position 'A' for Adaptive Headlight and automatic driving lights control
2	Indicator light (green LED) for the Adaptive Headlight and automatic driving lights control



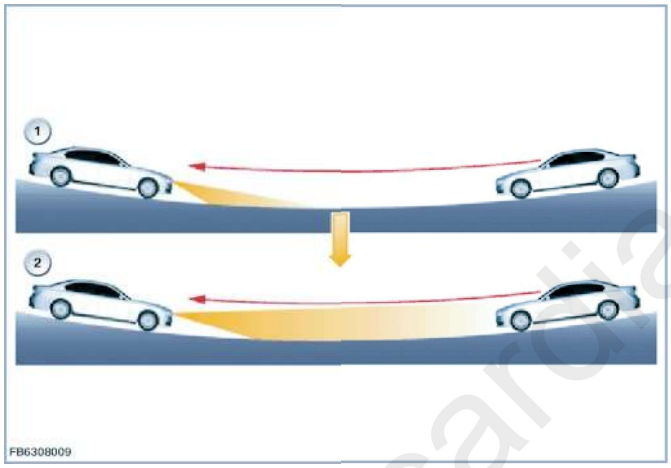
cardiagn.com

Adaptive headlight beam throw adjustment:



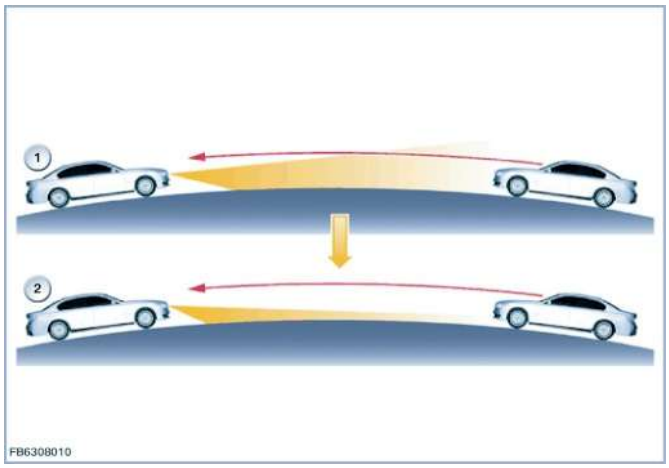
The following graphic shows the light cone's primary motion patterns during operation of the automatic headlight beam throw adjustment.

The adaptive headlight beam throw adjustment is employed when driving through dips and over crests. In accordance with a request from the footwell module (FRM), the headlight driver module activates the swivel module via the stepper motors and in this way adjusts the headlight beam throw. When the vehicle passes through a dip, the headlight beam throw is increased. The swivel module is moved up slightly. The roadway is illuminated a greater distance ahead.



Index	Explanation
1	Vehicle without adaptive headlight beam throw adjustment
2	Vehicle with adaptive headlight beam throw adjustment

When the vehicle passes over a crest, the headlight beam throw is reduced somewhat. The swivel module is moved down slightly. This reduces dazzling effect of an oncoming vehicle.



Index	Explanation
1	Vehicle without adaptive headlight beam throw adjustment
2	Vehicle with adaptive headlight beam throw adjustment

cardiagn.com

4.2.1 Rear lights status and function

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Visual inspection and operation

Fault determination according to EG PTI:

a)	Light source faulty.
b)	Headlight lens/end lens faulty.
c)	Light not attached safely. Very high risk of falling.

Methods according to vehicle manufacturer:

All vehicles are equipped with daytime running lights in the in headlights as standard. Daytime running lights in the rear lights are nevertheless only fitted in certain countries.

There are 2 - 4 rear lights on a vehicle depending on the model.

The rear lights have been integrated in pairs into the rear outer vehicle wall on the left and right.

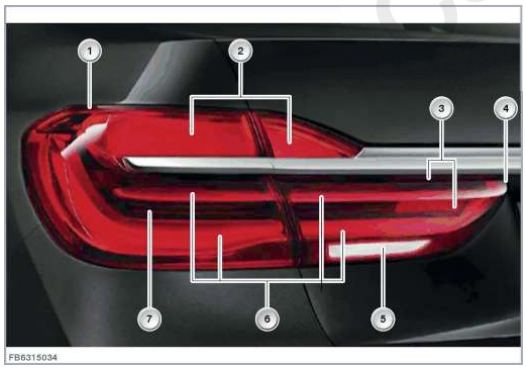
At BMW both rear lights must be the same as a result of the design. The following lighting functions are integrated irrespective of the series:

- Brake light and tail light.
- Turn indicator.
- Side marker light, integrated into the rear light assembly at the outside of the vehicle.
- Reversing light.
- Rear fog light.

Damaged glass panes can be easily identified as part of a visual inspection. It is considerably harder to detect a failure of individual LEDs as part of a visual inspection, however the OBD interface outputs this as an error.

The following section illustrates examples of rear lights for BMW passenger cars, BMW i, MINI passenger cars and ROLLS-ROYCE passenger cars.

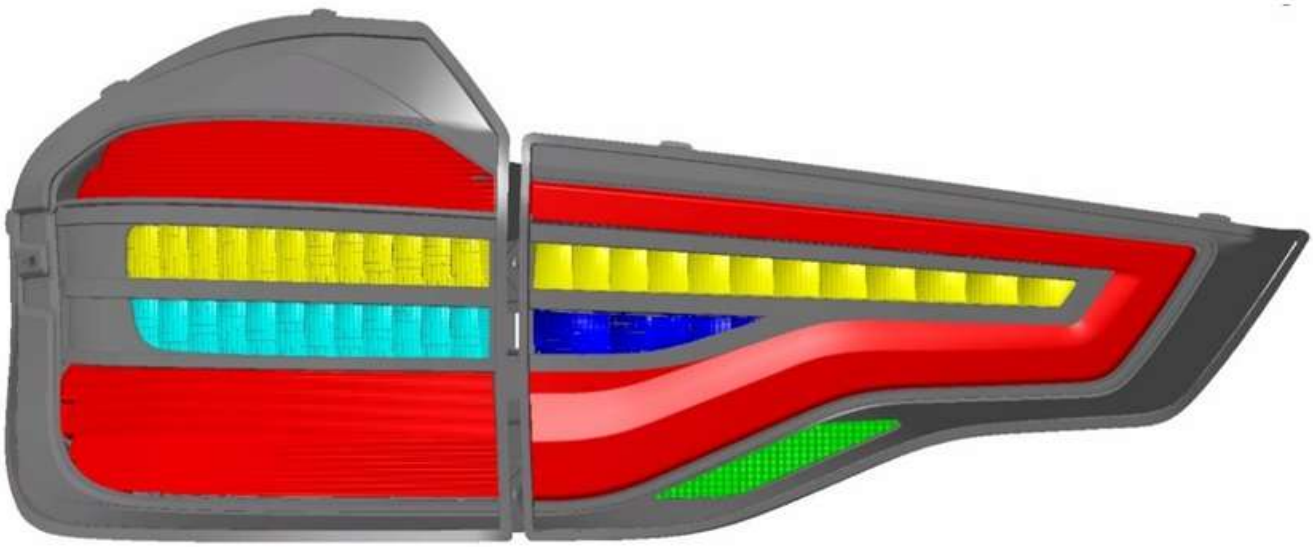
BMW passenger cars:



The graphic below shows a simplified representation of the outer left rear light and the inner left rear light using the G12 as an example.

Index	Explanation	Index	Explanation
1	Rear light, outer left	2	Direction indicator
3	Rear fog light	4	Rear light, inner left
5	Reversing lights	6	Tail light
7	Brake light		

cardiagn.com



Example of the G01 rear light cluster (OE 552)

	- The tail light (1) has been highlighted in red.	1
	- The turn indicator (2) has been illustrated in yellow.	2
	- The brake light (3) has been illustrated in light blue.	3
	- The reversing light (4) has been illustrated in green.	4
	- The fog light (5) has been illustrated in dark blue.	5

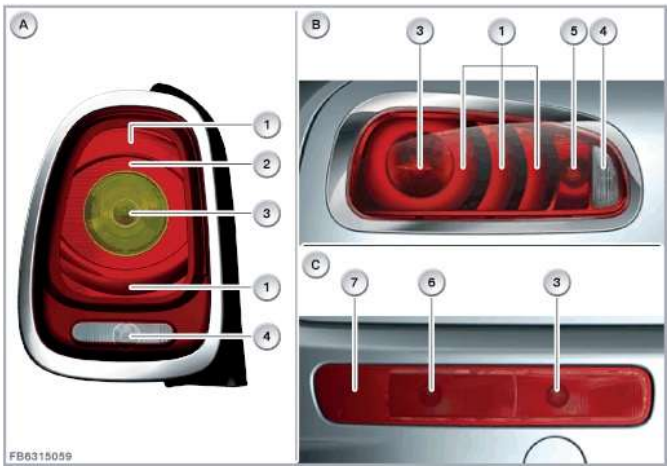
cardiagn.com



BMW i:

The following graphic shows the rear lights using the example of I12.

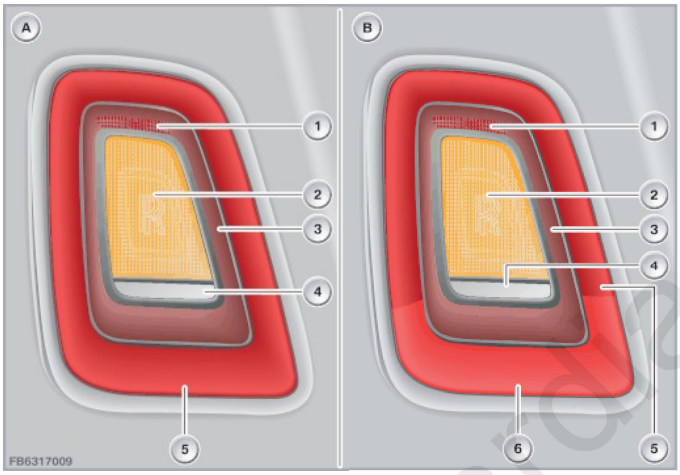
Index	Explanation	Index	Explanation
1	Rear right turn indicator	2	Top right rear light (tail light and brake light)
3	Bottom right rear light (reversing light and rear fog light)	4	Number plate light, right
5	Number plate light, left	6	Bottom left rear light (reversing light and rear fog light)
7	Top left rear light (tail light and brake light)	8	Rear left turn indicator



MINI passenger cars:

The following graphic shows a simplified representation of the left rear light in combination with LED headlights.

Index	Explanation	Index	Explanation
A	Rear light, outer left	B	Rear light, top left
C	Rear light, bottom left	1	Tail light
2	Brake light	3	Indicator light (turn indicator)
4	Reversing lights	5	Rear fog light
6	Brake light and tail light	7	Reflector



ROLLS-ROYCE passenger cars:

The lighting functions of the rear lights are produced by LEDs.

The following graphic shows a simplified representation of the rear light using the RR12 as an example.

Index	Explanation	Index	Explanation
A	Rear light, shown here: Rear fog light is not activated	B	Rear light, shown here: Rear fog light is activated
1	Rear fog light	2	Indicator light (turn indicator)
3	Reflector	4	Reversing lights
5	Tail light and brake light (light area runs all around when rear fog light is inactive)	6	Tail light (limited light surface when rear fog light is active)
7	Brake light (limited light surface when rear fog light is active)		

The hot monitoring is based on current measurement of the individual bulb outputs. A faulty bulb is detected within approximately 2 s.

cardiagn.com

4.3.2 Brake lights switch

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Visual inspection and operation or use of electronic vehicle interface.

Fault determination according to EG PTI:

a)	Switch cluster function not as per regulations. Delayed operation. No function.
b)	Impaired activation unit function.
c)	System outputs a CC message via the electronic vehicle interface.
d)	Emergency brake light not operating or not operating correctly.

Methods according to vehicle manufacturer

For electronic testing via the diagnostic interface (OBD socket), the read-out routines necessary for the EU testing organisation will be provided.

cardiagn.com

4.1.3 Headlamp switch

Validities

BMW PASSENGER CAR, BMW i, MINI PASSENGER CAR, ROLLS-ROYCE

Official method according to EG PTI:

Visual inspection and operation or use of electronic vehicle interface.

Fault determination according to EG PTI:

a)	Switch cluster function not as per regulations (number of simultaneously activated headlights). Maximum permissible light intensity exceeded towards the front.
b)	Impaired activation unit function.
c)	System outputs an error via the electronic vehicle interface.

Methods according to vehicle manufacturer:

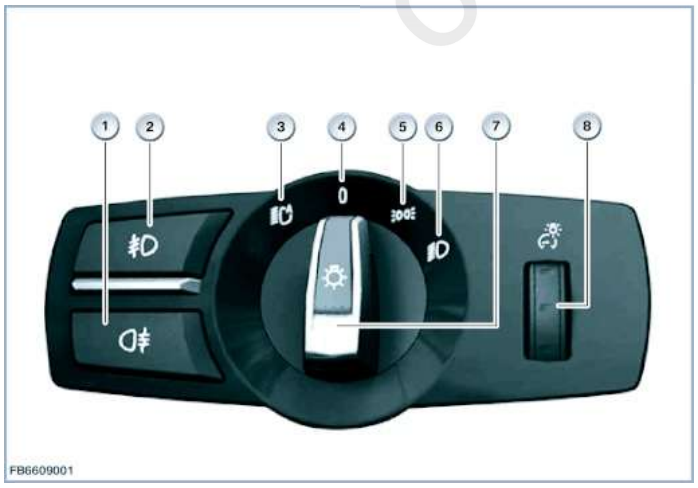
The front headlights are switched on using the standard light switch.

The figures of the light operating units shown here are merely examples and they may deviate in respective vehicle types and vehicle models.



Standard light switch (3) for vehicles with halogen headlights and manual headlight beam throw adjustment.

Index	Explanation
1	Front fog light switch
2	Rear fog light switch
3	Light switch (see next graphic for details)
4	Knurled wheel for manual headlight beam throw adjustment
5	Dimmer for instrument lighting

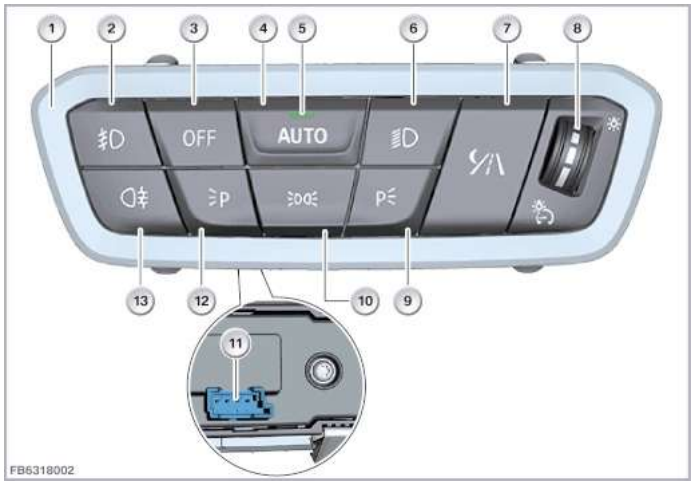


Standard light switch (7) for vehicles with bi-xenon and automatic headlight beam throw adjustment.

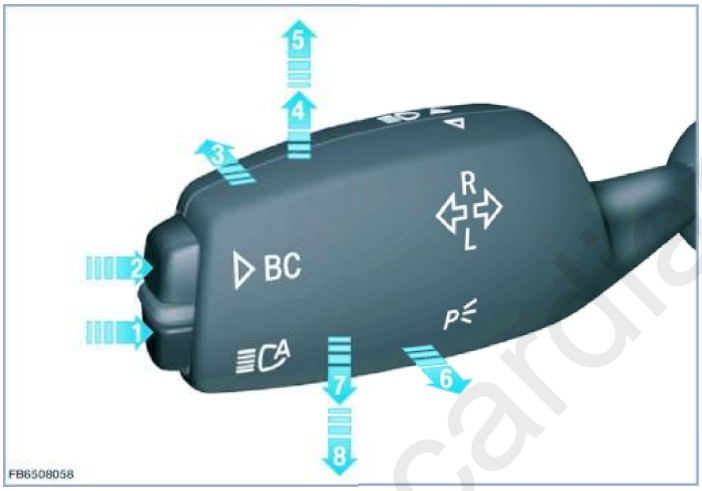
Index	Explanation
1	Rear fog light switch
2	Front fog light switch
3	Position A for automatic driving lights control (optional equipment)
4	Position 0 for daytime driving lights
5	Position 1 for side lights
6	Position 2 for driving lights
7	Light switch
8	Dimmer for instrument lighting

cardiagn.com

Standard light switch (5) as example X5



Index	Explanation
1	Light operating unit
2	Fog light button
3	OFF button
4	Automatic driving lights control button (AUTO button)
5	Function indicator light for automatic driving lights control
6	Low-beam headlight button
7	Night Vision camera button
8	Knurled wheel for the dimmable instrument lighting
9	Right parking light button
10	Side light button
11	4-pin plug connection
12	Left parking light button
13	Rear fog light button



The turn signal/high beam switch signal is controlled by the steering column switch cluster (SZL).

Index	Explanation	Index	Explanation
1	FLA button	5	Continuous flashing, right
2	On-board computer button	6	Headlight flasher
3	High-beam headlight	7	One-touch flashing, left
4	One-touch flashing, right	8	Continuous flashing, left

TECHNICAL INFORMATION

Note:

The automatic driving lights control is also active in switch position 0 of the light switch.

For all models with series launch from 02/2015 and depending on the national-market version, automatic driving lights control is also active when the light switch is in switch position 0.

TECHNICAL INFORMATION

A fault check can also be performed using the vehicle's OBD interface.

The location of the OBD interface is described in chapter **'6.2.7 Operating devices'** of the EG PTI documentation.

cardiagn.com

4.13 Battery (batteries)

Validities

BMW PASSENGER CAR

Official method according to EG PTI:

Visual inspection

Fault determination according to EG PTI:

a)	Unsafe, incorrectly secured; risk of short circuit
b)	Leakage, escaping hazardous substances
c)	Switch (if required) faulty
d)	Fuses (if required) faulty
e)	Insufficient ventilation (if required)

Methods according to vehicle manufacturer:

For the voltage supply of the low-voltage vehicle electrical system, up to 4 different 12 V batteries (colour in illustration: yellow) are used depending on the vehicle equipment::

- AGM battery
- Auxiliary battery in the engine compartment
- Auxiliary battery in the boot
- Lithium ion battery

For the vehicle electrical system support, an auxiliary battery is used in the engine compartment. For a vehicle with electrical ARS, the two actuators of the anti-roll bars are also supplied by it.

For the voltage supply of the high-voltage on-board power supply the following high-voltage batteries (shown in orange in the representation) are used:

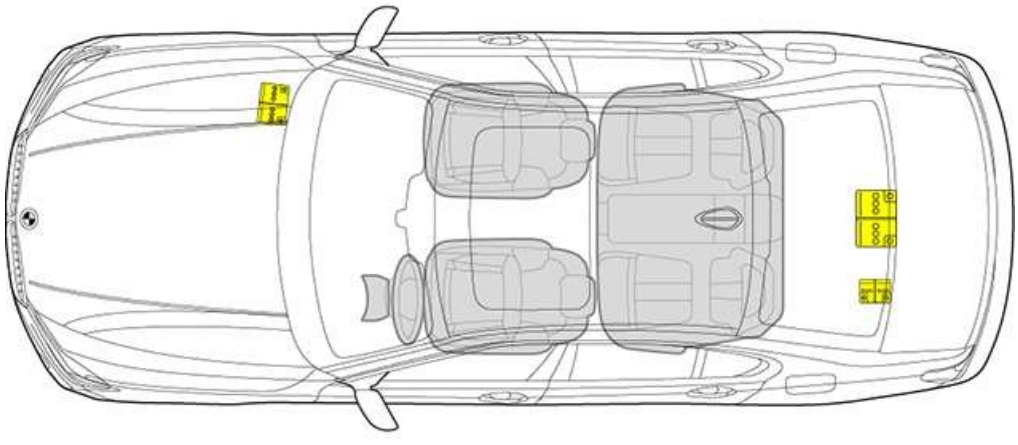
- High-voltage battery

Number of batteries

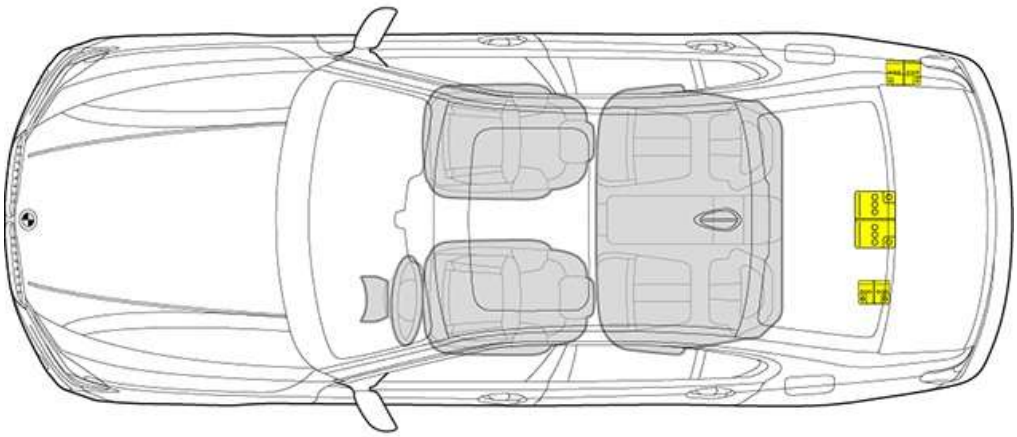
Up to 5 batteries can be used in one vehicle. Due to optional equipment, the number of batteries is variable. A fault is displayed via the corresponding warning light in the instrument cluster.

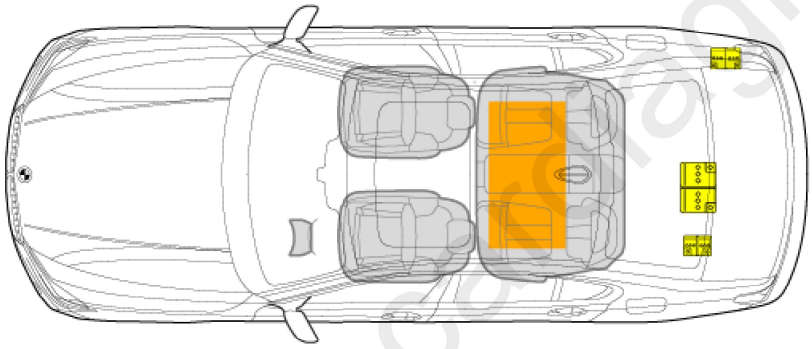
cardiagn.com

G11 Saloon

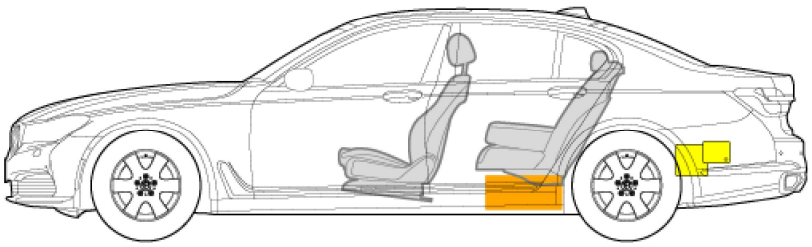


G12 Saloon

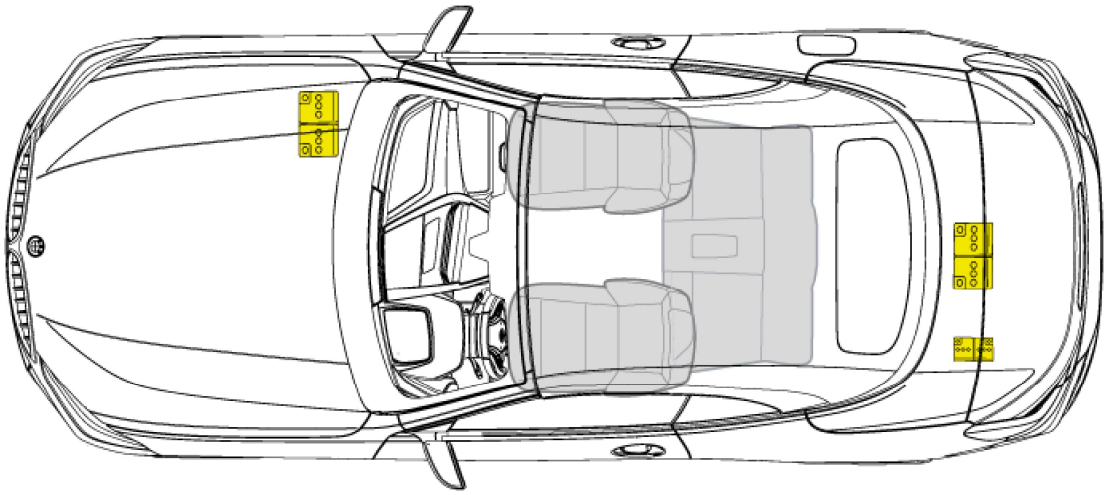


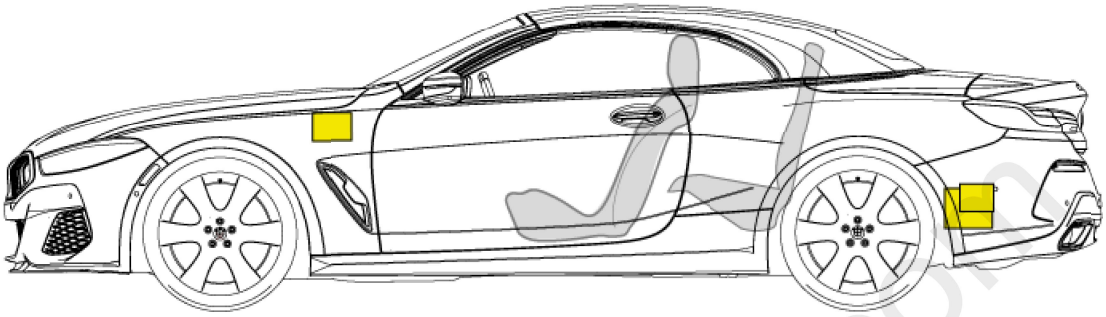


G11, G12 Limousine, Plug-in Hybrid Electric Vehicle

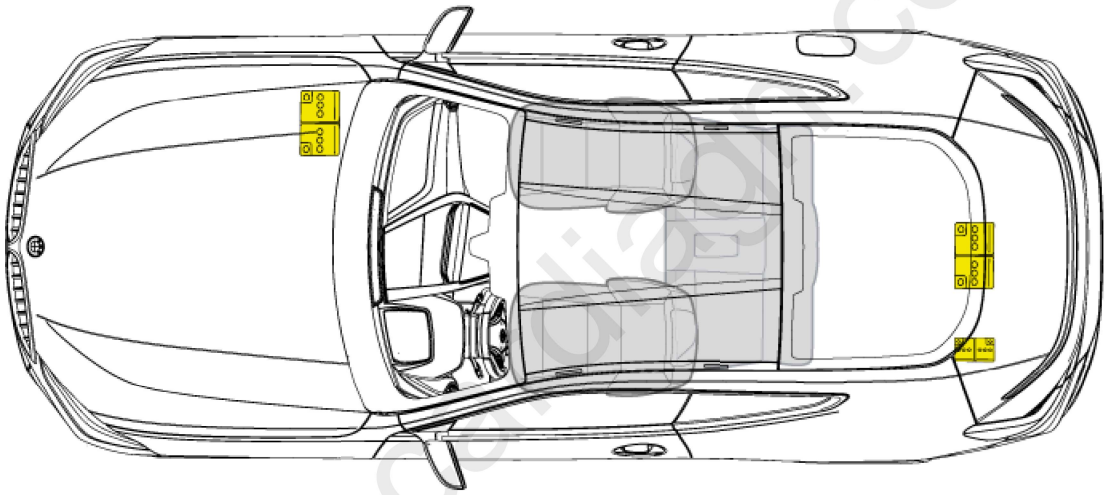


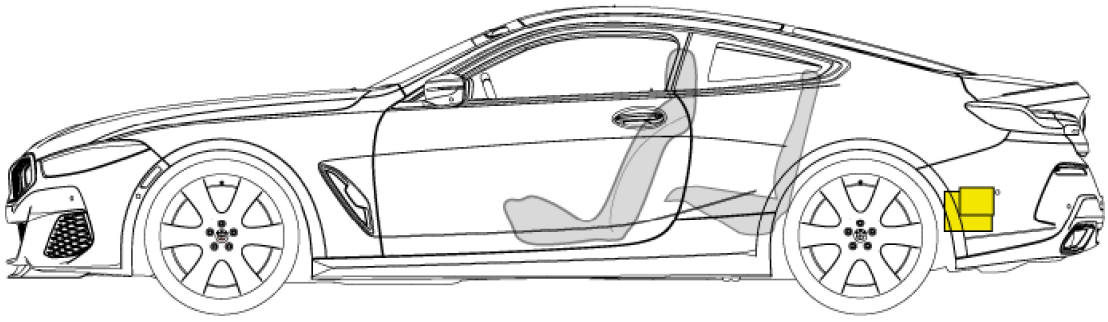
G14 Saloon





G15 Saloon





Special design for high-voltage batteries

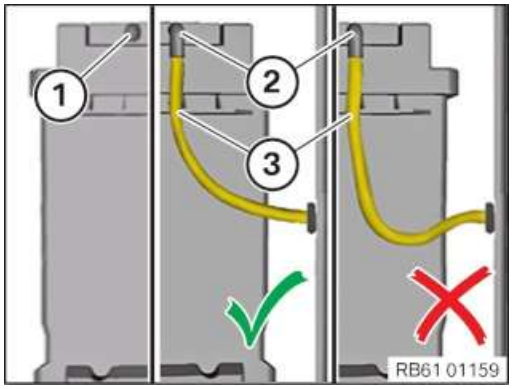
There are no special BMW devices with respect to the high-voltage batteries. There are only standard parts.

Vehicle identification number specific information related to the battery switch [Yes/No]

There is no specific information on the battery switches.

Vehicle identification number specific information related to the battery fuse [Yes/No]

There is no specific information on the battery fuse.



Vehicle identification number specific information related to the battery vent [Yes/No]

A battery has two vent holes (1, 2). One vent hole (1) must be closed correctly with a dummy plug. The vent hose (3) must be connected correctly at the other vent holeÂ (2) .

Vehicle identification number specific information related to the operating principle.

There is no specific information related to the operating principle.

cardiagn.com

Draw off the contaminated R1234yf refrigerant and dispose of it

Engine **at operating temperature** and switched off.

Draw off the contaminated R1234yf refrigerant and dispose of it

Parts required: See additional information

TECHNICAL INFORMATION

Exclusively apply the following procedure if the A/C service station detects contaminated R1234yf refrigerant prior to drawing off the refrigerant circuit. **Observe national/country-specific regulations.**

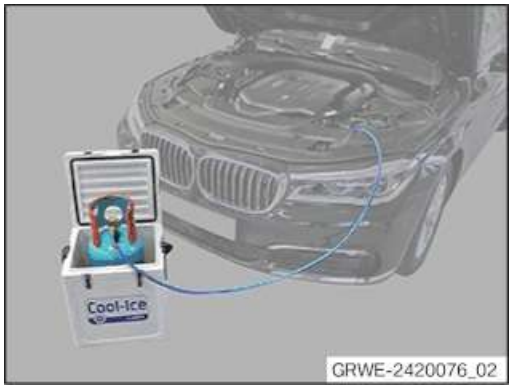
WARNING

Contact with hazardous substances.

Danger of injury!

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

cardiagn.com



- Observe additional information!
- Position the cool box in front of the vehicle as shown.
- Insert the mounting for the pressure cylinder into the cool box.
- Adjust the position of the pressure cylinder in the cool box.
- Connect the connecting hose at the pressure cylinder valve.
- Open the pressure cylinder valve.
- Run the air conditioning blower at a medium-high level.
- **Put on safety goggles and protective gloves.**
- Connect the connecting hose at the low-pressure connection of the vehicle.
- Prepare operating fluid for cooling (see additional information)
- Fill the cool box with operating fluid for cooling **to the side** of the pressure cylinder and distribute evenly.
- **Do not cover the upper section of the pressure cylinder including the valve with operating fluid for cooling!**
- Open the low-pressure connection in the vehicle.
- Draw off the refrigerant circuit for 30 min.
- Close the low-pressure connection of the vehicle and the valve on the pressure cylinder.
- Remove the connecting hose.
- Place the cool box including pressure cylinder in a location that is as warm as possible to allow the remaining operating fluid for cooling to evaporate.
- Take off protective equipment.
- Remove air conditioning compressor.
- Drain the refrigerant oil from the air conditioning compressor into a measuring cup.
- Take a note of the drained amount of refrigerant oil.
- Dispose of drained refrigerant oil.
- Fill new refrigerant oil that has been approved for the vehicle: capacity = quantity you wrote down + 15 ml
- Install the air conditioning compressor.
- **Evacuate the refrigerant circuit twice**.
- Fill the refrigerant circuit using R1234yf (amount of refrigerant as per type plate).
- Complete the delivery note and hand over the pressure cylinder to the waste disposal company.

cardiag.com

Additional Information

Links

Special tool service information
Disposal equipment for contaminated R134a / R1234yf refrigerant

Special tool service information

Disposal equipment for contaminated R134a / R1234yf refrigerant

cardiagn.com

8.1.1 Acoustic insulation system

Validities

BMW i, BMW passenger cars, MINI passenger cars, Rolls-Royce passenger cars

Official method according to EG PTI:

Subjective assessment (unless the tester finds that the noise level is at the limit range, then carry out a noise check at standstill using a noise level measuring device)

Fault determination according to EG PTI:

a)	Noise level exceeds the maximum value specified in the regulations1.
b)	A noise damping system component has come loose, is damaged, has been mounted incorrectly, is missing or has been evidently modified so that the noise level is affected. **Very high risk of the equipment falling off**

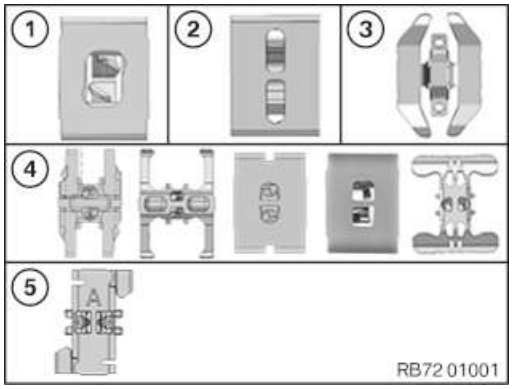
Methods according to vehicle manufacturer:

The information can be found on the registration certificate.

cardiagn.com

Overview of the clips and unlocking tools for head airbag fastening

Clips and related release tools



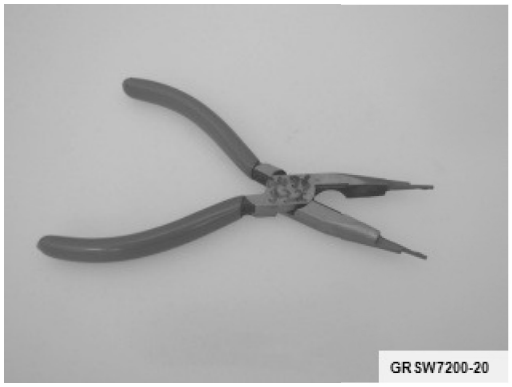
Clips are released with the following release tools:

1. Screwdriver
2. Special tool 0 496 932 (72 0 020)
3. Long-nose pliers, circlip pliers
4. Special tool 2 456 786
5. Special tool

Additional Information

Overview of Special Tools

0 496 932 (72 0 020) Release tool



Common	
Usage	Tool to unlock the clips on the head airbag
Included in the tool or work	
Storage location	A34
Replaced by	
In connection with	
SI-Number	01 12 11 (724)

2 456 786 Release tool



Common	
Usage	for releasing the clips on the head airbag, replaces special tool 83 30 2 230 142
Included in the tool or work	
Storage location	C29
Replaced by	
In connection with	
SI-Number	01 13 17 (498)

cardiagn.com

Cosmetic repairs on wheel rims

Cost-effectiveness of the repairs has been checked.

Arrangement of wheel rims

Type	Repair options
Cast aluminium wheel	see Point 2
Cast aluminium wheel (machine-polished)	see Point 3
Carbon-fibre wheel rim	see Point 4

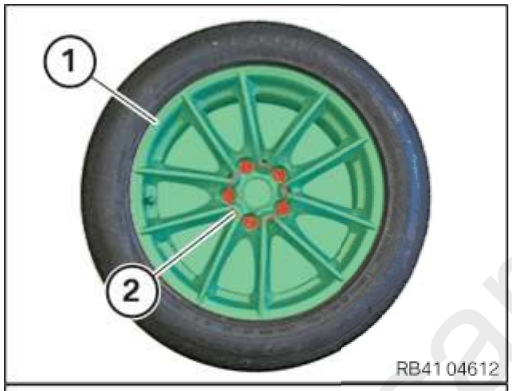
Cast aluminium rim

The rim must be replaced if damaged:

- All types of deformations
- All types of cracks
- All damage deeper than 1 mm of aluminium
- All damages on the inner surface of the wheel rim and in the rim base
- The radial runout and lateral runout prior to preparation exceed the production tolerance of 0.3 mm

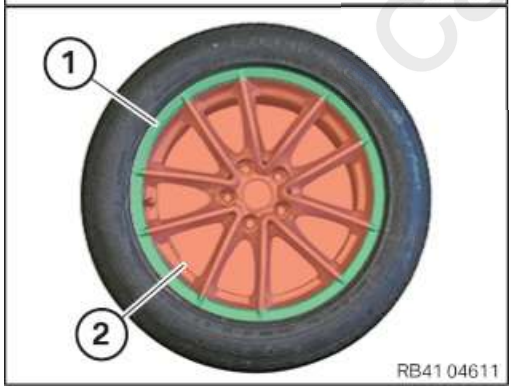
It is possible to repair the following damage:

- Maximum depth of damage to aluminium 1 mm
- The distance of the damage from the outer rim edge must not exceed 30 mm



Paintwork damage in area (1) can be repaired with paintwork.

Paintwork is not permitted in area (2).



In area (1) a repair to the aluminium up to a depth of 1 mm is allowed.

The wheel rim must be replaced if there is damage to the aluminium in area (2).

Repair procedure for cast aluminium wheel rim

1 – Preparing the wheel rim

cardiagn.com

- Dismount tyres.
- Clean the aluminium rim with a steam-jet cleaner.
- Dry the aluminium rim.
- Pre-grind the aluminium rim (break sharp edges with a grain P180 grinding wheel).
- Blow off the aluminium rim.
- Clean damaged areas extensively with silicone remover.

General information:



CAUTION

Materials harmful to health.

Health risks in the event of contact with substances that are harmful to health!

- Observe and comply with the Safety Information on the containers and the notes on the manufacturer's safety data sheet.
- Conduct all work in appropriate personal protective equipment only.

Putty S1

Processing time 20 °C	90 min
Processing time 30 °C	60 min
Age-hardening duration 60 °C	60 min
Storage	15 °C ... 25 °C
Durability (note the expiration date on the cartridge)	12 Monate

The barrel can be squeezed out with a commercially available cartridge press. Only use cartridge presses with a piston rod.

2 – Repairing the wheel rim

2 – Prepare surface for application of body filler

- Grind surface to a metallic bright-finish.

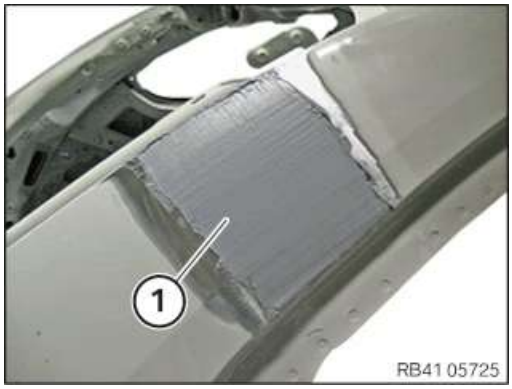
  For steel sheet, use grain 80.

  With aluminium sheet use grain 180.

  The surface must be clean, dry and free from grease.
- Clean surface with solvent cleaner R2 and leave to dry for 5 minutes.
- Clean surface with solvent cleaner R1 and leave to dry for 2-3 minutes.

2 – Apply body filler

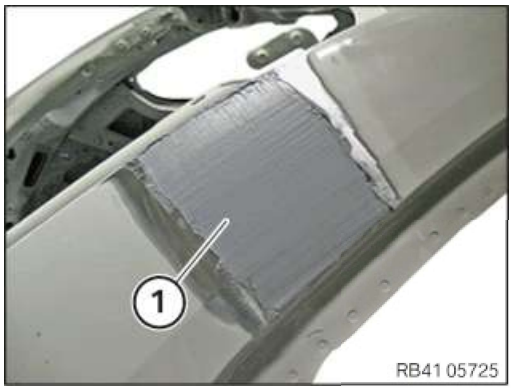
cardiagn.com



- Fill area (1) with body filler S1.

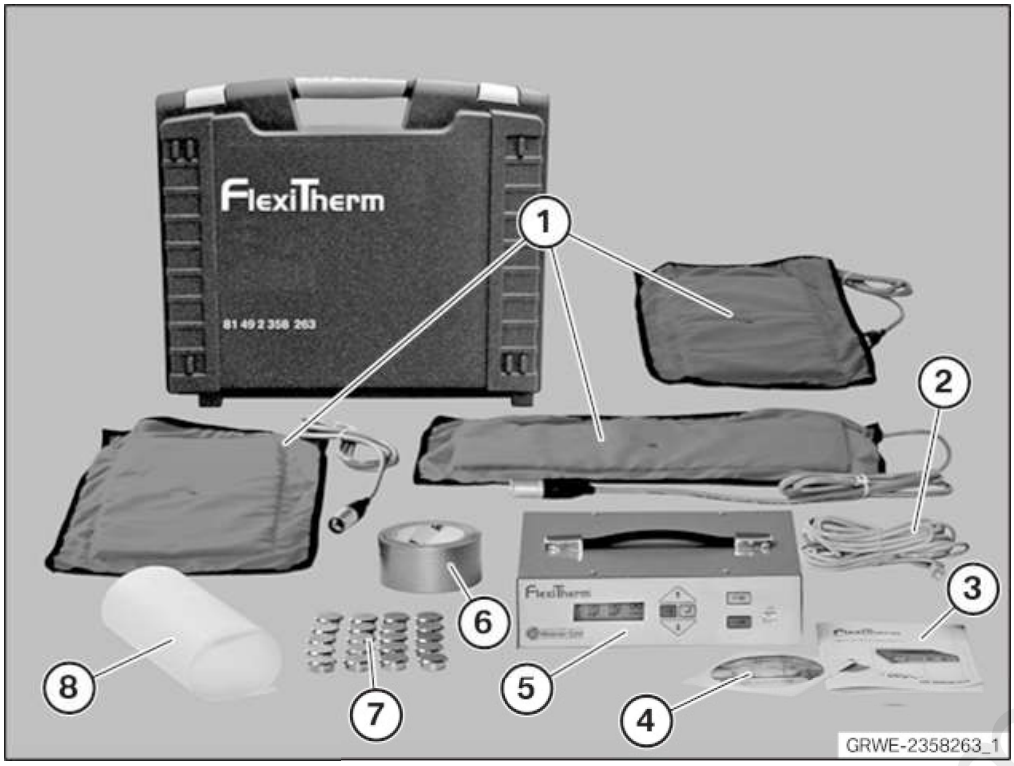
  Apply excess body filler S1.
- If possible, apply body filler S1 in one go to avoid air bubbles.

2 – Cure body filler



- Cure body filler S1.

cardiagn.com



TECHNICAL

Optionally, various devices can be used.

- Cure body filler S1 with “FlexiTherm” heater pad system.
- Please comply with instructions in Owner's Handbook.

  Select program in the control unit (5).

  The control unit autonomously controls and regulates the temperature of each individual heating mat (1).

  These are separately activated. The temperature sensor is located on the inside (red side).

  The heating mats may only be used in connection with the anti-adhesive paper (8).

  For trouble-free temperature measurements, the sensor must always be on the body filler (separated by anti-adhesive paper).

- Cure body filler S1 with infra-red heater.

RISK OF

Damage due to overheating

When using temperature-controlled infrared radiators, damage to adhesive bonds, paint and vehicle components

cardiagn.com



can occur when drying spatula and filler. The thermometers integrated in the infrared radiator only function reliably on large, even surfaces. On small surfaces such as C-pillars or sills, often only a colder, adjacent area is measured. This leads to actual surface temperatures of up to 130 °C, although only 70 °C is set on the infrared radiator. When the rear side walls are partially replaced by bonding and riveting, these high temperatures can lead to a visible pattern in the area of the joint.

- Check the surface temperatures on small component surfaces during the drying process with an external thermometer. The general rule is: The surface temperatures must not exceed 85°C.

- When the infrared heater is used for the first time, the correct distances for the desired temperatures must be determined.

cardiagn.com

Switch the infra-red heater on and change the distance until the surface temperature of the body filler no longer changes for a period of 2 min.

Measure temperature using an optical thermometer.

If optical thermometers are used (Epsilon value 0.92-0.95), the heater must be switched off briefly during the measurement.

Record the measurement

- Standard optical thermometers can be used to measure surface temperatures.



2 – Work body filler

CAUTION

Grinding dust when grinding components.

Hazardous to health!

- Directly draw off the grinding dust.
- Ensure adequate ventilation.
- Conduct all work in appropriate personal protective equipment only.

- Wear a fine dust mask with protection class P2-P3.
- Sand body filler S1 using a machine after cooling to 25 °C.

  Maximum permissible layer thickness after sanding is 5 mm.

  For steel sheet, use grain 80.

  With aluminium sheet use grain 180.
- Pores and faulty spots that become visible after grinding the surface must be closed with polyester filler (BMW Colour system).

  Use a drill bit with Ø40.2 mm. Turn the drill by hand to expand the pores in v shape. by t Fill cavities with polyester filler.
- Clean surface with solvent cleaner R2 and leave to dry for 5 minutes.
- Clean surface with solvent cleaner R1 and leave to dry for 2-3 minutes.

3 – Painting the wheel rim

- Pre-grind to apply filler (grain P220 grinding wheel or superfine soft pad).
- Blow off the aluminium rim.
- Clean the aluminium rim with silicone remover.
- Mask the aluminium rim, rim base and contact surface of the hub.
- Mask the rear side of the rim flange.
- Apply the filler.
- Dry the filler.
- Grind the filler (grain P400 grinding wheel).
- Blow off the aluminium rim.
- Clean the aluminium rim with hydro cleaner.
- Mask the screw holes.
- Clean the aluminium rim before applying the base coat.
- Apply the base coat.
- Dry the base coat.
- Apply the clear coat.
- Dry the clear coat.

cardiagn.com

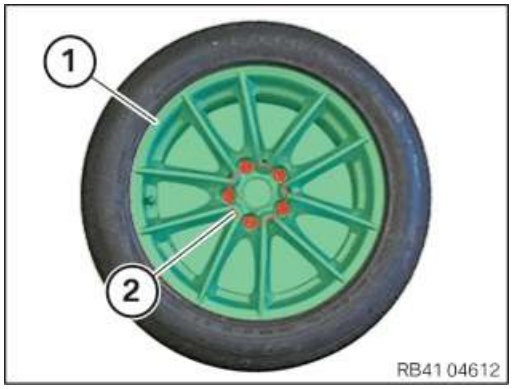
Cast aluminium wheel rim (machine-polished)

The rim must be replaced if damaged:

- All types of deformations
- All types of cracks
- All damage deeper than 1 mm of aluminium
- All damages on the inner surface of the wheel rim and in the rim base
- The radial runout and lateral runout prior to preparation exceed the production tolerance of 0.3 mm

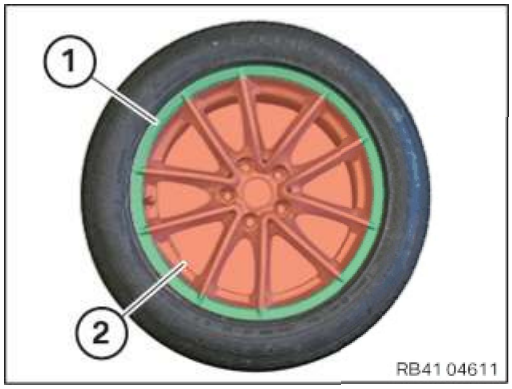
No cosmetic repairs to aluminium are allowed.

Only the clear coating may be repaired on the entire front side of the wheel rim of diamond polished cast aluminium wheels.



Paintwork damage in area (1) can be repaired with paintwork.

Paintwork is not permitted in area (2).



In area (1) damage to aluminium up to a depth of 1 mm is permissible.

For technical reasons, the rim must not be replaced.

The wheel rim must be replaced if there is damage to the aluminium in area (2).

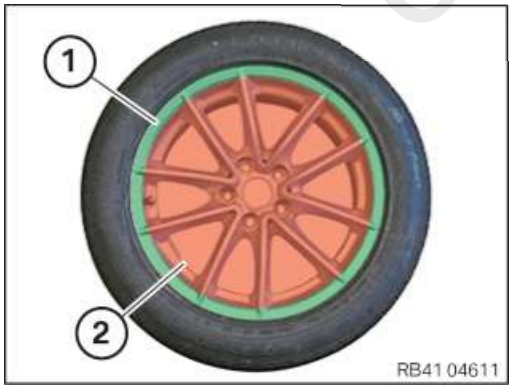
Carbon fibre wheel rims

No cosmetic repairs on carbon fibre wheel rims are permitted.

Assessment of damage to carbon fibre wheel rim

The wheel rim must be replaced in the event of the following damage:

- All types of deformations
- All types of cracks
- All damages greater than 1 mm depth
- The radial run-out and lateral run-out exceed the production tolerance of 0.3 mm

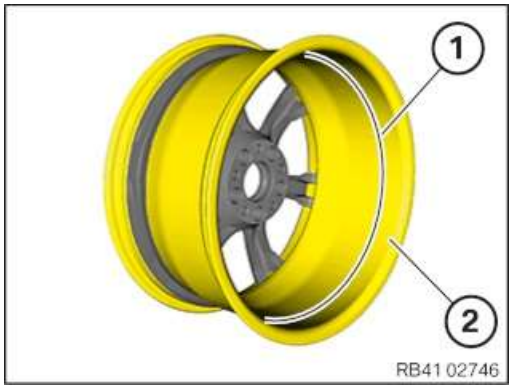


In area (1) damage up to a depth of 1 mm is permissible.

The wheel rim must not be replaced for technical reasons.

The rim will need to be replaced if there is damage in area (2).

cardiagn.com



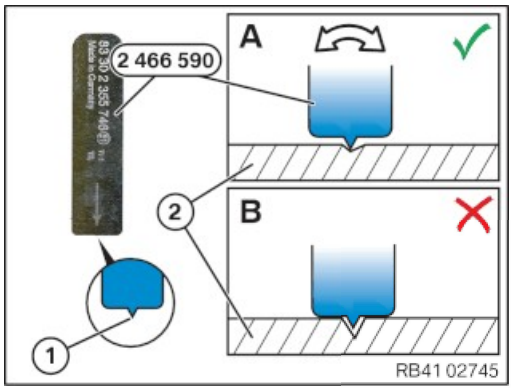
Radial scratches (1) on the interior (2) of the rim are permissible up to a depth of 0.4 mm.

The wheel rim must not be replaced for technical reasons.

The interior of the rim (2) can be coated with temperature-resistant matt paint.

The rim will need replacing if the depth of the scratches exceeds 0.4 mm.

4 – Determining depth of scratch



- Gauge has a test probe (1) with a height of 0.4 mm.
- If the test probe sits up at the deepest point of the scratch (figure A), it can be moved to the left and right. The scratch is less than 0.4 mm deep.
- If the test probe dips so deeply into the scratch that the gauge sits flat (figure B), the scratch is deeper than 0.4 mm and the part is damaged.

Additional Information

Overview of Special Tools

Overview Technical Data

Putty S1

Processing time 20 °C	90 min
Processing time 30 °C	60 min
Age-hardening duration 60 °C	60 min
Storage	15 °C ... 25 °C
Durability (note the expiration date on the cartridge)	12 Monate

cardiagn.com