

BMW

Body & Paint Training

Reference Manual

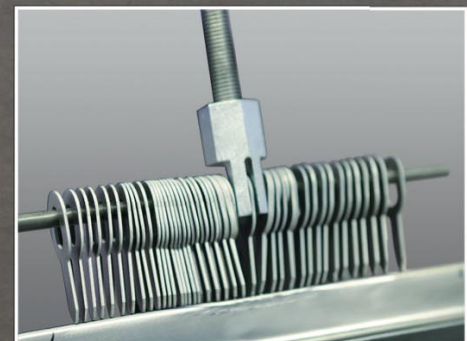
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013

Body Repair Level 1



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COURSE CODE: SB013 - BODY REPAIR LEVEL 1

This training manual is not intended to be a complete and all-inclusive source for repair and maintenance. It is only a part of a training information system designed to assure that uniform procedures and information are presented to all participants in the BMW Group University Body & Paint Training Center.

The technician must always refer and adhere to the following official BMW service publications available in Integrated Service Technical Application (ISTA) & Aftersales Information Research (AIR).

- Service Information
- Repair Manuals
- Technical Reference Information
- Specifications

The information contained in the training course materials is solely intended for participants in this training course conducted by BMW Body & Paint Training Group or one of its approved vendors.

For changes/additions to the technical data, please refer the current information issued via the Integrated Service Technical Application (ISTA), Aftersales Information Research (AIR), and Service Information Bulletins.



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TABLE OF CONTENTS

BODY REPAIR LEVEL 1

Subject	Page
Introduction5
Body Repair Level5
Repair Level 1a .....	.5
Repair Level 1b .....	.6
Outer Body Skin .....	.7
Requirements .....	.7
Rigidity .....	.8
Lightweight construction .....	.8
Materials .....	.9
Add-On Body parts .....	.10
Adjusting Procedures .....	.10
Gap dimensions .....	.11
Doors .....	.13
Side windows .....	.14
Engine compartment lid .....	.15
Tailgate .....	.16
Deformation Elements .....	.17
Glazing .....	.17
Windscreen .....	.18
Passive Safety .....	.20
Airbag and restraint systems .....	.20
Control Units, Sensors, and Switches .....	.21
Control units .....	.22
Airbag sensor, door .....	.22
Acceleration sensors .....	.22
Pyrotechnic Actuators .....	.23
Pedestrian impact severity mitigation .....	.24
Passive pedestrian protection .....	.24
Active Safety .....	.25
Driver assistance systems .....	.25
Sensors and cameras .....	.25
Repair .....	.26
Subsequent work .....	.27
Light setting .....	.28
Prerequisites .....	.28
Headlight beam throw adjustment .....	.30
Light switch .....	.30

Subject

Page

- Repair Methods for Level 1A31**
 - Thread Repair31
 - Rivet Nuts and Bolts31
 - Replacement of glass32
 - Removal of window glass32
 - Prepare bonding surfaces33
 - Bonding window glass33
 - Glass repair34

- Repair Methods35**
 - Overview35
 - Damage analysis37
 - Scope and severity of the damage37
 - Plastic bonding38
 - Plastic welding38

INTRODUCTION

BMW vehicles offer a high level of comfort, safety and dynamics. The body forms the basis for the properties of the complete vehicle. The body consists of the body structure, the joined outer body skin components and the add-on body parts.

An excellent property of BMW bodies is their external appearance. The exact gap dimensions of the add-on body parts, as well as the high surface quality of the outer body skin, are a strong selling point for the customer. The restoration of the external appearance is also an important factor during the repair and demands a proper and precise procedure.

The increasing complexity of modern vehicles is also noticeable in the work on the outer body skin. The numerous sensors and cameras require extensive background knowledge of the assistance and safety systems. Also the number of repair methods for the outer body skin repair has increased due to the constantly increasing number of lightweight materials.

The training on the body topic was fundamentally revised based on this development. The training program is now a three-stage process. This Product Information relates to the content of Body Repair Level 1.

BODY REPAIR LEVEL

Taking into account the repair stages of the BMW workshop information system, the body repair work in the Technical Qualification is divided into 3 repair levels. Each of the 3 Body Repair Levels includes certain prerequisites in terms of the qualifications of the employees and the workshop equipment.

- Body Repair Level 1

Body Repair Level 1 includes installation and adjusting procedures for screwed and clipped outer body skin components, work at the glazing and the repair of the outer body skin.

- Body Repair Level 2

Body Repair Level 2 covers the repair of the outer body skin by the joining methods bonding and riveting, as well as welding without the use of a straightening bench.

- Body Repair Level 3

Body Repair Level 3 covers the repair of the body structure by the joining methods bonding and riveting, as well as welding with the use of a straightening bench. Body Repair Level 1 is subdivided into Body Repair Level 1a and Body Repair Level 1b.

Repair Level 1a

Body Repair Level 1a includes the following body repair work:

- Exchange and repair of screwed and clipped add-on body parts
- Adjusting procedures for add-on body parts
- Replacement of blind rivet nuts and bolts
- Repair of steel and aluminum threads
- Repair of the glazing.

The repairs of Body Repair Level 1a can generally be carried out using standard tools. Nevertheless, comprehensive background knowledge, particularly in relation to the numerous assistance and safety systems, is required for this work.

Repair Level 1b

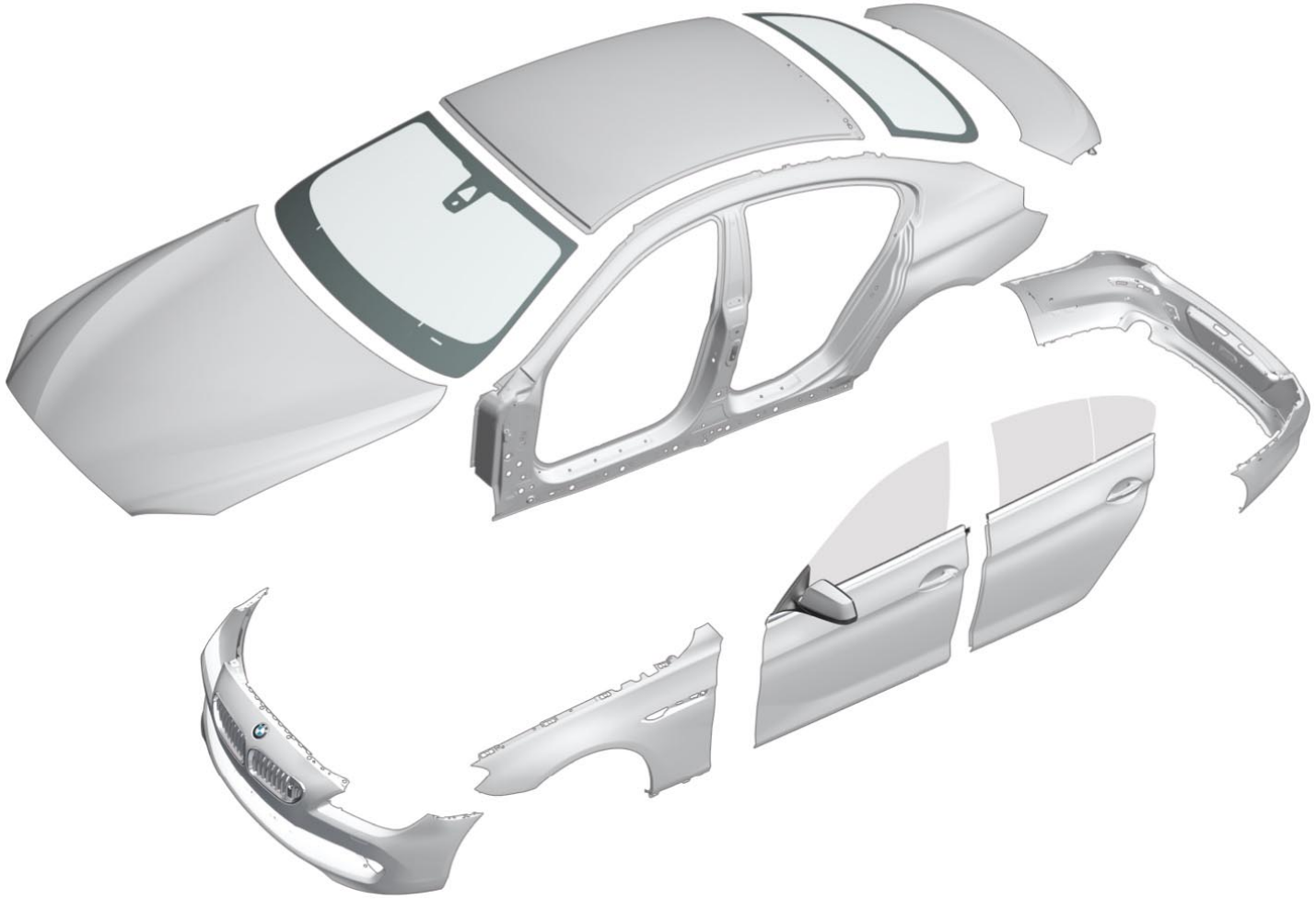
Body Repair Level 1b covers the repair of outer body skin components made from:

- Sheet steel
- Aluminum sheet
- Plastic
- Glass.

Special repair methods and special tools are required for the repair of the different materials. The corresponding guidelines and procedures can be found in the workshop information system ISTA.

OUTER BODY SKIN

F06 Outer body skin



Outer body skin components are all body components which are visible from the outside. These can be divided into 2 groups:

- 1 Outer body skin components which are firmly connected to the body frame
- 2 Outer body skin components which are located at add-on body parts such as doors and flaps.

REQUIREMENTS

The outer body skin must satisfy a number of requirements:

- High rigidity
- Low weight
- High surface quality
- Good crash properties
- Low drag
- Corrosion resistance
- Ease of repair.

Rigidity

Outer body skin components must have high torsion and bending stresses, and, at the same time, a small material thickness. A high rigidity of the components is therefore required. The rigidity of a component is determined by the elasticity of the material and its geometric shape. In order to produce lightweight components with a small material thickness and high rigidity, the following design measures can be used.

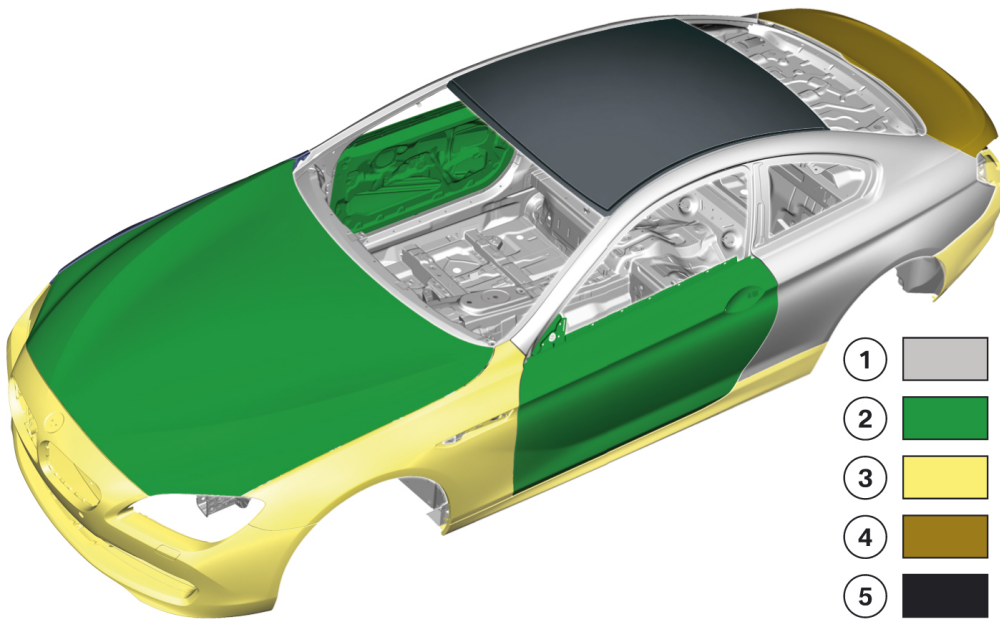
- Large curvatures where possible
- Support structures and reinforcement plates
- Beads
- Reinforced edges (for e.g. folds).

The rigidity can also be increased by using high-strength materials. However, these can be difficult to reshape. They are thus often not suitable for components with a high degree of forming. In order to be able to shape body components and still achieve components with high rigidity, bake-hardening steels and hardening aluminum alloys are being used more and more. The strength of the materials is increased by means of heat treatment, after the body components have been shaped in their finished form.

High rigidity is also necessary in terms of the acoustic behavior of the components. Otherwise, they would transmit oscillations – for e.g. from the engine, thus causing interference noises.

LIGHTWEIGHT CONSTRUCTION

F06 Outer body skin



Index	Explanation
1	Steel
2	Aluminum
3	Plastic (thermoplastic)
4	Plastic (composite)
5	Carbon

The proportion of the total weight of modern BMW vehicles allocated to the outer body skin has steadily reduced in recent years. For instance, the lightweight construction in the outer skin area has significantly helped reduce the fuel consumption and CO2 emissions.

In addition to the total weight, the axle-load distribution is also specifically influenced by the optimized weight of individual components. For example, the lightweight construction in the outer skin area also contributes to the increase in the driving dynamics.

Lightweight body components can be manufactured according to 3 lightweight construction principles:

- Design lightweight construction
The requirements of the component are determined and the styling, as well as the structures, are defined.
- Production lightweight construction
The optimal manufacturing procedures and joining methods for the component are selected.
- Material lightweight construction
The optimal material for the respective component is selected.

MATERIALS

Outer body skin components and add-on body parts are made of various materials.

- Aluminum
- Carbon
- Steel
- Plastic
- Glass.

These terms are only the generic terms for a variety of material versions used, which have very different properties.

Information on aluminum can be found in the Product Information "Fundamentals of Aluminum".

Information on carbon can be found in the Product Information "Fundamentals of Carbon".

Information on steel can be found in the Product Information "Fundamentals of Steel".

Information on plastic can be found in the Product Information "Plastic Restoration Techniques".

Information on glass can be found in the Product Information "Glass Repair and Replacement".

ADD-ON BODY PARTS

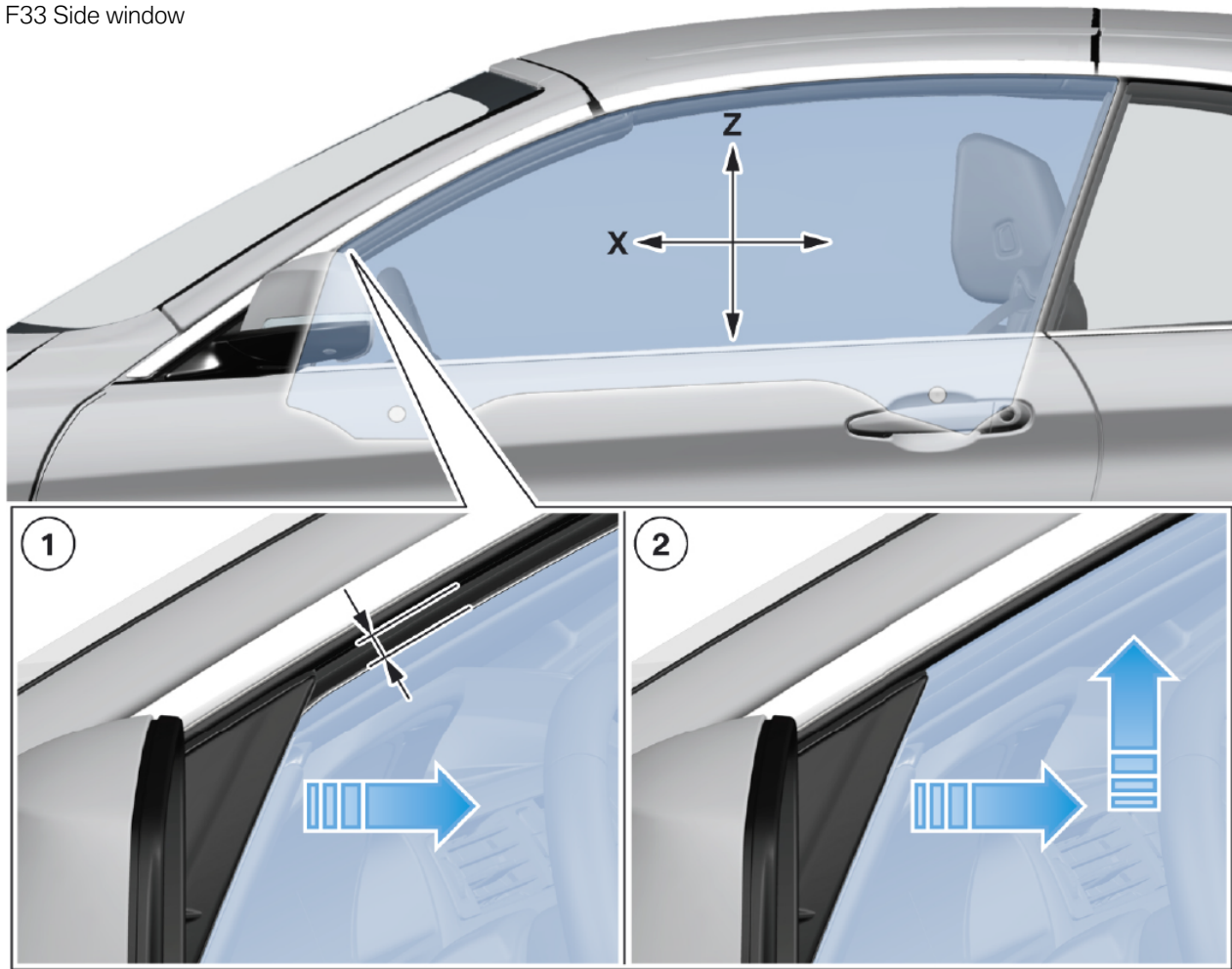
ADJUSTING PROCEDURES

Adjusting Directions



Add-on body parts are secured to the bodyshell. The attachment points of the adjustable add-on body parts at the vehicle can be adjusted in at least one direction. The possible directions are listed as follows:

- X direction
Along the vehicle longitudinal axis in direction of travel forwards and backwards
- Y direction
Along the vehicle transverse axis in direction of travel to the right and to the left
- Z direction
Along the vertical vehicle axis upwards and downwards.



Index	Explanation
1	Side windows not set correctly
2	Side windows set correctly

If the position of a component is changed in one direction, often additional testing and adjusting procedures are required. This can be explained using the example of the front side window of the F33.

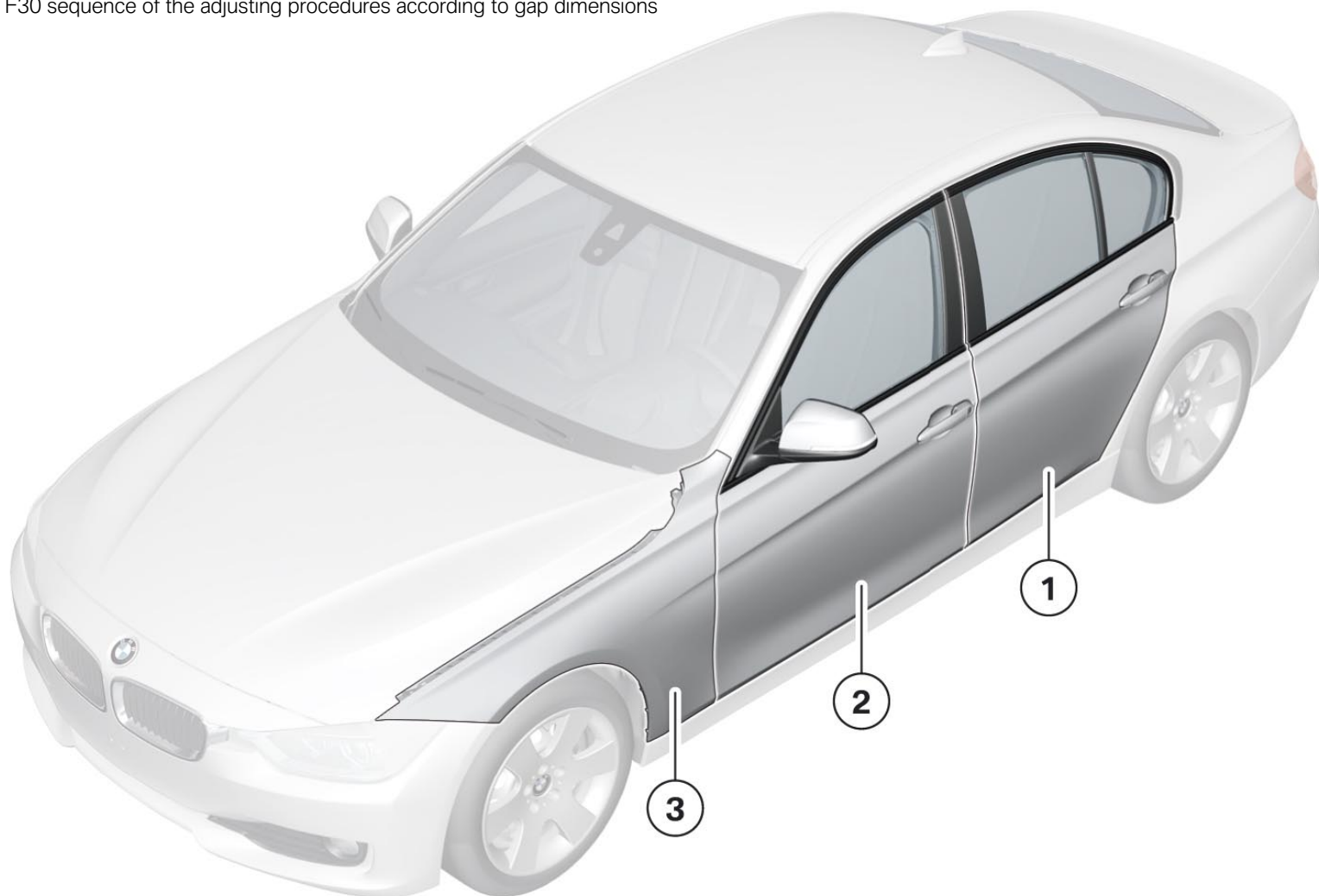
If the side window is only adjusted in X direction to the rear, the side window must be adjusted upwards in Z direction due to the incline at the A-pillar. Otherwise, the side window does not fully immerse in the A-pillar seal.



There are detailed descriptions available for many of the adjusting procedures in the workshop information system ISTA.

Gap dimensions

For the correct setting of the add-on body parts, mainly the gap dimensions, as well as component protrusion and shelter, are decisive. A vehicle-specific overview of the gap dimensions and their permissible tolerances can be found in the workshop information system ISTA. The symmetry of the gap dimensions between the left and right side of vehicle has priority over the absolute dimensions.



Index	Explanation
1	Rear door
2	Front door
3	Front side panel

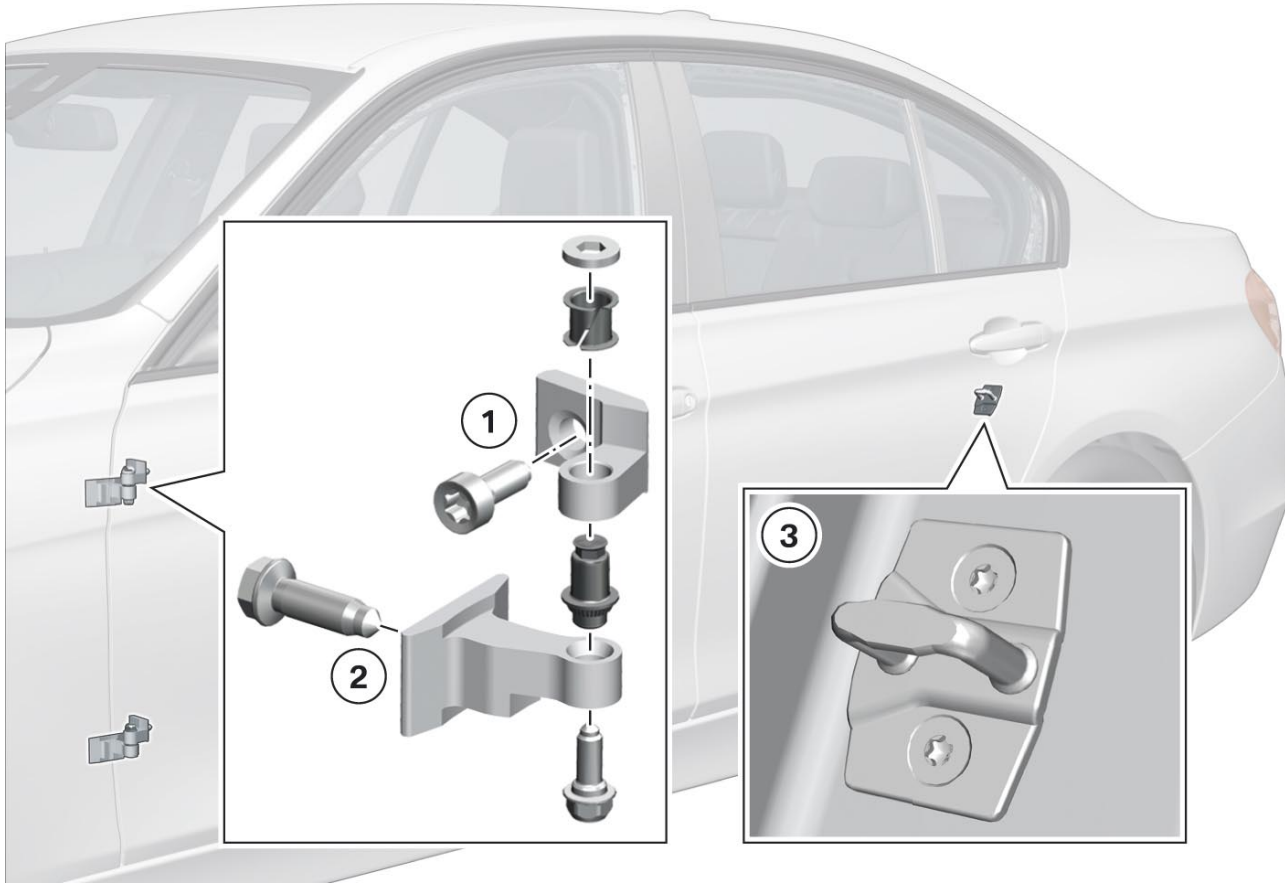
In general, the checking and setting of the gap dimensions at the vehicle starts where the adjustable add-on body parts meet the non-adjustable outer skin components. For example, the gap dimensions between the rear door and rear side panel are only checked before the front door can be adjusted.



For all adjusting procedures at add-on body parts, the symmetry of the gap dimensions between the right and left side of vehicle has top priority.

Doors

F30 sequence of the adjusting procedures according to gap dimensions



Index	Explanation
1	Door hinge, door side
2	Door hinge, body side
3	Striker

The doors can be adjusted via the door hinges and the striker. In the case of frameless doors, the side window glass can be adjusted separately. In order to guarantee a correct setting, the doors must have all mounted parts.

X direction

The gap dimensions between the rear door and the rear side panel are decisive for the setting of a door in X direction. The front door can thus only be adjusted if the rear door has already been adjusted correctly. If the door hinges on the body side are screwed, the door is adjusted in X direction via the door hinges on the body side at the top and bottom. In the case of welded door hinges on the body side, the adjustment is carried out using special shims.

Y direction

The doors are adjusted in Y direction at the door hinges on the door side and the striker. The gap dimensions specified in the repair instructions are important.

Z direction

The adjustment of the doors in Z direction is generally effected at the hinges on the door side. If the adjustment range is inadequate, the hinges on the body side can also be adjusted if possible. The adjustment of the door in Z direction cannot be influenced by the striker. When closing the door, the striker cannot bump or slide in the door lock.

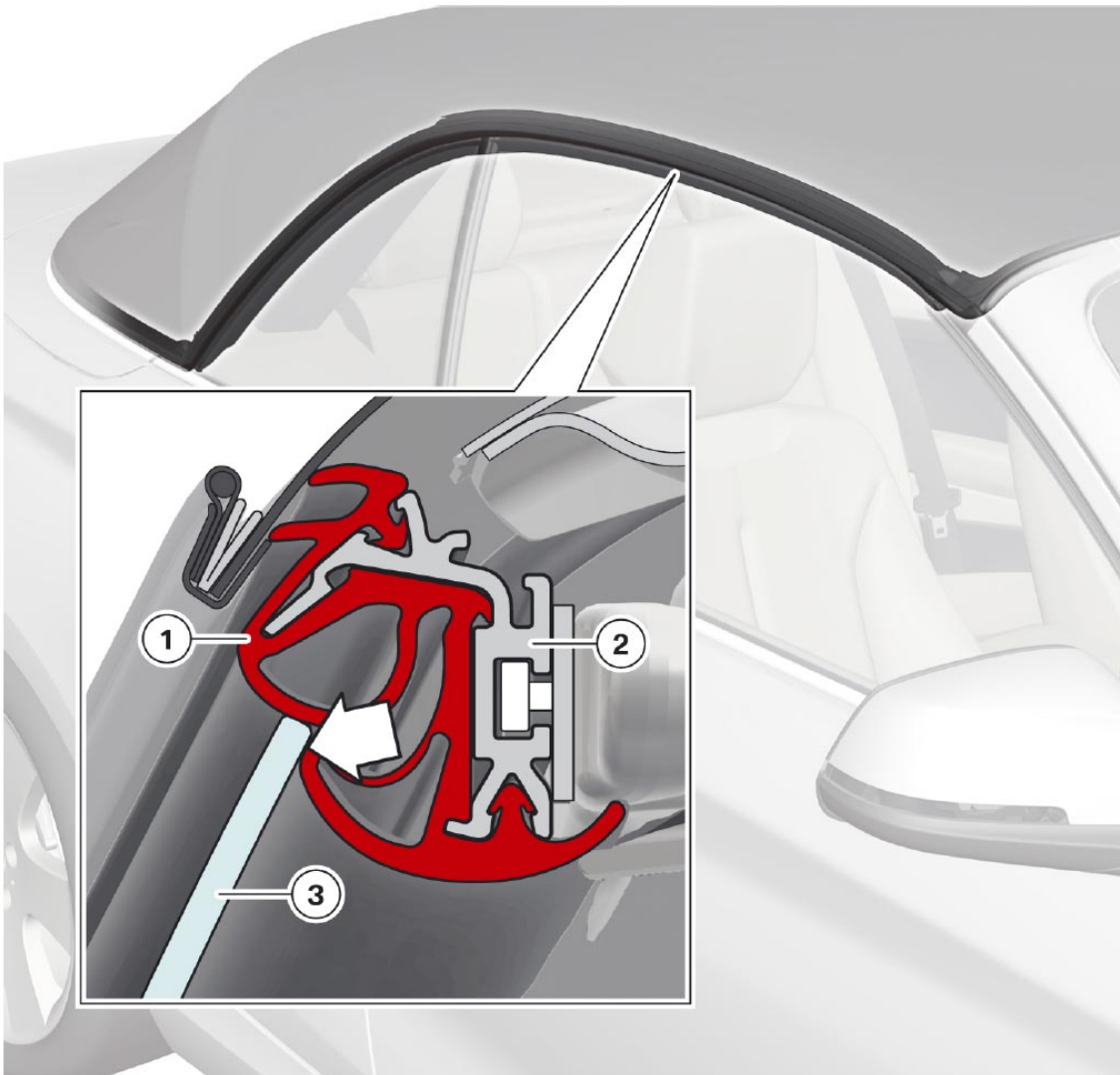
In general, the mounting bolts of the door hinges and the striker are only slackeden until they can move in a straight line. After the adjustment, the mounting bolts must be tightened to the tightening torque specified in the repair instructions.



Unpainted areas may become visible by adjusting the door hinges. The door hinges must be covered with paint in the corresponding color.

Side windows

F23 sealing, side window



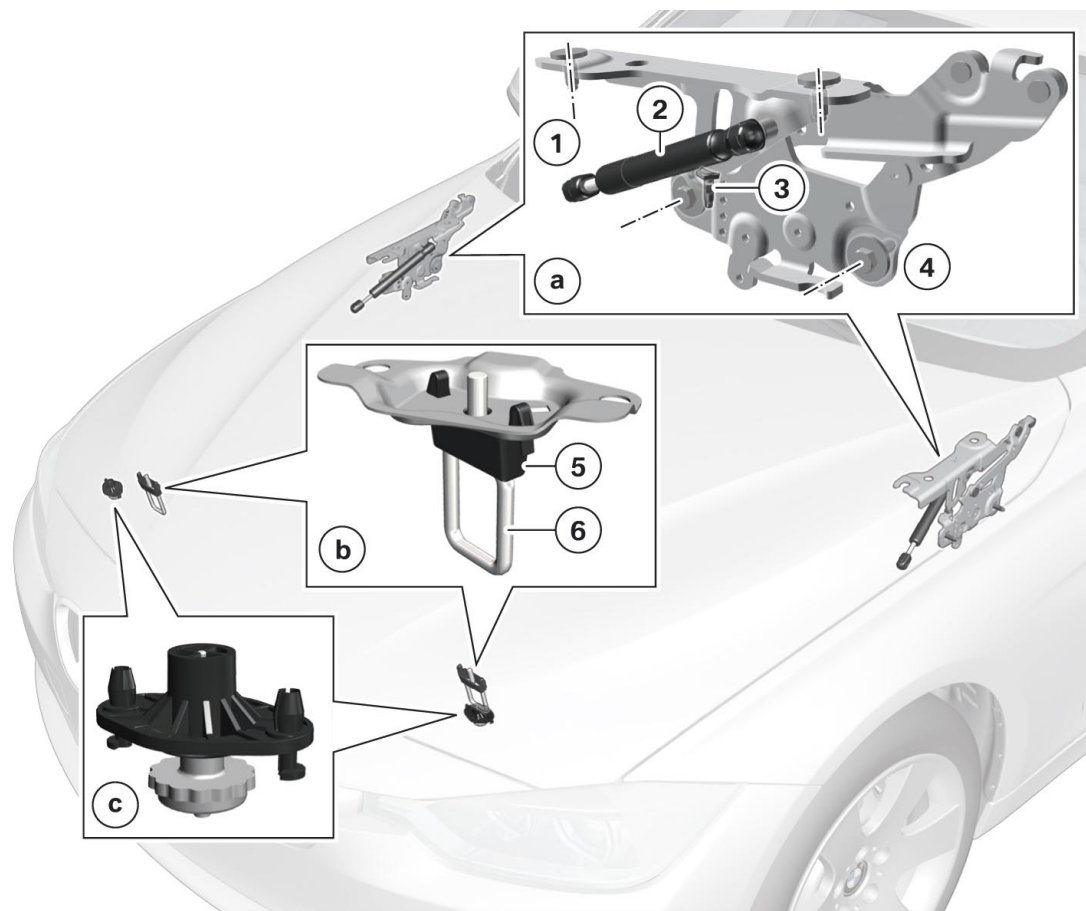
Index	Explanation
1	Profile seal
2	Gasket support
3	Side windows

All BMW convertibles and also BMW Coupés have frameless doors. In addition to the setting in X and Z direction, a setting in Y direction can also be carried out. As a result, the contact pressure of the side windows is adjusted at the gaskets. The precise procedure and the special tools required are described in the respective repair instructions.

Further information on the sealing of frameless doors can be viewed in the Product Information "Convertible Top Technology".

Engine compartment lid

F30 setting, engine compartment lid



Index	Explanation
a	Engine compartment lid hinge, as a whole
b	Striker, as a whole
c	Stop pad
1	Mounting, engine compartment lid side
2	Gas pressure spring
3	Stop screw
4	Mounting bolts, body side
5	Anti-twist lock (striker)
6	Striker

X direction

The adjustment of the engine compartment lid in X direction is generally carried out via the mounting of the engine compartment lid at the engine compartment lid hinges. If the adjustment range is inadequate, the engine compartment lid hinges on the body side can also be adjusted.

Y direction

The adjustment of the engine compartment lid in Y direction is only carried out via the mounting of the engine compartment lid at the engine compartment lid hinges. The gap dimensions between the right and left side panels are decisive.

Z direction

The adjustment of the engine compartment lid in Z direction is carried out via the mounting of the engine compartment lid hinges on the body side, the striker and the stop pad. Some engine compartment lid hinges have stop screws which are set at the factory (position 3). These cannot be adjusted in Service.

The correct setting is effected in relation to the interaction between the pull of the striker and the pressure of the stop pad. Incorrect adjusting procedures can cause wobbling or stiff unlocking of the engine compartment lid.



A special procedure must be observed for vehicles with active pedestrian protection.

Tailgate

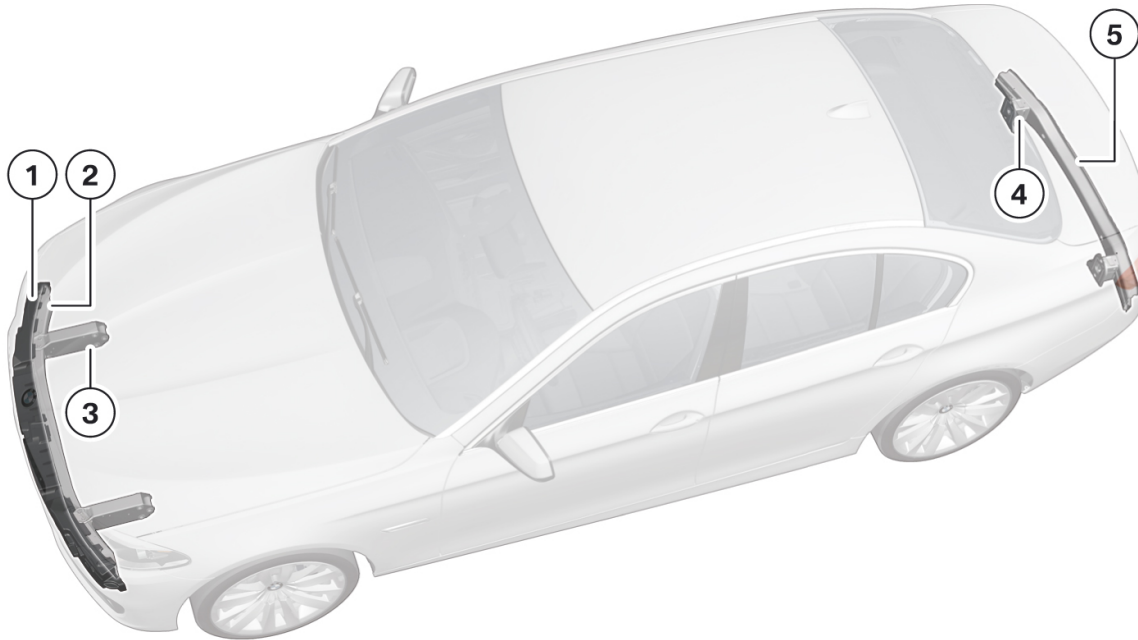
The tailgates are generally adjusted according to similar procedures for the adjustment of the doors and the engine compartment lid. Due to the high number of different systems, a precise description of the procedures is not provided here.

Notes

- The tailgate should have all mounted parts.
- For versions with an electrical tailgate drive, the plug connection must be disconnected and, if necessary, the spindle drive must be removed.
- A certain adjustment sequence must be followed for multipiece tailgates.
- If necessary, the stop pads at the side have to be adjusted.
- During closing, the strikers cannot bump or slide in the tailgate locks.

DEFORMATION ELEMENTS

F10 Deformation elements



Index	Explanation
1	Impact absorber
2	Front bumper support
3	Front deformation elements
4	Rear deformation elements
5	Rear bumper support

The deformation elements are secured at the front and rear at the body. In the event of a head-on or rear-end collision up to an impact speed of 15 km/h, within the body structure only the screwed deformation elements are damaged. The repair costs following accidents can be reduced significantly with the use of deformation elements.

The impact absorber is made from plastic and is located between the front bumper support and the rear bumper. Following a front-end collision, it is imperative the impact absorber is replaced. Otherwise, the pedestrian protection is not guaranteed in the event of another accident.

GLAZING

The following components belong to the glazing:

- Windscreen
- Rear window
- Side window glass
- Side windows
- Glass sunroof

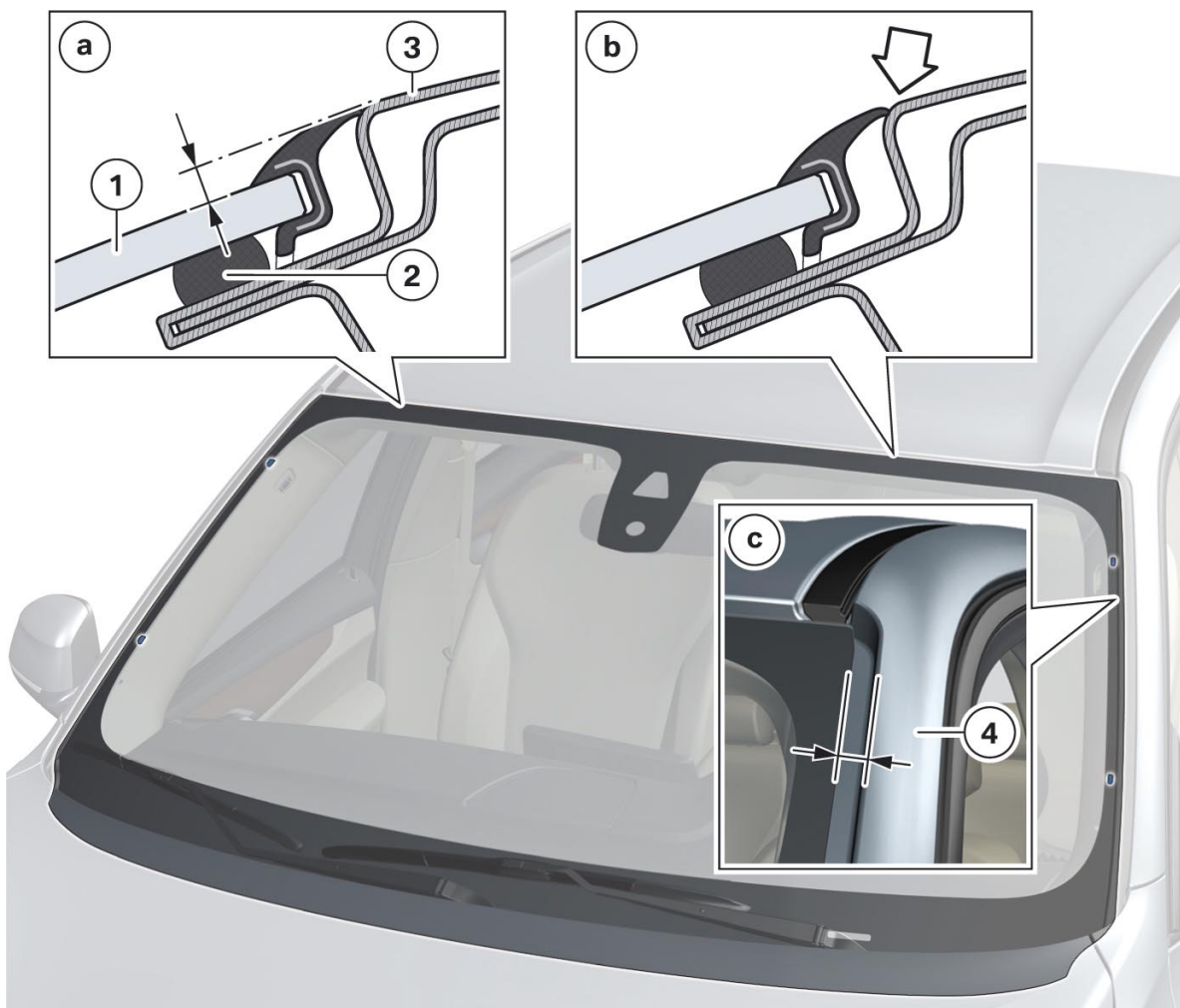
The technical difference between side window glass and side windows is that side windows are flexibly connected to the body and side window glass is prevented from moving with the connection to the body.

The windscreen, rear and side windows are bonded or screwed to the body. With the bonded connection there is an increased torsional rigidity of the body compared to other types of mountings.

The general procedure, as well as the tools and consumables for the replacement of the bonded fixed side window glass, are almost identical for the windscreen, rear window and side window glass.

Windscreen

Windscreen



Index	Explanation
a	Distance between windscreen and roof outer skin
b	Contact surface between rubber frame and roof edge
c	Gap dimension between windscreen and A-pillar
1	Windscreen
2	Window glass adhesive
3	Roof outer skin
4	A-pillar

In order to avoid wind noises, the windscreen must be installed lower than the roof outer skin. The dimension a specified in the repair instructions can be checked using a special gauge. The dimension a is influenced by the height of the adhesive bead, the force when pushing in the windscreen and any spacers.

The rubber frame of the windscreen must sit evenly at the roof edge across the entire width of the windscreen.

The gap dimensions between the windscreen and the A-pillars on the driver's and passenger's side must be aligned symmetrically.



Following the replacement of the windscreen, it may be necessary to calibrate the rain-light-solar-condensation sensor, as well as the KAFAS camera.

PASSIVE SAFETY

"Passive safety" is understood as all design measures which serve to protect the vehicle occupants against injury in the event of an accident, or reduce the effects of an accident. But the protection of other road users in the event of an accident also falls under the term "passive safety".

The deformation zones at the front, rear and side of the body, as well as the deformation-resistant passenger cell, are also part of passive safety. In addition, airbag and restraint systems are also an important element of the passive safety of a vehicle.

AIRBAG AND RESTRAINT SYSTEMS

The airbag and restraint systems are aligned precisely to the deformation behavior of the body. Depending on the type and severity of the accident, they are responsible for deploying the correct airbag with the required restraining effect at the exact time. Airbags and belt tensioners that are not required are not activated by the intelligent system. They continue to be available in the event of a possible second collision.

Control Units, Sensors, and Switches

F25 sensors, switches and control units of the airbag and restraint systems



Index	Explanation
1	Airbag front sensor, right and left (US version)
2	Switch for front passenger airbag deactivation
3	Lateral and longitudinal acceleration sensor, B-pillar, right and left
4	Seat occupancy mat (US version: CIS mat)
5	Integrated Chassis Management (ICM) (integrated sensors for roll-over detection, etc.)
6	Seat belt buckle switch for driver's and passenger belt
7	Airbag sensor, front door, driver's and passenger's side (US version)
8	Crash Safety Module (ACSM)

The number and version of the control units, sensors and switches of the airbag and restraint system vary depending on the national-market version. Information on the control units, sensors and switches must therefore be taken from the vehicle-specific repair instructions.

Control units

There are often additional sensors located in the control units. For example, the sensors for the rollover detection of the F25 are located in the Integrated Chassis Management (ICM). If control units with integrated sensors are moved adversely when a battery is connected, this may cause the activation of the individual airbags and belt tensioners. This is one of many reasons why it is imperative to disconnect the battery before the removal of control units.

Airbag sensor, door

Airbag sensors are also installed in the driver's and front passenger door depending on the national market version. The airbag sensors in the doors provide support in the event of a side impact detection by measuring the internal door pressure. In addition to the lateral acceleration values, the pressure in the door cavity also increases in the event of a side collision.

In order to ensure the correct function of the airbag sensors in the event of a side collision, it is necessary to pay attention to the correct installation of all sealing measures and the door trim panels during the repair.

Acceleration sensors

The lateral and longitudinal acceleration sensors provide support in the event of the detection of a front-end, side and rear-end collision. In general, at least two crash signals are required from different sensors to trigger the activation of airbags and belt tensioners.



All testing and installation work at airbag and restraint systems can only be performed by experienced and trained personnel.

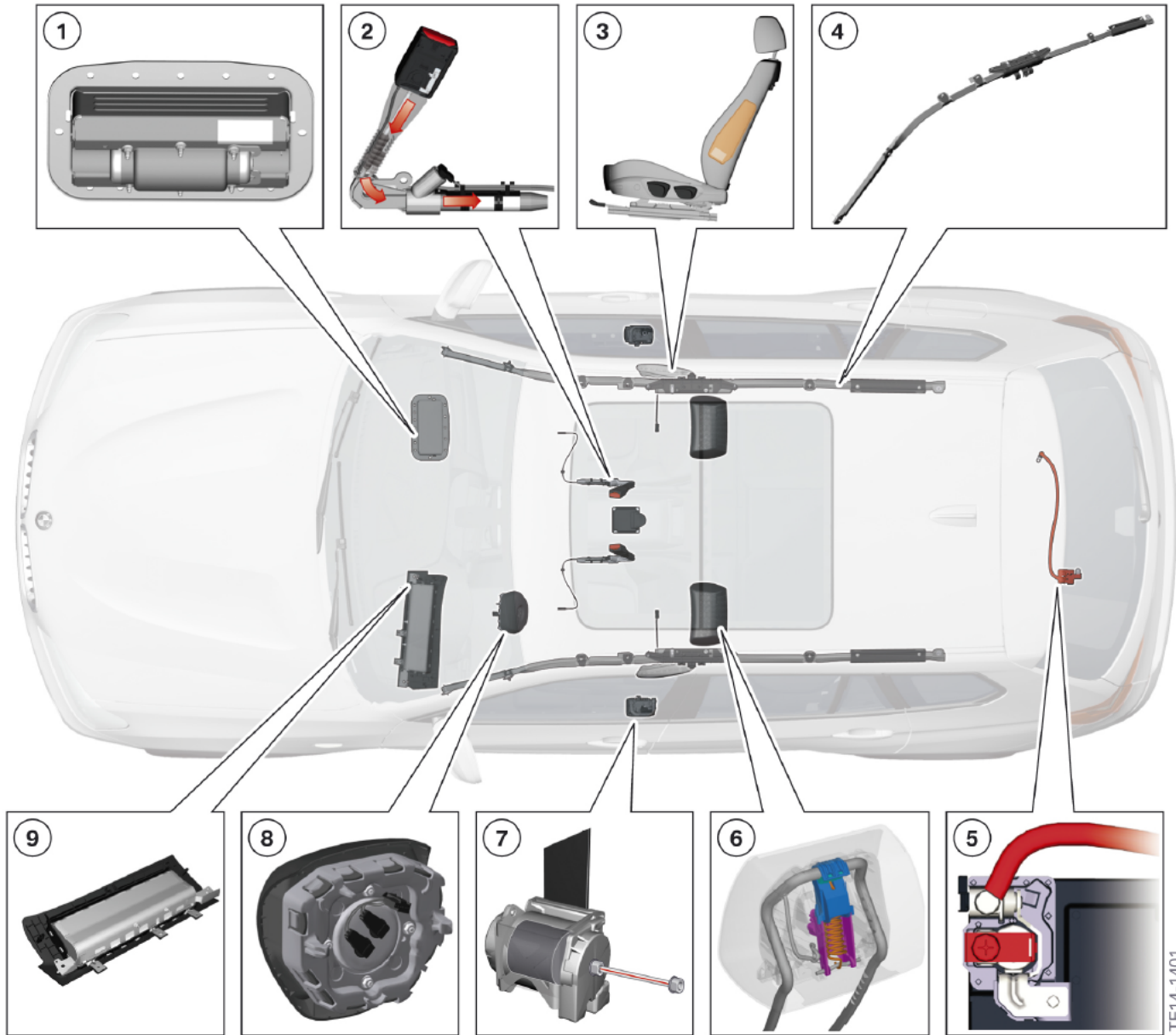
For all work on components of airbag and restraint systems, the information in the workshop information system ISTA, which is updated on a daily basis, must always be observed.

The battery must always be disconnected before the mounting of control units, sensors and gas generators is removed, or control units, sensors and gas generators are connected or disconnected.

Otherwise, it may cause fault messages, and even undesired activation of airbags or belt tensioners.

Pyrotechnic Actuators

F25 pyrotechnic actuators of airbag and restraint systems



Index	Explanation
1	Front passenger airbag
2	Belt tensioner for driver's and passenger belt
3	Side airbag for driver's and front passenger seat
4	Head airbag for driver's and passenger's side
5	Safety battery terminal SBK
6	Crash-active headrest, driver's and front passenger seat
7	Retractor tensioner for driver's and passenger belt
8	Driver's airbag
9	Knee airbag for driver's and passenger's side (US version)

TE14-1401

Airbags and belt tensioners are pyrotechnic objects. Their handling and transport are controlled differently depending on the national-market version.



All testing and installation work at airbag and restraint systems can only be performed by experienced and trained personnel.

For all work on components of airbag and restraint systems, the information in the workshop information system ISTA, which is updated on a daily basis, must always be observed.

Before all installation and removal work at airbag and restraint systems, the battery must be disconnected and the negative terminal, as well as the terminal, covered.

PEDESTRIAN IMPACT SEVERITY MITIGATION

Various measures are applied in order to reduce the severity of the injuries in the event of accidents with pedestrians.

Passive pedestrian protection

Passive measures for the protection of pedestrians in the event of accidents include:

- Engine compartment lid with flexible design
- Engine compartment lid hinge with mechanical release mechanism
- Module carrier of side panel modules with flexible design.

ACTIVE SAFETY

"Active safety" is understood as all measures which help avoid accidents. In particular, the electronic assistance systems support the driver in assessing driving situations, and some actively access different vehicle systems.

DRIVER ASSISTANCE SYSTEMS

Numerous assistance systems support the driver in various ways, thus increasing the comfort and safety of all occupants. The different technologies are assigned to an exact detection of the surrounding area. Visible and invisible sensors and cameras are also located in many areas of the body.

This document only addresses the sensors and systems relevant to Body Repair Level 1.

Sensors and cameras

F15 sensors, outer



Index	Explanation
1	Front radar sensor
2	KAFAS camera
3	Reversing camera
4	PDC ultrasonic sensor (Park Distance Control)
5	Rear radar sensor (right and left)
6	Top view camera (right and left)
7	PMA ultrasonic sensor (Parking Maneuvering Assistant)
8	Night Vision camera
9	Front camera

The number, version and installation position of the sensors and cameras may vary significantly depending on the model and equipment of the respective vehicle. The technology of the sensors and cameras is also constantly undergoing changes due to the further development of the assistance systems. Information on the assistance systems, as well as their sensors and cameras, should therefore always be taken from the vehicle-specific training documentation and repair instructions.

The sensors and cameras of the assistance systems are affected directly or indirectly for much of the work in the area of the outer body skin. Some general information therefore must be considered before, during and after repair work.

Further technical information can be found in the F01/F02 product information DCC, ACC.

Work planning

The following information on existing sensors and cameras should be ascertained before the repair of body components:

- Positions of sensors and cameras in the repair area
- Mounting type of the sensors, cameras, as well as their access lines and connectors
- Any existing fault code entries, which indicate faulty sensors or cameras
- Permissibility of the planned repair method.



Multilayer paintwork on ultrasonic sensors is not allowed.

Repair work involving the modification of the alignment of sensors or cameras is not allowed.

Repair

In addition to the procedure described in the respective repair instructions, the following general information should be observed:

- The holders of sensors and cameras cannot be repaired.
- The alignment of sensors and cameras should not be changed.
- The sensors and cameras, as well as their brackets, must be checked within the damaged area.
- A second coating of paintwork on ultrasonic sensors is not allowed.

- The repair of the outer body skin is not allowed in certain areas.

Plastic repairs and also repair painting are generally allowed only in areas where there are no radar or ultrasonic sensors on or behind the outer body skin. With the additional plastic layer or paintwork, the signals of these sensors are interrupted and the correct function of the corresponding assistance systems is no longer guaranteed.



During the repair of body components, ensure careful handling of sensors and cameras.

The areas of the outer body skin which cannot be repaired are described in the workshop information system ISTA.

Subsequent work

Following the repair of the body components, additional work is often required at the vehicle electronics. Different measures may be required, depending on whether a sensor or camera has been replaced or only removed. Sometimes these measures must be carried out with help of the diagnosis system. The precise procedure can be found in the workshop information system.

- Calibration
Mechanical or electronic setting of the sensor or camera alignment
- Initialization (teach-in)
Teach-in of start and end values
- Encoding
Adapting to national-market version, vehicle equipment and vehicle type
- Programming
Renewing the data and program status.

If the necessary work has not been carried out, this may lead to malfunctions or a total failure of the assistance systems. It often also causes fault messages and, as a result, fault memory entries. These then have to be processed according to the specifications in the workshop information system ISTA.



If the necessary calibrations, initializations, encoding or programming are not carried out, this may lead to malfunctions or a total failure of the assistance systems.

LIGHT SETTING

The exterior lights is an important element of active safety. In addition to the legal requirements, modern BMW vehicles also have numerous functions depending on the equipment and national market version in order to optimize the perception, and thus the safety and comfort, of the driver. Further technical information can be found in the G11/12 product information, general electrical system - exterior lights.

In order to guarantee the proper function of the headlights, the correct procedure for the adjusting procedures must be observed. This is described in the respective repair instructions.

1 Adjust headlight housing to gap dimensions

2 Adjust light.

The light setting is effected using adjusting screws. Using a headlight adjusting device, the actual and set-point values can be compared for the respective lighting function.

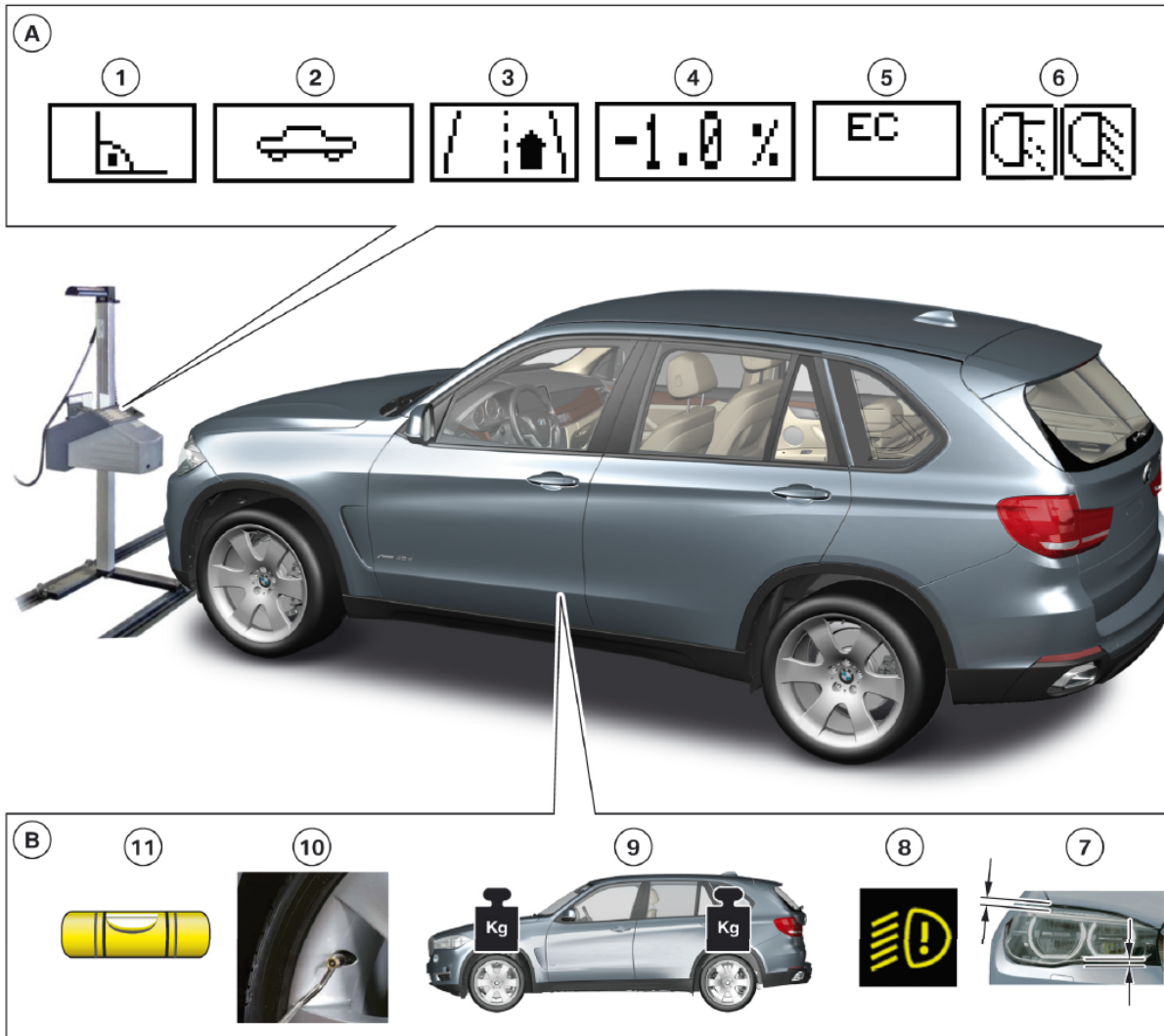
The headlights must be adjusted after the following work:

- Replacement of the headlight
- Slackening of the mounting bolts
- Modification of the vehicle height (for e.g. low-slung).

Prerequisites

Before the light setting, some general prerequisites must be satisfied at the vehicle and at the headlight adjusting device.

Prerequisites for the light setting



Index	Explanation
A	Prerequisites at the headlight adjusting device
B	Prerequisites at the vehicle
1	Correct alignment of headlight adjusting device to vehicle
2	Correct vehicle type
3	Correct selection of right-hand traffic/left-hand traffic
4	Correct setting dimension for light/dark boundary
5	Correct headlight type (halogen, xenon, LED)
6	Correct type of lighting effect of headlight (only for low-beam headlight and high beam)
7	Correct installation dimensions of the headlights
8	All light sources OK
9	Vehicle load as per the repair instructions
10	Correct tyre pressure
11	Vehicle is on an even surface

Depending on the equipment of the vehicle and version of the headlight adjusting device, other prerequisites may also have to be satisfied.

Headlight beam throw adjustment

If the vehicle has a manual headlight beam throw adjustment, the handwheel must be set to zero before the adjustment.

If the vehicle has an automatic headlight beam throw adjustment, a waiting period of 80 seconds must be observed after the light has been switched on. During this time the vehicle cannot be moved.

Light switch

In order to adjust the low-beam headlight, the light switch must be in the "low-beam headlight/driving light" position and not in the "automatic driving lights control" position.



For the adjustment of the headlight mechanics, it is absolutely imperative that the procedure described in the repair instructions and the information in the operating instructions of the headlight adjusting device are observed.

The headlight mechanics adjustment cannot be effected immediately after lowering the vehicle on the vehicle hoist. In this case, the vehicle must be moved approx. 15 meters on its own axles before adjusting the light setting.

REPAIR METHODS FOR LEVEL 1A

THREAD REPAIR

Helicoil® thread repair



Damaged thread – for e.g. at the engine support – can be repaired using Helicoil® threaded inserts.

RIVET NUTS AND BOLTS

Hand riveting machine MB 512 for thread diameter M5–M12



Damaged rivet nuts and bolts can be replaced in Service. Different tools are available for this purpose.

REPLACEMENT OF GLASS

Bonded glass panes contribute to the torsional rigidity of the body. For this reason, the vehicle must be on even ground with the wheels during the entire repair process. However, the towing away or maneuvering without windscreen, rear window and side window glass is possible.

Removal of window glass

The bonded windscreen, rear window and side window glass can be removed in a non-destructive manner. The bonded connection is cut through for this purpose. Depending on the access to the adhesive bead, different techniques are used.

Tools for the removal of bonded window glass



Index	Explanation
1	"Spider" removal system (cutting system with nylon string)
2	"Roll Out 2000" removal system (cutting system with cutting wire)
3	Wire pulling grips with cutting wire
4	Special electrical cutter SuperCut FSC 1.6Q

Airbags, aerials, sensors and cameras, as well as electrical lines, can be located in the area of the window glass of modern BMW vehicles. For the removal of bonded window glass, it is imperative that the information in the vehicle-specific repair instructions is observed. Otherwise, it may lead to damage relevant to safety, for e.g. by sharp tools.

The neighboring body areas should be covered with protective covers. The areas of the outer body skin, the interior equipment and the respective window glass, which are in immediate danger, can also be protected with fabric adhesive tape.

In order to reduce the danger of injury by cuts and glass splinters, gloves and safety goggles must always be worn for the removal of bonded window glass. The workbay should be tidy and offer sufficient space so that the doors can be opened fully.

The procedure for the application of the various repair systems and tools is described in the workshop information system ISTA.



For carbon components, particular caution is required, as minor damage can also have serious consequences.

Prepare bonding surfaces

The permissible connection between window glass and body requires the proper preparation of the splices. This includes the following operations:

- 1 Remove remains of the spacers
- 2 Cut back the adhesive bead to approx. 0.5 mm
- 3 Restore the corrosion protection in the case of possible paintwork damage *
- 4 Clean the bonding surfaces using a suitable cleaning agent
- 5 Apply paint activator for newly painted areas and wipe dry (observe air drying time)
- 6 Apply glass activator to bonding surface of the window glass (only for new window glass)

* Paintwork damage at the body aperture must be sanded and touched up with BMW multipurpose filler.

Only the cleaning agents, primers and activators specified in the repair instructions can be used, as these are compatible with each other.

After the use of cleaning agents, primers and activators, the air drying time and application time described in the repair instructions must be observed.

Areas treated with cleaning agents, primers or activators can no longer be touched with bare hands.

In order to guarantee the correct distance between the window glass and the window cutout, the new spacers must be mounted precisely at the position described in the repair instructions. Otherwise, it may cause wind noises and even a break of the window glass as a result of tension. If the spacer is located directly in the adhesive area, this may also cause leaks.

Bonding window glass

Depending on the version, sealings, expanding foam tape or sensors must be fitted or renewed before the installation of the window glass, as this is no longer possible in some cases after the installation of the window glass.

Bonding window glass



The window glass is bonded using single component window glass adhesive. This is applied to the adhesive area described in the repair instructions with help of an electric or pneumatic cartridge gun, vertical to the window glass. The adhesive quantity should also roughly correspond to the adhesive quantity of the old adhesive bead.

The possible consequences of an incorrect adhesive quantity are listed in the following table:

Too little adhesive	Too much adhesive
<ul style="list-style-type: none"> • Window glass is too low in the body aperture (visual defect) • Insufficient expansion of the adhesive bead (leak) • Wind noises 	<ul style="list-style-type: none"> • Window glass is too high in the body aperture (wind noises) • Appearance of tension (window glass break) • Emerging adhesive (contamination of mounted parts) • Adhesive at uninsulated screen painting lines of the aerial(s) (reception interference)



From the time of application of the adhesive bead, the window glass must be inserted within the application time specified on the glue cartridge.

When inserting the window glass, the gap dimensions described in the repair instructions must be observed, and the ride height must be checked. Then the window glass should be secured using suitable adhesive tape.



Fresh contamination by adhesive residue must be removed immediately using a suitable cleaning agent. Hardened adhesive residue can only be removed mechanically. In order to prevent pressure build-up in the vehicle interior when the doors are closed, a side window should be opened beforehand.

Glass repair




Damage by stone chipping on windscreens can be repaired in certain circumstances using a special synthetic resin. The assessment of the damage, as well as the procedure for the repair, can be found in the Product Information "Glass Repair and Replacement".

REPAIR METHODS

OVERVIEW

Damage to outer body skin components can be repaired up to a certain damage pattern, without replacing the component completely.

Different repair methods are available for the repair of the outer body skin. In order to be able to select the most suitable repair method, a thorough assessment of the respective damage should be carried out. A combination of different repair methods is often practical.

Repair Method	Advantages	Disadvantages
 <p data-bbox="82 926 310 961">Hammer & dolly</p>	<ul data-bbox="548 562 959 688" style="list-style-type: none"> • Established repair method • Suitable for steel and aluminum 	<ul data-bbox="1089 562 1549 632" style="list-style-type: none"> • Accessibility required on both sides
 <p data-bbox="82 1356 456 1392">Welding and slide hammer</p>	<ul data-bbox="548 993 992 1119" style="list-style-type: none"> • Established repair method • Possible with access on one side 	<ul data-bbox="1089 993 1533 1119" style="list-style-type: none"> • Inaccurate control of reshaping force • Not suitable for aluminum
 <p data-bbox="82 1787 467 1822">Welding and pulling system</p>	<ul data-bbox="548 1423 1008 1738" style="list-style-type: none"> • Minimum installation work • Possible with access on one side • Accurate control of reshaping force • Suitable for steel and aluminum 	<ul data-bbox="1089 1423 1516 1493" style="list-style-type: none"> • Special training required for employees

Repair Method	Advantages	Disadvantages
 <p data-bbox="81 472 259 514">Glue system</p>	<ul data-bbox="544 115 998 430" style="list-style-type: none"> • Minimum installation work • Possible with access on one side • Suitable for steel and aluminum • Possible to remove dents without paintwork damage 	<ul data-bbox="1079 115 1550 378" style="list-style-type: none"> • Only low reshaping forces possible • Only possible for minor damage • Only possible for "soft" dents and bulges
 <p data-bbox="81 892 308 934">PDR / Pre-Push</p>	<ul data-bbox="544 546 998 766" style="list-style-type: none"> • Minimum installation work • Suitable for steel and aluminum • Possible to remove dents without paintwork damage 	<ul data-bbox="1079 546 1550 588" style="list-style-type: none"> • Specialist employees required
 <p data-bbox="81 1333 300 1375">Plastic Bonding</p>	<ul data-bbox="544 976 958 1165" style="list-style-type: none"> • No heating of material • Simple to apply • No identification of plastic required 	<ul data-bbox="1079 976 1502 1102" style="list-style-type: none"> • Only suitable for plastic • Restricted use (see repair instructions)
 <p data-bbox="81 1638 300 1680">Plastic Welding</p>	<ul data-bbox="544 1407 909 1543" style="list-style-type: none"> • Identification of plastic required • Simple to apply 	<ul data-bbox="1079 1407 1502 1543" style="list-style-type: none"> • Heating of material • Restricted use (see repair instructions)



The quality of the repair result has top priority. If in doubt, the faulty body component should be replaced. Repair methods belonging to "Body Repair Level 2" may be required.

DAMAGE ANALYSIS

Scope and severity of the damage

Damage to dog leg area



The body components affected in the event of an accident often incur varying degrees of damage. In order to determine which repair methods can be used in the respective body area, all damaged body components must be identified and the damage individually analysed. This way the optimal repair method can be determined for each case of damage.

In general, only minor to medium damage can be repaired by removing dents. The general prerequisites here are:

- There is no damage to the struts or reinforcements behind the outer body skin.
- Bonded or welded connections are not torn.
- There are no cracks in the outer body skin.

Additional prerequisites must be satisfied for certain areas of damage. These are listed in the workshop information system ISTA.



Detailed information on dent repair and repair methods is available in the product information "Small dent repair" and "Medium dent repair".

PLASTIC BONDING

With the plastic bonding repair method, identification of the plastic grade is not required. Following hardening, the repair area on the front side of the component is filled with adhesive. Once the hardening time is completed again, the surface can be ground to match the original shape of the component.

The repair kit comprises the following:

- Two-component adhesive
- Plastic primer
- Cleaning agent and thinner
- Cartridge gun
- Reinforcement fleece
- Reinforcement strip.

Plastic bonding repair kit



The permissibility of the repair by plastic bonding is dependent on the type and severity, as well as the position, of the damage. The conditions can be found in the workshop information system ISTA. In general, no fluid tanks, such as fuel tanks, can be repaired by plastic bonding. Due to the pedestrian protection, no metal inserts can be used to reinforce the repair area.

PLASTIC WELDING

With the plastic welding repair method, smaller cracks on plastic components (thermoplastics) made of PP+EPDM and ABS for example can be repaired. A plastic repair kit with soldering iron and welding adapter is used in the BMW workshop environment. A specific welding wire is used for this, depending on the material composition of the component.

Not all types of plastic can be welded. Further information can be found in the workshop information system ISTA.

The repair kit comprises the following:

- Hot air welding torch
- Welding wire PP
- Welding wire ABS
- Flat jaw vice grips

Plastic welding repair kit



The advantage when compared to the plastic bonding repair method is that an adhesive hardening time is not required and fewer operations are necessary.

The distinguishing characteristic of thermoplastics is that they, similar to metals, can be re-fused and their geometry modified. The permissibility of the repair by plastic welding is dependent on the type and severity, as well as the position, of the damage.



The conditions for a repair can be found in the workshop information system ISTA.

In general, **no** fluid tanks, such as fuel tanks, can be repaired by plastic welding.