

BODY REPAIRS - GENERAL INFORMATION

BODY REPAIRS (G2394448)

DESCRIPTION AND OPERATION

New Land Rover Defender



E255007

INTRODUCTION

The body plays a significant role in the increasing trend of ever more rapidly changing model variants. The different customer groups are strongly influenced by the design and shape of the body. At the same time the stability of the body plays the most important part in passenger and driver safety. Lightweight construction, alternative materials, composite materials, plastics and appropriate joining processes are all design features that characterize modern Jaguar Land Rover vehicle bodies.

In terms of manufacturing technology, modern safety cell bodies can be produced almost without any problems. Jaguar Land Rover guarantee high quality standards by making sure that mechanical strength properties are tried and

tested in numerous computer simulations, crash tests, by testing materials and by employing sophisticated manufacturing technologies. In the event of repairs it is vital that the production quality standards are upheld. This requires a well-equipped workshop, and places particular emphasis on the qualifications of the workshop technicians. Up-to-date knowledge of current manufacturing technologies and continuous training on new repair methods and techniques are vital for high-quality body repairs. The model-specific repair manuals and the general repair techniques provide valuable support when undertaking body repairs.

Always follow the repair instructions published in this manual. Failure to observe this instruction can result in serious impairment of vehicle safety. All specified safety requirements must be met after the work has been completed.

VEHICLE DESIGN

The design of the modern motor vehicle attempts to overcome two conflicting needs:

- Energy efficiency - lighter, aerodynamic and Eco sensitive technology.
- High levels of comfort - this often equates to higher specifications and more accessories.

Aluminum alloy is the ideal material to meet these demands; it provides a lighter vehicle body. Aluminum is different from traditional steel, with the correct knowledge and suitable tools it is easily repaired.

1. Bodyshell for Fixed roof variant.



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2. Bodyshell for Fixed roof variant. **Roof panel removed for illustration purposes.**



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3. Bodysell for roof opening panel variant.



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The body

The body is manufactured like a conventional monocoque. Two monosides are joined the floor, roof and bulkheads, creating a strong, single structure. The roof structure can accommodate a glass roof panel. When a glass roof is not installed the outer roof panel is a single reinforced large pressing.

The safety of the driver and the passengers is paramount for every body design. There are two key safety aspects in the body:

- Safety passenger cell.
- Crumple zones.

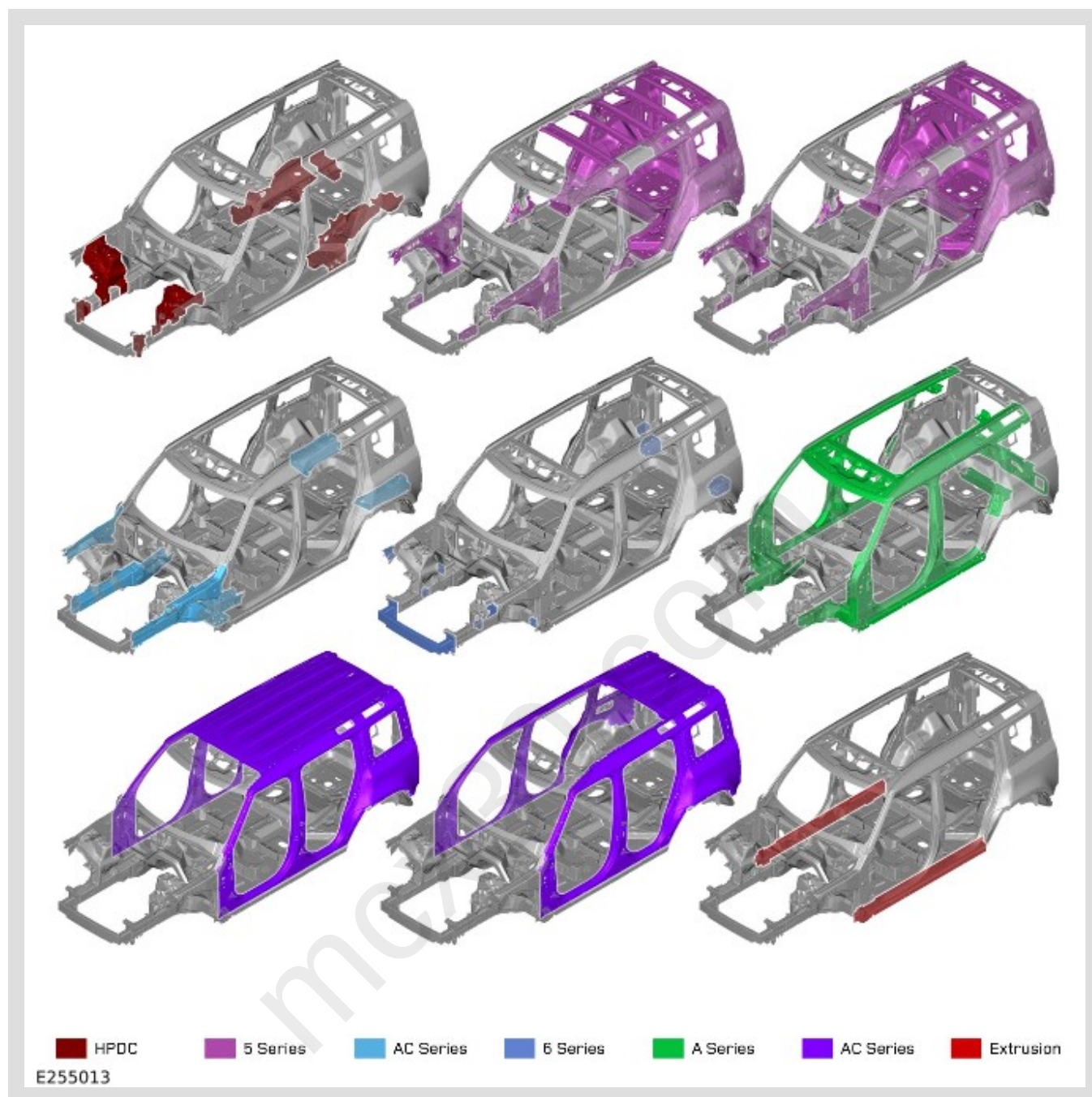
Safety passenger cell

- Stable pillars, rocker panel and door profiles.
- Side impact protection in the doors.
- Doors are designed to open even in the event of extreme deformation.

Crumple zone

- Dynamic absorption of deforming forces.
- Protection of the passenger cell.

MATERIALS USED IN BODY STRUCTURE.



MATERIAL	TYPE
Aluminum	HPDC
Aluminum	5 Series
Aluminum	AC Series
Aluminum	6 Series
Aluminum	A Series
Aluminum	AC Series
Aluminum	Extrusion

Jaguar Land Rover do not approve of the structural straightening or pulling of aluminum vehicles.

Attempting to straighten or pull structural aluminum panels will result in a vehicle repair that does not meet stringent engineering standards in terms of vehicle strength, safety and performance.

In the event of an aluminum structure requiring repair following a collision, vehicle alignment must be assessed (body alignment jig). Damaged panels must be removed and replaced following the appropriate procedures as listed under Workshop Manual – 5: Body and Paint.

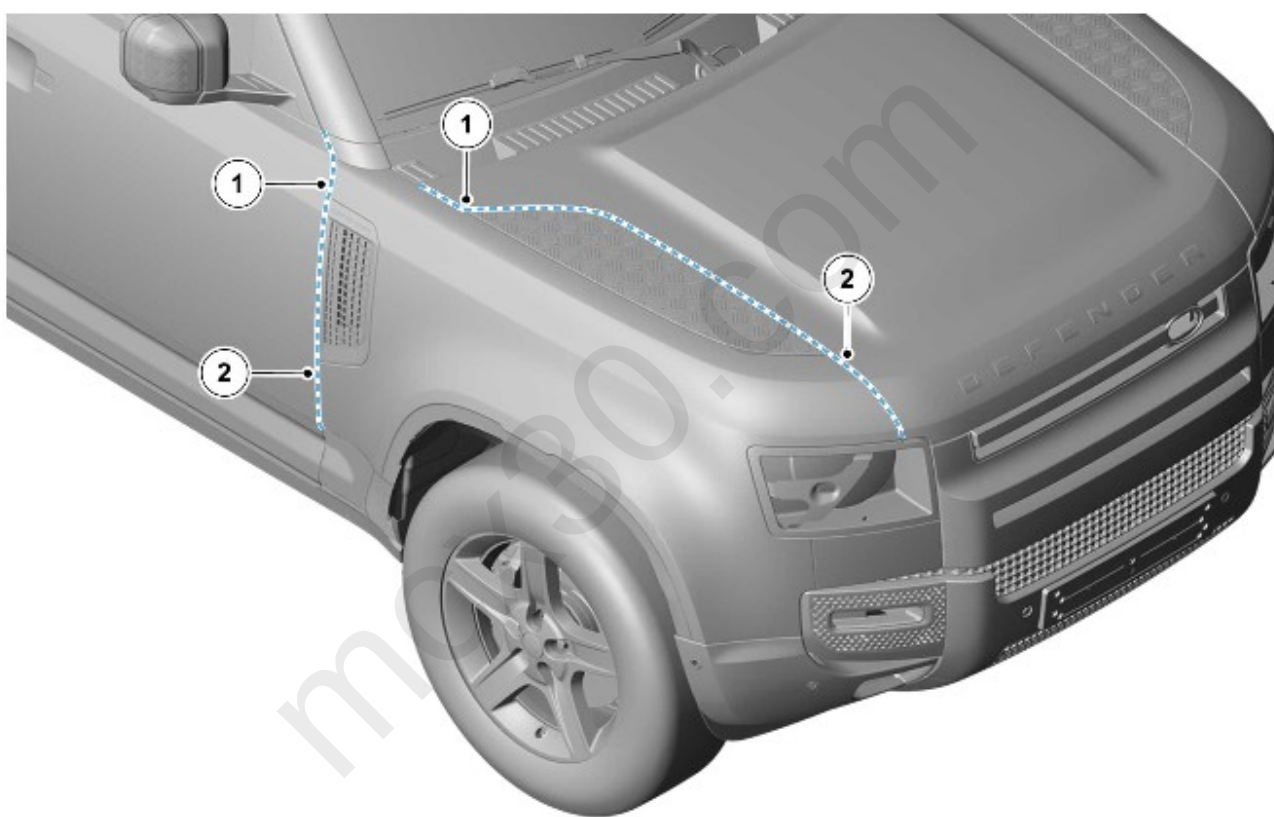
Accident damage and diagnosis

General notes

- Exact diagnosis of the extent of the damage enables proper repair planning
- All body repairs must be completed out in accordance with the guidelines in this Body Repair Manual
- The stability and strength properties of the body must be taken into account during body repairs. The body has exact defined deformation patterns that must not be affected by any repair work
- For instance, the crumple zones absorb the bulk of the impact energy. If any unprofessional repair techniques or methods are used in these areas then this can pose a fundamental threat to vehicle safety.

Hidden damage

- As well as looking at external indicators like flaked off paint, it is vital to check for hidden body damage or deformation that is not visible from the outside. Large attached parts like bumpers and inner fenders often need to be removed to allow accurate assessment of damage to underlying body parts
- Gap dimensions offer another alternative for diagnosis by visual inspection. If any changes or misaligned edges are apparent, then this usually indicates that the dimensions of the affected part are incorrect.



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1	Gap too wide
2	Gap too small

**NOTE:**

Vehicle components like drive shafts and trailer attachments transfer forces. If a vehicle is subjected to a rear impact then all connected body parts and mechanical components (for example transmission mountings) should be thoroughly checked. Electronic components should be checked to make sure that they still operate correctly.

Furthermore it is possible to deduce the overall extent of damage from the direction and magnitude of the impact forces. This does however require extensive body-specific knowledge.

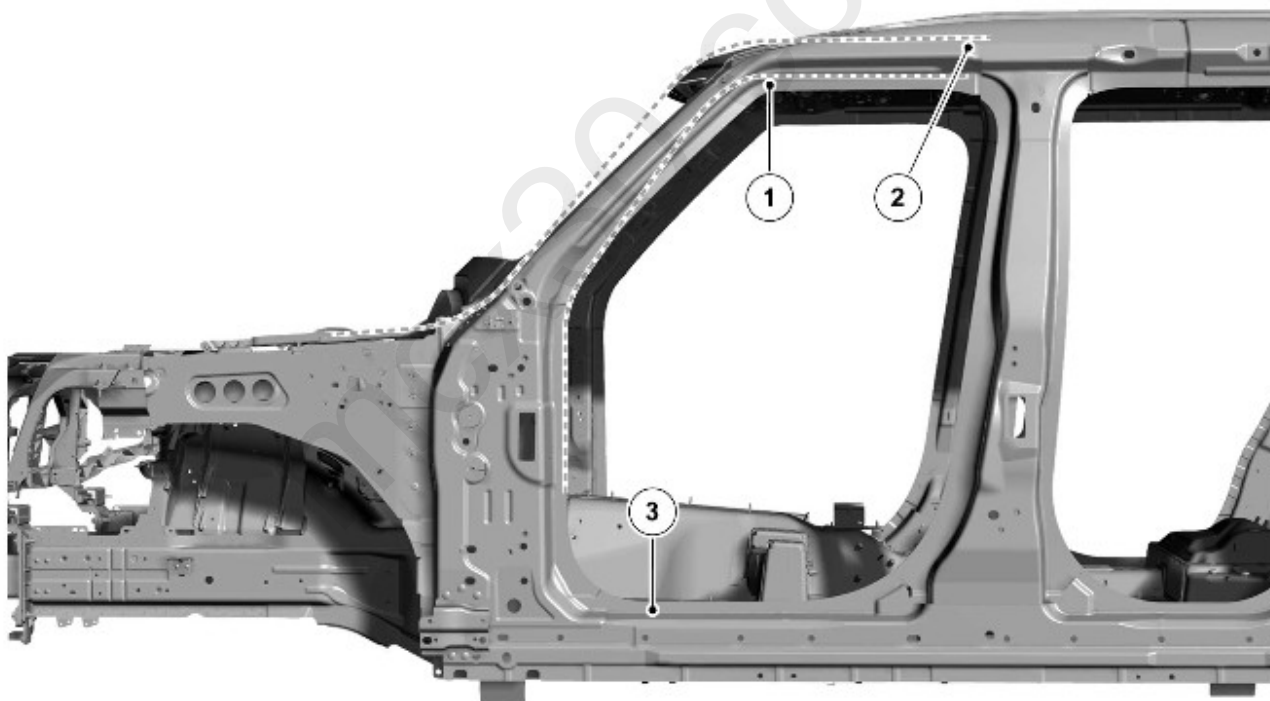
If, for instance, an impact occurs at the front left side member, then the right side member is usually also affected as a result of the rigid body-shell design (crossmember). Often the length of this side member will not have changed, but because of the rigid body-shell design it may have moved from its original position (often only by a very small amount). If any visual deviations are present this can usually be detected by checking the gap dimensions between door and fender or by checking for changes in dimension.

In the case of more severe impacts, the front part of the body cannot absorb all of the impact energy, and the passenger cell is also deformed. Here the impact energy is transferred through the side member to the A-pillar (see diagram). This results in deformations in the area of the roof and the door rocker panel.

The body reacts quite differently to side impacts where there is hardly any crumple zone. As the passenger cell is extremely stable, there are comparatively few local deformations at the site of the impact. However, the impact forces are transferred to the entire vehicle floor, which often results in chassis and panel deformation.

Impact energy is transferred through the side member to the A-pillar**NOTE:**

Damage exaggerated for clarity.



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ITEM	DESCRIPTION
1	Deformation area - roof rail
2	Deformation area - roof
3	Deformation area - door rocker panel

ESTIMATING

The authorized repair network is divided into Structural and Non-Structural. This section describes the process required to identify Structural and Non-Structural damage. Should damage be identified as Structural, the vehicle should be referred to the nearest Structural repair facility.

In line with the Jaguar Land Rover continuous improvement program, information and data contained in this manual will be updated through Jaguar Land Rover technical bulletins.

DEFINITION OF STRUCTURAL AND NON-STRUCTURAL

Structural



NOTE:

Specific equipment and facilities are required to complete Structural repairs, see the equipment section of this manual.

Damage that requires panel(s) to be replaced with any one or combination of the following procedures:

- Welded panel
- Bonded panel
- Panel secured with fixings - Self Piercing Rivets (SPRs) or Breakstem Fasteners (BSFs)

Non-Structural

Damage associated to bolt on panel(s) that are replaced, or light surface damage to exterior cosmetic panels.

IDENTIFYING THE CORRECT JAGUAR LAND ROVER APPROVED BODY CENTRES

Through extensive research, Jaguar Land Rover has identified the most appropriate method to rectify aftermarket damage. It is key to safety and vehicle integrity that only the approved methods, materials and equipment are used.

Issues that could arise from the use of non-approved methods, materials and equipment include:

- Warranty invalidation.
- Safety.
- Galvanic corrosion.

Therefore, structural damage should always be referred to a structural Jaguar Land Rover Approved Body Centres.

THE ESTIMATING PROCESS

Step 1:

Visual inspection, assess overall vehicle condition. Has damage traveled, distorting internal structural panels?

This is a visual check of the complete vehicle.

Possible indicators:

- Panel misalignment.
- Panel gaps no longer uniform.
- Hinged panels catch on locks.
- Exterior cosmetic panels show signs of stress distortion.
- Customer describes unusual driving characteristics post incident.

If structural distortion is visible, vehicle body alignment should be checked/corrected on a body repair jig, refer to an Authorized Structural Bodyshop facility.

If no visual indications of damage transfer, go to Step 2.

Step 2:

If no visual signs indicate distortion to internal structural panels, but the customer is concerned with unusual driving characteristics post incident, and there is no damage to the suspension. Vehicle body alignment should be checked using four-wheel alignment geometry equipment.

If structural distortion is identified refer to an Authorized Structural Bodyshop facility.

Step 3:

If there is no sign or concern regarding vehicle body alignment, focus on the local area of damage.

Do any of the panels require replacement?

If no, go to Step 4.

If yes, are any of the panels secured with:

- Bonding adhesive?
- Fixings?
- Weld?

If yes, refer to an Authorized Structural Bodyshop facility.

Step 4:

Can the damage be repaired by hand using serrated spoon, dolly, file and/or hot air?

If no, refer to an Authorized Structural Bodyshop facility.

OBTAINING SPARE PARTS

The availability of spare parts often determines how easily the body repairs can be completed. The following procedure is recommended:

- Obtain all the data for the vehicle, including type, Vehicle Identification Number, trim code, engine identification letters, initial registration etc.
- Establish all of the damaged components that need to be renewed.
- Establish all of the attached parts that need to be renewed, including small parts like rivets, clips etc.

EQUIPMENT

Jaguar Land Rover Approved Body Centres are expected to be equipped in line with the Body Centre Tools and Equipment standards.

Only equipment that meets or exceeds the minimum welder standard in the Global Body Centre Tools and Equipment standards should be used in the repair of Jaguar Land Rover products.



NOTE:

The approved body equipment for the new Land Rover Defender is listed as either:

- Structural
- Non-structural

Information is available on the Jaguar Land Rover HUB at the following location: <https://jaguarlandroverhub.jlrext.com/censhare5/client/>

PLANNING A REPAIR

The following decisions have to be made before the repairs are started.

- Does the vehicle need to be put on a body repair alignment/straightening/welding jig?
- Does the body need to be measured?

- Do aggregates like engine or axles need to be removed?
- Which body parts need to be renewed?
- Which body parts can be repaired?

The following points must be followed to make sure that the repairs are completed professionally and that all the dimensions are correct after the repairs have been completed.

- Structure:
 - The repair sequence depends on the individual repair plan (taking any necessary disassembly work into account).
 - Clean the attachment areas.
 - Anchor the vehicle free of stress on the relevant system.
 - Support the aggregates to take strain off the body.
 - Decide on at least three measuring/mounting points that are undamaged and as far apart as possible (for basic adjustment).
 - Check the dimensions of the measuring/mounting points.

ALIGNMENT

Fit the new part.

- Make sure that the new parts fit exactly to the specified dimensions. Suitable equipment:
 - Alignment jig.
 - Universal measuring system.
 - Jig system.
 - Ruler or tape measure.
 - Compass.
 - Frame dimensions can be found in the model-specific repair manuals.



NOTE:

Any attached body parts that require accurate alignment and fitting must be incorporated in this step; for instance bumpers, seals, headlamps, rear lamps and lock assembly components. If this is not done carefully it may result in water leaks, wind noises and substantial follow-on work.

Make sure that edges line up with adjacent parts and check that gaps are consistent (compare left and right-hand sides). Make sure that the shape of the vehicle is retained.

Secure the new part



NOTE:

The need for subsequent follow-on work can be significantly reduced if aligning and tack-welding are completed with due care.

Depending on accessibility the following methods for securing are available:

- Grip pliers (set of).
- Screw clamp (set of).
- Tack welds.
- Use a staking tool or a screwdriver to make sure that the edges of sectional replacements of profiled parts line up. The edge is then tack welded to make sure that it lines up.

CUTTING OUT BODY PARTS

Depending on how the parts are joined/connected, different tools are suitable for cutting/separating body parts.

Drill



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NOTES:

- All other parts like interior equipment, window glass etc. must be protected against flying sparks.
- Make sure that the drilling depth is set correctly to prevent the remaining flange from being weakened.

Rod sander



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NOTE:

Wear protective clothing. Protect any vulnerable body or glass areas against flying sparks. Remove explosive materials from the vicinity.

Inaccessible Breakstem Fasteners/Self Piercing Rivets should be removed using a rod sander. The same applies to Metal Inert Gas spot welds or seams.

Short stroke saw



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NOTE:

Underlying parts, wiring harnesses, hoses etc. must not be damaged - remove them beforehand if necessary.

Body saws are particularly versatile and are therefore very suitable for making severance cuts on body parts.

In addition to the short stroke saw, the reciprocating saw can be used. With this, it is possible to make narrow and straight cuts to an exact depth.

**NOTE:**

The severance cut should always be kept as short as possible on sectional replacement. Only cut at the severance lines shown in the repair chapters.

Do not make any cuts near reinforcements or pre-determined folding lines.

Pre-Weld**WARNING:**

Prior to starting any procedure, make sure the relevant Electric Vehicle cautions are observed and followed.

- **Power Up/Down or remove the Electric Vehicle battery as indicated in each procedure.**
- Remove any Control Module's (ECM) within 500 mm of the weld area.
- Adjacent vehicle parts and adjacent vehicles must be shielded against flying sparks and heat.

The aluminum surfaces **MUST** be cleaned prior to welding. Cleaning will aid penetration and avoid contamination. There are three steps to this process:

1. Clean surface:

To remove wax and any other contaminants use a chemical surface cleaner:

- Use a Jaguar Land Rover approved product.
- Alternatively an Isopropyl based product

2. Remove Oxide

This can be achieved through a number of processes:

**NOTE:**

Items used to remove oxide should not be contaminated by use on a steel vehicle.

- Stainless Steel brush
- 80 Grit abrasive paper
- Non-Metallic scuff pad

3. Remove Oxide Dust

**NOTE:**

Oxide builds up very quickly, therefore, perform steps 2 and 3 immediately prior to welding. If left for a period of time, steps 2 and 3 should be repeated.

- Remove dust with a lint free cloth

WELD VARIANTS**WARNING:**

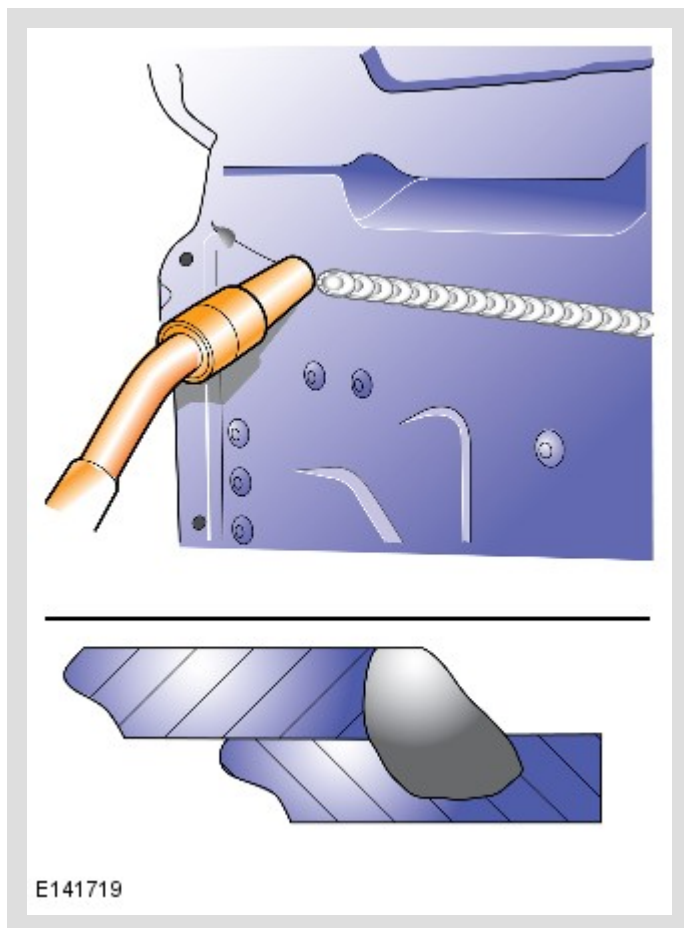
An Electric Vehicle Competent Person must remove the battery before welding work is completed in the vicinity of the Electric Vehicle battery.

For additional information, refer to: [Electric Vehicle Safety Rules](#) (414-01A Battery, Mounting and Cables - Vehicles With: Non-Electric Vehicles, Description and Operation).

The following identifies the three types of weld variants used in Category A panel replacement. It is not a guide to welding, as all Category A repairers will have staff who have attended and completed the Jaguar Land Rover aluminum welding accreditation.

This section highlights the key points for each weld variant.

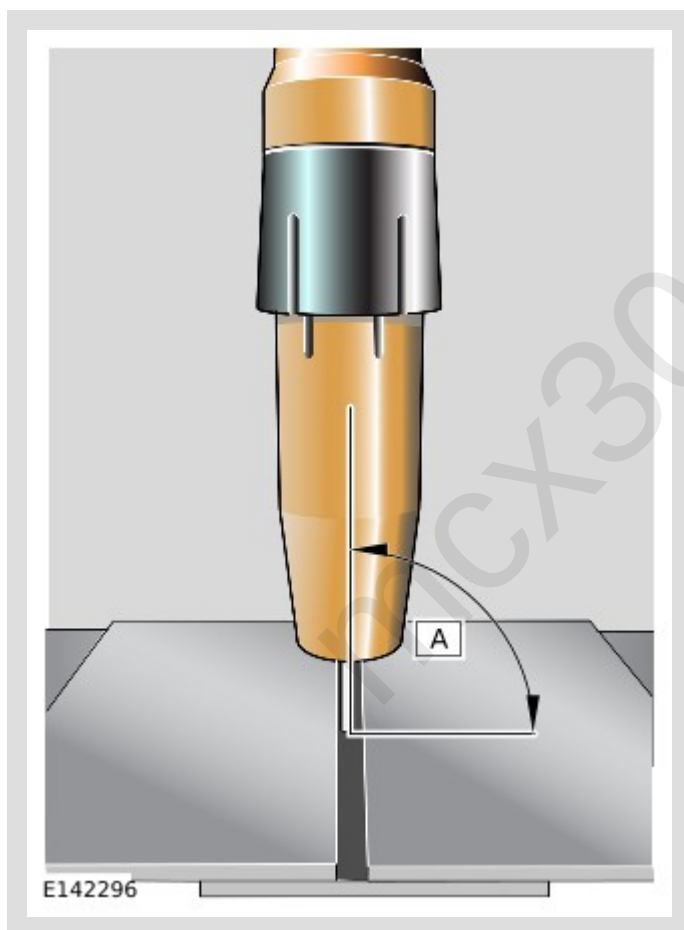
Lap Weld



Key points:

- Run-In/Out distance of 5 mm
- Minimum overall length of 20 mm
- Must use Start/Finish weld tabs

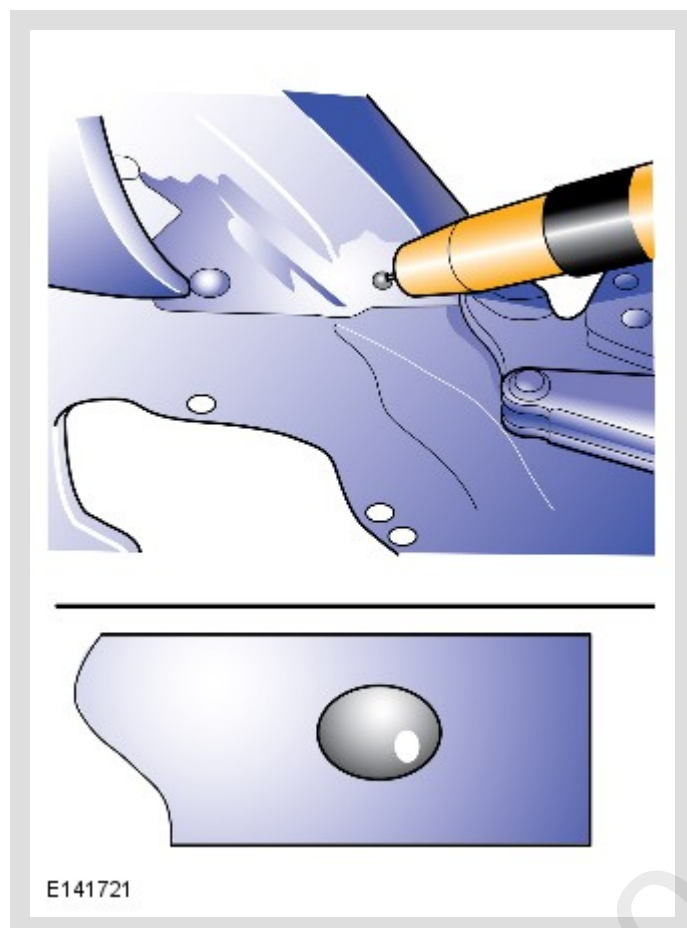
Butt Weld



Key points:

- Run-In/Out distance of 5 mm
- Minimum overall length of 20 mm
- Must use Start/Finish weld tabs
- Backing plate required

Plug Weld



Backing Plates

Backing plates are required for all aluminum butt-welded joints. Backing plate fabrication is made from waste material and have a width of 50 mm. Securing backing plates is by either an interference fit, lap-weld, plug-weld or self-tapping screws. Backing plate thickness is determined by work piece thickness, for example; (3 mm work piece will require a 3 mm backing plate). Backing plates are used to avoid excess penetration, dissipate the heat and supports the molten weld pool while cooling.

Weld Tabs

Weld tabs are required for all aluminum seam welded joints. They are manufactured from waste material and placed at the start and end of the effective weld length.

Test Weld

A test weld using identical coupons from waste panels should take place prior to working on the vehicle. The test piece is then visually checked and destructively tested to make sure all settings are correct and an acceptable weld has been achieved.

Prior to starting, the following should be checked:

- Gas - Correct for the type of job

- Filler Wire - Correct for the type of material to be welded

An effective weld should demonstrate the following qualities:

- All visible weld surfaces shall be clean, bright and of a uniform profile
- The weld seam should show uniform height and width over its entire length
- There shall be complete fusion between the surfaces of the work piece and the weld metal deposit

Correct level of penetration will be visible at the rear of the coupon as a fine continuous line.

Effective Weld Length

The effective weld length is the weld seam as described in the Body Repair Sections. The effective weld length does not include allowances for the run-in/run-out, or termination defects, (start/stop), of the weld seam. It is permissible that the overall weld length is longer than detailed in the repair section, as the overall weld will include a minimum of 5 mm at both the start and the stop of the weld seam, provided the function of the part is not affected, or the weld finishes on the edge of a panel.

POST WELD CHECKS

Weld inspections take the form of a visual examination, non-destructive and destructive testing.

Visual Examination

A visual examination of fusion welds should be completed in accordance with the acceptance criteria detailed in the following Imperfections/Defect Levels table.

Imperfection/Defect Levels Table

DEFECT /IMPERFECTION TYPE	DETAILS	LIMITS
Burn-through	Burn holes	Not permitted
Seam offset, sides melted away	Incomplete fusion	Not permitted within effective weld length
Cracks	Any form of cracking is not permitted at any position along the entire length of the weld seam	Not permitted
Fused weld spatter		Limited acceptance. Not permitted on visible surfaces or in areas where functional performance of the part is affected, for example mating surfaces, sealing surfaces, etc. In such instances spatter is to be removed. All loosely adherent spatters must be removed
Visible ignition marks	Local melting of parent metal due to arc	Permitted provided functional performance of the component is not affected.

DEFECT /IMPERFECTION TYPE	DETAILS	LIMITS
Open end crater	Reduces the cross sectional area of the weld seam	Not permitted
Visual pores		Not permitted
Weld skip	Discontinuity/interruption in weld seam	Not permitted at any position along the entire length of the weld seam

Non Destructive

Dye penetrate testing **MUST** be used for detection of discontinuities, such as cracks, laps, folds, porosity and lack of fusion that are open to the surface of the material. Typical defects include start, (cold start/incomplete fusion) and stop, (crater cracking), defects within a fusion weld run. In addition to this lack of fusion/coalescence at the weld toe, solidification cracks in the weld bead may also be detected.

Non Destructive Crack Inspection Process

Use the product as listed in the Approved Materials Section, this product is supplied within the Category A tool kit. The product is an aerosol applied dye system. It is designed to penetrate the finest cracks and flaws to facilitate detection, the system includes: Cleaner, Penetrant and Developer.

The process is as follows:

- 1. Use the cleaner to de-grease/clean the test area, then wipe with a lint free cloth.
- 2. When the surface is completely dry, apply the penetrant. Cover the test area and allow a minimum contact time of 10 minutes.
- 3. Remove excess penetrant from the surface with a lint free cloth wetted with the cleaner.
- 4. Apply a THIN film of the developer and leave for a minimum of 10 minutes to draw up the retained dye from flaws or cracks.
- 5. Weld tested areas should then be examined under natural or electric light for signs of flaws and/or cracks. Cracks will show up as lines and porosity will appear as pin holes.

Destructive Testing

Each test weld should be pulled apart to check the quality and penetration of the weld.

SAFETY MEASURES

- The Electronic Control Modules (ECM) installed to vehicles make it advisable to follow suitable precautions prior to carrying out welding repair operations. Harsh conditions of heat and vibration may be generated during these operations which could cause damage to the modules. In particular, it is essential to follow the appropriate precautions when disconnecting or removing the airbag Restraints Control Module (RCM).
- Do not allow electronic modules or lines to come into contact with the ground connection or the welding electrode.
- Seatbelt anchorages are a safety critical. When making repairs in these areas, it is essential to follow design specifications. Note that extra strength low alloy steel may be used for seatbelt anchorages. Where possible, the original production assembly should be used, complete with its seatbelt anchorages, or the cut line should be so arranged that the original seatbelt anchorage is not disturbed.
- All welds within 250 mm (9.842) of seatbelt anchorages must be carefully checked for weld quality, including spacing of spot welds.
- Never weld, on components of a filled air conditioning system. The same applies if there is a risk of the air conditioning system heating up.
- Connect the ground connection of the electrical welder directly to the part that is to be welded. Make sure that there are no electrically insulating parts between the ground connection and the welding point.

PROTECTIVE EQUIPMENT AND SAFETY AT WORK

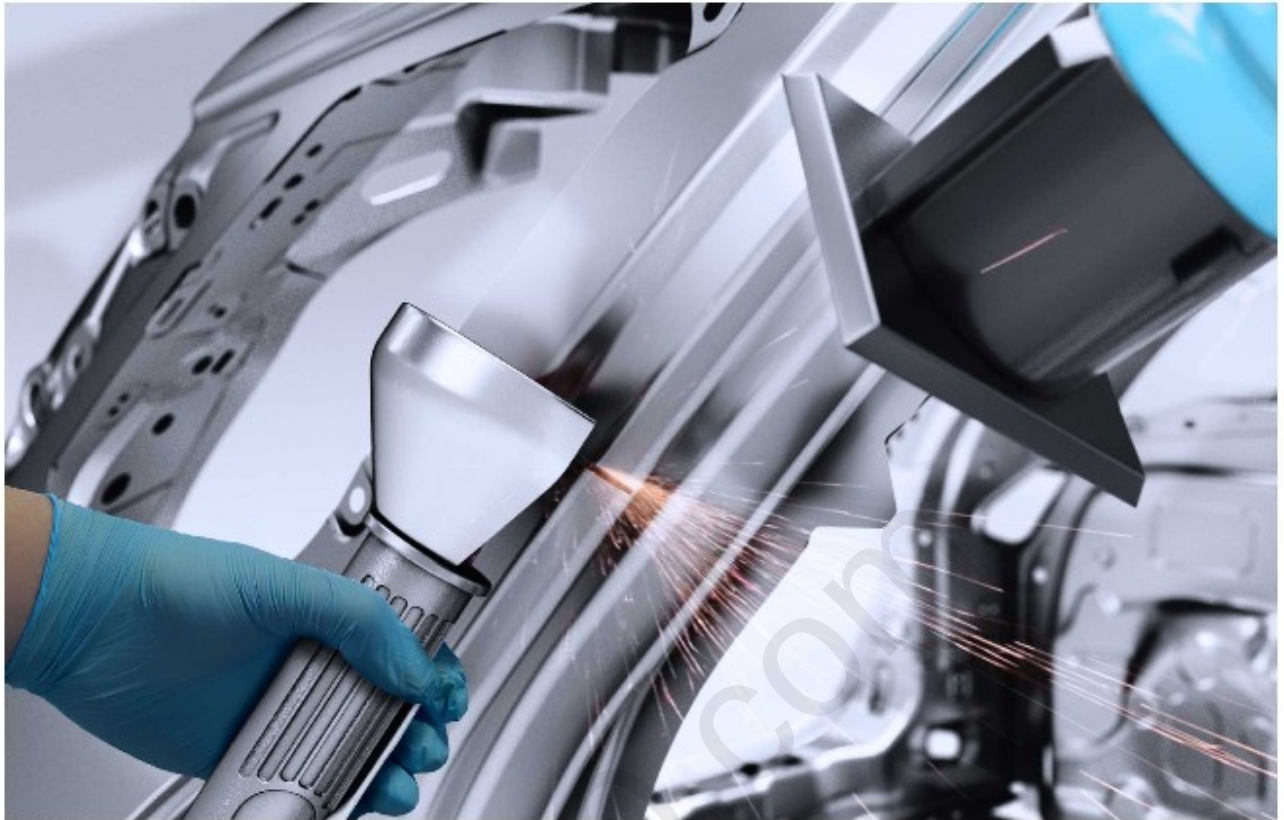
- Various safety measures and legal requirements must be met when carrying out repairs. All regulations relating to health and safety at work must be followed.

Welding safety precautions

- The following safety precautions must be observed to prevent the risk of personal injury:
 - Safety hood (face protection).
 - Welding shield.
 - Safety gloves.
 - Safety shoes.
 - Extraction unit for welding smoke.
- Welding should always be completed in well ventilated areas. A fire extinguisher must also always be within reach.

General body repair safety measures

Extraction unit



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- Sealing compound, underbody protection etc. must not be burned off with a naked flame. This would produce toxic gases. If for instance PVC is burned, then gases containing hydrochloric acid are produced. For this reason a suitable extraction unit should always be used when performing grinding, welding or soldering work.
- Always make sure there is good ventilation when working with materials that contain solvents, wear breathing equipment and use an extraction unit.
- Ear defenders should always be worn when cutting, grinding or straightening metal, as the noise levels can reach or even exceed 85 - 90 dB(A).
- Take care not to look directly into any laser measuring systems, for instance used to measure the under body.
- When removing components from a vehicle mounted on a lifting ramp, watch out for a shift in its center-of-gravity. When first placing the vehicle on the ramp, take into account that it may need to be secured against tipping over.