PUBLISHED: 15-APR-2021 2018.0 RANGE ROVER (LG), 501-25A

**BODY REPAIRS – GENERAL INFORMATION** 

# BODY CONSTRUCTION – [+] WITHOUT ARMOUR (G1987889)

#### 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 ensuring 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 ensuring 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. All specified safety requirements must be met after the work has been carried out.

It is key to safety and vehicle integrity that only the approved methods, materials and equipment are used. To successfully complete structural repairs to Jaguar Land Rover products, it is necessary for the repairs to follow the correct aftermarket process for adhesive (bonding), riveting and welding to ensure vehicle integrity is maintained after a collision. For additional information, refer to: Adhesives, Fixings and Consumables (501-25A Body Repairs - General Information, Description and Operation).

# CONTENTS

This document includes technical data and information for the all new Range Rover L405 aluminum range. The information contained within is valid at the time of production and incorporates:

- Who should use this information?
- Repair category definition
- Accident damage and diagnosis
- Impact effects on the body
- Planning a repair
- Estimating

- Identifying the correct Jaguar Land Rover Approved Body Centres
- Obtaining spare parts
- Equipment
- Aluminum Information

In line with Jaguar Land Rover continuous improvement program, information and data contained will be updated periodically.

All activities described within are based on the use of genuine Jaguar Land Rover Parts, tools and approved materials.

# WHO SHOULD USE THIS INFORMATION?

The information and repair methods listed are designed as an aid for Jaguar Land Rover Approved Body Centres achieving the approved Bodyshop Operating Standards. The relevant section should be read completely before commencing any repairs. Only technicians who have successfully completed the approved L405 aluminum training program should work on the model. Approved Bodyshop Operating Standards require that the skills of technicians be regularly assessed and that any training needs identified are addressed within a reasonable time. This information complements the Jaguar Land Rover training program.

The authorized repair network is divided into Structural and Non-Structural. The following describes the process required to identify Structural and Non-Structural damage.

# DEFINITION OF STRUCTURAL AND NON-STRUCTURAL

# Structural

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Specific equipment and facilities are required to carry out 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.

General notes:

- Exact diagnosis of the extent of the damage enables proper repair planning
- All body repairs must be carried 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

#### IMPACT EFFECTS ON THE BODY

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-hand side member, then the right-hand 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 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 via the side member to the A-pillar. This results in deformations in the area of the roof and the door rocker panel.

#### 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 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?

# BATTERY CARE STANDARDS

To ensure that the correct maintenance actions are carried out before and during a repair.For additional information, refer to: Battery Care Requirements (414-00 Battery and Charging System - General Information, Description and Operation) / Body Construction - [+] With Armour (501-25A Body Repairs - General Information, Description and Operation).

# HYBRID ELECTRIC VEHICLES (HEV)

When planning a repair on Hybrid Electric Vehicle (HEV) make sure that the vehicle is inspected by an authorised person. This will then determine whether the vehicle needs to be decommissioned before any repair work can commence.

If the vehicle needs to be decommissioned this can only be carried out by an authorised person. The authorised person will also issue a permit to work on the vehicle.

#### 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.

#### THE ESTIMATING PROCESS

Step 1:

Visual inspection, assess overall vehicle condition. Has damage travelled, 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 Authorised 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 Authorised 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 Authorised 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 Authorised Structural Bodyshop facility.

#### 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 an Authorised Structural Bodyshop facility.

#### **OBTAINING SPARE PARTS**

The availability of spare parts often determines how easily the body repairs can be carried out. 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 metal parts 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.

The approved body equipment for the all new L405 aluminum range is listed as either:

- Structural
- Non-Structural

A copy of the approved equipment standards for Structural and Non-Structural repair facilities is available on request from and the Global Body Centre Standards have been published on the HUB, along with the personal protective equipment requirements, at the following locations:

# https://jaguarlandroverhub.jlrext.com

# ALUMINUM INFORMATION

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

- Fuel economy lighter, aerodynamic and fuel 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 with improved rigidity. aluminum is different from traditional Steel, with the correct knowledge and suitable tools it is easily repaired.

There are two aluminum alloys discussed in this manual, the attributes detailed in the following table should be considered when deciding to repair or replace:

	6XXX	5754
Material Description	6xxx Series is a Magnesium/Silicon aluminum alloy	5000 Series is an aluminum alloy with Magnesium content
Location on Vehicle	This alloy is used mainly in the outer body panels. Thickness: 0.9 - 2.0mm	Internal structural panels Thickness: 1.0 - 3.0mm
Attributes	High dent resistance	Strength and durability
Repairable	Yes - Light damage only	All repairs to 5754 are restricted to Structural Jaguar Land Rover approved Body Repair Centres only.

6XXX	5754
	Yes - Light damage only

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.

Other materials are used in the construction of the all new L405 aluminum range, however, repair of these materials is not covered as they fall outside the scope of this manual.

Steel, (including Bake Hardened (BH) and High Strength Low Alloy (HSLA): Used in seat belt anchorages, hinge reinforcements and various small brackets and mountings.

Magnesium Die Cast Alloy (AM60B): Used in the hood latch panel.

Plastics: Used in the front fender support bracket and for reinforcements in the B-pillar and rear side member.

The following illustrations identify the aluminum alloys and other materials used in body construction.

# Bodyshell



# GENERAL INFORMATION

#### CONTENTS

This document includes technical data and information for the all new Range Rover L405 aluminum range. The information contained within is valid at the time of production and incorporates:

- Panel replacement times
- Fixings
- Bonding
- Materials
- aluminum Welding
- Tolerances and gap specification
- Body alignment

All activities described within are based on the use of genuine Jaguar Land Rover Parts, tools and approved materials.

#### FIXINGS

There are three groups of fixings used on the all new L405 aluminum range, other than conventional nuts and bolts. It is important that the correct procedures are followed for the removal and replacement of these fixings and, where applicable, the correct tools are used.

- Self-Piercing Rivet (SPR)
- Breakstem Fastener
- Torx Screw and Rivnut

# △ NOTE:

Always refer to TOPIx when undertaking body repairs, to ensure the correct Jaguar Land Rover approved methods and fixings are used.

For additional information, refer to: Adhesives, Fixings and Consumables (501-25A Body Repairs - General Information, Description and Operation).

#### ALUMINUM WELDING

#### Health and Safety

Refer to Land Rover Global Tools and Equipment Standards and Equipment Manufactures Manual.

# Set Up/Equipment Check

Refer to equipment manufacturers operators' manual.

#### Weld Process

This section provides information on aftermarket aluminum welding for the all new L405 aluminum range. It covers the following areas:

- Equipment: Metal Inert Gas (MIG)
- Materials: Extruded and pressed aluminum sheet alloy.
- Weld Structure: Fusion welding process: Metal Inert Gas (MIG).
- Weld Procedures: Pre-weld, test weld, weld and post weld checks.
- Weld Variants: Lap weld, Butt weld, Plug weld.

# Equipment

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The Global Body Centre Standards have been published on the HUB, along with the personal protective equipment requirements, at the following locations:

#### https://jaguarlandroverhub.jlrext.com

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.

The accuracy of the approved equipment enables the delivery of one droplet of wire per pulse. This enables welding of incredibly thin parent material, i.e. 0.6mm sheet can be welded using a 1.2mm filler wire.

The approved MIG welder uses Direct Current, (DC) and does not produce High Frequency, (HF), at start up, (initial arc).

#### Welder Set Up



The user should always refer to the operators' manual for detailed instructions.

The following provides an overview of the set-up procedure:

- Health and Safety read operators' manual
- Check correct power supply
- Check gas supply
- Check all equipment parts safety check
- Attach power cables, connect to supply
- Purge gas bottle, attach
- Attach clamp

Approved equipment obtained from the Jaguar Land Rover Equipment Program :

- Speedglas with Adflo face shield/weld mask
- Approved fume extractor
- Stainless Steel Brush
- Personal Protection Equipment (PPE)

#### **Materials**

Prior to any welding activity, it is necessary to identify the type of material to be welded. The all new L405 aluminum range is constructed from a number of aluminum alloys, each has different attributes that should be considered prior to the weld process.

#### **Body Materials**

The repair methods shown focus on the replacement of:

- Pressed aluminum Alloy sheet 6xxx series Used in skin-panels
- Extruded aluminum Alloy 5754 Used in structural panels

#### Weld Wire

The approved weld wires for these alloys are:

- 6xxx series 4043 or 4047 filler wire
- 5754 5554 filler wire

#### Weld Structure

The approved aftermarkets weld process is based on Fusion Welding:

Metal Inert Gas (MIG) Welding

The approved MIG welder uses direct current (DC). The Electrode, (filler wire), is Positive Pole and the work piece is Negative Pole. The arc burns between a melting electrode, (which also acts as the filler wire) and the work piece. The shielding gas is Argon, Helium or a mixture of these, (MIG).

Successful aluminum welding is partly dependent on the removal of surface Oxidization. Oxide MUST be removed prior to welding. The oxide melts at a different temperature:

- aluminum melting temperature approximately 660°C
- aluminum Oxide melting temperature approximately 2040°C

#### WELD PROCEDURES

#### **Pre-Weld**

Prior to starting any weld procedure, the following safety precautions should always be implemented:

- Disconnect the vehicle battery
- Disconnect the generator electrical connectors
- Remove any engine control module (ECM)'s within 500mm of the weld area
- Remove the battery before carrying out welding work in its vicinity
- Utmost care must be taken when welding near the fuel tank or other components that contain fuel. If the tank filler neck or a fuel line must be detached to allow access for welding work, then the fuel tank must be drained and removed
- 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:

- Jaguar Land Rover approved product: DuPont 3608S
- Alternatively, an Isopropyl based product

# 2. Remove Oxide

This can be achieved through a number of processes:

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

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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

The following identifies the three types of weld variants used in Structural panel replacement. It is not a guide to welding, as all Structural repair facilities 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 5mm
- Minimum overall length of 20mm
- Must use Start/Finish weld tabs

# Butt Weld



Key points:

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

Plug Weld



Key Points:

- Hole size 10mm
- Position of MIG nozzle vertical

#### **Backing Plates**

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Within certain repair procedures there is a requirement to carry out seam welding without the installation of welding backing plates. This is due to insufficient clearance between the two components. Please note that run on/run off tabs must still be used.

Backing plates are required for all butt-weld joints. Backing plate fabrication is made from waste material and have a width of 50mm. 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; (3mm work piece will require a 3mm 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 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 5mm 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 carried out 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	Not permitted

DEFECT /IMPERFECTION TYPE	DETAILS	LIMITS
	weld seam	
Fused weld spatter		Limited acceptance. Not permitted on visible surfaces or in areas where functional performance of the part is affected, e.g. 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.
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 Authorised Structural Bodyshop facility 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. Suspect areas should then be examined under natural or electric light for signs of flaws and/or cracks. Cracks will show up as lines whilst porosity will appear as pin holes.

#### **Destructive Testing**

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

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