

Accessories and Body, Cab

Body Collision Repair

01 - BODY COLLISION REPAIR - GENERAL INFORMATION

SAFETY INSTRUCTIONS

--> **Removing Components**

--> **Battery, Welding Procedures**

--> **Electronic Control Modules**

--> **Paint, Glass, Upholstery, Trim**

--> **Fuel Tank or Fuel Lines**

--> **Air Conditioning**

--> **Airbag System**

--> **Seat Belts, Inspecting**

--> **Working on Vehicles with Belt Tensioners**

--> **Separating Work, Straightening Work and/or Dent Removal on Vehicles with Airbags**

--> **Seats with Side Airbags, Removing**

Removing Components

The vehicle must be secured on the hoist before its center of gravity changes due to disassembly.

Battery, Welding Procedures

NOTE:

- **Before disconnecting battery ensure that radio code is available. Ensure radio is in an operational condition by inputting radio code before releasing vehicle to customer.**

Before welding, you must disconnect both battery terminals and cover both battery poles.

You must remove the vehicle battery before performing work near the battery that could produce sparks.

CAUTION: Switch off ignition before connecting battery! --> 27 - STARTER, GENERATOR, CRUISE CONTROL

On vehicles with electronic ignition lock, ignition must be switched off before removal

There should not be any people inside the vehicle when connecting the battery!

Electronic Control Modules

Connect the ground (GND) connection of the electric welding appliance directly to the part to be welded. When doing this, make sure that no electrically insulated parts are between the ground (GND) connection and the welding point..

Do not allow the ground (GND) connection or the welding electrode to touch the electronic control units and electrical wiring.

Procedure for Electronic Control Modules after accident repairs

It is only necessary to install new electronic control units after an accident where at least one of the following conditions is present:

- The function check results in the message "Control module faulty".

If electronic components, e.g. ABS control modules, were removed for servicing and then reused, these are to be checked for function according to the available documentation after installing. To do this, check all DTC memories with a tester and correct any possible malfunctions present.

Paint, Glass, Upholstery, Trim

No other vehicles may be parked unprotected in areas used for body repairs. (Fire hazard due to flying sparks, battery, damage to paintwork and glass).

Fuel Tank or Fuel Lines

Use extreme care when performing sanding and welding work near the tank or other components carrying fuel. Where there are doubts regarding safety, these parts must be removed.

Air Conditioning

No parts of the charged air conditioner system may be welded, brazed or soldered. This also applies to any part of the vehicle if there is a risk that the parts of the air conditioner system could heat up. After paint repairs, the vehicle must not be heated up to more than 176 F (80 C) in the drying booth or preliminary heating zone, because heat causes a pressure increase which can burst the system..

NOTE:

- **The system must be evacuated when it is necessary to weld electrically near the refrigerant hoses. During the electrical welding process invisible ultraviolet rays are given off which penetrate the refrigerant hoses and**

decompose the refrigerant.

Solution

Evacuate air conditioning system: --> **87 - AIR CONDITIONING** Only extract system if it is required by the safety precautions.

If it is necessary to evacuate the refrigerant when carrying out repairs to a vehicle, avoid all contact with liquid refrigerant or refrigerant vapor!

Wear rubber gloves to protect the hands and goggles to protect the eyes! If the refrigerant comes into contact with unprotected parts of the body it will cause frostbite..

CAUTION: It is advisable to have a rinsing bottle for the eyes handy at all times. If liquid refrigerant gets into the eyes, they should be rinsed thoroughly with water for about 15 minutes.

Then use eye drops and obtain medical attention immediately even if no pain is felt in the eyes. The doctor should be informed that the cause of the frostbite was R12 or R134a refrigerant.

If the refrigerant comes into contact with other parts of the body despite compliance with safety measures, the part of the body concerned must be rinsed immediately with cold water for at least 15 minutes. --> 87 - AIR CONDITIONING

Although refrigerant does not present a fire hazard, smoking is not permitted in rooms containing refrigerant vapors. The high temperature of a burning cigarette causes a chemical breakdown of the refrigerant vapor. The products of this breakdown are poisonous and cause violent coughing and sickness when inhaled.

Airbag System

Repair notes --> **69 - PASSENGER PROTECTION - AIRBAGS, SEAT BELTS**

The battery Ground (GND) strap must be disconnected when working on the airbag system or when performing straightening work when repairing the body.

CAUTION: Switch off ignition before connecting battery! --> 27 - STARTER, GENERATOR, CRUISE CONTROL

On vehicles with electronic ignition lock, ignition must be switched off before removal

There should not be any people inside the vehicle when connecting the battery!

Airbag components must not even briefly be subjected to temperatures above 100C (212F).

Additional notes --> **69 - PASSENGER PROTECTION - AIRBAGS, SEAT BELTS**

Airbag components must not come into contact with grease, cleaning agent, oil or similar.

Mechanically damaged airbag components must be replaced --> **Airbag**

Wash hands after touching deployed airbag units.

Seat Belts, Inspecting

CAUTION: After every accident, seat belt system must be checked systematically. If damage is determined when checking the test points, customer must be informed regarding necessity of changing belts..

Additional notes --> **69 - PASSENGER PROTECTION - AIRBAGS, SEAT BELTS**

Working on Vehicles with Belt Tensioners

CAUTION: Before beginning separation work, straightening work or dent removal, remove mechanically activating belt tensioners without load detection (release lock). With electrically activating belt tensioners, the battery Ground (GND) strap must be disconnected.

Additional notes --> **69 - PASSENGER PROTECTION - AIRBAGS, SEAT BELTS**

NOTE:

- If the belt webbing is completely unrolled, the load detection (release lock) hinders the release of the mechanically activated belt tensioner in an accident.

CAUTION: With belt tensioners with load detection, the belt webbing must not be pulled out when performing separation work, straightening work or dent removal. If strong shaking motions are generated by separating work, straightening work or dent removal, the belt tensioners with load detection must be removed.

Additional notes --> **69 - PASSENGER PROTECTION - AIRBAGS, SEAT BELTS**

The following vehicles with no load detection on belt tensioners:

- Audi 100 sedan From MY 1982

- Audi 200/V8 From MY 1983

Safety belts with belt tensioners, removing and installing --> **69 - PASSENGER PROTECTION - AIRBAGS, SEAT BELTS**

Separating Work, Straightening Work and/or Dent Removal on Vehicles with Airbags

The battery Ground (GND) strap must be disconnected when working on the airbag system or when performing straightening work when repairing the body.

CAUTION: Switch off ignition before connecting battery!

There should not be any people inside the vehicle when connecting the battery!

Repair notes --> **69 - PASSENGER PROTECTION - AIRBAGS, SEAT BELTS**

Seats with Side Airbags, Removing

CAUTION: You must always follow safety precautions when removing seats.

You can find the safety precautions in the repair information belonging to each vehicle model --> **69 - PASSENGER PROTECTION - AIRBAGS, SEAT BELTS** .

GENERAL INFORMATION

--> **Diagnosis of Accident Vehicles**

--> **General Information**

--> **Conditions in which Body and/or Parts are Passed for Painting**

--> **Straightening**

--> **Separating Cuts**

--> **Replacement Body Sub-Parts and Part Sections**

--> **Original Joint**

--> **Galvanized Body Parts**

--> **Removing Remaining Material**

--> **New Parts**

--> **Replacement Parts**

Diagnosis of Accident Vehicles

Damage to the running gear and assembly mountings, which could have very serious effects later on is sometimes not discovered when accident vehicles are being repaired. Where the accident damage indicates over-stressing of the vehicle, special attention must be paid to the following components, completely independent of the axle geometry check which must be done in all cases:

- Check steering and steering linkages using steering wheel angle for problem-free function, visual inspection for bends or cracks.
- Check suspension, all suspension parts such as links, struts, steering knuckle, stabilizer, subframe, axle body and their securing parts for bends or cracks.
- Check rims and tires for damage, true running and imbalance. Check tires for cuts in the profile and the sides, check tire pressure.
- Check mounts for engine, transmission, axles and exhaust system for damage.
- Finally, a proper road test after repairs ensures that the vehicle is safe to drive and can be handed over to the customer.

General Information

When repairing, the original connection should always be restored.

Standard repairs are described in the repair information. Further descriptions are not given because if there are more extensive repairs, the damaged area should be removed at the original connection. Where this is possible, the joining techniques can be implemented according to the preceding comparison.

All repairs with special separating cuts and joining techniques that do not correspond to the original connection (production status) checked and approved by the Technical Development by means of calculation, strength testing and crash.

Conditions in which Body and/or Parts are Passed for Painting

Before a repaired vehicle or part is handed over to the paint shop for painting, the repaired or beaten out, and where necessary, filled surfaces must be prepared for painting by rubbing-down with abrasive paper having a grade of P 80 - P 100.

This preparatory work is the job of the sheet metal worker and is included in the time allowed for the repair.

Straightening

Body and floor sections are produced mainly from cold formed deep drawn sheet metal. For this reason the reshaping of accident damaged areas should be carried out in the same manner.

If the size of the damage does not allow it to be reshaped against the direction of damage, the damaged part must be removed after straightening the connecting surfaces.

Separating Cuts

In areas where cutting and the subsequent joining affect the rigidity of the body and also the operational safety and serviceability of the vehicle, the parting cuts must be made in accordance with the Repair Information instructions.

Replacement Body Sub-Parts and Part Sections

"Sub-parts" include sections of individual parts (e.g. front and rear end points) that are delivered pre-cut from the parts depot.

- o In contrast to this, "partial sections" are to be cut out from replacement parts. In individual cases, work is to be performed exactly according to the methods described and represented in the body repair information.
- o Because the use of "sub-parts" or "partial sections" as well as special resources influence repair times, the special resources are included separately in the repair description.

Original Joint

"Original joint" refers to welding that is used by the vehicle manufacturer.

These welds should be reconstructed when performing body repairs.

When doing so, ensure that the production number of weld points is not exceeded when making repairs.

Methods and procedures differing from the original connection are described in the applicable body repair information.

Galvanized Body Parts

Fully galvanized panels provide a high level of bodywork anti-corrosion protection during manufacture. To be able to maintain the warranty guarantee against perforation rusting when carrying out repairs, the repair information from --> **Galvanized Body Parts**

CAUTION: Because toxic galvanized oxide develops in welding emissions when welding galvanized sheet steel panels, there must be good workplace ventilation and flue-gas removal through appropriate means, e.g. welding emission exhaust system V.A.G 1586 A.

Removing Remaining Material

If the damaged body piece is removed roughly according to the separating cuts in the applicable repair information, e.g. with pressure hammer V.A.G 1577 or body repair saw V.A.G 1523 A , drill out most spot weld connections with spot weld remover V.A.G 1731.

In addition, we recommend the degree sander V.A.G 1529 as well as an angle sander to remove the weld connections that cannot be removed with the spot weld remover.

New Parts

New parts which are not accessible from the inside after a repair, e.g. side members, should, to prevent corrosion, be pre-painted in the color of the vehicle before being welded in. Here it is recommended to mask the welding flanges.

Replacement Parts

In many cases, replacement parts are delivered only in the "basic version" for parts reduction.

Examples:

- Audi 100 from MY 1991 roof without roof rail holes.

In these cases, we recommend that the workshop creates "patterns" from damaged parts.

Example: from MY Audi 100 1991 roof rail holes:

- Cut out side part from roof with the body repair saw V.A.G 1523 A , observing prominent contours, e.g. a part of the depression (rain gutter), when doing so. Deburr cut edges and protect with fabric-reinforced adhesive tape.

Apply patterns before painting and allow for the material strength of the pattern when marking the bore holes.

Check new replacement parts, such as doors, panels or fenders for transport damage before sending to paint shop. This prevents double painting, if transport or accident damage to the vehicle is noticed during assembly.

EXPANDED FOAM INSERTS

CAUTION: Expanded foam inserts expand only after reaching 180 C. Because of this, filler foam is used for repairs

Filler foam D 506 000 A2 is required for repairs.

Insert replacement expanded foam inserts.

Foam D 506 000 A2 must be applied before fitting replacement part.

The foam hardens within 25 minutes

Do not do perform welding within 15 mm on either side of molded foam element.

After painting vehicle, preserve cavities in repair area.

SYMBOLS

Welding Legend

Straight-line spot weld seam (single row) RP = Spot weld

Straight-line spot weld seam (double row)

Straight-line spot weld seam (double row, staggered)

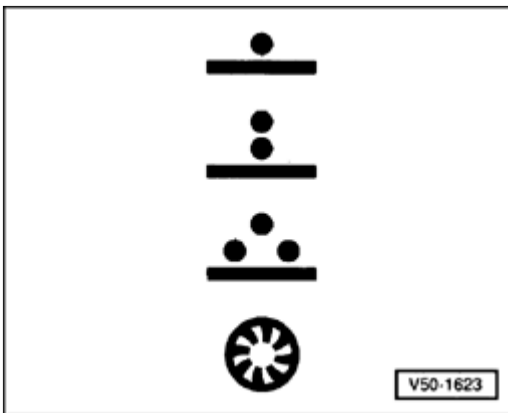


Fig. 1: Spot Weld Symbols

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Gas-shielded arc plug weld seam SG = gas-shielded welding

Gas-shielded arc stitch weld seam

Gas-shielded arc continuous weld seam

Gas-shielded arc continuous weld seam (intermittent)

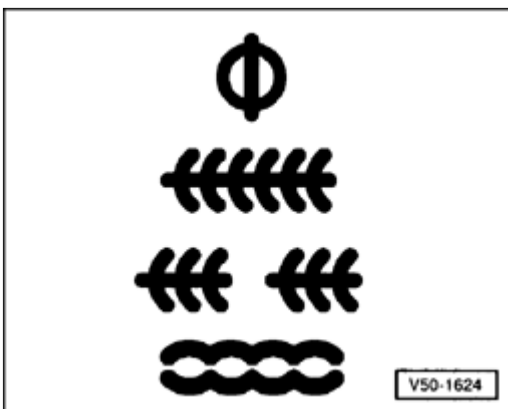


Fig. 2: Seam Weld Symbols

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Hard soldering

--> **Work Procedures Legend**

Work Procedures Legend

Sanding

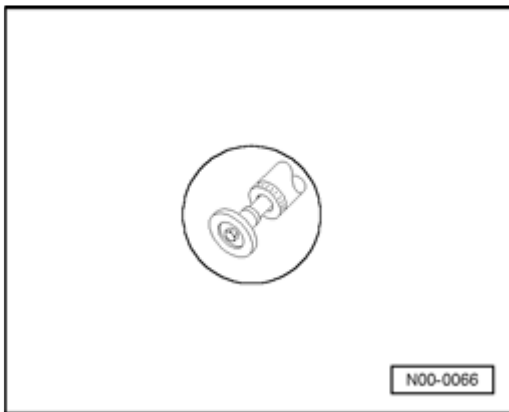


Fig. 3: Grind Symbol

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Wear away weld seam with a grinder around material application.

NOTE:

- **The weld seams must be sanded so that the panel strength of the exterior panels is not or only slightly weakened.**

Set an Edge

- To perform an overlapping weld.

Perforate

- To perform a gas-shielded arc plug weld later.

Drill

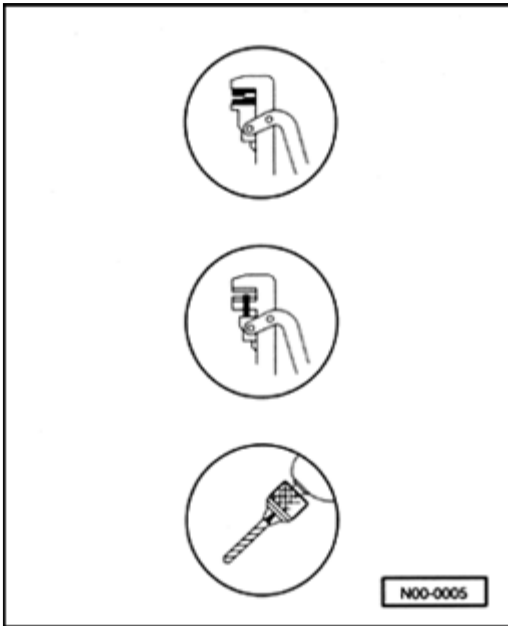


Fig. 4: Offset, Punch And Drill Symbols

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To perform a gas-shielded arc plug weld later or drill out spot welds (original connection).

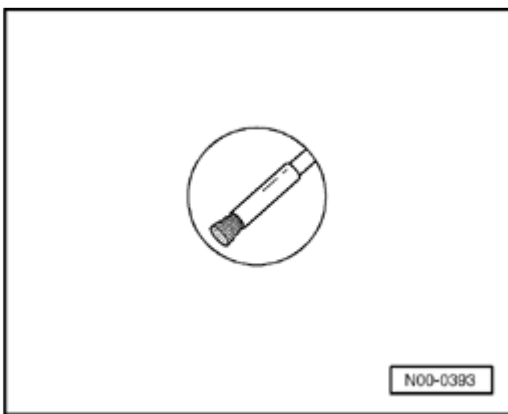


Fig. 5: Removing Paint On Hard-To-Reach Areas With Brush VAS 5182

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Sanding

- Removing paint on hard-to-reach areas (e.g. interior roof frame) with brush VAS 5182.

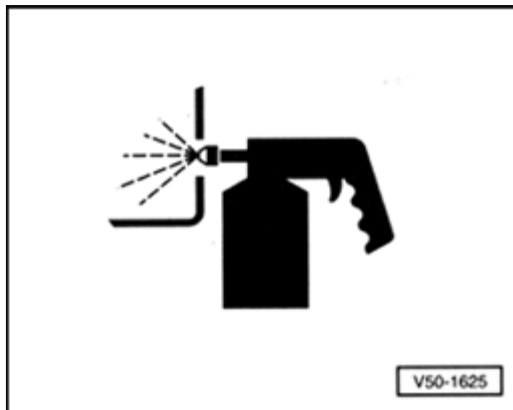


Fig. 6: Cavity Conservation Symbol

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Cavity Sealant

Adhesives

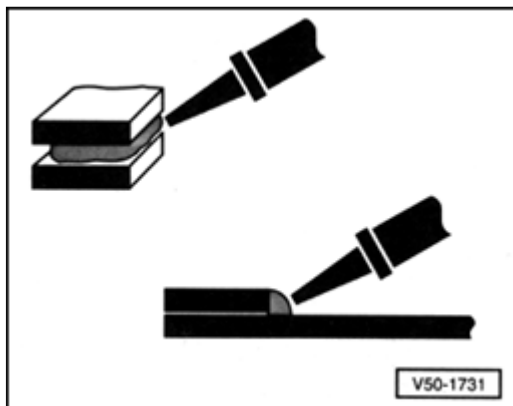


Fig. 7: Bond & Seal Symbols

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Fine Seal

BODY REPAIR TOOLS

NOTE:

- The following tools are organized according to V.A.G / VAS numbers.

Special tools, testers and auxiliary items required

- Hole pliers V.A.G 1329

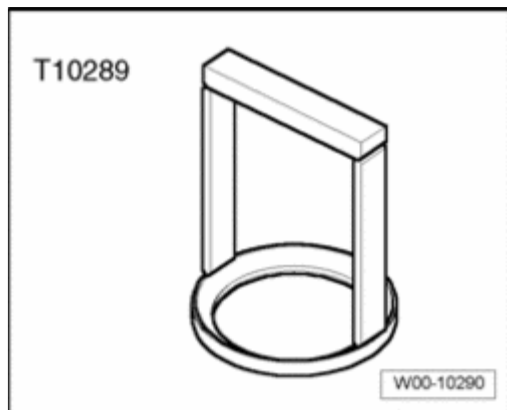


Fig. 8: Basic Equipment V.A.G 1366/3
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Basic equipment V.A.G 1366/3

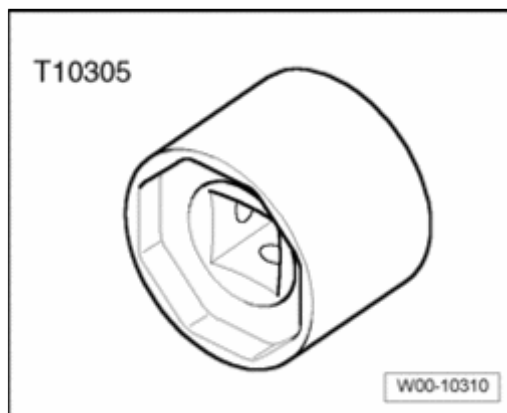


Fig. 9: Undersealant Spray Gun V.A.G 1379
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Undersealant spray gun V.A.G 1379



Fig. 10: Identifying Heat Gun V.A.G 1416
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Heat gun V.A.G 1416

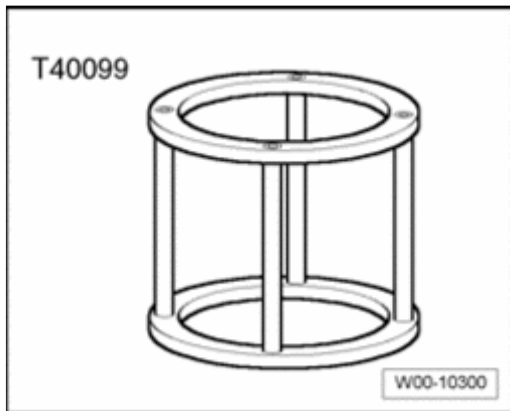


Fig. 11: Door Tensioner V.A.G 1438
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Door tensioner V.A.G 1438

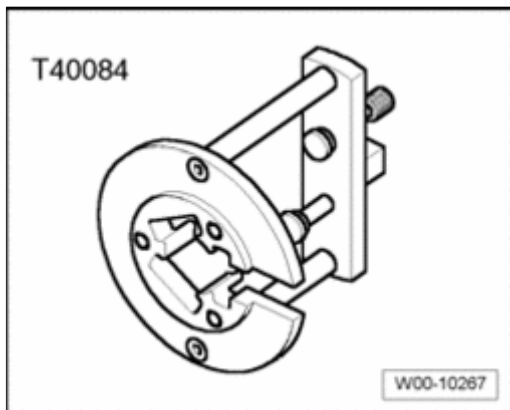


Fig. 12: Body Tool Trolley V.A.G 1439
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Body tool trolley V.A.G 1439

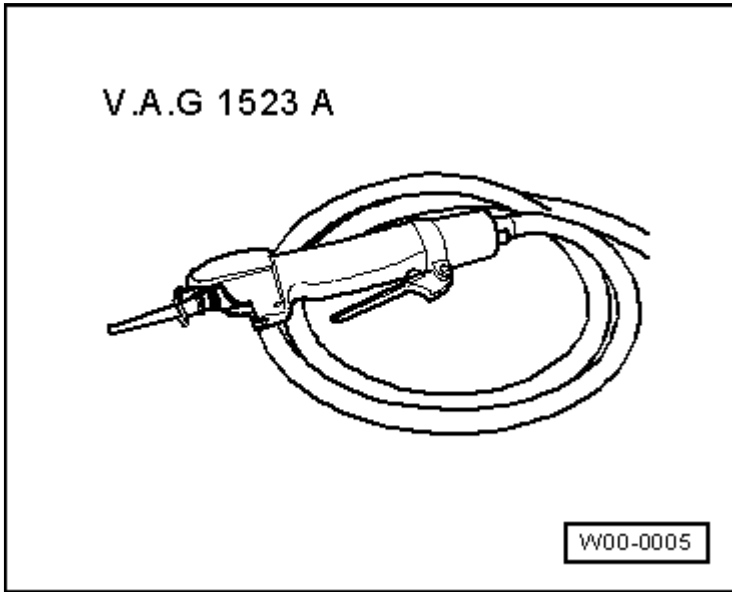


Fig. 13: Identifying Body Repair Saw V.A.G 1523 A
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Body repair saw V.A.G 1523 A

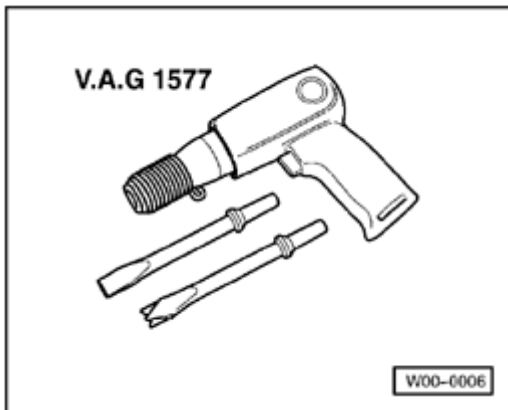


Fig. 14: Pneumatic Hammer (V.A.G 1577)
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Compressed-air chisel V.A.G 1577

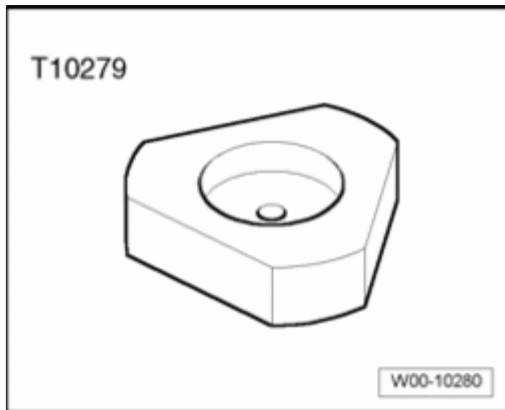


Fig. 15: Flange Finishing Iron V.A.G 1585
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Flange finishing iron V.A.G 1585

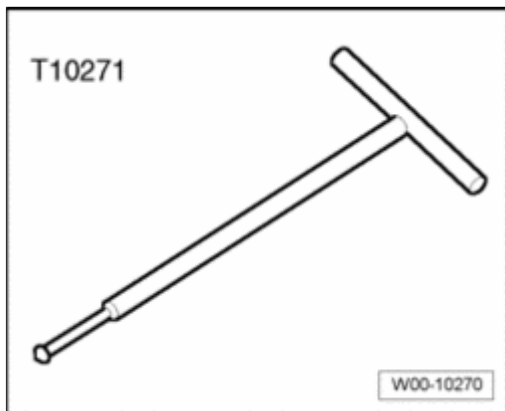


Fig. 16: Welding Emission Exhaust System V.A.G 1586
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Welding emission exhaust system V.A.G 1586

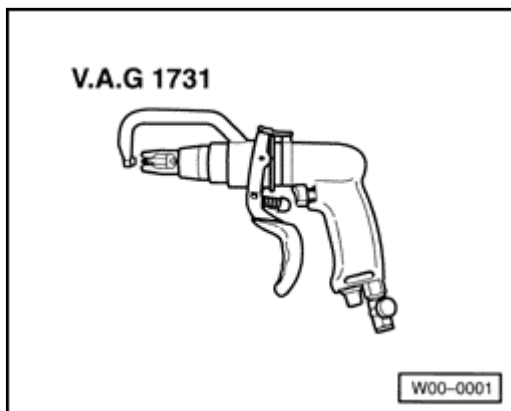


Fig. 17: Spot Weld Remover V.A.G 1731
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Spot weld remover V.A.G 1731

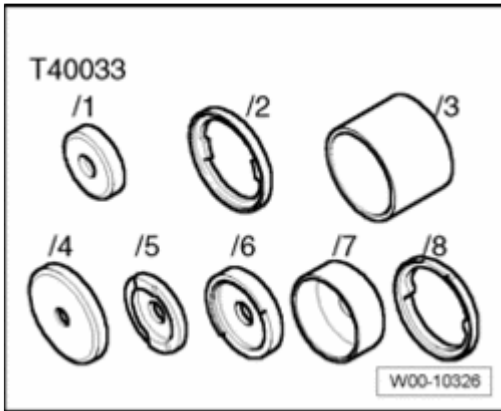


Fig. 18: Compressed Air Gun V.A.G 1761/1
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Compressed air gun V.A.G 1761/1
- Compressed air gun for producing seals and undercoating with factory-original optical characteristics.
- Also, all 310 ml cartridges can be used with this gun.

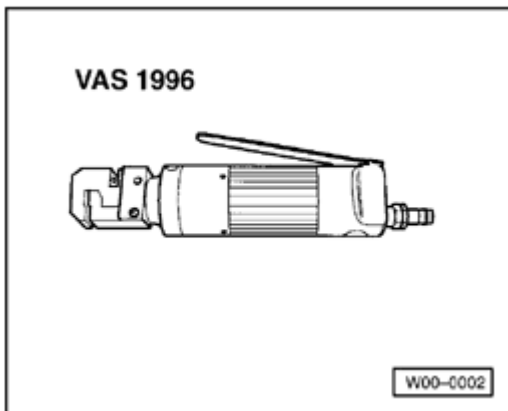


Fig. 19: Compressed Air Punch Pliers And Edge Setter VAS 1996
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Compressed air punch pliers and edge setter VAS 1996

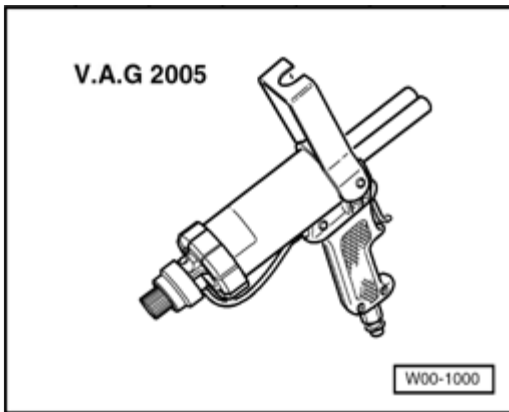


Fig. 20: Compressed-Air Adhesive Gun V.A.G 2005
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Compressed-air adhesive gun V.A.G 2005
- For body adhesive

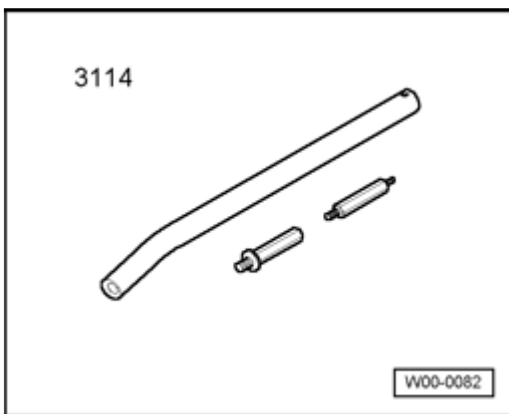


Fig. 21: Door Hinge Replacement Stud 3114
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Door hinge replacement stud 3114

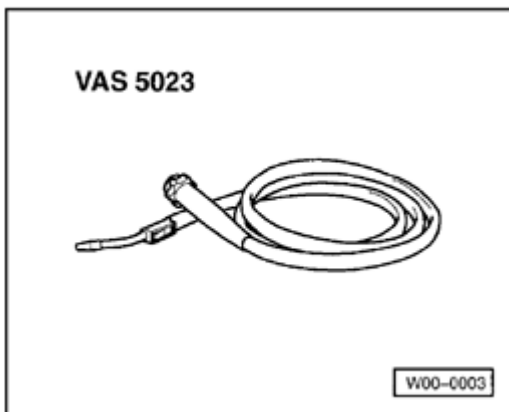


Fig. 22: Hose Packet (VAS 5023)

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Hose package VAS 5023
- Nozzle set 5023/1

- Angle sander VAS 5174
- 710 Watt; 115 mm
- Angle sander VAS 5175
- 1500 Watt; 180 mm



Fig. 23: Wire Brush VAS 5182

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Brush VAS 5182
- For removing paint in hard-to-reach places (e.g. interior roof frame)

BONDED BODY JOINTS

--> **Supporting Bonds**

--> **Types of Bonding**

--> **Repair Methods for Replacing Parts**

Supporting Bonds

The following procedure is used when repairing bonded points:

Separating procedure:

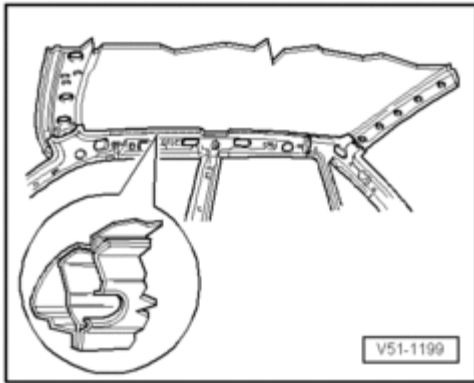


Fig. 24: Roughly Cutting Out Roof To Gain Access To Bonded Point
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Roughly cut out roof to gain access to the bonded point.
- Cut through bonded point with oscillating knife.

Types of Bonding

To increase body rigidity and strength, adhesive and spot-weld bonded joints are being increasingly used in production. They are differentiated as follows:

High-Strength bonded joints

In bonded joints, the sheet metal parts are only bonded by adhesive.

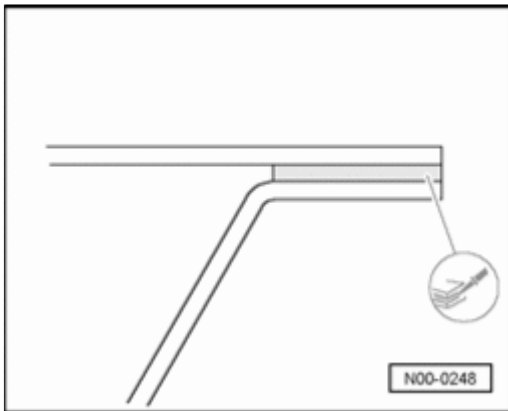


Fig. 25: Strength Bonded Joints (Adhesive Only)
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

The distance of the high-strength adhesive surfaces to each should not be less than 2 mm or greater than 4 mm. If necessary, the adhesive surfaces must be prepared.

Repair measures

- The bonded joints are restored with the materials specified in the repair information or replacement parts program.

Spot-weld bonded joints

In spot-welded bonded joints, an electrically conductive adhesive is used between the panels, allowing good root penetration for spot welding.

The distance of the spot-weld surfaces to each other should not be greater than 1 mm. If necessary, the adhesive surfaces must be prepared.

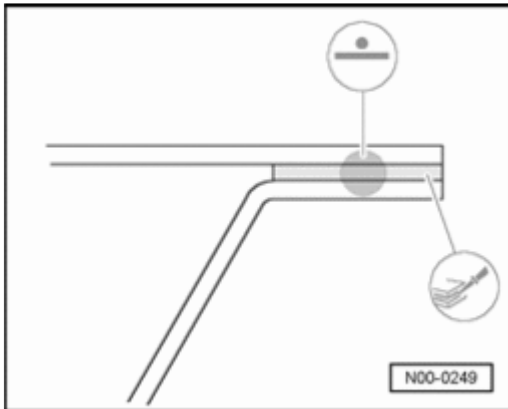


Fig. 26: Spot Welded Bonded Joints

Courtesy of VOLKSWAGEN UNITED STATES, INC.

The welding current must not be increased for spot-weld bonding operations. The pre-press period must be extended to approx. 30 - 50 cycles because of the displacement of the adhesive. The fumes produced must be exhausted.

Repair Methods for Replacing Parts

Adhesive DA 001 730 A should be used in connection with compressed-air adhesive gun V.A.G 2005 as replacement for spot-weld adhesive.

For simultaneous bonding and welding, the procedures are differentiated according to the type of weld (spot weld, gas-shielded weld) as follows:

Straight-line spot weld and bonding

With spot welding and bonding, the entire area of spot welds and bonding is replaced when making repairs, as in production.

With welding problems, e.g. there is a 3-layer panel connection and only the outer panel is replaced, the repair spot weld should be placed on the "old" spot weld.

Gas-shielded welding and bonding (if spot welding is not possible)

If an adhesion area is not accessible with a straight-line spot welding device, the area is welded with a gas-shielded arc plug weld seam.

In this case, adhesive is done without in order to maintain the welding bead. The gas-shielded arc plug weld distance is 15 mm.

Gas-shielded welding

SG 2 welding wire is suitable all steel types.

For variations, see **00 - TECHNICAL DATA** .

On vehicles with highest strength steel, spot welding devices with inverter technology (see workshop equipment and special tools catalog) are to be used.

Welding emission exhaust system

For spot welding in conjunction with spot weld adhesive, the same standard exhaust system is used as with welding galvanized panels.

Preparation

The panels to be welded must be fitted before applying adhesive.

Due to adhesive displacement when spot welding, the bare spot weld flange is coated with adhesive and thus protected from corrosion.

The adhesive surfaces in the welding area must be free of primer and adhesive residue and well as dust and grease.

Our vacuum device VAS 6216 is recommended for this.

Reconditioning

- Wipe escaping adhesive.
- Corrosion protection measure Surface technology / chemical materials binder
- Paint structure Surface technology / chemical materials binder

DA 001 730 A1 instructions for use

- If the adhesive escapes on both sides along the entire length, too much was applied.
- On large parts, such as the roof, it is necessary to perform the work with a helper. Otherwise the adhesive will dry before work is complete.
- Before inserting mixing nozzle, ensure double cartridge openings are clean. Secure mixing nozzle and press out a bead about 5 cm. long. Then apply adhesive to adhesive surface.

- After long breaks up to 30 minutes, press out a bead about 10 cm long so that new material is mixed. After breaks more than 30 min., replace mixing nozzle.
- 1 cartridge with 37 ml is enough for approx. 4 m of flange.
- The adhesive must cure before further surface work. Curing time: 68 F (20 C 8 h 176 F (80 C) 20 min.

CORROSION PROTECTION MEASURES**--> Corrosion Protection****--> Long-Term Body Protection****--> Warranty Notes****--> Electro galvanization****--> Hot Galvanized Coating****Corrosion Protection**

The production standard corrosion protection should be renewed after servicing with the materials specified by the manufacturer.

Long-Term Body Protection

- Paint inside of new parts with finishing paint before welding.
- Prime bare panel surfaces immediately after repair (corrosion protection primer ALN 002 003 10 or ALK 007 003 10).
- Holes must be deburred.
- Apply welding primer to both sides of welding flange (D 007 500 04).
- Primer weld area on inside and outside before sealing.
- Apply sealant only to primed panels.
- Completely seal panel overlap, panel edges, butt joints, weld seams, etc. with sealant.
- Restore paint structure.
- Restoring undercoating with long-term underbody protective material.
- Preserve cavities in repair area after finish painting.
- Separation cuts (e.g. in side panel) must be completely preserved.
- Open water drains after cavity sealant material dries.

Warranty Notes

- 3 years - paint defects, since 03/25/83 for Audi passenger car chassis

- 6 years - corrosion perforation, since 07.03.79 for Audi passenger car chassis.
- 12 years - corrosion perforation on all Audi vehicles starting at model year 1998

Electrogalvanization

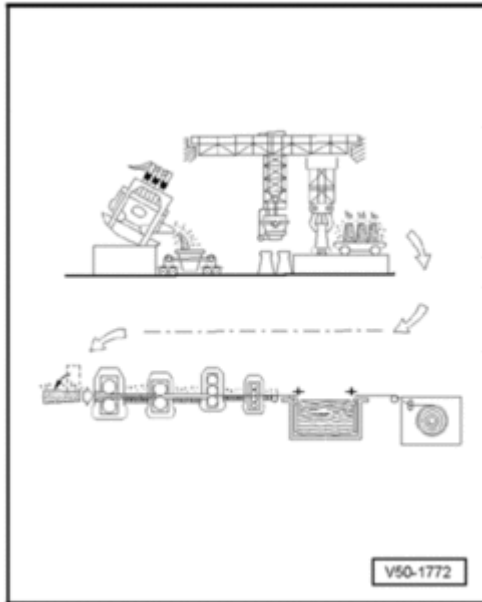


Fig. 27: Electrolytic Galvanizing Process
Courtesy of VOLKSWAGEN UNITED STATES, INC.

With electrogalvanization, the sheet steel band functions as a cathode to zinc anode plates (positive electrodes).

The gap to the sheet steel is filled with electrolyte, an acidic, electroconductive liquid that contains zinc ions.

It is an electrochemical process by which zinc is dissolved with the help of electric current and transferred to the sheet steel.

An even, fine, unstructured layer of zinc forms which can easily be manipulated further, such as with cutting, pressing, welding, priming and painting.

Hot Galvanized Coating

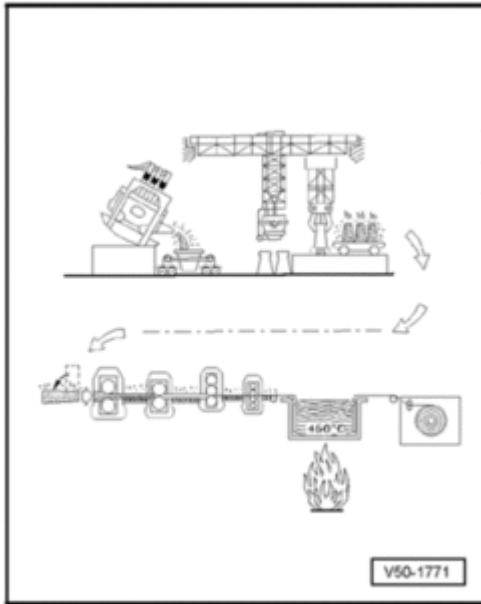


Fig. 28: Hot Galvanizing Process

Courtesy of VOLKSWAGEN UNITED STATES, INC.

With hot-dip galvanized coating, the sheet steel panel runs through an approx 842 F (450 C) liquid zinc bath. An extremely thin layer of zinc-iron alloy forms directly on the panel surface as an "adhesive material" for a layer of pure zinc which eventually reaches a thickness of about 10 mm per side.

The galvanized blooms characteristic of hot-dip galvanized coating are undesirable for body pieces and are therefore largely prevented with various techniques, such as rerolling.

The body pieces of the floor assemblies, door pillars and wheel housings that are not visible are hot-dip galvanized on both sides.

DISPOSAL INFORMATION

--> **Environment Protection Practiced During Production**

--> **Recycling**

--> **Plastics**

--> **Disposal**

--> **Airbag**

Environment Protection Practiced During Production

The following are disposal requirements that apply to production in Audi facilities:

- Omission or reduction of fluorohydrocarbons -HFCs- in soft foam propellants (e.g. for seat upholstery), in release agents in plastic finishing and cleaning solutions in production facilities.
- Use of solvent-free adhesive and production aids, thereby considerably reducing emissions (pollution), disturbing odors and fogging on glass surfaces.
- The use of recyclable materials for plastic parts such as:
 - Bumper covers
 - Instrument panel
 - Engine encapsulation and the like
 - Plastics made from recycled materials are being produced at this time:
 - Wheel housing liners
 - Luggage compartment floor coverings
 - Insulation mats and more
 - The use of recycling-friendly materials as well as the reduction of the number of types.
 - Recycling-friendly designs lower-cost removal.

Recycling means:

- Avoiding contamination
- Protection of landfill space
- Economical use of raw materials

Basic environmental principles

- Prevention before reduction
- Prevention before reuse
- Reuse before disposal

Recycling

As an important contribution to preserving the environment, plastic parts are produced partly from reusable "recyclable" or already "recycled" raw materials.

Recycling concepts used must be as logistically simple as possible for the service organization and the recycling company.

Self-imposed requirements: for basic recycling

- The removability of the parts was already simplified constructively.
- The variety of plastic part types was reduced.
- The plastic parts were already marked by the manufacturer according to VDA-260.

With the help of this material identification "standardized coding" , parts can be separated and collected according to type and targeted for recycling by the manufacturer or a recycling company.



Fig. 29: Recycling Identification Tag
Courtesy of VOLKSWAGEN UNITED STATES, INC.

The identification field contains:

- Manufacturers identification
- Part number
- Production date and time
- Material code

For example, PP+ EPDM T20 means:

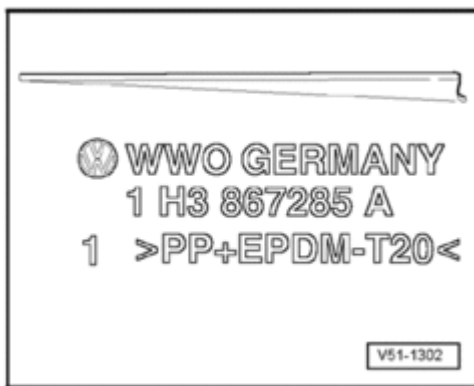


Fig. 30: Recycling Identification Tag
Courtesy of VOLKSWAGEN UNITED STATES, INC.

it can be recycled

- Polypropylene -PP
- Elastomer-modified ethylene-propylene diene monomer

- Talcum reinforced - T20

Plastics

Table 1

Examples of basic polymers often used in the automotive industry (thermoplastics and duroplastics), abbreviation according to DIN 7728 or ISO 1043:

Abbreviation	Description
ABS	Acrylonitrile-butadiene-styrene-copolymer
EP	Epoxy resin
PA 6	Polyamide with 6 c-atoms in monomer building block
PA 11	Polyamide with 11 c-atoms in monomer building block
PA 12	Polyamide with 12 c-atoms in monomer building block
PA 66	Polyamide of 2 monomer building blocks with 6 c-atoms each
PBT	Polybutylene-terephthalate (linear polyester)
PES	Polyether sulfide
PET	Polyethylene-terephthalate
PC	Polycarbonate
PE	Polyethylene
PF	Phenolic formaldehyde resin
PMMA	Polymethylmetacrylate
POM	Polyoxymethylene, Polyacetylene

Abbreviation	Description
PP	Polypropylene
PPE	Polyphenylene ether
PPS	Polyphenylene sulfide
PTFE	Polytetrafluoroethylene
PUR	Polyurethane
PVC	Poly vinyl chloride
SAN	Styrene acrylonitrile copolymer

Table 2

Examples of abbreviations according to DIN 7728 or ISO 1043 for filler and strengthening materials frequently used in the automotive industry:

Abbreviation	Description
GF	Glass fiber
GM	Glass mats

GB	Glass beads
T	Talcum
M	Mineral reinforcement
WD	Sawdust

Table 3

- Examples of elastomer base polymers frequently used in the automotive industry, abbreviations according to DIN-ISO 1629:

Abbreviation	Description
ACM	Copolymers of ethyl acrylate or other acrylates with a small amount of a monomer which facilitates vulcanization
AU	Polyester urethane rubber
BR	Butadiene rubber
CSM	Chlorosulfonated polyethylene
CR	Chloroprene rubber
EPDM	Terpolymers composed of ethylene, propylene and a diene with an unsaturated part of the diene in the side chain
ECO	Copolymers composed of ethylene oxide (oxirane) and chloromethyloxirane (epichlorohydrin)
FPM	Fluorine rubber, fluoro-oxy groups on polymer chain
MVQ	Silicone rubber with methyl and vinyl groups on polymer chain
NBR	Acrylonitrile-butadiene rubber
NR	Isoprene rubber (natural rubber)
SBR	Styrene-butadiene rubber

Disposal

In order to be able to recycle vehicle parts after repair or servicing, you must first collect all accumulated Audi recycling materials according to type.

This pre-sorting should be done according to the following material groups:

- Sheet metal or iron materials ("scrap steel") scrap dealer and shredder operator
- Aluminum engine reconditioning company; scrap dealer or special engine scrap dealer
- Tires scrap dealer
- Plastics Polypropylene bumpers using Audi collecting logistics at the present time, further plastic recycling projected
- Batteries existing recycling cycle using regional disposers
- Used oil existing disposal method
- Brake fluid Material cycle being prepared

- Coolant Material cycle being prepared
- Refrigerant existing disposal method
- Refrigerant oil for R12 such as engine oil refrigerant oil for R134a Material cycle being prepared
- Oil-filled damping equipment, e.g. bumper dampers remove oil and use existing disposal method
- Gas-filled damping equipment, e.g. gas-filled struts remove gas, absorb escaping oil and use existing disposal method
- Separate recycling materials from foreign materials to make segregated recycling possible. For example, remove tires from rims and use both separate disposal methods.

Airbag

CAUTION: Undeployed airbag units present a danger during disposal.

Disposal of pyrotechnic components

(e.g. airbags, safety belts, pyrotechnic battery elements) are to be disposed of properly in their original packaging, in accordance with national legislation.

Refer to: --> **69 - PASSENGER PROTECTION - AIRBAGS, SEAT BELTS**

Undeployed pyrotechnic components

(e.g. airbags, safety belts, pyrotechnic battery elements) are to be disposed of properly in their original packaging, in accordance with national legislation.

Refer to: --> **69 - PASSENGER PROTECTION - AIRBAGS, SEAT BELTS**

If questions arise, contact Audi of America.

Pyrotechnic components

Pyrotechnic components deployed in an actual accident can be disposed of as industrial waste.

CAUTION: This does not apply to belt tensioners that function according to the Wankelstraffer principle. These are to be treated like undeployed pyrotechnic components (such as airbags, seat belts, pyrotechnic battery components). Reason: Workshop equipment cannot determine if Wankelstraffer belt tensioners have deployed all pyrotechnic materials.

CONTACT CORROSION PROTECTION

Connections between Aluminum/Magnesium and Steel

NOTE:

- With connections between aluminum or magnesium and steel, the corrosion protection measures described below must be observed. At attachment points between aluminum and steel or magnesium and steel:
- Fender
- Front hood
- Doors
- You must use protective foil on rear lid.
- When bolting aluminum or magnesium to steel, you may only use Dacromet-coated screws which may only be used one time. Dacromet is a green, chemical protective coating that prevents contact corrosion.
- Non-metallic fastening or sealing elements (door seals, rear lid seal) between two different metals should not be electrically conductive.
- You can find special notes about the procedure in the corresponding repair groups in the repair information.

SHEET STEEL REPAIRS

--> **Strengthened Steel Body Panels**

--> **Yield Points of Steel Panels Used**

--> **Galvanized Body Parts**

--> **Welding Work on Galvanized Body Panels**

Strengthened Steel Body Panels

Reinforced (high-strength) panels are being used increasingly in our vehicles. You can see the areas where these panels are used in a picture in the **00 - TECHNICAL DATA** High-Strength Hot-Formed Steel

What are high-strength panels?

Optically normal panels, but they possess a higher yield point than normal body panels because of various alloys. That is, with the same force applied to the panel, the dent in the high-strength panel is not as deep as that in a normal body panel.

What must be observed when removing dents?

Dents are removed with standard tools. Due to the higher dent resistance, there is greater rebound so that it may be necessary to expend more force. When buckled areas are reshaped, breaks in the material may occur.

What must be observed when straightening with a bench-type straightening system or hydraulic press?

Due to the greater rebound characteristics of high-strength panels, it must be stretched more than a normal panel

before it remains in the desired position. Due to the higher application of force, normal panels that are welded with high-strength panels are strained more. In order to prevent normal panels from yielding or tearing, an additional anchorage must be provided.

CAUTION:

- **If a high-strength panel is stretched too much, it suddenly springs back a lot unintentionally!**
- **For safety reasons, high-strength body panels must not be heated when reforming as with normal body panels!**
- **Welding high-strength steel is not allowed due to strength reasons.**

What must be observed when painting?

If high-strength panels are warmed too quickly by a dryer, they expand. If the panel is firmly secured by spot welds or bonding with reinforcements located behind, dents will appear in these places and remain visible after cooling off. For this reason, heaters should only be brought up to full capacity slowly. The drying can be done safely in a drying booth.

What are high-strength hot-formed steel panels?

They are steel panels that, as their name suggests, are formed in a warm condition at temperatures between 900 C and 950 C. The steel panels gain their high strength through a specific cooling process in the reshaping tool. they are form hardened.

The vehicle weight can be reduced without losing strength by using high-strength hot-formed steel panels.

Yield Points of Steel Panels Used

1 MPa = 1 Newton/mm²

- Steel panel up to 140 MPa
- High-strength steel panels from 180 to 240 MPa
- High-strength steel panels from 260 to 300 MPa
- High-strength steel panels from 3000 to 420 MPa

- High-strength steel panels from 180 to 240 MPa
- High-strength hot-formed steel panels over 1000 MPa

Galvanized Body Parts**Preparation**

- Warm undercoating/sealing materials only with hot air device (max. 420C) or remove with rotating wire brush.
- Remove paint and priming material with paint remover (LLE 812 000 A2) or rotating plastic brush.

Separating procedure

- Do not use thermodynamic separating procedures (cutting torch) if possible (only for rough cuts).
- In order to not cause any damage to the galvanized coating in the area of separation, mechanical separation procedures are preferred, e.g. spot weld drill, body repair saw.

Joining techniques

The resistance spot welding procedure only causes slight erosion in the galvanized layer in the area of the weld. The protective galvanized ring formed at the same time around the weld point protects against corrosion.

Always use resistance spot welding whenever possible.

When using resistance spot welding, always observe galvanized coatings of different thickness (perform a test weld).

Use gas-shielded welding as a substitute for resistance spot welding only if necessary.

Welding primer (galvanized spray D 007 500 04) must be applied between the fastening flanges.

Apply filler (ALN 787 200 10) to all connecting points.

Welding Work on Galvanized Body Panels

CAUTION: Because toxic galvanized oxide develops in welding emissions when welding galvanized sheet steel panels, there must be good workplace ventilation and exhaust gas removal through appropriate exhaust system, e.g. V.A.G 1586.

Gas-shielded welding on galvanized panels**NOTE:**

- The amperage at welding transformer must be increased.
- At the same time, the wire feed must be readjusted because increasing the voltage alone generates a large electric arc (lower fusion penetration, porous seam construction).
- Use cylindrical gas nozzles instead of conical (splashes on a gas nozzle that is too narrow causes formation of pores).
- Direct burner bout 12 cm over welding material in a neutral angle position up to 10.
- Use softest wire quality possible.
- CO₂ as well as mixed gasses can be used as inert gas.

Joining techniques used (On Audi steel bodies)

On Audi steel bodies

In production	In repair
Spot welds	Spot weld bonding / MAG plug welding / MAG welding
MAG welding	MAG welding
MIG soldering	MAG welding
Laser welds	MAG welding
Adhesives	Bonding / MAG welding
Spot weld bonding	Bonding with spot welding / additional spot welds / additional MAG welding
Pop rivets	Pop rivets Only use specified pop rivets according to repair information. Commercially-available pop rivets generally are not strong enough.
Punch rivet	Pop rivet N 909 236 01 4.8 mm clamp length 6 - 8.5 mm

Joining techniques used (On Audi aluminum bodies)

On Audi aluminum bodies

In production	In repair
MIG welding	MIG welding
Spot welds	not used
MIG soldering	not used
Laser welds	Bonding and riveting
Adhesives	Bonding and riveting
Punch rivets	Punch rivets with VAS 5279
Pop rivets	Pop rivets Only use specified pop rivets according to repair information. Commercially-available pop rivets generally are not strong enough.

Straight-line welding on galvanized panels

When performing resistance spot welding on galvanized panels, observe following points:

- The flanges to be spot welded must lie against each other. Clamp flanges with pliers, if necessary.
- This is especially important with high-strength panels because the electrode strength is not great enough.
- Do not weld directly by the clamping pliers with the welding tongs because a large amount of the welding current flows through here due to shunting.
- With small spot weld spacing, weld points in sequential order or weld every 3rd point to secure then finish welding. This minimizes the shunting influence.
- Observe users instructions and adjustment notes from manufacturer.

Unbuttoning test

For the necessary unbuttoning diameter, determine the panel pairing based on the manufacturers specifications and check with test panels.

Check all spot weld connections 100% with bit sample.

Qualitatively acceptable spot welds do not tear into the contact surface, but rather "unbutton".

Calculate unbuttoning diameter with the following formula and check on test panels before beginning repair.

- Square root $T1 \times 3.5 \times 1.15$

NOTE:

- **T1 is the thinnest panel in a panel pairing**

e.g. panel pairing 1.5 mm and 0.8 mm

- Example calculation: Root of $0.8 \times 3.5 \times 1.15 = 3.6$ mm unbuttoning diameter

With the test, the small welded test strip is rolled or pulled from the second test strip with force perpendicular to the panel surface.

If the pressure of the welding tongs is not great enough, clamp flanges with pliers as well to attain the proper force.

If the welding transformer amperage is not great enough for the panel pairing, perform a gas-shielded plug weld.

WINDSHIELD REPAIR

Aside from replacing windshields, under certain conditions there is the less expensive possibility of repairing a windshield that has been damaged by a stone.

Tinted windshields, windshields with colored liners or insulated glass (Audi A8, A6) can be repaired because the tint is created with colored intermediate foil.

Repairing the windshield is preferred to replacing it under the following conditions.

Special tools

Required special tools, workshop equipment, testing and measuring equipment, and aids

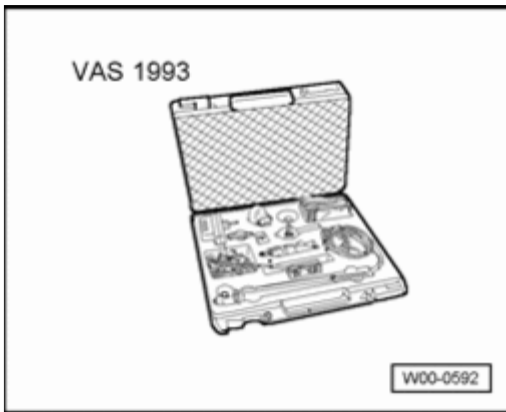


Fig. 31: Windshield Repair Set VAS 1993
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Window repair kit VAS 1993

Contains the following tools:

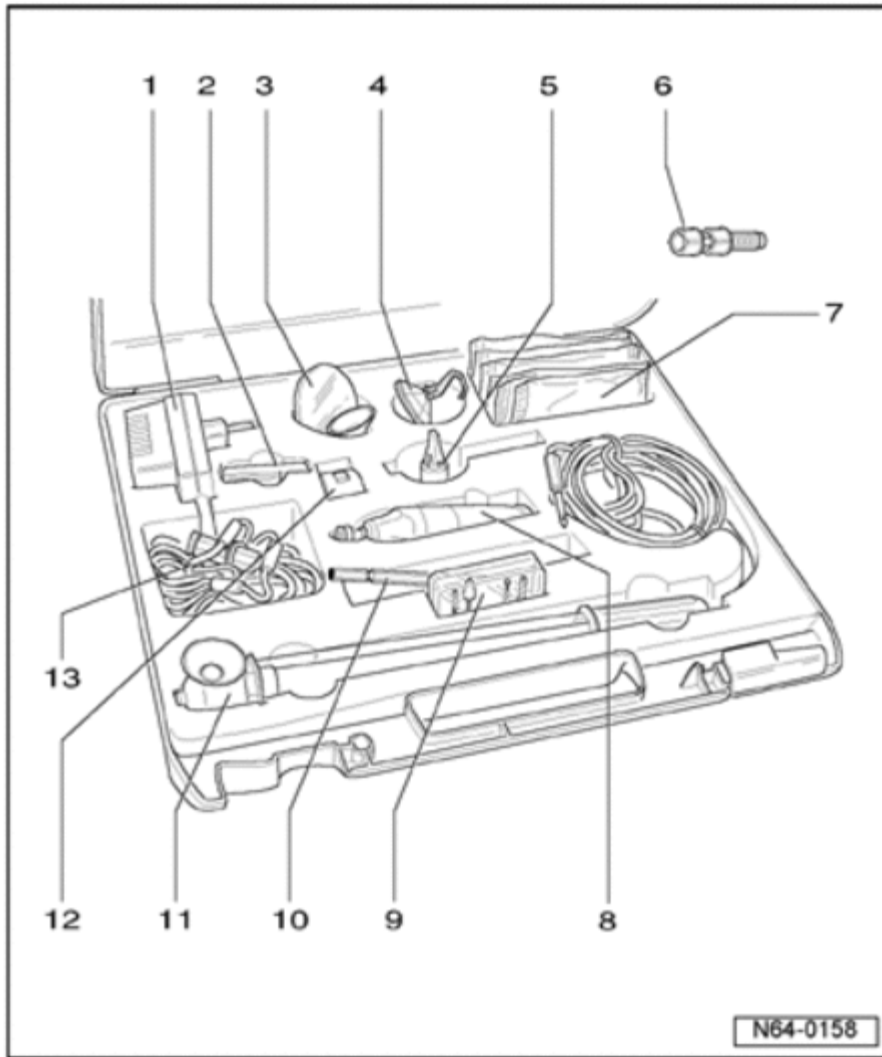


Fig. 32: Windshield Repair Set (Vas 1993) Components
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 1 - Transformer
- 2 - 1 set resin gauges
- 3 - Mirror
- 4 - Suction hook
 - Use as vacuum pump
- 5 - Tool carrier
- 6 - Injector

- After first use in opaque packaging

7 - Resins for at least 15 applications

8 - 12V drill machine

9 - Drill and polish set

10 - Awl

11 - UV lamp

12 - Foil

13 - Battery connector cable

Conditions

- The damage location must not lie within the drivers direct field of vision - **1** -. This field corresponds to a strip about 29 cm wide (DIN A4 format across) central to the drivers line of sight in direction of travel, bordered above and below by the windshield washer field.

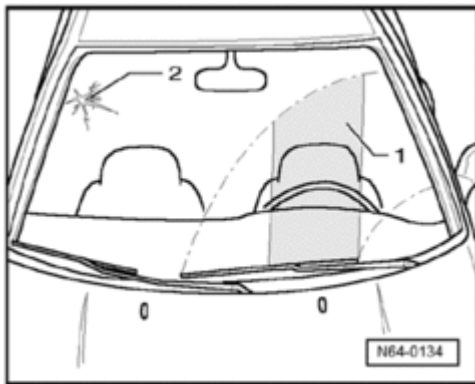


Fig. 33: Identifying Field Of Vision & Damaged Area On Windshield
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cracks radiating out from the point of damage - **2** - must not be longer than 50 mm and/or continue outward into the peripheral area.
- The diameter of the point of damage - **1** - must not be larger than 5 mm.

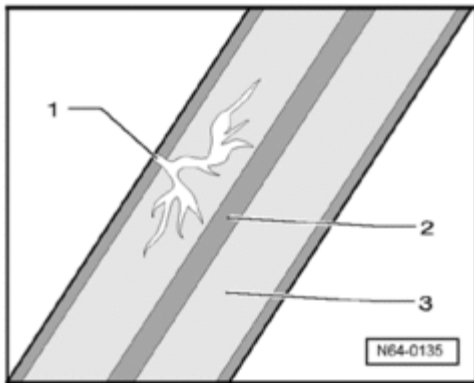


Fig. 34: Identifying Windshield Layers

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- The intermediate foil - **2** - or interior glass - **3** - must not be damaged.
- There must not be any dirt or moisture penetrating into the lower area of the crack.
- Therefore, the date of damage should not date back very long.

The following damage may be repaired as long as it is not in the field of vision or in the peripheral areas of the windshield:

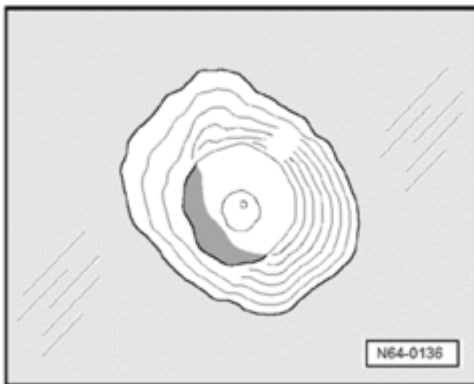


Fig. 35: Identifying Bulls Eye Damage

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Bulls eye

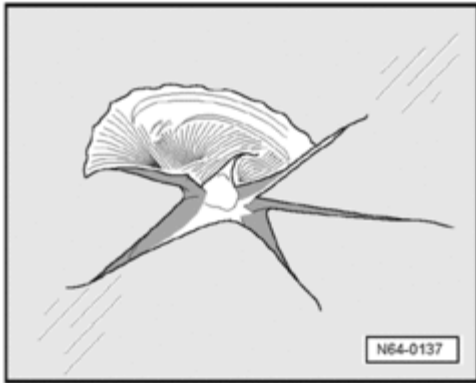


Fig. 36: Identifying Combination Break Damage
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Combination break



Fig. 37: Identifying Star And Crack Damage
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Star and crack

Repair description

- Repairs should not take place in direct sunlight.
- The repair location must be room temperature.
- The work area must be protected against moisture.

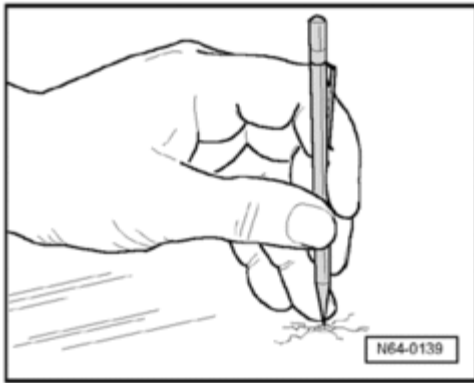


Fig. 38: Preparing Penetration Point With Scribe

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Loosen impact area with hard metal awl but do not expand it or remove any glass fragments.
- Remove any possible moisture with suction hooks while helping with hair dryer from inside. Stop repair if moisture cannot be removed.
- Mount mirror - 1 - on inside and align so location of damage can be seen clearly.

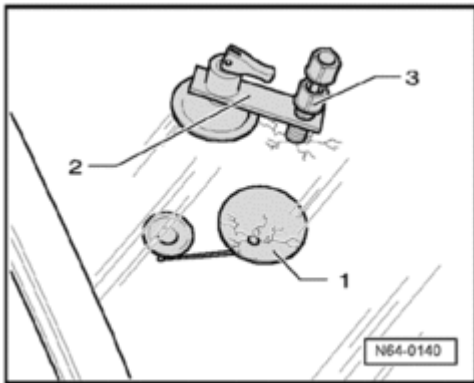


Fig. 39: Installing Mirror, Holder & Injector

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Mount tool carrier - 2 - with injector - 3 - so injectors rubber seal lies directly over point of impact. Check by looking in mirror.

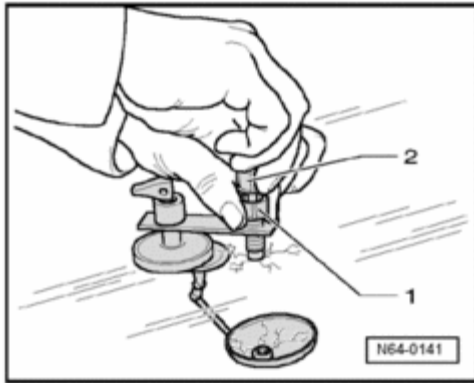


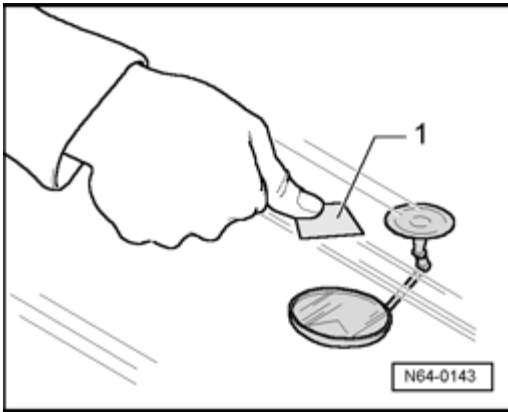
Fig. 40: Identifying Injector Components

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Completely remove threaded spindle - 2 - from injector - 1 -.
- Fill injector - 1 - with 2 to 3 drops resin (this amount of resin is sufficient for any damage).
- Return resin bottle to package immediately because resin is UV sensitive.
- Wait until resin advances into rubber seal.
- Tighten injector - 1 - by turning threaded spindle - 2 -. The correct pressure is achieved when the impact point turns clear from the center out.

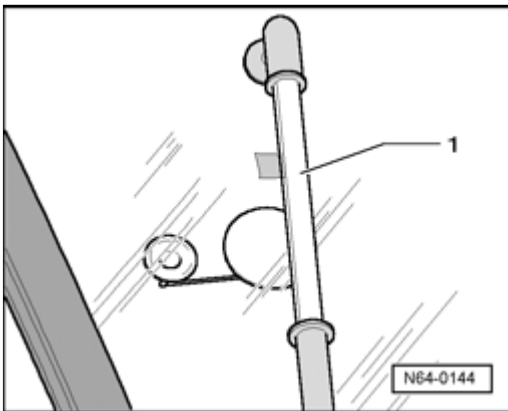
NOTE:

- The resin penetrates into the cracks very slowly and may not be visible right away.
- Wait 10 minutes, then release injector to end of threads.
- Hold injector tightly when loosening so that it does not slip.
- Repeat procedure (at least 3 times) until all air is removed from damage location. You can recognize this by the fact that all of the cracks will no longer be visible. Tightening the injector creates pressure up to 18 bar.
- Note in mirror when the damage location is filled. Then end injection.
- Then swing carrier with injector to side and check whether resin has flowed into all points of fracture.
- Remove any possible trapped air with the suction hook placed on the repair location.

**Fig. 41: Applying Foil**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Cut cover foil - 1 - keep ready. Remove injector with tool carrier and lay cover foil immediately on damage location (do not press down) to prevent air from entering. The foil contains an activator to dry the resin.
- Immediately return injector to packaging because resin is UV sensitive and can be reused for the next repair. Replace tool carrier in released position in case and remove mirror with mount.

**Fig. 42: Securing UV Lamp**

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Secure UV lamp - 1 - over damage location. Allow UV light to act on resin for 10 minutes, then remove UV lamp.
- Smooth out damage location with removal blade and possibly polish with 12 Volt drill machine and polishing set.

NOTE:

- After the repair, the vehicle is ready to operate again without any waiting time.
- Traces of fractures cannot be removed completely with many types of breaks but they do not affect the results of the repair.
- After repair, the window is as strong as normal and further cracks are

prevented by the molded and hardened plastic resin. The hardened resin is colorless and has the same refraction index as glass.

ALUMINUM REPAIRS

CAUTION: Use tools for either steel or aluminum.

Recommendation: Aluminum tool kit in tool storage unit V.A.G 2010/2

NOTE:

- This guide only applies to conventional steel vehicles on which aluminum panels are installed.
- You can see the areas where these panels are used in a picture in 00 - TECHNICAL DATA Aluminum Panels
- For repairs with all-aluminum vehicles, e.g. Audi A8, the following 00 - TECHNICAL DATA Aluminum Panels.

Paint

Paint structure is identical to a steel body.

Only approved, aluminum-compatible materials may be used.

CAUTION: Only remove glue dots on ground connections after painting.

Surface treatment

Only use wire brush on high-grade steel.

Grinding disks should not be used because of their lubricating effect.

Use P 80 to P 200 grit sanding discs.

Only use sanding discs, drill bit, drill and cutting discs with cleaning block DA 009 802.

Clean surface with thinner.

Additional surface treatment same as with steel.

NOTE:

- Cover aluminum parts when sanding or welding steel parts. If steel shavings get onto aluminum, remove this immediately because they can cause contact corrosion.

CAUTION: Use tools for either steel or aluminum.

Recommendation: Aluminum tool kit in tool storage unit V.A.G 2010/2

Removing dents

There is a greater danger of stretching with aluminum than with steel.

Sharp-edged and hard dent removal tools (e.g. steel hammer) should be avoided and should be replaced with plastic, wood or aluminum hammers.

Direct dent removal procedures, that is, aluminum panel lies directly between counterhold and dent removal hammer, should be reduced.

In contrast to steel, dent removal work on aluminum panels begins in the middle of the dent.

Aluminum panels should be pressed more than struck.

When finishing, handle counterhold loosely. Finishing that is too forceful can cause the material to stretch. For this reason, you should use a counterhold made of hardwood.

If the material still stretches, this can be corrected by supplying heat and retracting.

CAUTION: Retracting heat 302 F (150 C) max.

Replace part if a tear forms when removing dents.

Controlling temperature when heating

No tempering colors can be recognized when heating aluminum.

Therefore, temperature must be determined with thermo-pegs or thermo-strips.

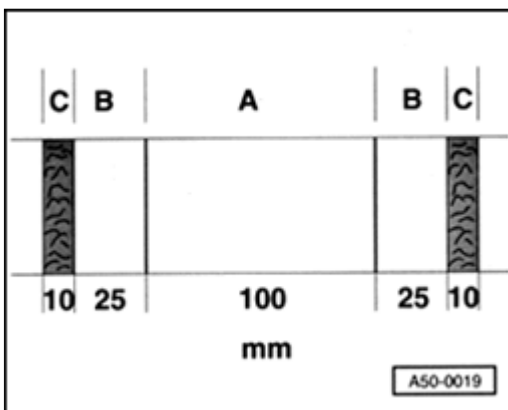


Fig. 43: Thermo-Strips Section Identification

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Thermo-pegs and thermo-strips change color at specific temperatures.

A - Warming area

B - Free zone

C - Thermo-pin or thermo-strip

ALUMINUM PANELS

The Audi Space Frame Concept

For the first time ever, not just for Audi, but for the entire world, vehicle bodies are being assembled as ASF - Audi Space Frame.

ASF means: A combination of aluminum sections and aluminum die-cast joints.

All additional aluminum body pieces are attached to this new Audi frame construction with gas-shielded welding, punch rivets, bonding and clinching (caulking two panels).

The special repair techniques are described in the following information.

CONTACT CORROSION

Contact corrosion may occur if unsuitable connecting elements (bolts, nuts, washers and so on) are used.

For this reason, only connecting elements with a special surface coating are installed (Dacromet). These elements are distinguished by their greenish hue.

Furthermore, all rubber, plastic and adhesive materials used are non-conductive.

If there is any doubt about the reusability of parts, always install new replacement parts.

NOTE:

- **Only use genuine Audi replacement parts! They are tested and aluminum-compatible.**
- **Additional equipment must be approved by Audi of America!**
- **Damage via contact corrosion is not covered by warranty!**

THREADS

If damaged threads are repaired, inserts with galvanized coating must be used.

Steel shavings from drilling must be removed completely.

Only replace threaded pins with genuine Audi parts.

Damaged threads can be repaired with thread inserts with galvanized coating.

Contact corrosion is prevented only by using this coating.

Some threads are already supplied with thread inserts at the factory.

BOLTS

Bolts cannot be welding with devices available in service.

In case of repairs, use steel hollow rivets with galvanized coating.

Contact corrosion is prevented only by using this coating.

Required drill bit diameter 5 mm.

NOTE:

- **Rivet must sit flush against surface and rivet head must break away predetermined breaking point in the rivet.**

PAINT

Paint structure is identical to a steel body.

Only approved, aluminum-compatible materials may be used.

CAUTION: Only remove glue dots on ground connections after painting.

REPLACEMENT PARTS

Special aluminum alloys are used for the body.

The manufacturer heat-hardens the aluminum body after assembly. A temperature of 400 F (205 C) for 30 min. is needed for this.

Because it is not possible to harden the body with workshop tools, replacement parts are delivered pre-hardened.

Only use genuine Audi parts for repairs and follow specified instructions.

SAFETY PRECAUTIONS

Welding and sanding must be carried out with ventilation.

Never weld and sand in any area at the same time.

Clean workplace regularly in proportion to the amount of dust.

Accumulated dust must not be blown away with compressed air.

The exhaust system must be cleaned regularly.

Also, observe the corresponding regulations from the UVW and the BG.

SURFACE TREATMENT

Due to the especially light way, aluminum dust or shavings do not fall to the floor immediately, but rather stay in the air for some time.

Only perform surface or cutting work with ventilation.

Only use wire brush on high-grade steel.

Grinding disks should not be used because of their lubricating effect.

Use P 80 to P 200 grit sanding discs.

Only use sanding discs, drill bit, drill and cutting discs with cleaning block DA 009 802.

Commercially-available sanding materials can be used on aluminum without the cleaning block.

Clean surface with thinner.

CAUTION: Use tools for either steel or aluminum.

CUTTING

Cutting

Perform cutting work only with the body repair saw or panel shears.

The tooth pitch for aluminum saw blades is greater than for steel panels.

Only use cutting discs with cleaning block DA 009 802.

Always use ventilation.

CAUTION: Perform cutting work only according to the repair information specifications in the appropriate Body Collision Repair Information

REMOVING DENTS

There is a greater danger of stretching with aluminum than with steel.

Sharp-edged and hard dent removal tools (e.g. steel hammer) should be avoided and should be replaced with plastic, wood or aluminum hammers.

Direct dent removal procedures, that is, aluminum panel lies directly between counterhold and dent removal hammer, should be reduced.

In contrast to steel, dent removal work on aluminum panels begins in the middle of the dent.

Aluminum panels should be pressed more than struck.

Handle counterhold loosely when finishing. Forceful finishing can cause the material to stretch. Use a hardwood counterhold to avoid this.

Stretches in the material can be corrected by supplying heat and retracting.

RESHAPING

Reshaping cannot be done as with a steel body.

Damaged cast joints or assembly sections must be replaced.

CONTROLLING TEMPERATURE WHEN HEATING

No tempering colors can be recognized when heating aluminum.

Therefore, the temperature must be determined using thermo-strips.

If thermo-strips are used: V/150.4 temperature range 210 F (99 C) - -260 F (-127 C) V/150.5 temperature range 269 F (132 C) - -320 F (-160 C)

Supply source: Matra.

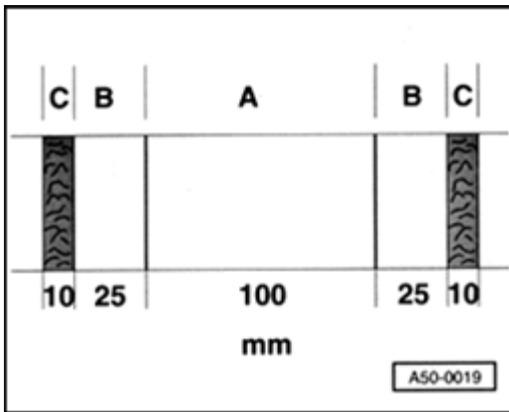


Fig. 44: Thermo-Strips Section Identification
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

Thermo-strips change color at specific temperatures.

A - Warming area

B - Free zone

C - Thermo-strips

FLANGING

The outer side panel is delivered pre-hardened.

Therefore, flanging requires a special procedure and is carried out in 2 steps.

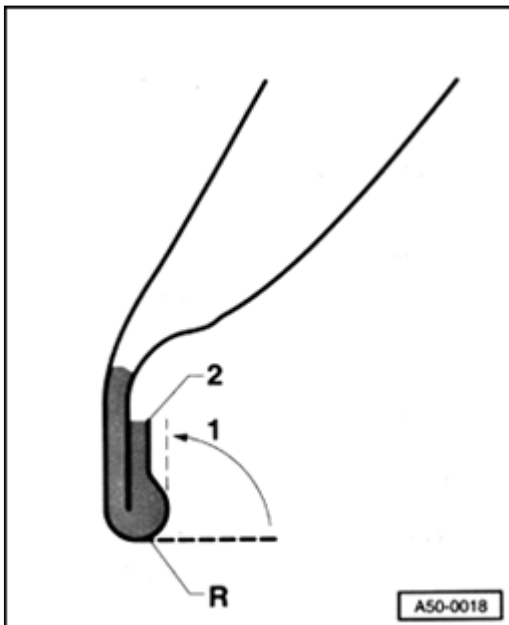


Fig. 45: Bending Flange Up & Fastening Upper Area

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- 1. Bend flange up with pliers. Maintain radius $R = 2.5$ mm.
- 2. Fasten upper area with hammer using counterhold. Radius $R = 2.5$ mm must be maintained when doing so.

If the radius is not maintained the side panel could tear.

A level bond must be provided between inner and outer parts in shaded area.

WELDING REPAIRS

Assembly Section Cast Joints

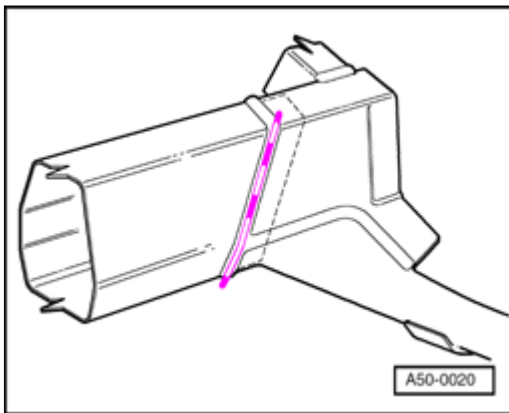


Fig. 46: Assembly Section Weld Seam
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Assembly section weld seam - saw of cast joints in center.
- Sand away rest of weld seam.

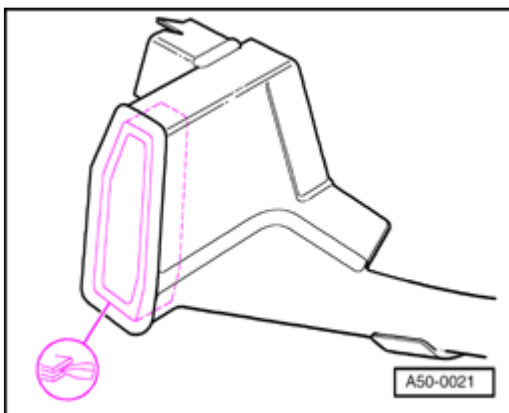


Fig. 47: Separating Rest Of Assembly Section From Cast Joints With Chisel
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Separate rest of assembly section from cast joints with chisel.

CAUTION: Do not damage cast joints. If a cast joint is damaged or deformed it must be replaced.

- Adjust new parts.
- Clean 40 mm on both sides of flange with wire brush and remove oxide layer.
- Weld on assembly section, original weld seam.

ASSEMBLY SECTION

- Remove damaged area.
- Adjust new parts. To do this, shorten each welding groove by 1 material thickness - **a** -.
- Prepare sleeve - **A** - for insertion. Length approx. 40 mm.

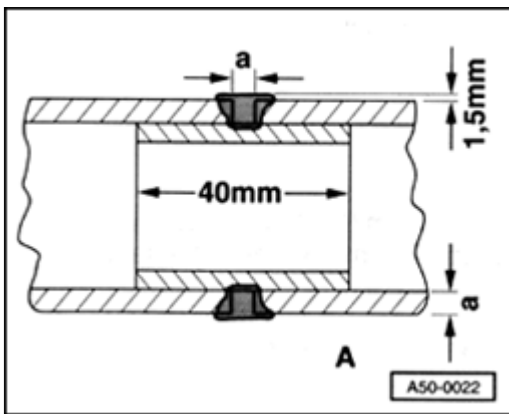


Fig. 48: Shortening Each Welding Groove By 1 Material Thickness
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert sleeve in old and new piece.
- Clean 40 mm on both sides of flange and sleeve with wire brush and remove oxide layer.

NOTE:

- **The sleeve functions as a welding line retainer. The seam base should fuse onto the sleeve.**
- **Weld connection, gas-shielded arc continuous weld seam all around.**

Maximum weld seam projection: 1.5 mm. Sand down if necessary.

PANEL

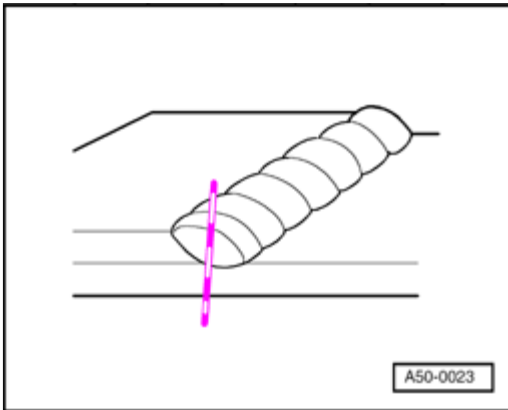


Fig. 49: Separating Weld Seam At Center With Body Repair Saw
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Separate weld seam at center with body repair saw and remove damaged part.

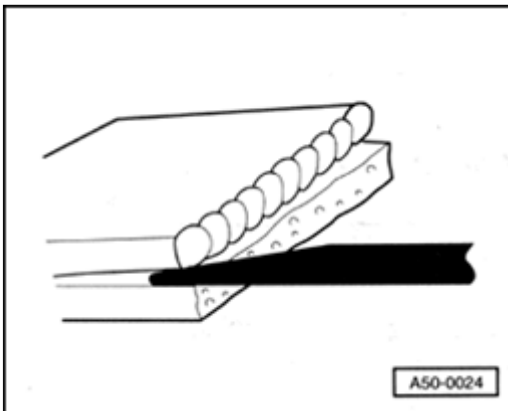


Fig. 50: Removing Rest Of Panel With Chisel
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Remove rest of panel with chisel. Sand front of weld seam if needed.
- Adjust new parts.
- Clean 40 mm on both sides of flange with wire brush and remove oxide layer.
- Weld panel, original weld seam.

RESISTANCE SPOT WELDING

- Loosen spot welds with spot weld drill or sand off.

CAUTION: Use tools for either steel or aluminum.

- Remove damaged part, separate with chisel if needed.
- Sand down projections.

- Adjust new part.
- Drill upper panel for plug welding - d - 8 mm for 1.3 mm, 10 mm for 2 mm panel thickness.
- Clean flanges and remove oxide layer with wire brush.

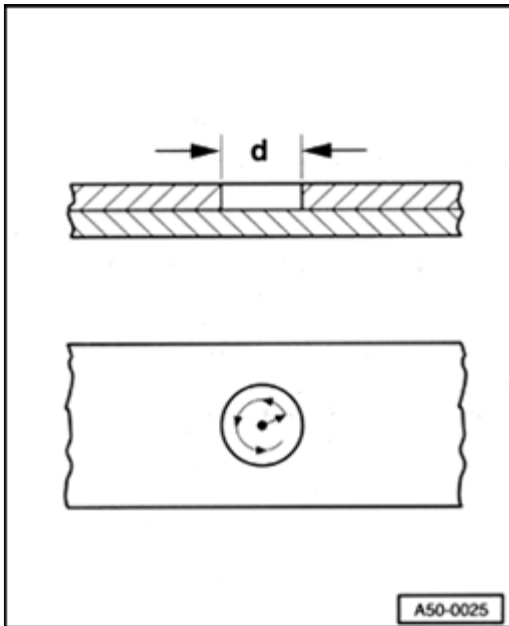


Fig. 51: Performing Plug Welding From Center Outward
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Perform plug welding from center outward.

NOTE:

- Rivets are also permitted, to some extent. Observe **BODY COLLISION REPAIR** .

WELDING ALUMINUM

Metal Inert Gas (MIG) welding is used by the manufacturer and in service.

Argon is used as inert gas.

AISi 12 1 mm welding wire is used.

The welding device has a current control on the handle.

Clean undercoating and paint off of about 40 mm on both sides of parts and then remove oxide layer with a wire brush before welding.

To avoid formation of cracks, weld seams must be drawn around section corners.

Only weld with ventilation VAG 2011.

Use panel 4D0 899 103 for welding practice and repairs.

Full particulars can be found in the aluminum welding training guide.

Welding power source, inert gase and welding wire, refer to the Special Tools and Equipment Catalog.

CHECKING WELD SEAMS AND CAST JOINTS

The color penetration process is used to test for surface cracks.

CAUTION: Do not brush before the test or the cracks will be smeared.

All cracks must be sanded out and re-welded.

LASER WELD SEAM

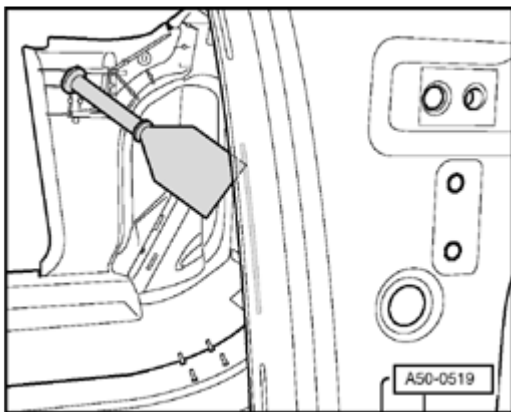


Fig. 52: Laser Weld Seam

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Aluminum laser welding was adopted by Audi starting with the A2.

- Separate laser weld in upper area with straight sander.
- Remove part and loosen remainder with chisel, if necessary.

RIVETS AND TOOLS OVERVIEW

Special tools, testers and auxiliary items required

- Compressed air rivet pliers V.A.G 2002B
- Solid rivet N 103 239.01 4 x 8
- Solid rivet N 103,240.01 4 x 12

Special tools, testers and auxiliary items required

- Pop rivet pliers VAS 5072
- Punch rivet 4d0 803 217 N 3,35 x 5
- Punch rivet 4d0 803 217 C 3,35 x 4

Special tools, testers and auxiliary items required

- Pneumatic pop rivet pliers V.A.G 2003
- Pop rivet N 906 634.01 6 x 9

REPAIRING RIVETS**Punch Rivets**

- First make separating cuts, if necessary.

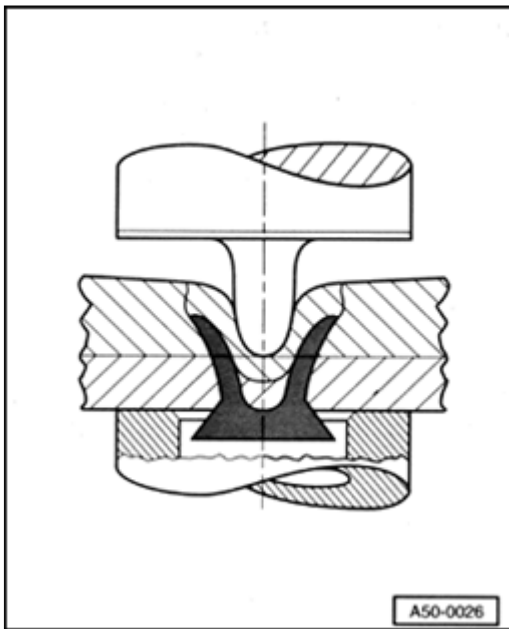


Fig. 53: Inserting Tip Of Die In Imprint In Panel
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press out punch rivet with rivet tool. Insert tip of die in imprint in panel.

NOTE:

- **Adjust rivet tool to material thickness for all procedures. If flange is not accessible with rivet tool, remove damaged part with rough cut.**

CAUTION: Punch rivets can either be drilled out or sanded down.

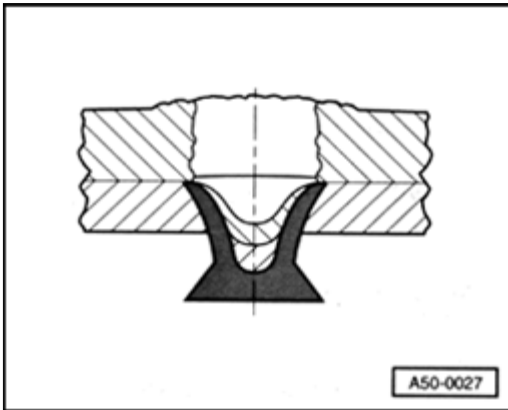


Fig. 54: Identifying Hole Forms On Inner Panel While Punch Rivet Remains On Outside
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

When pressing down, a hole forms on the inner panel while the punch rivet remains on the outside.

Different inserts are used for the various rivet sizes.

- Separate bonded joint with chisel and remove part.

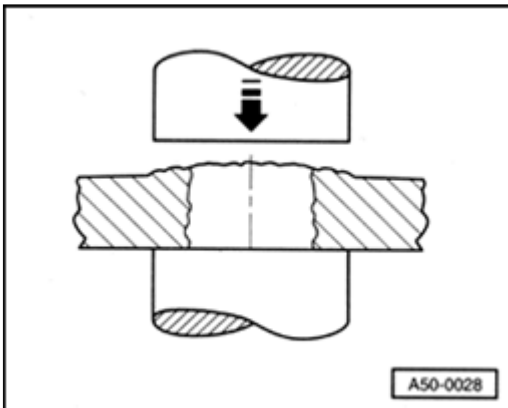


Fig. 55: Reshaping Flange On Undamaged Panel With Rivet Tool
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Reshape flange on undamaged panel with rivet tool.
- Fit new parts and install solid or pop rivets, according to the repair information.

NOTE:

- The punch rivet is made of steel and is provided with a special coating. Sparks when sanding are an indication of punch rivet remnants. Remove punch rivet remnants and change sanding disc.

NOTE:

- If punch rivet cannot be access with rivet tool, the aluminum can be drilled out around the rivet with a nickel-plated spot weld drill with spring-mounted bit (e.g. Hazet 1967).

If punch rivets fall into inside of vehicle, these must be removed. A magnet can be used.

CLINCHING

- First make separating cuts, if necessary.

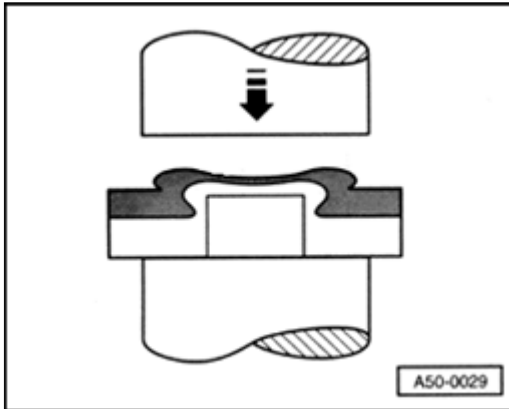


Fig. 56: Pressing Back Clinch Point With Rivet Tool
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Press back clinch point with rivet tool.

NOTE:

- Adjust rivet tool to material thickness for all procedures.
- Remove damaged part, separate with chisel if needed.
- Fit new parts and install solid or pop rivets, according to the **BODY COLLISION REPAIR** .

SOLID RIVET

- First make separating cuts, if necessary.

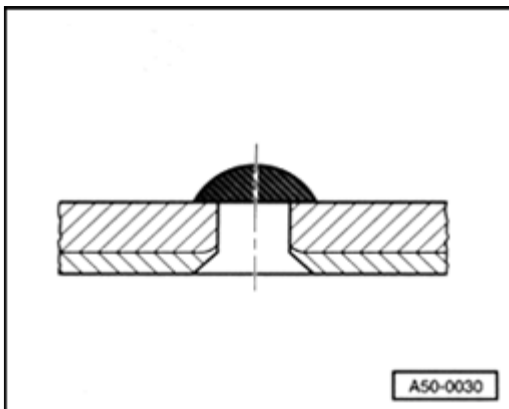


Fig. 57: Identifying Solid Rivet
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Sand off closing head and press out solid rivet with rivet tool.
- Remove damaged part, separate with chisel if needed.
- Fit new parts and install solid rivets.

POP RIVET

- First make separating cuts, if necessary.

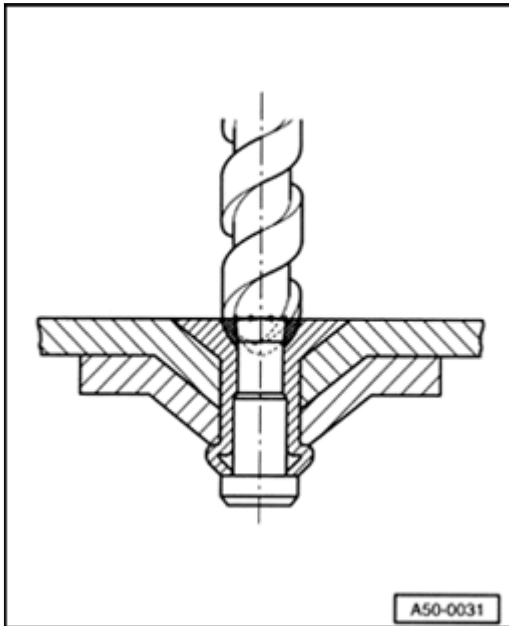


Fig. 58: Identifying Pop Rivet

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drill out pop rivet, drill bit diameter 4.5 mm.

CAUTION: Catch pop rivet remnants. If remnants fall in cavities, they should be removed with wax.

- Remove damaged part, separate with chisel if needed.
- Fit new parts and install pop rivets.

NOTE:

- Rivet is composed entirely of aluminum.

SOLID RIVET, INSTALLING

- Fit new parts, apply adhesive and place new part on body and secure.

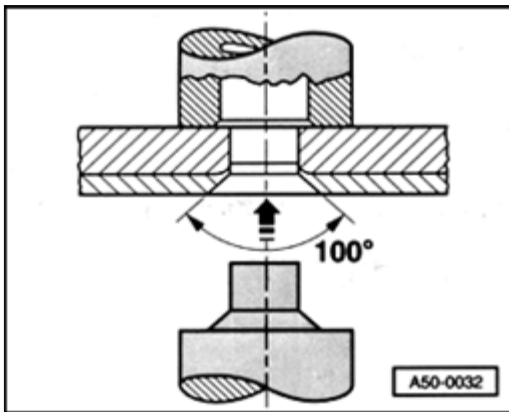


Fig. 59: Stamping Flange With Rivet Tool
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Stamp flange with rivet tool.

When stamping, the punch hole and the imprint are made in one process.

NOTE:

- Adjust rivet tool to material thickness for all procedures. To prevent flange from gaping after stamping, insert staples in stamping holes.

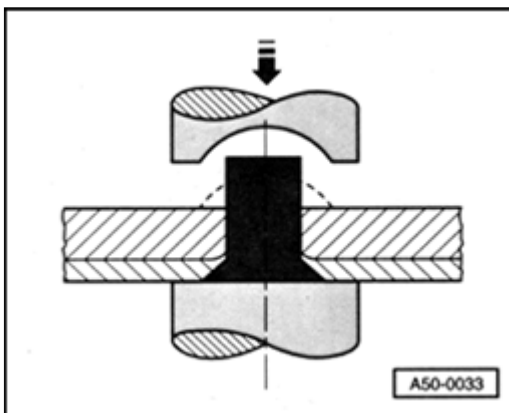


Fig. 60: Inserting Solid Rivet And Affixing Closing Head With Rivet Tool
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Insert solid rivet and affix closing head with rivet tool.

There are corresponding rivet tool inserts for the various rivet diameters.

NOTE:

- In contrast to production, all rivet joints in service are also bonded. See bonded joint. The solid rivet is made of aluminum.

2 solid rivets are available:

Solid rivet 4 x 8 for 2 panel connection

Solid rivet 4 x 12 for 3 panel connection

PUNCH RIVET, INSTALLING

- Fit new parts, apply adhesive and place new part on body and secure.
- No drilling or stamping of holes is needed with punch rivets.
- Attach Battery Punch Rivet Pliers VAS 5279 A and attach rivets.

2 punch rivets are available:

4D0 803217 N

4D0 803217 Q

NOTE:

- In contrast to production, all rivet joints in service are also bonded. See bonded joint. The punch rivet is made of aluminum.

POP RIVET, INSTALLING

- Fit new parts, place on body and secure.

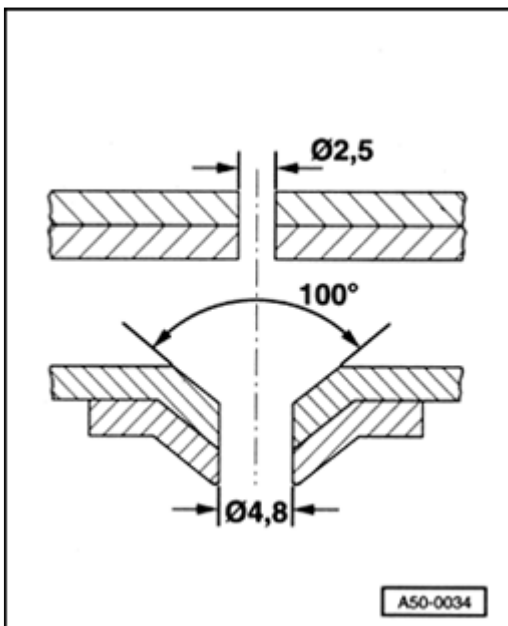


Fig. 61: Drilling Old And New Part Or Same Material Together
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Drill old and new part or same material together, 2.5 mm.
- Remove new part.

- Imprint drilled holes in all parts with rivet tool.

NOTE:

- **Adjust rivet tool to material thickness for all procedures. The diameter increases to 4.8 mm with imprinting. The imprint must face inward on all parts.**

Assembly sections cannot be imprinted. Lower new part with assembly section, remove part and drill out assembly profile to 4.8 mm.

- Apply adhesive.

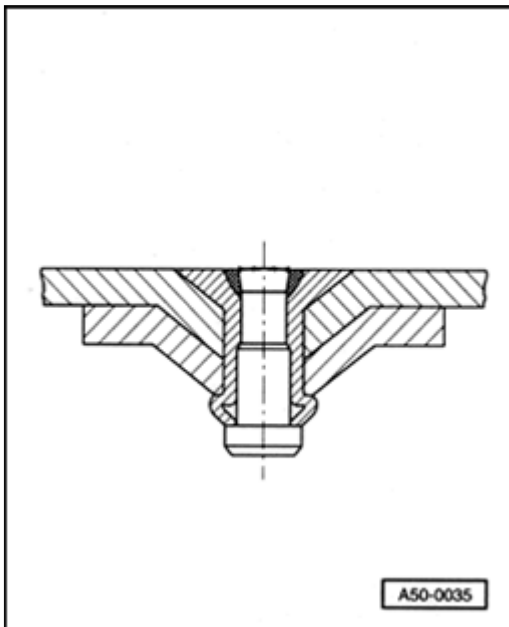


Fig. 62: Installing Pop Rivet And Pulling Pin With Rivet Pliers
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Install pop rivet and pull pin with rivet pliers.

NOTE:

- **In contrast to production, all rivet joints in service are also bonded. See bonded joint. The rivet is made entirely of aluminum.**

CAUTION: Rivets with steel pins may not be used.

RIVET PROBLEMS

--> **Open Countersinks**

--> **Non-Fitting Rivet Heads**

--> **Air Gap**

--> **Rings**

Open Countersinks

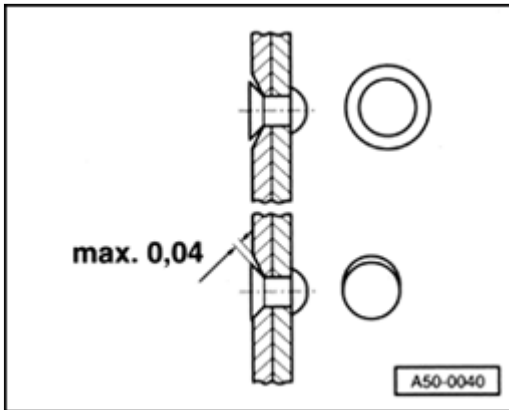


Fig. 63: Open Countersinks

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Countersinks open over the entire circumference are not permitted. Partially open countersinks up to a gap width of 0.04 mm are permitted.

Sizing, e.g. with a cambered riveting die, is permitted as long as the tolerance for closing and setting head are maintained.

Non-Fitting Rivet Heads

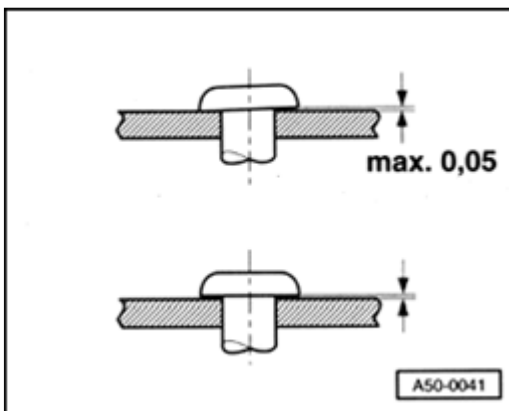


Fig. 64: Non-Fitting Rivet Heads

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Loose rivets are not permissible.

Partial gap up to 0.05 mm allowed in some instances.

Air Gap

Bulge

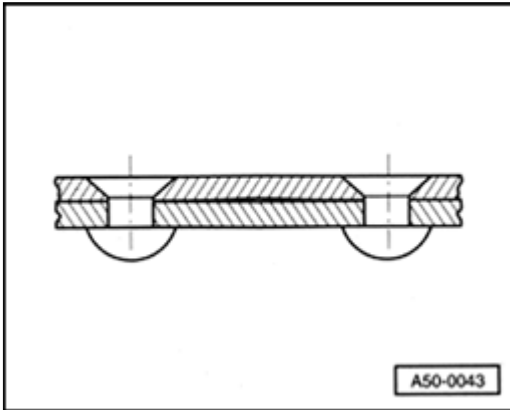


Fig. 65: Identifying Air Gap Bulge
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Bulges must not exceed a gap width of 0.3 mm.

Torque cracks

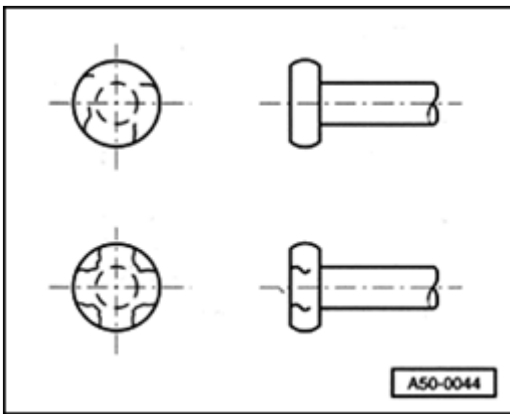


Fig. 66: Identifying Torque Cracks
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Cracks must not overlap.

Permissible.

Indent

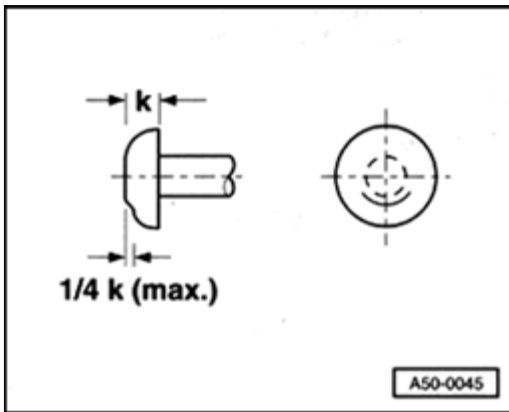


Fig. 67: Identifying Indent

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Permissible indent depth $1/4 \times$ height of head.

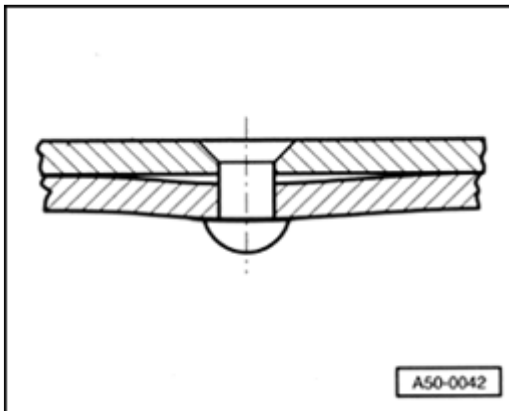


Fig. 68: Identifying Rivet Material Is Pushed Into Gap And Causes Bending Stress To Rivet

Courtesy of VOLKSWAGEN UNITED STATES, INC.

During the riveting process, the rivet material is pushed into the gap and causes bending stress to the rivet.

Not permissible.

Rings

Offset closing head

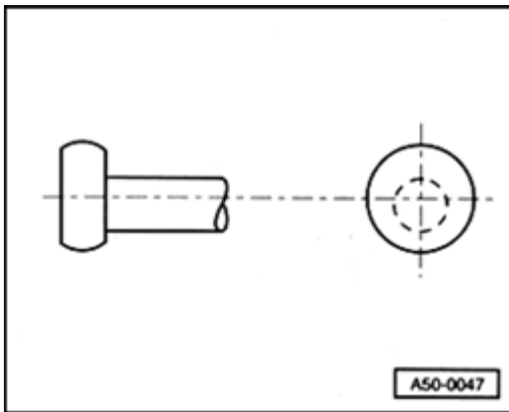


Fig. 69: Identifying Offset Closing Head
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

Impermissible as soon as the closing head touches the shaft and the rivet hole is visible.

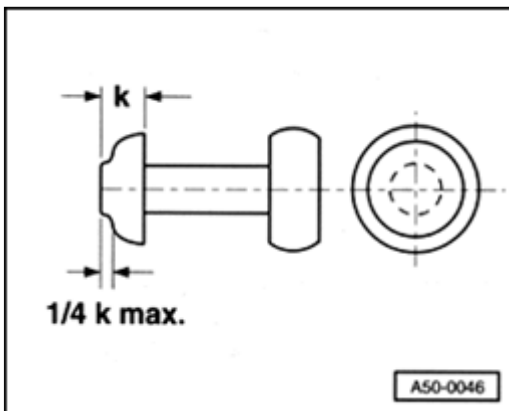


Fig. 70: Identifying Rings Form When Riveting Die Too Small
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

Rings form when riveting die that is too small is used.

Not permissible.

SETTING EDGES

- Set with setting pliers.

NOTE:

- **Allow 22 mm for overlap when making separating cuts. Cannot be set. Underlay same material.**

In order to be able to spackle the cut location later, bevel upper panel 45 and chamfer edges.

A special metal filler is used. See Release.

NOTE: • Spacking is applied to bare aluminum. filler cures at 120 C.

Perforate

To perform a gas-shielded arc plug weld later.

Drill

- To perform gas-shielded arc plug welding or drill out clinching points (original connection) or drill out retainer holes.

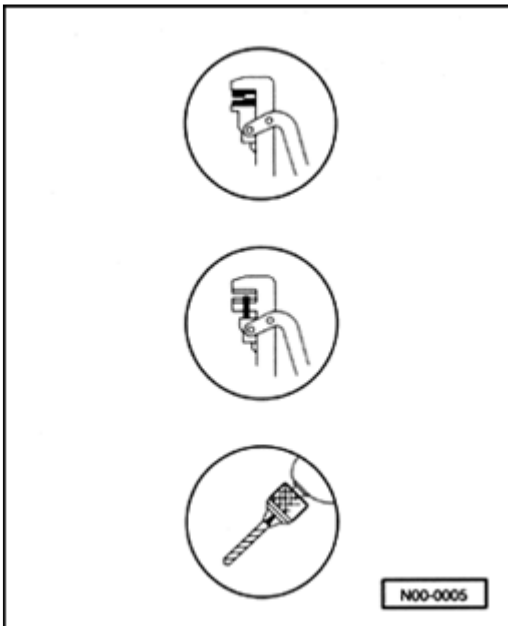


Fig. 71: Offset, Punch And Drill Symbols
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- To perform overlapping riveting.

UNDERLAYING MATERIAL

Same material - **C** - is created from remainder of new - **B** - or old parts - **A** -. Same material should also be underlaid on beaded panel edges. On small cross sections or large panel edges, the same material is separated.

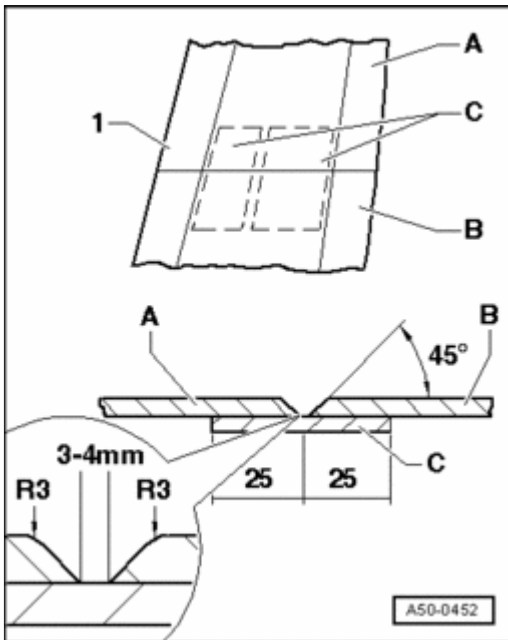


Fig. 72: Identifying Underlying Material
 Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Bevel both panels 45. Round outer edge (radius = 3) and chamfer inner edge.

Panel tips must be 3 to 4 mm apart.

FILLING SEPARATING CUTS

A special aluminum filler is used. Aluminum powder DA 004 200 A2 and hardener DA --4 201 A1. Hardener DA 004 211 A1 must be used at temperatures over 68 F (20 C) and/or relative humidity above 80%.

- Follow instructions for use on container.
- Clean adhesive residue from gap with wire brush.
- Apply filler to bare aluminum and fill gap up to level of panel.
- Leave filler at room temperature about 20 min. until surface is matte gray.
- Cure filler with hot air gun or infrared lamp at 248 F (120 C) for approx. 20 min.
- Finish filler.

BONDED JOINT

CAUTION: Pretreatment only valid for old flange.

- Remove adhesive residue, paint, wax, etc.
- Sand adhesive surface down to bare metal with clean 80 or 100 grit sanding disc.

- Work on flange with grindstone DA 009 800 and mount VAG 1931.

There is no silica-based undercoating that guarantees long-term durability of the bonded joint. The surface becomes matte.

- Remove sanding dust with clean brush.

Do not use any solvent.

- Lightly apply aluminum primer DA 009 801 with brush and allow to dry.

Pretreatment Valid for Replacement Part --> **Pretreatment Valid for Replacement Part**

Pretreatment Valid for Replacement Part

- Clean painted flange with D 009 401.04

CAUTION: Cover adhesive surfaces when painting inner side.

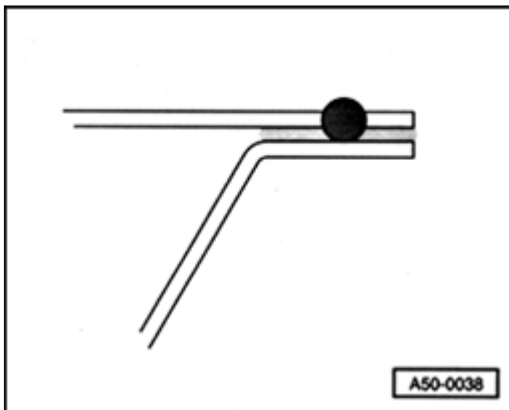


Fig. 73: Applying Adhesive DA 001 730 A1 To Body Side
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Apply adhesive DA 001 730 A1 to body side, add parts and secure. Adhesive bead diameter 3.5 mm.

Add and secure parts within 30 min. Otherwise, the adhesion will be insufficient due to the formation of a surface skin.

- Install rivets and wipe away escaping adhesive.

Rivets must be installed at temperature up to 68 F (20 C) within 150 min and within 40 min. at temperatures over 68 F (20 C, beginning at application of adhesive.

NOTE:

- If the adhesive escapes on both sides along the entire length, too much

was applied.

- 1 cartridge with 37 ml is enough for approx. 4 m of flange.

The adhesive must cure before further surface work.

Curing time:

68 F (20 C): 8 h

176 F (80 C): 20 min.

NOTE:

- On large parts, such as the roof, it is necessary to perform the work with a helper. Otherwise the adhesive will dry before work is complete.
- Before inserting mixing nozzle, ensure double cartridge openings are clean. Firmly install mixing nozzle and press out a bead about 10 cm long and apply adhesive.
- After breaks up to 30 minutes, press out a bead about 10 cm long so that new material is mixed. After breaks over 30 min., replace mixing nozzle and press out a 10 cm long bead. If more cartridges are needed for a repair, these can be processed with a mixing nozzle.

RIVETS ACCESSIBLE FROM ONE SIDE

- Remove paint and oxide layer on rivet head and glue dot for ground pliers.
- Attach ground pliers as close to rivets as possible.
- Set welding current on Dent removing device for aluminum vehicles VAS 5196 to display 150.

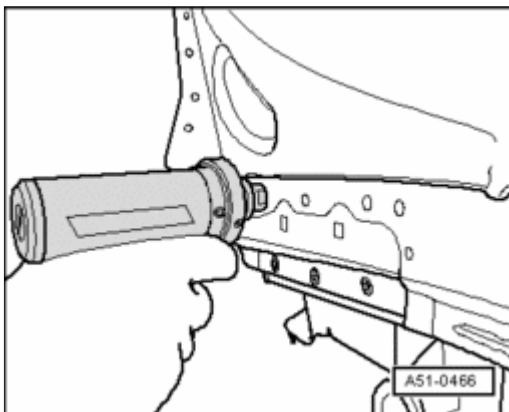


Fig. 74: Welding 4 mm Bolts With VAS 5196/1
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Weld 4 mm bolts with VAS 5196/1.

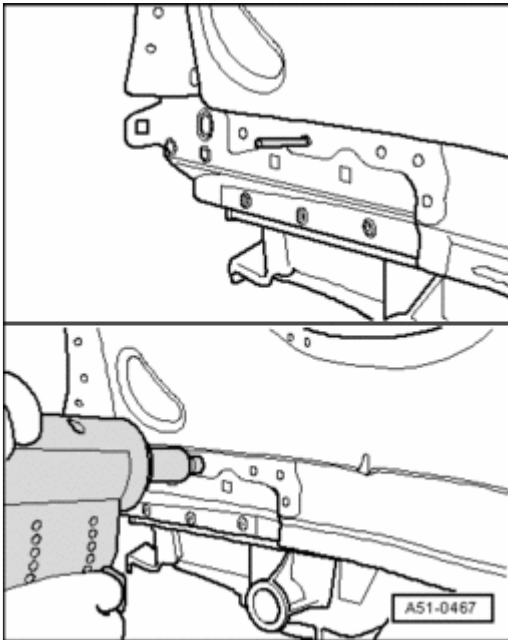


Fig. 75: Pulling Out Bolts With VAS 2003 And Mouthpiece VAS 2003/1
Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Pull out bolts with VAS 2003 and mouthpiece VAS 2003/1.

EXPLANATION OF SYMBOLS

Welding Legend

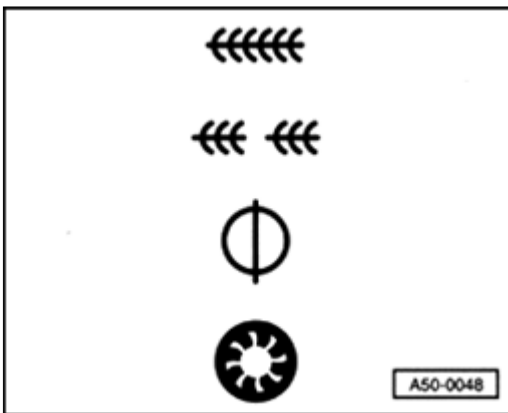


Fig. 76: Welding Legend
Courtesy of VOLKSWAGEN UNITED STATES, INC.

Gas-shielded arc continuous weld seam

Gas-shielded arc continuous weld seam intermittent

Gas-shielded arc stitch weld seam

Gas-shielded arc plug weld seam SG = gas-shielded welding

RIVETING LEGEND

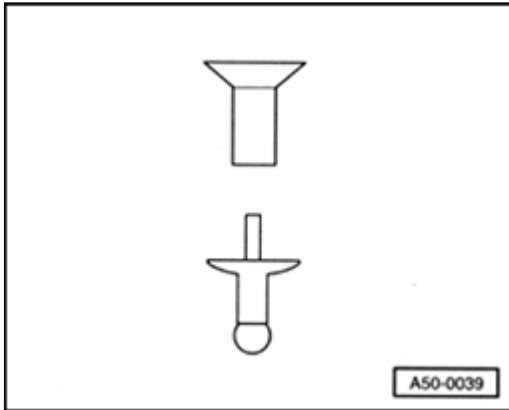


Fig. 77: Riveting Legend

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Solid rivet with countersunk head

Pop rivet with countersunk head

CAVITY SEALANT

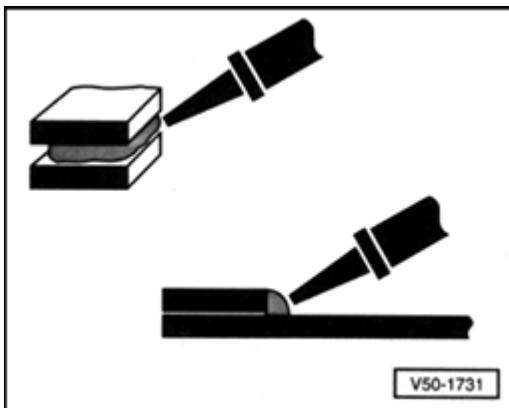


Fig. 78: Bond & Seal Symbols

Courtesy of VOLKSWAGEN UNITED STATES, INC.

Adhesives

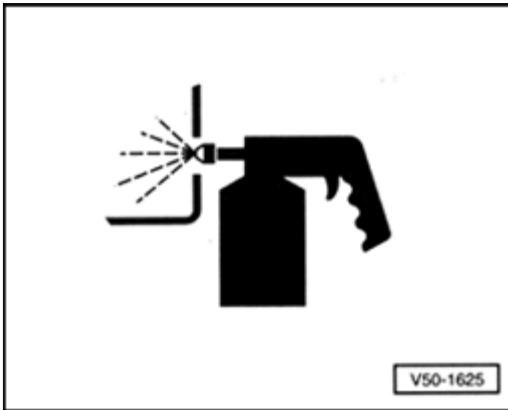


Fig. 79: Cavity Conservation Symbol

Courtesy of VOLKSWAGEN UNITED STATES, INC.

- Sealant spraying gun