

Repair Manual

Audi A1 2011 ➤ , Audi A2 2001 ➤ ,
Audi A3 2004 ➤ , Audi A4 2001 ➤ ,
Audi A4 2008 ➤ ,
Audi A4 Cabriolet 2003 ➤ ,
Audi A5 Cabriolet 2009 ➤ ,
Audi A5 Coupé 2008 ➤ , Audi A6 1998 ➤ ,
Audi A6 2005 ➤ ,
Audi A7 Sportback 2011 ➤ ,
Audi A8 2003 ➤ , Audi A8 2010 ➤ ,
Audi Q5 2008 ➤ , Audi Q7 2007 ➤ ,
Audi R8 2007 ➤ , Audi TT 1999 ➤ ,
Audi TT 2007 ➤

Electrical Equipment General Information

Edition 10.2010



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List of Workshop Manual Repair Groups

Repair Group

27 - Battery, Starter, Generator, Cruise Control

92 - Windshield Wiper/Washer System

94 - Exterior Lights, Switches

96 - Interior Lights, Switches

97 - Wiring



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Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

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27 – Battery, Starter, Generator, Cruise Control

1 General Information

⇒ [“1.1 Battery”, page 1](#)

⇒ [“1.2 Battery, Charging”, page 2](#)

⇒ [“1.3 Cruise Control, Vehicles With Electronic Power Control”, page 7](#)

⇒ [“1.4 Safety Procedures And Precautions”, page 8](#)

⇒ [“1.5 Lead-Acid Battery Warnings and Safety Precautions”, page 8](#)

⇒ [“1.6 Non Maintenance-Free Batteries, Without Visual Indicator”, page 11](#)

⇒ [“1.7 Maintenance-Free Battery”, page 16](#)

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1.1 Battery



WARNING

Risk of injury.

- ◆ *Follow all Warnings and Safety Precautions. Refer to [“1.5 Lead-Acid Battery Warnings and Safety Precautions”, page 8](#).*



Caution

Risk of damage to battery or vehicle.

- ◆ *Vehicles with a battery that is not maintenance-free: Follow the instructions, refer to [“1.6.5 Visual Check”, page 12](#).*
- ◆ *Vehicles with a battery that is not maintenance-free: Follow the instructions, refer to [“1.7.8 Visual Check”, page 19](#).*

- ◆ To guarantee a long service life, the battery must be checked, serviced and maintained as described in this repair manual.
- ◆ In addition to its starting function, the battery acts as back-up and supplies power for the entire electrical system.



Note

For additional information, refer to Self Study Program No. 234; Vehicle Batteries.

1.2 Battery, Charging

⇒ [“1.2.1 Charging The Battery Using VAS 5903 “, page 2](#)

⇒ [“1.2.2 Exhaustively Discharged Battery“, page 3](#)

⇒ [“1.2.3 Rapid Charging The Battery, Vehicles Without Battery Monitoring Control Module J367 Or Energy Management Control Module J644 “, page 5](#)

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1.2.1 Charging The Battery Using -VAS 5903-

Special tools and workshop equipment required

- ◆ Battery Charger VAS 5903 -VAS 5903-



Note

- ◆ *Battery charger -VAS 5903- charges without current and voltage peaks. Batteries can therefore also be charged when installed. When doing this, heed the safety instructions. The devices provide an assistance mode in which they provide supply for the circuits.*
- ◆ *When working on the electrical system with the electrical consumers temporarily switched on and for “Guided Fault Finding“, the battery must be charged with a battery charger in assistance mode to prevent damage to the battery. Refer to ⇒ [“1.2.4 Battery Support Mode With VAS 5903 “, page 6](#) .*
- ◆ *For more information regarding the battery charger, refer to the Operating Instructions that came with the charger.*

Procedure

- The battery temperature must be at least +10 °C.



WARNING

Risk of explosion due to open flame, fire and smoking.

- ◆ *On non-maintenance-free batteries, the sealing plugs must be installed tightly.*
- ◆ *Provide sufficient ventilation.*
- ◆ *A highly flammable gas forms when batteries are charged. Never enter rooms where batteries are being charged carrying an open flame or while smoking.*
- ◆ *Follow the battery charger and battery manufacturer safety requirements.*
- ◆ *Rapid-charging batteries, refer to ⇒ [“1.2.3 Rapid Charging The Battery, Vehicles Without Battery Monitoring Control Module J367 Or Energy Management Control Module J644 “, page 5](#) .*

Risk of explosion on discharged battery with visual indicator.

- ◆ *If the visual indicator has no color or is light yellow, the battery may not be tested or charged. Jump starting must not be used! There is a risk of explosion during testing, charging or jump starting. The battery must be replaced.*



Caution

Risk of damaging AGM batteries.

◆ *AGM batteries must be protected from over voltage.*

- Switch off ignition and remove ignition key.
- Turn off all electrical consumers.
- Perform the battery charging prep work. Refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Description and Operation .



Note

- ◆ *In vehicles without a Battery monitoring control module -J367- or Energy management control module -J644- , the battery charger clamps can be connected to the battery terminals or the positive and ground terminals in the engine compartment.*
- ◆ *In vehicles with a Battery monitoring control module -J367- or Energy management control module -J644- , the black charger clamp “-“ must not be connected to the battery negative terminal but to the ground terminal in the engine compartment or the ground pin of the energy management control module -J644- .*
- After connecting the charging clamps, connect the battery charger electrical system connector.
- Switch the charger on.
- If necessary, adjust the charge current according to the battery capacity.
- Current should be 10% of the battery capacity (with a 60 Ah battery, about 6 Ah).
- When the battery is fully charged, refer to Battery charger operating instructions, disconnect the battery charger clamps “+“ and “-“ from the battery.
- Disconnect the battery charger electrical system connector.

1.2.2 Exhaustively Discharged Battery

- ◆ Batteries that have not been used in driving operation for a long time, for example in stored vehicles, discharge themselves.
- ◆ Batteries are considered to be exhaustively discharged if the no-load voltage drops below 11.6 V. In the case of extended downtime under 12.2 volts, the battery is prematurely damaged.
- ◆ Measure the no-load voltage in vehicles without a Battery monitoring control module -J367- or Energy management control module -J644- . Refer to ⇒ [“4.1.2 Measuring No Load Voltage“, page 32](#)
- ◆ **Perform a battery test with a Vehicle Diagnosis Tester** if the vehicle has a Battery monitoring control module -J367- or Energy management control module -J644- . Refer to ⇒ [“4.2.2 Battery Test with Vehicle Diagnosis Tester -“, page 34](#) .
- ◆ With exhaustively discharged batteries, the battery acid (mixture of sulfuric acid and water) is mostly water, with a greatly reduced sulfuric acid content.

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- ◆ Exhaustively discharged batteries become sulfated, i.e. all the plate surfaces of such batteries become hardened. Instead of being transparent, the electrolyte has a slightly milky appearance.
- ◆ The sulfating process may be reversed if an exhaustively discharged battery is recharged immediately.
- ◆ If battery is not recharged, plates will continue to harden, and ability to accept a charge will diminish. This results in reduction of battery performance.

Procedure

- The battery temperature must be at least +10 °C.



WARNING

Risk of explosion on discharged battery with visual indicator.

- ◆ ***If the visual indicator has no color or is light yellow, the battery may not be tested or charged. Jump starting must not be used! There is a risk of explosion during testing, charging or jump starting. The battery must be replaced.***



Caution

Risk of exhaustively discharged batteries freezing.

- ◆ ***Exhaustively discharged batteries freeze at low temperatures, the housing can crack.***
- ◆ ***Batteries that have frozen must no longer be used.***

Discharged sulfated batteries must be charged as follows using a low charging current:

- Adjust the charge current to approximately 5% of the battery capacity, i.e., the charging current for a 60 Ah battery is then approximately 3 ampere.



Note

- ◆ ***The battery voltage must be at least 0.6 V!***
- ◆ ***The -VAS 5903- battery charger automatically detects exhaustively discharged batteries and carefully starts the charging procedure with a low charging current. The charge current is automatically adjusted to the battery charge state.***



Caution

Risk of damaging exhaustively discharged batteries.

- ◆ ***Do not rapid-charge exhaustively discharged batteries.***

- Charge the battery. Refer to [⇒ "1.2.1 Charging The Battery Using VAS 5903", page 2](#).
- The charging voltage may be a maximum of 14.4 V.

 Note

If the battery must be replaced, follow the disposal regulations, refer to ⇒ [page 11](#) .

1.2.3 Rapid Charging The Battery, Vehicles Without Battery Monitoring Control Module -J367- Or Energy Management Control Module -J644-

Procedure

- The battery temperature must be at least +10 °C.



WARNING

Risk of explosion due to open flame, fire and smoking.

- ◆ *On non-maintenance-free batteries, the sealing plugs must be installed tightly.*
- ◆ *Provide sufficient ventilation.*
- ◆ *A highly flammable gas forms when batteries are charged. Never enter rooms where batteries are being charged carrying an open flame or while smoking.*
- ◆ *Follow the battery charger and battery manufacturer safety requirements.*

Risk of explosion on discharged battery with visual indicator.

- ◆ *If the visual indicator has no color or is light yellow, the battery may not be tested or charged. Jump starting must not be used! There is a risk of explosion during testing, charging or jump starting. The battery must be replaced.*

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Caution

Risk of damaging the battery and vehicle electronic components.

- ◆ *Do not rapid charge AGM batteries.*
- ◆ *Do not rapid charge batteries in vehicles with a battery monitoring control module -J367- or energy management control module -J644- .*
- ◆ *Do not rapid-charge exhaustively discharged batteries.*
- ◆ *Rapid-charging of batteries should only be performed in exceptional circumstances (for example, jump starting) since rapid charging may cause damage.*
- ◆ *Battery must not be connected to vehicle electrical system when performing rapid charging. Disconnect the positive and negative cables from the terminals. Refer to⇒ Electrical system; Rep. Gr. 27 ; Removal and Installation .*
- ◆ *The maximum charging voltage is 14.8 volt.*



Note

If the battery must be replaced, follow the disposal regulations, refer to ⇒ [page 11](#) .

1.2.4 Battery Support Mode With -VAS 5903-

Special tools and workshop equipment required

- ◆ Battery Charger VAS 5903 -VAS 5903-

The battery support mode is needed, for example, when taking breaks from fault finding in the workshop or when replacing the battery.

Procedure



Note

- ◆ For more information regarding the battery charger, refer to the Operating Instructions that came with the charger.
- ◆ In the following, the battery support mode is described as an example of -VAS 5900- .
- Switch off ignition and remove ignition key.
- Turn off all electrical consumers.
- Connect the battery charger electrical system connector -VAS 5900- .
- The last selected operating mode appears on the display.
- Press the **Start/Stop** button for approximately 5 seconds.
- The menu selection “Charging severely discharged batteries/ Support mode” is activated.
- Press the **↑** button or the **↓** button in order to adjust the vehicle electrical system.



Note

If no button is pressed within 5 seconds, the -VAS 5900- switches back to the main menu.

- Confirm selected battery voltage with **Start/Stop** button.
- Perform the battery support mode prep work. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Description and Operation .
- The charging clips are checked for connection to correct poles.



Caution

Risk of damaging the -VAS 5900- and vehicle electronic components.

- ◆ If the battery terminal clamps are connected incorrectly, the **Start/Stop** button must not be pressed.

- Confirm charging clips are connected to correct poles via **Start/Stop**.

- The -VAS 5900- starts the assistance mode.
- To end support mode, press the **Start/Stop** button.
- Disconnect the battery charger electrical system connector.

1.2.5 Maintenance Charging With Solar Panel -VAS 6102 A-

Special tools and workshop equipment required

- ◆ Solar Panel -VAS 6102 A-
- ◆ The solar panel -VAS 6102 A- supports the vehicle electrical system and prevents the battery from self-discharging.
- ◆ All chargeable batteries can be charged by the solar panel.
- ◆ The solar panel is connected at the diagnostic connection inside the vehicle. A battery charger may not be connected to the diagnostic connection.

Procedure

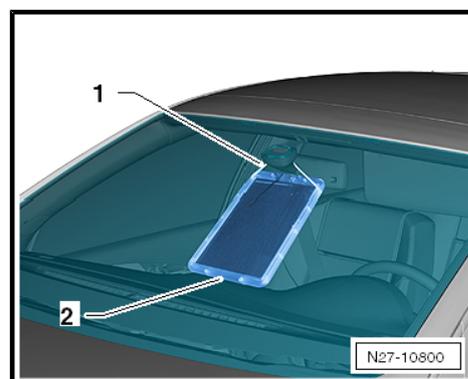


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For more information regarding the solar panel -VAS 6102 A- refer to the Owner's Manual that came with -VAS 6102 A- .

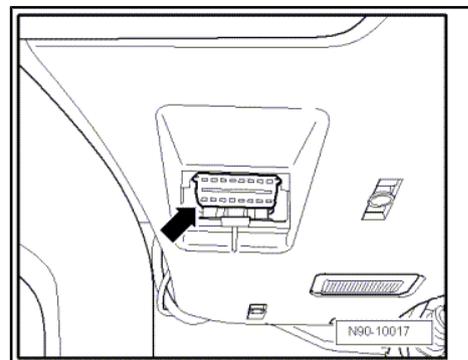
- Secure the solar panel -VAS 6102 A- on the interior rearview mirror -1-.
- Lay the bottom of the solar panel on the instrument panel -2-.



Note

The whole solar panel -VAS 6102 A- may not lie on the instrument panel. Only the bottom edge may be used for support. If it touches completely, the color of the instrument panel could change.

- Pull the securing string together so that the solar panel is close to the windshield.
- Connect the solar panel to the diagnostic connection -arrow-.
- The green LED in the solar panel frame displays the function: The brighter the LED, the higher the charging current. It is not possible to overcharge the battery due to the integrated electronics.



1.3 Cruise Control, Vehicles With Electronic Power Control

- ◆ The function of the Cruise Control System (CCS) is controlled by the Engine Control Module on vehicles with Electronic Power Control (EPC).



- ◆ Malfunctions in relation to CCS are sent via the Engine Control Module (ECM).
- For trouble shooting, use a Vehicle Diagnosis, Testing & Information System -VAS5051B- in the “Guided Fault Finding” function.

1.4 Safety Procedures And Precautions

Before beginning work, the mechanics must be acquainted with the possible risks when handling batteries.



Caution

Personnel instructed in protection, such as a trainee or apprentice, may only perform work on vehicle batteries under the supervision of technical personnel such as a master automotive mechanic or a master automotive electrician.

1.5 Lead-Acid Battery Warnings and Safety Precautions

Recognizing and Preventing Risks

It is dangerous to handle batteries. These risks can be avoided by following the warnings on the battery, in the operating instructions, and in the repair manual.



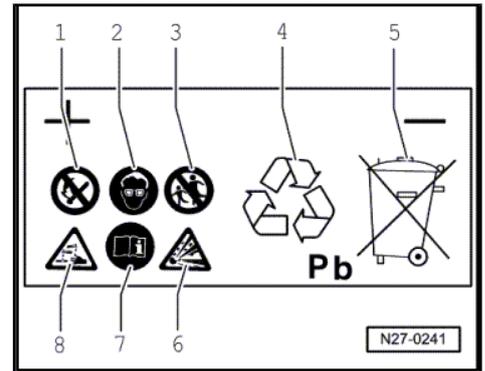
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Explanation Of Battery Symbols

- 1 - When working in the area of the battery, fire, sparks, open light and smoking are prohibited. Avoid sparks from cables, electrical devices and electrostatic discharge. Do not place any tools on the battery to avoid short circuits.
- 2 - Eye protection must be worn when working on the battery.
- 3 - Keep electrolyte and batteries out of the reach of children.
- 4 - Disposal: Old batteries require special disposal. They must only be disposed of in accordance with the legal requirements at an authorized site.
- 5 - Do not dispose of old batteries in household waste.
- 6 - When handling batteries, there is a risk of explosion. Battery charging produces a highly explosive gas mixture.
- 7 - Follow the information regarding batteries in this Repair Manual and in the Owner's Manual.
- 8 - **Battery acid can cause severe burns! Battery acid is severely corrosive so protective gloves and eye wear must be worn when working on the battery. The battery must not be tipped, because acid may spill from the ventilation openings.**



WARNING

There is a risk of injury from the battery acid.

- ◆ *Can cause severe injury to the eyes, skin and mucous membranes.*
- ◆ *Inhalation can damage the respiratory system.*
- ◆ *Swallowing is harmful to the digestive system.*
- ◆ *First Aid: Rinse eyes and immediately consult first aid station or inform doctor.*
- ◆ *Never tilt battery. Electrolyte may leak out of vents.*
- ◆ *Catch spilled acid with a bonding agent, neutralize residue. Suitable remedy is e.g. soap solution.*
- ◆ *Never allow electrolyte to come into contact with bare hands.*
- ◆ *Avoid contact with skin.*
- ◆ *Never touch mouth, nose or eyes with soiled hands.*
- ◆ *Immediately remove electrolyte-contaminated clothing and place in water.*
- ◆ *Do not eat, drink or store food in work areas.*
- ◆ *Wash thoroughly before breaks and on completion of work.*



WARNING

Protect against injury by using protective eyewear and clothing.

- ◆ *Wear safety goggles and an acid-resistant apron or alternatively electrolyte-proof overalls.*
- ◆ *Wear electrolyte-proof gloves.*

**WARNING**

Risk of explosion due to the explosive gas that forms during battery charging.

- ◆ ***The gas resulting from charging and partially when resting after charging is explosive. In extreme cases, if battery is handled inappropriately, the emitted gases may cause the battery to explode.***
- ◆ ***Smoking, open flame, fire and sparks (from sanding, welding or separating work) are prohibited when working near the battery.***
- ◆ ***Avoid short circuits when working with electrical wires and devices. Do not place any tools on the battery.***
- ◆ ***To prevent sparks from forming due to electrostatic discharge, always touch the vehicle body before touching the battery.***

**WARNING**

Protect against explosion.

- ◆ ***On batteries with a visual indicator, the battery must not be tested or charged if the indicator has no color or is light yellow. Jump starting must not be used! There is a risk of explosion during testing, charging or jump starting. The battery must be replaced.***
- ◆ ***Used batteries (lengthy period of use over 6 months) must be treated with an anti-static spray (currently "Neostatic Antistatikum HB 155") prior to handling.***
- ◆ ***In the case of batteries that are not maintenance-free, the sealing plugs must be securely installed when charging the battery.***
- ◆ ***Charging of removed batteries is only permitted while extracting fumes in ventilated cabinets.***
- ◆ ***After charging, the battery must be kept in the area where it was charged for an appropriate time period.***
- ◆ ***Only perform battery procedures in suitable and well-ventilated rooms.***
- ◆ ***Batteries are always to be transported in conductive metal containers.***
- ◆ ***Do not use any materials that can be charged electrostatically.***

**WARNING**

Risk of damage to the vehicle.

- ◆ ***Safety-related vehicle components could be damaged by acid burns and corrosion due to escaping battery acid.***



WARNING

Pollution risk.

- ◆ *Old batteries require special disposal. They contain poisonous lead (Pb) and sulfuric acid.*
- ◆ *Follow disposal requirements, only dispose of used batteries in suitable containers at an authorized collection site.*

1.6 Non Maintenance-Free Batteries, Without Visual Indicator

⇒ ["1.6.1 General Information", page 11](#)

⇒ ["1.6.2 Central Venting System", page 11](#)

⇒ ["1.6.3 Battery Post/Terminal", page 12](#)

⇒ ["1.6.4 Testing", page 12](#)

⇒ ["1.6.5 Visual Check", page 12](#)

⇒ ["1.6.6 Electrolyte Level, Checking", page 13](#)

⇒ ["1.6.7 Acid Density, Measuring", page 14](#)

1.6.1 General Information

Lead acid batteries that are not maintenance-free are filled with fluid electrolyte (wet battery). They have sealing plugs.



WARNING

Risk of injury from direct exposure to battery acid!

- ◆ *Observe warning notes and safety precautions. Refer to ⇒ [page 9](#).*

Risk of explosion due to the explosive gas that forms during battery charging.

- ◆ *Observe warning notes and safety precautions. Refer to ⇒ [page 10](#).*

1.6.2 Central Venting System

To prevent the gas resulting from battery charging from causing damage or putting health at risk, the gas is discharged centrally through an opening on the top cover side of the battery.

- Make sure the central venting hose or tube is always secured on the battery.
- Make sure the central venting hose or tube is not pinched. Only then can battery be properly vented.

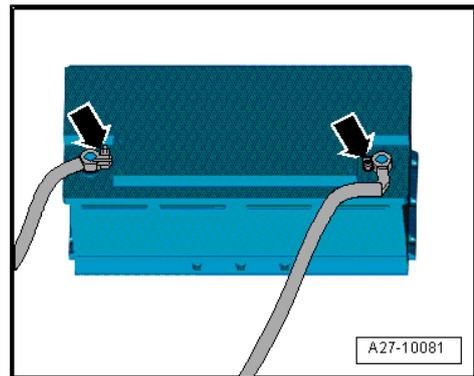
**Note**

Newer generation batteries have a fine mesh flame trap at the central venting exit point. The flame trap is a round fiberglass mat approximately 15 mm wide and 2 mm thick that works like a valve. On the one hand, it allows the gas formed during battery charging to flow out and on the other hand, prevents the explosive gas in the battery from igniting.

1.6.3 Battery Post/Terminal

To prevent damage to the battery terminals and battery housing, observe the following:

- ◆ Do not put any grease on the battery terminals.
- ◆ Battery terminal clamps -arrows- must only be installed by hand without applying force.
- ◆ Install battery terminal clamps so the terminal is flush with the clamp or protrudes out of it.
- ◆ Battery terminal clamps and auxiliary clamps, tightening specification, refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Specifications .
- ◆ After tightening the battery terminal clamps to the specified torque, the threaded connections must not be tightened again.



1.6.4 Testing

**WARNING**

Risk of injury and explosion!

- ◆ Follow all Warnings and Safety Precautions. Refer to ⇒ ["1.5 Lead-Acid Battery Warnings and Safety Precautions", page 8](#) .

Perform Battery Checks In The Following Sequence

1. Visual check. Refer to ⇒ ["1.6.5 Visual Check", page 12](#) .
2. Check the battery electrolyte level. Refer to ⇒ ["1.6.6 Electrolyte Level, Checking", page 13](#) .
3. Battery testing with the Battery tester -VAS 6161- , refer to ⇒ ["4.1.1 Battery Test Using Battery Tester VAS 6161", page 28](#) or measure the battery acid density, refer to ⇒ ["1.6.7 Acid Density, Measuring", page 14](#) .
4. Additional procedure depends on the result of the battery test with the battery tester.

1.6.5 Visual Check

- Before performing extensive measurements, inspect visually.
- ◆ External battery condition;
- ◆ Battery connections;
- ◆ Secure battery seating.



Caution

Risk of explosion, inadequate crash safety, risk of corrosion, shortened service life.

- ◆ *A loose battery retaining bracket can damage the battery housing and allow battery acid to leak.*
- ◆ *A battery that is mounted incorrectly can sustain vibration damage resulting in damage to the battery plates.*
- ◆ *Tighten retaining bracket bolt; tightening specification, refer to → *Electrical Equipment; Rep. Gr. 27; Specifications*.*

Risk of malfunction in the electrical system or wiring burn.

- ◆ *The wiring connection contact is not guaranteed if the battery terminals are damaged or the battery terminal clamps are loose. Check the condition of the battery terminals; battery terminal clamp and auxiliary clamp tightening specification. Refer to → *Electrical Equipment; Rep. Gr. 27; Specifications*.*
- ◆ *Risk of corrosion due to leaking battery acid.*
- ◆ *To ensure that the various battery connection systems are free of leaks, the battery's original sealing plugs must be installed in the battery openings. Only replace missing or damaged sealing plugs with the same type of original plugs.*
- ◆ *The sealing plugs must be equipped with an O-ring.*

1.6.6 Electrolyte Level, Checking

Procedure

Maintaining the correct electrolyte level in the battery is an important factor affecting the length of the battery's service life.



WARNING

Risk of injury from direct exposure to battery acid.

- ◆ *Follow accident prevention regulations when working with battery acid. Refer to → [page 9](#).*
- ◆ *Wear protective eyewear and clothing. Refer to → [page 9](#).*

Risk of explosion due to open flame, fire and smoking.

- ◆ *Only illuminate the inside of the battery housing with a flashlight.*
- ◆ *Never illuminate the inside of the battery housing with an open flame.*
- ◆ *Never handle open flame or burning cigarettes near batteries.*

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– If the “Min” and “Max” marking on the outside of the battery can be seen, simply inspect by sight.

- The electrolyte level must be above the “Min” marking but must only go as high as the “Max” marking.
- If it is difficult to see the “Min” and “Max” markings on the outside of the battery or they cannot be seen because the battery housing is opaque, remove the sealing plugs.

- Check electrolyte level by visually checking the inside of the battery.
- The electrolyte level must coincide with the internal level mark (plastic web). This corresponds to the outer "Max" marking.

**Caution**

Risk of corrosion due to leaking battery acid.

- ◆ *To ensure that the various battery connection systems are free of leaks, the battery's original sealing plugs must be installed in the battery openings. Only replace missing or damaged sealing plugs with the same type of original plugs.*
- ◆ *The sealing plugs must be equipped with an O-ring.*
- ◆ *If the acid level is too low, the battery must be replaced. Do not add distilled water.*

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- Screw in the sealing plugs of battery cells.

1.6.7 Acid Density, Measuring

Special tools and workshop equipment required

- ◆ Refractometer -T10007- or
- ◆ Commercially Available Hydrometer

Procedure

In conjunction with the battery test using the Battery tester - VAS 6161- , refer to [⇒ "4.1.1 Battery Test Using Battery Tester VAS 6161 "](#), [page 28](#) , the acid density test provides information about the condition of the battery.

- The temperature of the battery acid must be at least +10° C (50° F).

**WARNING**

Risk of injury from direct exposure to battery acid.

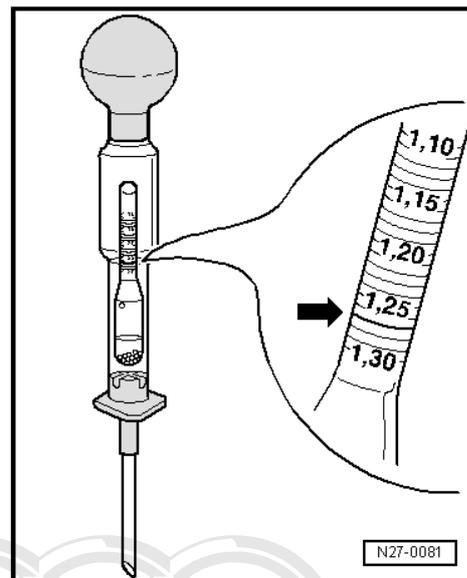
- ◆ *Follow accident prevention regulations when working with battery acid. Refer to [⇒ page 9](#) .*
- ◆ *Wear protective eyewear and clothing. Refer to [⇒ page 9](#) .*

**Note**

Specific density of the electrolyte can be checked immediately after charging battery.

- Remove all sealing plugs of battery cells.

- Dip hydrometer into battery cell and siphon off enough electrolyte until the float floats freely in electrolyte.
- ◆ The higher the specific weight of the siphoned battery acid, the higher the float will float.
- ◆ The acid density of the electrolyte can be read off in kg/dm³ on the hydrometer scale (specific density of the battery acid).
- Compare hydrometer reading to values given in table.



Charge condition	Acid Density in kg/dm ³	
	In Normal Climates	In The Tropics
Discharged	1.12	1.08
Partial charge	1.20	1.16
Fully charged	1.28	1.23

Specific acid density must be at least 1.24 kg/dm³ in moderate climate zones. If the acid density in all battery cells is too low:

- Charge battery and repeat acid density test.

Example 1						
Battery cell	1	2	3	4	5	6
Acid density per battery cell in kg/dm ³	1.24	1.25	1.25	1.10 ¹⁾	1.24	1.25
• ¹⁾ The acid density in battery cell 4 is too low (deviation greater than 0.03 kg/dm ³).						

Example 2						
Battery cell	1	2	3	4	5	6
Acid density per battery cell in kg/dm ³	1.26	1.26	1.25	1.14 ¹⁾	1.18 ¹⁾	1.24
• ¹⁾ The acid density in battery cells 4 and 5 is too low (deviation greater than 0.03 kg/dm ³).						

- If the specified values are not reached, replace the battery.

 **Note**

The measured values for the specific density of the individual battery cells must not deviate by more than 0.03 kg/dm³, otherwise the battery should be replaced.

 **Caution**

Risk due to leaking battery acid.

- ◆ **To ensure that the various battery connection systems are free of leaks, the battery's original sealing plugs must be installed in the battery openings. Only replace missing or damaged sealing plugs with the same type of original plugs.**
- ◆ **The sealing plugs must be equipped with an O-ring.**

- If the specified values are reached, reinstall the sealing plugs on the battery cells.



Note

If the battery must be replaced, follow the disposal regulations.
Refer to ⇒ [page 11](#) .

1.7 Maintenance-Free Battery

⇒ ["1.7.1 General Information", page 16](#)

⇒ ["1.7.2 Battery With Visual Indicator ", page 16](#)

⇒ ["1.7.3 Battery with Visual Indicator, Checking", page 17](#)

⇒ ["1.7.4 Absorbent Glass Mat \(AGM\) Battery, Without Visual Indicator", page 17](#)

⇒ ["1.7.5 Absorbent Glass Mat \(AGM\) Battery, Checking", page 18](#)

⇒ ["1.7.6 Central Venting System", page 18](#)

⇒ ["1.7.7 Battery Post/Terminal", page 18](#)

⇒ ["1.7.8 Visual Check", page 19](#)

⇒ ["1.7.9 Electrolyte Level Color, Checking", page 20](#)

⇒ ["1.7.10 Electrolyte Level, Checking", page 20](#)

1.7.1 General Information

Only maintenance-free batteries conforming to standards "TL82506" (as of December 1997) and "VW75073" (as of August 2001) may be installed.



WARNING

Risk of injury due to contact with battery acid!

- ◆ *Observe warning notes and safety precautions. Refer to ⇒ [page 9](#) .*

Risk of explosion due to the explosive gas that forms during battery charging.

- ◆ *Observe warning notes and safety precautions. Refer to ⇒ [page 10](#) .*

1.7.2 Battery With Visual Indicator

Lead acid batteries with visual indicators are filled with fluid electrolyte (wet battery). They do not have sealing plugs for filling with distilled water.

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Note

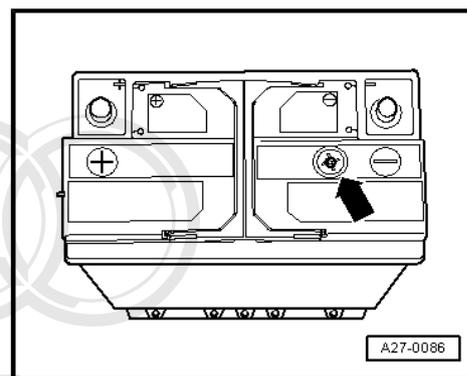
- ◆ *If batteries with a visual indicator are equipped with sealing plugs for production reasons, the plugs are covered with plastic sheeting.*
- ◆ *The covering must not be removed and distilled water must not be added.*
- ◆ *Only perform a visual inspection.*

The visual indicator -arrow- gives information about the electrolyte level and charge condition of the battery by means of a color display. Possible color displays, refer to ⇒ "1.7.2 Battery With Visual Indicator ", page 16 .

 **WARNING**

Risk of explosion on discharged battery with visual indicator.

- ◆ *Do not test or charge a battery if the visual indicator has no color or is light yellow. Jump starting must not be used! There is a risk of explosion during testing, charging or jump starting. The battery must be replaced.*



1.7.3 Battery with Visual Indicator, Checking

 **WARNING**

Risk of injury and explosion!

- ◆ *Follow all Warnings and Safety Precautions. Refer to ⇒ "1.5 Lead-Acid Battery Warnings and Safety Precautions", page 8 .*

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Perform Battery Checks In The Following Sequence

1. Visual check. Refer to ⇒ "1.6.5 Visual Check", page 12 .
2. Check the color of the visual indicator. Refer to ⇒ "1.7.9 Electrolyte Level Color, Checking", page 20 .
3. Check the battery electrolyte level. Refer to ⇒ "1.7.10 Electrolyte Level, Checking", page 20 .
4. Test the battery. Refer to ⇒ "4.1 Battery, Checking - Vehicles Without A Battery Monitoring Control Module J367 or Energy Management Control Module J644 ", page 28 or ⇒ "4.2.3 Current Draw Test", page 35 .
5. Additional procedure depends on the result of the battery test with the battery tester.

1.7.4 Absorbent Glass Mat (AGM) Battery, Without Visual Indicator

- ◆ AGM batteries are deep cycle-resistant and leak-proof.
- ◆ Lead-acid batteries, or AGM batteries, are filled with electrolyte contained in an absorbent glass mat ("A"bsorbent "G"lass "M"at = AGM). The battery is closed and equipped with breather valves.
- ◆ These batteries cannot have a "visual indicator" due to the fixed electrolyte. AGM batteries are marked with "AGM" on the battery.

Note

- ◆ *AGM batteries cannot and must not be opened and distilled water must not be added.*
- ◆ *Only perform a visual inspection.*

**Caution**

Crash safety is inadequate if the incorrect battery is installed.

- ◆ *If the vehicle was originally equipped with an AGM battery, another AGM battery must be installed when replacing.*

1.7.5 Absorbent Glass Mat (AGM) Battery, Checking

**WARNING**

Risk of injury and explosion!

- ◆ *Follow all Warnings and Safety Precautions. Refer to ⇒ ["1.5 Lead-Acid Battery Warnings and Safety Precautions"](#), page 8 .*

Perform Battery Checks In The Following Sequence

1. Visual check. Refer to ⇒ ["1.6.5 Visual Check"](#), page 12 .
2. Test the battery. Refer to ⇒ ["4.1 Battery, Checking - Vehicles Without A Battery Monitoring Control Module J367 or Energy Management Control Module J644"](#), page 28 or ⇒ ["4.2.3 Current Draw Test"](#), page 35 .
3. Additional procedure depends on the result of the battery test with the battery tester.

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1.7.6 Central Venting System

To prevent the gas that forms in the engine compartment or vehicle interior during battery charging from causing damage or posing a threat to health, the gas is discharged centrally through an opening on the top cover side of the battery.

- Make sure the central venting hose or tube is always secured on the battery.
- Make sure the central venting hose or tube is not pinched. Only then can battery be properly vented.

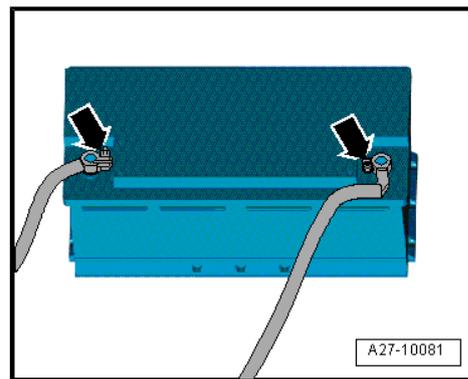
**Note**

Newer generation batteries have a fine mesh flame trap at the central venting exit point. The flame trap is a round fiberglass mat approximately 15 mm wide and 2 mm thick that works like a valve. On the one hand, it allows the gas formed during battery charging to flow out and on the other hand, prevents the explosive gas in the battery from igniting.

1.7.7 Battery Post/Terminal

To prevent damage to the battery terminals and battery housing, observe the following:

- ◆ Do not put any grease on the battery terminals.
- ◆ Battery terminal clamps -arrows- must only be installed by hand without applying force.
- ◆ Install battery terminal clamps so the terminal is flush with the clamp or protrudes out of it.
- ◆ Battery terminal clamps and auxiliary clamps, tightening specification. Refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Specifications .
- ◆ After tightening the battery terminal clamps to the specified torque, the threaded connections must not be tightened again.



1.7.8 Visual Check

- Before performing extensive measurements, inspect visually.
- ◆ External battery condition;
- ◆ Battery connections;
- ◆ Secure battery seating.



Caution

Risk of explosion, inadequate crash safety, risk of corrosion, shortened service life.

- ◆ *A loose battery retaining bracket can damage the battery housing and allow battery acid to leak.*
- ◆ *A battery that is mounted incorrectly can sustain vibration damage resulting in damage to the battery plates.*
- ◆ *Tighten retaining bracket bolt; tightening specification, refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Specifications .*

Risk of malfunction in the electrical system or wiring burn.

- ◆ *The wiring connection contact is not guaranteed if the battery terminals are damaged or the battery terminal clamps are loose. Check the condition of the battery terminals; battery terminal clamp and auxiliary clamp tightening specification. Refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Specifications .*

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1.7.9 Electrolyte Level Color, Checking

Procedure



Note

Because the visual indicator is located in only one battery cell, the battery acid level is only checked for that cell.

- To obtain an accurate reading, gently tap the visual indicator -arrow- with a screwdriver handle.



Note

When charging the battery and while driving, air bubbles can form below the visual indicator and result in an incorrect color display. Tapping releases the air bubbles under the visual indicator.

- Check the battery acid level using the color indicator. Two different displays are possible:

Color Indication	Battery Charge Condition
Black or green	• Battery acid level OK
Colorless or bright yellow	• Battery acid level too low. Risk of explosion, the battery must not be tested or charged.



WARNING

Risk of explosion on discharged battery with visual indicator.

- ◆ *If the visual indicator has no color or is light yellow, the battery may not be tested or charged. Jump starting must not be used! There is a risk of explosion during testing, charging or jump starting. The battery must be replaced.*



Note

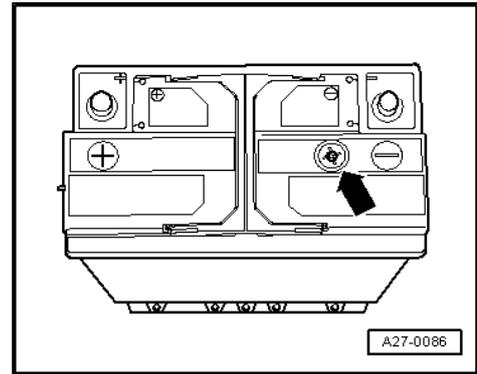
If the battery must be replaced, follow the disposal regulations. Refer to ⇒ [page 11](#) .

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1.7.10 Electrolyte Level, Checking

Procedure

Maintaining the correct electrolyte level in the battery is an important factor affecting the length of the battery's service life.





WARNING

Risk of injury due to contact with battery acid.

- ◆ *Follow accident prevention regulations when working with battery acid. Refer to ⇒ [page 9](#) .*
- ◆ *Wear protective eyewear and clothing. Refer to ⇒ [page 9](#) .*
- ◆ *If the electrolyte level is too low, the battery must be replaced. It must not be opened and distilled water must not be added.*

Risk of explosion due to open flame, fire and smoking.

- ◆ *Never handle open flame or burning cigarettes near batteries.*

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- If the “Min” and “Max” marking on the outside of the battery can be seen, simply inspect by sight.
- The electrolyte level must be above the “Min” marking but must only go as high as the “Max” marking.

2 Description and Operation

⇒ "2.1 Bosch Generator Overview, Through 2000", page 22

⇒ "2.2 Bosch Generator Overview, From 2001", page 23

⇒ "2.3 Bosch Generator Overview, From 2007", page 24

⇒ "2.4 Valeo Generator Overview, Through 2000", page 25

⇒ "2.5 Valeo Generator Overview, From 2001", page 26

2.1 Bosch Generator Overview, Through 2000

1 - Bolts

- 1 Nm

2 - Cover

- With 3 retaining tabs

3 - Bolts

- 2 Nm

4 - Voltage Regulator

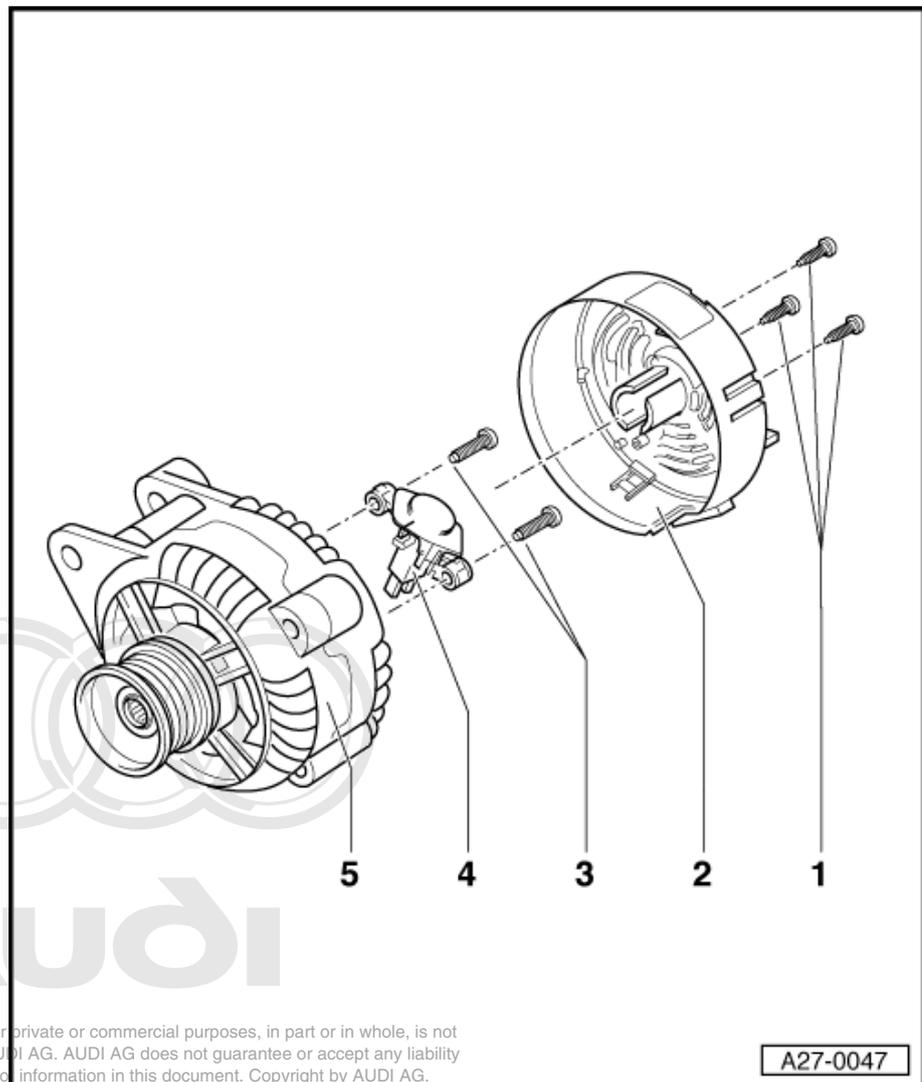
- Removing:

- Remove bolts -item 1- and remove protective cap -item 2-.

- Remove the bolts -item 3- and remove the voltage regulator.

- Carbon brush wear limit: 5 mm

5 - Generator



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2.2 Bosch Generator Overview, From 2001

Note

The generators were implemented as a running change.

1 - Generator

2 - Voltage Regulator

- Removing and installing, refer to
⇒ ["5.1 Voltage Regulator, Bosch Generator, From 2001", page 40](#) .
- Carbon brushes, checking, refer to
⇒ ["4.4 Carbon Brush, Checking, Bosch Generators From 2001", page 38](#) .

3 - Screw

- 2.5 Nm

4 - Cover

5 - Nut

- 12 Nm

6 - Nut

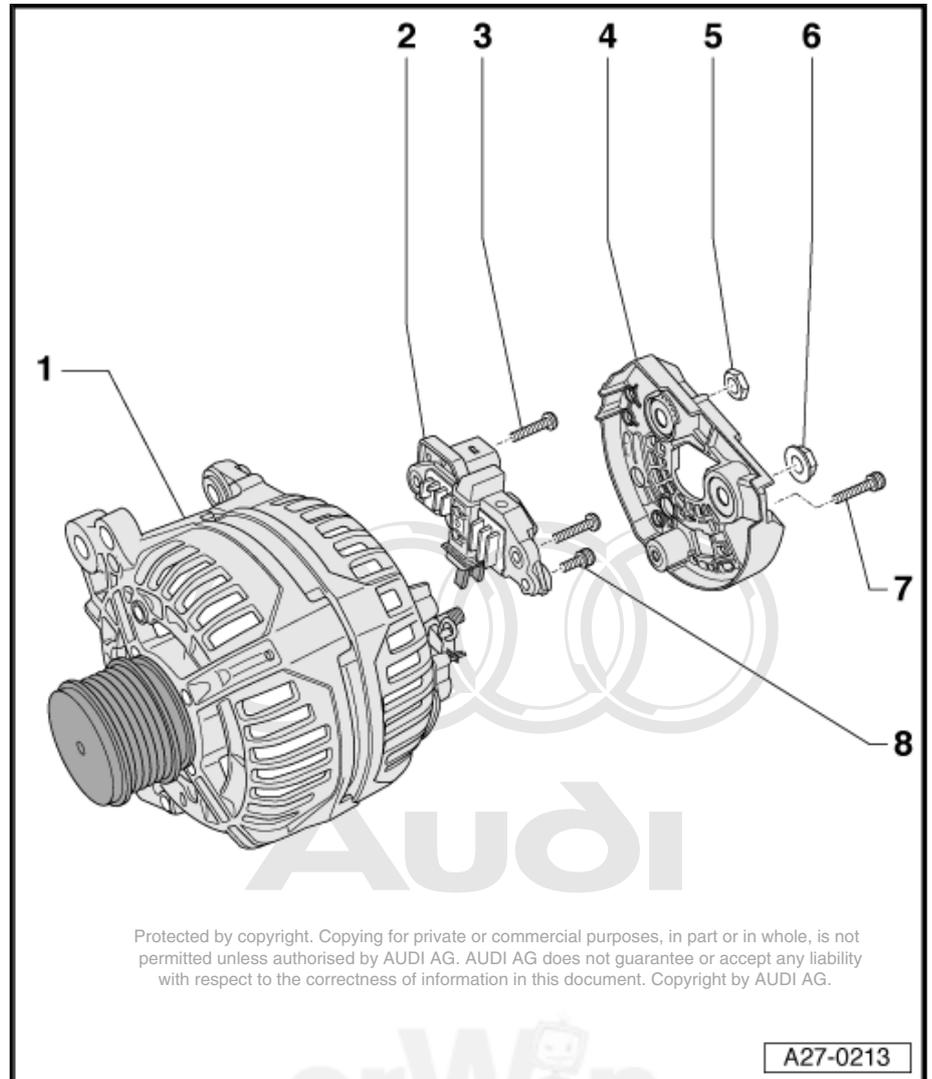
- 30 Nm

7 - Screw

- 3 Nm

8 - Screw

- 1.5 Nm



2.3 Bosch Generator Overview, From 2007

Note

The new generators are installed as a running change.

1 - Nut

- 65 Nm

2 - Ribbed Belt Pulley

3 - Generator

4 - Voltage Regulator

- Removing and installing, refer to [⇒ "5.2 Voltage Regulator, Bosch Generator, From 2007", page 40](#) .
- Carbon brushes, checking, refer to [⇒ "4.4 Carbon Brush, Checking, Bosch Generators From 2001", page 38](#) .

5 - Screw

- 1.5 Nm

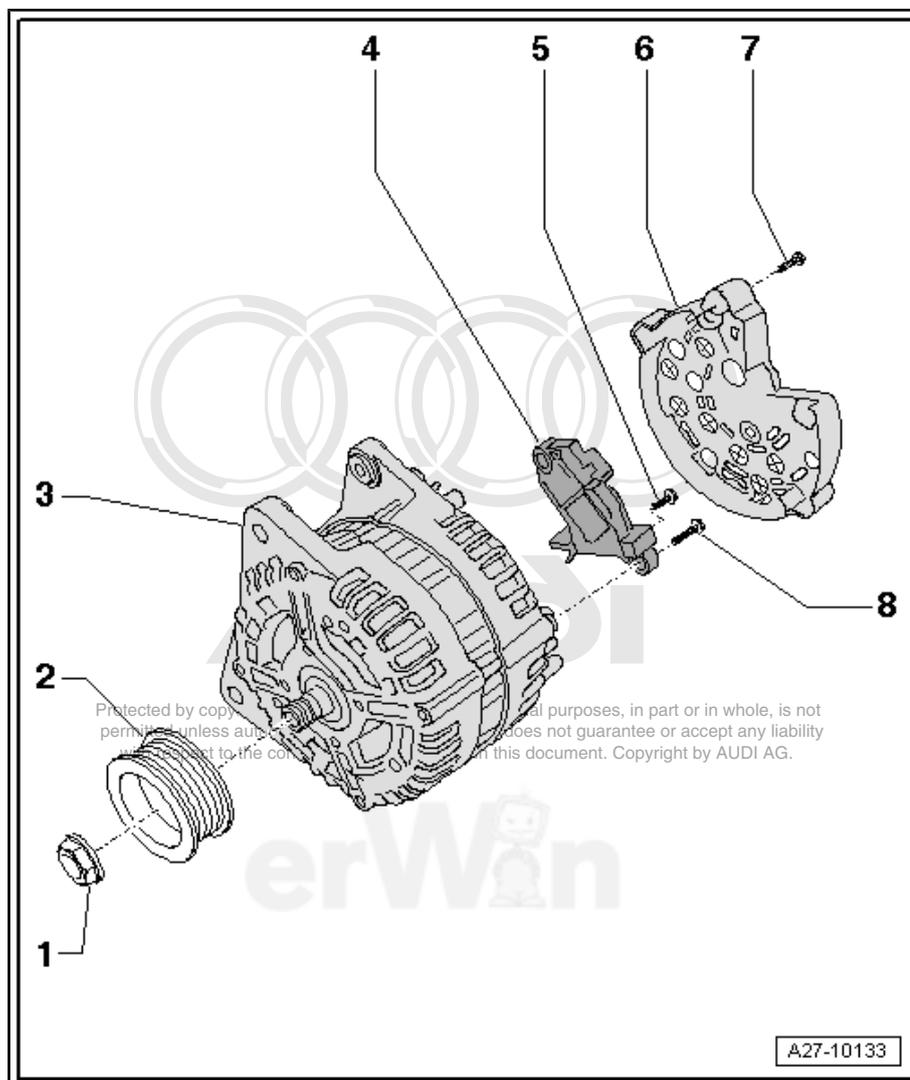
6 - Cover

7 - Screw

- 3 Nm

8 - Screw

- 2.5 Nm



2.4 Valeo Generator Overview, Through 2000

1 - Generator

2 - Voltage Regulator

- Removing:
- Remove the nuts -item 5- and cover -item 4-.
- Remove the bolt -item 6- and nuts -item 7- and remove the voltage regulator.

- Carbon brush wear limit: 5 mm

3 - Protective Cap

4 - Cover

5 - Nut

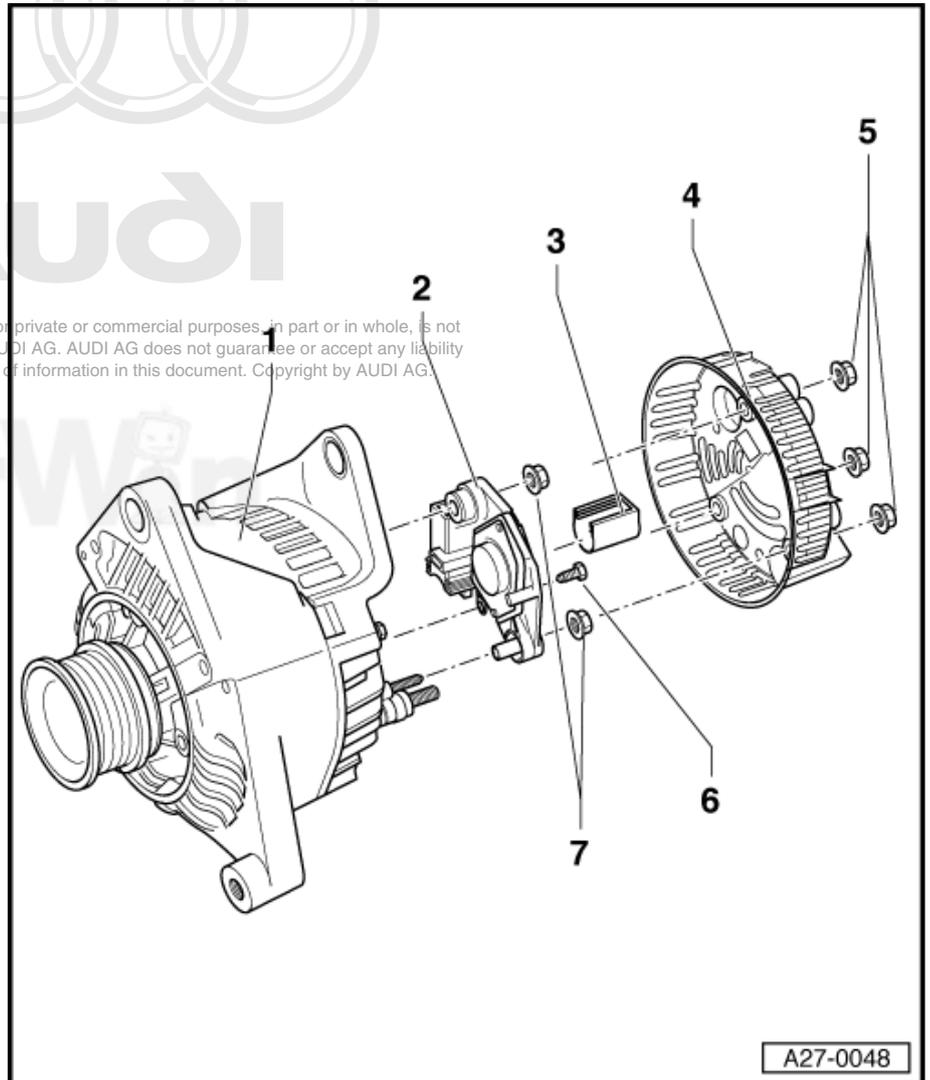
- 2 Nm

6 - Screw

- 2 Nm

7 - Nut

- 3.5 Nm
- Quantity 2



2.5 Valeo Generator Overview, From 2001



Note

The generators were implemented as a running change.

1 - Generator

2 - Voltage Regulator

- ❑ Removing and installing, refer to one of the following:

Through MY 07, refer to
⇒ [“5.3 Voltage Regulator, Valeo Generator, From 2001”](#), page 41 .

From MY 07, refer to
⇒ [“5.4 Voltage Regulator, Valeo Generator, From 2007”](#), page 42 .

- ❑ Carbon brush, checking, refer to one of the following:

Through MY 07, refer to
⇒ [“4.5 Carbon Brush Checking, Valeo Generator, From 2001”](#), page 38 .

From MY 07, refer to
⇒ [“4.6 Carbon Brush Checking, Valeo Generator, From 2007”](#), page 38 .

3 - Screw

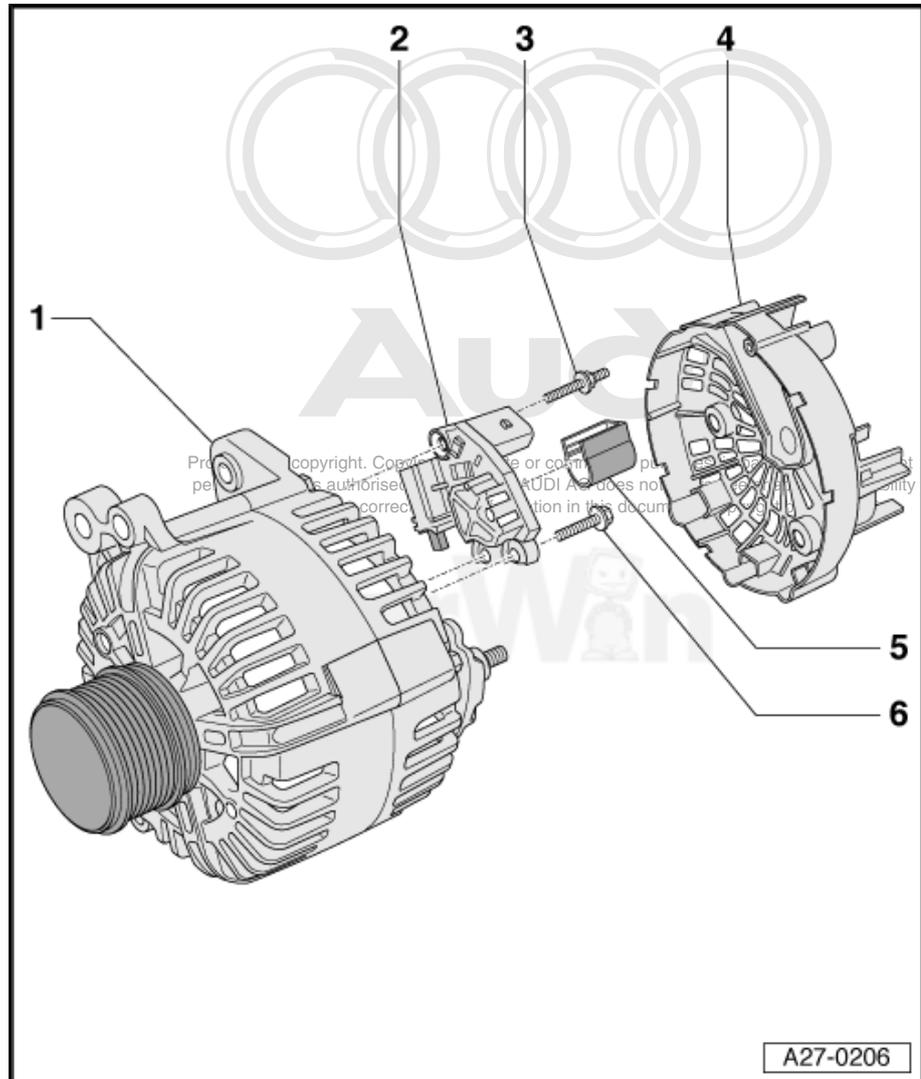
- ❑ 2 Nm

4 - Cover

5 - Protective Cap

6 - Screw

- ❑ 2 Nm



3 Specifications

⇒ ["3.1 Fastener Tightening Specifications", page 27](#)

3.1 Fastener Tightening Specifications

Component	Nm
Pulley (with freewheel) to generator	80
Pulley (without freewheel) to generator	65
Bosch Generator, Through 2000	
Cover to Generator Screw	1
Voltage Regulator to Generator Screw	2
Bosch Generator, from 2001	
Cover to Generator Nut ¹	12
	30
Cover to Generator Screw	3
Voltage Regulator to Generator Screw ²	2.5
	1.5
Bosch Generator, from 2007	
Cover to Generator Screw	3
Pulley to Generator Shaft Nut	65
Voltage Regulator to Generator Screw ³	2.5
	1.5
Valeo Generator, through 2000	
Cover to Generator Nut	2
Voltage Regulator to Generator Nut	3.5
Voltage Regulator to Generator Screw	2
Valeo Generator, from 2001	
Voltage Regulator to Generator Stud Bolt/Screw	2
<ul style="list-style-type: none"> • ¹For clarification of the nuts, refer to items -5 and 6- in ⇒ "2.2 Bosch Generator Overview, From 2001", page 23 • ² For clarification of the screws, refer to items -3 and 8- in ⇒ "2.2 Bosch Generator Overview, From 2001", page 23 • ³ For clarification of the screws, refer to items -5 and 8- in ⇒ "2.3 Bosch Generator Overview, From 2007", page 24 	

4 Diagnosis and Testing

⇒ ["4.1 Battery, Checking - Vehicles Without A Battery Monitoring Control Module J367 or Energy Management Control Module J644 ", page 28](#)

⇒ ["4.2 Battery Checking - Vehicles With A Battery Monitoring Control Module J367 Or Energy Management Control Module J644 ", page 34](#)

⇒ ["4.3 Generator, Checking", page 37](#)

⇒ ["4.4 Carbon Brush, Checking, Bosch Generators From 2001", page 38](#)

⇒ ["4.5 Carbon Brush Checking, Valeo Generator, From 2001", page 38](#)

⇒ ["4.6 Carbon Brush Checking, Valeo Generator, From 2007", page 38](#)

4.1 Battery, Checking - Vehicles Without A Battery Monitoring Control Module - J367- or Energy Management Control Module -J644-

⇒ ["4.1.1 Battery Test Using Battery Tester VAS 6161 ", page 28](#)

⇒ ["4.1.2 Measuring No Load Voltage", page 32](#)

⇒ ["4.1.3 Current Draw Test ", page 33](#)

4.1.1 Battery Test Using Battery Tester - VAS 6161-

Special tools and workshop equipment required

- ◆ Battery Tester -VAS 6161-

Maintenance-free batteries must not be opened. Otherwise, the warranty is voided.

- ◆ When performing the battery test with the -VAS 6161- , the battery ground wire must not be disconnected.
- ◆ When using the -VAS 6161- the battery is no longer being charged. The principle of dynamic conductivity measurement is applied. As a result, numerous measurements are possible without recharging the battery.
- ◆ The no-load voltage measurement can be performed without a waiting period.
- ◆ All battery types are stored in the device. They can be refreshed by performing an update.
- ◆ The battery barcode can be directly recorded via the optional 2D scanner.
- ◆ The integrated temperature sensor increases the quality of the measurements.
- ◆ The data can be stored on a SD memory card.



Note

Information about the -VAS 6161- refer to the operating instructions.

 Note

Using the -VAS 6161- , refer to the operating instructions.

Procedure

- The battery temperature must be at least +10° C (50 °F).

 **WARNING**

There is a risk of injury from the battery acid.

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- ◆ *Follow accident prevention regulations when working with battery acid. Refer to ⇒ [page 9](#) .*
- ◆ *Wear protective eyewear and clothing. Refer to ⇒ [page 9](#) .*
- ◆ *On non-maintenance-free batteries, the sealing plugs must always be firmly tightened during the voltage under load measurement.*

Risk of explosion on discharged battery with visual indicator.

- ◆ *If the visual indicator has no color or is light yellow, the battery may not be tested or charged. Jump starting must not be used! There is a risk of explosion during testing, charging or jump starting. The battery must be replaced.*

- Turn off the ignition and all electrical consumers.
- On a battery with a visual indicator, check its color display. Refer to ⇒ [“1.7.9 Electrolyte Level Color, Checking”, page 20](#) .
- Switch on the -VAS 6161- .
- Clamp the red battery tester test clamp “+” to the battery positive terminal or the jump start terminal in the engine compartment.
- Clamp the black battery tester test clamp “-” to the battery ground terminal or the jump start terminal in the engine compartment.

 Note

Make sure the test clamps make good contact!

- Select one of the following:
 - ◆ Maintenance test
 - ◆ Service test
 - ◆ Warranty test

Maintenance test

- Select “Maintenance Test”.
- Connect the scanner and scan in the vehicle identification number.
- Select the connection type: “at the battery terminal” or “at the jump start terminal”.
- Section vehicle model.



- Scan in the battery barcode.
- To determine the temperature, hold the temperature sensor approximately 5 cm above the battery or the jump start terminal until a constant temperature is shown.
- Start the test.
- When necessary, print out the test protocol.

Service test

- Select "Service Test".
- Section vehicle model.
- To determine the temperature, hold the temperature sensor approximately 5 cm above the battery until a constant temperature is shown.
- Select the type of battery: "Standard", "AGM", "2*6V" or "Gel".
- Select the standard: "CCA", "JIS", "DIN", "SAE", "IEC" or "EN".
- Start the test.
- When necessary, print out the test protocol.

Warranty test

- Select "Warranty Test".
- Select the installation location: "inside the vehicle" or "outside the vehicle".
- Section vehicle model.
- To determine the temperature, hold the temperature sensor approximately 5 cm above the battery until a constant temperature is shown.
- Select the type of battery: "Standard", "AGM", "2*6V" or "Gel".
- Select the appropriate capacity with the arrow buttons.
- Start the test.
- When necessary, print out the test protocol.



Note

The printed test results are required for warranty claims.

- Switch off the battery tester.
- Remove the test clamps.



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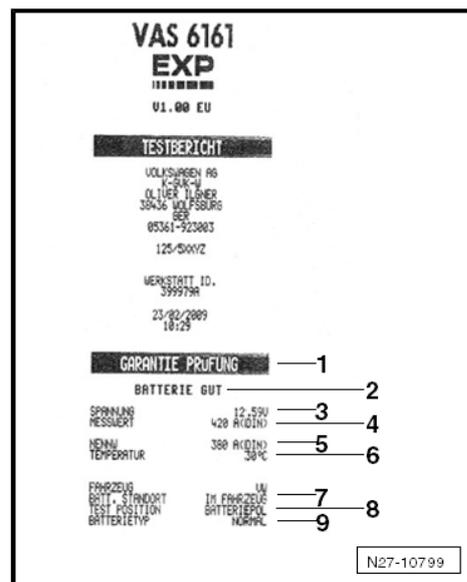
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Test Result On The Printout

- 1 - Type of test
- 2 - Test result
- 3 - Measured voltage
- 4 - Measured nominal value of the battery
- 5 - Battery nominal value set at the tester
- 6 - Temperature measured above the battery
- 7 - Battery installed location
- 8 - Location of the battery terminal set at the tester
- 9 - Set battery type

Result of the Maintenance Test	Measures
Batter good	Battery OK.
Charge the battery immediately	Charge the battery completely. Refer to "1.2.1 Charging The Battery Using VAS 5903" , page 2 and test again. Errors can occur if the battery is not fully charged and is retested.
Mark as defective	Mark as "defective" and remove from the vehicle
Check the tester connection	Disconnect the battery and test again. The result "check the tester connection" can occur because the cable contact is weak.
Check the connection	Connect the cable directly to the battery and not to the battery jump start terminal.



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Results of the Service Test and Warranty Test	Measures
Batter good	Battery OK.
Battery good - recharge	Charge the battery completely, refer to ⇒ "1.2.1 Charging The Battery Using VAS 5903", page 2 . If necessary, search for the cause of the discharging
Perform a current draw test	Perform a current draw test, refer to ⇒ "4.1.3 Current Draw Test", page 33 . Charge the battery completely. Refer to ⇒ "1.2.1 Charging The Battery Using VAS 5903", page 2 and test again.
Replace the battery	Disconnect the battery and test again. The result "replace the battery" can occur due to a weak cable contact.
Battery cell faulty - replace	Replace the battery
Battery frozen	Thaw the battery and perform the test again
Check the connection	Connect the cable directly to the battery and not to the battery jump start terminal.

**Note**

If the battery must be replaced, follow the disposal regulations. Refer to ⇒ [page 11](#) .

4.1.2 Measuring No Load Voltage

Special tools and workshop equipment required

- ◆ Hand-Held Multimeter -V.A.G 1526E-

Maintenance-free batteries must not be opened. Otherwise, the warranty is voided.

**Note**

Measuring the no-load voltage, for example, during the prescribed maintenance and service work on vehicles in storage, determines whether the battery must be recharged. Refer to *Maintenance Intervals Rep. Gr. 03*.

Procedure

To ensure a correct measurement, the following points must be followed.

- Battery must not be loaded by electrical consumers within the next 2 hours before measurement.
- After battery charging or engine operation, the measurement can be performed only after a 12 hour waiting period.
- The battery temperature must be at least 10° C (50 °F).

After a waiting period of at least 12 hours:

- Measure the voltage between the battery terminal clamps.
- Specified value: 12.5 volts or higher, the battery is OK.
- If the no-load voltage is under 12.5 volts, the battery must be recharged. Refer to
⇒ ["1.2.1 Charging The Battery Using VAS 5903 "](#), [page 2](#) .
- After charging for 5 minutes, the current draw must be measured again. Refer to
⇒ ["4.1.3 Current Draw Test "](#), [page 33](#) .
- If the battery no-load voltage is 11.6 volts or lower, the battery is exhaustively discharged. Refer to ⇒ [page 3](#) .

4.1.3 Current Draw Test

Special tools and workshop equipment required

- ◆ Battery Charger VAS 5903 -VAS 5903-

Maintenance-free batteries must not be opened. Otherwise, the warranty is voided.

By checking a battery's current draw capacity during charging, a decision can be quickly made as to whether a partially or exhaustively discharged battery, refer to
⇒ ["1.2.2 Exhaustively Discharged Battery"](#), [page 3](#) can be made usable again by recharging or if it must be replaced.



Note

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- ◆ *When charging with the battery charger, -VAS 5903-, displays the current draw on the device.*
- ◆ *For more information regarding the battery charger, refer to the Operating Instructions that came with the charger.*

Procedure

- The battery temperature must be at least +10° C (50 °F).
- The battery charger must be able to deliver at least 30 amps (A), as with the battery charger -VAS 5903- .
- Battery charger connected and switched on.
- Measure the battery charge current after 5 minutes of charging.
- Specified value: The charge current must be higher than 10% of the nominal capacity.
- Example: Charge current on a 60 Ah battery after 5 minutes of charging: greater than 6 A.
- If the target value is reached, proceed with the charging operation until the battery is fully charged.
- Then test the battery with the battery tester:
- ◆ With the Battery tester -VAS 6161- without waiting period, refer to
⇒ ["4.1.1 Battery Test Using Battery Tester VAS 6161 "](#), [page 28](#) .
- If the specified value is not met, replace the battery. Refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .



Note

If the battery must be replaced, follow the disposal regulations.
Refer to ⇒ [page 11](#) .

4.2 Battery Checking - Vehicles With A Battery Monitoring Control Module -J367- Or Energy Management Control Module -J644-

⇒ ["4.2.1 General Information", page 34](#)

⇒ ["4.2.2 Battery Test with Vehicle Diagnosis Tester -", page 34](#)

⇒ ["4.2.3 Current Draw Test", page 35](#)

⇒ ["4.2.4 Measuring No-Load Voltage, Transport Mode Not Active", page 36](#)

⇒ ["4.2.5 Measuring No-Load Voltage, Transport Mode Active", page 37](#)

4.2.1 General Information

- ◆ In certain model series the following is responsible for monitoring the electrical system: energy management control module -J644- or battery monitoring control module -J367- in connection with the data bus on board diagnostic interface - J533- ; allocation, refer to ⇒ Wiring diagrams, Troubleshooting & Component locations. The battery test for these vehicles is performed during "Guided Fault Finding".
- ◆ If the battery test is not possible with "Guided Fault Finding" due to a partially or exhaustively discharged battery, the battery can be quickly evaluated with the help of the "current draw test".
- ◆ Maintenance-free batteries must not be opened. Otherwise, the warranty is voided.

4.2.2 Battery Test with Vehicle Diagnosis Tester -

Special tools and workshop equipment required

- ◆ Vehicle tester

Procedure

- No charging unit must be connected when checking the battery, and the engine must not be running.
- The battery temperature must be at least -10°C (14°F).
- Diagnostic system temperature must be between $+5$ and 45°C (41 and 113°F).
- Connect the Vehicle Diagnosis Tester. Refer to ⇒ ["1.6.2 Connecting the Vehicle Diagnosis Tester", page 85](#) .



Note

If a malfunction message appears in the display, refer to the Vehicle Diagnosis Tester Operating Instructions.

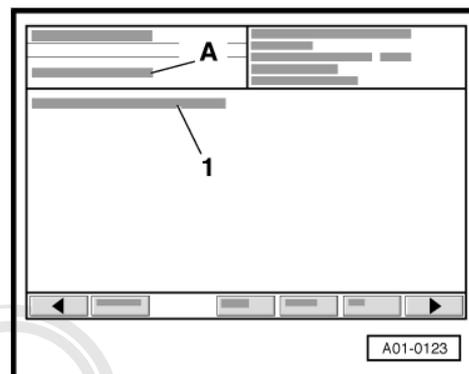
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- Press the **Guided Functions** button in the selection.

Display for example:

- Enter vehicle identification number by selecting -A- and the appropriate text line -1-.
- Select the function or path:

Vehicle brand
Engine codes
61 - Battery regulation or 19 - data bus on board diagnostic interface or service work
A - Battery, checking, Repair Group 27



- Follow the instructions on the Vehicle Diagnosis Tester display. The following results can be displayed:

- Battery is OK.
- Charge battery.
- Replace battery.

After battery check:

- Press the **GO TO** button.
- Select function “Exit”.
- Switch ignition off and **disconnect diagnostic connector**.
- If necessary, charge the battery. Refer to ⇒ [“1.2.1 Charging The Battery Using VAS 5903”, page 2](#) or replace it. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .

 **Note**

If the battery must be replaced, follow the disposal regulations. Refer to ⇒ [page 11](#) .

4.2.3 Current Draw Test

Special tools and workshop equipment required

- ◆ Battery Charger VAS 5903 -VAS 5903-

By checking a battery's current draw capacity during charging, a decision can be quickly made as to whether a partially or exhaustively discharged battery, refer to ⇒ [“1.2.2 Exhaustively Discharged Battery”, page 3](#) can be made usable again by recharging or if it must be replaced.

 **Note**

- ◆ *When charging with the battery charger, -VAS 5903- , displays the current draw on the device.*
- ◆ *For more information regarding the battery charger, refer to the Operating Instructions that came with the charger.*

Procedure

- The battery temperature must be at least +10° C (50° F).

- The battery charger must be able to deliver at least 30 amps (A), as with the battery charger -VAS 5903- .
- Battery charger connected and switched on.
- Measure the battery charge current after 5 minutes of charging.
- Specified value: The charge current must be higher than 10% of the nominal capacity.
- Example: Charge current on a 60 Ah battery after 5 minutes of charging: greater than 6 A.
- If the target value is reached, proceed with the charging operation until the battery is fully charged.
- Then test the battery with the vehicle diagnostic tester. Refer to [⇒ “4.2.2 Battery Test with Vehicle Diagnosis Tester -“, page 34](#) .
- If the specified value is not met, replace the battery. Refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .



Note

If the battery must be replaced, follow the disposal regulations. Refer to [⇒ page 11](#) .

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4.2.4 Measuring No-Load Voltage, Transport Mode Not Active

Special tools and workshop equipment required

- ◆ Hand-Held Multimeter -V.A.G 1526E-



Note

The no-load voltage measurement should only be used to evaluate the battery condition if it is not possible to perform the battery test with the Vehicle Diagnosis Tester and if the transport mode is not activated in the battery monitoring control module -J367- or energy management control module -J644- .

Procedure

- Always observe the following to ensure correct measurement:
- Battery remains installed in vehicle, battery ground (GND) strap must not be disconnected.
- Open the front lid or rear lid and lock the lid lock in the closed position so that the luggage compartment lamp is not switched on.
- Lock vehicle with central locking system.
- Battery must not be loaded by electrical consumers within the next 2 hours before measurement.
- Battery must not be charged within the next 12 hours before measurement.
- The battery temperature must be at least $-10\text{ }^{\circ}\text{C}$ ($14\text{ }^{\circ}\text{F}$).
- Perform the prep work for the no-load voltage measurement. Refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Description and Operation .

After a waiting period of at least 2 hours:

- Connect the -V.A.G 1526E- between the battery terminal clamps or to the positive terminal “+” and ground terminal “-“.
- Measure the voltage between the battery terminal clamps.
- Specified value: 12.5 volts or higher, the battery is OK.
- If the no-load voltage is under 12.5 volts, the battery must be recharged. Refer to [⇒ “1.2.1 Charging The Battery Using VAS 5903 “, page 2 .](#)
- After charging for 5 minutes, the current draw must be measured again. Refer to [⇒ “4.2.3 Current Draw Test“, page 35 .](#)
- If the battery no-load voltage is 11.6 volts or lower, the battery is exhaustively discharged. Refer to [⇒ “1.2.2 Exhaustively Discharged Battery“, page 3 .](#)

4.2.5 Measuring No-Load Voltage, Transport Mode Active



Note

During the prescribed maintenance and service work on vehicles in storage, the charge state can be read in % (SOC = state of charge) in the trip odometer display when the transport mode is active. This determines whether the battery needs to be fully charged. Refer to Maintenance Intervals Rep. Gr. 03.

Procedure

The following test is only possible if the transport mode is active in the battery monitoring control module -J367- or energy management control module -J644-. If the transport mode is activated later, for example, when storing used vehicles, the SOC can first be determined when “the bus is at rest“.

- Open the driver door.
- Switch ignition on.
- Read the SOC in % on the trip odometer display.



Note

Depending on the version, “TRA“ can precede the value.

- Specified value: 50% or higher, the battery charge level is OK.
- If the battery charge level is less than 50%, the battery must be fully charged. Refer to [⇒ “1.2 Battery, Charging“, page 2 .](#)
- After charging for 5 minutes, the current draw must be measured again. Refer to [⇒ “4.2.3 Current Draw Test“, page 35 .](#)
- If the battery charge level is 0%, the battery is exhaustively discharged. Refer to [⇒ “1.2.2 Exhaustively Discharged Battery“, page 3 .](#)

4.3 Generator, Checking

- Test the generator in “Guided Fault Finding“ under “Body/ Electrical System/26 - Starter, voltage supply/electrical components/C generator, testing“, refer to Vehicle Diagnosis, Testing & Information System -VAS5051B- .

4.4 Carbon Brush, Checking, Bosch Generators From 2001

Procedure

- Remove the voltage regulator, refer to one of the following:

Through MY 07, refer to

⇒ [“5.1 Voltage Regulator, Bosch Generator, From 2001”, page 40](#) .

From MY 07, refer to

⇒ [“5.2 Voltage Regulator, Bosch Generator, From 2007”, page 40](#) .

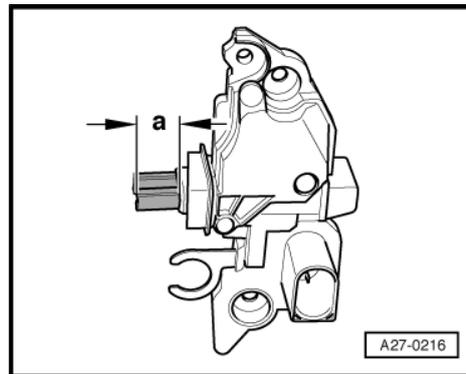
- Check carbon brushes for length -a-.
- Wear limit: -a- = 5 mm.
- Install the voltage regulator, refer to one of the following:

Through MY 07, refer to

⇒ [“5.1 Voltage Regulator, Bosch Generator, From 2001”, page 40](#) .

From MY 07, refer to

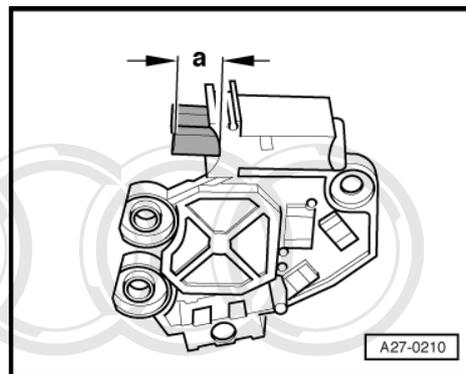
⇒ [“5.2 Voltage Regulator, Bosch Generator, From 2007”, page 40](#) .



4.5 Carbon Brush Checking, Valeo Generator, From 2001

Procedure

- Remove voltage regulator. Refer to
⇒ [“5.3 Voltage Regulator, Valeo Generator, From 2001”, page 41](#) .
- Check carbon brushes for length -a-.
- Wear limit: -a- = 5 mm.
- Install the voltage regulator. Refer to
⇒ [“5.3 Voltage Regulator, Valeo Generator, From 2001”, page 41](#) .



4.6 Carbon Brush Checking, Valeo Generator, From 2007

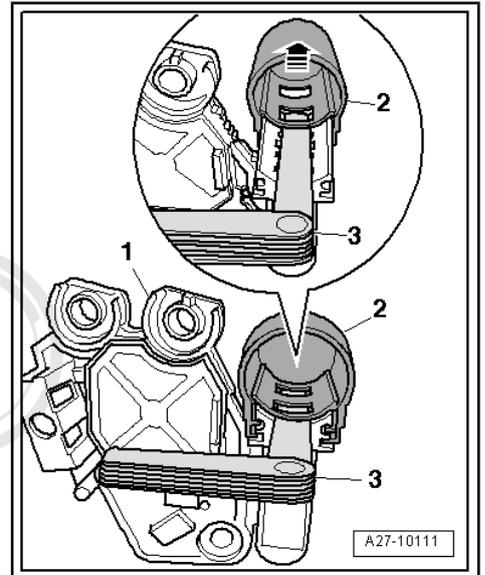
Special tools and workshop equipment required

- ◆ Feeler Gauge 0.3 mm

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Procedure

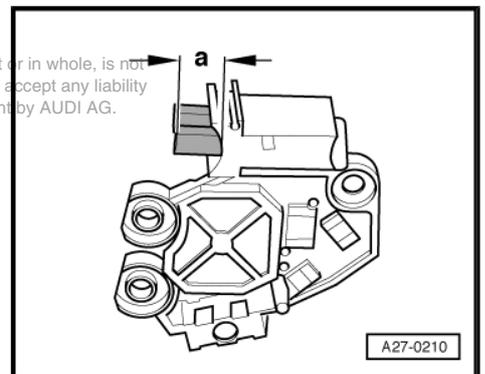
- Remove voltage regulator. Refer to ["5.4 Voltage Regulator, Valeo Generator, From 2007", page 42](#).
- Insert a feeler gauge 0.3 mm -3- between protective cap -2- and the carbon brushes.
- Remove the protective cap from voltage regulator -1- -arrow-.



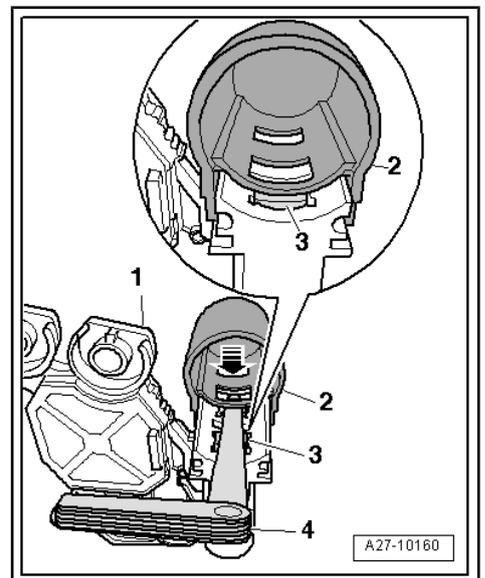
- Check carbon brushes for length -a-.

- Wear limit: -a- = 5 mm.

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- With protective cap -2- installed, use feeler gauge -4- to press carbon brushes-3- down.
- Push the protective cap off -arrow- until the bar of the protective cap presses the carbon brushes down.
- Install the voltage regulator. Refer to ["5.4 Voltage Regulator, Valeo Generator, From 2007", page 42](#).



5 Removal and Installation

⇒ ["5.1 Voltage Regulator, Bosch Generator, From 2001", page 40](#)

⇒ ["5.2 Voltage Regulator, Bosch Generator, From 2007", page 40](#)

⇒ ["5.3 Voltage Regulator, Valeo Generator, From 2001", page 41](#)

⇒ ["5.4 Voltage Regulator, Valeo Generator, From 2007", page 42](#)

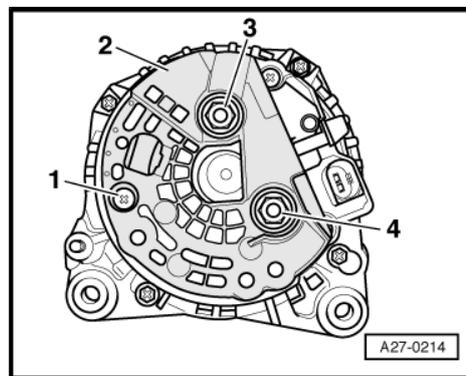
⇒ ["5.5 Ribbed Belt Pulley Without Freewheel", page 42](#)

⇒ ["5.6 Ribbed Belt Pulley With Freewheel", page 43](#)

5.1 Voltage Regulator, Bosch Generator, From 2001

Removal

- Remove the generator. Refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .
- Remove bolt -1- and nuts -3- and -4-.
- Remove cover -2- at rear side of generator.



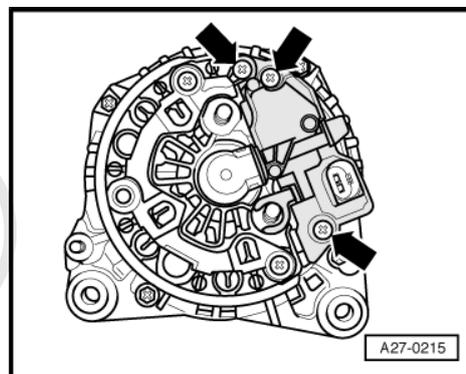
- Remove screws -arrows-.
- Remove voltage regulator.

Installation

- When installing the voltage regulator, make sure the carbon brushes rest properly on the slip rings.

Install in reverse order of removal, observing the following:

- Install the generator. Refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .
- Tightening specification, refer to ["2.2 Bosch Generator Overview, From 2001", page 23](#) .

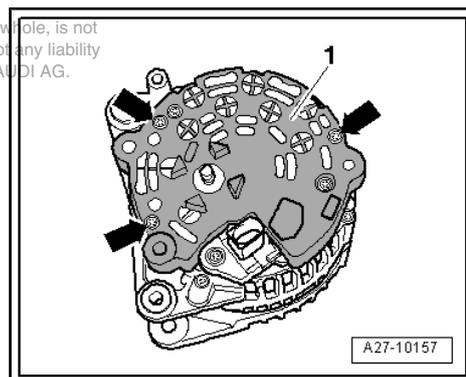


5.2 Voltage Regulator, Bosch Generator, From 2007

Removal

- Remove the generator. Refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .
- Remove screws -arrows-.
- Remove cover -1- at rear side of generator.

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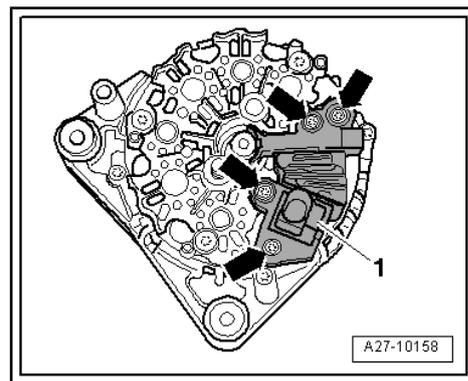
- Remove screws -arrows-.
- Remove voltage regulator -1-.

Installation

- When installing the voltage regulator, make sure the carbon brushes rest properly on the slip rings.

Install in reverse order of removal, observing the following:

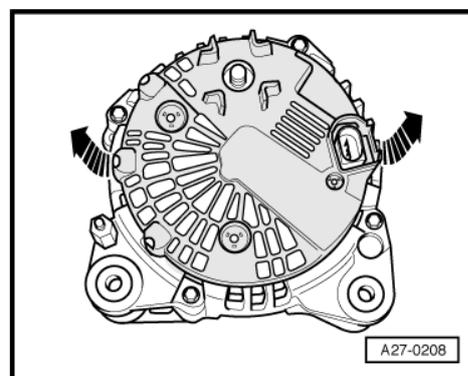
- Install the generator. Refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .
- Tightening specification, refer to ⇒ ["2.3 Bosch Generator Overview, From 2007", page 24](#) .



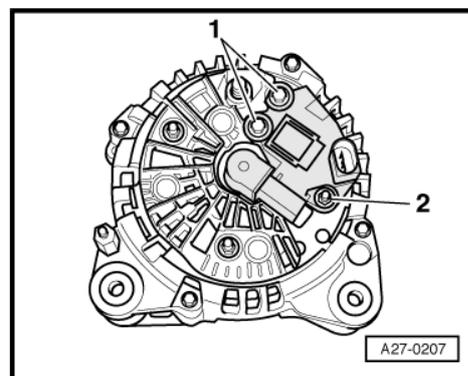
5.3 Voltage Regulator, Valeo Generator, From 2001

Removal

- Remove the generator. Refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .
- Press out cover from threaded pins at rear side of generator -arrows-.



- Remove bolts -1- and double bolt -2-.
- Remove voltage regulator.

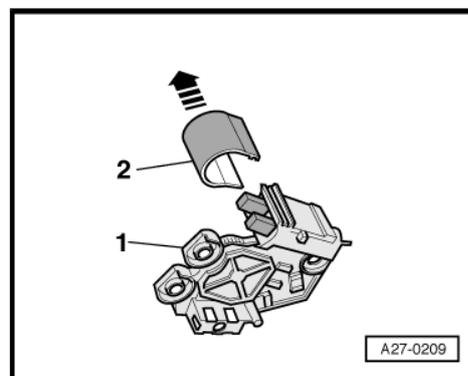


Installation

- Press off protective cap -2- from voltage regulator -1- in -direction of arrow-.
- When installing the voltage regulator, make sure the carbon brushes rest properly on the slip rings.
- Attach protective cap with voltage regulator installed.

Install in reverse order of removal, observing the following:

- Install the generator. Refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .
- Tightening specification, refer to ⇒ ["2.5 Valeo Generator Overview, From 2001", page 26](#) .



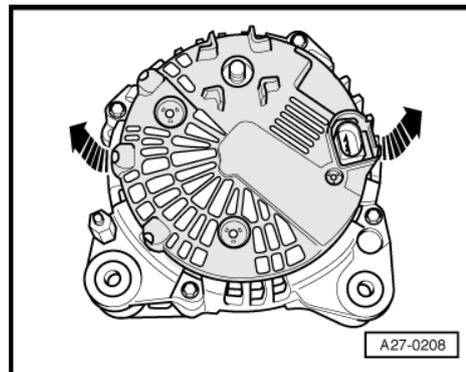
5.4 Voltage Regulator, Valeo Generator, From 2007

Special tools and workshop equipment required

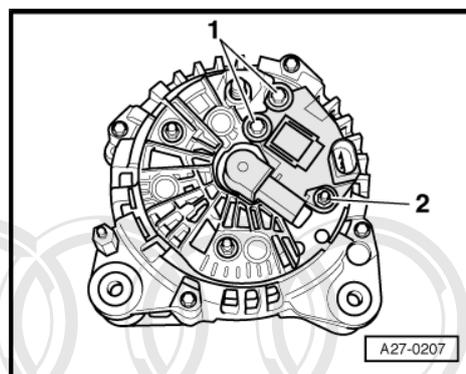
- ◆ Feeler Gauge 0.3 mm

Removal

- Remove the generator. Refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .
- Press out cover from threaded pins at rear side of generator -arrows-.



- Remove bolts -1- and double bolt -2-.
- Remove voltage regulator.

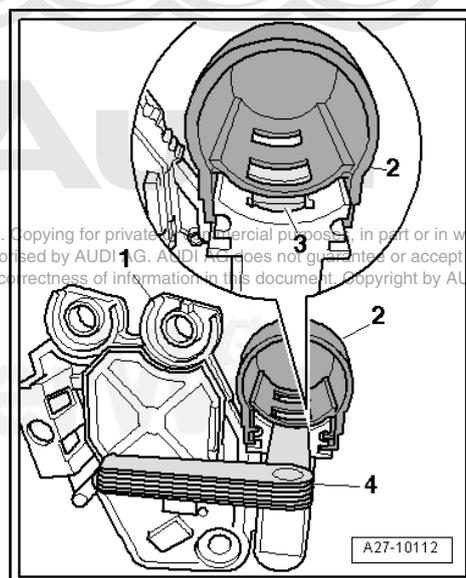


Installation

- Insert a feeler gauge 0.3 mm -4- between protective cap -2- and carbon brushes -3-.
- Pull the protective cap off until the bar of the protective cap presses the carbon brushes down.
- After installation of the voltage regulator, press the protective cap all the way on.

Install in reverse order of removal, observing the following:

- Install the generator. Refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .
- Tightening specification, refer to ⇒ ["2.5 Valeo Generator Overview, From 2001", page 26](#) .



5.5 Ribbed Belt Pulley Without Freewheel

Special tools and workshop equipment required

- ◆ Socket -3310-
- ◆ 8 mm Hex Socket or TORX T50

Removal

- Remove the generator. Refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .
- If present, press the protective cap off the generator pulley.
- Counter-hold nut using -3310- and rotate generator shaft clockwise to loosen it.
- Remove ribbed belt pulley.

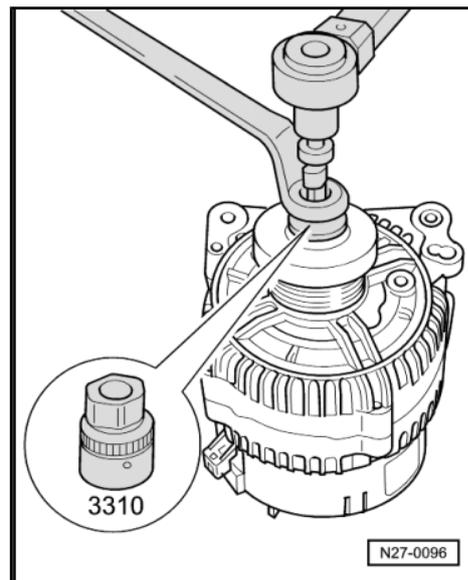
Installation

Install in reverse order of removal. Note the following:

- Turn the generator shaft counterclockwise to tighten.
- Clip protective cap onto generator pulley.

Tightening Specifications

Component	Nm
Ribbed belt pulley to generator	65



5.6 Ribbed Belt Pulley With Freewheel

Special tools and workshop equipment required

- ◆ Multi-point Adapter -3400-
- ◆ 8 mm hex socket or TORX T50

Removal

- Remove the generator. Refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .
- If present, press the protective cap off the generator pulley.
- Counter-hold pulley using -3400- and rotate generator shaft clockwise to loosen it.

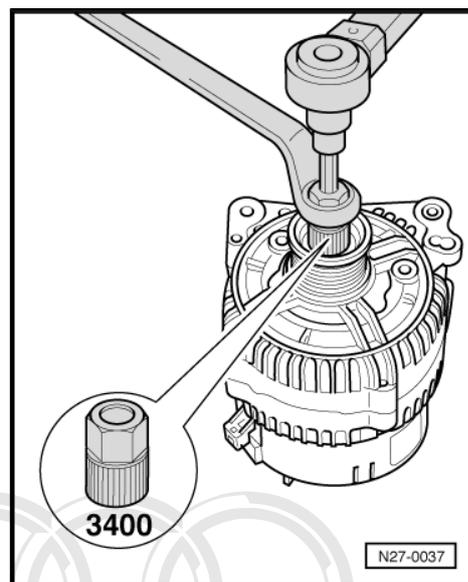
Installation

Install in reverse order of removal. Note the following:

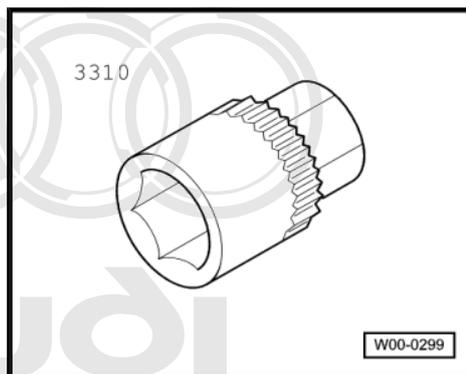
- Turn the generator shaft counterclockwise to tighten.
- Clip protective cap onto generator pulley.

Tightening Specifications

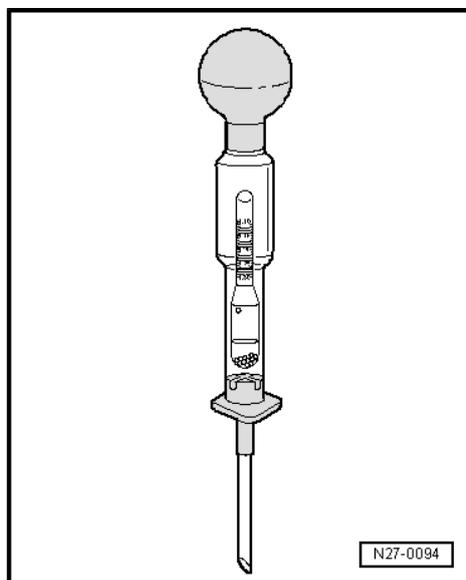
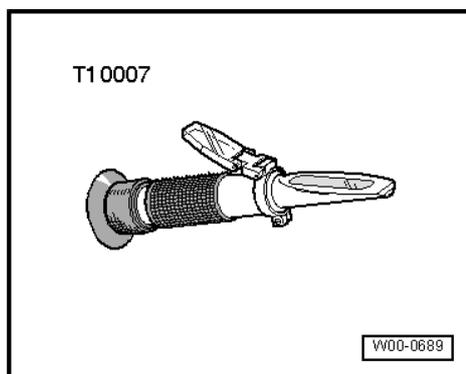
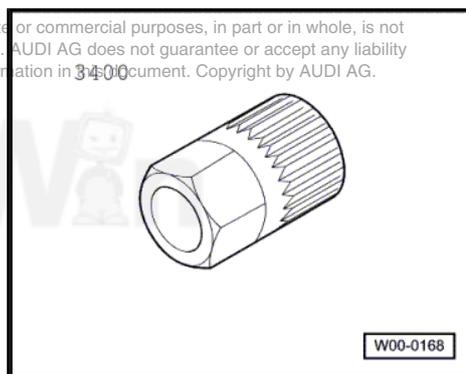
Component	Nm
Ribbed belt pulley with freewheel to generator	80

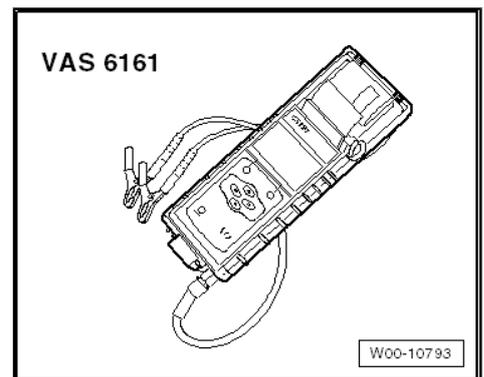
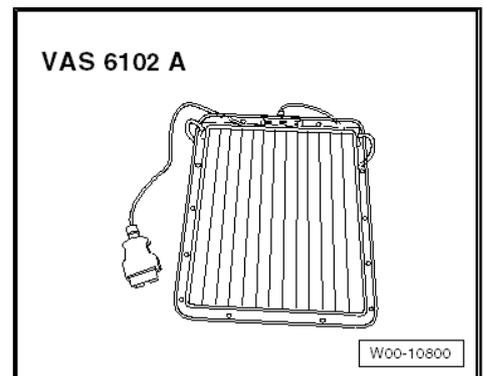
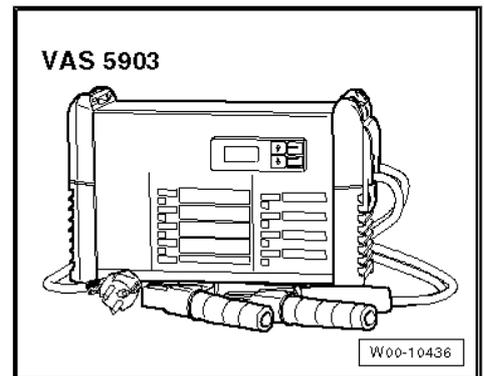
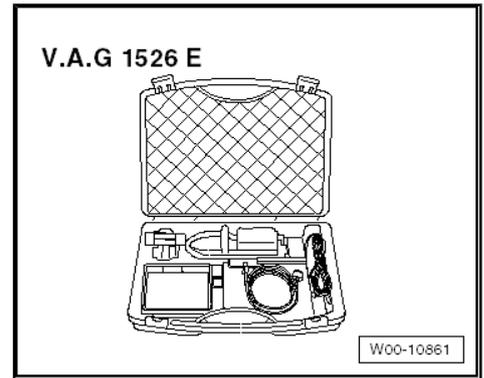


6 Special Tools



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- ◆ Socket -3310-
- ◆ Multi-point Adapter -3400-
- ◆ 8 mm Hex Socket or TORX T50
- ◆ Feeler Gauge 0.3 mm
- ◆ Refractometer -T10007- or
- ◆ Commercially Available Hydrometer
- ◆ Hand-Held Multimeter -V.A.G 1526E-
- ◆ Battery Charger VAS 5903 -VAS 5903-
- ◆ Solar Panel -VAS 6102 A-
- ◆ Battery Tester -VAS 6161-

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92 – Windshield Wiper/Washer System

1 General Information

⇒ [“1.1 Smooth Hose Washer Fluid Line, Repairing”, page 46](#)

⇒ [“1.2 Corrugated Hose Washer Fluid Line, Repairing”, page 46](#)

1.1 Smooth Hose Washer Fluid Line, Repairing

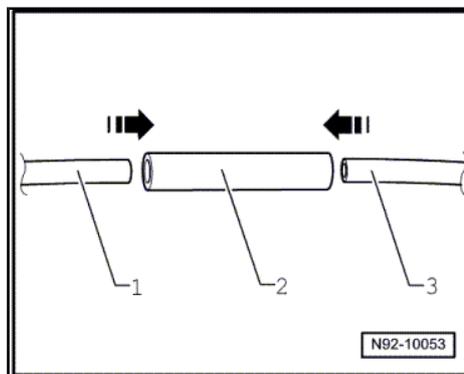


Note

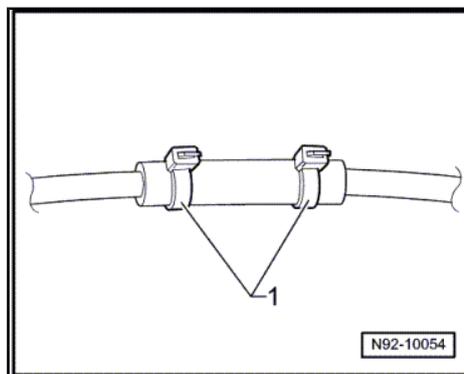
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Smooth hoses with a diameter of 5 x 1 mm or 6 x 1 mm can be replaced with an Ethylene Propylene Diene Monomer (EPDM) hose. Refer to Electronic Parts Catalog (ETKA).

- Trim and remove damaged sections of hose.
- Select the appropriate EPDM hose -2- and cable tie. Refer to Electronic Parts Catalog (ETKA).
- Cut a length of EPDM hose -2- so that the ends of the smooth hose -1- and -3- can be pushed approximately 10 mm into the EPDM hose -2-.



- Secure with cable ties as illustrated -1-.
- Check for function and leaks.



1.2 Corrugated Hose Washer Fluid Line, Repairing

Special tools and workshop equipment required

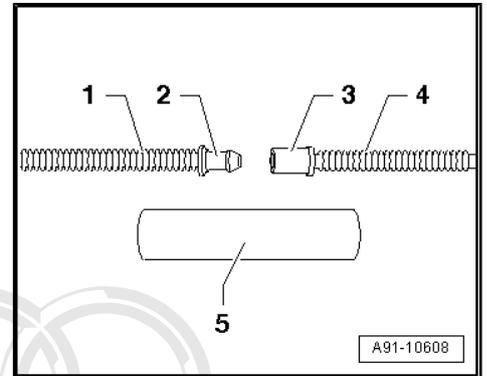
- ◆ Hot Air Blower -VAS 1978/14A- from the Wiring Harness Repair Set -VAS 1978 B- .
- ◆ Air Hose Pliers -VAS 6228-
- ◆ Connecting Piece -1J0 955 875 R-
- ◆ Connecting Piece -1J0 955 875-

 Note

Corrugated hoses can be replaced with heat-shrink sleeves. Refer to Electronic Parts Catalog (ETKA).

Procedure

- Disconnect the damaged part of the washer fluid hose with the -VAS 6228- .
- Connect the ends -1 and 4- of the washer fluid line with connector pieces -2 and 3-.
- Slide the heat-shrink sleeve -5- over an end of the washer fluid line and connect the connector pieces with each other.
- Slide the heat-shrink sleeve over the washer fluid connector pieces.
- After sliding on, the heat-shrink sleeve must be shrunk with the -VAS 1978/14A- .
- The heat-shrink sleeve must be heated from the center outward until it seals completely.
- Set the hot air blower to the correct temperature according to the operating instructions.
- When shrinking, ensure no other lines, plastic parts or insulation material is damaged by the hot nozzle.
- Check for function and leaks.



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2 Removal and Installation

⇒ "2.1 Washer Fluid Line Hose Connections, Disconnecting and Connecting", page 48

2.1 Washer Fluid Line Hose Connections, Disconnecting and Connecting

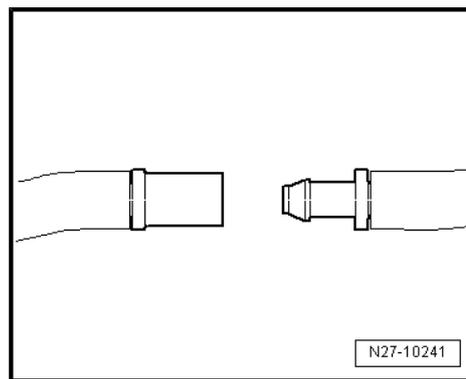
Special tools and workshop equipment required

- ◆ Hose Clamp Pliers -V.A.G 1275-
- ◆ Hose Clamp Pliers -V.A.G 1921-

Various hose couplings are used to connect the hoses to the washer fluid pumps and spray jets or as separating points.

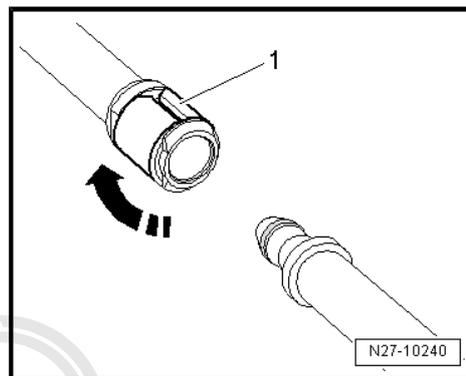
Unsecured Hose Coupling

- To disconnect the connection, pull both parts of the coupling apart.
- To connect, press both parts of the coupling together firmly until they noticeably engage.



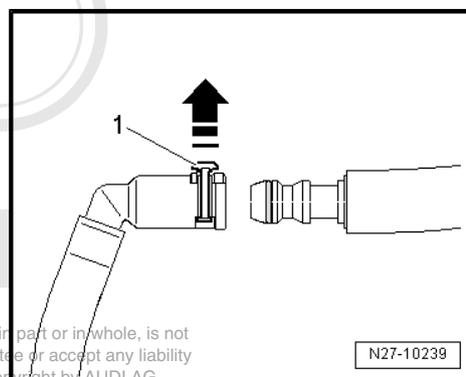
Secured Hose Coupling With Circlip

- To disconnect the connection, turn the circlip -1- 90° -arrow- and remove the hose connector.
- To connect, attach the hose connector and turn circlip -1- -arrow- until it engages.



Secured Hose Coupling With Circlip, Version 1

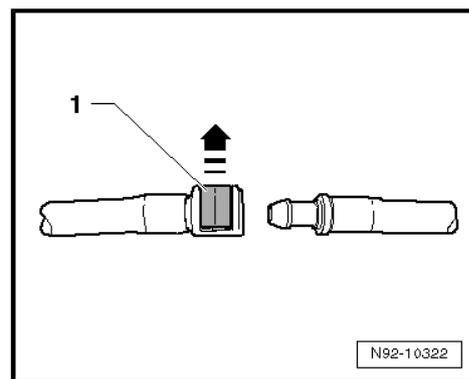
- To disconnect the connection, pull circlip -1- up approximately 1 mm -arrow- and remove the hose connector.
- To connect, attach the hose connector and press the circlip in until it engages.



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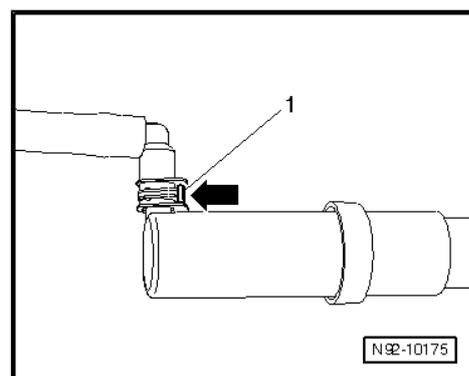
Secured Hose Coupling With Circlip, Version 2

- To disconnect the connection, pull circlip -1- up -arrow- and remove the hose connector.
- To connect, attach the hose connector and press the circlip in until it engages.



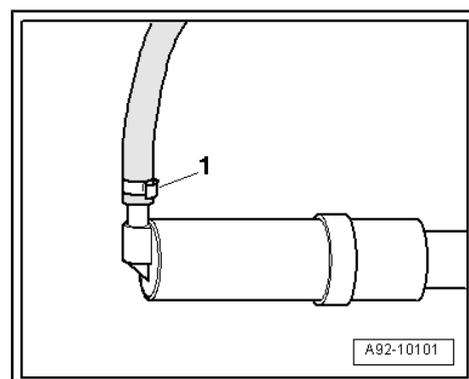
Headlamp Washer System Hose Connection With Circlip

- To disconnect the connection, press circlip -1- -arrow- and remove the hose connector.
- To connect, hold the circlip pressed -arrow- and attach the hose connector.
- Make sure the connection is engaged securely by pulling on the hose without pressing the circlip.



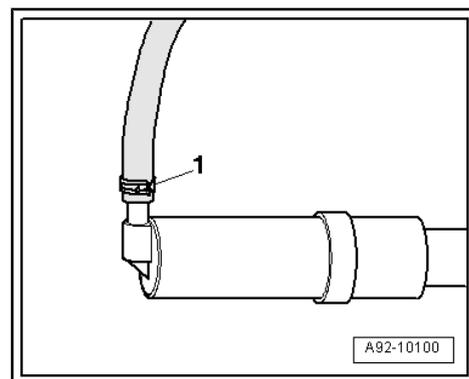
Headlamp Washer System Hose Coupling With Clamp

- To disconnect the hose clamp connection -1-, cut with side cutting pliers and remove the hose connector.
- To connect, slide the new hose clamp onto the hose, attach the hose connector and install the hose clamp with -V.A.G 1275- .



Headlamp Washer System Hose Coupling With Spring Clamp

- Open the spring clamp with -1- with -V.A.G 1921- and remove the hose connection.
- To connect, open the spring clamp with -V.A.G 1921- and attach the connector.



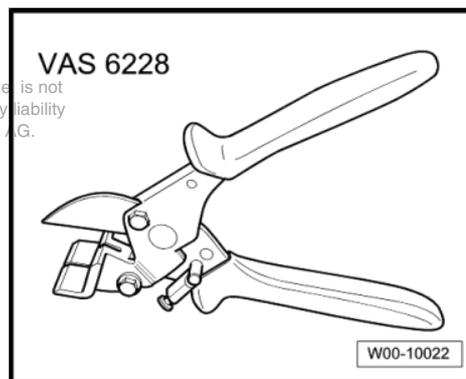
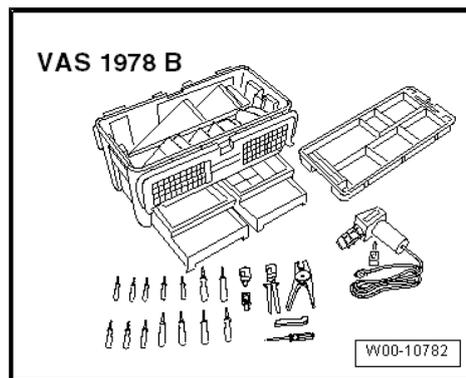
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3 Special Tools



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- ◆ Connecting Piece -1J0 955 875 R-
- ◆ Connecting Piece -1J0 955 875-
- ◆ Hose Clamp Pliers -V.A.G 1275-
- ◆ Hose Clamp Pliers -V.A.G 1921-
- ◆ Hot Air Blower -VAS 1978/14A- from the Wiring Harness Repair Set -VAS 1978 B- .
- ◆ Air Hose Pliers -VAS 6228-



94 – Exterior Lights, Switches

1 General Information

⇒ [“1.1 HID Headlamps, Usage and Safety Precautions”, page 51](#)

1.1 HID Headlamps, Usage and Safety Precautions

Never replace bulbs if you are not familiar with the procedures, safety precautions and tools.



WARNING

Danger to life due to high voltage.

- ◆ *Always disconnect the battery ground cable before working on gas-discharge headlamp components marked with yellow high-voltage symbols.*
- ◆ *Then switch low beams on and back off. This removes any possible residual voltage.*
- ◆ *Turn off the ignition and all electrical consumers and remove the ignition key.*
- ◆ *The gas-discharge lamp control module should not be operated without the gas-discharge lamp.*
- ◆ *Due to the high voltage (over 28000 volts when igniting the lamp), the gas-discharge lamp should only be operated inside the headlamp housing.*



WARNING

Risk of injury due to burning, Ultra Violet (UV) rays, blinding and explosion.

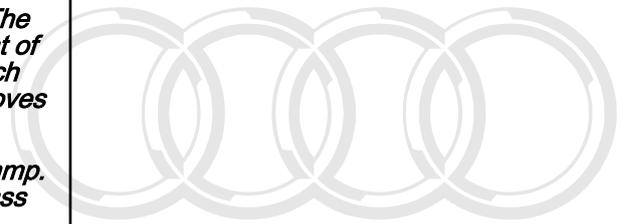
- ◆ *Due the high temperatures, absorption of UV rays, and the risk of blinding, the gas-discharge lamp should only be operated inside the headlamp housing.*
- ◆ *Do not look into the beam of light. It may interfere with the ability to see for a significant period of time.*
- ◆ *Gas-discharge lamps are under pressure and can crack when bulbs are replaced.*
- ◆ *When removing and installing HID bulbs, always wear safety glasses and gloves.*

**WARNING*****Pollution risk.***

- ◆ ***Gas-discharge bulbs require special disposal. They contain metallic mercury (Hg) and traces of thallium.***
- ◆ ***Do not destroy gas-discharge lamps. Avoid contact with burst glass bulbs.***
- ◆ ***Follow disposal requirements, only dispose of gas-discharge lamps in suitable containers at an authorized collection site.***

**Caution**

- ◆ ***Do not touch gas-discharge bulbs with bare hands. The remaining fingerprint would evaporate due to the heat of the operated bulb and condense on the reflector which would impair headlamp luminosity. Use clean cloth gloves to insert the gas-discharge lamp.***
- ◆ ***Only replace faulty HID lamps with the same type of lamp. Bulb identification can be found on bulb socket or glass cone.***
- ◆ ***Harness connectors must engage correctly when installed and must be checked for proper connection.***

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96 – Interior Lights, Switches

1 General Information

⇒ [“1.1 Immobilizer, Vehicles Without an Access/Start Authorization Switch E415 \(Mechanical Ignition Switch\)”, page 53](#)

⇒ [“1.2 Immobilizer, Vehicles With an Access/Start Authorization Switch E415 \(Electronic Ignition Switch\)”, page 54](#)

⇒ [“1.3 Heated Steering Wheel”, page 54](#)

1.1 Immobilizer, Vehicles Without an Access/Start Authorization Switch -E415- (Mechanical Ignition Switch)

⇒ [“1.1.1 General Information”, page 53](#)

⇒ [“1.1.2 Faulty Transponder Or Lost Key”, page 53](#)

⇒ [“1.1.3 Induction Coil, Replacing”, page 53](#)

⇒ [“1.1.4 Lock Set, Replacement Procedure”, page 53](#)

1.1.1 General Information

The immobilizer control module is integrated in the instrument cluster. The immobilizer control module is replaced together with the instrument cluster. Refer to ⇒ Electrical Equipment; Rep. Gr. 90 : Removal and Installation

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– If the control module is replaced, select the “Replace” function for the respective control module in “Guided Functions” using the Vehicle Diagnosis, Testing & Information System - VAS5051B- .

1.1.2 Faulty Transponder Or Lost Key

- ◆ The transponder is integrated in the ignition key and cannot be replaced separately.
- ◆ If the transponder is faulty, the entire ignition key must be replaced.
- Order a replacement key through the distributor or importer with the vehicle-specific lock number using the VIN.
- Perform the adaptation on all ignition keys in “Guided Fault Finding” using the Vehicle Diagnosis, Testing & Information System -VAS5051B- .

1.1.3 Induction Coil, Replacing

- ◆ The induction coil is integrated in the lock cylinder and cannot be replaced separately.
- ◆ If the induction coil is faulty, the entire lock cylinder must be replaced.
- Order a lock cylinder through the distributor or importer with the vehicle-specific lock number using the VIN.

1.1.4 Lock Set, Replacement Procedure

Ignition keys can only be adapted in “Guided Fault Finding” using the Vehicle Diagnosis, Testing & Information System - VAS5051B- .

1.2 Immobilizer, Vehicles With an Access/ Start Authorization Switch -E415- (Elec- tronic Ignition Switch)

The immobilizer control is integrated either in the Comfort system central control module -J393- or in the Access/start authorization control module -J518- . Component location, refer to ⇒ Wiring diagrams, Troubleshooting & Component locations.

The following components are also part of the immobilizer:

- ◆ Ignition key with built-in transponder.
- ◆ Induction coil in Access/start authorization switch -E415- (electronic ignition lock).
- ◆ Engine control module (ECM).
- ◆ Transmission control module (TCM).

If control module is replaced, select Guided Functions of the respective control module using the Vehicle Diagnosis, Testing & Information System -VAS5051B-

1.3 Heated Steering Wheel

- Remove the airbag unit for fault finding. Refer to ⇒ Body Interior; Rep. Gr. 69 ; Removal and Installation .
- Remove steering wheel. Refer to ⇒ Suspension, Wheels, Steering; Rep. Gr. 48 ; Removal and Installation .
- Check wire connections. Refer to ⇒ Wiring diagrams, Troubleshooting & Component locations.



Note

The heated steering wheel must be replaced if faulty.

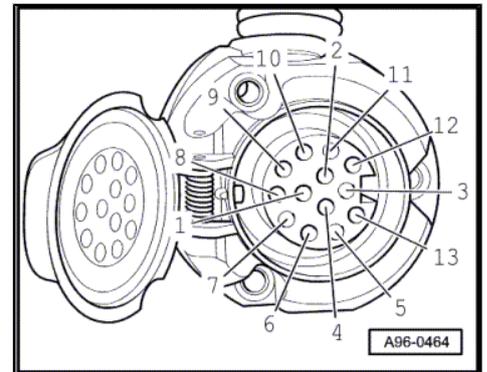
2 Description and Operation

⇒ **"2.1 Trailer Hitch Socket Connector Assignment", page 55**

2.1 Trailer Hitch Socket Connector Assignment

13-pin Trailer Hitch Socket (Country Version)

- 1 - Terminal BL (Left turn signal)
- 2 - Terminal NSL (Rear fog lamp)
- 3 - Terminal 31, Ground (GND)
- 4 - Terminal BR (Right turn signal)
- 5 - Terminal 58 R (Right tail lamp)
- 6 - Terminal 54 (Brake light)
- 7 - Terminal 58 L (Left tail lamp)
- 8 - Terminal RF (Back-up light)
- 9 - Refer to⇒ Wiring diagrams, Troubleshooting & Component locations
- 10 - Refer to⇒ Wiring diagrams, Troubleshooting & Component locations
- 11 - Refer to⇒ Wiring diagrams, Troubleshooting & Component locations
- 12 - Refer to⇒ Wiring diagrams, Troubleshooting & Component locations
- 13 - Refer to⇒ Wiring diagrams, Troubleshooting & Component locations



Socket with Rear Fog Lamp Shut-Off Contact Switch -F216-

Connector assignment on Rear fog lamp shut-off contact switch, refer to ⇒ Wiring diagrams, Troubleshooting & Component locations.

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3 Removal and Installation

⇒ "3.1 Trailer Hitch Socket - Version 1", page 56

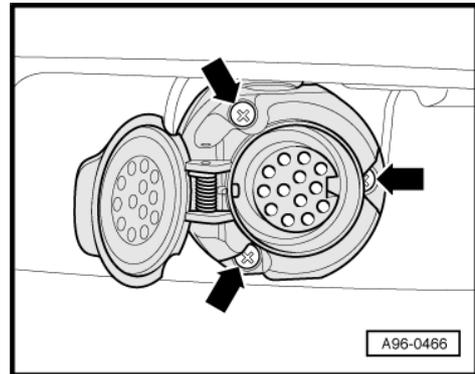
⇒ "3.2 Trailer Hitch Socket - Version 2", page 57

⇒ "3.3 Trailer Hitch Socket - Version 3", page 59

3.1 Trailer Hitch Socket - Version 1

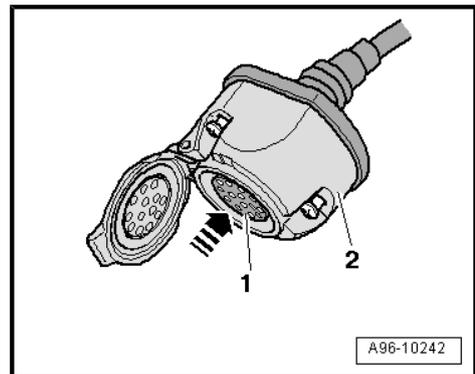
Removal

- Switch off ignition and remove ignition key.
- Remove screws -arrows-.
- Detach the socket from the retaining plate.



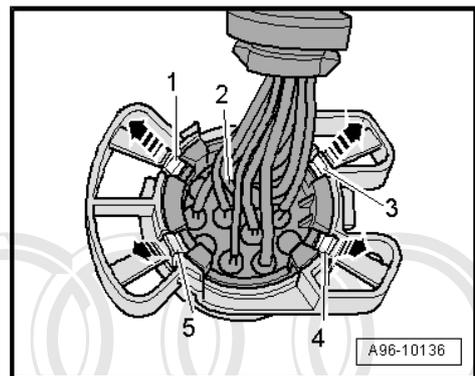
Socket without a rear fog lamp shut-off contact switch -F216-

- Press multiple connector -1- in the -direction of the arrow- out of socket -2-.



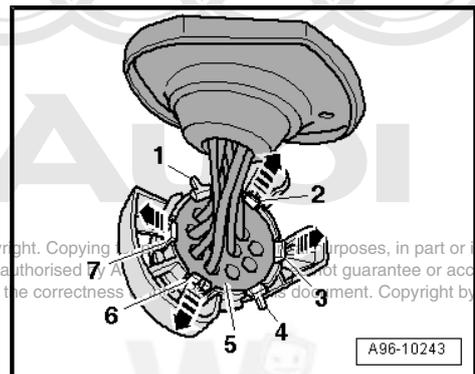
Version 1

- Release securing tabs -arrows- and then release retainer clips -1- and -3 through 5-.
- Remove retainer from harness connectors -2-.



Version 2

- First release securing tabs -arrows- and then retaining clips -1, 2, 3, 4, 6, 7-.
- Remove the retainer from multiple connector -5-.



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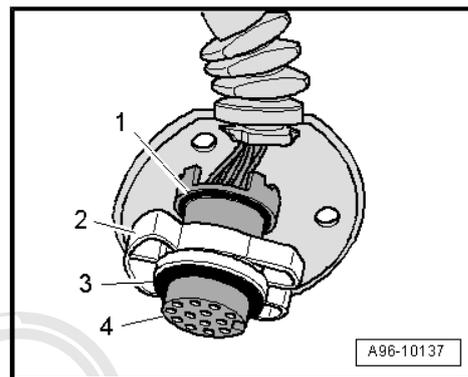
Installation

Install in reverse order of removal. Note the following:

Note

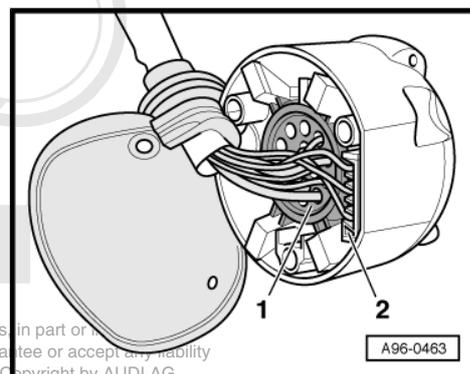
Make sure O-rings -1- and -3- are not damaged.

- Push electrical connectors -4- until they audibly engage inside the retainer -2-.



Socket with rear fog lamp shut-off contact switch -F216-

- Remove harness connector -2- for the rear fog lamp shut-off contact switch and harness connector -1- from the trailer socket -U10-.



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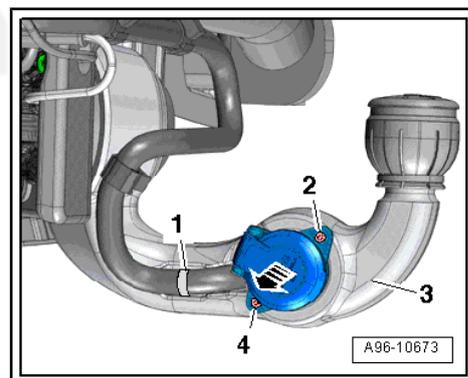
3.2 Trailer Hitch Socket - Version 2

Removal

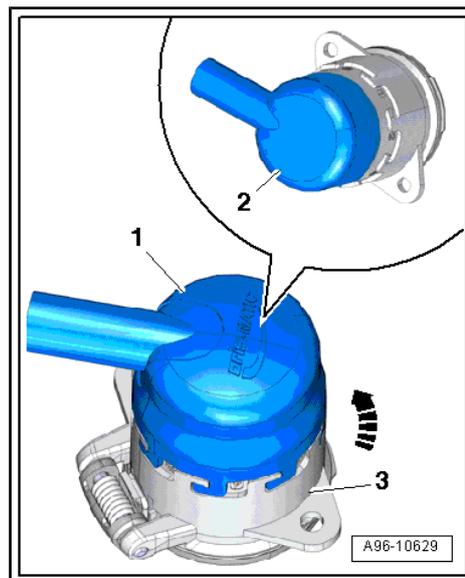
Note

During installation, install the cable ties at the same location.

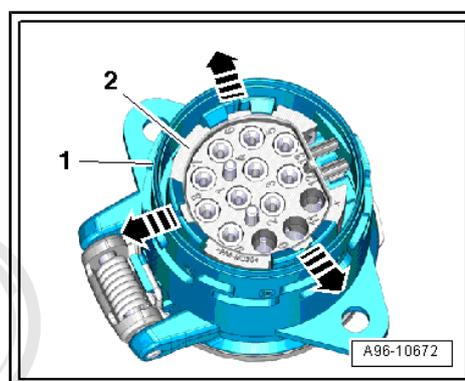
- Switch off ignition and remove ignition key.
- Unfold and engage the trailer hitch.
- Cut the cable tie -1- and remove the screws -2- and -4-.
- Press the socket out of trailer hitch -3- in the -direction of the arrow-.



- Turn cap -1- counterclockwise -arrow- and remove it from socket -3-.
- Remove rubber cover -2-.



- Release the retaining clips -arrows- and press multiple connector -2- out of socket -1-.



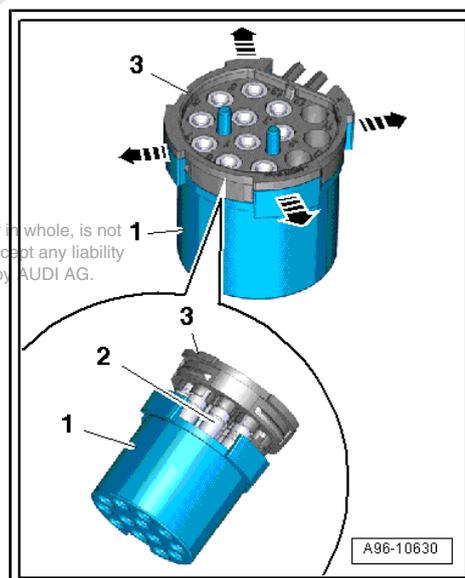
- Release the retaining clips -arrows- and remove retainer -1- from multiple connector -3-.



Note

Carefully remove the retainer so that contacts -2- of the multiple connector are not disconnected from the wiring harness.

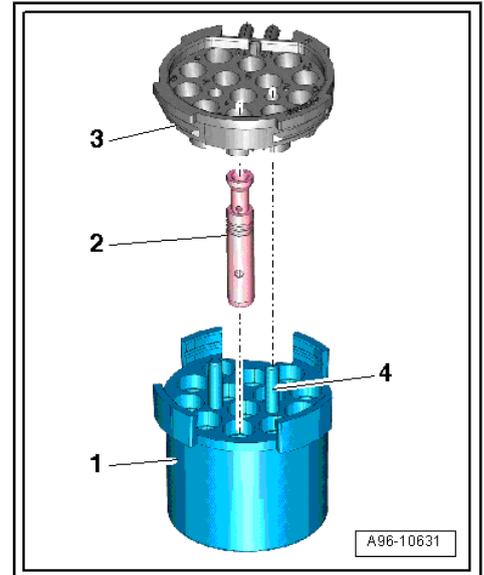
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Installation

Install in reverse order of removal. Note the following:

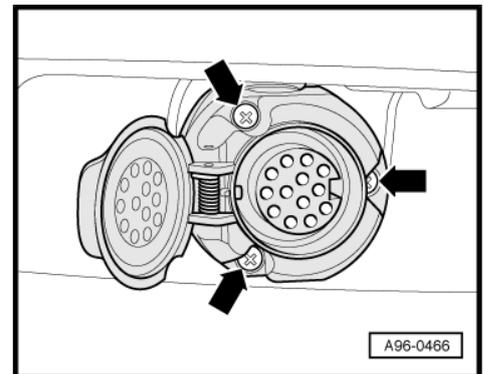
- The retainer -1- can be pushed onto multiple connector -3- in only one position.
- Guide pins -4- can be inserted into the retainer in only one position. Contacts -2- must be inserted in the retainer for this purpose.
- Insert the retainer into the multiple connector until it engages audibly.



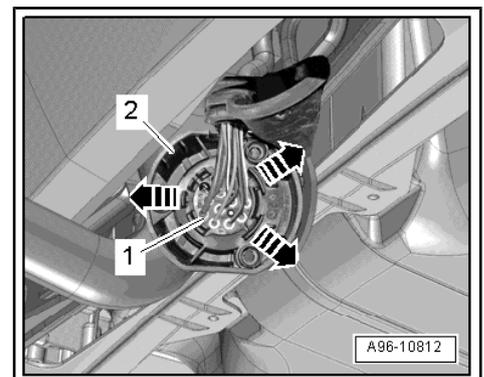
3.3 Trailer Hitch Socket - Version 3

Removal

- Fold out the trailer hitch. Refer to the vehicle Owner's Manual.
- Switch off the ignition and remove the ignition key.
- Remove the bolts -arrows-.
- Remove the socket from the retaining plate.
- Remove the rubber cover from the socket.



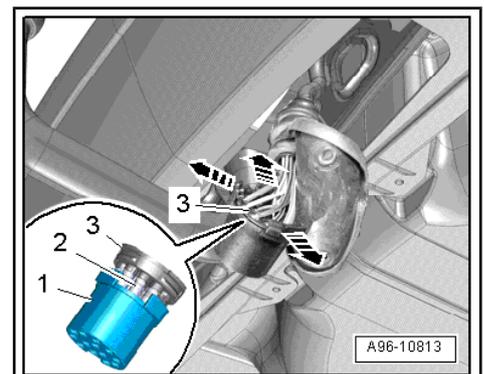
- Release the retaining clips -arrows- and press multiple connector -1- out of socket -1-.



- Release the retaining clips -arrows- and remove retainer -2- from multiple connector -3-.

Note

Carefully remove the retainer so that contacts -2- of the multiple connector are not disconnected from the wiring harness.

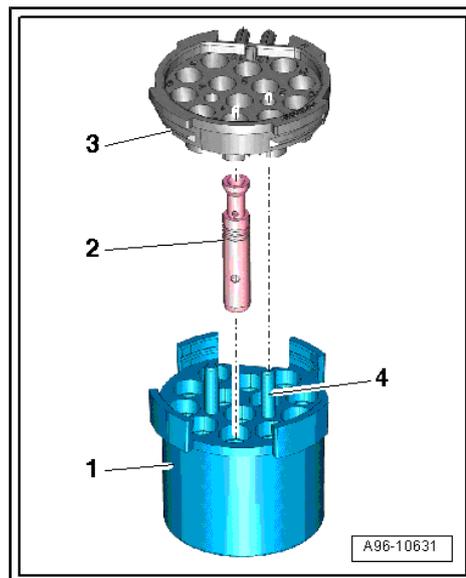




Installation

Install in reverse order of removal. Note the following:

- The retainer -1- can be pushed onto multiple connector -3- in only one position.
- Guide pins -4- can be inserted into the retainer in only one position. Contacts -2- must be inserted in the retainer for this purpose.
- Insert the retainer into the multiple connector until it engages audibly.



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97 – Wiring

1 General Information

⇒ [“1.1 Antenna Wires, Repairing”, page 61](#)

⇒ [“1.2 Fiber Optic Cable”, page 62](#)

⇒ [“1.3 Connector Housings and Connectors, Repairing”, page 68](#)

⇒ [“1.4 Contact Housings, Releasing and Disassembling”, page 71](#)

⇒ [“1.5 Cleaning contact surfaces with the contact surface cleaning set VAS 6410”, page 78](#)

⇒ [“1.6 Vehicle Diagnosis, Testing and Information Systems”, page 84](#)

⇒ [“1.7 Wiring Harnesses and Connectors, Repairing”, page 86](#)

1.1 Antenna Wires, Repairing

A repair procedure has been developed for repairing antenna wires. Instead of a complete antenna wire, connecting wires of different lengths and various adapter leads are now available as replacement parts.

Replacement parts, refer to Electronic Parts Catalog; Special Catalog “Electrical Connection Elements”; Accessories; Sub-group 35 chart 035-20.

Note

- ◆ *Do not repair antenna wires. Replace them using connector and adapter wires available as original replacement parts.*
- ◆ *These original replacement parts are suitable for all antenna wires and wire cross sections that need to be replaced.*
- ◆ *Individual antenna connectors are not designed to be replaced.*
- ◆ *The wires must be used retroactively for all Audi models, for all installed antenna wire diameters.*
- ◆ *All adapter leads and connecting wires are suitable for various transmission and reception signals.*
- ◆ *The repair concept can also be used as a testing or retrofitting solution.*

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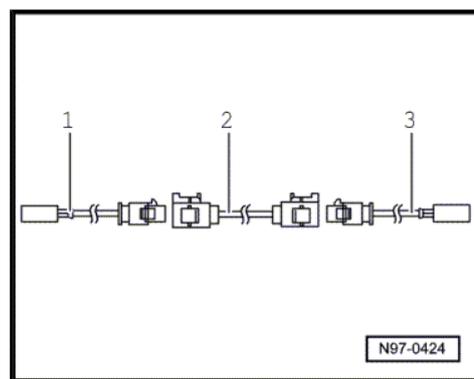
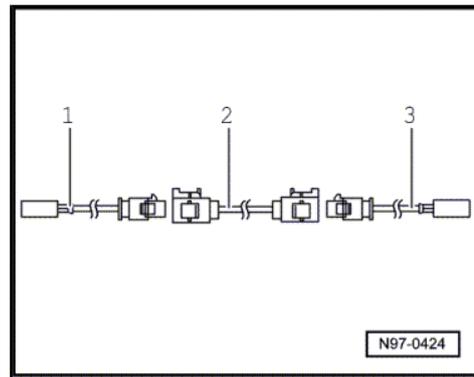
Special tools and workshop equipment required

- 1- Adapter wire, for connection to radio; length: approximately 30 cm
- 2- Connecting wire, available in various lengths
- 3- Adapter wire, for connection to antenna; length: approximately 30 cm

Procedure

Example: Antenna wire from radio to antenna is faulty.

- Separate the connectors of the faulty antenna wiring from their components.
- Determine the path of the faulty antenna wire in the vehicle and measure the total length of antenna wire to be replaced.
- The entire length of the antenna wire consists of the length of the required adapter wires -1 and 3- and the connecting wire -2-.
- Subtract 60 cm from the total length of antenna wire measured, to receive the length of connecting wire required.
- Obtain the correct length of the required adapter wires and connecting wires as an original replacement part. Refer to Electronic Parts Catalog (ETKA).
- Cut the connectors off of the faulty antenna wiring.
- Leave the rest of the defective antenna wire in the vehicle.
- Connect the adapter wires to the devices in the vehicle.
- Provide harness connectors with piece of foam hose to avoid rattle.
- Route and secure connecting wire parallel to old antenna wire.



Note

Antenna wires must not be kinked or excessively bent! The bending radius must never be below 50 mm.

- Connect the connecting wire with the adapter leads.
- To avoid rattle, slide a suitable piece of foam hose onto antenna connector.
- Perform a function test.

1.2 Fiber Optic Cable

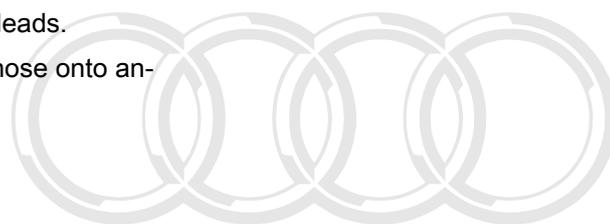
⇒ ["1.2.1 Repairing", page 62](#)

⇒ ["1.2.2 Disconnecting From Wiring Harness Connector", page 66](#)

1.2.1 Repairing

Special tools and workshop equipment required

- ◆ Fiber Optic Pliers Repair Set -VAS 6223-
- ◆ Air Hose Pliers -VAS 6228-



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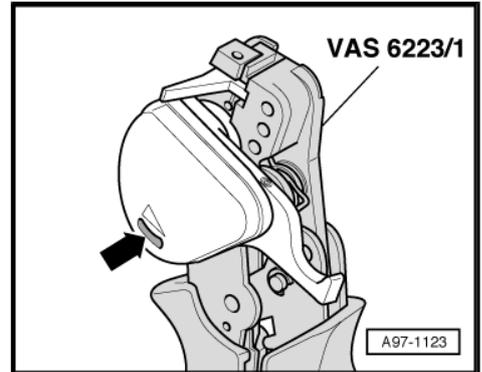


Caution

Do not excessively bend or kink fiber optic cables. (minimum bending radius 25 mm).

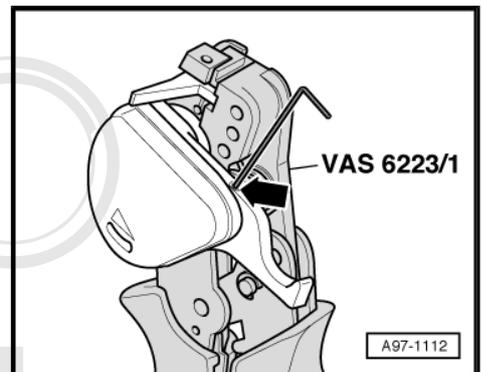
Checking Remaining Cut Indicator

- Start by checking remaining cut indicator:
- ◆ The -VAS 6223/1- cutting device can perform approximately 1260 cuts. The blade is rotated for each additional cut.
- ◆ The last remaining 150 cuts are indicated via the remaining cut display -arrow-.
- ◆ Once no further cuts are available, the blade is blocked. It must be replaced. Refer to the Operating Instructions that come with -VAS 6223/1- .



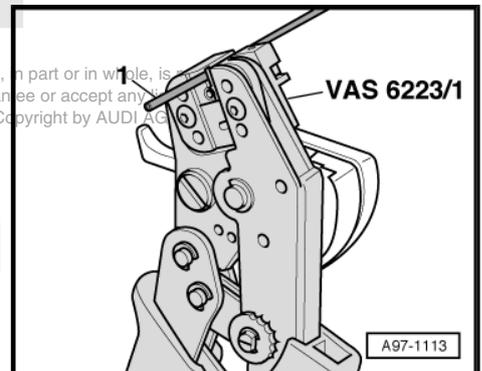
Preparing Pliers For Fiber-Optic Conductor -VAS 6223/1-

- Release transport safety device on cutter by loosening hex socket bolt -arrow-.



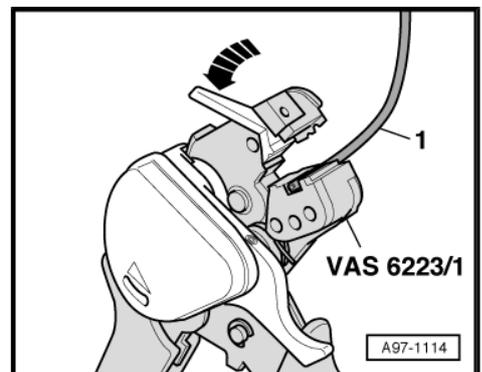
Fiber Optic Cable, Cutting To Length

- Establish length of fiber optic cable required.
- Open -VAS 6223/1- and insert fiber optic cable -1- into trimming station.
- Close cutting tool to cut fiber optic cable to length.

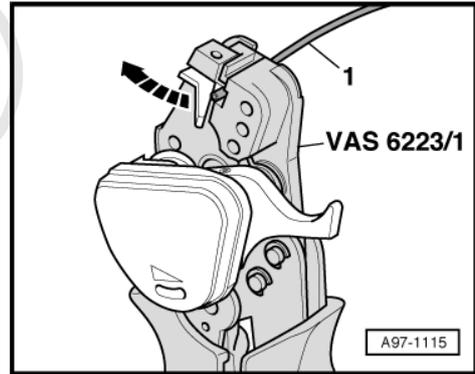


Stripping

- Open -VAS 6223/1- .
- Stripping lever must be located in the lower position -arrow-.
- Insert fiber-optic cable -1- into stripping station.
- Fiber-optic cable must terminate flush to rear side of cutting pliers.

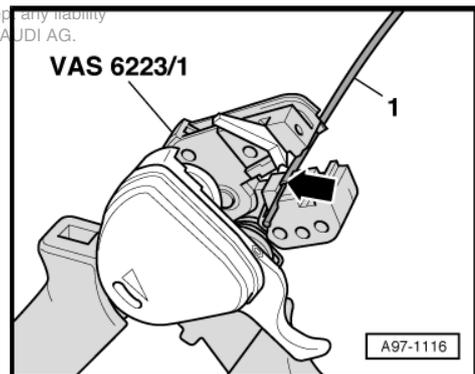


- Close -VAS 6223/1- until stop and keep closed.
- Pivot stripping lever upward -arrow-.
- Open cutting pliers and remove fiber-optic cable -1-.
- Detach separated section of insulation from fiber-optic cable.



Precision Cutting (Production Of Optical End Face)

- Slide fiber-optic cable -1- into cutting station.
- Insulation must make contact at stop -arrow- of cutting station.
- Close -VAS 6223/1- .

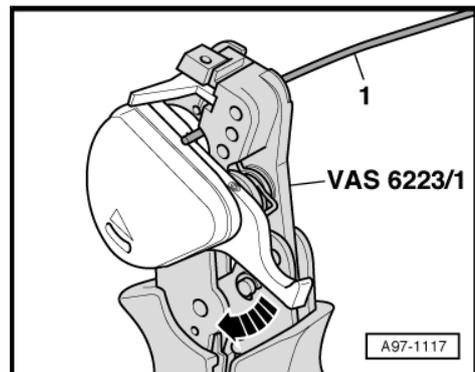


- Press down -arrow- cutting device.
- Open -VAS 6223/1- and remove fiber-optic cable -1-.



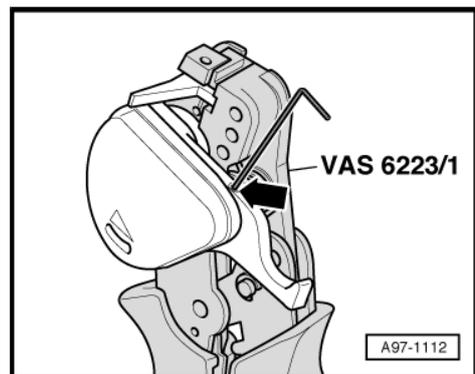
Note

Fiber-optic cable is only to be placed on an absolutely clean surface.



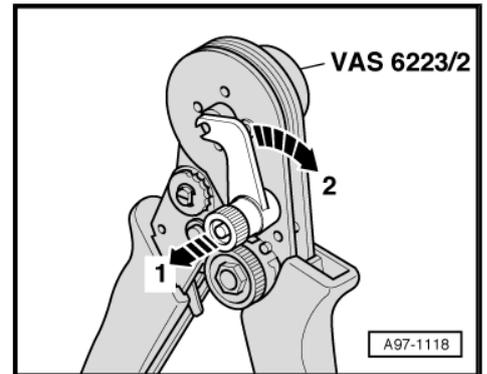
Activating Transportation Safeguard

- Close -VAS 6223/1- .
- Tighten hex socket bolt -arrow- for transport safety device on cutter.

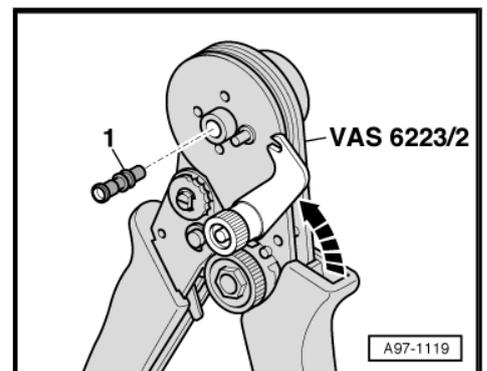


Attaching Brass Pin Contact To Fiber-Optic Cable

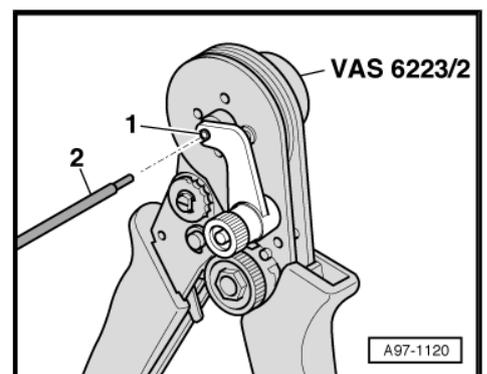
- Open securing lever on -VAS 6223/2- -arrow 1- and -arrow 2-.



- Insert a brass pin contact -1- into mount.
- Close securing lever on -VAS 6223/2- -arrow-.



- Slide fiber-optic cable -2- in brass pin contact -1- up to spring-loaded stop.
- Continue sliding fiber optic cable in as far as fixed stop and close -VAS 6223/2- .
- Open crimping pliers for fiber-optic cable and remove fiber-optic cable with brass pin contact.

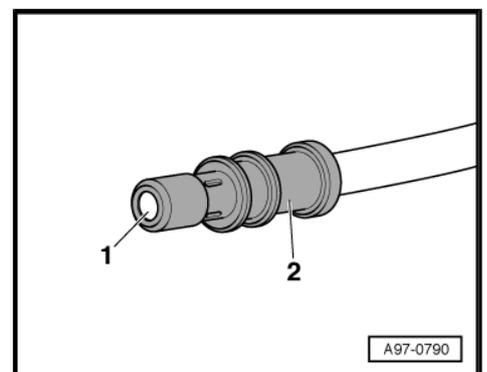




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Do not excessively bend or kink fiber optic cables, (minimum bending radius 25 mm).

- Check the connection of brass pin contact -2- to fiber-optic cable -1- for secure installation.
- 4 crimp points must be visible at brass connection pin.
- The brass pin contact must not be able to be removed by hand from fiber-optic cable.
- The end face of the fiber-optic cable is located 0.01 to 0.1 mm behind the brass pin contact (visual inspection).

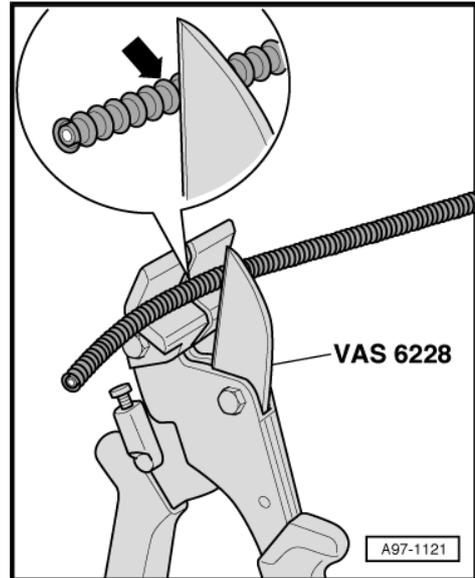


Note

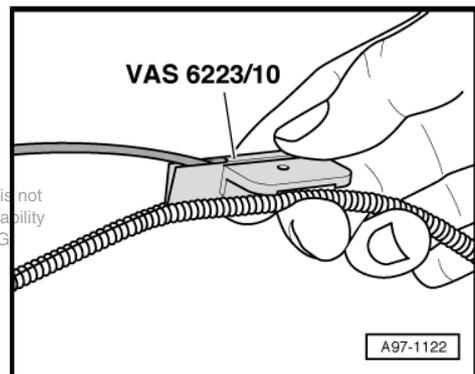
- ◆ Connector couplings are available for connecting fiber-optic cables. Refer to Electronic Parts Catalog (ETKA).
- ◆ Installing a new fiber-optic cable in a wiring harness connector, refer to [⇒ "1.2.2 Disconnecting From Wiring Harness Connector", page 66](#) .

Installing Corrugated Tube On Fiber-Optic Cable

- Cut the corrugated tube to the appropriate length.
- Use -VAS 6228- or a sharp knife for cutting.
- The corrugated tube must not be cut through using a side cutter under any circumstances
- The corrugated tube must be cut on the wave peak -arrow-, not in the wave trough.



- Guide fiber-optic cable into -VAS 6223/10- as shown in illustration.
- Position crimping pliers for fiber-optic cable at slot of corrugated tube.
- Position crimping pliers for fiber-optic cable at slot of corrugated tube. **By doing this, fiber-optic cable is fed in corrugated tube.**



1.2.2 Disconnecting From Wiring Harness Connector

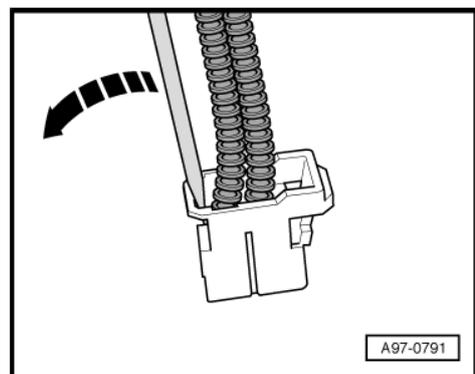


Caution

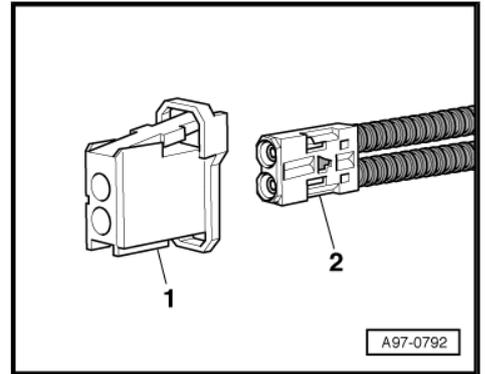
Do not excessively bend or kink fiber optic cables. (minimum bending radius 25 mm).

Removal

- Unplug connector for fiber optic cable from appropriate control unit.
- Release locking latch in fiber-optic cable connector -arrow-.



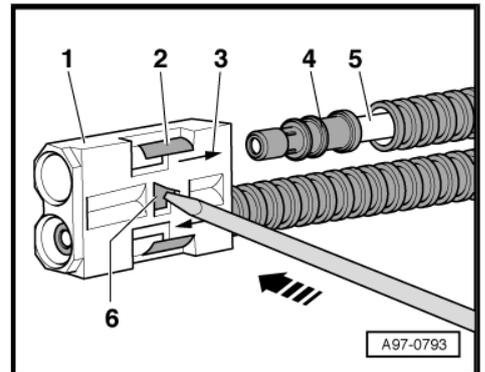
- Pull base module -2- for fiber-optic cable from connector housing -1-.



Caution

- ◆ *Mark allocation of fiber-optic cable -5- to the appropriate connector socket in base module -1- with color marking.*
- ◆ *Note the arrows -3- for allocation on the base module "IN" and "OUT".*

- Release secondary latch -6- (blue pin) using a small screwdriver -arrow-.
- Release catch -2- and remove fiber-optic cable -5- with brass connector pin -4- from base module -1-.



Installation

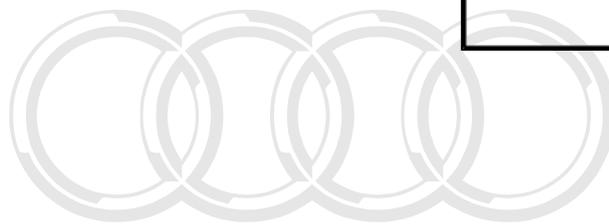
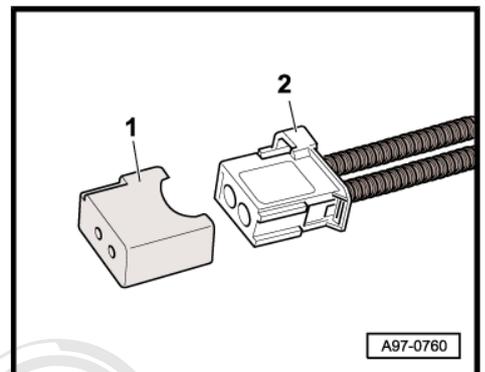
Install in reverse order of removal. Note the following:

- Install fiber optic cable in line with markings.



Note

- ◆ *Seal open harness connector -2- for fiber-optic cable using Protective Cap For Cable Connector -VAS 6223/9- -item 1-.*
- ◆ *Protective cap prevents contamination of or mechanical damage to end face of fiber optic cable which would impair signal transmission.*



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1.3 Connector Housings and Connectors, Repairing

⇒ ["1.3.1 Connector Housings and Connectors, Repair Information", page 68](#)

⇒ ["1.3.2 Contacts in Connector Housing, Repairing", page 68](#)

⇒ ["1.3.3 Single Wire Seals, Installing", page 70](#)

⇒ ["1.3.4 Connector Housings with Insulation Displacement Terminal, Repairing", page 71](#)

1.3.1 Connector Housings and Connectors, Repair Information



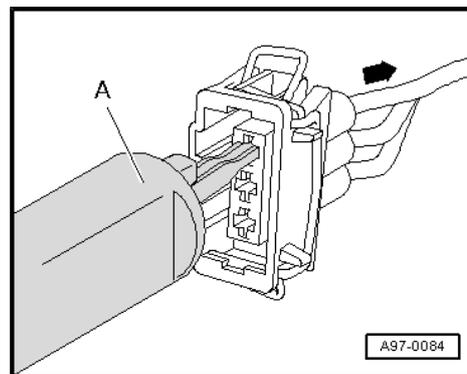
Note

- ◆ *Observe general notes for repairs to the vehicle electrical system. Refer to*
⇒ ["1.7.2 General Notes on Repairs on Vehicle Electrical System", page 87](#).
- ◆ *Allocation of crimp contacts with correct fit to connector housing is performed according to the part number stamped in on the connector housing. Connector housing part numbers in conjunction with the appropriate crimp contacts. Refer to Electronic parts catalog; Special Catalog "Electrical connecting components"; Electrical equipment; subgroup 70, chart 970-00.*
- ◆ *Damaged connector housings must always be replaced.*

1.3.2 Contacts in Connector Housing, Repairing

Procedure

- First, open or release if necessary the secondary lock of the connector housing. Refer to
⇒ ["1.4 Contact Housings, Releasing and Disassembling", page 71](#).
- Release the contact (primary lock) using the appropriate release tool -A-. Refer to
⇒ ["1.4 Contact Housings, Releasing and Disassembling", page 71](#).
- Pull the contact back out of the connector housing -arrow- at the single wire (with the single wire seal if necessary).



- Cut off the old contact (with the single wire seal) from the vehicle-specific wiring harness.
- Take the yellow repair wire with the correct contact out of the Wiring harness repair set -VAS 1978 B- .
- Free up the wire to be repaired approximately 20 cm on both sides of the repair point.



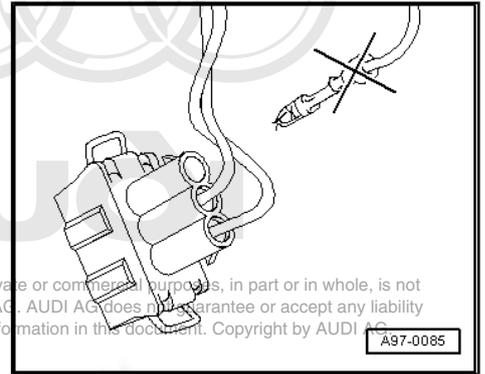
Caution

Risk of damaging the electrical wires.

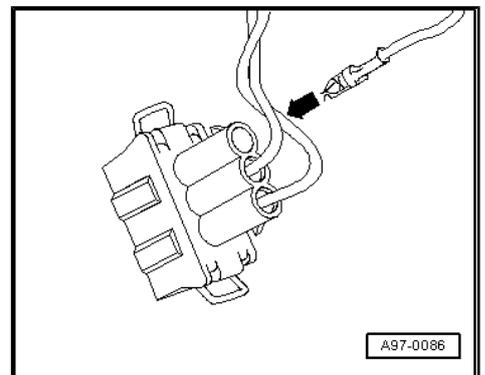
- ◆ **Expose wrapped wiring harnesses carefully.**

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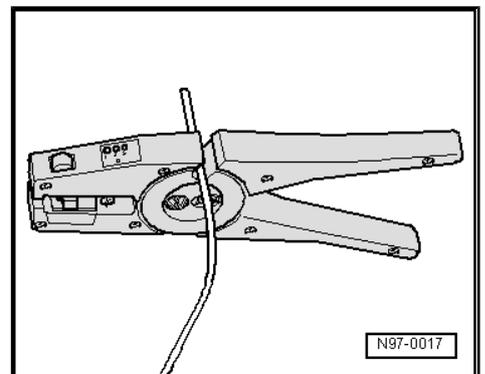


- If necessary, removing the wiring harness wrapping using a knife.
- Slide the new repair wire contact into the corresponding connector housing compartment until it engages.
- If necessary, install the single wire seal on the repair wire. Refer to ⇒ ["1.3.3 Single Wire Seals, Installing", page 70](#) .



A97-0086

- Shorten the repair wire and the vehicle-specific wiring harness single wire as needed using the Wire Stripper -VAS 1978/3- .
- Remove the insulation from the ends of the repair wire and vehicle-specific single wire and crimp the ends with the crimping wires and a crimp connector. Refer to ⇒ ["1.7.7 0.25 mm² Wire With Individual Crimp Connector, Repairing", page 92](#) or ⇒ ["1.7.10 0.35 mm² Or Greater With Intermediate Wire Section, Repairing", page 99](#) .



N97-0017

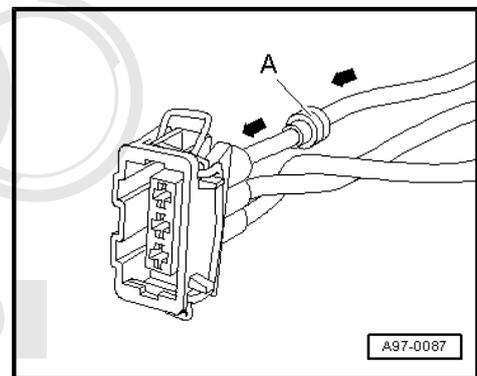
1.3.3 Single Wire Seals, Installing

Procedure

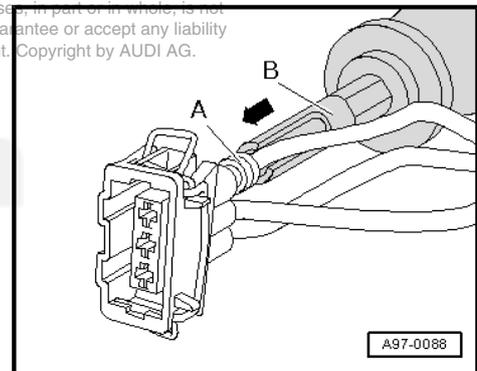


Note

- ◆ *Single wire seals prevent the penetration of water and dirt into the connector housing. They are installed e.g. in engine compartment and must be reinstalled after a repair.*
 - ◆ *Single wire seal is crimped on at the factory together with contact on the wire, this is not the case for repair wires. The single wire seal must be slid onto the wire before crimping the repair wire.*
 - ◆ *Single wire seals must always fit with the repair wire cross-section. Outer circumference of single wire seal is aligned according to chamber circumference of the connector housing. Perform assembly using only the assembly tool with correct fit.*
- Put single wire seal -A- onto free end of repair wire.
 - When doing this, the single wire seal small diameter must point toward the connector housing.



- Slide the single wire seal -A- onto the repair wire up to the connector housing and then into the housing as far as the stop using the appropriate assembly tool -B-.

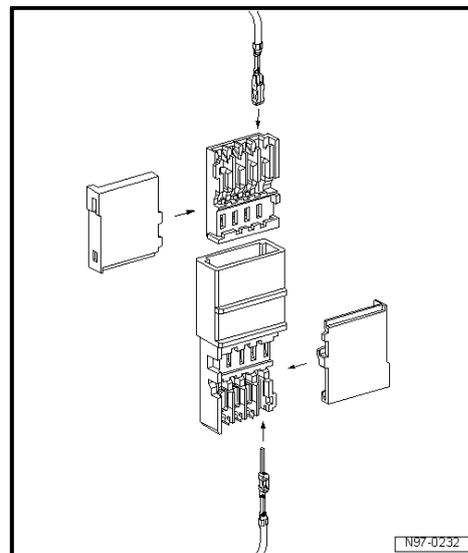


1.3.4 Connector Housings with Insulation Displacement Terminal, Repairing



Note

- ◆ For technical reasons, connector housings with insulation displacement can be supplied only with the insulation displacement contacts pushed in.
- ◆ If these contacts are not needed, they can be removed as on any other connector housing.
- ◆ Repair wires that already have the corresponding contacts crimped on are available. Refer to Electronic Parts Catalog (ETKA).



1.4 Contact Housings, Releasing and Disassembling

⇒ ["1.4.1 Releasing and Disassembling Connector Housings, General Information", page 71](#)

⇒ ["1.4.2 Secondary Lock", page 72](#)

⇒ ["1.4.3 Primary Lock", page 73](#)

⇒ ["1.4.4 Primary Connector With Round Connector Systems", page 73](#)

⇒ ["1.4.5 Primary Connector With Flat Connector Systems", page 74](#)

⇒ ["1.4.6 Primary Connector With Special Connector Systems", page 76](#)

1.4.1 Releasing and Disassembling Connector Housings, General Information



WARNING

Risk of injury.

- ◆ Some tools are supplied with a tool safety clip, which is slid over the tool points after using the tool, in order to protect other workers from injuries and tool points from damage.

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Note

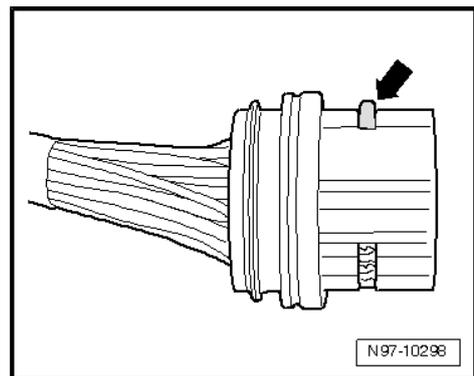
- ◆ *Observe general notes for repairs to the vehicle electrical system. Refer to ⇒ ["1.7.2 General Notes on Repairs on Vehicle Electrical System", page 87](#).*
- ◆ *Always use the release tools intended for the releasing process. Under no circumstances may terminals be pulled forcefully out of connector housings.*
- ◆ *Damaged connector housings must always be replaced.*
- ◆ *Small screwdrivers may be used as an aid to release the secondary locks.*
- ◆ *The pin assignment is partially stamped on the secondary lock or the rear side of the connector housing.*
- ◆ *Detailed information on component locations of harness connectors. Refer to ⇒ [Wiring diagrams, Troubleshooting & Component locations](#).*
- ◆ *Allocation of the correct release tool to the respective retainers, refer to the Operating Instructions that come with -VAS 1978/35-.*

1.4.2 Secondary Lock

- ◆ The secondary lock is a housing securing mechanism (second locking mechanism) that secures all wires in one connector housing. If a secondary lock is installed at a connector housing, it must always be opened or removed using specified tool before releasing and pulling out individual crimp contacts.
- ◆ Secondary lock is distinguished by a different color from the rest of the connector housing. It simplifies recognizing the secondary lock and clarifies its function.
- ◆ The shapes of the connector housings depicted here are only a selection which, as an example, should make clear the various functions of the secondary lock.

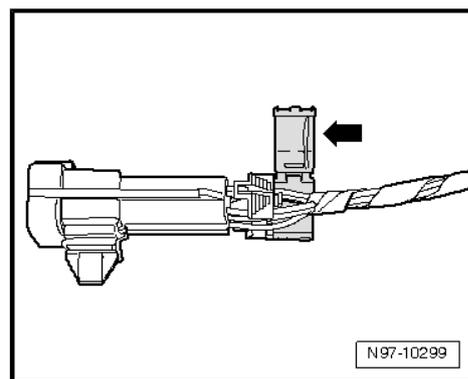
Example 1

- Release the housing lock by removing the "comb" -arrow-



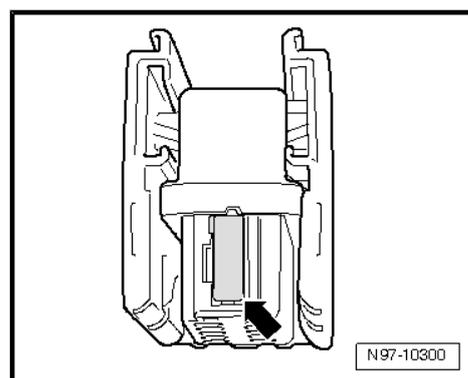
Example 2

- Release the housing lock by opening the “lid” -arrow-.



Example 3

- Release the housing lock by disengaging a “slider” -arrow-.



1.4.3 Primary Lock

- ◆ The primary lock is the locking mechanism of an individual crimp contact in the connector housing.
- ◆ If necessary, housing securing mechanisms (secondary locks) must be released or removed using specified tool before releasing the contacts. Refer to [⇒ “1.4.2 Secondary Lock”, page 72](#) .
- ◆ The shapes of the primary locks depicted in the following are only a selection which, as an example, should make clear the various functions of the primary lock.
- ◆ Allocation of the correct release tool to the respective locking mechanism, refer to the Operating Instructions that come with -VAS 1978/35- .

1.4.4 Primary Connector With Round Connector Systems

Procedure



Note

If necessary, housing securing mechanisms (secondary locks) must be released or removed using specified tool before releasing the contacts. Refer to [⇒ “1.4.2 Secondary Lock”, page 72](#) .

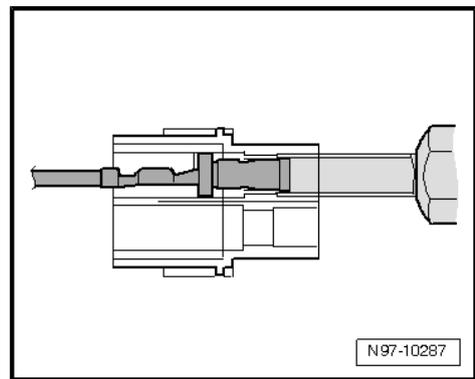
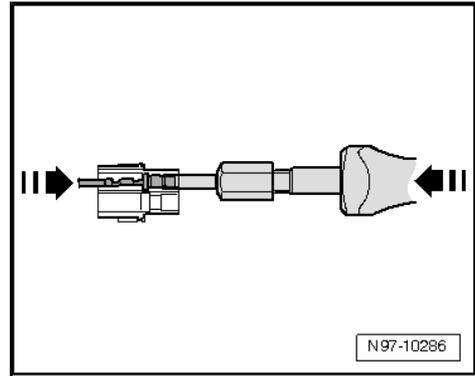
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- Guide the release tool which fits the connector housing into release channel on connector housing.
- Grasp the contact at the wire and gently push it into the connector housing -left arrow-.

**Note**

By pushing the contact in the direction of the connector housing, contact retaining tabs are lifted off the housing shoulder and can be released using the release tool.

- At the same time, push the release tool in the direction of the connector housing -right arrow- and pull the released contact out of the connector housing.
- Remove the release tool after removing the contact from the housing.



1.4.5 Primary Connector With Flat Connector Systems

Procedure**Note**

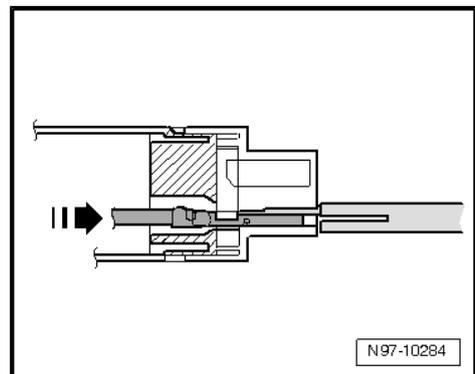
If necessary, housing securing mechanisms (secondary locks) must be released or removed using specified tool before releasing the contacts. Refer to ⇒ ["1.4.2 Secondary Lock", page 72](#) .

Flat Connector System With One Retaining Tab

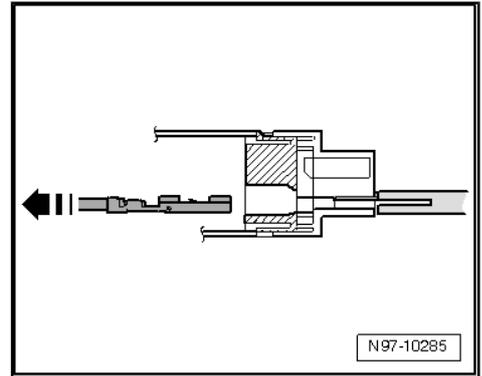
- Guide the release tool which fits the connector housing into release channel on connector housing.
- Grasp contact at wire and push it gently into connector housing -arrow-

**Note**

By pushing the contact in the direction of the connector housing, the contact retaining tab is lifted off the housing shoulder and can be released using the release tool.



- At the same time, push the release tool in the direction of the connector housing and pull the released contact out of the connector housing -arrow-.
- Remove the release tool after removing the contact from the housing.



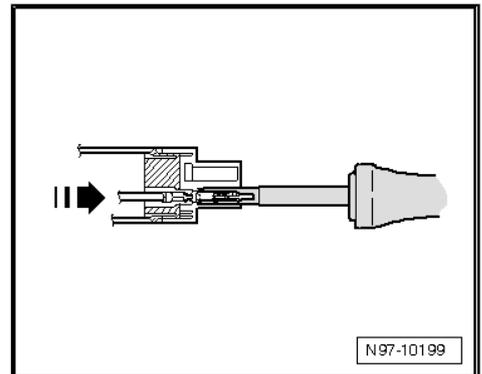
Flat Connector System With Two Retaining Tabs

- Guide the release tool which fits the connector housing into release channel on connector housing.
- Grasp contact at wire and push it gently into connector housing until it stops -arrow-.

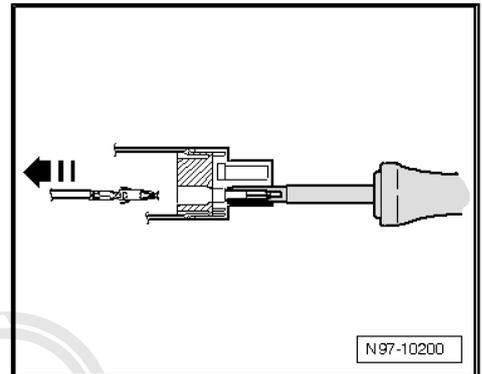


Note

By pushing the contact in the direction of the connector housing, contact retaining tabs are lifted off the housing shoulder and can be released using the release tool.



- At the same time, push the release tool in the direction of the connector housing and pull the released contact out of the connector housing -arrow-.
- Remove the release tool after removing the contact from the housing.



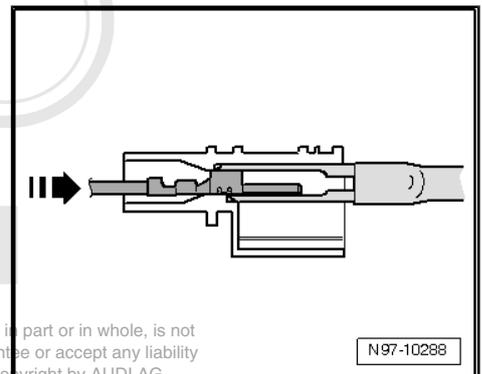
Asymmetrical

- Guide the release tool which fits the connector housing into release channel on connector housing.
- Grasp contact at wire and push it gently into connector housing -arrow-.

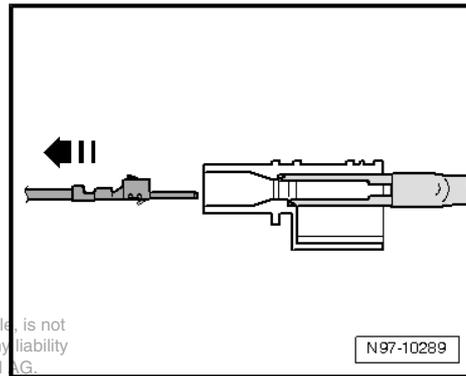


Note

By pushing the contact in the direction of the connector housing, contact retaining tabs are lifted off the housing shoulder and can be released using the release tool.



- At the same time, push the release tool in the direction of the connector housing and pull the released contact out of the connector housing -arrow-.
- Remove the release tool after removing the contact from the housing.



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1.4.6 Primary Connector With Special Connector Systems

Procedure



Note

If necessary, housing securing mechanisms (secondary locks) must be released or removed using specified tool before releasing the contacts. Refer to ⇒ ["1.4.2 Secondary Lock", page 72](#).

Faston Contacts

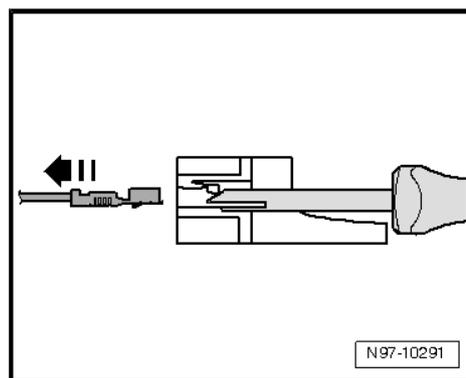
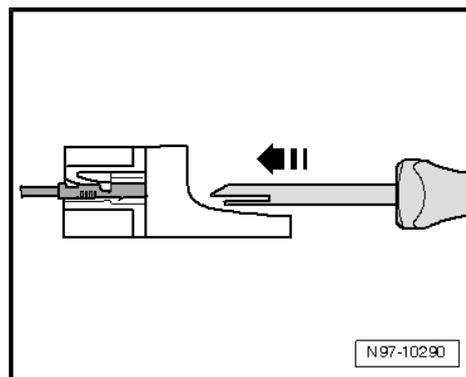
- Guide the release tool which fits the connector housing into release channel on connector housing -arrow-.
- Grasp contact at wire and push it gently into connector housing.



Note

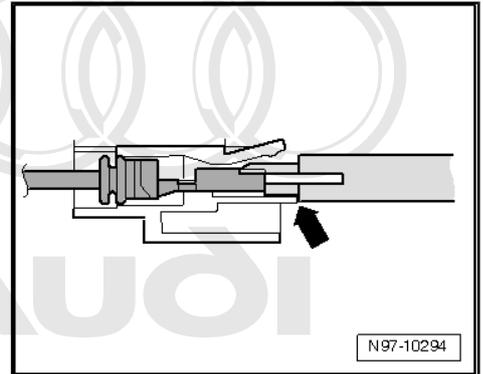
By pushing the contact in the direction of the connector housing, contact retaining tabs are lifted off the housing shoulder and can be released using the release tool.

- At the same time, push the release tool in the direction of the connector housing and pull the released contact out of the connector housing -arrow-.
- Remove the release tool after removing the contact from the housing.



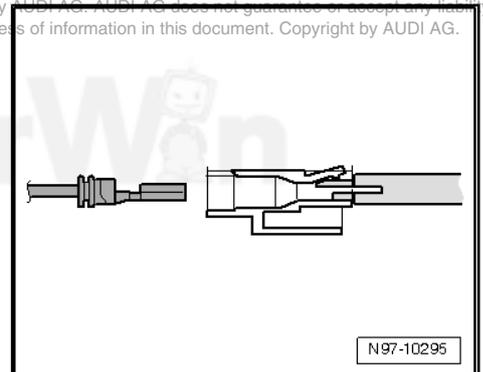
GT 150/280 Contacts

- Guide the release tool which fits the connector housing under retaining tab into connector housing.
- Push tool into connector housing until it stops -arrow-.



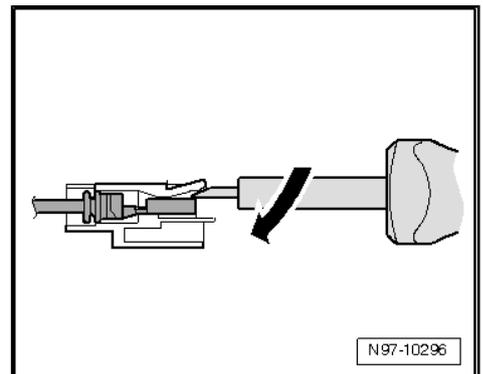
- Contact is ejected from the connector housing.
- Remove the release tool after removing the contact from the housing.

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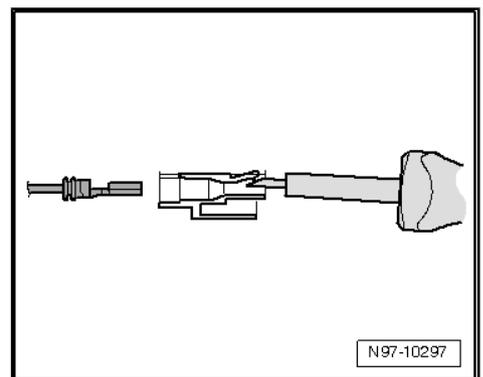


Contacts Without Retaining Tabs

- Insert release tool under retaining tab of connector housing.
- Push release tool through until it stops by gently lifting -arrow-.



- Contact is ejected from the connector housing.
- Remove the release tool after removing the contact from the housing.



1.5 Cleaning contact surfaces with the contact surface cleaning set -VAS 6410-

⇒ ["1.5.1 Wiring Eyelets, Servicing", page 78](#)

⇒ ["1.5.2 Threaded Connections, Servicing", page 79](#)

⇒ ["1.5.3 Battery Clamps and Terminals, Cleaning", page 81](#)

⇒ ["1.5.4 Protecting", page 82](#)

1.5.1 Wiring Eyelets, Servicing

Special tools and workshop equipment required

- ◆ Contact Surfaces Cleaning Set -VAS 6410-



Note

- ◆ *Using the Contact surface cleaning set VAS 6410-VAS 6410-, service work can be performed in the area of the contact sensor on the threaded connection wiring harnesses in the high current circuit (starter and charging current).*
- ◆ *The gray sanding pads are for slight contamination and suitable for "soft surfaces". The red sanding pads are for heavy contamination and suitable for "hard surfaces".*



Note

Do not use rust remover, contact spray or grease because the lack of friction will cause the torque to be exceeded when installing and this will lead to the threaded connection breaking.



WARNING

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Risk of injury.

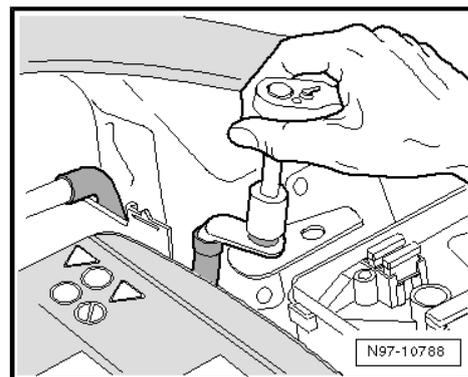
- ◆ ***Follow all Warnings and Safety Precautions. Refer to ⇒ ["1.5 Lead-Acid Battery Warnings and Safety Precautions", page 8](#).***

- Disconnect the battery. Refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .

- Loosen the cap nut and remove the wiring eyelet from the threaded connection.
- Check the wiring eyelet for corrosion, contamination, etc.
- Select the corresponding adapter and the corresponding sanding pad.

 **Note**

A sanding block can be used instead.



 **Caution**

Increased corrosion due to an exposed copper layer.

- ◆ *Make sure the tin layer is not worn down too much and the copper is not visible. Increased corrosion can result due to the galvanizing effects.*

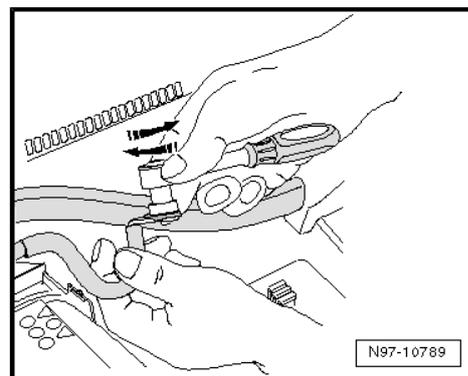
 **Note**

Due to the different thicknesses of the tin layer, the cleaning process must be performed in several steps and a visual inspection of the wiring eyelet between steps is necessary.

- Insert the adapter in the wiring eyelet and sand off the corrosion and contamination with circular motion.
- Check the wiring eyelet and sand it again if necessary.
- If necessary, remove the burr on the wiring eyelet with the deburrer.
- Reinstall the wiring eyelet to the tightening specification.

 **Note**

Optimal contact is ensured if the bolted components are tightened to the specified torque after cleaning.



- Protect the connection with the corresponding protection material. Refer to ⇒ ["1.5.4 Protecting", page 82](#) .
- Reconnect the battery. Refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .

1.5.2 Threaded Connections, Servicing

Special tools and workshop equipment required

- ◆ Contact Surfaces Cleaning Set -VAS 6410-



Note

- ◆ *Using the Contact surface cleaning set VAS 6410-VAS 6410-, service work can be performed in the area of the contact sensor on the threaded connection wiring harnesses in the high current circuit (starter and charging current).*
- ◆ *The gray sanding pads are for slight contamination and suitable for "soft surfaces". The red sanding pads are for heavy contamination and suitable for "hard surfaces".*



Note

Do not use rust remover, contact spray or grease because the lack of friction will cause the torque to be exceeded when installing and this will lead to the threaded connections breaking.



WARNING

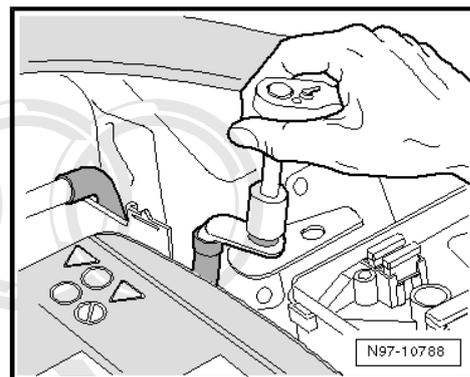
Risk of injury.

- ◆ ***Follow all Warnings and Safety Precautions. Refer to ⇒ "1.5 Lead-Acid Battery Warnings and Safety Precautions", page 8 .***

- Disconnect the battery. Refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .

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- Loosen the cap nut and remove the wiring eyelet from the threaded connection.
- Check the threaded connection for corrosion, contamination, etc.
- Select the corresponding adapter and the corresponding sanding pad for the threaded connection.



Caution

Increased corrosion due to an exposed copper layer.

- ◆ **Make sure the tin layer is not worn down too much and the copper is not visible. Increased corrosion can result due to the galvanizing effects.**



Note

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Due to the different thicknesses of the tin layer, the cleaning process must be performed in several steps and a visual inspection of the threaded connection between steps is necessary.

- Insert the adapter in the threaded connection and sand off the corrosion and contamination with circular motion.
- Check the threaded connection and sand it again if necessary.
- Tighten the connection and, if necessary, the anti-rotation protection to the tightening specification.



Note

Optimal contact is ensured if the bolted components are tightened to the specified torque after cleaning.

- Protect the connection with the corresponding protection material. Refer to ⇒ [“1.5.4 Protecting”, page 82](#) .
- Reconnect the battery. Refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .

1.5.3 Battery Clamps and Terminals, Cleaning

Special tools and workshop equipment required

- ◆ Contact Surfaces Cleaning Set -VAS 6410-



Note

- ◆ *Using the Contact surface cleaning set VAS 6410 -VAS 6410-, service work can be performed in the area of the contact sensor on the threaded connection wiring harnesses in the high current circuit (starter and charging current).*
- ◆ *The gray sanding pads are for slight contamination and suitable for "soft surfaces". The red sanding pads are for heavy contamination and suitable for "hard surfaces".*

Note

Do not use rust remover, contact spray or grease because the lack of friction will cause the torque to be exceeded when installing and this will lead to the battery terminals breaking.

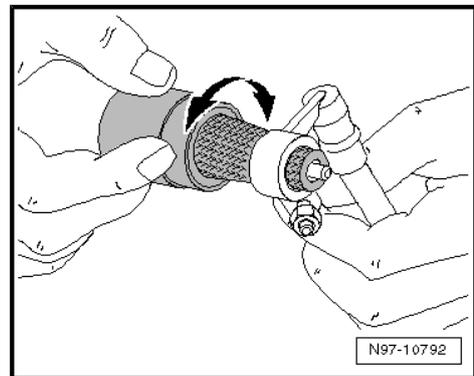


WARNING

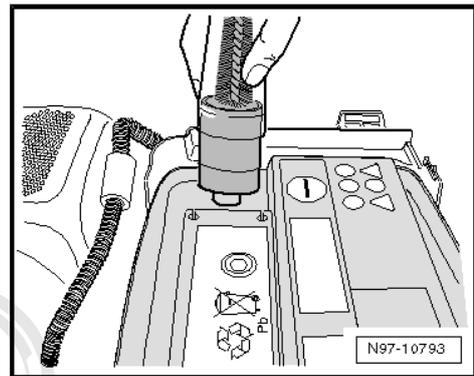
Risk of injury.

- ◆ *Follow all Warnings and Safety Precautions. Refer to ⇒ "1.5 Lead-Acid Battery Warnings and Safety Precautions", page 8.*

- Disconnect the battery. Refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .
- Check the battery terminal clamp and battery terminal for corrosion and dirt.
- Clean the battery terminal with a wire brush and battery terminal cleaner -arrows-.



- Clean the battery terminal with the bottom side of the battery terminal cleaner with circular motions.
- Reconnect the battery. Refer to ⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation while paying attention to the specified torque for the battery terminal clamps.



Note

Optimal contact is ensured if the bolted components are tightened to the specified torque after cleaning.

1.5.4 Protecting

Special tools and workshop equipment required

- ◆ Contact Surfaces Cleaning Set -VAS 6410-

 Note

- ◆ *Using the Contact surface cleaning set VAS 6410-VAS 6410-, service work can be performed in the area of the contact sensor on the threaded connection wiring harnesses in the high current circuit (starter and charging current).*
- ◆ *The gray sanding pads are for slight contamination and suitable for "soft surfaces". The red sanding pads are for heavy contamination and suitable for "hard surfaces".*

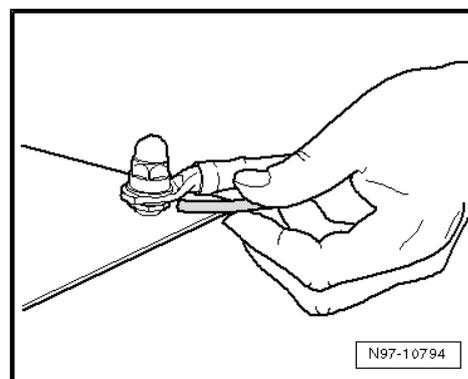
 **Caution**

Danger of corrosion.

◆ **Missing protection leads to the electrical system damage.** is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

 Note

- ◆ *All threaded connections must be tightened to the specified torque.*
 - ◆ *Always use the accompanying hose on the protection container.*
 - ◆ *Protection wax is used in the cool area and cavity protection wax is used in the warm area.*
 - ◆ *The protection material draws itself into the affected places by capillary action.*
- Hold the injector under the wiring eyelet and spray all around the pins.
- Hold the injector above the wiring eyelet and spray all around the pins and wiring eyelet.



1.6 Vehicle Diagnosis, Testing and Information Systems

⇒ [“1.6.1 Application Information and Safety Precautions”, page 84](#)

⇒ [“1.6.2 Connecting the Vehicle Diagnosis Tester”, page 85](#)

1.6.1 Application Information and Safety Precautions

Audi A1, Audi A2, Audi A3, Audi A4, Audi A4 Cabriolet, Audi A5, Audi A6, Audi A7, Audi A8, Audi Q5, Audi Q7



WARNING

Distraction and inadequately secured measuring equipment poses an accident risk.

There is a risk due to deployment of the front passenger airbag in an accident.

- *Operating measuring equipment while driving creates a distraction.*
- *There is an increased risk of injury if measuring equipment is not secured.*
- ◆ *Always secure measuring equipment with a strap on the rear seat and have a 2nd person in the rear seat operate it.*

Audi TT and Audi R8

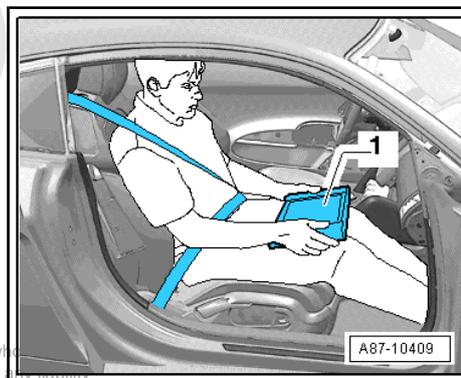


WARNING

Distraction and inadequately secured measuring equipment poses an accident risk.

There is a risk due to deployment of the front passenger airbag in an accident.

- *Operating measuring equipment while driving creates a distraction.*
- *There is an increased risk of injury if measuring equipment is not secured.*
- ◆ *Position the passenger's seat as far back as possible.*
- ◆ *Only use the Vehicle Diagnosis and Service Information System -VAS 5052 A- or Diagnostic system -VAS 5053- .*
- ◆ *Measuring equipment -1- must lie flat on the passenger's legs and be operated by that person, as shown in the illustration.*



Note

- ◆ *The Vehicle Diagnosis Tester can perform all adaptations, coding, etc.*
- ◆ *All work instructions can be reached in the operating modes “Guided Fault Finding” and “Guided Functions”.*

1.6.2 Connecting the Vehicle Diagnosis Tester

Note

*Follow the current instructions on the Vehicle Diagnosis Tester. Use the **Administration** and **User Documentation** buttons.*

Special tools and workshop equipment required

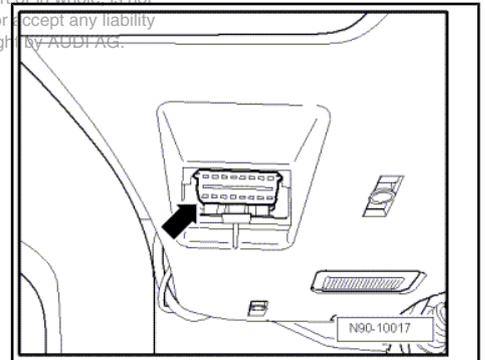
- ◆ Vehicle Diagnosis Tester and diagnostic cable

Procedure

- Engage the parking brake or operate the electromechanical parking brake.
- Shift the shifter lever into neutral or place the selector lever in the “P” or “N” position.
- Turn off the ignition and connect the Vehicle Diagnosis Tester to the diagnostic connection with the diagnostic cable -arrow-.
- When using the Remote diagnosis head -VAS 5054 A- or the Diagnosis interface -VAS 5055- refer to the Operating Instructions.
- Switch on ignition.
- Turn off all electrical consumers.

Note

If an error message appears on the screen of the Vehicle Diagnosis Tester, refer to the Operating Instructions.



1.7 Wiring Harnesses and Connectors, Repairing

⇒ [“1.7.1 General Notes For Repairing Wiring Harnesses and Connectors”, page 86](#)

⇒ [“1.7.2 General Notes on Repairs on Vehicle Electrical System”, page 87](#)

⇒ [“1.7.3 Electro-Static Discharge Work Surface VAS 6613”, page 88](#)

⇒ [“1.7.4 Pyrotechnic Component Wire, Repairing”, page 88](#)

⇒ [“1.7.5 CAN Bus Wire, Repairing”, page 90](#)

⇒ [“1.7.6 FlexRay Wire, Repairing”, page 91](#)

⇒ [“1.7.7 0.25 mm 2 Wire With Individual Crimp Connector, Repairing”, page 92](#)

⇒ [“1.7.8 0.25 mm² Wire With Intermediate Wire Section, Repairing”, page 94](#)

⇒ [“1.7.9 0.35 mm 2 Or Greater With Individual Crimp Connector, Repairing”, page 97](#)

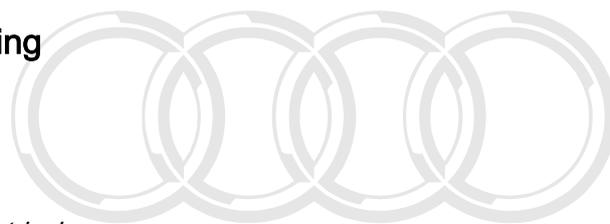
⇒ [“1.7.10 0.35 mm² Or Greater With Intermediate Wire Section, Repairing”, page 99](#)

1.7.1 General Notes For Repairing Wiring Harnesses and Connectors



Note

- ◆ *Observe general notes for repairs on the vehicle electrical system. Refer to*
⇒ [“1.7.2 General Notes on Repairs on Vehicle Electrical System”, page 87](#).
- ◆ *The Wiring harness repair set -VAS 1978 B- does not contain all the wire cross-sections in the vehicle. If the required wire cross-section is not present, the next greater cross-section must be used.*
- ◆ *For repairs on the vehicle electrical system, soldering is not permitted.*
- ◆ *Do not repair crimp connectors. If necessary, lay a wire parallel to the faulty wire.*
- ◆ *After crimping, crimp connections must be heat-shrunk using the hot air blower to prevent moisture penetration.*
- ◆ *Shielded wires such as for speed sensors and knock sensors may not be repaired. If faulty, the entire harness must be replaced.*
- ◆ *Exclusive use is to be made of yellow wires for wiring harness repairs.*
- ◆ *Wiring harness repairs should not be made again in the wrapping on the vehicle-specific wiring harness.*
- ◆ *Mark repaired areas using yellow adhesive tape.*
- ◆ *Yellow wires and areas in the wiring harness wrapped with yellow adhesive tape mark a previously performed repair.*
- ◆ *Perform a function test after each repair. If necessary, check DTC memory, erase and/or bring systems into basic setting.*



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1.7.2 General Notes on Repairs on Vehicle Electrical System

Special tools and workshop equipment required

- ◆ Wiring Harness Repair Set VAS 1978/A -VAS 1978 B-



Caution

- ◆ *Repairs to the wiring harnesses and connectors must only be performed using the Wiring harness repair set -VAS 1978 B- .*
- ◆ *Observe the country-specific requirements.*



Note

- ◆ *Use of the Wiring harness repair set -VAS 1978 B- is described in detail in the attached operating instructions.*
- ◆ *Repairs on open circuits and faulty connectors are also explained using examples.*



WARNING

Risk of injury.

- ◆ *Pay attention to decals designating high voltage components. When performing repairs, residual voltage must be discharged.*
- ◆ *Some tools are supplied with a tool safety clip, which is slid over the tool points after using the tool, in order to protect other workers from injuries and tool points from damage.*



Caution

- ◆ *Observe the country-specific requirements.*
- ◆ *By disconnecting the battery ground (GND) wire, safe work on the vehicle electrical system is guaranteed. With the ignition switched off, disconnect the ground wire on the battery. Refer to⇒ Electrical Equipment; Rep. Gr. 27 ; Removal and Installation .*
- ◆ *Before starting a repair, the cause of the damage must be eliminated first, such as, sharp edges on chassis parts, faulty electrical consumers, corrosion, etc.*

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Note

- ◆ *If possible, do not loosen the ground (GND) straps from body (danger of corrosion).*
- ◆ *Further information relating for example to the removal and installation of individual components can be found in the appropriate repair manual.*

1.7.3 Electro-Static Discharge Work Surface - VAS 6613-



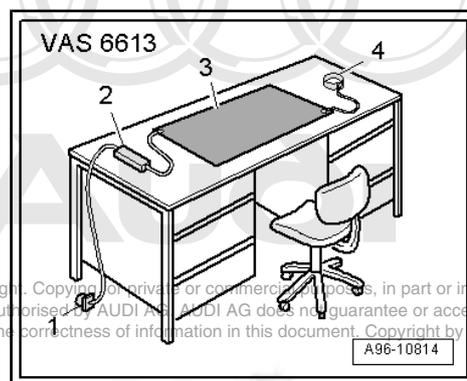
Caution

- ◆ *Repairs to the wiring harnesses and connectors must only be performed using the Wiring harness repair set -VAS 1978 B- .*
- ◆ *Observe the country-specific requirements.*



Note

- ◆ *Use of the Wiring harness repair set -VAS 1978 B- is described in detail in the attached operating instructions.*
 - ◆ *Repairs on open circuits and faulty connectors are also explained using examples.*
 - ◆ The electro-static discharge work surface -VAS 6613- protects electronic components from getting damaged by an electro-static charge.
 - ◆ This makes it possible to perform repairs on sensitive electronic components on an open mat.
 - ◆ For more information as to what work can be performed on the electro-static discharge work surface -VAS 6613- , refer to "Electrical Equipment" chapter in the repair manual.
- Place the electro-static discharge mat -3- from -VAS 6613- on a clean, dry table.
 - Connect the ground -2- to one of the buttons on the mat.
 - Connect the ground connector adapter -1- to the adapter connector on a outlet with contact protection or connect the alligator clip to a ground in the building or a water pipe.
 - Connect the wrist strap -4- to one of the buttons on the mat.
 - Attach the wrist strap directly to your wrist - never to your shirt sleeve or jacket sleeve.



Caution

If working on especially sensitive electronic component and with the pad exposed, use only non-magnetic tools, for example, a socket wrench -T10072-

1.7.4 Pyrotechnic Component Wire, Repairing

Special tools and workshop equipment required

- ◆ Wiring Harness Repair Set VAS 1978/A -VAS 1978 B-



Caution

- ◆ **Repairs to the wiring harnesses and connectors must only be performed using the Wiring harness repair set -VAS 1978 B-.**
- ◆ **Observe the country-specific requirements.**



Note

- ◆ *Use of the Wiring harness repair set -VAS 1978 B- is described in detail in the attached operating instructions.*
- ◆ *Repairs on open circuits and faulty connectors are also explained using examples.*



Note

- ◆ *Observe general notes for repairs on the vehicle electrical system. Refer to [⇒ "1.7.2 General Notes on Repairs on Vehicle Electrical System", page 87](#).*
- ◆ *Observe the notes on wiring harness and connector repairs. Refer to [⇒ "1.7.1 General Notes For Repairing Wiring Harnesses and Connectors", page 86](#) including identifying repair locations.*



WARNING

Passenger protection malfunction due to faulty repairs to the wires for pyrotechnic components - for example, airbag, belt tensioner.

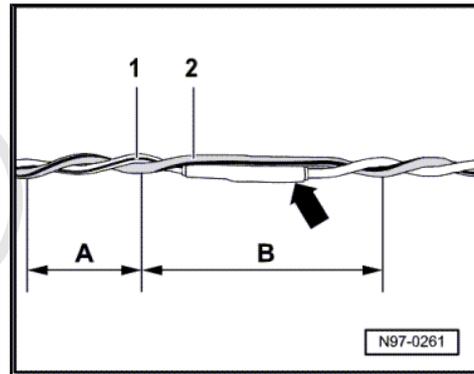
- ◆ **Repairs to wires for pyrotechnic components may only be performed on the vehicle side using the Wiring harness repair set -VAS 1978 B- and original replacement parts (connector housing, contacts, wires) in order to guarantee the repair quality required by Audi AG.**
- ◆ **Wires at individual airbag units may not be repaired.**
- ◆ **If the wires or connectors on the airbag units are damaged, the respective airbag unit must be replaced for safety reasons.**

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- ◆ A maximum of two repairs may be performed when repairing wires for pyrotechnic components. Repairs increase the electrical resistance in the wire and may trigger malfunctions in the system On Board Diagnostic (OBD).
- ◆ Repairs in the area of the pyrotechnic components should be performed a maximum of 30 cm from the next connector housing. Together with the identification using yellow adhesive tape, this procedure makes it possible to obtain a quick overview of previously performed repairs.
- ◆ Both wires to the airbag igniter have a twist with 20 +/- 5 mm routing length. This routing length must be maintained when repairing the twisted wires.
- ◆ When repairing, both wires to the airbag igniters must be the same length. When twisting the wires -1 and 2- together, the -A- = 20 mm routing length must be maintained.
- ◆ While doing so, no section of wire may be greater than -B- = 100 mm without twisting the wires, for example, in the area of crimp connectors -arrow-
- ◆ Repairs are to be documented in the Audi Service Plan under "Space for workshop entries" with a short commentary of scope of repairs, workshop stamp and signature.
- ◆ Any warranty claims to Audi AG are void for repairs on airbag wiring harness which were not performed using original replacement parts and -VAS 1978 B- .



1.7.5 CAN Bus Wire, Repairing

Special tools and workshop equipment required

- ◆ Wiring Harness Repair Set VAS 1978/A -VAS 1978 B-



Caution

- ◆ **Repairs to the wiring harnesses and connectors must only be performed using the Wiring harness repair set -VAS 1978 B- .**
- ◆ **Observe the country-specific requirements.**



Note

- ◆ *Use of the Wiring harness repair set -VAS 1978 B- is described in detail in the attached operating instructions.*
- ◆ *Repairs on open circuits and faulty connectors are also explained using examples.*



Note

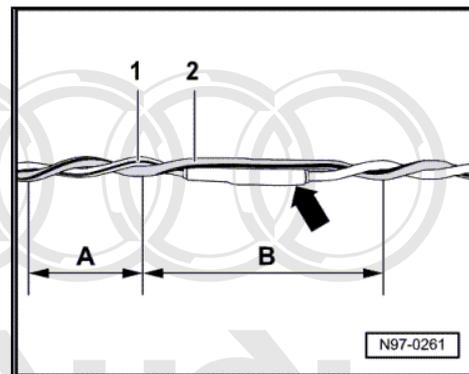
- ◆ *Observe general notes for repairs on the vehicle electrical system. Refer to ["1.7.2 General Notes on Repairs on Vehicle Electrical System"](#), page 87 .*
- ◆ *Observe the notes on wiring harness and connector repairs. Refer to ["1.7.1 General Notes For Repairing Wiring Harnesses and Connectors"](#), page 86 including identifying repair locations.*

An unshielded two-strand wire -1 and 2- with a cross section of 0.35 mm² or 0.5 mm² can be used as CAN-Bus wiring.

◆ CAN bus wires have the following color coding:

Powertrain CAN bus high wire	orange/black
Comfort CAN bus high wire	orange/green
Infotainment CAN Bus High wire	orange/violet
CAN bus wiring Low wire	orange/brown

- ◆ When repairing CAN bus wires, both wires must be same length.
- ◆ When twisting the wires -1 and 2- together, the -A- = 20 mm routing length must be maintained.
- ◆ While doing so, no section of wire may be greater than -B- = 50 mm without twisting the wires, e.g. in the area of crimp connectors -arrow-.



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1.7.6 FlexRay Wire, Repairing

Special tools and workshop equipment required

- ◆ Wiring Harness Repair Set VAS 1978/A -VAS 1978 B-

 **Caution**

- ◆ *Repairs to the wiring harnesses and connectors must only be performed using the Wiring harness repair set -VAS 1978 B-.*
- ◆ *Observe the country-specific requirements.*

Note

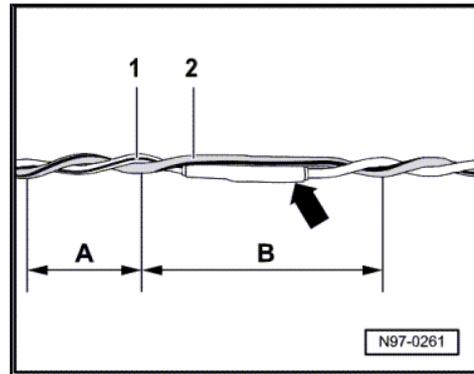
- ◆ *Use of the Wiring harness repair set -VAS 1978 B- is described in detail in the attached operating instructions.*
- ◆ *Repairs on open circuits and faulty connectors are also explained using examples.*

Note

- ◆ *Observe general notes for repairs on the vehicle electrical system. Refer to ["1.7.2 General Notes on Repairs on Vehicle Electrical System", page 87](#).*
- ◆ *Observe the notes on wiring harness and connector repairs. Refer to ["1.7.1 General Notes For Repairing Wiring Harnesses and Connectors", page 86](#) including identifying repair locations.*

A two-layer wire -1 and 2- with a 0.35 mm^2 profile is used as a FlexRay wire.

- ◆ During repair work, both wires must have the same length.
- ◆ When twisting the wires -1 and 2- together, the -A- = 30 mm routing length must be maintained.
- ◆ While doing so, no section of wire may be greater than -B- = 30 mm without twisting the wires, for example, in the area of crimp connectors -arrow-.
- ◆ Maximum exposed wire length: 100 mm.
- ◆ Protect the area being repairs from the environment. Use a crimp connector with heat-shrinkable tube over the untwisted location being repairs and waterproof insulation over the exposed wire.



1.7.7 0.25 mm^2 Wire With Individual Crimp Connector, Repairing

Special tools and workshop equipment required

- ◆ Wiring Harness Repair Set VAS 1978/A -VAS 1978 B-



Caution

- ◆ **Repairs to the wiring harnesses and connectors must only be performed using the Wiring harness repair set -VAS 1978 B-.**

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- ◆ **Observe the country-specific requirements.**



Note

- ◆ *Use of the Wiring harness repair set -VAS 1978 B- is described in detail in the attached operating instructions.*
- ◆ *Repairs on open circuits and faulty connectors are also explained using examples.*

Procedure

- Free up the wire to be repaired approximately 20 cm on both sides of the repair point.



Caution

Risk of damaging the electrical wires.

- ◆ **Expose wrapped wiring harnesses carefully.**

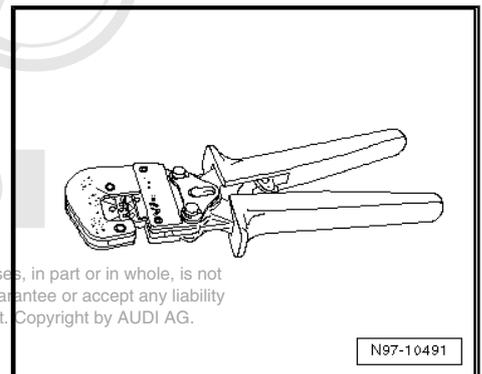
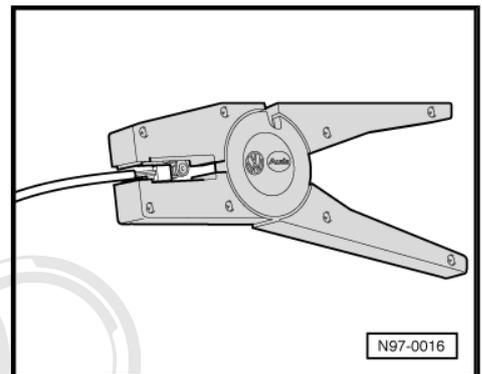
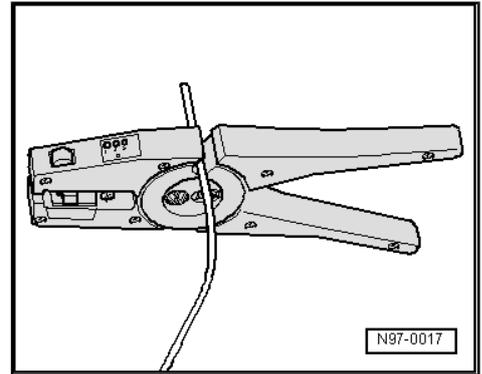
- If necessary, removing the wiring harness wrapping using a knife.

- Cut out the damaged wire section using wire stripper -VAS 1978/3- .

 **Note**

If, by cutting out the damaged wire section, both ends of the vehicle-specific single wire are too short for a repair using a single crimp connector, insert a repair wire section of matching length with two crimp connections. Refer to ⇒ "1.7.8 0.25 mm² Wire With Intermediate Wire Section, Repairing", page 94 .

- Adjust the sliding stop in the -VAS 1978/3- jaws to 12 to 14 mm for the wire to be stripped.
- Insert wire end from front up to stop into jaws of pliers and squeeze the pliers completely.
- Open pliers again and remove the stripped wire end.
- Twist bare strands one-half turn.
- For the repair of a 0.25 mm² wire, use a small yellow crimp connector from the -VAS 1978 B- .
- Use crimping pliers (base tool) -VAS 1978/1-2- with exchangeable head, 0.35 mm² - 2.5 mm² -VAS 1978/1-1- .

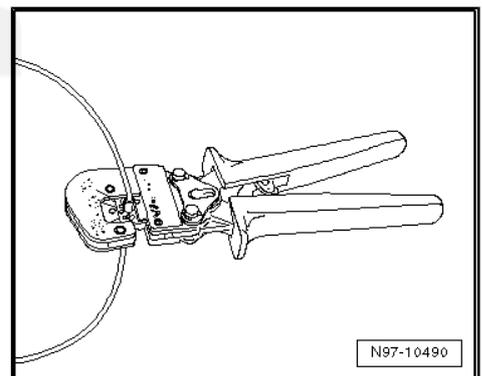


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- Slide the small yellow crimp connector onto both stripped, non-insulated wire ends on the vehicle-specific single wire and crimp them using crimp pliers.

 **Note**

Do not crimp wire insulation.



After crimping, crimp connections must be heat-shrunk using hot air gun to prevent moisture penetration.

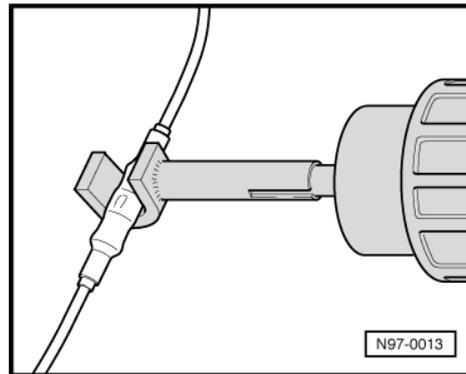
- Place the shrink element for hot air blower -VAS 1978/15A- on the hot air blower -VAS 1978/14A- .



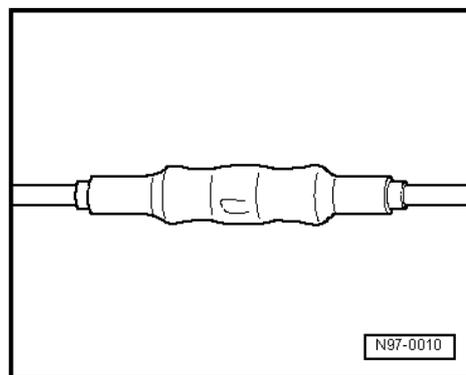
Caution

Risk of damaging surrounding components.

- ◆ **When heat-shrinking crimp connections, be careful not to damage any other wiring, plastic parts or insulating material with the hot nozzle of the hot air blower.**
- ◆ **Always observe operating instructions of heat gun.**

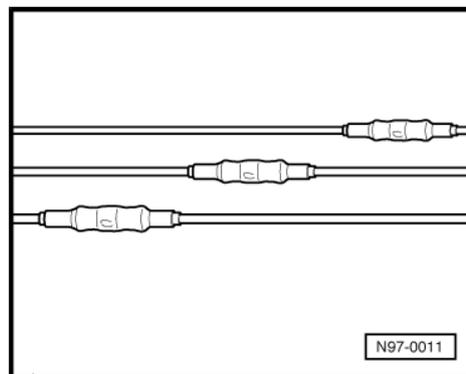


- Heat crimp connection using the hot air blower lengthwise from center outward until it is sealed completely and adhesive comes out the ends.
- This is how the completed repair location with individual crimp connector should appear.



Note

- ◆ **Make sure that crimp connections do not lie directly next to each other when several wires need to be repaired. Arrange the crimp connectors at a slight offset so that the circumference of the wiring harness does not become too large.**
- ◆ **If the repair point was previous taped, this point must be taped again with yellow insulating tape after repairs.**
- ◆ **Secure the repaired wiring harness if necessary with a cable tie to prevent flapping noises while driving.**



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1.7.8 0.25 mm² Wire With Intermediate Wire Section, Repairing

Special tools and workshop equipment required

- ◆ Wiring Harness Repair Set VAS 1978/A -VAS 1978 B-



Caution

- ◆ **Repairs to the wiring harnesses and connectors must only be performed using the Wiring harness repair set -VAS 1978 B- .**
- ◆ **Observe the country-specific requirements.**

 **Note**

- ◆ *Use of the Wiring harness repair set -VAS 1978 B- is described in detail in the attached operating instructions.*
- ◆ *Repairs on open circuits and faulty connectors are also explained using examples.*

 **Note**

Only 0.5 mm² repair wires are available for repairing a 0.25 mm² wire.

Procedure

- Free up the wire to be repaired at two places approximately 20 cm on both sides of the repair point.

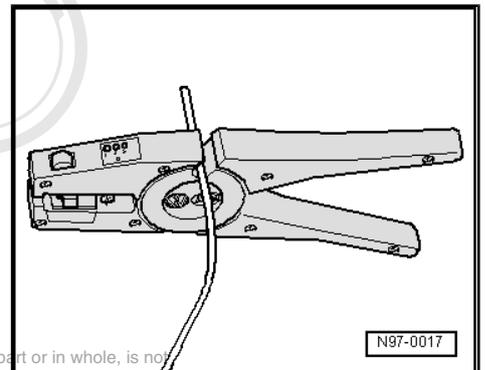


Caution

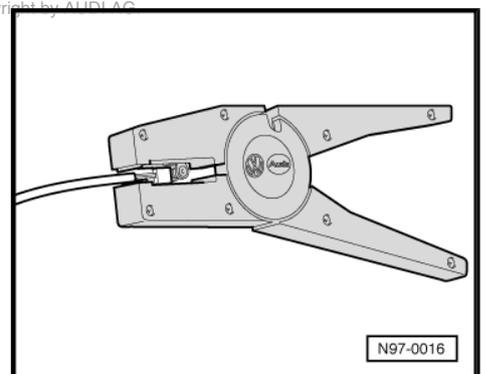
Risk of damaging the electrical wires.

- ◆ ***Expose wrapped wiring harnesses carefully.***

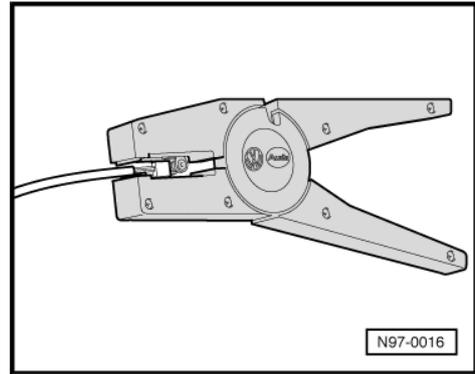
- If necessary, removing the wiring harness wrapping using a knife.
- Route yellow repair wire next to damaged wiring harness and cut repair wire to the required length using wire stripper -VAS 1978/3- .
- Cut damaged wire section from the vehicle-specific single wire.



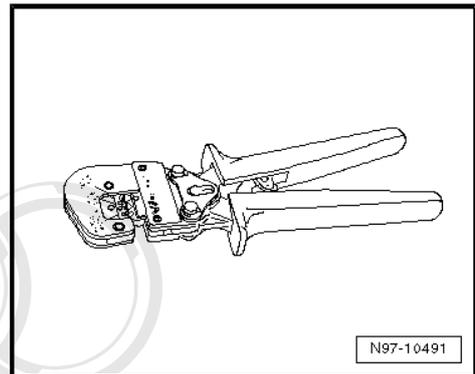
- Adjust the sliding stop in the -VAS 1978/3- jaws to 12 to 14 mm for the wire to be stripped.
- Insert the vehicle-specific single wire end from the front into the pliers jaws as far as the stop and squeeze the pliers together completely.
- Open pliers again and remove the stripped wire end.
- Twist bare strands one-half turn.
- Repeat the procedure on the other end of the vehicle-specific individual wire.



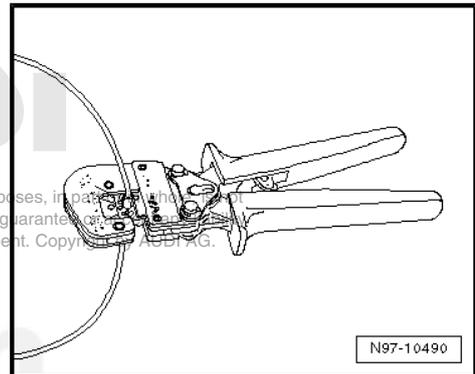
- Adjust the sliding stop in the -VAS 1978/3- jaws to 6 to 7 mm for the wire to be stripped.
- Insert the yellow repair wire end from the front into the pliers jaws as far as the stop and squeeze the pliers together completely.
- Open pliers again and remove the stripped wire end.
- Repeat this procedure on the other repair wire end.
- For the repair of a 0.25 mm² wire, use a small yellow crimp connector from the -VAS 1978 B- .



- Use -VAS 1978 B- crimping pliers (base tool) -VAS 1978/1-2- with exchangeable head, 0.35 mm² - 2.5 mm² -VAS 1978/1-1- to crimp the connector.
- Slide the small yellow crimp connector onto the vehicle-specific single wire at one side and onto the repair wire at the other side.



- Crimp the crimp connection at both wire ends using crimp pliers.
- Repeat this procedure at the other repair wire end.



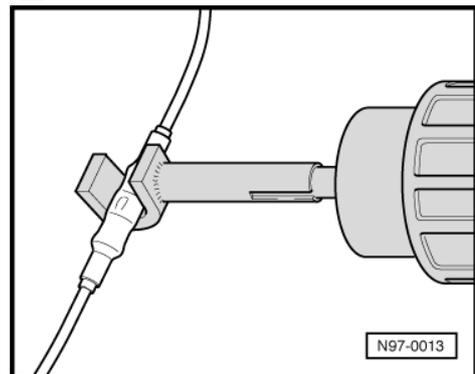
Note

Do not crimp wire insulation.

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After crimping, crimp connections must be heat-shrunk using hot air gun to prevent moisture penetration.

- Place the shrink element for hot air blower -VAS 1978/15A- on the hot air blower -VAS 1978/14A- .

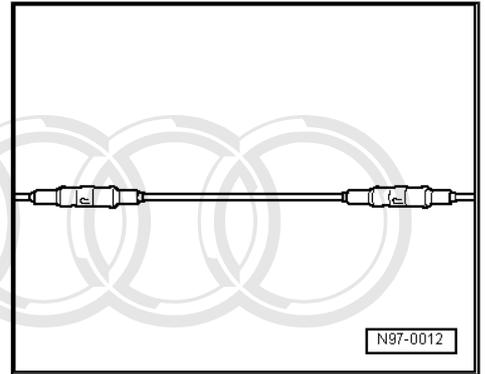


Caution

Risk of damaging surrounding components.

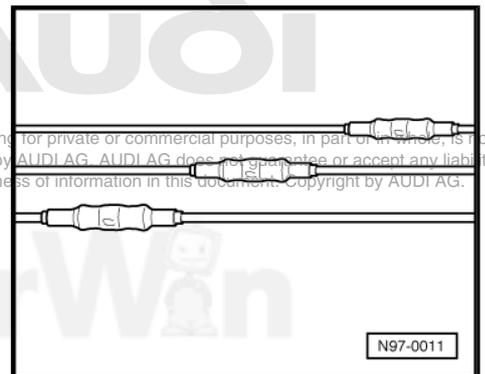
- ◆ *When heat-shrinking crimp connections, be careful not to damage any other wiring, plastic parts or insulating material with the hot nozzle of the hot air blower.*
- ◆ *Always observe operating instructions of heat gun.*

- Heat crimp connection using the hot air blower lengthwise from center outward until it is sealed completely and adhesive comes out the ends.
- This is how the completed repair location with the inserted wire and two crimp connectors should look.



 Note

- ◆ *Make sure that crimp connections do not lie directly next to each other when several wires need to be repaired. Arrange the crimp connectors at a slight offset so that the circumference of the wiring harness does not become too large.*
- ◆ *If the repair point was previously taped, this point must be taped again with yellow insulating tape after repairs.*
- ◆ *Secure the repaired wiring harness if necessary with a cable tie to prevent flapping noises while driving.*



1.7.9 0.35 mm² Or Greater With Individual Crimp Connector, Repairing

Special tools and workshop equipment required

- ◆ Wiring Harness Repair Set VAS 1978/A -VAS 1978 B-

 **Caution**

- ◆ *Repairs to the wiring harnesses and connectors must only be performed using the Wiring harness repair set -VAS 1978 B-.*
- ◆ *Observe the country-specific requirements.*

 Note

- ◆ *Use of the Wiring harness repair set -VAS 1978 B- is described in detail in the attached operating instructions.*
- ◆ *Repairs on open circuits and faulty connectors are also explained using examples.*

Procedure

- Free up the wire to be repaired approximately 20 cm on both sides of the repair point.

 **Caution**

Risk of damaging the electrical wires.

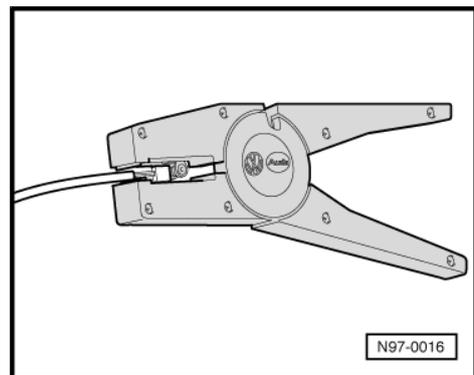
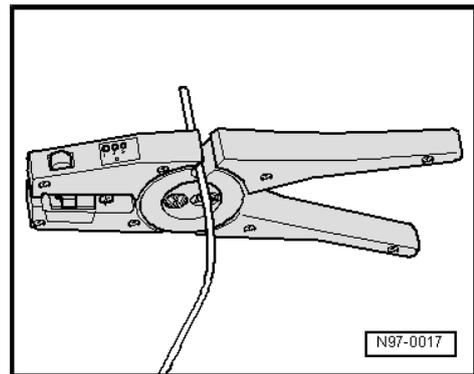
- ◆ *Expose wrapped wiring harnesses carefully.*

- If necessary, removing the wiring harness wrapping using a knife.
- Cut out the damaged wire section using wire stripper -VAS 1978/3- .

**Note**

If, by cutting out the damaged wire section, both ends of the vehicle-specific single wire are too short for a repair using a single crimp connector, insert a repair wire section of matching length with two crimp connections. Refer to [⇒ "1.7.10 0.35 mm² Or Greater With Intermediate Wire Section, Repairing", page 99](#) .

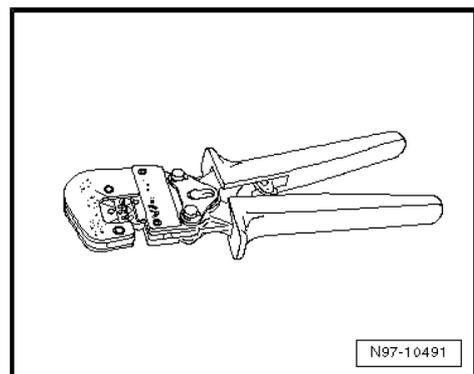
- Adjust the sliding stop in the -VAS 1978/3- jaws to 6 to 7 mm for the wire to be stripped.
- Insert wire end from front up to stop into jaws of pliers and squeeze the pliers completely.
- Open pliers again and remove the stripped wire end.
- For the repair, use a suitable crimp connector from the -VAS 1978 B- .



- Use the crimping pliers (base tool) -VAS 1978/1-2- to press the crimp connector.

The following exchangeable heads are available for the -VAS 1978/1-2- :

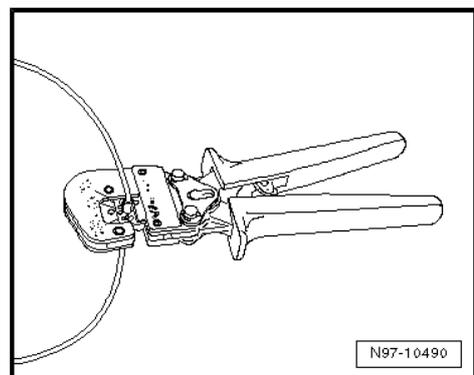
- ◆ Exchange head, 0,35 mm² - 2,5 mm² -VAS 1978/1-1-
- ◆ Exchangeable head, 4.0-6.0 mm² -VAS 1978/2 A-



- Slide crimp connection onto both stripped wire ends of vehicle-specific single wire and crimp them using crimp pliers.

**Note**

Do not crimp wire insulation.



After crimping, crimp connections must be heat-shrunk using hot air gun to prevent moisture penetration.

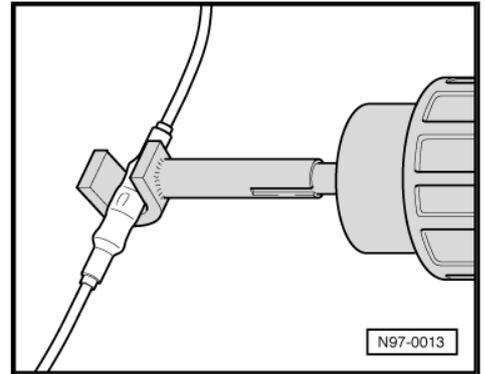
- Place the shrink element for hot air blower -VAS 1978/15A- on the hot air blower -VAS 1978/14A- .



Caution

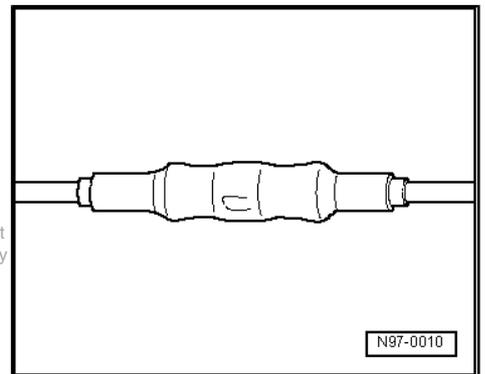
Risk of damaging surrounding components.

- ◆ *When heat-shrinking crimp connections, be careful not to damage any other wiring, plastic parts or insulating material with the hot nozzle of the hot air blower.*
- ◆ *Always observe operating instructions of heat gun.*



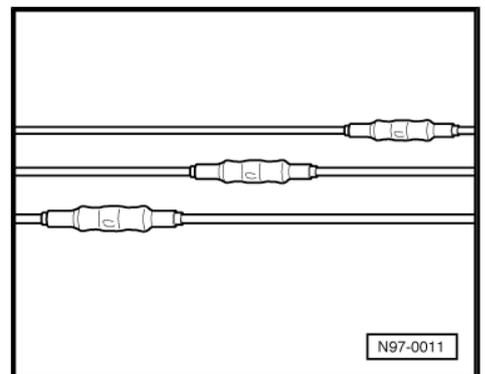
- Heat crimp connection using the hot air blower lengthwise from center outward until it is sealed completely and adhesive comes out the ends.
- This is how the completed repair location with individual crimp connector should appear.

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Note

- ◆ *Make sure that crimp connections do not lie directly next to each other when several wires need to be repaired. Arrange the crimp connectors at a slight offset so that the circumference of the wiring harness does not become too large.*
- ◆ *If the repair point was previous taped, this point must be taped again with yellow insulating tape after repairs.*
- ◆ *Secure the repaired wiring harness if necessary with a cable tie to prevent flapping noises while driving.*



1.7.10 0.35 mm² Or Greater With Intermediate Wire Section, Repairing

Special tools and workshop equipment required

- ◆ Wiring Harness Repair Set VAS 1978/A -VAS 1978 B-



Caution

- ◆ *Repairs to the wiring harnesses and connectors must only be performed using the Wiring harness repair set -VAS 1978 B- .*
- ◆ *Observe the country-specific requirements.*

 **Note**

- ◆ *Use of the Wiring harness repair set -VAS 1978 B- is described in detail in the attached operating instructions.*
- ◆ *Repairs on open circuits and faulty connectors are also explained using examples.*

 **Note**

Only 0.5 mm² repair wires are available for repairing a 0.35 mm² wire.

Procedure

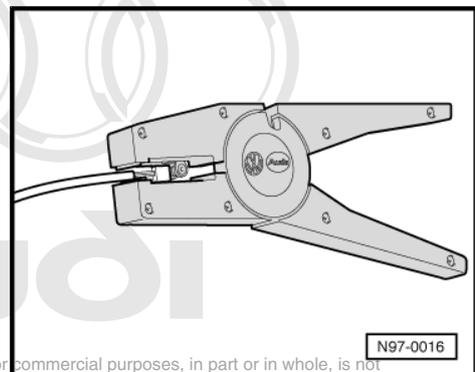
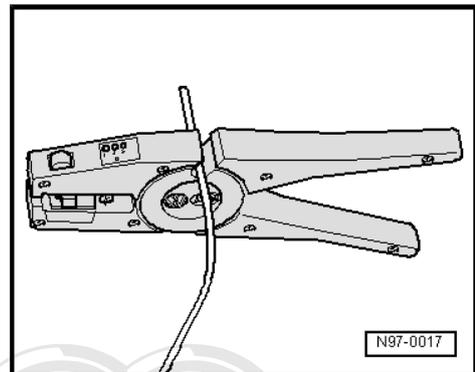
- Free up the wire to be repaired at two places approximately 20 cm on both sides of the repair point.

**Caution**

Risk of damaging the electrical wires.

- ◆ ***Expose wrapped wiring harnesses carefully.***

- If necessary, removing the wiring harness wrapping using a knife.
 - Route yellow repair wire next to damaged wiring harness and cut repair wire to the required length using wire stripper -VAS 1978/3- .
 - Cut damaged wire section from the vehicle-specific single wire.
-
- Adjust the sliding stop in the -VAS 1978/3- jaws to 6 to 7 mm for the wire to be stripped.
 - Insert the vehicle-specific single wire end from the front into the pliers jaws as far as the stop and squeeze the pliers together completely.
 - Open pliers again and remove the stripped wire end.
 - Repeat the procedure on the other end of the vehicle-specific individual wire.
 - For the repair, use two suitable crimp connectors from the -VAS 1978 B- .

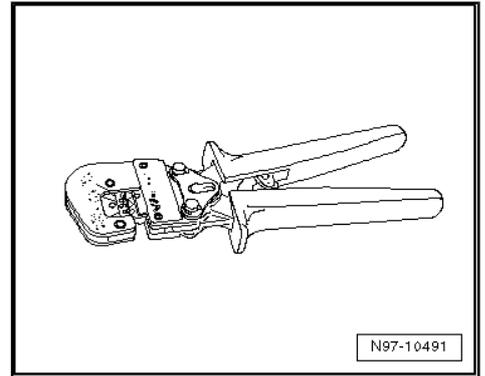


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- Use the crimping pliers (base tool) -VAS 1978/1-2- to press the crimp connector.

The following exchangeable heads are available for the -VAS 1978/1-2- :

- ◆ Exchange head, 0,35 mm² - 2,5 mm² -VAS 1978/1-1-
- ◆ Exchangeable head, 4.0-6.0 mm² -VAS 1978/2 A-
- Slide the crimp connector onto the vehicle-specific single wire at one side and onto repair wire at the other side.

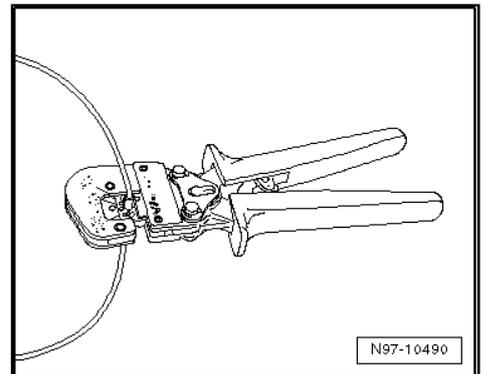


- Crimp the crimp connection at both wire ends using crimp pliers.
- Repeat this procedure on the other wire ends.



Note

Do not crimp wire insulation.



After crimping, crimp connections must be heat-shrunk using hot air gun to prevent moisture penetration.

- Place the shrink element for hot air blower -VAS 1978/15A- on the hot air blower -VAS 1978/14A- .

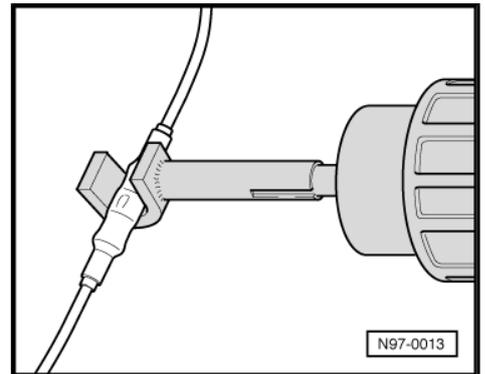


Caution

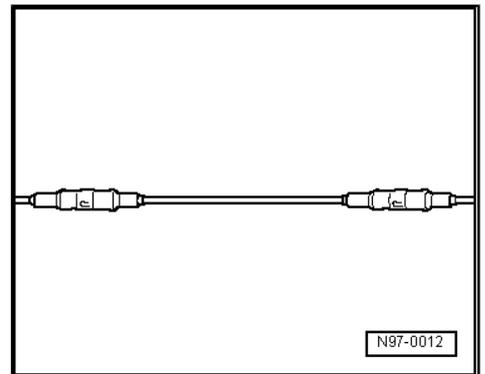
Risk of damaging surrounding components.

- ◆ **When heat-shrinking crimp connections, be careful not to damage any other wiring, plastic parts or insulating material with the hot nozzle of the hot air blower.**

- ◆ **Always observe operating instructions of heat gun.**



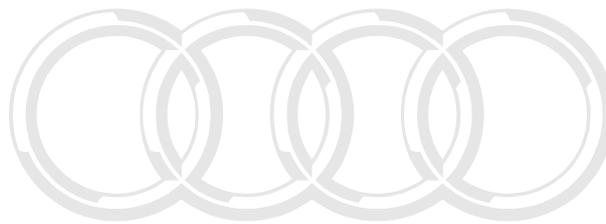
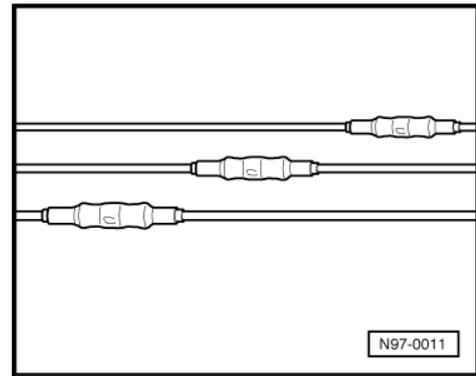
- Heat crimp connection using the hot air blower lengthwise from center outward until it is sealed completely and adhesive comes out the ends.
- This is how the completed repair location with the inserted wire and two crimp connectors should look.





Note

- ◆ *Make sure that crimp connections do not lie directly next to each other when several wires need to be repaired. Arrange the crimp connectors at a slight offset so that the circumference of the wiring harness does not become too large.*
- ◆ *If the repair point was previous taped, this point must be taped again with yellow insulating tape after repairs.*
- ◆ *Secure the repaired wiring harness if necessary with a cable tie to prevent flapping noises while driving.*

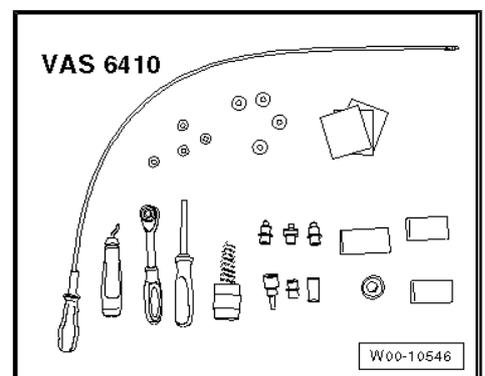
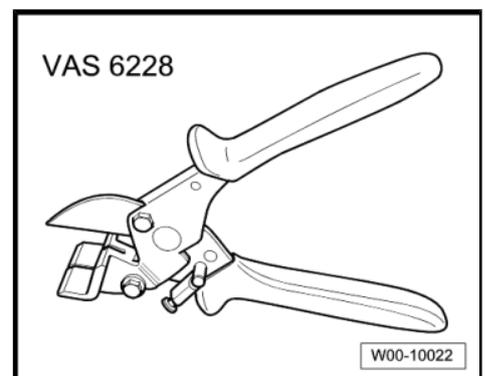
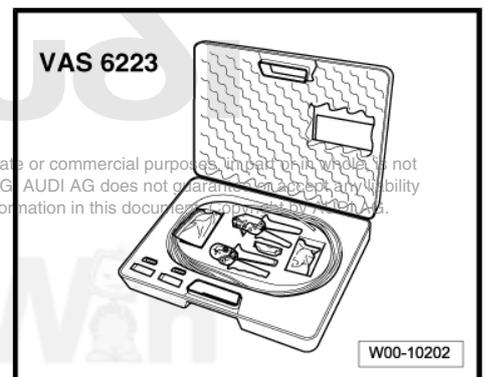
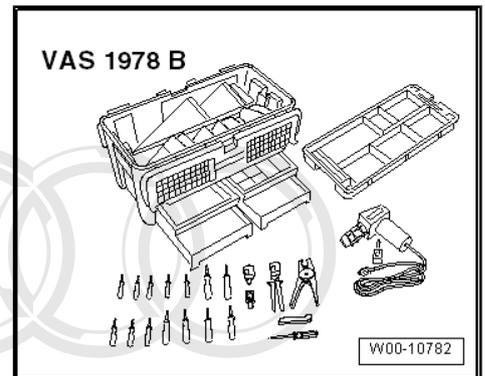


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2 Special Tools



- ◆ Wiring Harness Repair Set VAS 1978/A -VAS 1978 B-
- ◆ Fiber Optic Pliers Repair Set -VAS 6223-
- ◆ Air Hose Pliers -VAS 6228-
- ◆ Contact Surfaces Cleaning Set -VAS 6410-

Edition 02042012

Cautions & Warnings

Please read these WARNINGS and CAUTIONS before proceeding with maintenance and repair work. You must answer that you have read and you understand these WARNINGS and CAUTIONS before you will be allowed to view this information.

- If you lack the skills, tools and equipment, or a suitable workshop for any procedure described in this manual, we suggest you leave such repairs to an authorized Audi retailer or other qualified shop. We especially urge you to consult an authorized Audi retailer before beginning repairs on any vehicle that may still be covered wholly or in part by any of the extensive warranties issued by Audi.
- Disconnect the battery negative terminal (ground strap) whenever you work on the fuel system or the electrical system. Do not smoke or work near heaters or other fire hazards. Keep an approved fire extinguisher handy.
- Audi is constantly improving its vehicles and sometimes these changes, both in parts and specifications, are made applicable to earlier models. Therefore, part numbers listed in this manual are for reference only. Always check with your authorized Audi retailer parts department for the latest information.
- Any time the battery has been disconnected on an automatic transmission vehicle, it will be necessary to reestablish Transmission Control Module (TCM) basic settings using the VAG 1551 Scan Tool (ST).
- Never work under a lifted vehicle unless it is solidly supported on stands designed for the purpose. Do not support a vehicle on cinder blocks, hollow tiles or other props that may crumble under continuous load. Never work under a vehicle that is supported solely by a jack. Never work under the vehicle while the engine is running.
- For vehicles equipped with an anti-theft radio, be sure of the correct radio activation code before disconnecting the battery or removing the radio. If the wrong code is entered when the power is restored, the radio may lock up and become inoperable, even if the correct code is used in a later attempt.
- If you are going to work under a vehicle on the ground, make sure that the ground is level. Block the wheels to keep the vehicle from rolling. Disconnect the battery negative terminal (ground strap) to prevent others from starting the vehicle while you are under it.
- Do not attempt to work on your vehicle if you do not feel well. You increase the danger of injury to yourself and others if you are tired, upset or have taken medicine or any other substances that may impair you or keep you from being fully alert.
- Never run the engine unless the work area is well ventilated. Carbon monoxide (CO) kills.
- Always observe good workshop practices. Wear goggles when you operate machine tools or work with acid. Wear goggles, gloves and other protective clothing whenever the job requires working with harmful substances.
- Tie long hair behind your head. Do not wear a necktie, a scarf, loose clothing, or a necklace when you work near machine tools or running engines. If your hair, clothing, or jewelry were to get caught in the machinery, severe injury could result.

Cautions & Warnings

- Do not re-use any fasteners that are worn or deformed in normal use. Some fasteners are designed to be used only once and are unreliable and may fail if used a second time. This includes, but is not limited to, nuts, bolts, washers, circlips and cotter pins. Always follow the recommendations in this manual - replace these fasteners with new parts where indicated, and any other time it is deemed necessary by inspection.
- Illuminate the work area adequately but safely. Use a portable safety light for working inside or under the vehicle. Make sure the bulb is enclosed by a wire cage. The hot filament of an accidentally broken bulb can ignite spilled fuel or oil.
- Friction materials such as brake pads and clutch discs may contain asbestos fibers. Do not create dust by grinding, sanding, or by cleaning with compressed air. Avoid breathing asbestos fibers and asbestos dust. Breathing asbestos can cause serious diseases such as asbestosis or cancer, and may result in death.
- Finger rings should be removed so that they cannot cause electrical shorts, get caught in running machinery, or be crushed by heavy parts.
- Before starting a job, make certain that you have all the necessary tools and parts on hand. Read all the instructions thoroughly, do not attempt shortcuts. Use tools that are appropriate to the work and use only replacement parts meeting Audi specifications. Makeshift tools, parts and procedures will not make good repairs.
- Catch draining fuel, oil or brake fluid in suitable containers. Do not use empty food or beverage containers that might mislead someone into drinking from them. Store flammable fluids away from fire hazards. Wipe up spills at once, but do not store the oily rags, which can ignite and burn spontaneously.
- Use pneumatic and electric tools only to loosen threaded parts and fasteners. Never use these tools to tighten fasteners, especially on light alloy parts. Always use a torque wrench to tighten fasteners to the tightening torque listed.
- Keep sparks, lighted matches, and open flame away from the top of the battery. If escaping hydrogen gas is ignited, it will ignite gas trapped in the cells and cause the battery to explode.
- Be mindful of the environment and ecology. Before you drain the crankcase, find out the proper way to dispose of the oil. Do not pour oil onto the ground, down a drain, or into a stream, pond, or lake. Consult local ordinances that govern the disposal of wastes.
- The air-conditioning (A/C) system is filled with a chemical refrigerant that is hazardous. The A/C system should be serviced only by trained automotive service technicians using approved refrigerant recovery/recycling equipment, trained in related safety precautions, and familiar with regulations governing the discharging and disposal of automotive chemical refrigerants.
- Before doing any electrical welding on vehicles equipped with anti-lock brakes (ABS), disconnect the battery negative terminal (ground strap) and the ABS control module connector.
- Do not expose any part of the A/C system to high temperatures such as open flame. Excessive heat will increase system pressure and may cause the system to burst.

Cautions & Warnings

- When boost-charging the battery, first remove the fuses for the Engine Control Module (ECM), the Transmission Control Module (TCM), the ABS control module, and the trip computer. In cases where one or more of these components is not separately fused, disconnect the control module connector(s).
- Some of the vehicles covered by this manual are equipped with a supplemental restraint system (SRS), that automatically deploys an airbag in the event of a frontal impact. The airbag is operated by an explosive device. Handled improperly or without adequate safeguards, it can be accidentally activated and cause serious personal injury. To guard against personal injury or airbag system failure, only trained Audi Service technicians should test, disassemble or service the airbag system.
- Do not quick-charge the battery (for boost starting) for longer than one minute, and do not exceed 16.5 volts at the battery with the boosting cables attached. Wait at least one minute before boosting the battery a second time.
- Never use a test light to conduct electrical tests of the airbag system. The system must only be tested by trained Audi Service technicians using the VAG 1551 Scan Tool (ST) or an approved equivalent. The airbag unit must never be electrically tested while it is not installed in the vehicle.
- Some aerosol tire inflators are highly flammable. Be extremely cautious when repairing a tire that may have been inflated using an aerosol tire inflator. Keep sparks, open flame or other sources of ignition away from the tire repair area. Inflate and deflate the tire at least four times before breaking the bead from the rim. Completely remove the tire from the rim before attempting any repair.
- When driving or riding in an airbag-equipped vehicle, never hold test equipment in your hands or lap while the vehicle is in motion. Objects between you and the airbag can increase the risk of injury in an accident.

I have read and I understand these Cautions and Warnings.



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