

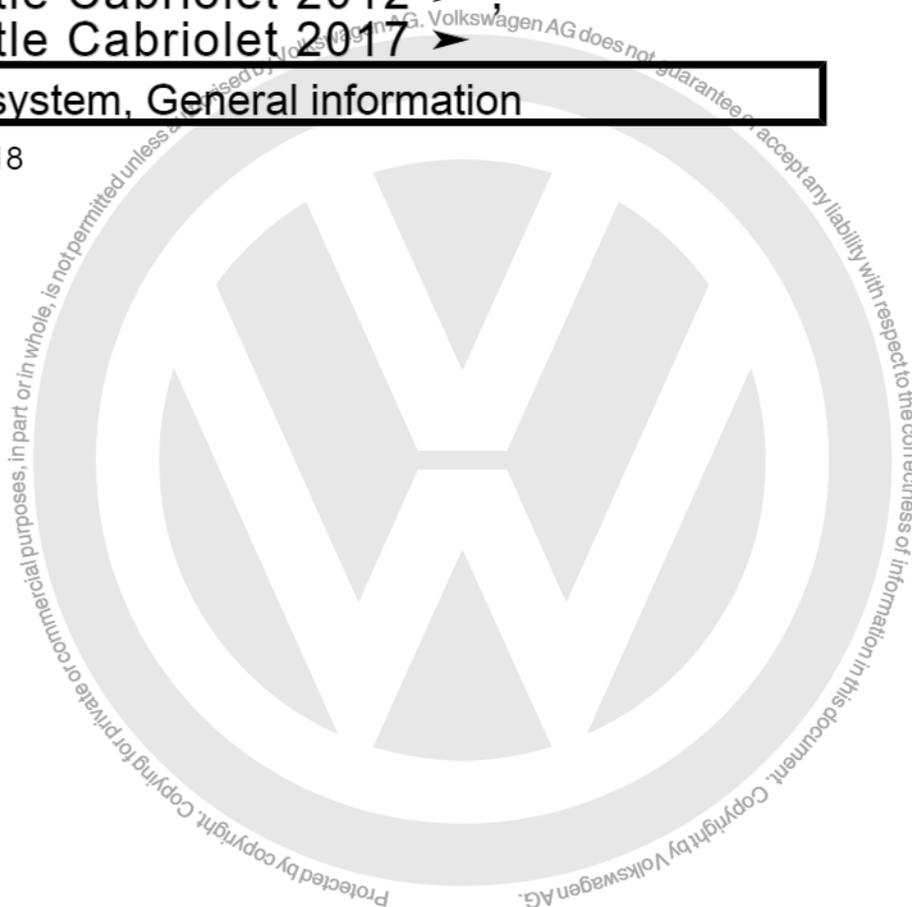


Workshop Manual

Beetle 2012 > , Golf 2015 > ,
Golf MEX 2018 > , Golf Variant 2007 > ,
Golf Variant 2010 > ,
Golf Variant 2015 > ,
Golf Variant MEX 2018 > , Jetta 1999 > ,
Jetta 2005 > , Jetta 2011 > ,
Jetta 2013 > , Jetta 2015 > ,
Jetta 2018 > , New Beetle 1999 > ,
New Beetle Cabrio 2003 > ,
New Beetle RSI 2001 > ,
The Beetle 2017 > ,
The Beetle Cabriolet 2012 > ,
The Beetle Cabriolet 2017 > ,

Electrical system, General information

Edition 03.2018





List of Workshop Manual Repair Groups

Repair Group

27 - Starter, current supply, CCS

90 - Gauges, instruments

92 - Windscreen wash/wipe system

94 - Lights, bulbs, switches - exterior

96 - Lights, bulbs, switches - interior

97 - Wiring

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 – Starter, current supply, CCS

1 Battery

(VRL011547; Edition 03.2018)

⇒ [“1.1 Battery - general notes”, page 1](#)

⇒ [“1.2 Types of battery”, page 1](#)

⇒ [“1.3 Warning notices and safety regulations”, page 3](#)

⇒ [“1.4 Battery terminal connection”, page 5](#)

1.1 Battery - general notes

To ensure long use, the battery - A- must be checked, serviced and maintained according to the instructions in this manual.

The battery - A- supplies the energy for starting the engine. The battery - A- also acts as a buffer and supplies electrical energy for the entire onboard supply system in the vehicle.



Note

Observe ⇒ *Self-study programme No. 234 ; Vehicle batteries .*



Caution

To prevent damage to the battery - A- and the vehicle, observe the following instructions for the types of battery ⇒ [page 1](#) .



WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#) !

1.2 Types of battery

⇒ [“1.2.1 Battery with standard colour indicator”, page 1](#)

⇒ [“1.2.2 Absorbent glass mat battery \(AGM battery\)”, page 2](#)

⇒ [“1.2.3 EFB battery with enhanced colour indicator”, page 2](#)

1.2.1 Battery with »standard« colour indicator

Maintenance-free battery - A- with liquid electrolyte (wet battery)



Caution

No stickers may be removed and do not replenish with distilled water. Only make visual inspections. Note the battery test chapter ⇒ [page 6](#) .



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion during checking and charging or during jump starting

These batteries - A- must be replaced.

This battery - A- is equipped with a colour indicator (magic eye). The magic eye shows different colours to provide information concerning the level of electrolyte and the charge level of the battery - A- .

Checking the colour indicator ⇒ [page 10](#)

For this battery type, all checks can be performed using the approved battery chargers. Note the settings on the battery chargers ⇒ [page 6](#) .

1.2.2 Absorbent glass mat battery (AGM battery)

Maintenance-free battery - A- with solidified electrolyte (fleece battery) and no colour indicator



Caution

No stickers may be removed and do not replenish with distilled water. Only make visual inspections. Note the battery test chapter ⇒ [page 6](#) .

Lead-acid battery whereby the electrolyte is held in an absorbent glass mat (AGM). Battery - A- is sealed and fitted with valves.

“AGM” stands for »Absorbent Glass Mat«.

Due to the electrolyte being held in a mat, these batteries - A- do not have a magic eye. Absorbent glass mat batteries are identified by the abbreviation AGM on the battery - A- .

Always replace an AGM battery with another AGM battery.

For AGM batteries, all checks can be performed using the approved battery chargers. Note the settings on the battery chargers ⇒ [page 6](#) .

1.2.3 EFB battery with »enhanced« colour indicator

Maintenance-free battery - A- with liquid electrolyte (wet battery)



Caution

No stickers may be removed and do not replenish with distilled water. Only make visual inspections. Note the battery test chapter ⇒ [page 6](#) .



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion during checking and charging or during jump starting

These batteries - A- must be replaced.

The battery - A- is used for particular requirements in certain stop-start vehicles. The battery can be identified by the lettering "EFB" on the battery cover.

"EFB" stands for »Enhanced Flooded Battery«.

Only replace an EFB battery with another EFB battery.

The EFB battery has a colour indicator to enable the electrolyte level to be checked.



Note

EFB batteries have been used in the smaller petrol engines with stop-start systems and manual gearboxes since 05.2011.

Checking the colour indicator ⇒ [page 10](#)

For EFB batteries, all checks can be performed using the approved battery chargers. Note the settings on the battery chargers ⇒ [page 6](#).

1.3 Warning notices and safety regulations

⇒ ["1.3.1 Dangers when handling batteries", page 3](#)

⇒ ["1.3.2 Safety markings on battery", page 4](#)

⇒ ["1.3.3 Working on airbag system", page 5](#)

1.3.1 Dangers when handling batteries

Recognition and avoidance of dangers

Batteries - A- can be dangerous. These dangers can be avoided when the warnings on the battery - A-, in the ⇒ owner's manual and in ELSA are observed.



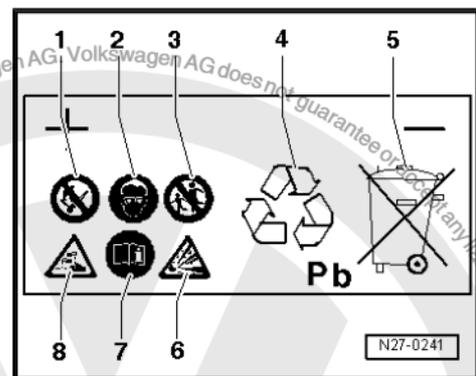
WARNING

- ◆ *Untrained personnel e.g. apprentices, trainees etc. may only work on batteries - A- when supervised by a vehicle mechanic/foreman or vehicle electrician/foreman.*
- ◆ *Acid is highly corrosive. Incorrect handling of batteries - A- could expose staff to harmful electrolyte effects. Therefore suitable measures must be taken to ensure that equipment/solutions etc. are available to neutralize acid burns. A suitable solution is soap solution.*
- ◆ *Electrolyte leaks from the battery - A- can cause skin burns, acid deterioration and corrosion on the vehicle. This may damage safety relevant components on the vehicle.*
- ◆ *The gas which forms when charging and the gas which may escape through vent valves is explosive. In extreme cases, incorrect handling can lead to the battery - A- exploding as a result of gas leaks.*
- ◆ *Batteries - A- whose magic eye is »colourless/light yellow« have to be replaced. They must not be checked or charged and do not slave/jump start. Danger of explosion when checking and charging or slave/jump starting*
- ◆ *It is prohibited to cause sparks through grinding, welding, cutting operations and use naked lights in the vicinity of batteries. Smoking is also prohibited. Sparks generated by electrostatic charging must also be avoided. The vehicle body must be touched before touching the battery - A- .*
- ◆ *Only work on batteries - A- in well ventilated and suitable rooms.*

1.3.2 Safety markings on battery

Safety markings on battery - A-

- 1 - Fire, sparks, naked light and smoking are prohibited when handling batteries - A- . Avoid sparks as well as electrostatic discharge when working with cables and electrical units. Avoid short circuits. Therefore do not lay any tools on battery - A- .
- 2 - Wear eye protection before commencing work on battery - A- .
- 3 - Keep children away from acid and batteries - A- .
- 4 - Disposal: old batteries are classed as hazardous waste. They may only be disposed of through a suitable collection centre and only in accordance with respective legislation.
- 5 - Never dispose of old batteries in household waste system!
- 6 - When handling batteries - A- there is a risk of explosion. Charging batteries - A- creates a highly explosive oxyhydrogen gas mixture.
- 7 - Always take note of the information on the battery - A- , in the ⇒ electronic parts catalogue "ETKA" and in the ⇒ operating instructions .
- 8 - Risk of corrosion: Electrolyte acid is highly corrosive, which is why protective gloves and eye protection must be worn when working on battery - A- . The battery - A- must not be tilted as acid could leak from battery vents.





1.3.3 Working on airbag system



WARNING

When work is performed on the airbag system (pyrotechnical components, airbag control unit - J234- , wiring) the battery earth strap must be disconnected with the ignition switched on.

Exception: in vehicles with a battery in the vehicle interior, the ignition must be switched off.

- ◆ *Then cover negative terminal.*
- ◆ *A waiting time of 10 seconds is necessary after disconnecting the battery.*
- ◆ *Battery must be connected with ignition switched on.*
- ◆ *No persons may be in the interior when the battery is re-connected.*

Ensure, in this case, that you are not within the effective range of the airbag and the belt tensioner.

If when reconnecting the battery and the ignition was not in the on position - warning lights in dash panel will not light up - the ignition may only be switched on (key/button) from the driver's seat with the seat set in the rearmost position.

1.4 Battery terminal connection



Caution

To prevent damage to the battery clamp and battery terminals, the following should be observed:

- ◆ *The battery clamps should only be fitted by hand and without using force.*
- ◆ *Battery terminals must not be greased.*
- ◆ *The battery clamps should be fitted so that the battery terminal is either flush with the clamp or protruding from it.*
- ◆ *Once the battery terminal clamps have been tightened to the specified torque, the threaded connections should not be tightened any further.*

Specified torque for battery clamps ⇒ Electrical system; Rep. gr. 27 ; Battery; Assembly overview - battery .



2 Checking battery

⇒ [“2.1 Testing different battery types”, page 6](#)

⇒ [“2.2 Inspection”, page 8](#)

⇒ [“2.3 Information about battery replacement and battery gas venting”, page 9](#)

⇒ [“2.4 Checking colour indicator in battery cover, magic eye”, page 10](#)

⇒ [“2.5 Battery tester with printer VAS 5097 A”, page 12](#)

⇒ [“2.6 Battery tester with printer VAS 6161”, page 17](#)

⇒ [“2.7 Midtronics battery tester MCR340V, only for USA and Canada”, page 22](#)

⇒ [“2.8 Battery test using the vehicle diagnostic tester”, page 26](#)

⇒ [“2.9 Current draw test”, page 27](#)

⇒ [“2.10 Checking no-load voltage of battery \(stock and stored vehicles\)”, page 28](#)

2.1 Testing different battery types

⇒ [“2.1.1 Checking battery with colour indicator, magic eye”, page 6](#)

⇒ [“2.1.2 Checking absorbent glass mat battery \(AGM battery\)”, page 6](#)

⇒ [“2.1.3 Checking EFB battery”, page 7](#)

2.1.1 Checking battery with colour indicator, magic eye



WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#)!

Perform the checks in the following sequence:

1. Visual check ⇒ [page 8](#)
2. Colour indicator check
 - ◆ 3-colour check ⇒ [page 10](#)
 - ◆ 2-colour check ⇒ [page 11](#)



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion during checking and charging or during jump starting

These batteries - A- must be replaced.



 Note

The battery tester with printer - VAS 5097 A- has been discontinued for the warranty test. Only the battery tester with printer - VAS 6161- will be used.

3. Battery load test with
 - ◆ Battery tester with printer - VAS 5097 A- ⇒ [page 13](#) .
 - ◆ Battery tester with printer - VAS 6161- ⇒ [page 17](#) .
 - ◆ Midtronics battery tester - MCR340V- (only for USA/Canada) ⇒ [page 22](#) .
4. Depending on the result of the battery load test, perform "current draw test" ⇒ [page 27](#) .

2.1.2 Checking absorbent glass mat battery (AGM battery)



WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#)!

Perform the checks in the following sequence:

1. Visual check ⇒ [page 8](#) .

 Note

The battery tester with printer - VAS 5097 A- has been discontinued for the warranty test. Only the battery tester with printer - VAS 6161- will be used.

2. Battery load test with
 - ◆ Battery tester with printer - VAS 5097 A- ⇒ [page 13](#) .
 - ◆ Battery tester with printer - VAS 6161- ⇒ [page 17](#) .
 - ◆ Midtronics battery tester - MCR340V- (only for USA/Canada) ⇒ [page 22](#) .
3. Depending on the result of the battery load test, perform "current draw test" ⇒ [page 27](#) .

2.1.3 Checking EFB battery



WARNING

Danger of injury! Comply with the warning notices and safety regulations!

Perform the checks in the following sequence:

1. Visual check ⇒ [page 8](#) .
2. Colour indicator check
 - ◆ 3-colour check ⇒ [page 10](#)
 - ◆ 2-colour check ⇒ [page 11](#)



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion during checking and charging or during jump starting

These batteries - A- must be replaced.



Note

The battery tester with printer - VAS 5097 A- has been discontinued for the warranty test. Only the battery tester with printer - VAS 6161- will be used.

3. Battery load test with

- ◆ Battery tester with printer - VAS 5097 A- ⇒ [page 13](#) .
 - ◆ Battery tester with printer - VAS 6161- ⇒ [page 17](#) .
 - ◆ Midtronics battery tester - MCR340V- (only for USA/Canada) ⇒ [page 22](#) .
4. Depending on the result of the battery load test, perform "current draw test" ⇒ [page 27](#) .

2.2 Inspection



WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#) !

Before carrying out any extensive measurements, inspect the exterior and the connections and check that the battery - A- is firmly seated and secured.

Observe the chapter "Battery" for the respective vehicle ⇒ Maintenance ; Booklet .



Caution

- ◆ *Battery - A- will be damaged if it is not secured correctly.*
- ◆ *Vibrations shorten the life of the battery, there is a danger of an explosion, the cell plates may be damaged and the clamping bracket may damage the battery housing.*
- ◆ *Check if the battery - A- is seated securely and, if necessary, tighten securing bolt to the specified torque.*

Points to check in the visual inspection:

- ◆ **Damage to battery housing.** Electrolyte can leak out if the housing is damaged. If battery acid leaks out, serious damage to the vehicle could be caused. Treat components affected by leaked battery acid immediately with acid neutraliser or a soap solution.
- ◆ **Damage to battery terminals.** The necessary contact on the battery terminal clamps cannot be guaranteed if the battery terminals are damaged. When connecting the battery terminal



clamps, always observe the specified torque indicated in the workshop manual ⇒ Electrical system; Rep. gr. 27 ; Battery; Assembly overview - battery for the respective vehicle. If the battery terminal clamps are not correctly seated and tightened, the wiring may burn. Which will cause malfunctions in the electrical system. Safe operation of the vehicle is no longer guaranteed.

Damage to gas vent hose and sealing plugs. On vehicles with batteries in the passenger compartment or luggage compartment, it is essential to ensure that the gas vent hose is fitted correctly. Make sure that there are no exposed gas vent openings in the area of the positive battery terminal. If a gas vent opening is exposed in this area, it must be sealed with a plug. The gas vent hose must be connected in the area of the negative battery terminal to the exposed gas vent opening. Observe chapter ⇒ ["2.3 Information about battery replacement and battery gas venting", page 9](#)

2.3 Information about battery replacement and battery gas venting

- ◆ For safety reasons, it is important to determine which side of the battery gas is vented from.
- ◆ For areas of application in which a gas vent hose is used, ensure that the gas vent hose is seated securely and that the gas vent opening on the opposite side is sealed.
- ◆ When renewing the vehicle battery, make absolutely sure that the gas vent opening in the area of the positive battery terminal is not exposed. Should a vent opening be exposed in this area, it must be sealed with a plug and the vent in the area of the negative battery terminal must be opened.
- ◆ If the vehicle is installed with an AGM battery outside the engine compartment, ensure that the battery is replaced with a different AGM battery.
- ◆ If there is a protective cap with sprayed on plug on the battery positive terminal of the replacement part battery 000.915.105.DX, with the exception of 000.915.105.DN and all Economy batteries with single index, this must also be changed on the negative battery terminal or positive battery terminal side according to the situation. A list of batteries can be found here ⇒ [page 9](#) .
- ◆ All AGM, EFB+, EFB batteries and the 36AH battery with original part no.: 000.915.105.DN, installed e.g. in the up! and Polo, have a protective cap without sprayed on plug on the positive battery terminal. The gas vent on the positive battery terminal side is already sealed here.

If a genuine replacement part battery is discovered with the following part numbers, a red sealing plug must be fitted either on the positive or negative battery terminal side. If this is not installed, it must be retrofitted - genuine part no.: 000.915.506

List of batteries with protective cap and sprayed on plug

OES wet:

- ◆ "110 Ah" 000.915.105.DL
- ◆ "95 Ah" 000.915.105.DK
- ◆ "85 Ah" 000.915.105.DJ
- ◆ "80 Ah" 000.915.105.DH
- ◆ "72 Ah" 000.915.105.DG
- ◆ "61 Ah" 000.915.105.DE



- ◆ "51 Ah" 000.915.105.DC
- ◆ "44 Ah" 000.915.105.DB

Economy batteries:

- ◆ "44 Ah" JZW.915.105.C
- ◆ "61 Ah" JZW.915.105.
- ◆ "72 Ah" JZW.915.105.A
- ◆ "80 Ah" JZW.915.105.F
- ◆ "85 Ah" JZW.915.105.B
- ◆ "95 Ah" JZW.915.105.E

2.4 Checking colour indicator in battery cover, magic eye

⇒ ["2.4.1 Checking colour indicator, 3-colours, up to 03/2008", page 10](#)

⇒ ["2.4.2 Checking colour indicator, 2-colours, as of 04/2008", page 11](#)

2.4.1 Checking colour indicator, "3-colours", up to 03/2008



WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3!](#)

General information on magic eye:

The magic eye provides information concerning the electrolyte level and the charge state of battery - A- .

Before the visual check, tap the magic eye lightly and carefully using the handle of a screwdriver. The air bubbles, which can influence the display, will dissipate when this is done. The colour display of the magic eye will be more accurate.



Note

- ◆ *Air bubbles can form below the magic eye particularly if the battery - A- has been recharged, even if the battery - A- was charged during normal vehicle operation. These distort the colour displayed by the magic eye.*
- ◆ *Because the magic eye is located in only one cell, the display applies only to this cell. An exact determination of the battery condition is only possible through a battery load test ⇒ [page 13](#) .*
- ◆ *The magic eye can be located at various positions on the battery - A- .*

Three different colour displays are possible:

- ◆ »Green«: Battery - A- is charged sufficiently.
- ◆ »Black«: Battery - A- partly discharged, charge level less than 65% or completely discharged.
- ◆ »Colourless/light yellow«: Battery - A- must be renewed.



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.

2.4.2 Checking colour indicator, "2-colours", as of 04/2008



WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#)!

General information on magic eye:

On these batteries - A- there is no »green« colour display for charge level indication. The only remaining colours are »black« or »colourless/light yellow«.

The colour indicator shows the electrolyte level of the battery - A- .

The charge level of the battery - A- cannot be determined by means of the magic eye; a battery load test must be carried out for this ⇒ [page 13](#) .

Before the visual check, tap the magic eye lightly and carefully using the handle of a screwdriver. The air bubbles, which can influence the display, will dissipate when this is done. The colour display of the magic eye will be more accurate.



Note

- ◆ *Air bubbles can form below the magic eye particularly if the battery - A- has been recharged, even if the battery - A- was charged during normal vehicle operation. These distort the colour displayed by the magic eye.*
- ◆ *Because the magic eye is located in only one cell, the display applies only to this cell. An exact determination of the battery condition is only possible through a battery load test ⇒ [page 13](#) .*
- ◆ *The magic eye can be located at various positions on the battery - A- .*

Three different colour displays are possible:

- ◆ »Black«, electrolyte level is OK.
- ◆ »Colourless/light yellow«: Electrolyte level too low. The battery - A- must be renewed.



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.

2.5 Battery tester with printer - VAS 5097 A-



WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#)!

If battery tester with printer - VAS 5097 A- is used, it is not necessary to disconnect battery - A- or remove it.

The battery tester with printer - VAS 5097 A- can be used to test/check the following batteries - A- :

- ◆ 80 to 499 A: Low-temperature test current according to DIN (Deutsche Industrie Norm (German Industrial Standard))¹⁾
- ◆ 95 to 574 A: Low-temperature test current according to IEC (International Engineering Consortium)
- ◆ 136 to 855 A: Low-temperature test current according to EN/SAE (European Norm/Standard of Automotive Engineers)

1) Batteries - A- with a low-temperature test current greater than 499 A according to DIN can be tested using setting for 499 A according to DIN.

For testing, batteries - A- are loaded with a current equivalent to the starting current of a passenger car. Under this load the battery - A- is tested and the result of the measurement is printed out.



Note

Observe ⇒ instruction manual for battery tester with printer - VAS 5097 A- and the sticker ⇒ Brief instructions for battery tester with printer - VAS 5097 A- on battery tester with printer - VAS 5097 A- and the table for low-temperature test current ⇒ [page 15](#) .

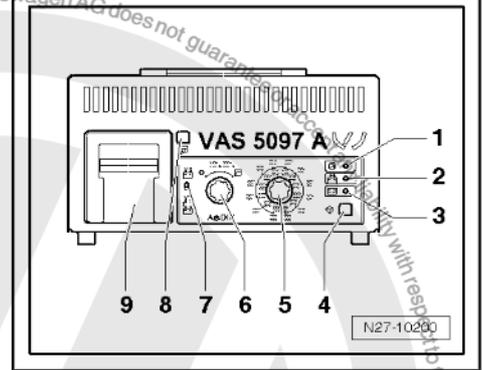
- ◆ Description of battery tester with printer - VAS 5097 A- ⇒ [page 13](#)
- ◆ Battery load test ⇒ [page 13](#) .
- ◆ Table: Low-temperature test current ⇒ [page 15](#)
- ◆ Results of battery load test ⇒ [page 16](#) .
- ◆ Explanations of test printout ⇒ [page 16](#)
- ◆ Evaluation of test result ⇒ [page 16](#) .



2.5.1 Description of battery tester with printer - VAS 5097 A-

Battery tester with printer - VAS 5097 A-

- 1 - Green LED "unit operating"
- 2 - Red LED "unit reverse-polarity connected"
- 3 - Red LED "Battery cannot be tested" Battery - A- has to be replaced.
- 4 - **Start** button
- 5 - Cold cranking current selection switch
- 6 - **ON/OFF** function switch
- 7 - Selection switch (pick-off point on battery - A- /on jump-start point)
- 8 - **Paper feed** button
- 9 - Printer



2.5.2 Battery load test

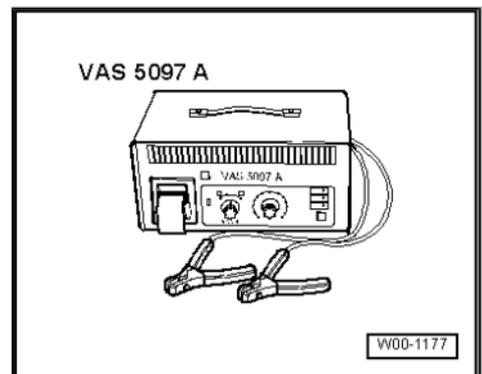


WARNING

Danger of injury! Comply with the warning notices and safety regulations => page 3!

Special tools and workshop equipment required

- ◆ Battery tester with printer - VAS 5097 A-



Observe => TPL 2012182 .

Procedure



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.



Note

The temperature of the battery - A- must be at least 10°C.



Caution

- ◆ Switch off ignition and all electrical consumers.
- ◆ Withdraw ignition key.

- Check the colour indicator when checking batteries - A- with a magic eye ⇒ [page 6](#) .
- Switch on battery tester with printer - VAS 5097 A- ⇒ [page 13](#) .
- Ascertain the low-temperature test current in amperes (A) according to DIN from details given on battery - A- and determine the setting range of battery tester with printer - VAS 5097 A- according to table ⇒ [page 15](#) .



Note

If the battery - A- values are shown in IEC or EN/SAE units instead of DIN units, then convert figures using table or using table ⇒ [page 15](#) on battery tester with printer - VAS 5097 A- .

- Set low-temperature test current with low-temperature test current selection switch ⇒ [page 13](#) .
- Select measuring range (80 to 379 A or 380 to 499 A) with ON/OFF function switch ⇒ [page 13](#) .



Note

Batteries - A- with a low-temperature test current greater than 499 A according to DIN can be tested using setting for 499 A according to DIN.

- Connect red terminal (+) to positive terminal of battery - A- .
- Connect black terminal (-) to negative terminal of battery - A- .

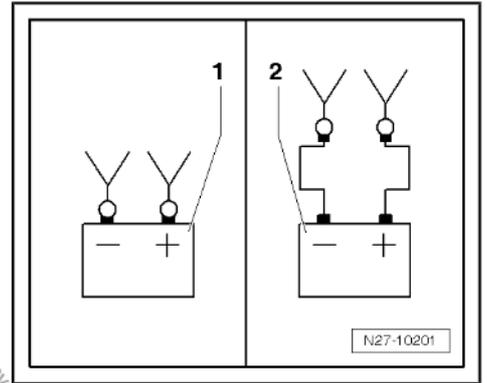


Note

- ◆ Make sure test terminals make good contact!
- ◆ Observe technical product information ⇒ TPL 2012182 for battery tester with printer - VAS 5097 A- .



- Select connection point of test terminals with selection switch ⇒ [page 13](#) .
- 1- Connected directly to battery - A- .
- 2- Connection to jump start point
- Check that the low-temperature test current given on battery - A- is correct for the setting on battery tester with printer - VAS 5097 A- .
- Press **Start** button ⇒ [page 13](#) .



- The green LED lights up ⇒ [page 13](#) . The test program runs through automatically. The test result is printed out by the printer ⇒ [page 16](#) . If battery tester with printer - VAS 5097 A- does not start (LED does not light up, no printout), recharge battery - A- ⇒ [page 30](#) .
- Switch off battery tester with printer - VAS 5097 A- ⇒ [page 13](#) .
 - Remove test terminals.



Note

- ◆ *The test takes about 20 seconds.*
- ◆ *The result of the test is printed out by the printer.*
- ◆ *Only perform test once. Repeating the test falsifies the result.*
- ◆ *The battery tester with printer - VAS 5097 A- needs approximately 30 minutes (to cool down) before it is ready for the next measurement.*

2.5.3 Table showing low-temperature test current

Cold cranking current in A		
EN/SAE	IEC	DIN
136 – 177	95 – 124	80 – 104
178 – 219	125 – 154	105 – 129
220 – 261	155 – 184	130 – 154
262 – 303	185 – 214	155 – 179
304 – 345	215 – 244	180 – 204
346 – 387	245 – 274	204 – 229
388 – 429	275 – 304	230 – 254
430 – 471	305 – 334	255 – 279
472 – 513	335 – 364	280 – 304
514 – 555	365 – 394	305 – 329
556 – 597	395 – 424	330 – 354
598 – 639	425 – 454	355 – 379
640 – 657	455 – 464	380 – 389
658 – 675	465 – 474	390 – 399
676 – 693	475 – 484	400 – 409
694 – 711	485 – 494	410 – 419
712 – 729	495 – 504	420 – 429
730 – 747	505 – 514	430 – 439
748 – 765	515 – 524	440 – 449
766 – 783	525 – 534	450 – 459
784 – 801	535 – 544	460 – 469



Cold cranking current in A		
EN/SAE	IEC	DIN
802 – 819	545 – 554	470 – 479
820 – 837	555 – 564	480 – 489
838 – 855	565 – 574	490 – 499 ²⁾

2) Batteries - A- with a low-temperature test current greater than 499 A according to DIN can be tested using setting for 499 A according to DIN.

2.5.4 Results of battery load test

Because of the high load on the battery - A- during this test, the battery voltage drops.

- ◆ If the battery - A- is OK, the voltage only drops to the minimum voltage.
- ◆ If the battery - A- is defective or has a low charge, the battery voltage quickly drops below the minimum voltage.
- ◆ After the test is completed, this low voltage value remains over a longer period, and the voltage increases very slowly again.
- ◆ Only perform test once. Repeating the test falsifies the result.
- ◆ The battery tester with printer - VAS 5097 A- requires approx. 30 minutes to cool down before carrying out another test or testing another battery - A- . This ensures that the results are not falsified.

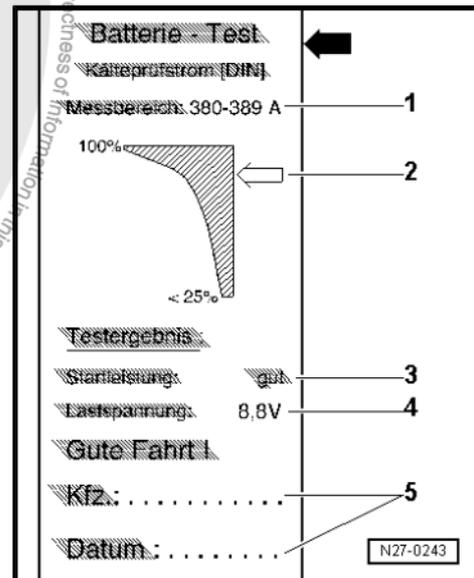
2.5.5 Explanations of test printout

- 1 - Measuring range set on battery tester with printer - VAS 5097 A- .
- 2 - Diagram, -arrow- indicates condition of battery - A- .
- 3 - Test result
- 4 - Battery - A- voltage during load test.
- 5 - Vehicle data and date. Must be completed by test personnel.



Note

- ◆ The test printout is required for warranty claims.
- ◆ Only perform test once. Repeating the test falsifies the result.



2.5.6 Evaluation of test result

Printout	Measures
Starting capability very good	Battery - A- OK
Starting capability good	Battery - A- OK
Starting capability sufficient	Evaluation by current draw test ⇒ page 27
Starting capability poor	Evaluation by current draw test ⇒ page 27
Starting capability very poor	Evaluation by current draw test ⇒ page 27



Printout	Measures
Cannot be tested	- Charge battery - A- ⇒ page 30 and repeat test.

2.6 Battery tester with printer - VAS 6161-

General description

 **WARNING**

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#)!

If battery tester with printer - VAS 6161- is used, it is not necessary to disconnect battery - A- or remove it.

The battery tester with printer - VAS 6161- does not load the battery - A- . It works on the principle of dynamic conductance acquisition.

All types of battery are stored in the battery tester with printer - VAS 6161-

Data can be stored on an SD card.

The battery tester with printer - VAS 6161- can be updated via an interface or an SD card, so that battery data from VW are always up to date.

Integrated infrared sensor (battery temperature measurement) improves measurement quality.

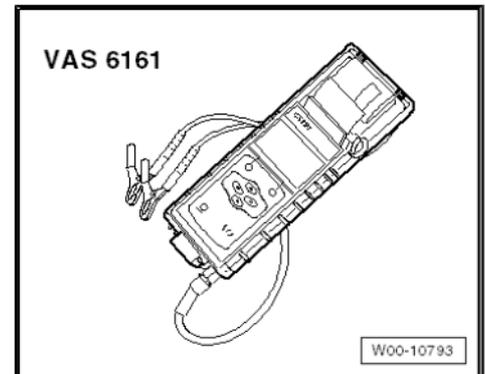
A 2D scanner is available as an option to read data directly from the bar code of the battery - A- .

Note

Observe ⇒ operating instructions for battery tester with printer - VAS 6161- .

◆ Description of battery tester with printer - VAS 6161-
⇒ [page 18](#)

- ◆ Battery test ⇒ [page 18](#) .
- ◆ Performing test on genuine VW battery ⇒ [page 19](#) .
- ◆ Performing test on non-VW battery ⇒ [page 20](#) .
- ◆ Performing maintenance in storage ⇒ [page 20](#) .
- ◆ Explanations of test printout ⇒ [page 21](#)
- ◆ Evaluation of test result ⇒ [page 21](#) .





2.6.1 Description of battery tester with printer - VAS 6161-

Battery tester with printer - VAS 6161-

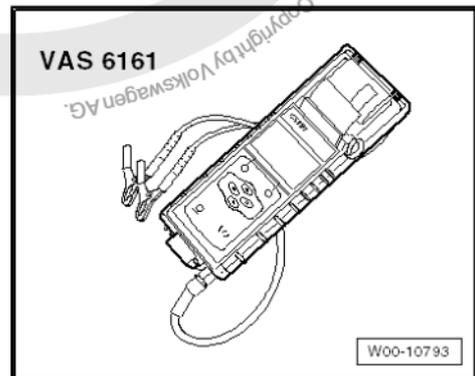
- 1 - Internal printer
- 2 - Operating lever for paper compartment
- 3 - Paper slot
- 4 - Display with main menu
- 5 - Control panel with **ON/OFF** (power) button, cursor buttons for selection
- 6 - Connection for battery test cable
- 7 - Card slot for SD card
- 8 - Infrared temperature sensor
- 9 - Data transmitter for PC



2.6.2 Performing battery test using battery tester with printer - VAS 6161-

Special tools and workshop equipment required

- ◆ Battery tester with printer - VAS 6161-



WARNING

Danger of injury! Comply with the warning notices and safety regulations => [page 3](#)!

Procedure



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.



Note

The temperature of the battery - A- must be at least 10°C.



- Switch off ignition and all electrical consumers, and withdraw ignition key.
- Check the colour indicator when checking batteries - A- with a magic eye ⇒ [page 6](#) .
- Switch on battery tester with printer - VAS 6161- ⇒ [page 18](#) .
- Connect red terminal (+) to positive terminal of battery - A- .
- Connect black terminal (-) to negative terminal of battery - A- .

 Note

Make sure test terminals make good contact!

- Select one of the following functions:

 Note

- ◆ *Genuine VW battery test: all Genuine VW batteries are to be tested with this, both during and after warranty.*
- ◆ *Non-VW battery test: batteries from all other manufacturers are to be tested with this.*
- ◆ *Stock maintenance: for batteries in showroom and storage vehicles requiring maintenance.*
- ◆ *Genuine VW battery*
⇒ ["2.6.3 Genuine Volkswagen battery test", page 19](#) .
- ◆ *Non-VW battery* ⇒ ["2.6.4 Non-VW battery test", page 20](#) .
- ◆ *Storage maintenance*
⇒ ["2.6.5 Carrying out stock maintenance", page 20](#) .

 Note

- ◆ *The test takes about 10 seconds.*
- ◆ *The result of the test is printed out by the printer.*
- ◆ *The battery tester with printer - VAS 6161- requires no cooling phase before it is ready for the next measurement.*
- Switch off battery tester with printer - VAS 6161- ⇒ [page 18](#) .
- Remove test terminals.

2.6.3 Genuine Volkswagen battery test



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.

Procedure

- Select "Genuine Volkswagen battery test" in the menu.



- Select "In vehicle" or "Outside vehicle".
- Select "On battery terminal" or "On jump-start point".
- Scan in bar code or select battery type and current rating in menu.
- Measure temperature above battery - A- . To do this, hold infrared sensor about 5 cm above one battery terminal until temperature stabilises.
- Start test.
- Print test report.

2.6.4 Non-VW battery test



Note

- ◆ *The print-out may vary depending on software version.*
- ◆ *Observe the ⇒ operating manual of the battery tester with printer - VAS 6161- .*



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.

Procedure

- Select "Non-Volkswagen battery test" in the menu.
- Select "On battery terminal" or "On jump-start point".
- Select vehicle type.
- Select type of battery (normal, AGM, 2*6 V or Gel).
- Select standard (CCA, JIS, DIN, SAE, IEC or EN).
- Select battery capacity.
- Measure temperature above battery - A- . To do this, hold infrared sensor about 5 cm above one battery terminal until temperature stabilises.
- Start test.
- Print test report.

2.6.5 Carrying out stock maintenance



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.



Procedure

- Select "Stock maintenance" in the menu.
- Connect scanner.



Note

If no scanner is available, write vehicle identification number on test printout by hand.

- Scan in vehicle identification number.
- Select "On battery terminal" or "On jump-start point".
- Scan in bar code or select manually in "Type and Manufacturer" menu.
- Select vehicle type.
- Measure temperature above battery - A- . To do this, hold infrared sensor about 5 cm above one battery terminal until temperature stabilises.
- Start test.
- Print test report.

2.6.6 Comments concerning test print out



Note

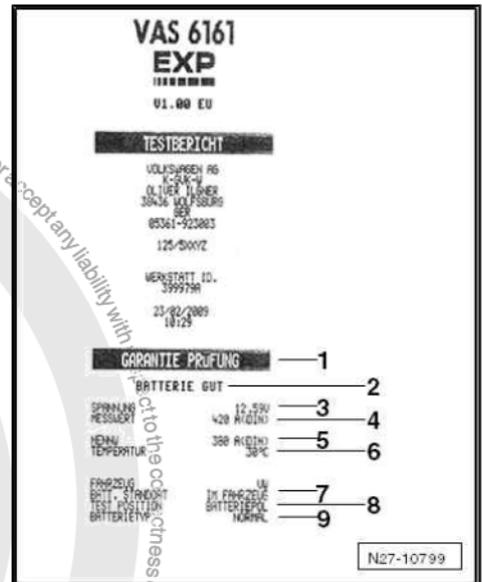
- ◆ *The print-out may vary depending on software version.*
- ◆ *The test printout is required for warranty claims.*

- 1- Type of test
- 2- Test result
- 3- Measured voltage
- 4- Measured cold start value of battery - A-
- 5- Cold-start value of battery - A- set on battery tester with printer - VAS 6161- .
- 6- Measured temperature above battery - A-
- 7- Installation location of battery - A-
- 8- Position of battery clamp set on battery tester with printer - VAS 6161-
- 9- Selected battery type



Note

The test printout is required for warranty claims.



2.6.7 Evaluation of test result

Evaluation of from battery test results for VW genuine battery test/
non-VW battery test

Battery test results	Measure
Battery - A- OK	No measure required on battery - A- .



Battery test results	Measure
Battery - A- OK - recharge	- Charge battery - A- ⇒ page 30 and look for faults causing discharge.
Perform current draw test	- Perform current draw test ⇒ page 27 . - Charge battery - A- ⇒ page 30 and repeat test.
Renew battery - A-	- Disconnect battery - A- and repeat test. The result "Renew battery" may be caused by a weak cable contact.
Battery cell defective - renew.	- Renew battery - A- ⇒ Electrical system; Rep. gr. 27 ; Battery; Removing and installing battery .
Check connection.	- Connect testing lead terminals directly to battery - A- and not to jump start terminal.
Battery - A- service life expired	Renew battery - A-

Evaluating battery test results for storage maintenance test

Battery test results	Measure
Battery - A- OK	No measure
Charge battery - A- immediately	- Charge battery - A- ⇒ page 30 .
Mark as defective.	- Mark battery - A- as "defective".
Check tester connection.	- Disconnect battery - A- and repeat test. The result "Check tester connection" may be caused by a weak test clamp contact.
Check connection.	- Connect testing lead terminals directly to battery - A- and not to jump start terminal.
Noises	Wait until measured value appears on display.
Battery - A- service life expired	Renew battery - A-

2.7 Midtronics battery tester - MCR340V- , only for USA and Canada

	WARNING
<i>Danger of injury! Comply with the warning notices and safety regulations ⇒ page 3 !</i>	

Refer to ⇒ operating instructions Midtronics - MCR340V- .

- ◆ Description of Midtronics - MCR340V- ⇒ [page 23](#) .
- ◆ Battery test ⇒ [page 23](#) .



- ◆ Dealing with problems ⇒ [page 25](#) .

2.7.1 Description of Midtronics - MCR340V- battery tester

Batteries - A- in VW vehicles are only allowed to be tested with battery testers approved by VW. In the USA/Canada, it is permissible to use the Midtronics - MCR340V- battery tester.

Comply with all safety and operating instructions in the ⇒ Operating manual Midtronics - MCR340V- .

Additional information in ⇒ Self-study programme No. 234 ; Vehicle batteries .

The following charging and analysis procedures apply to all batteries - A- , all battery installation locations (engine compartment or luggage compartment) and battery purposes (starter battery or second/convenience battery).

Always comply with the following:

- ◆ Safety requirements
- ◆ Instructions for setting up the Midtronics - MCR340V- tester
- ◆ Display menu
- ◆ Display buttons and LEDs
- ◆ Operating procedures in ⇒ operating instructions Midtronics - MCR340V- .

2.7.2 Performing battery test using Midtronics - MCR340V-



WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#) !



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.

Conditions

- Read description of device ⇒ [page 23](#) .
- Perform visual check ⇒ [page 8](#) .
- Open bonnet or covers for other installation location of battery - A- .
- Select battery type (standard or AGM).
- Remove covers from positive and negative terminals of battery - A- .
- Use wing covers or other kinds of cover before you start work in engine compartment or interior.
- Close all doors.



Note

- ◆ *The temperature of the battery - A- must be at least 10°C.*
- ◆ ⇒ *Operating instructions Midtronics - MCR340V-*

Procedure



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.

- Switch off ignition and all electrical consumers, and withdraw ignition key.
- Check the colour indicator when checking batteries - A- with a magic eye ⇒ [page 6](#) .
- Switch Midtronics - MCR340V- on ⇒ Operating instructions Midtronics - MCR340V- .
- Connect red terminal (+) to positive terminal of battery - A- .
- Connect black terminal (-) to negative terminal of battery - A- .



Note

Make sure test terminals make good contact!

- Select "Warranty test" in the menu.
- Select "In vehicle" or "Outside vehicle".



Note

Use the print function of the Midtronics - MCR340V- tester if the test results are required for handling warranty applications.

- Select battery type (standard or AGM).
- Make a note of the DIN value of the battery - A- shown on the battery sticker. Make a note of SAE value if sticker does not show a DIN value.
- Enter the DIN value into the Midtronics - MCR340V- and carry out battery test ⇒ Operating instructions Midtronics - MCR340V- .
- If you are using SAE value, open the "Miscellaneous" menu and change from "DIN" to "SAE" ⇒ Operating instructions Midtronics - MCR340V- .
- Switch Midtronics - MCR340V- off.
- Remove test terminals.



i Note

Always use the DIN value shown on the battery sticker! Otherwise, test result will be falsified.

2.7.3 Evaluation of test result

Results of battery test

Battery test results	Measure
Battery - A- OK	None
Good - charge	- Charge battery - A- ⇒ page 30 .
Use Incharge	- Charge battery - A- ⇒ page 30 .
Renew battery - A-	- Renew battery - A- ⇒ Electrical system; Rep. gr. 27 ; Battery; Removing and installing battery .
Battery cell defective	- Renew battery - A- ⇒ Electrical system; Rep. gr. 27 ; Battery; Removing and installing battery .

2.7.4 Handling problems with Midtronics - MCR340V-

Under certain circumstances, the display may show errors or messages according to status.

The most frequent display messages are listed below, together with suggested solutions.

For messages not listed here, please refer to ⇒ Operating manual Midtronics - MCR340V- .

Display message	Measure
No display	<ul style="list-style-type: none"> - Check whether testing terminals of Midtronics - MCR340V- are firmly connected to battery terminals. - Check if battery terminals are tightened according to specifications ⇒ Electrical system; Rep. gr. 27 ; Battery; Removing and installing battery and check for corrosion. <p>Charge battery - A- ⇒ page 30 .</p>



Display message	Measure
System noise	<ul style="list-style-type: none">- Switch off all electrical consumers.- Wait until all electrical loads monitored by onboard supply control unit - J519- have switched off.- Withdraw ignition key.- Disconnect any suspect electrical equipment not connected to onboard supply as standard.

Wait a few minutes and repeat test ⇒ [page 23](#) .



Note

If the test was performed on the jump-start point and the message does not disappear, perform the test directly on the battery - A- .

2.8 Battery test using the vehicle diagnostic tester

The battery - A- can be tested using the ⇒ Vehicle diagnostic tester with the battery installed and without connecting the battery charger.

Special tools and workshop equipment required

- ◆ ⇒ Vehicle diagnostic tester

Conditions for testing

- ◆ No battery charger connected.
- ◆ Battery - A- is connected.
- ◆ Battery temperature must be at least +10°C.

Procedure

- Connect ⇒ Vehicle diagnostic tester ⇒ [page 85](#) .
- Select **Diagnosis** mode, and start diagnosis.
- Select **Test plan** tab.
- Push **Select own test** button, and select the following menu items one after the other:
 - ◆ Body
 - ◆ Electrical system
 - ◆ 27 - Starter, current supply
 - ◆ Electrical components
 - ◆ A - battery, test

From this point, further guidance on battery test is provided by ⇒ Vehicle diagnostic tester.



2.9 Current draw test



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.

Ensure that the correct charging mode is set on the battery charger so that the current draw test is not distorted.

- ◆ Battery charger - VAS 5095 A- ⇒ [page 31](#) .
- ◆ Battery charger - VAS 5900- ⇒ [page 35](#) .
- ◆ Battery charger - VAS 5903- ⇒ [page 47](#) .

To quickly ascertain the condition of a discharged battery - A- , the current draw test whilst charging will help to ascertain the condition of a discharged battery - - to establish whether the battery - A- must be replaced or fully recharged.



Note

For battery tester with printer - VAS 6161- , the current draw test must always be performed when the test result "Perform current draw test" appears on the display.

The current draw test must be carried out when the test result with battery tester with printer - VAS 5097 A- is as follows:

- 1 - Starting capability sufficient
- 2 - Starting capability poor
- 3 - Starting capability very poor
- 4 - Cannot be tested – charge battery - A- and repeat test
- 5 - Battery tester with printer - VAS 5097 A- does not switch on (no LED, no printout)

Depending on the test result ⇒ [page 16](#) of the battery tester with printer - VAS 5097 A- , further procedures or tests may be required before a final decision can be made on the condition of the battery.

Performing a current draw test whilst charging a battery - A- will quickly establish whether a partly or fully discharged battery - A- ⇒ [page 67](#) can be recharged to return it to a serviceable condition.

Conditions for testing

- ◆ When battery is being charged, battery temperature must be at least 10°C.
- ◆ The battery charger must be able to output at least 30 A of charge current as in the case of battery charger - VAS 5095 A- / battery charger - VAS 5900- / battery charger - VAS 5903- .
- ◆ If charging with battery charger - VAS 5095 A- , current draw of battery - A- must be measured with current clamp (100 A current clamp - VAS 5051B/7-).



- ◆ Battery charger - VAS 5900- and battery charger - VAS 5903- display the current draw. Battery charger - VAS 5900- performs the current draw test automatically with menu guidance.

Procedure

- Connect battery - A- to battery charger and start charging procedure.
- Measure charge current of battery - A- after 5 minutes.

Test result

Charge current must be more than 10% of nominal capacity 5 minutes after charging begins.

Example:

For a 60 Ah battery, the charge current must be higher than 6 A five minutes after charging is started.

- Fully charge battery - A- if charge current is more than 10% of rated capacity.
- After 2 hours of resting time, perform a battery load test on battery - A- ⇒ [page 13](#) .

If charge current is below 10% of rated capacity five minutes after start of charging (example for a 60 Ah battery with less than 6 A), renew battery - A- ⇒ Electrical system; Rep. gr. 27 ; Battery; Removing and installing battery .

- For guarantee and ex-gratia cases: complete battery test sheet and keep it together with the battery - A- .

2.10 Checking no-load voltage of battery (stock and stored vehicles)



WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#) !

The no-load voltage test may only be carried out to assess the condition of the battery - A- on stock and stored vehicles within the framework of prescribed maintenance.

The no-load test is used as a criterion for assessing whether a battery - A- on a stock or stored vehicle requires recharging ⇒ Maintenance tables "Service for stock and stored vehicles" .

Special tools and workshop equipment required

- ◆ Hand multimeter - V.A.G 1526 B-





Conditions for testing

Battery - A- must not have been charged or discharged within the last 2 days.

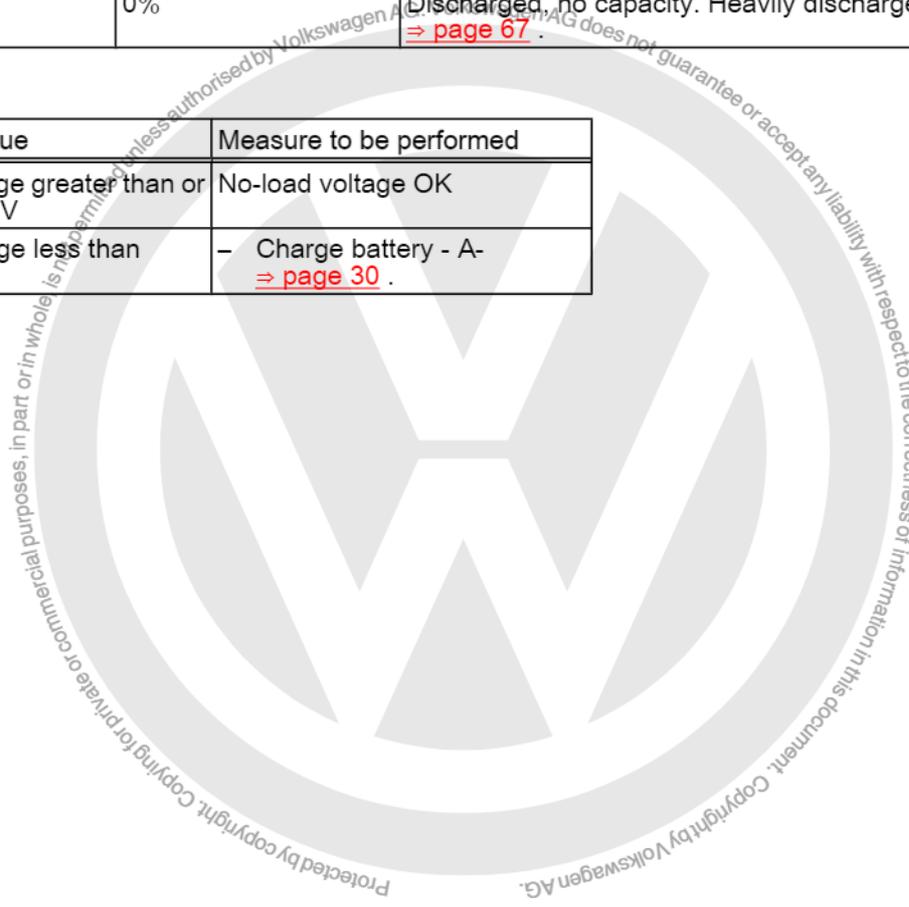
Procedure

- Measure no-load current of battery - A- using hand-held multimeter - V.A.G 1526 B- .

Test result

No-load voltage	Charge level	Condition of battery - A-
11.60 V	0%	Discharged, no capacity. Heavily discharged ⇒ page 67 .

Measured value	Measure to be performed
No-load voltage greater than or equal to 12.5 V	No-load voltage OK
No-load voltage less than 12.5 V	- Charge battery - A- ⇒ page 30 .





3 Charging battery

⇒ ["3.1 Battery charger VAS 5095 A", page 30](#)

⇒ ["3.2 Battery charger VAS 5900", page 35](#)

⇒ ["3.3 Battery charger VAS 5903", page 47](#)

⇒ ["3.4 Battery charger VAS 5906", page 59](#)

⇒ ["3.5 Midtronics battery charger INC 940, only for USA/Canada", page 61](#)

⇒ ["3.6 Solar charger module VAS 6102 A", page 66](#)

⇒ ["3.7 Totally discharged batteries", page 67](#)

3.1 Battery charger - VAS 5095 A-



WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#)!

To prevent damage to the battery - A- and the vehicle, observe the following instructions for the types of battery ⇒ [page 1](#).



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.

The charge current cannot be read on this battery charger - VAS 5095 A- . Charge current must be read externally using a pick-up clamp (100 A pick-up clamp - VAS 5051B/7-).

Observe ⇒ operating instructions for battery charger - VAS 5095 A- .

- ◆ Description of battery charger - VAS 5095 A- ⇒ [page 30](#) .
- ◆ Charge battery - A- ⇒ [page 31](#) .
- ◆ Charging totally discharged battery - A- ⇒ [page 32](#) .
- ◆ Support mode ⇒ [page 33](#) .
- ◆ Buffer mode/trickle charging ⇒ [page 34](#)

3.1.1 Description of battery charger - VAS 5095 A-

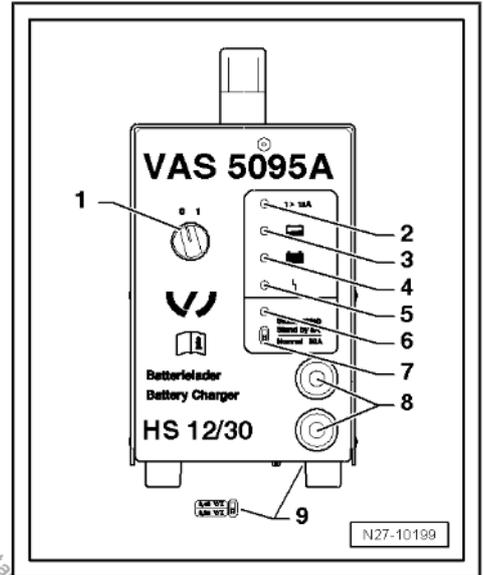
The battery charger - VAS 5095 A- is suitable for charging all 12 V batteries - A- supplied by Volkswagen.



The battery charger charges without peaks in amperage or voltage. This will not adversely effect the on-board electronics. Battery - A- can remain in vehicle while charging and does not have to be disconnected from on-board supply.

Battery charger - VAS 5095 A-

- 1 - **ON/OFF** switch (0 = OFF)
- 2 - Charging current indicator (I greater than 12 A)
- 3 - Charging current indicator, battery - A- partially charged (greater than 90%)
- 4 - Maintenance mode, lights up green when battery - A- is fully charged
- 5 - Malfunction indicator
- 6 - Support mode indicator
- 7 - **Support mode/normal mode** changer-over switch
- 8 - Charger cable: red terminal (+), black terminal (-)
- 9 - **Battery type** changeover switch (on floor of charger)

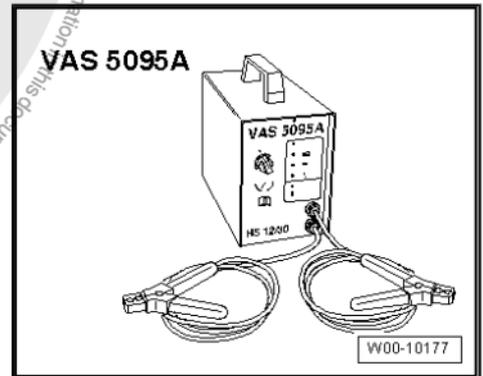


3.1.2 Charging battery with battery charger - VAS 5095 A-

⚠ WARNING
Danger of injury! Comply with the warning notices and safety regulations => page 3!

Special tools and workshop equipment required

- ◆ Battery charger - VAS 5095 A-



⚠ Caution
Always set battery type 2.4 V/C (volts/battery cell) when charging! This applies to all batteries - A- .

i Note

The temperature of the battery - A- must be at least 10°C.



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.

Procedure

- Switch off ignition and all electrical consumers, and withdraw ignition key.
- Check battery type setting on battery type change-over switch [⇒ page 30](#) . The battery type switch must be set to 2.4 V/C (volts/battery cell).
- Connect red terminal clamp (+) to positive terminal of battery -A- .



Note

In vehicles with start/stop function and battery monitor control unit J367- fitted, the black terminal clamp (-) must be connected to body earth. Connecting it to the negative terminal of the battery's A- will cause start/stop system to malfunction.

- Connect black terminal clamp (-) to negative terminal of battery - A- /negative connection point.
- Switch battery charger - VAS 5095 A- on [⇒ page 30](#) .

The charge current indicators [⇒ page 31](#) -2- and -3- light up yellow. If only the yellow LED -3- lights up, battery - A- is partially charged. (approx. 90%).

If the green LED [⇒ page 31](#) -4- lights up as well, the battery charger - VAS 5095 A- has switched to trickle charging mode. Battery - A- is fully charged.

- Switch battery charger - VAS 5095 A- off [⇒ page 30](#) .
- Remove charger terminals from battery terminal clamps.

3.1.3 Charging totally discharged battery with battery charger - VAS 5095 A-



WARNING

Danger of injury! Comply with the warning notices and safety regulations [⇒ page 3](#) !

Battery charger - VAS 5095 A- detects fully discharged batteries - A- automatically and starts the charging process gently with a low charging current. The charge current is automatically adapted to suit the charge condition of the battery.

- ◆ Follow instructions in chapter [⇒ page 67](#) .
- ◆ The battery voltage must be at least 0.6 V.
- ◆ Totally discharged batteries - A- in vehicles before registration must be exchanged prior to delivery. Preliminary damage cannot be excluded.



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.

Procedure

- Charge battery - A- ⇒ [page 31](#) .

3.1.4 Charging battery in support mode with battery charger - VAS 5095 A-

General information

The support mode provides the onboard supply with power when the battery - A- is removed or disconnected.

For additional information, refer to ⇒ Operating instructions for battery charger - VAS 5095 A- .

The support mode is suitable in the following situations:

- ◆ Support mode of onboard supplies without installed battery - A-
- ◆ Power conservation when renewing the battery
- ◆ Ancillaries test without battery - A-



WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#) !



WARNING

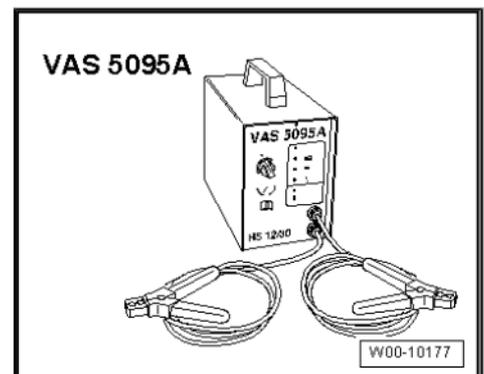
Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.

Special tools and workshop equipment required

- ◆ Battery charger - VAS 5095 A-





Procedure



Caution

- ◆ *The terminal polarity protection in operating mode "charging totally discharged batteries/support mode" is not active. Connect battery charger terminal clamps correctly to battery terminals.*
- ◆ *It can cause sparks through a short-circuit.*
- ◆ *Danger of explosion*
- ◆ *Ensure charger terminals are fitted securely.*

- Remove battery - A- ⇒ Electrical system; Rep. gr. 27 ; Battery; Removing and installing battery .



Caution

When battery - A- has been removed, ensure there is no contact between terminal clamp connected to positive battery clamp and body earth. Also ensure there is no contact between battery clamps.

- Connect red terminal clamp + to positive terminal of vehicle's battery.



Note

In vehicles with start/stop function and battery monitor control unit - J367- fitted, the black terminal clamp (-) must be connected to body earth. Connecting it to the negative terminal of the battery's - A- will cause start/stop system to malfunction.

- Connect black terminal clamp (-) to negative terminal of vehicle's battery.
- Check setting of `support mode/normal mode` changeover switch ⇒ [page 30](#) . It must be switched on "support mode".
- Check that connections of charger terminals have correct polarity.
- Switch battery charger - VAS 5095 A- on ⇒ [page 30](#) .

The battery charger - VAS 5095 A- starts with support mode.

End battery support mode

- Switch battery charger - VAS 5095 A- off ⇒ [page 30](#) .
- Remove charger terminals from battery terminal clamps.
- Disconnect battery charger - VAS 5095 A- from mains supply.

3.1.5 Maintenance mode with battery charger - VAS 5095 A-



WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#) !



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.

In trickle charge mode, battery charger - VAS 5095 A- ensures that battery - A- is charged correctly and its charge is maintained.

Procedure

- Adopt same procedure as that for charging battery - A-
⇒ [page 31](#) .

When battery - A- is being charged in trickle charge mode and an electrical load draws current from battery, battery charger - VAS 5095 A- automatically compensates for charge.

The maintenance mode can be continued for an unlimited period. Battery - A- is always ready for use.

3.2 Battery charger - VAS 5900-



WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#) !



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.

In this case of the battery charger - VAS 5900- , the effective charge current cannot be read directly on the battery charger - VAS 5900- .

Observe ⇒ operating instructions for battery charger - VAS 5900- .

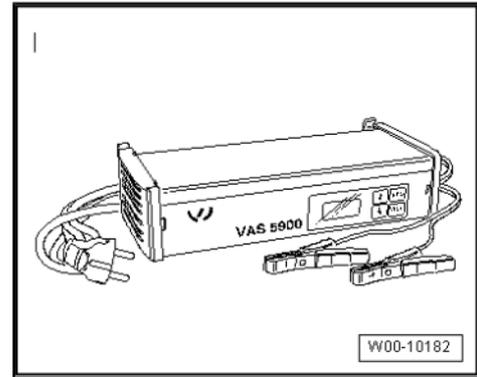
- ◆ Description of battery charger - VAS 5900- ⇒ [page 36](#) .
- ◆ Charge battery - A- ⇒ [page 36](#) .
- ◆ Service charging ⇒ [page 38](#)
- ◆ Charging totally discharged battery - A- ⇒ [page 41](#) .
- ◆ Support mode ⇒ [page 43](#) .
- ◆ Trickle charging ⇒ [page 45](#) .



3.2.1 Description of battery charger - VAS 5900-

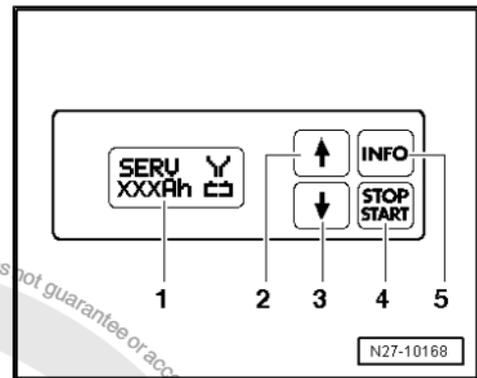
The battery charger - VAS 5900- is suitable for charging all 12 V batteries - A- supplied by Volkswagen.

Battery charger - VAS 5900-



Overview - controls

- 1 - Display
- 2 - button "Up"
- 3 - button "Down"
- 4 - button
- 5 - button



3.2.2 Charging battery with battery charger - VAS 5900-

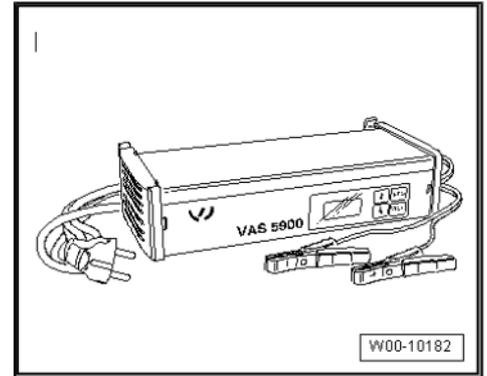
WARNING
Danger of injury! Comply with the warning notices and safety regulations => [page 3](#) !

WARNING
Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!
Danger of explosion when checking and charging or slave/jump starting.
These batteries - A- must be replaced.

Special tools and workshop equipment required



◆ Battery charger - VAS 5900-



i Note

The temperature of the battery - A- must be at least 10°C.

Procedure

- Switch off ignition and all electrical consumers, and withdraw ignition key.
- Connect battery charger - VAS 5900- to mains supply. The last selected operating mode will appear on display ⇒ [page 36](#).

Set battery type with **INFO** button.

On the display, the symbol -1- for “Standard charging of wet batteries” or the symbol -2- for “Standard charging of gel/absorbent glass mat batteries” will appear.

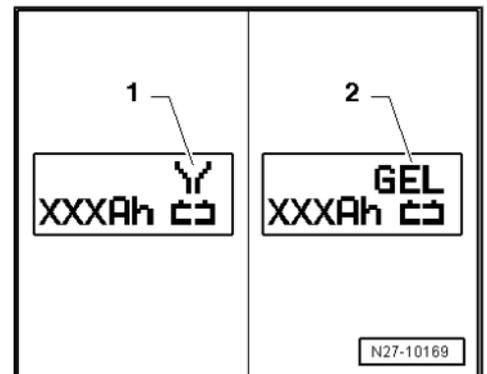
- Set battery capacity (Ah) of battery - A- to be charged using **↑** button or **↓** button.
- Connect red terminal clamp (+) to positive terminal of battery - A- .

i Note

In vehicles with start/stop function and battery monitor control unit - J367- fitted, the black terminal clamp (-) must be connected to body earth. Connecting it to the negative terminal of the battery's - A- will cause start/stop system to malfunction.

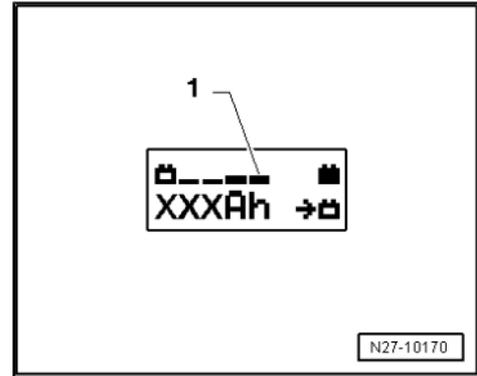
- Connect black terminal clamp (-) to negative terminal of battery - A- /negative connection point.

Battery charger - VAS 5900- detects voltage required for connected battery - A- (6 V/12 V/24 V) and initiates charging sequence automatically.





When the charge reaches about 80 - 85% the battery charger - VAS 5900- starts the "final charging". The fourth bar appears in display -1-. Battery - A- is now ready for operation.



At a charge condition of 100% all bars appear in display -1-.

In the case of "standard charging", parallel operation of electric loads is possible during charging. The charging period will be longer.

Depending on battery type, battery charger - VAS 5900- switches over to maintenance mode after approx. 1 to 7 hours. For 100% charge of battery, battery - A- should be connected to battery charger - VAS 5900- for this length of time.

Possible faults and fault rectification

- 1 - Displayed battery voltage is not as per nominal voltage:
 - Press and hold down  or  button until charging process starts.
- 2 - Displayed battery voltage is not as per nominal voltage – charging process has already started:
 - Press **START / STOP** button twice.
 - Press and hold down  or  button until charging process starts again.
- 3 - Battery charger - VAS 5900- does not detect a battery - A- if battery voltage is less than 2 V:

Display remains unchanged.

The battery type and ampere hours (Ah) as set is displayed.

Ending battery - A- charging process

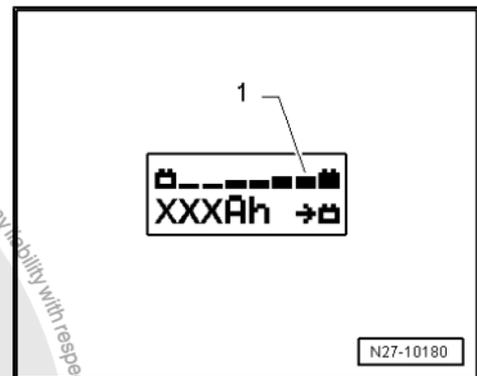
- Press **START/STOP** button.
- Remove charger terminals from battery terminal clamps.
- Disconnect battery charger - VAS 5900- from mains supply.

3.2.3 Service charge with battery charger - VAS 5900-



WARNING

Danger of injury! Comply with the warning notices and safety regulations => page 3!





Caution

The operating mode "service charge" is not permitted on VW vehicles as the voltage peaks will damage the on-board electronics.

If the "Service charging" mode is used, the battery - A- must be disconnected from the onboard supply.



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.



Caution

When charging always set battery charger to the correct type of battery - A- ⇒ Operating instructions for battery charger - VAS 5900- .

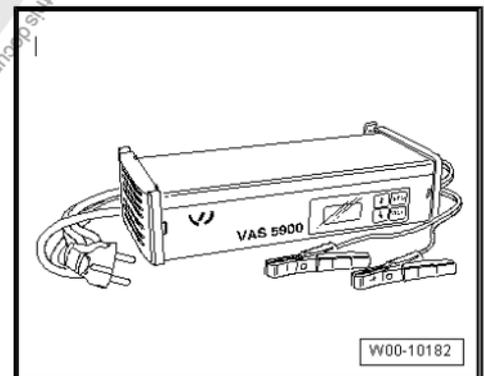
The "service mode" is suitable for:

- ◆ *Wet batteries where the magic eye allows charging (magic eye black or green)*

Operating mode "service charging (SERV)" is only used for sulphated batteries - A- . Battery - A- is charged at voltages higher than 14.4 V. This can result in a partial reduction of the sulphated layer. After charging, always check colour of magic eye before using battery - A- ⇒ [page 10](#) .

Special tools and workshop equipment required

- ◆ Battery charger - VAS 5900-



Note

The temperature of the battery - A- must be at least 10°C.

Procedure

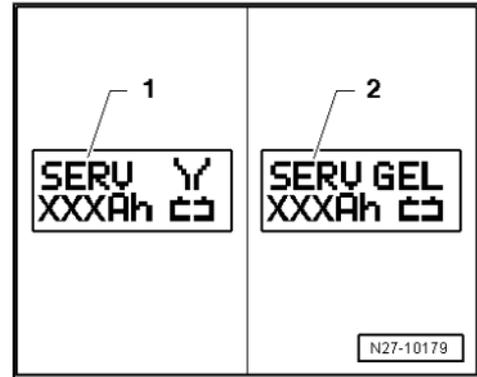
- Switch off ignition and all electrical consumers, and withdraw ignition key.



- Connect battery charger - VAS 5900- to mains supply. The last selected operating mode will appear on display ⇒ [page 36](#) .
- Set battery type with **INFO** button.

On the display, the symbol -1- for “Service charging of wet batteries” or symbol -2- for “Service charging of gel/absorbent glass mat batteries” will appear.

- Set battery capacity (Ah) of battery - A- to be charged using **↑** button or **↓** button.
- Connect red terminal clamp (+) to positive terminal of battery - A- .



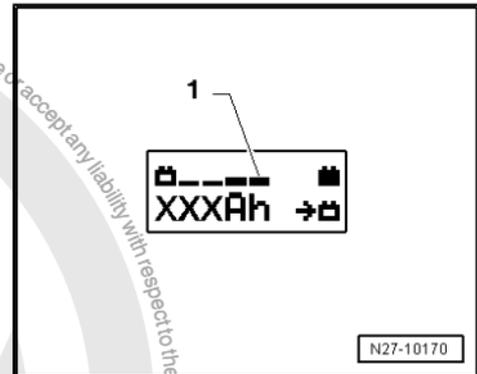
Note

In vehicles with start/stop function and battery monitor control unit - J367- fitted, the black terminal clamp (-) must be connected to body earth. Connecting it to the negative terminal of the battery's - A- will cause start/stop system to malfunction.

- Connect black terminal clamp (-) to negative terminal of battery - A- /negative connection point.

Battery charger - VAS 5900- detects voltage required for connected battery - A- (6 V/12 V/24 V) and initiates charging sequence automatically.

When the charge reaches about 80 to 85% of the battery voltage the battery charger - VAS 5900- starts the “final charging”. The fourth bar appears in display -1-. Battery - A- is now ready for operation.



Note

The success of the “service charge” depends on the severity of the sulphation of the battery - A- .

Possible faults and fault rectification

- 1 - Displayed battery voltage is not as per nominal voltage:
 - Press and hold down **↑** or **↓** button until charging process starts.
- 2 - Displayed battery voltage is not as per nominal voltage – charging process has already started:
 - Press **START / STOP** button twice.
 - Press and hold down **↑** or **↓** button until charging process starts.
- 3 - Battery charger does not detect a battery - A- if battery voltage is less than 2 V:

Display remains unchanged.

The operating mode and ampere hours (Ah) as set are displayed.

Ending battery - A- charging process

- Press **START/STOP** button.
- Remove charger terminals from battery terminal clamps.
- Disconnect battery charger - VAS 5900- from mains supply.



3.2.4 Charging totally discharged battery with battery charger - VAS 5900-



WARNING

Danger of injury! Comply with the warning notices and safety regulations => [page 3](#)!



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.



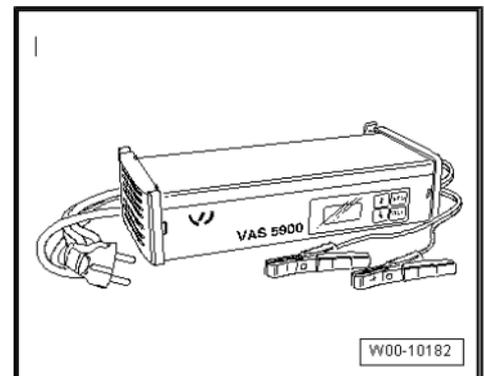
Caution

- ◆ *The terminal polarity protection in operating mode "charging totally discharged batteries/support mode" is not active. Connect battery charger terminal clamps correctly to battery terminals.*
- ◆ *When charging always set battery charger to the correct type of battery - A- => Operating instructions for battery charger - VAS 5900- .*
- ◆ *Totally discharged battery - A- is not recognised by battery charger - VAS 5900- => [page 67](#) .*
- ◆ *Do not press **START / STOP** button when charger unit cables are connected incorrectly. This may damage the battery charger - VAS 5900- .*

Regarding batteries - A- that have a voltage of less than 2 V, automatic recognition of battery - A- by battery charger - VAS 5900- is not possible.

Special tools and workshop equipment required

- ◆ Battery charger - VAS 5900-





Note

- ◆ Follow instructions in chapter ⇒ [page 67](#) .
- ◆ The temperature of the battery - A- must be at least 10°C.
- ◆ Totally discharged batteries in unregistered vehicles must be exchanged prior to delivery. Preliminary damage cannot be excluded.

Procedure

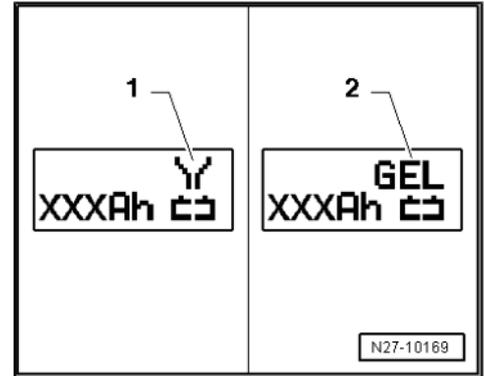
- Switch off ignition and all electrical consumers, and withdraw ignition key.
- Connect battery charger - VAS 5900- to mains supply. The last selected operating mode will appear on display ⇒ [page 36](#) .



- Set battery type with **INFO** button.

On the display, the symbol -1- for "Service charging of wet batteries" or symbol -2- for "Service charging of gel/absorbent glass mat batteries" will appear.

- Set battery capacity (Ah) of battery - A- to be charged using **↑** button or **↓** button.
- Connect red terminal clamp (+) to positive terminal of battery - A- .



i Note

In vehicles with start/stop function and battery monitor control unit - J367- fitted, the black terminal clamp (-) must be connected to body earth. Connecting it to the negative terminal of the battery's - A- will cause start/stop system to malfunction.

- Connect black terminal clamp (-) to negative terminal of battery - A- /negative connection point.
- Press **START / STOP** button for approx. 5 seconds. The menu "charging totally discharged batteries/support mode" will be activated.
- Press appropriate **↑** or **↓** button to set the corresponding battery voltage (6 V/12 V/24 V).

i Note

If a button is not pressed within 5 seconds, the battery charger - VAS 5900- will return to the main menu (select operating mode).

- Confirm selected battery voltage with **START / STOP** button.

Then follows the enquiry for "is charger cable terminal polarity correct".

- Check that connections of charger terminals have correct polarity.
- Confirm that connections of charger terminals have correct polarity with **START / STOP** button.

Battery charger - VAS 5900- will start charging sequence for totally discharged battery - A- .

Ending battery - A- charging process

- Press **START/STOP** button.
- Remove charger terminals from battery terminal clamps.
- Disconnect battery charger - VAS 5900- from mains supply.

3.2.5 Charging battery in support mode with battery charger - VAS 5900-

General information

The support mode provides the onboard supply with power when the battery - A- is removed or disconnected.

For additional information, refer to ⇒ Operating instructions for battery charger - VAS 5900- .

The support mode is suitable in the following situations:



- ◆ Support mode of onboard supplies without installed battery - A-
- ◆ Power conservation when renewing the battery
- ◆ Ancillaries test without battery - A-



WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#)!



WARNING

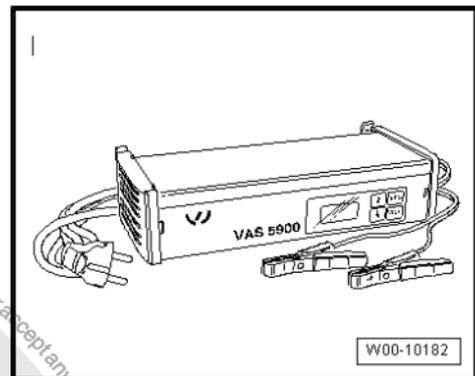
Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.

Special tools and workshop equipment required

- ◆ Battery charger - VAS 5900-



Procedure



Caution

- ◆ *The terminal polarity protection in operating mode "charging totally discharged batteries/support mode" is not active. Connect battery charger terminal clamps correctly to battery terminals.*
- ◆ *It can cause sparks through a short-circuit.*
- ◆ *Danger of explosion*
- ◆ *Do not press **START / STOP** button when charger unit cables are connected incorrectly. This may damage the battery charger - VAS 5900- .*

- Remove battery - A- ⇒ Electrical system; Rep. gr. 27 ; Battery; Removing and installing battery .
- Connect battery charger - VAS 5900- to mains supply. The last selected operating mode will appear on display ⇒ [page 36](#).



Caution

When battery - A- has been removed, ensure there is no contact between terminal clamp connected to positive battery clamp and body earth. Also ensure there is no contact between battery clamps.

- Connect red terminal clamp (+) to positive terminal of battery - A- .



Note

In vehicles with start/stop function and battery monitor control unit - J367- fitted, the black terminal clamp (-) must be connected to body earth. Connecting it to the negative terminal of the battery's - A- will cause start/stop system to malfunction.

- Connect black terminal clamp (-) to negative terminal of battery - A- /negative connection point.
- Press **START / STOP** button for approx. 5 seconds. The menu "charging totally discharged batteries/support mode" will be activated.
- Press appropriate or button to set the corresponding battery voltage (6 V/12 V/24 V).



Note

If a button is not pressed within 5 seconds, the battery charger - VAS 5900- will return to the main menu (select operating mode).

- Confirm selected battery voltage with **START / STOP** button.

Then follows the enquiry for "is charger cable terminal polarity correct".

- Check that connections of charger terminals have correct polarity.
- Confirm that connections of charger terminals have correct polarity with **START / STOP** button.

Battery charger - VAS 5900- starts with support mode of battery - A- .

End battery support mode

- Press **START/STOP** button.
- Remove charger terminals from battery terminal clamps.
- Disconnect battery charger - VAS 5900- from mains supply.

3.2.6 Maintenance mode with battery charger - VAS 5900-

When battery - A- is being charged in trickle charge mode and an electrical load draws current from battery, battery charger - VAS 5900- automatically compensates for charge.

The maintenance mode can be continued for an unlimited period. Battery - A- is always ready for use.



Note

Observe battery manufacturer's maintenance instructions.



WARNING

Danger of injury! Comply with the warning notices and safety regulations => page 3!



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

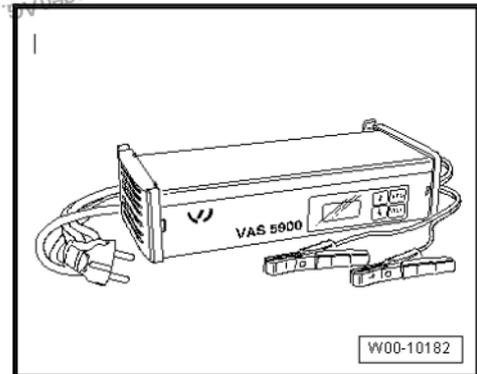
Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.

When battery - A- is fully charged, the battery charger - VAS 5900- switches to trickle charging mode.

Special tools and workshop equipment required

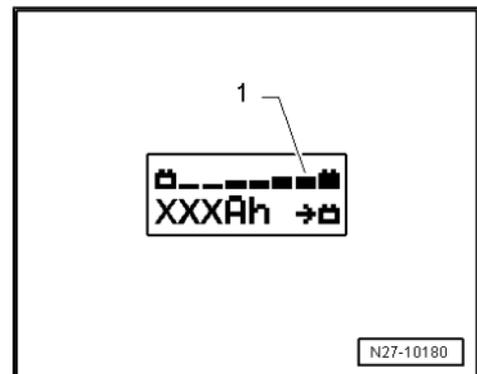
- ◆ Battery charger - VAS 5900-



Procedure

- Adopt same procedure as that for charging battery - A- => page 36 .

At a charge condition of 100% all bars appear in display -1-.





3.3 Battery charger - VAS 5903-

WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#)!

WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.

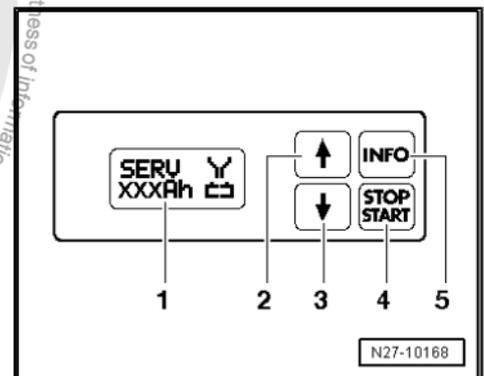
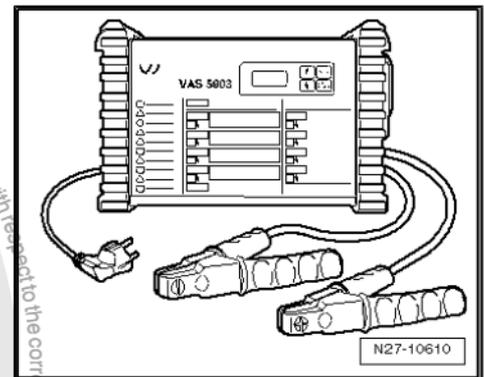
Observe ⇒ operating instructions for battery charger - VAS 5903- .

- ◆ Description of battery charger - VAS 5903- ⇒ [page 47](#) .
- ◆ Charge battery - A- ⇒ [page 48](#) .
- ◆ Refresh charge ⇒ [page 50](#) .
- ◆ Charging totally discharged battery - A- ⇒ [page 53](#) .
- ◆ Support mode ⇒ [page 55](#) .
- ◆ Trickle charging ⇒ [page 57](#) .

3.3.1 Description of battery charger - VAS 5903-

The battery charger - VAS 5903- is suitable for charging all 12 V batteries - A- supplied by Volkswagen.

Battery charger - VAS 5903-



Overview - controls

- 1 - Display
- 2 - button "Up"
- 3 - button "Down"
- 4 - button
- 5 - button



3.3.2 Charging battery with battery charger - VAS 5903-



WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#)!



WARNING

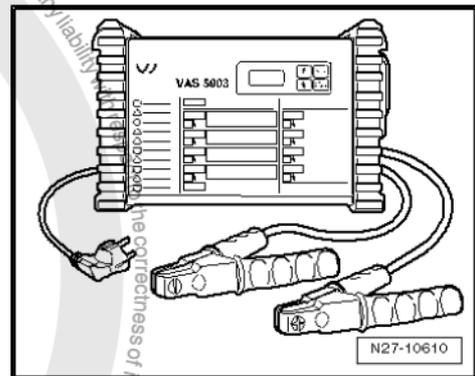
Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.

Special tools and workshop equipment required

- ◆ Battery charger - VAS 5903-



Note

The temperature of the battery - A- must be at least 10°C.

Procedure

- Switch off ignition and all electrical consumers, and withdraw ignition key.
- Connect battery charger - VAS 5903- to mains supply. The last selected operating mode will appear on display ⇒ [page 47](#) .



- Set battery type with **INFO** button.

On the display, the symbol -1- for "Standard charging of wet batteries" or the symbol -2- for "Standard charging of gel/absorbent glass mat batteries" will appear.

- Set battery capacity (Ah) of battery - A- to be charged using **1** button or **2** button.
- Connect red terminal clamp (+) to positive terminal of battery - A- .



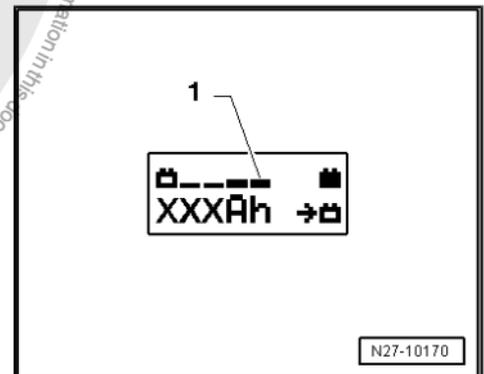
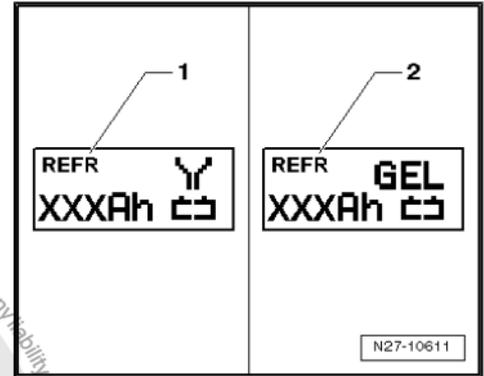
Note

In vehicles with start/stop function and battery monitor control unit - J367- fitted, the black terminal clamp (-) must be connected to body earth. Connecting it to the negative terminal of the battery's - A- will cause start/stop system to malfunction.

- Connect black terminal clamp (-) to negative terminal of battery - A- /negative connection point.

Battery charger - VAS 5903- detects voltage required for connected battery - A- (6 V/12 V/24 V) and initiates charging sequence automatically.

When the charge reaches about 80 - 85% the battery charger - VAS 5903- starts the "final charging". The fourth bar appears in display -1-. Battery - A- is now ready for operation.





At a charge condition of 100% all bars appear in display -1-.

During "standard charge" battery mode, the parallel operation of electrical consumers while charging is possible. The charging period will be longer.

Depending on battery type, battery charger - VAS 5903- switches over to maintenance mode after approx. 1 to 7 hours. For 100% charge of battery, battery - A- should be connected to battery charger - VAS 5903- for this length of time.

Possible faults and fault rectification

- 1 - Displayed battery voltage is not as per nominal voltage:
 - Press and hold down or button until charging process starts.
- 2 - Displayed battery voltage is not as per nominal voltage – charging process has already started:
 - Press **START STOP** button twice.
 - Press and hold down or button until charging process starts again.
- 3 - Battery charger does not detect a battery - A- if battery voltage is less than 2 V:

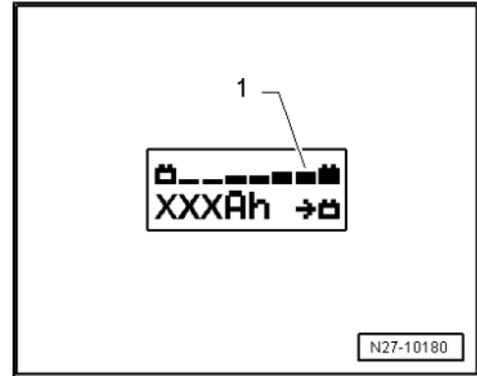
Display remains unchanged.

The battery type and ampere hours (Ah) as set is displayed.

Ending battery - A- charging process

- Press **START/STOP** button.
- Remove charger terminals from battery terminal clamps.
- Disconnect battery charger - VAS 5903- from mains supply.

3.3.3 Charging battery in refresh charge mode with battery charger - VAS 5903-



WARNING

Danger of injury! Comply with the warning notices and safety regulations = page 3!



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.



Caution

The Refresh Charge mode is not permitted on VW vehicles as the voltage peaks will damage the onboard electronics.

Always disconnect the battery - A- from the onboard supply when using the Refresh Charge mode.



Caution

When charging always set battery charger to the correct type of battery - A- ⇒ Operating instructions for battery charger - VAS 5903- .

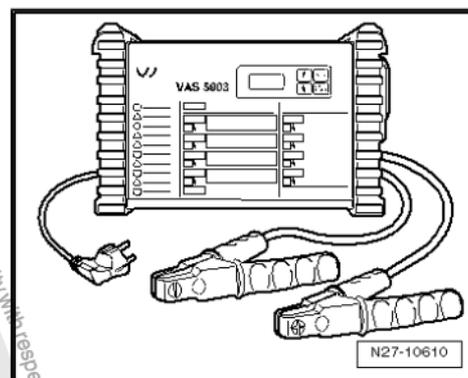
The Refresh Charge mode is suitable for wet batteries which can be topped up with distilled water.

Do not use Refresh Charge mode for maintenance-free wet batteries.

“Refresh Charge (Refr)” mode is only used on batteries - A- presumed to be defective (e.g. as a result of sulphation). Battery - A- is charged up to maximum electrolyte density and plates are reactivated (reduction of sulphate layer).

Special tools and workshop equipment required

- ◆ Battery charger - VAS 5900-



Note

The temperature of the battery - A- must be at least 10°C.

Procedure

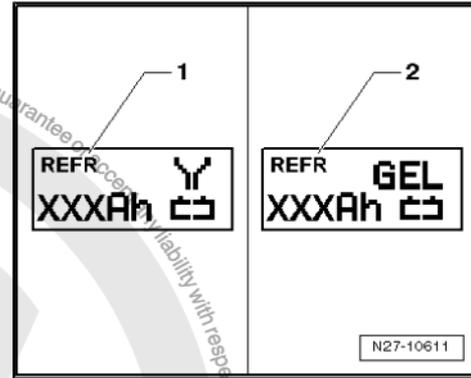
- Switch off ignition and all electrical consumers, and withdraw ignition key.
- Connect battery charger - VAS 5903- to mains supply. The last selected operating mode will appear on display ⇒ [page 47](#) .



- Set battery type with **INFO** button.

In the display, the symbol -1- for "Refresh Charge for wet batteries" or symbol -2- for "Refresh Charge for gel batteries" will appear.

- Set battery capacity (Ah) of battery - A- to be charged using **↑** button or **↓** button.
- Connect red terminal clamp (+) to positive terminal of battery - A- .



i Note

In vehicles with start/stop function and battery monitor control unit - J367- fitted, the black terminal clamp (-) must be connected to body earth. Connecting it to the negative terminal of the battery's - A- will cause start/stop system to malfunction.

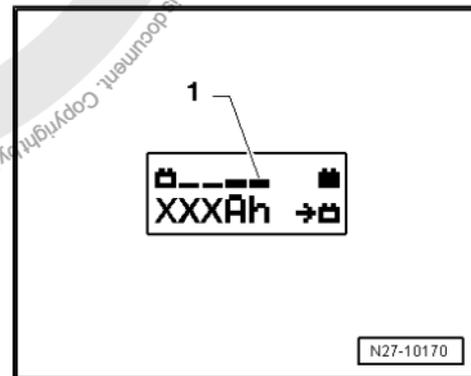
- Connect black terminal clamp (-) to negative terminal of battery - A- /negative connection point.

Battery charger - VAS 5900- detects voltage required for connected battery - A- (6 V/12 V/24 V) and initiates charging sequence automatically.

When the charge reaches about 80 to 85% of the battery voltage, the battery charger - VAS 5900- starts the "final charging". The fourth bar appears in display -1-. Battery - A- is now ready for operation.

i Note

The success of the Refresh Charge depends on the severity of sulphation in the battery - A- .



Possible faults and fault rectification

- 1 - Displayed battery voltage is not as per nominal voltage:
 - Press and hold down **↑** or **↓** button until charging process starts.
- 2 - Displayed battery voltage is not as per nominal voltage – charging process has already started:
 - Press **START / STOP** button twice.
 - Press and hold down **↑** or **↓** button until charging process starts.
- 3 - Battery charger does not detect a battery - A- if battery voltage is less than 2 V:

Display remains unchanged.

The operating mode and ampere hours (Ah) as set are displayed.

Ending battery - A- charging process

- Press **START/STOP** button.
- Remove charger terminals from battery terminal clamps.
- Disconnect battery charger - VAS 5903- from mains supply.



3.3.4 Charging totally discharged battery with battery charger - VAS 5903-



WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#)!



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle.

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.



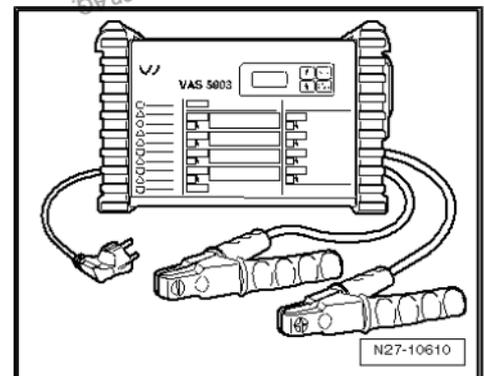
Caution

- ◆ *The terminal polarity protection in operating mode "charging totally discharged batteries/support mode" is not active. Connect battery charger terminal clamps correctly to battery terminals.*
- ◆ *When charging always set battery charger to the correct type of battery - A- ⇒ [Operating instructions for battery charger - VAS 5903-](#) .*
- ◆ *Totally discharged battery - A- is not recognised by battery charger - VAS 5903- ⇒ [page 67](#) .*
- ◆ *Do not press **START** / **STOP** button when charger unit cables are connected incorrectly. This may damage the battery charger - VAS 5903- .*

Regarding batteries - A- that have a voltage of less than 2 V, automatic recognition of battery - A- by battery charger - VAS 5903- is not possible.

Special tools and workshop equipment required

- ◆ Battery charger - VAS 5903-





Note

- ◆ Follow instructions in chapter ⇒ [page 67](#) .
- ◆ The temperature of the battery - A- must be at least 10°C.
- ◆ Totally discharged batteries in unregistered vehicles must be exchanged prior to delivery. Preliminary damage cannot be excluded.

Procedure

- Switch off ignition and all electrical consumers, and withdraw ignition key.
- Connect battery charger - VAS 5903- to mains supply. The last selected operating mode will appear on display ⇒ [page 47](#) .





- Set battery type with **INFO** button.

On the display, the symbol -1- for "Service charging of wet batteries" or symbol -2- for "Service charging of gel/absorbent glass mat batteries" will appear.

- Set battery capacity (Ah) of battery - A- to be charged using **1** button or **2** button.
- Connect red terminal clamp (+) to positive terminal of battery - A- .



Note

In vehicles with start/stop function and battery monitor control unit - J367- fitted, the black terminal clamp (-) must be connected to body earth. Connecting it to the negative terminal of the battery's - A- will cause start/stop system to malfunction.

- Connect black terminal clamp (-) to negative terminal of battery - A- /negative connection point.
- Press **START / STOP** button for approx. 5 seconds. The menu "charging totally discharged batteries/support mode" will be activated.
- Press appropriate **1** or **2** button to set the corresponding battery voltage (6 V/12 V/24 V).



Note

If a button is not pressed within 5 seconds, the battery charger - VAS 5903- will return to the main menu (select operating mode).

- Confirm selected battery voltage with **START / STOP** button.

Then follows the enquiry for "is charger cable terminal polarity correct".

- Check that connections of charger terminals have correct polarity.
- Confirm that connections of charger terminals have correct polarity with **START / STOP** button.

Battery charger - VAS 5903- will start charging sequence for totally discharged battery - A- .

Ending battery - A- charging process

- Press **START/STOP** button.
- Remove charger terminals from battery terminal clamps.
- Disconnect battery charger - VAS 5903- from mains supply.

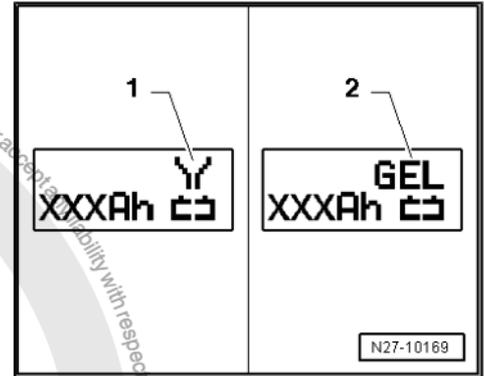
3.3.5 Charging battery in support mode with battery charger - VAS 5903-

General information

The support mode provides the onboard supply with power when the battery - A- is removed or disconnected.

For additional information, refer to ⇒ Operating instructions for battery charger - VAS 5903- .

The support mode is suitable in the following situations:





- ◆ Support mode of onboard supplies without installed battery - A-
- ◆ Power conservation when renewing the battery
- ◆ Ancillaries test without battery - A-



WARNING

Danger of injury! Comply with the warning notices and safety regulations => [page 3](#)!



WARNING

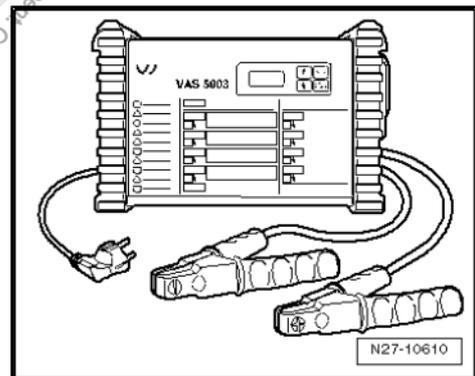
Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.

Special tools and workshop equipment required

- ◆ Battery charger - VAS 5903-



Procedure



Caution

- ◆ *The terminal polarity protection in operating mode "charging totally discharged batteries/support mode" is not active. Connect battery charger terminal clamps correctly to battery terminals.*
- ◆ *It can cause sparks through a short-circuit.*
- ◆ *Danger of explosion*
- ◆ *Ensure charger terminals are fitted securely.*
- ◆ *Do not press **START / STOP** button when charger unit cables are connected incorrectly. This may damage the battery charger - VAS 5903-.*

- Remove battery - A- => Electrical system; Rep. gr. 27 ; Battery; Removing and installing battery .
- Connect battery charger - VAS 5903- to mains supply. The last selected operating mode will appear on display => [page 47](#) .



Caution

When battery - A- has been removed, ensure there is no contact between terminal clamp connected to positive battery clamp and body earth. Also ensure there is no contact between battery clamps.

- Connect red terminal clamp (+) to positive terminal of battery - A- .



Note

In vehicles with start/stop function and battery monitor control unit - J367- fitted, the black terminal clamp (-) must be connected to body earth. Connecting it to the negative terminal of the battery's - A- will cause start/stop system to malfunction.

- Connect black terminal clamp (-) to negative terminal of battery - A- /negative connection point.
- Press **START / STOP** button for approx. 5 seconds. The menu "charging totally discharged batteries/support mode" will be activated.
- Press appropriate **1** or **2** button to set the corresponding battery voltage (6 V/12 V/24 V).



Note

If a button is not pressed within 5 seconds, the battery charger - VAS 5903- will return to the main menu (select operating mode).

- Confirm selected battery voltage with **START / STOP** button.

Then follows the enquiry for "is charger cable terminal polarity correct"

- Check that connections of charger terminals have correct polarity
- Confirm that connections of charger terminals have correct polarity with **START / STOP** button.

Battery charger - VAS 5903- starts with support mode of battery - A- .

End battery support mode

- Press **START/STOP** button.
- Remove charger terminals from battery terminal clamps.
- Disconnect battery charger - VAS 5903- from mains supply.

3.3.6 Maintenance mode with battery charger - VAS 5903-

When battery - A- is being charged in trickle charge mode and an electrical load draws current from battery, battery charger - VAS 5903- automatically compensates for charge.

The maintenance mode can be continued for an unlimited period. Battery - A- is always ready for use.



Note

Observe battery manufacturer's maintenance instructions.



WARNING

Danger of injury! Comply with the warning notices and safety regulations => [page 3](#)!



WARNING

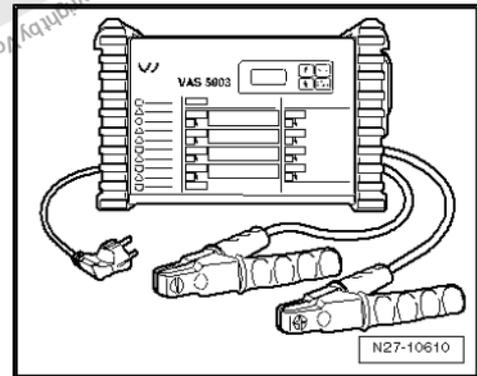
Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.

Special tools and workshop equipment required

- ◆ Battery charger - VAS 5903-

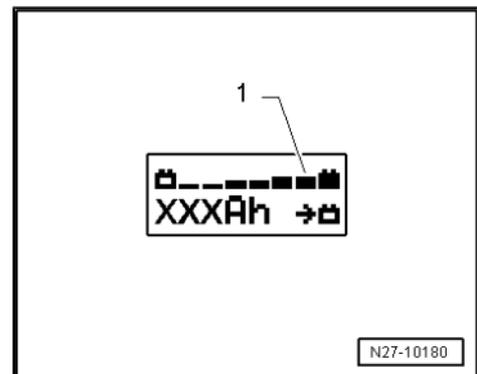


When battery - A- is fully charged, the battery charger - VAS 5903- switches to trickle charging mode.

Procedure

- Adopt same procedure as that for charging battery - A- => [page 48](#) .

At a charge condition of 100% all bars appear in display -1-.





3.4 Battery charger - VAS 5906-

WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#)!

WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.

Observe ⇒ operating instructions for battery charger - VAS 5906- .

- ◆ Description of battery charger - VAS 5906- ⇒ [page 59](#) .
- ◆ Charge battery - A- ⇒ [page 60](#) .

3.4.1 Description of battery charger - VAS 5906-

Battery charger - VAS 5906-

Battery charger - VAS 5906- has been specially developed for charging in vehicle on-board supply during vehicle presentation.

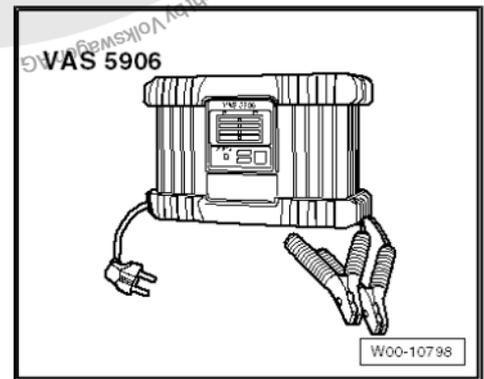
It has an automatic charging characteristic for starter batteries, 3 to 300 AH.

The maximum charging voltage 14.4 V is not exceeded. All electrical loads are supported by up to 30 A by the trickle charging.

For sustained operation, battery charger - VAS 5906- changes to trickle charging once battery - A- is fully charged.

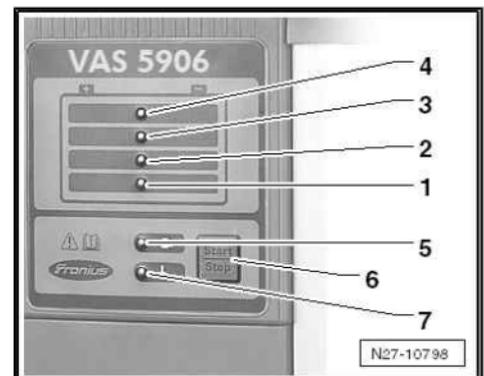
The battery charger - VAS 5906- starts fully automatically and does not require any settings. All that is required is to connect terminal clamps and mains cable.

For additional information, refer to ⇒ Operating instructions for battery charger - VAS 5906- .



Overview - controls

- 1 - Charge level display 25%
- 2 - Charge level display 50%
- 3 - Charge level display 75%
- 4 - Charge level display 100%
- 5 - Display ready
- 6 - **START/STOP** button and **Setup** button for interrupting and resuming charging process. Used to enter the Setup menu and select type of characteristic (press for 10 seconds)
- 7 - Malfunction display.





3.4.2 Charging battery with battery charger - VAS 5906-



WARNING

Danger of injury! Comply with the warning notices and safety regulations => [page 3](#)!



WARNING

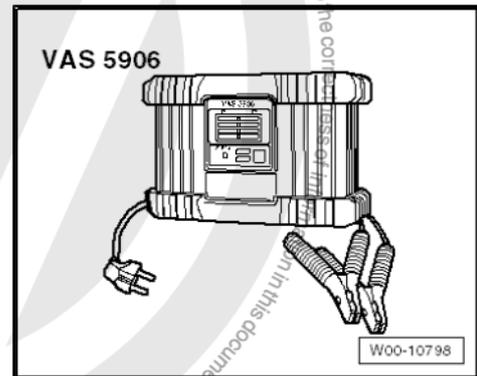
Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.

Special tools and workshop equipment required

- ◆ Battery charger - VAS 5906-



Procedure

- Switch off ignition and all electrical consumers, and withdraw ignition key.
- Place charger - VAS 5906- in engine compartment or under vehicle.
- Connect battery charger - VAS 5906- to mains supply.

Battery charger - VAS 5906- is in no-load operation - "ready" indicator is on.



WARNING

Danger of injury! Comply with the warning notices and safety regulations => [page 3](#)!

- Connect red terminal clamp (+) to positive terminal of battery - A- .



 Note

In vehicles with start/stop function and battery monitor control unit - J367- fitted, the black terminal clamp (-) must be connected to body earth. Connecting it to the negative terminal of the battery's - A- will cause start/stop system to malfunction.

- Connect black terminal clamp (-) to negative terminal of battery - A- /negative connection point.

Charging starts after approximately 2 seconds.

Number of LEDs lit indicates charge level of battery - A- . Battery - A- has been charged up once all lights are lit.

When battery - A- is fully charged, battery charger - VAS 5906- automatically switches over to trickle charging.



Caution

*Danger of sparking if charging terminals are removed too soon. Terminate charging by pressing **START/STOP** button.*

Ending battery - A- charging process

- Press **START/STOP** button.
- Remove charger terminals from battery terminal clamps.
- Disconnect battery charger - VAS 5906- from mains supply.

3.5 Midtronics battery charger - INC 940- , only for USA/Canada



WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#) !



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.

Refer to ⇒ operating instructions Midtronics - INC 940- .

- ◆ Description of Midtronics - INC 940- ⇒ [page 62](#) .
- ◆ Charge battery - A- ⇒ [page 63](#) .
- ◆ Dealing with Midtronics - INC 940- problems ⇒ [page 65](#) .



3.5.1 Description of Midtronics - INC 940- battery tester

Batteries - A- in VW vehicles are only allowed to be charged with battery chargers approved by VW. In the USA/Canada, it is permitted for the Midtronics - INC 940- battery charger to be used.

Midtronics - INC 940- battery charger combines battery charging with a charge condition checks and a battery test.

The following charging and analysis procedures apply to all batteries - A- , all battery installation locations (engine compartment or luggage compartment) and battery application purposes (starter battery or second/convenience battery).

Always comply with the following:

- ◆ Safety requirements
- ◆ Instructions for setting up the Midtronics - MCR340V- tester
- ◆ Display menu
- ◆ Display buttons and LEDs
- ◆ Operating procedures in ⇒ operating instructions Midtronics - MCR340V- .

Additional information: ⇒ Self-study programme No. 234 ; Vehicle batteries .



WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#) !



WARNING

Keep bare flames and sparks away from batteries - A- and do not smoke in their vicinity.

The Midtronics - INC 940- battery charger must be switched off before cables are connected or disconnected.

Do not remove cell plugs during charging.

Overcharging of sulphated batteries - A- can lead to explosion.

Do not store precision tools in rooms where batteries are charged, because corrosion can ensue due to chemical reactions.



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.



3.5.2 Charging battery using Midtronics - INC 940- battery charger

Conditions



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.

- ◆ Perform initial setup (dealership number/date/time) ⇒ Operating instructions for Midtronics - INC 940- .
- ◆ Check general information ⇒ [page 62](#) .
- ◆ Perform visual check of battery - A- ⇒ [page 8](#) .
- ◆ Specify battery type (standard or AGM).
- ◆ Close all vehicle doors.



Note

- ◆ *The temperature of the battery - A- must be at least 10°C.*
- ◆ *Additional information:* ⇒ *Operating instructions Midtronics - INC 940-*

Procedure

- Switch off ignition and all electrical consumers, and withdraw ignition key.
- Connect red terminal clamp (+) to positive terminal of battery - A- .



Note

In vehicles with start/stop function and battery monitor control unit - J367- fitted, the black terminal clamp (-) must be connected to body earth. Connecting it to the negative terminal of the battery's - A- will cause start/stop system to malfunction.

- Connect black terminal clamp (-) to negative terminal of battery - A- /negative connection point.
- Connect Midtronics - INC 940- to mains supply.
- Set **ON/OFF** switch of Midtronics - INC 940- battery charger to "ON".
- Select charging mode (Automatic or Manual).
- Select test (In vehicle or Outside vehicle).
- Select battery type (Standard or AGM).
- Select test type (Guarantee or Other). *Note additional details (depending on type of test).*



Note

- ◆ *Additional information:* ⇒ *Operating instructions Midtronics - INC 940-* .
- ◆ *Note the menu items necessary for the "Warranty" type of test* ⇒ *Warranty and service circular* .

Midtronics - INC 940- battery charger checks battery - A- and starts charging process. Display then shows one of 3 results, as well as approximate charging time.

Result	Measure
Battery - A- OK	Battery - A- can be used again.
Charging required	<ul style="list-style-type: none"> ◆ Test found low charge level. ◆ Charging starts and approximate charging duration is displayed. ◆ Achieved cold-start performance and remaining charging time are displayed, and are updated regularly.
Renew battery - A-	Battery - A- defective. Charging procedure is interrupted. <ul style="list-style-type: none"> - Renew battery - A- ⇒ Electrical system; Rep. gr. 27 ; Battery; Removing and installing battery .



Note

If Midtronics - INC 940- displays fault messages or texts other than those listed above, refer to ⇒ [page 65](#) .



WARNING

*Stop charging if battery - A- is generating a lot of gas. Press **[stop]** button on the front.*

When charging and testing procedure has finished, Midtronics - INC 940- battery charger displays "Battery good" or "Replace battery" and total charging time.

There are 3 possible messages depending on individual circumstance (printout for warranty, repair job, evaluation and filing):

- ◆ Generate test code (only possible after automatic charging and test)
- ◆ Print last test result (for warranty)
- ◆ Display last test results



Note

See additional information in ⇒ *Operating instructions Midtronics - INC 940-* .



Ending battery - A- charging process

- Remove charger terminals from battery terminal clamps.
- Disconnect Midtronics - INC 940- from mains supply.

3.5.3 Handling problems with Midtronics - INC 940-

Under certain circumstances, the display may show errors or messages according to status.

The most frequent display messages are listed below, together with suggested solutions.



Note

For messages not listed here, refer to ⇒ *Operating instructions Midtronics - INC 940- .*

Display message	Measure
Check connection.	<ul style="list-style-type: none"> - Check that the charging terminal clamps of the Midtronics - INC 940- are firmly connected to battery terminals. - Check that battery terminal bolts are tightened according to regulations and are free of corrosion.
Terminals connected?	<p>Safety function of Midtronics - INC 940- charger.</p> <ul style="list-style-type: none"> - Connect terminal clamps to battery - A- before starting charging process.
System noise	<ul style="list-style-type: none"> - Switch off all electrical consumers. - Wait until all electrical loads monitored by the onboard supply control unit - J519- have been switched off. - Withdraw ignition key. - Disconnect any suspect electrical equipment not connected to onboard supply as standard equipment.

- Wait a few minutes and repeat charging procedure ⇒ [page 63](#)



3.6 Solar charger module - VAS 6102 A-

⇒ "3.6.1 Description of solar panel VAS 6102 A", page 66

⇒ "3.6.2 Solar panel VAS 6102 A trickle charging", page 66

3.6.1 Description of solar panel - VAS 6102 A-

Solar charger module - VAS 6102 A-

Solar panel - VAS 6102 A- supports onboard supply and prevents spontaneous discharging of battery - A- .

Solar panel - VAS 6102 A- achieves max. voltage of 14.3 V and a maximum charging current of 255 mA.

Use of the solar panel - VAS 6102 A- is permissible for charging all rechargeable lead or lead-gel batteries.

Solar charger module - VAS 6102 A- is connected to diagnostic connection in vehicle.

A green LED is integrated in the frame of the solar panel - VAS 6102 A- to indicate that the panel is functioning. The brighter the LED, the higher the charging current.

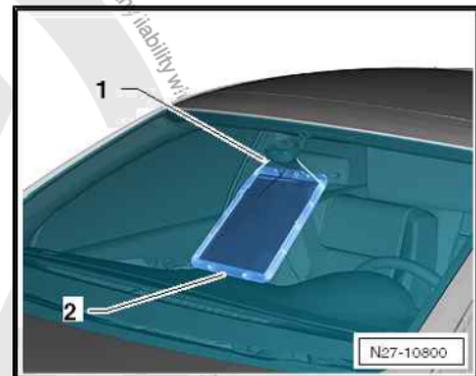
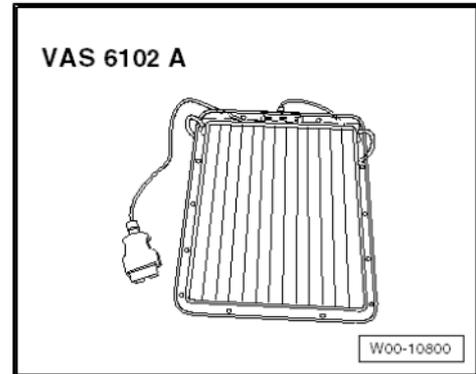
The integrated electronics prevent battery - A- overcharging.

The solar panel - VAS 6102 A- is attached to the interior mirror -1-. The underside rests on the dash panel -2-.



Note

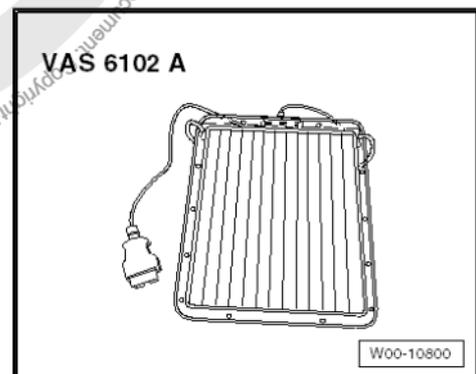
Solar charger module - VAS 6102 A- is not allowed to lie fully on dash panel. It is only allowed to be positioned with the bottom edge for support. Placing it fully on the surface can result in discolouration of the dash panel.



3.6.2 Solar panel - VAS 6102 A- trickle charging

Special tools and workshop equipment required

- ◆ Solar panel - VAS 6102 A-





Procedure

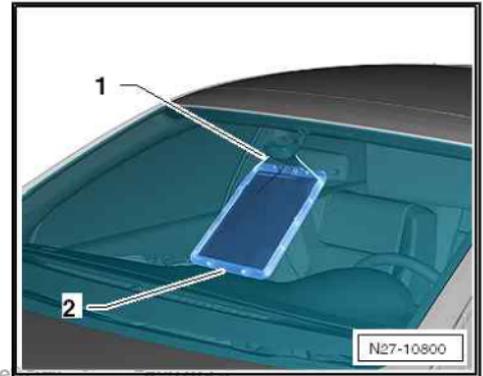
- Secure solar panel - VAS 6102 A- on interior mirror -1-.
- Place underside on dash panel -2-.



Note

Solar charger module - VAS 6102 A- is not allowed to lie fully on dash panel. It is only allowed to be positioned with the bottom edge for support. Placing it fully on the surface can result in discolouration of the dash panel.

- Pull attachment string tight so that solar charger module - VAS 6102 A- is positioned close to windscreen.
- Connect solar panel - VAS 6102 A- plug to diagnostic connection of vehicle. Connect in same way as ⇒ Vehicle diagnostic tester ⇒ [page 85](#) .
- Check function of solar panel - VAS 6102 A- The green LED must light up.



3.7 Totally discharged batteries



WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#) !

A battery - A- is designated "totally discharged" if the no-load voltage is less than 11.6 V.



WARNING

Do not test or charge batteries - A- whose magic eye is »colourless/light yellow«. Do not slave/jump start the vehicle!

Danger of explosion when checking and charging or slave/jump starting.

These batteries - A- must be replaced.



Caution

- ◆ *Totally discharged batteries - A- freeze prematurely.*
- ◆ *Frozen batteries - A- must no longer be used.*

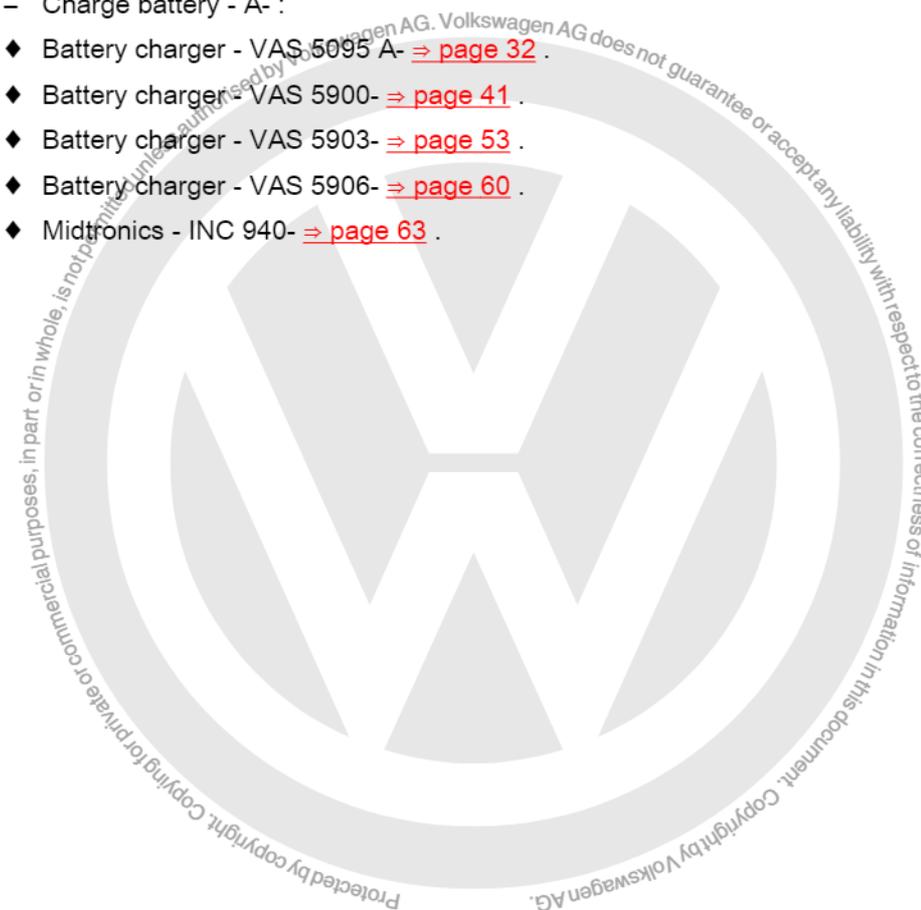


Note

- ◆ *Batteries - A- that have not been used for a long time (vehicles that have been stored) self-discharge.*
- ◆ *In totally discharged batteries - A- , the electrolyte is comprised almost entirely of water because the acid content is so low.*
- ◆ *Totally discharged batteries - A- sulphate, that is, the entire plate surfaces of the batteries - A- harden.*
- ◆ *If a battery - A- is recharged shortly after it has totally lost its charge, the sulphation will dissipate.*
- ◆ *If these batteries - A- are not recharged, the plates continue to harden and the ability to recharge is reduced. The result of which is a reduction in the battery output.*
- ◆ *Totally discharged batteries - A- in vehicles before registration must be exchanged prior to delivery. Preliminary damage cannot be excluded.*

Procedure

- Checking no-load voltage of battery - A- [⇒ page 30](#) .
- Charge battery - A- :
- ◆ Battery charger - VAS 5095 A- [⇒ page 32](#) .
- ◆ Battery charger - VAS 5900- [⇒ page 41](#) .
- ◆ Battery charger - VAS 5903- [⇒ page 53](#) .
- ◆ Battery charger - VAS 5906- [⇒ page 60](#) .
- ◆ Midtronics - INC 940- [⇒ page 63](#) .





4 Cruise control system (CCS)

⇒ ["4.1 Function of cruise control system", page 69](#)

⇒ ["4.2 Activating and deactivating cruise control system \(CCS\)", page 69](#)

4.1 Function of cruise control system

General description

The functions of the cruise control system are controlled by engine control unit - J623- .

Activating and deactivating cruise control system (CCS)
⇒ [page 69](#) .

Fault detection and fault display

Faults relating to the cruise control system are indicated by way of the engine control unit - J623- .

For fault finding ⇒ Vehicle diagnostic tester, use the "Guided fault finding" mode.

4.2 Activating and deactivating cruise control system (CCS)

Procedure

- Connect ⇒ Vehicle diagnostic tester ⇒ [page 85](#)
- Select `guided fault finding` mode.
- Using `GoTo` button, select "Functions/component" and then the following menu options in succession:
 - ◆ Drive
 - ◆ Engine code
 - ◆ 01 - Self-diagnosis compatible systems
 - ◆ Engine control or direct diesel injection and pre-glow system
 - ◆ Functions
 - ◆ Activating and deactivating cruise control system (CCS)



90 – Gauges, instruments





92 – Windscreen wash/wipe system

1 Washer fluid lines

⇒ [“1.1 Windscreen and rear window washer system”, page 71](#)

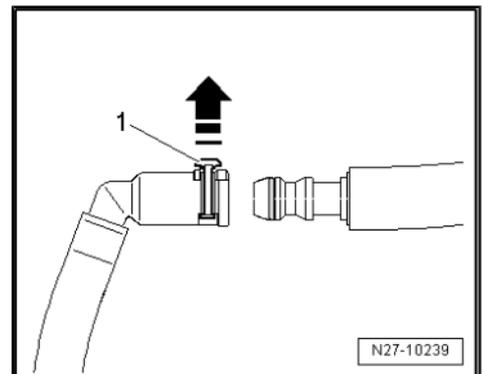
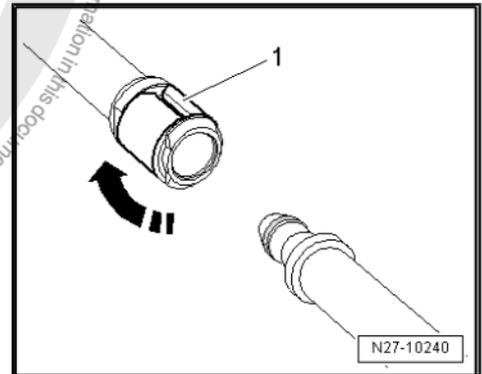
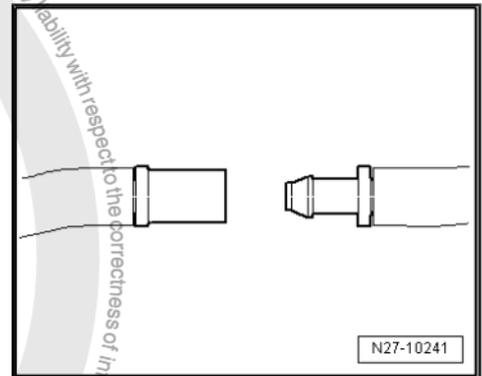
⇒ [“1.2 Headlight washer system”, page 72](#)

⇒ [“1.3 Repairing washer fluid lines”, page 72](#)

1.1 Windscreen and rear window washer system

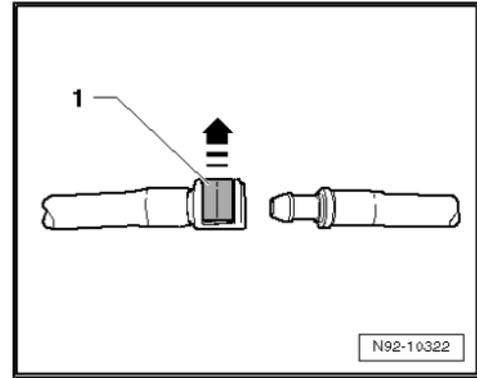
Procedure

- Pull the two coupling sections apart (no securing device) to loosen the connection.
- To secure the connection, push the two coupling sections together, until you hear and feel them engage.
- To loosen the connection, rotate the lock ring -1- through 90° -arrow- and pull off the hose connection.
- To secure the connection, push on the hose connection and rotate the lock ring -1- in -direction of arrow- until it engages.
- To loosen the connection, pull up the lock ring -1- by approximately 1 mm -arrow- and pull off the hose connection.
- To secure connection, attach hose connection and press in clip -1- until it engages.





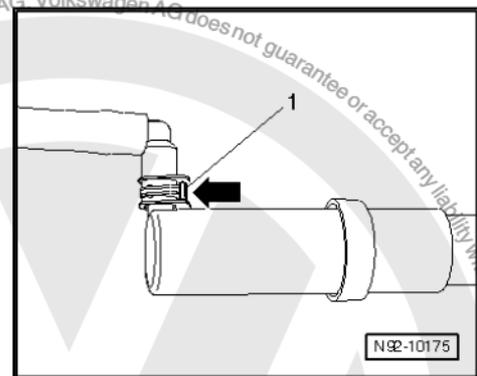
- To loosen the connection, pull the lock ring -1-
-direction of arrow- and pull off the hose connection.
- To secure connection, attach hose connection and press in
clip -1- until it engages.



1.2 Headlight washer system

Procedure

- To loosen the connection, press the lock ring -1-
-direction of arrow- and pull off the hose connection.
- To secure the connection, press and hold the lock ring -1-
-direction of arrow- and then pull off the hose connection.
Check proper engagement of clip by attempting to pull off
without pressing clip.



1.3 Repairing washer fluid lines

⇒ ["1.3.1 General description", page 72](#)

⇒ ["1.3.2 Repairing smooth pipe", page 72](#)

⇒ ["1.3.3 Repairing corrugated pipe", page 73](#)

1.3.1 General description

A new repair concept has been developed for repair work on wash system hoses. Various connectors, special EPDM hoses (ethylene-propylene-diene monomer) and heat-shrink hose are available as spare parts.

- ◆ The replacement parts can be found in the ⇒ [electronic parts catalogue "\(ETKA\)"](#) .
- ◆ Replacement parts are available for repair of both smooth and corrugated pipes.

1.3.2 Repairing smooth pipe

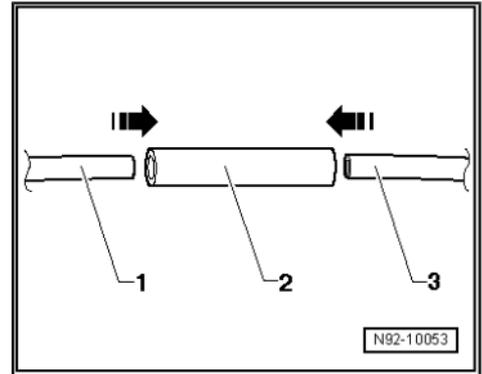
Smooth pipe with a diameter of 5x1 mm or 6x1 mm can be repaired with EPDM hose.

Procedure

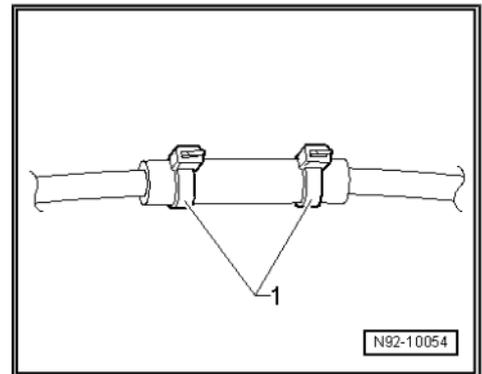
- Cut damaged piece (cuts straight through pipe) out of the smooth pipe to be repaired.



- Select the appropriate EPDM hose -2- and cable ties according to the ⇒ electronic parts catalogue "(ETKA)".
- Cut EPDM hose -2- to size so that smooth-type pipe ends -1- and -3- can be inserted approx. 10 mm in EPDM hose -2-.



- Secure repair point with cable ties -1-.



1.3.3 Repairing corrugated pipe

Special tools and workshop equipment required

- ◆ Hot air blower - VAS 5179- or



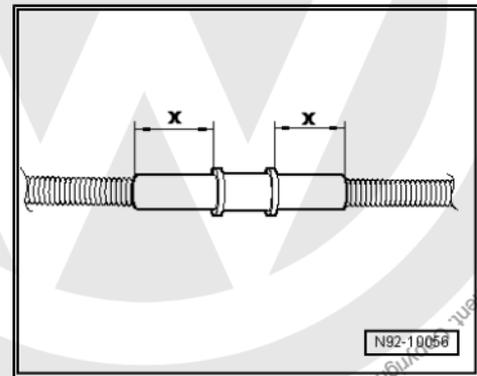
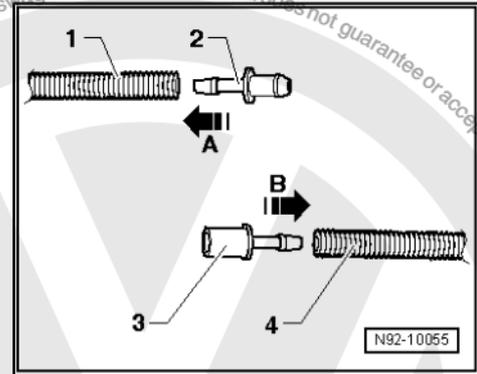
Note

- ◆ *Repair points must not be subjected to pulling or bending forces.*
- ◆ *If the damaged section is longer than 20 mm, a new piece of corrugated pipe must be used and the procedure described below must be performed twice.*



Procedure

- Cut damaged piece (cut through pipe in a straight line) out of the corrugated pipe to be repaired.
- Select the appropriate connecting pieces -2- and -3- as well as the appropriate heat-shrink hose according to the ⇒ Electronic Parts Catalogue "(ETKA)".
- Heat end of corrugated pipe -1- with hot air blower - VAS 5179- .
- Push connecting piece -2- into corrugated pipe -2- -arrow A-.
- Heat end of corrugated pipe -4- with hot air blower - VAS 5179- .
- Push connecting piece -3- into corrugated pipe -4- -arrow B-.
- Cut heat-shrink hose so that ends of corrugated pipe are each covered by about 20 mm -dimension x- of heat-shrink hose.
- Push heat-shrink hose over the corrugated pipe, couple the connecting pieces and secure the repaired piece with the heat-shrink hose.





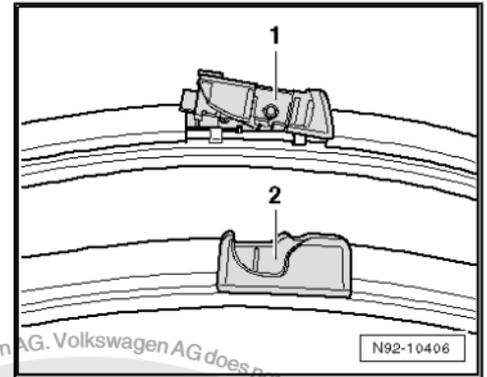
2 Distinguishing features of jointless wiper blades

Distinguishing features of Bosch and Federal Mogul products.

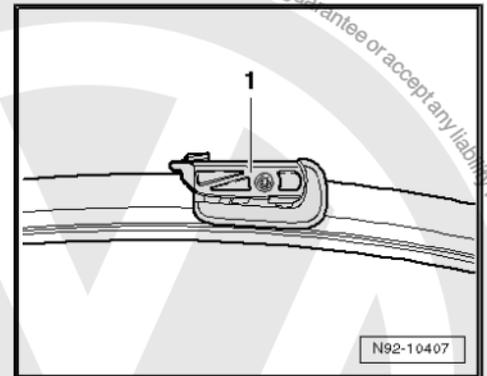
When renewing wiper rubbers, note the make. When renewing wiper blades, the same make must be used.

Wiper blades can be identified according to wiper arm fastening.

Bosch wiper blades -1 and 2-:



Federal Mogul wiper blades -1-:



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94 – Lights, bulbs, switches - exterior

1 Operation and safety notes for gas discharge lamps

Observe the following instructions when performing installation work on a headlight with gas discharge light:

- ◆ Signs of dangerous high voltage/currents ⇒ [page 76](#)
- ◆ Notes on pressure, temperature and radiation/arcs ⇒ [page 77](#)
- ◆ Assembly notes for gas discharge bulbs ⇒ [page 78](#)
- ◆ Disposal regulations for gas discharge bulbs ⇒ [page 78](#)

Special tools and workshop equipment required

- ◆ Safety glasses
- ◆ Gloves



WARNING

Make absolutely sure that the battery - A- is disconnected before starting any work on parts of the headlight with gas discharge light marked with yellow high voltage symbols ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .

Then switch dipped beam on and off again. This will eliminate any possible residual voltage.

The gas discharge lamp control unit must never be operated without a gas discharge lamp.

Due to the high voltages (above 28,000 V when igniting) and temperatures, the gas discharge bulb must only be operated in the headlight housing.



WARNING

- ◆ *Never change gas discharge bulbs if you are not familiar with the appropriate procedures, safety precautions and tools.*

Notes on dangerous high voltage and currents



WARNING

Control units of light systems, connectors and components pertaining to bulb holders conduct lethally high voltage.

Operating the control unit and the starter unit is permitted only with the gas discharge bulb fitted.



WARNING

- *Switch off ignition and all electrical consumers, and withdraw ignition key.*
- *Before working on headlight system, make sure that no components are live and that the residual voltage after the headlights are switched off has dissipated.*
- *Residual voltage can be dissipated by turning the dipped beams on and then off again after withdrawing the ignition key.*
- *When working on the headlight system, ensure that the lights cannot be switched on.*

Notes on pressure temperature and radiation/arcs



WARNING

- *The gas discharge bulb may be operated in the headlight housing only (touch protection due to very hot bulbs, absorption of UV radiation, avoidance of dazzling light, protection against explosion).*
- *The glass bulb of the gas discharge bulbs can be very hot - danger of burns!*
- *Avoid looking directly into the beam, as the UV rays from the gas discharge bulb are about 2.5 times greater than normal halogen bulbs.*
- *Avoid looking into the light beam (danger of glare); vision may be impaired for a substantial time.*



WARNING

- *Avoid contact with burst glass bulbs.*
- *H7 bulbs and gas discharge bulbs are under pressure and can explode while being changed - danger of injury.*
- *Always wear eye protection and gloves when removing and installing gas discharge lamps!*



Assembly notes for gas discharge bulbs



Caution

- ◆ *Before renewing a gas discharge bulb, always switch off the affected electrical load.*
- ◆ *Switch off ignition and all electrical consumers, and withdraw ignition key.*
- ◆ *Do not touch glass of gas discharge bulb with bare fingers, use clean fabric gloves. When the gas discharge bulb is switched on, the heat would vaporise the oil of the finger prints which would then settle on the reflector, impairing the brightness of the headlight.*
- ◆ *A gas discharge bulb must always be replaced with a gas discharge bulb of the same kind. The designation appears on the base of the bulb or on the bulb glass.*
- ◆ *Properly engage connectors during installation and the connection is seated tightly.*

Disposal regulations for gas discharge bulbs



WARNING

- *Gas discharge bulbs must be disposed of as hazardous waste; never dispose of gas discharge bulbs as consumer waste.*
- *Gas discharge bulbs contain metallic mercury (Hg) and traces of thallium; never destroy these bulbs.*
- *These components must be recycled in the correct manner according to national law.*
- *Only dispose of in containers intended for this purpose at an authorised collection point.*





96 – Lights, bulbs, switches - interior

1 Cigarette lighter socket

⇒ ["1.1 Assembly overview - cigarette lighter, 12 V socket", page 79](#)

⇒ ["1.2 Removing and installing cigarette lighter U1", page 80](#)

⇒ ["1.3 Removing and installing socket illumination bulb L42", page 83](#)

⇒ ["1.4 Removing and installing cigarette lighter illumination bulb L28", page 83](#)

1.1 Assembly overview - cigarette lighter, 12 V socket



Caution

If excessive force is exerted on sockets - U- without bulb for socket illumination - L42- , the retaining sleeve may be damaged.

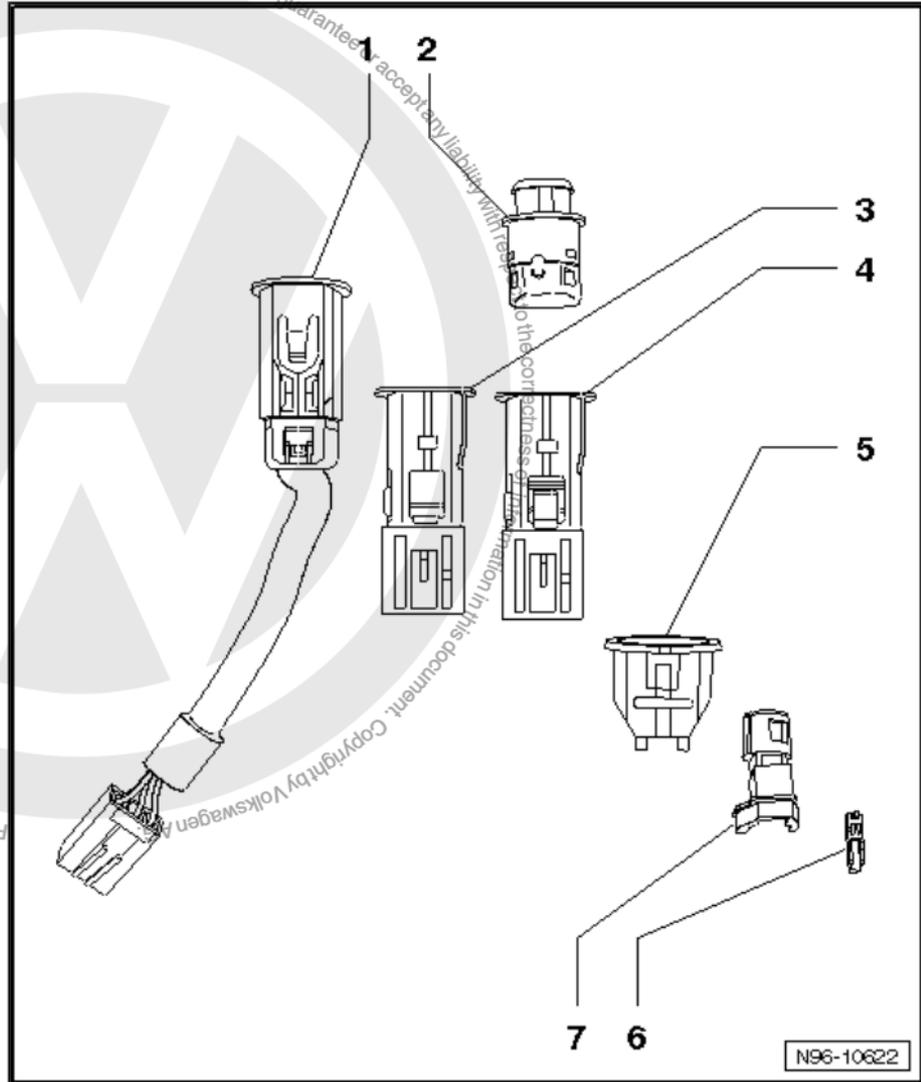
Puller - T40148- can only be used to remove sockets - U- (cigarette lighter - U1-) with socket illumination bulb - L42- .

The puller - T40148- cannot be used for releasing the locking lugs of the sockets - U- without illuminated retaining sleeve.

Usually, sockets - U- without bulb for socket illumination - L42- cannot be removed without damaging them.



- 1 - Cigarette lighter socket with trailing wire
- 2 - Cigarette lighter - U1-
 - ❑ Removing and installing
⇒ [page 80](#)
- 3 - Electric socket - U-
 - ❑ Removing and installing
⇒ [page 80](#)
- 4 - Cigarette lighter socket
- 5 - Clamping sleeve
- 6 - Bulb for socket illumination L42-
 - ❑ Bulb 12 V/1.2 W
 - ❑ Removing and installing
⇒ [page 83](#)
- 7 - Bulb carrier



1.2 Removing and installing cigarette lighter - U1-



Caution

If excessive force is exerted on sockets - - without bulb for socket illumination - L42- , the retaining sleeve may be damaged.

Puller - T40148- can only be used to remove sockets - U- (cigarette lighter - U1-) with socket illumination bulb - L42- .

The puller - T40148- cannot be used for releasing the locking lugs of the sockets - U- without illuminated retaining sleeve.

Usually, sockets - U- without bulb for socket illumination - L42- cannot be removed without damaging them.

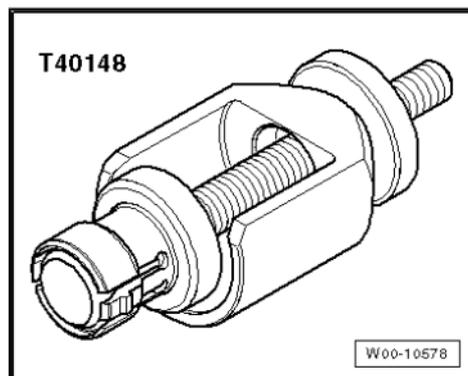


i Note

The removal and installation procedure is the same for all sockets - U- and is therefore described here only for the cigarette lighter socket.

Special tools and workshop equipment required

- ◆ Puller - T40148-



- ◆ Thrust piece - 40148/1-

Removing

- Disconnect battery - A- ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .
- Remove cigarette lighter - U1- from socket - U- .

i Note

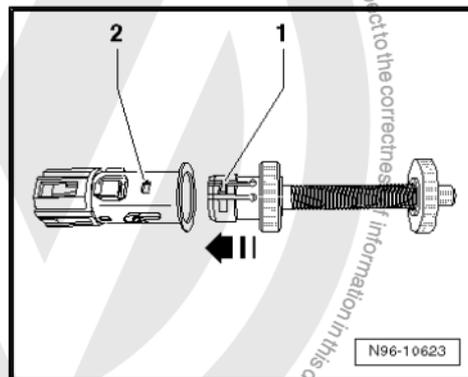
For reasons of clarity, socket - U- is removed in illustration.

⚠ Caution

Socket - U- or retaining sleeve can be damaged.

Ensure that the puller - T40148- is seated correctly, otherwise the retaining lugs of the retaining sleeve will not be released.

- Push puller - T40148-  into socket - U- so that locking lugs -1- engage in recesses -2-.





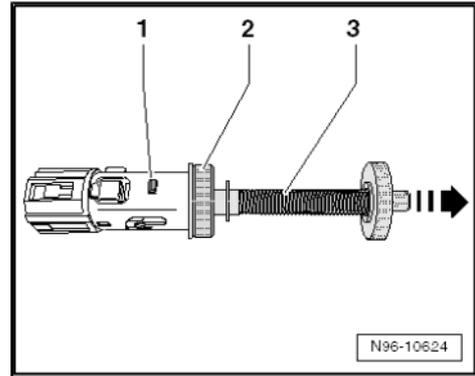
- Pull grip -3- in direction of -arrow- to release locking lugs of retaining sleeve.
- Remove socket - U- from retaining sleeve using puller - T40148- .



Caution

The wiring for socket - U- can be damaged.

When pulling socket - U- out, take the wiring lengths into consideration.

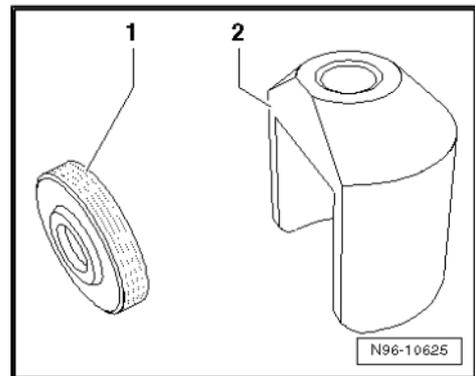


Depending on the mounting location, the thrust piece - 40148/1- -2- with the knurled nut -1- can be used.



Caution

When using the thrust piece - 40148/1- , ensure that no surrounding components are damaged.



- Release and detach connector of socket - U- .



Note

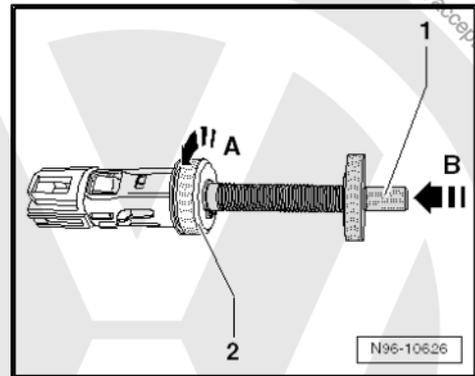
Depending on the space requirement, the vehicles are equipped with various electric sockets - U- and cigarette lighter sockets. They differ in length and have different electrical connections. In the case of electric sockets - U- and cigarette lighter sockets with trailing wires, it may be necessary to perform additional work in order to gain access to the connector.

- Release puller - T40148- locking lugs by pressing spindle -1- in -direction of arrow B-. Then, release puller - T40148- -2- by turning it briefly to left in -direction of arrow A-. Remove puller - T40148- from socket - U- .



Note

Ensure that the puller - T40148- locking lugs are not spread.



Caution

Cigarette lighter - U1- might be ejected out of the socket - U- after the heating phase.

When puller - T40148- is inserted, retaining springs of socket - U- are pressed apart and retaining force is reduced.

After removing socket - U- , carefully press retaining springs together and check if cigarette lighter - U1- remains in removal position after heating phase.

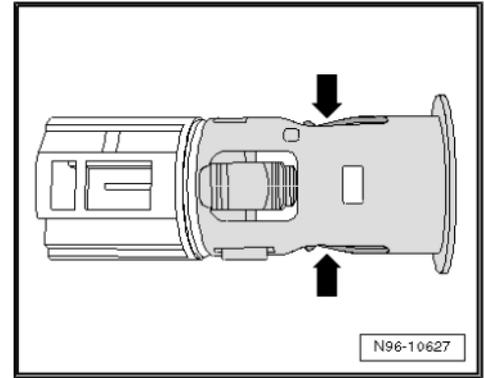


- Carefully press retaining springs of socket - U- together -arrows-.
- Check whether cigarette lighter - U1- remains in removal position after heating phase and ensure it is not ejected in vehicle interior.

Installing

Installation is carried out in the reverse sequence of removal.

- Connect battery - A- => Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .



1.3 Removing and installing socket illumination bulb - L42-

The removal of the socket illumination bulb - L42- is performed in the same way as the removal of the cigarette lighter illumination bulb - L28- => [page 83](#) .

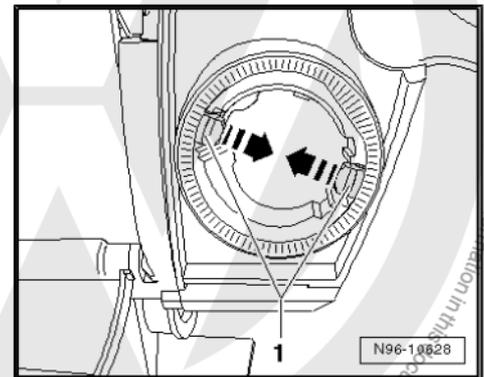
1.4 Removing and installing cigarette lighter illumination bulb - L28-

With some vehicle equipment, bulb for cigarette lighter illumination - L28- is not an incandescent bulb, but an LED. This LED is permanently attached to the retaining sleeve and cannot be renewed separately.

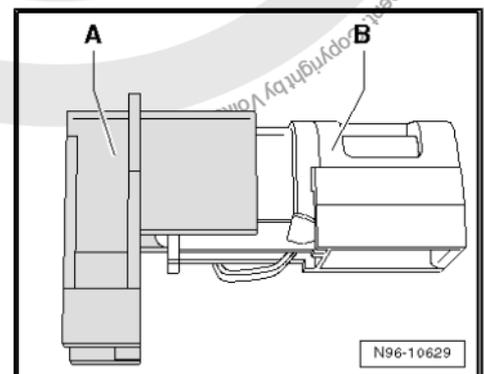
There are several versions of retaining sleeves with a bulb: one version which allows for renewing the bulb and one which does not. In this case, the bulb carrier has to be replaced together with the light bulb.

Removing

- Remove cigarette lighter - U1- => [page 80](#) .
- Push retaining lugs -1- in -direction of arrow- and remove retaining sleeve together with bulb carrier.
- Unclip bulb carrier from retaining sleeve.



- Detach bulb carrier in area -A- and -B-.
- Open part -B- of bulb carrier.

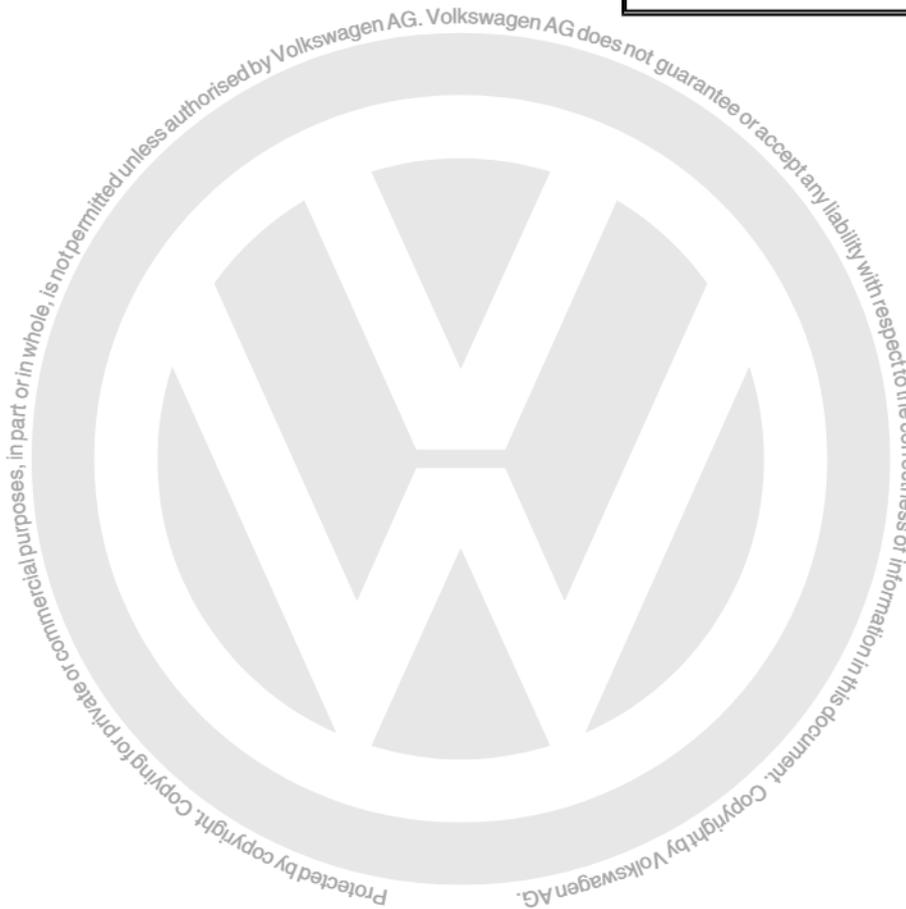
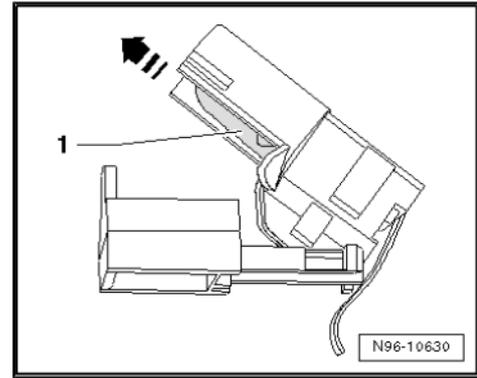




– Remove bulb in -direction of arrow-

Installing

Installation is carried out in the reverse sequence of removal.





97 – Wiring

1 Vehicle diagnosis, testing and information systems

⇒ [“1.1 General description - vehicle diagnosis, testing and information system”, page 85](#)

⇒ [“1.2 Connecting vehicle diagnostic tester”, page 85](#)

⇒ [“1.3 Connecting vehicle diagnostic tester, Bora/Golf, model years 1998 to 2003”, page 86](#)

1.1 General description - vehicle diagnosis, testing and information system



WARNING

- ◆ *During testing or measuring trips in the vehicle with a ⇒ Vehicle diagnostic tester, there is a risk of serious or even fatal injury!*
- ◆ *If the ⇒ Vehicle diagnostic tester is lodged in the activity area of an airbag during a testing or measuring operation, a triggered airbag can result in serious or even fatal injury!*
- ◆ *During testing and measuring trips, work with a second person who can operate the ⇒ Vehicle diagnostic tester from one of the back seats.*



Note

All work procedures can be found in “guided fault finding” and “guided functions” modes.

Additional information:

- ◆ ⇒ Self-study programme No. 202 ; Vehicle diagnostic, testing and information system VAS 5051
- ◆ ⇒ Self-study programme No. 256 ; VAS 5052
- ◆ ⇒ Self-study programme No. 294 ; Online connection of VAS 5051
- ◆ Comply with the current operating instructions for the ⇒ Vehicle diagnostic tester. To display these instructions, select the buttons “Administration” and “Operating Manual”.

Connect ⇒ Vehicle diagnostic tester ⇒ [page 85](#) .

1.2 Connecting vehicle diagnostic tester



Note

Comply with the current operating instructions for the ⇒ Vehicle diagnostic tester. To display these instructions, select the buttons “Administration” and “Operating Manual”.

Special tools and workshop equipment required

- ◆ ⇒ Vehicle diagnostic tester

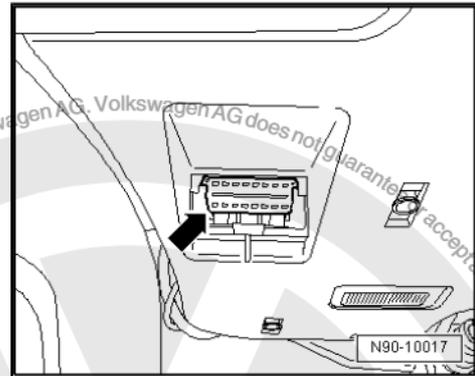


Procedure

- Switch off ignition and all electrical consumers, and withdraw ignition key.
- In vehicles with automatic gearbox, move selector lever to position "P" or "N".
- In vehicles with a manual gearbox, move gear lever to neutral position.
- Connect ⇒ Vehicle diagnostic tester to diagnostic connection -arrow- of vehicle after making sure ignition has been switched off.
- Switch on ignition.

All ⇒ Vehicle diagnostic testers are connected analogously to the procedure described above.

Fitting location and pin assignment of diagnostic connection ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.



1.3 Connecting vehicle diagnostic tester, Bora/Golf, model years 1998 to 2003

Special tools and workshop equipment required

- ◆ ⇒ Vehicle diagnostic tester

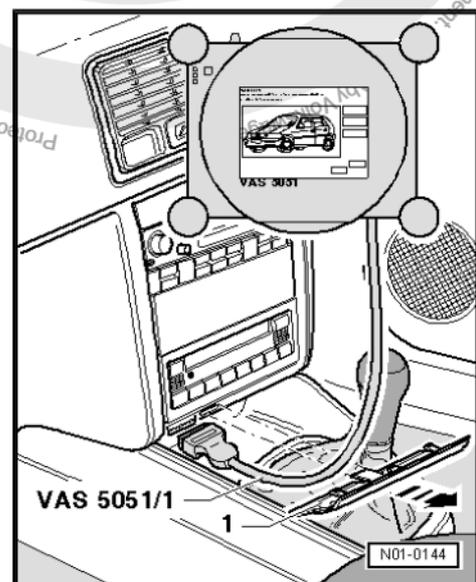
Procedure

- Switch off ignition and all electrical consumers, and withdraw ignition key.
- In vehicles with automatic gearbox, move selector lever to position "P" or "N".
- In vehicles with a manual gearbox, move gear lever to neutral position.
- Pull trim -1- out in -direction of arrow-.
- Connect ⇒ Vehicle diagnostic tester to diagnostic connection of vehicle after making sure ignition has been switched off.
- Switch on ignition.



Note

Connect all other and following ⇒ Vehicle diagnostic tester in the same way in sequence described above.





2 Wiring harness and connector repairs

⇒ [“2.1 General notes concerning repairs to vehicle electrical system”, page 87](#)

⇒ [“2.2 Wiring harness repair set”, page 88](#)

⇒ [“2.3 Tool descriptions”, page 90](#)

⇒ [“2.4 Repairs to wiring harnesses”, page 93](#)

⇒ [“2.5 Repairs to fibre optic cables”, page 109](#)

⇒ [“2.6 Repair of aerial wires”, page 115](#)

⇒ [“2.7 Repairs to contact housings and connectors”, page 126](#)

⇒ [“2.8 Releasing and dismantling contact housings”, page 130](#)

2.1 General notes concerning repairs to vehicle electrical system



Caution

When battery - A- is disconnected and reconnected, the procedure described in the workshop manual must be strictly adhered to ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and reconnecting battery .



WARNING

Some tools are equipped with a tool safety device. This must be pushed over the tip of the tool after use in order to protect the tip and prevent personal injury.

- ◆ Observe the latest notes in the respective workshop manual when carrying out repairs.
- ◆ Observe country-specific regulations.
- ◆ Always disconnect battery - A- before working on electrical system ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and reconnecting battery . Disconnecting the battery - A- (open circuit) ensures a safe working environment for repairs to the electrical system. The battery positive wire need only be disconnected for removal of the battery - A- .
- ◆ Before starting a repair, it is important to identify the cause of damage (e.g. sharp edges on body panels, defective electrical components, corrosion, etc.).
- ◆ For further information on procedures such as the removal and installation of individual components, please refer to the relevant workshop manual.
- ◆ Soldering is not permitted for repairs to vehicle wiring.
- ◆ Wiring harness and connector repairs to the vehicle electrical system may only be carried out using wiring harness repair set - VAS 1978- / wiring harness repair set - VAS 1978 A- / wiring harness repair set - VAS 1978 B- .
- ◆ Only use yellow wires for repairs to wiring harnesses.



- ◆ Wiring harness repairs may not be integrated in the vehicle's own wiring harness and must be marked with the use of yellow adhesive tape.
- ◆ These yellow wires and any part of the wiring harness marked with yellow insulating tape indicate a previous repair.
- ◆ It is not permissible to repair crimp connectors. Run a cable parallel to the defective one.
- ◆ After crimping, crimp connectors must be shrink fitted using the hot air blower, 220 V/50 Hz - VAS 1978/14- , in order to prevent any ingress of moisture.
- ◆ It is essential that the supplementary information is observed regarding repairs to wiring harnesses in airbag system and belt tensioners, fibre optic cables, CAN bus lines, aerial cables and wiring with cross sections up to 0.35 mm² ⇒ [page 98](#) .
- ◆ Carry out a function test after every repair. It may be necessary to read and delete the event memory and/or to reset the systems.
- ◆ Do not loosen any earth wires from the body (danger of corrosion).
- ◆ Wiring harness repair set - VAS 1978 B- and previous versions do not cover all wiring cross sections that occur in the vehicle. If the required wiring cross section is not available, the next largest one should be used.
- ◆ Screened wires must not be repaired. If damaged they must be replaced complete.
- ◆ Heat resistant wiring can be found in various places in the vehicle, mainly in the engine compartment. Heat resistant wiring can be identified by its slightly matt and softer insulation. To repair these wires, only heat resistant wiring may be used.

2.2 Wiring harness repair set

⇒ ["2.2.1 Wiring harness repair set VAS 1978 "](#) , page 88

⇒ ["2.2.2 Upgrade kit VAS 1978/50 "](#) , page 89

⇒ ["2.2.3 Wiring harness repair set VAS 1978 A "](#) , page 89

⇒ ["2.2.4 Release tool set VAS 1978/35 "](#) , page 89

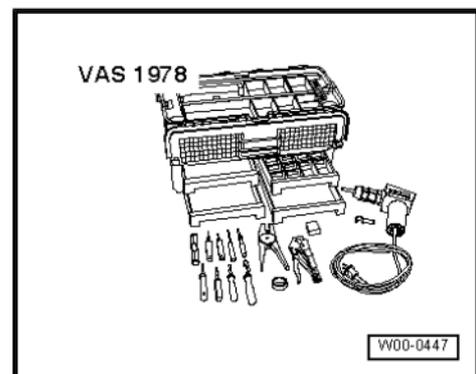
2.2.1 Wiring harness repair set - VAS 1978-

Wiring harness repair set - VAS 1978- allows optimal repair quality to be achieved in the area of vehicle electrics. Using the tools, repairs to connectors and wiring open circuits can be carried out. To do this, complete repair wire sections with contacts already crimped on are used and joined to the vehicle's own wiring harness with the aid of crimp connectors. A perfect electrical connection can be achieved using crimping pliers - VAS 1978/1- with head adapter - VAS 1978/2- and three different crimp recesses as well as a hot air blower, 220 V/50 Hz - VAS 1978/14- for shrink-fitting crimp connectors.

Wiring harness repair set - VAS 1978-

Additional information:

- ◆ ⇒ Operating instructions Wiring harness repair set - VAS 1978-

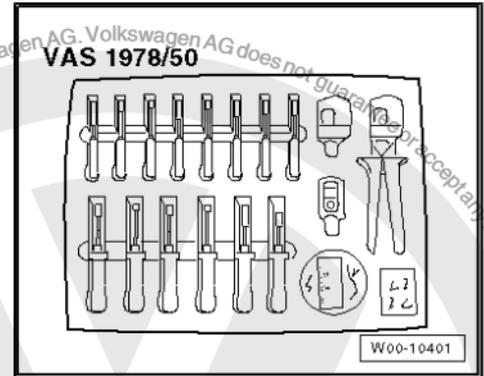




2.2.2 Upgrade kit - VAS 1978/50-

The upgrade kit - VAS 1978/50- is required to bring the "old" wiring harness repair set - VAS 1978- up to the latest standard of wiring harness repair set - VAS 1978 A- . The upgrade kit - VAS 1978/50- consists of 4 assembly tools and 10 release tools, new crimping pliers (base tool) - VAS 1978/1-2- for crimp connector with head adapter 0.35-2.5 mm/2 - VAS 1978/1-1- , head adapter 4.0-6.0 mm/2 - VAS 1978/2 A- and head adapter for JPT contact - VAS 1978/9-1- . Also included are new stickers, a new set of operating instructions, crimp connectors for 0.35 mm² cable cross-sections and a roll of black felt adhesive tape.

Upgrade kit - VAS 1978/50-



2.2.3 Wiring harness repair set - VAS 1978 A-

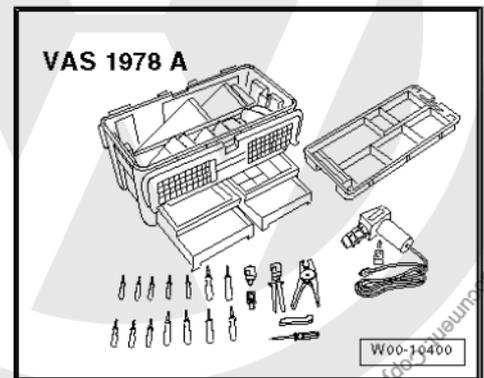
The new wiring harness repair set - VAS 1978 A- allows optimal repair quality to be achieved in the area of vehicle electrics. Using the new pliers, repairs to connectors and wiring open circuits can be carried out. To do this, complete repair wire sections with contacts already crimped on are used and joined to the vehicle's own wiring harness with the aid of four different types of crimp connectors. A perfect electrical connection can be achieved using new crimping pliers (base tool) - VAS 1978/1-2- with interchangeable head adapter 0.35-2.5 mm/2 - VAS 1978/1-1- or head adapter 4.0-6.0 mm/2 - VAS 1978/2 A- and a hot air blower, 220 V/ 50 Hz - VAS 1978/14- for shrink-fitting crimp connectors.

Wiring harness repair set - VAS 1978 A-

Additional information:

- ◆ ⇒ Operating instructions Wiring harness repair set - VAS 1978 A-

The wiring harness repair set - VAS 1978 A- has been supplemented with the wiring harness repair set - VAS 1978 B- .

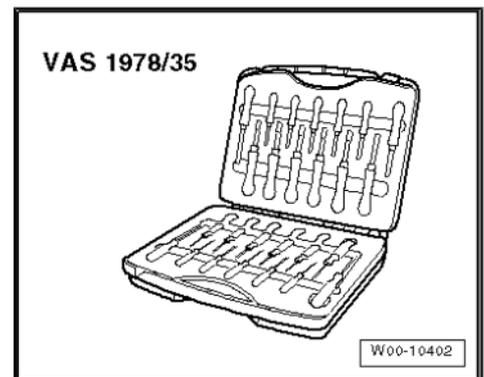


2.2.4 Release tool set - VAS 1978/35-

Release tool set - VAS 1978/35- serves as a means of releasing various primary and secondary locking devices in Group vehicles. The set comprises 26 different tools with which, for example, round connector systems, flat contacts with one or two locking devices and also single wire seals can be released and fitted.

Release tool set - VAS 1978/35-

Which release tool belongs to which locking device is indicated in the table in the ⇒ operating instructions of the set of release tools - VAS 1978/35- .





2.3 Tool descriptions

⇒ ["2.3.1 Special pliers with insert", page 90](#)

⇒ ["2.3.2 Release tools for contacts", page 90](#)

⇒ ["2.3.3 Assembly tools for single wire seals", page 91](#)

⇒ ["2.3.4 Wire stripper VAS 1978/3 ", page 91](#)

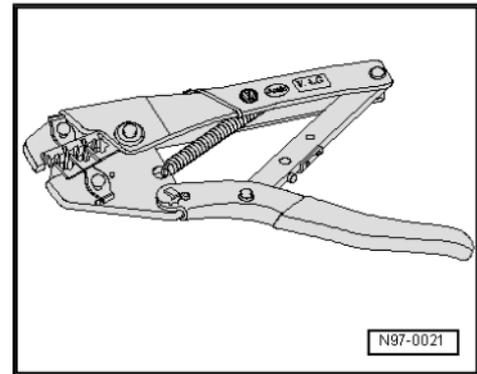
⇒ ["2.3.5 Hot air blower 220 V/50 Hz VAS 1978/14 ", page 92](#)

⇒ ["2.3.6 Crimping pliers VAS 1978/1 A ", page 92](#)

2.3.1 Special pliers with insert

Crimping pliers - VAS 1978/1- with head adapter - VAS 1978/2- are part of wiring harness repair set - VAS 1978- / wiring harness repair set - VAS 1978 A- / wiring harness repair set - VAS 1978 B- and are used to crimp connectors during wiring harness repairs.

Colour of crimp connector	Colour of crimp recess	Wiring cross section
yellow	yellow	0.35 mm ²
red	red	0.5 mm ² to 1.0 mm ²
blue	blue	1.5 mm ² to 2.5 mm ²
yellow	yellow	4.0 mm ² to 6.0 mm ²



Note

- ◆ *As an alternative, the connectors can also be crimped using crimping pliers (base tool) - VAS 1978/1-2- in conjunction with head adapters 0.35 - 2.5 mm² - VAS 1978/1-1- or 4.0 - 6.0 mm² - VAS 1978/2 A- .*
- ◆ *Make absolutely sure that the correct crimp recess is chosen for the crimp connectors being used .*
- ◆ *The insulation on the wires must not be crimped.*

2.3.2 Release tools for contacts

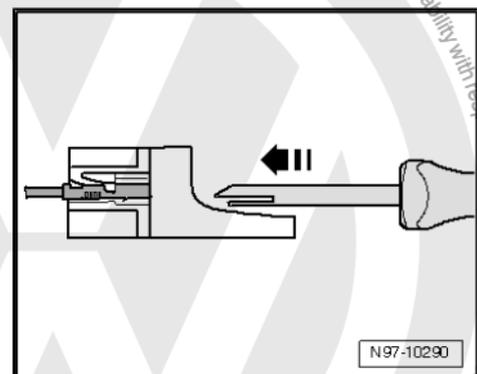
The various release tools serve as a means of detaching the different contacts from the connector housing without damage.

A selection of release tools is included in the wiring harness repair set - VAS 1978- / wiring harness repair set - VAS 1978 A- / wiring harness repair set - VAS 1978 B- . The complete set of release tools is included in release tool set - VAS 1978/35- .



WARNING

Some tools are equipped with a tool safety device. This must be pushed over the tip of the tool after use in order to protect the tip and prevent personal injury.

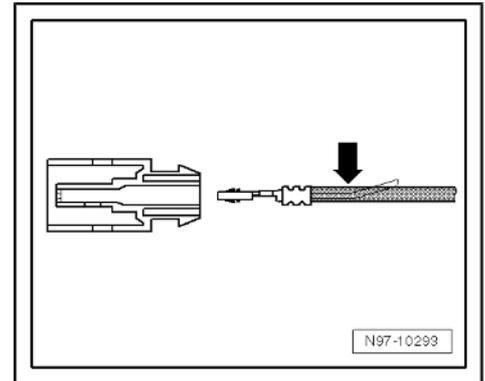




2.3.3 Assembly tools for single wire seals

The assembly tools serve as a means of sliding the single wire seals fully into the connector housing without damage and thereby assure complete sealing between single wire and connector housing.

Four assembly tools for single wire seals are included in wiring harness repair set - VAS 1978- / wiring harness repair set - VAS 1978 A- / wiring harness repair set - VAS 1978 B- .



2.3.4 Wire stripper - VAS 1978/3-

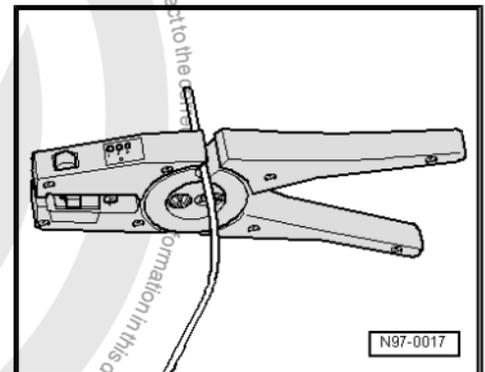
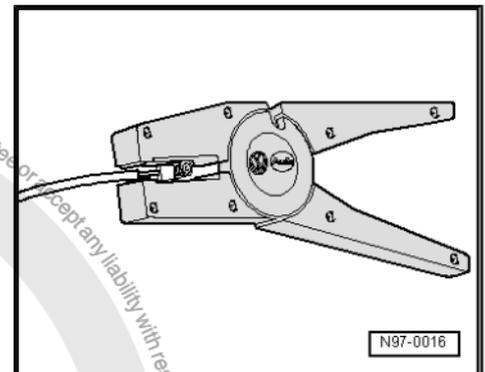
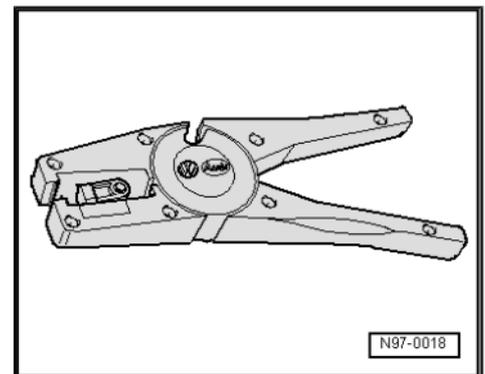
Wire strippers - VAS 1978/3- serve as a means of stripping insulation off wires and cutting wires in the correct manner.

The wire stripper - VAS 1978/3- is included in wiring harness repair set - VAS 1978- / wiring harness repair set - VAS 1978 A- / wiring harness repair set - VAS 1978 B- .

Wire stripper - VAS 1978/3- has an adjustable limit stop within the pliers jaws, with which the desired length of insulation to be removed can be adjusted.

Stripping off insulation

- Set sliding stop in jaws of pliers to desired insulation stripping length.
- Insert end of wire as far as it will go into jaws of pliers and fully close wire stripping pliers - VAS 1978/3- , applying sufficient force.
- Open wire stripper - VAS 1978/3- again, and remove stripped insulation from end of wire.
- Cut the wires with the cutting part on the upper side of the wire stripping pliers - VAS 1978/3- .





2.3.5 Hot air blower 220 V/50 Hz - VAS 1978/14-

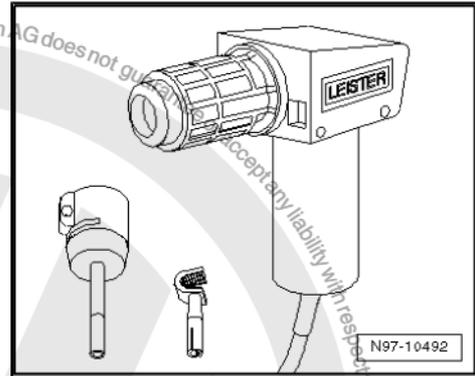
Hot air blower 220 V/50 Hz - VAS 1978/14-



Caution

When shrink-fitting, take care not to damage any other wiring, plastic parts or insulating material with the hot air blower, 220 V/50 Hz - VAS 1978/14-.

Observe ⇒ Operating instructions for hot air blower, 220 V/50 Hz - VAS 1978/14-!



The hot air blower, 220 V / 50 Hz - VAS 1978/14- is used in conjunction with shrink element for hot air blower - VAS 1978/15- to shrink fit the crimp connectors. After crimping, the crimp connector has to be shrink fitted using the hot air blower, 220 V/50 Hz - VAS 1978/14- in order to prevent any ingress of moisture.

The hot air blower, 220 V/50 Hz - VAS 1978/14- is included in wiring harness repair set - VAS 1978- / wiring harness repair set - VAS 1978A- / wiring harness repair set - VAS 1978 B- .

2.3.6 Crimping pliers - VAS 1978/1 A-

The crimping pliers - VAS 1978/1 A- or crimping pliers (base tool) - VAS 1978/1-2- together with head adapter 0.35-2.5 mm/2 - VAS 1978/1-1- and head adapter 4.0-6.0 mm/2 - VAS 1978/2 A- are used to crimp connectors from wiring harness repair sets.

Crimping connectors using crimping pliers - VAS 1978/1 A- .

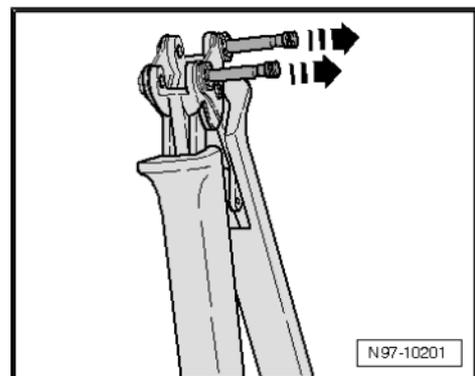
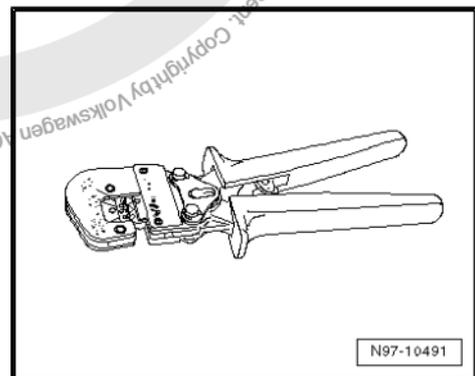
The following heads adapters are available for crimping pliers (base tool) - VAS 1978/1-2- :

- ◆ Adapter 0.35 mm² - 2.5 mm² - VAS 1978/1-1-
- ◆ Adapter 4.0 - 6.0 mm² - VAS 1978/2 A-
- ◆ Head adapter for JPT contacts - VAS 1978/9-1-

The crimping pliers are used in conjunction with adapter for JPT contacts - VAS 1978/9-1- to crimp contacts to single wires during repairs to wiring with cross sections up to 0.35 mm².

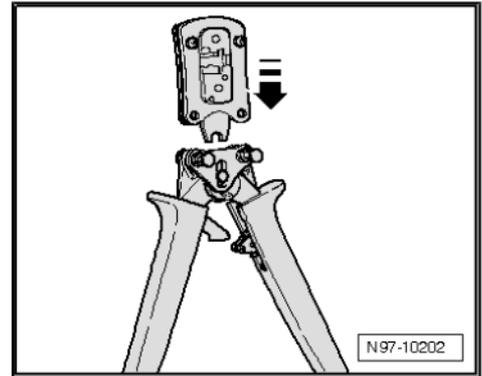
Replacing head adapter

- Open crimping pliers (base body) - VAS 1978/1-2- fully.
- Disengage both locking pins -arrows- from base body of crimping pliers - VAS 1978/1-2- .

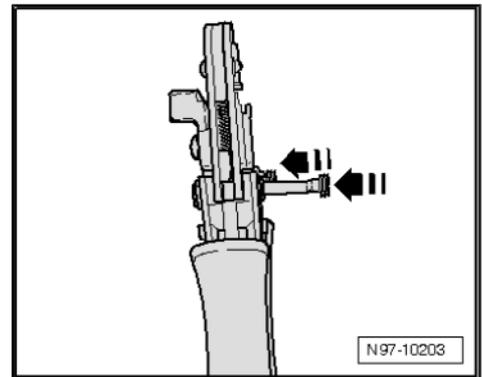




- Insert required head adapter in base body of crimping pliers - VAS 1978/1-2- from above -arrow-.



- Lock head adapter by engaging pins -arrows- in base body of crimping pliers (base body) - VAS 1978/1-2- .



2.4 Repairs to wiring harnesses

⇒ [“2.4.1 Notes on repairs to wiring harnesses”, page 93](#)

⇒ [“2.4.2 Notes on repairs to airbag and belt tensioner wiring”, page 94](#)

⇒ [“2.4.3 Notes on repairs to CAN bus wiring”, page 96](#)

⇒ [“2.4.4 Renewal of aerial wiring”, page 96](#)

⇒ [“2.4.5 Repairing 0.13 mm²/0.35 mm²/0.5 mm² wire”, page 98](#)

⇒ [“2.4.6 Repair of 10 mm² or 16 mm² wire with single butt connector”, page 101](#)

⇒ [“2.4.7 Wiring open circuit with one repair position”, page 106](#)

⇒ [“2.4.8 Wiring open circuit with two repair positions”, page 107](#)

2.4.1 Notes on repairs to wiring harnesses

- ◆ Adhere to general instructions concerning repairs to vehicle electrical system ⇒ [page 87](#).
- ◆ The wiring harness repair set - VAS 1978- / wiring harness repair set - VAS 1978 A- does not cover all wiring cross sections that occur in the vehicle. If the required wiring cross section is not available, the next largest one should be used.
- ◆ Wiring harness and connector repairs to the vehicle electrical system must be carried out using wiring harness repair set - VAS 1978- / wiring harness repair set - VAS 1978 A- only.
- ◆ Soldering is not permitted for repairs to vehicle wiring.
- ◆ Only use yellow wires for repairs to wiring harnesses.
- ◆ Wiring harness repairs may not be integrated in the vehicle's own wiring harness and must be marked with the use of yellow adhesive tape.



- ◆ A yellow wire or a section of wiring wrapped with yellow insulating tape always indicates a previous repair.
- ◆ It is not permissible to repair crimp connectors. Run a cable parallel to the defective one.
- ◆ After crimping, crimp connectors must be shrink fitted using the hot air blower, 220 V/50 Hz - VAS 1978/14- , in order to prevent any ingress of moisture.
- ◆ Screened wires must not be repaired. If damaged they must be replaced complete.
- ◆ Heat resistant wiring can be found in various places in the vehicle, mainly in the engine compartment. Heat resistant wiring can be identified by its slightly matt and softer insulation. To repair these wires, only heat resistant wiring may be used.
- ◆ It is essential that the supplementary information is observed regarding repairs to wiring harnesses in airbag system and belt tensioners, fibre optic cables, CAN bus lines, aerial cables and wiring with cross sections up to 0.35 mm².

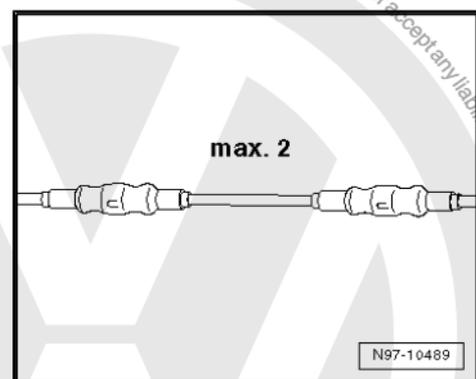
2.4.2 Notes on repairs to airbag and belt tensioner wiring

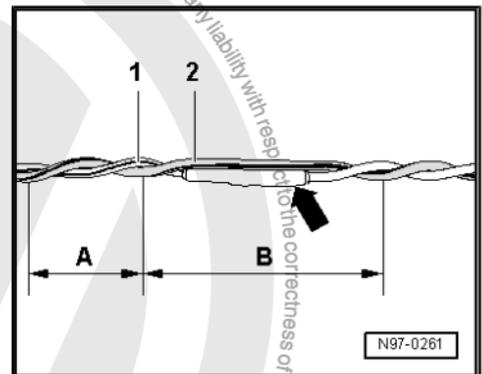
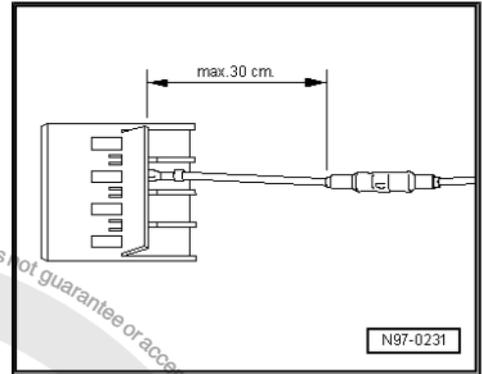
In addition to the general notes on repairs to wiring harnesses, the following instructions must be observed on how to repair wiring in airbag system and belt tensioners:



WARNING

- ◆ *The airbag system and belt tensioner may fail.*
- ◆ *Faulty repairs to the airbag and seat belt tensioning system can cause malfunctions in the passenger protection system.*
- ◆ *For repair work on airbag and seat belt tensioner wiring harnesses, only contacts, connectors and wiring designed specifically for this purpose may be used ⇒ Electronic parts catalogue“(ETKA)”.*





- ◆ Repairs to the airbag system and belt tensioner wiring must only be carried out using wiring harness repair set - VAS 1978- / wiring harness repair set - VAS 1978A- / wiring harness repair set - VAS 1978 B- .
- ◆ Observe vehicle stickers indicating high voltage components. Discharge residual voltage before performing any repairs ⇒ Rep. gr. 00 ; Safety instructions; Safety precautions when working on pyrotechnic components .
- ◆ For repairs to wiring in the airbag system and belt tensioner, a maximum of 2 repairs may be performed. The more the repairs there are in the wiring, the greater the resistance and this can trigger faults in the self-diagnosis of the system.
- ◆ To avoid corrosion, the crimp connectors must always be shrink-fitted when performing airbag or belt tensioner wiring harness repairs.
- ◆ Only use yellow wires for repairs to wiring harnesses.
- ◆ Do not wrap the repair position in vehicle's own wiring harness and mark the repair position with yellow insulating tape to make it clearly visible.
- ◆ Repairs in the airbag or belt tensioner area should not be more than 30 cm from the next connector housing. Together with the yellow insulating tape, this gives a clear indication of repairs that have already been carried out.
- ◆ In series production, the wires leading to the trip units (airbags) are twisted with a length of lay of $20\text{ mm} \pm 5\text{ mm}$. This length of lay is ensured in series production by means of standard-part numbers for pairs of wires and must be adhered to under all circumstances when sections of twisted wires are repaired.
- ◆ During repairs, the wiring to the triggering units (airbags) must have the same length. When wires -1- and -2- are entwined, the twine spacing of $A = 20\text{ mm} \pm 5\text{ mm}$ must be adhered to without fail.
- ◆ It must be ensured that no part of the wiring, including wiring in the vicinity of crimp connectors -arrow-, is longer than $B = 100\text{ mm}$ without the wires being twisted.

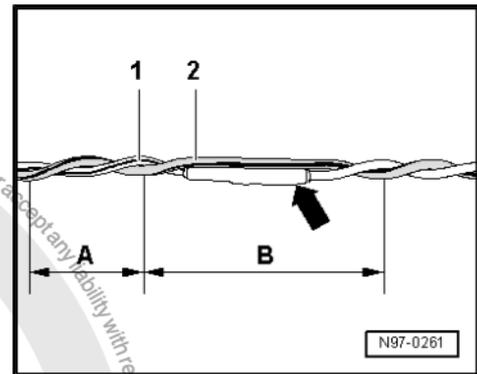
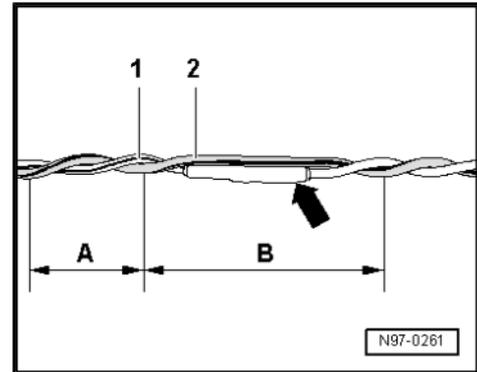


2.4.3 Notes on repairs to CAN bus wiring

- ◆ An unshielded two-wire line -1- and -2- with a cross section of 0.35 mm^2 or 0.5 mm^2 is used for CAN bus wiring.
- ◆ The colour codes of the CAN bus wiring are indicated in the following table:

Powertrain CAN, high	Orange/black
Convenience CAN, high	Orange/green
Infotainment CAN, high	Orange/violet
CAN low wire, all	orange/brown

- ◆ Repairs to CAN bus wiring can be carried out either with sections of repair wiring with the correct cross section or with twisted pair wires "green/yellow" or "white/yellow" as per → Electronic Parts Catalogue "ETKA".
- ◆ When repairs are performed, both CAN bus wires must have the same length. When twisting the wires -1- and -2- together, the length of each complete twist must be $A = 20 \text{ mm}$.
- ◆ It must be ensured that no part of the wiring, including wiring in the vicinity of crimp connectors -arrow-, is longer than $B = 50 \text{ mm}$ without the wires being twisted.
- ◆ Mark the area of repair with yellow insulation tape to make it easy to identify.



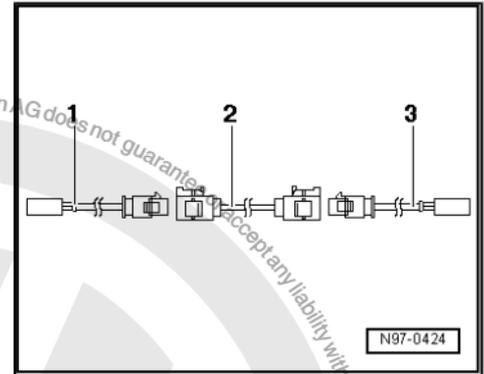
2.4.4 Renewal of aerial wiring

A new concept for repair work on aerial wires has been developed. Now connecting wires in different lengths and various adapter cables are available as replacement parts instead of a complete aerial wire.



General description

- ◆ Aerial wires cannot be repaired. If repair is required, they must be replaced only by connecting wires and adapter cables offered as genuine parts.
- ◆ The replacement parts can be found in the ⇒ electronic parts catalogue “(ETKA)” .
- ◆ These genuine parts are suitable for all aerial wires and wire diameters which may need to be replaced.
- ◆ The connector housings for aerial cables are only available as replacement parts in one colour. However, they can be used for all colours of aerial connector.
- ◆ No provision has been made for replacement of individual aerial connectors in the event of repair.
- ◆ The wires can be used retroactively for all VW vehicles, with all installed aerial wire diameters.
- ◆ All adapter and connection wires are suitable for all transmitter and receiver signals.
- ◆ This repair method can also be used for testing or retrofitting.



Assembly overview - aerial wire

Example: aerial wire between radio - R- and aerial - R11- is defective. The following wires are required for the repair:

- 1 - Adapter cable for connection to radio - R- , length: approx. 30 cm
- 2 - Connecting wire available in different lengths.
- 3 - Adapter cable for connection to aerial - R11- , length: approx. 30 cm

Installing a new aerial cable:

Note that the total length of an aerial wire, depending on vehicle equipment level, can be divided into sections by aerial selection control unit - J515- , control unit for traffic information - J559- or aerial amplifier - R24- . Only the defective section of aerial wire must be replaced.

Procedure

- Disconnect connectors of defective aerial cable from devices.
- Ascertain routing of defective aerial lead in vehicle and measure total length of aerial connection to be renewed in vehicle.

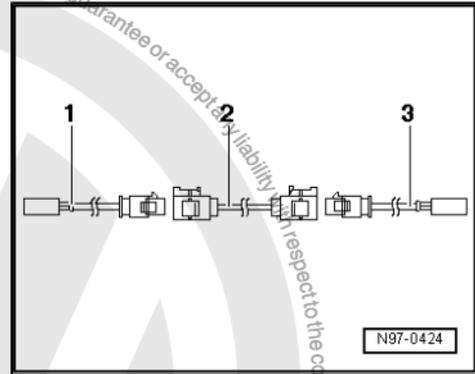


The total length of aerial connecting wire is the sum of the length of adapter cables required -1- and -3- and the connecting wire -2-.

- To determine the length of connecting wire required, subtract 60 cm from the measured total length of aerial connecting wire -2-.
- Procure the required adapter cables -1- and -3- and connecting wire -2- at length calculated as genuine part from the ⇒ Electronic Parts Catalogue "ETKA" .
- Cut off connectors from defective aerial cable.

The remainder of the defective aerial wire remains in the vehicle.

- Connect adapter cables -1- and -3- to equipment in vehicle.
- Lay and secure connecting wire -2- in the direct vicinity of where the wiring is laid in series-produced vehicles.



Note

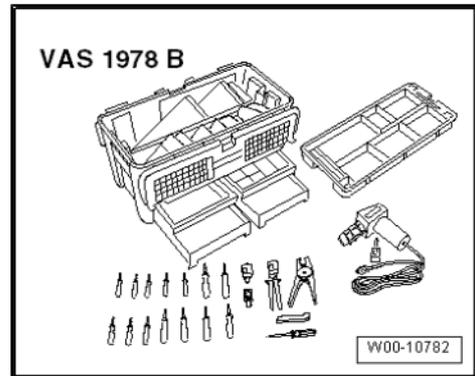
Do not kink or excessively bend aerial wires! The bending radius must not be below 50 mm.

- Connect connecting wire to adapter cables.
- Perform functional check.

2.4.5 Repairing 0.13 mm²/0.35 mm²/0.5 mm² wire

Special tools and workshop equipment required

- ◆ Hot air blower - VAS 1978/14A- from wiring harness repair set - VAS 1978 B-



- ◆ Crimping pliers (body) - VAS 1978/1-2- from wiring harness repair set - VAS 1978 B-
- ◆ Adapter head 0.13 - 0.5 mm² - VAS 1978/1-3-



Note

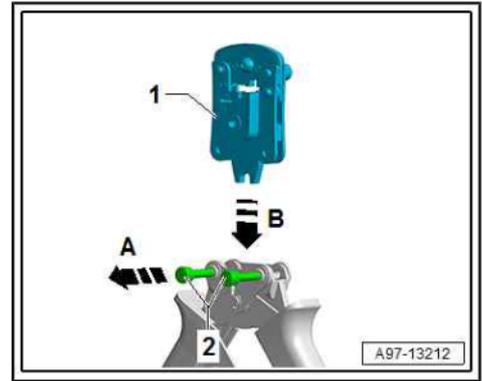
Repair wires with a cross section of 0.35 mm² and 0.5 mm² are available for the repair.

Procedure

- Fit adapter head 0.13 - 0.5 mm² - VAS 1978/1-3- -1- on crimping pliers (body) - VAS 1978/1-2- as follows:
- Open crimping pliers -VAS 1978/1-2- .



- Pull out locking pins -2- in direction of -arrow A- as far as stop.
- Fit adapter head -VAS 1978/1-3- -1- centrally on crimping pliers -VAS 1978/1-2- in direction of -arrow B-.
- Insert locking pins -2- again as far as stop.
- Clear the wire to be repaired about 20 cm either side of the repair position.



Caution

Risk of damage to electrical wiring.

- ◆ *Carefully lay wrapped wiring harnesses aside.*

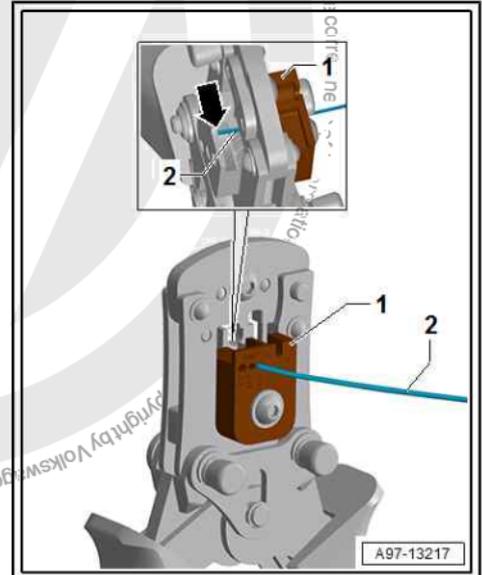
- If necessary, remove wrapping of wiring harness.
- Cut out the damaged piece of wiring using side cutters.



Note

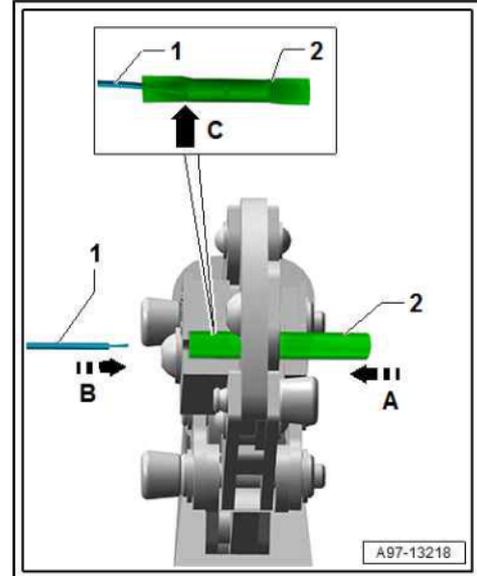
- ◆ *If, after the damaged wire has been cut out, both ends of the vehicle's own wiring are too short for a repair using single butt connectors, use a piece of yellow repair wire of the appropriate length with two crimp connectors.*
- ◆ *When repairing a single wire with crimped/attached contact, lay the yellow repair wire next to the damaged single wire of the vehicle and cut to the required length.*

- Fit end of wire -2- as far as stop -arrow- in receiver on adapter head -VAS 1978/1-3- -1- with appropriate cross section.
- Press together crimping pliers completely and hold in this position.
- Pull out end of wire -2- from adapter head -VAS 1978/1-3- -1- to strip insulation.
- Open crimping pliers again.
- Insulation must be cut cleanly and removed from the wire
- Do not leave any insulation on the stripped wires
- Single wires must not be damaged
- Choose a small transparent crimp connector from wiring harness repair set - VAS 1978 B- .
- For 0.13 mm² wires, also push a shrink tube onto one of the wires ⇒ Electronic parts catalogue (ETKA) .

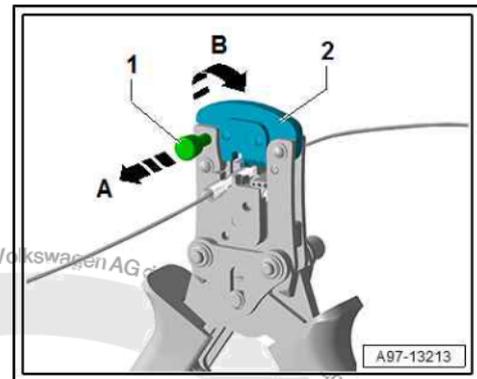




- Push crimp connector -2- in direction of -arrow A- as far as stop into crimp opening in adapter head -VAS 1978/1-3- .
- Push stripped wire -1- in direction of -arrow B- into crimp connector -2-.
- All single wires must be pushed into crimp connector -2-
- Insulation on wire -arrow C- must not be crimped.
- Press together crimping pliers completely and then open.
- Remove wire with crimp connector.
- Crimp wire with crimp connector on other side as described.

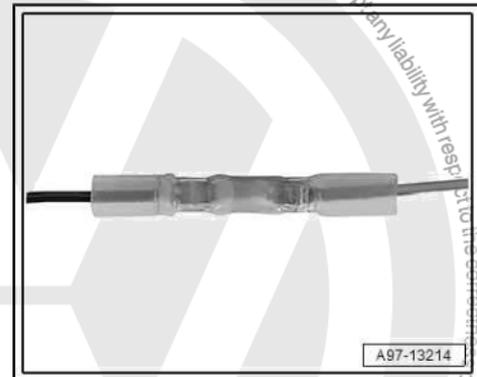


- Pull out locking pin -1- in direction of arrow -A- as far as it will go.
- Swivel upper part of adapter head -VAS 1978/1-3- -2- in direction of -arrow B-.
- Remove crimped crimp connector.



Correct crimping result

- After crimping, the crimp connector has to be shrink fitted using the hot air blower in order to prevent any ingress of moisture.
- For 0.13 mm^2 wires, it is then necessary to shrink-fit the additional shrink hose to ensure complete sealing.

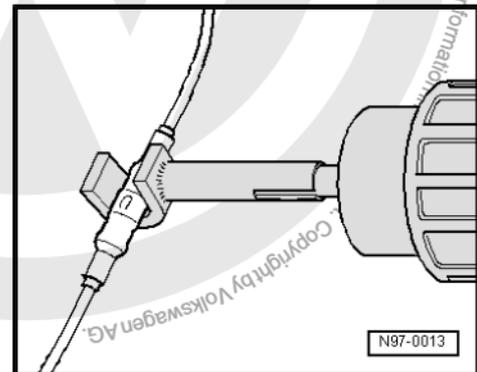


- Fit shrink element for hot air blower - VAS 1978/15A- onto hot air blower - VAS 1978/14A.-

 **Caution**

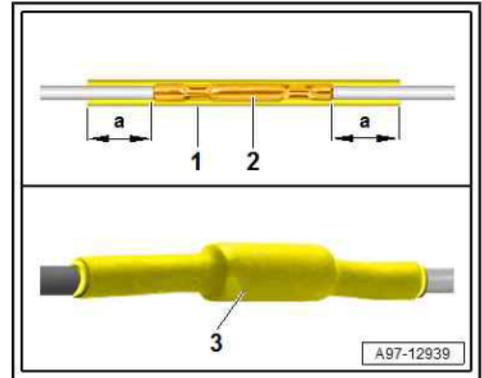
Risk of damage to electrical wiring.

- ◆ *When shrink-fitting the hose, take care not to damage any other wiring, plastic parts or insulating material with the hot nozzle of the hot air blower.*
- ◆ *Observe the operating instructions of the hot air blower without fail!*



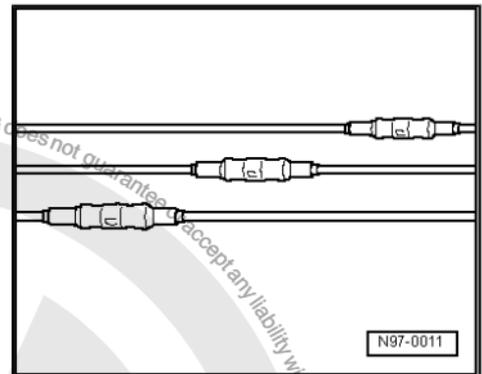


- For 0.13 mm² wires, position heat-shrink hose -1- centrally over crimp connector -2- by feeling contours.
- Dimension -a- must be approximately even on both sides.
- Heat up heat-shrink hose/crimp connector using hot air blower along a straight line, working from centre outwards, until it is sealed completely and adhesive escapes from the ends.
- This is how the finished repair point should look -3-.



i Note

- ◆ Ensure that, where several wires have to be repaired, the crimp connectors are not directly adjacent to each other. To prevent the circumference of the wiring harness from becoming too great, position the crimp connectors so they are offset slightly.
- ◆ If the repair position was already wrapped, this section has to be wrapped again with yellow adhesive tape once the repair has been carried out.
- ◆ Attach the repaired wiring harness with a cable tie, if necessary, to prevent it from generating noise when the vehicle is in motion.

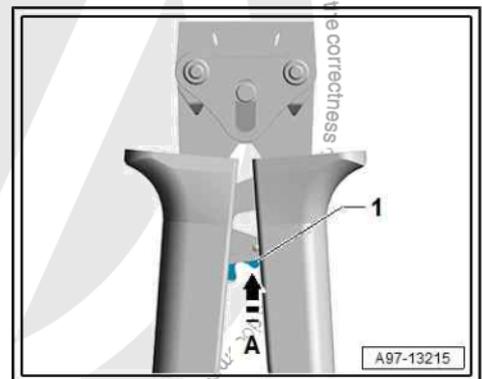


Premature release

- Push release lever -1- upwards in direction of -arrow A-.
- At same time, press together crimping pliers slightly and then open.

⚠ Caution

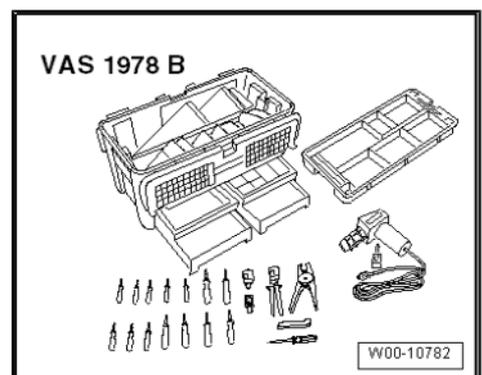
- ◆ Do not use the crimp connector after premature release.



2.4.6 Repair of 10 mm² or 16 mm² wire with single butt connector

Special tools and workshop equipment required

- ◆ Hot air blower - VAS 1978/14A- from wiring harness repair set - VAS 1978 B-





- ◆ Shrink element for hot air blower - VAS 1978/15A- from wiring harness repair set - VAS 1978 B-
- ◆ Wiring harness repair set - VAS 631 003-

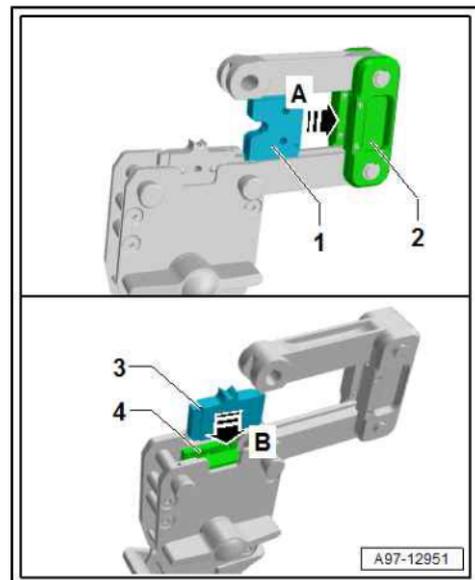
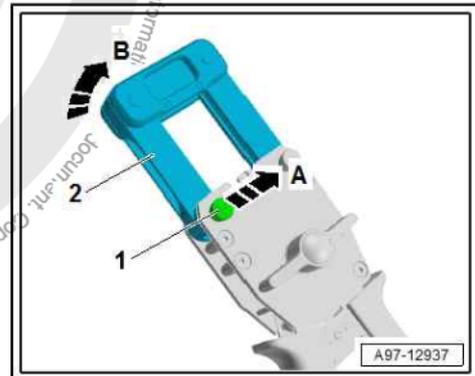


Note

- ◆ *Repair wires (by the metre) with a cross section of 10 mm² or 16 mm² are available for the repair.*
- ◆ *Furthermore, single repair wires with a crimped/attached contact are available for repair work.*

Procedure

- Attach the crimping anvil and crimping stamp relevant to the wire thickness to the crimping pliers as follows:
- Open crimping pliers from wiring harness repair set - VAS 631 003- .
- Pull out locking pin -1- in direction of arrow -A- as far as it will go.
- Open adapter -2- in direction of arrow -B-.
- Insert crimping stamp -1- until it is heard to engage in mounting -2- on adapter -arrow A-.
- Insert crimping anvil -3- until it is heard to engage in mounting -4- of crimping pliers -arrow B-.





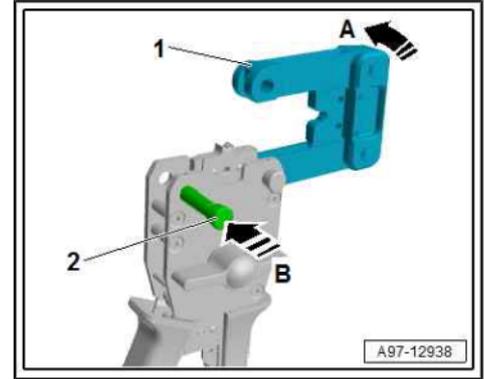
- Close adapter -1- in direction of arrow -A-.
- Insert locking pin -2- onto stop in direction of arrow -B-.
- Clear the wire to be repaired about 20 cm either side of the repair position.



Caution

Risk of damage to electrical wiring.

- ◆ *Carefully lay wrapped wiring harnesses aside.*



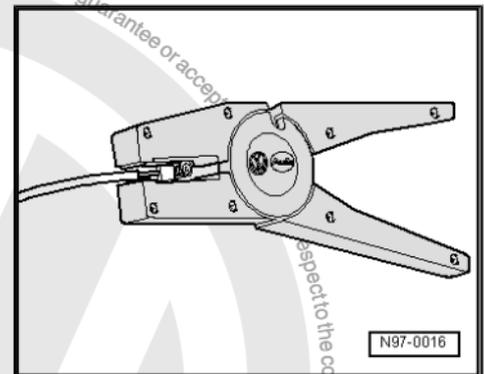
- If necessary, cut through wrapping of wiring harness with a knife.
- Cut out damaged section of wire with wire stripper from wiring harness repair set - VAS 631 003- .



Note

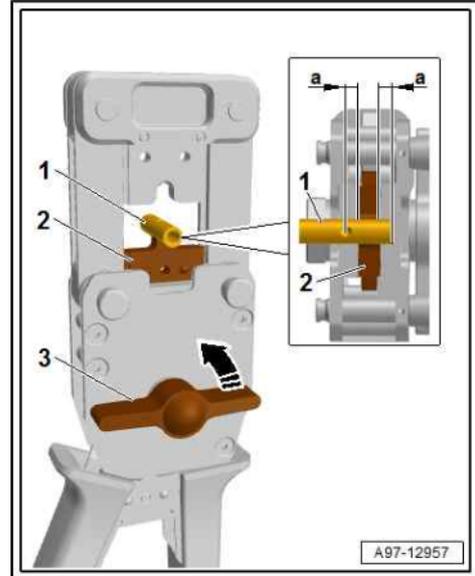
- ◆ *If, after the damaged wire has been cut out, both ends of the vehicle's own wiring are too short for a repair using single butt connectors, use a piece of yellow repair wire of the appropriate length with two crimp connectors.*
- ◆ *When repairing a single wire with crimped/attached contact, lay the yellow repair wire next to the damaged single wire of the vehicle and cut to the required length.*

- Set the adjustable stop in the wire stripper from wiring harness repair set - VAS 631 003- to the length that needs to be stripped.
- ◆ 10 mm² wires: 14 mm
- ◆ 16 mm² wires: 16.5 mm
- Insert the end of the wire from the front fully into the pliers jaws and squeeze the pliers together completely.
- Open the pliers and removed the stripped wire end.
- Insulation must be cut cleanly and removed from the wire
- Do not leave any insulation on the stripped wires
- Single wires must not be damaged
- Use a suitable butt connector and heat-shrink hose from wiring harness repair set - VAS 631 003- to perform repair.
- Push heat-shrink hose onto one of the wires.

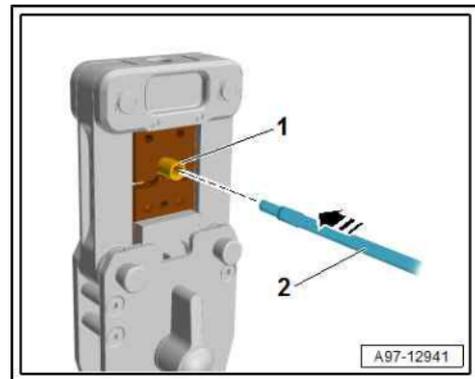




- Position butt connector -1- with first crimping point centrally on crimping anvil -2-.
- Dimension -a- must be even on both sides
- Turn quick-action lever -3- in anti-clockwise direction -arrow- until butt connector -1- is secure.



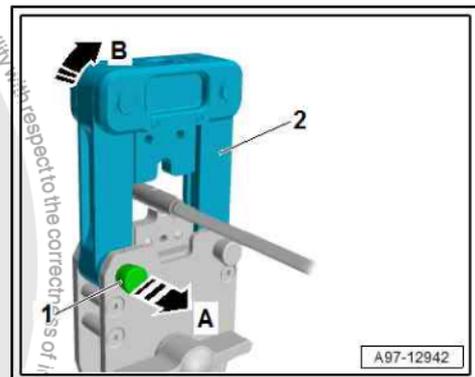
- Insert wire -2- with stripped end into butt connector -1- as far as stop -arrow-.
- All single wires must be pushed into the butt connector
- Close and open the crimping pliers several times until the crimping anvil moves downwards automatically to the start position.



Note

The insulation on the wires must not be crimped.

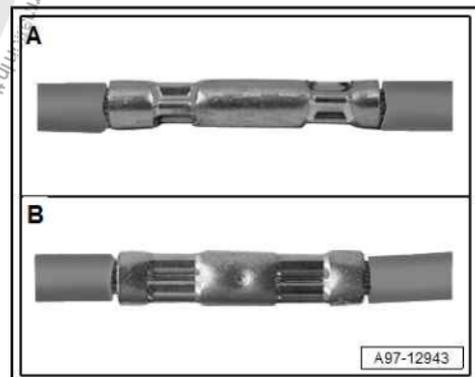
- Crimping the wire with butt connector on the other side as described.
- Pull out locking pin in direction of arrow -A- as far as it will go.
- Open adapter in direction of arrow -B-.
- Remove crimped butt connector.



Correct crimping result

A - 10 mm², star crimp

B - 16 mm², B crimp





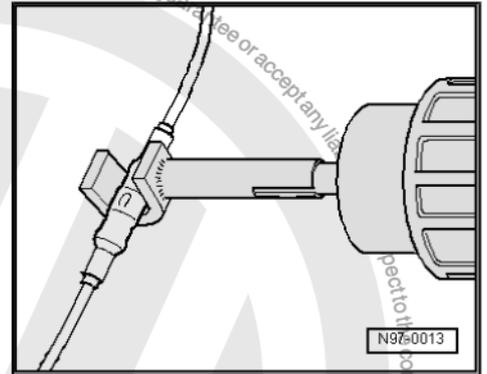
After crimping, the heat-shrink hose over the butt connector has to be shrink fitted using the hot air blower. In order to prevent any ingress of moisture.

- Fit shrink element for hot air blower - VAS 1978/15A- onto hot air blower - VAS 1978/14A- .

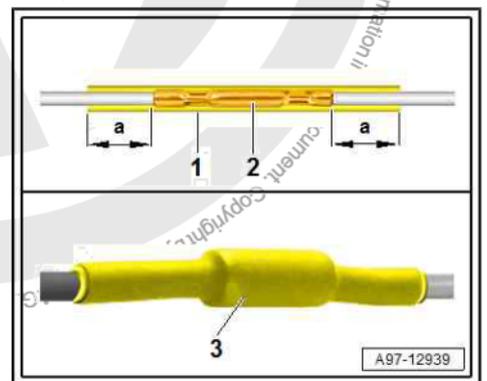
 **Caution**

Risk of damaging adjacent components.

- ◆ *When shrink-fitting the hose, take care not to damage any other wiring, plastic parts or insulating material with the hot nozzle of the hot air blower.*
- ◆ *Observe the operating instructions of the hot air blower without fail!*

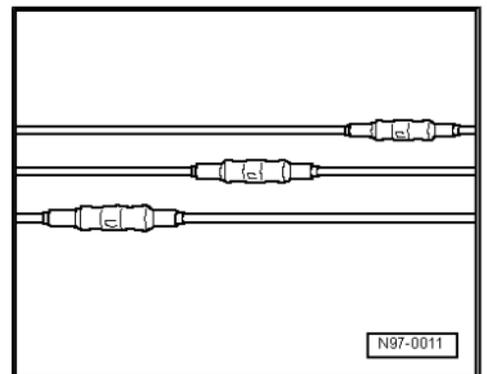


- Position heat-shrink hose -1- centrally over butt connector -2- by feeling contours.
- Dimension -a- must be roughly even on both sides
- Heat up heat-shrink hose using hot air blower along a straight line, working from centre outwards, until it is sealed completely and adhesive escapes from the ends.
- This is how the finished repair point should look -3-.



 **Note**

- ◆ *Ensure that, where several wires have to be repaired, the butt connectors are not directly adjacent to each other. To prevent the circumference of the wiring harness from becoming too great, position the butt connectors so they are offset slightly.*
- ◆ *If the repair position was already wrapped, this section has to be wrapped again with yellow adhesive tape once the repair has been carried out.*
- ◆ *Attach the repaired wiring harness with a cable tie, if necessary, to prevent it from generating noise when the vehicle is in motion.*





Premature release

- Push lever -1- downwards -arrow A-.
- Turn quick-action lever -2- in clockwise direction -arrow B- until crimping anvil is in the start position.

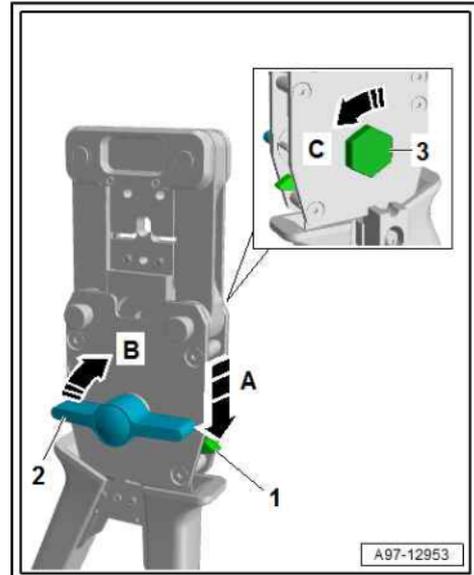
If premature release is not possible by hand:

- Push lever -1- downwards -arrow A-.
- Place wrench from wiring harness repair set - VAS 631 003- on bolt -3- on rear.
- Turn wrench in anti-clockwise direction -arrow C- until crimping anvil is in the start position.



Caution

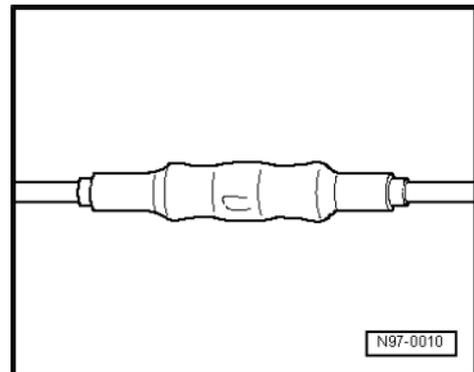
Do not use the butt connector after premature release.



2.4.7 Wiring open circuit with one repair position

Repair position with single crimp connector

- Place the wire to be repaired to one side (about 20 cm either side of repair position).
- If necessary, remove binding around wiring harness using folding knife.

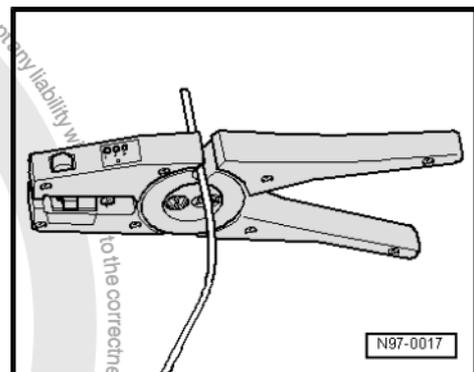


- Cut out damaged section of wire using wire strippers - VAS 1978/3-

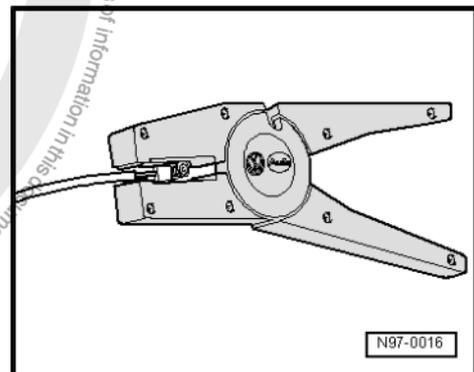


Note

If, after the damaged wire has been cut out, both ends of the vehicle's own wiring are too short for a repair using single crimp connectors, use a piece of repair wire of the appropriate length with 2 crimp connectors => [page 107](#).



- Strip 6 - 7 mm of insulation from ends of wire, using wire strippers - VAS 1978/3- .





- Slide crimp connectors onto both stripped ends of vehicle's own single wire and crimp together using crimping pliers - VAS 1978/1A- .

i Note

- ◆ *Ensure without fail that the correct crimp recess is chosen for the crimp connectors being used.*
- ◆ *The insulation on the wires must not be crimped.*

After crimping, the crimp connector has to be shrink fitted using the hot air blower, 220 V/50 Hz - VAS 1978/14- in order to prevent any ingress of moisture.

- Place shrink element for hot air blower - VAS 1978/15- on hot air blower, 220 V / 50 Hz - VAS 1978/14- .

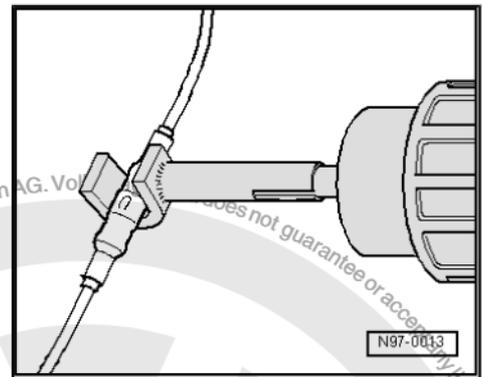
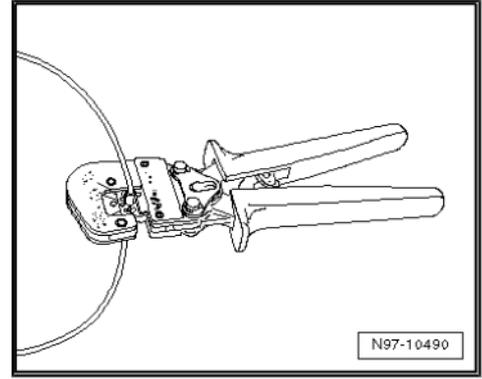
- Heat up the crimp connector using the hot air blower, 220 V / 50 Hz - VAS 1978/14- along a straight line, working from the middle outwards, until it is sealed completely and the adhesive escapes from the ends.



Caution

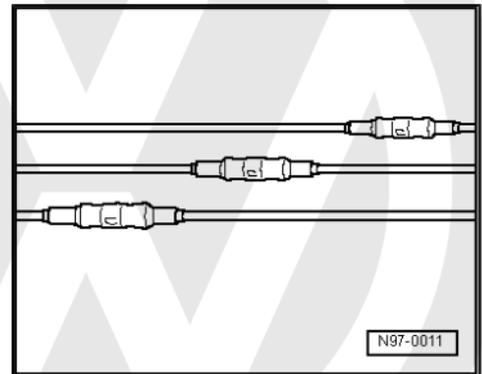
When shrink-fitting, take care not to damage any other wiring, plastic parts or insulating material with the hot air blower, 220 V/50 Hz - VAS 1978/14- .

Observe ⇒ Operating instructions for hot air blower, 220 V / 50 Hz - VAS 1978/14- !



i Note

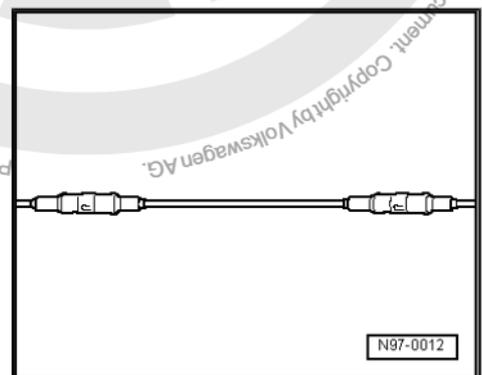
- ◆ *Ensure that, where several wires have to be repaired, the crimp connectors are not directly adjacent to each other. To prevent the circumference of the wiring harness from becoming too great, position the crimp connectors so they are offset slightly.*
- ◆ *If the repair position was already wrapped, this section has to be wrapped again with yellow insulation tape once the repair has been carried out.*
- ◆ *Attach the repaired wiring harness with a cable tie to prevent it from generating noise when the vehicle is in motion.*



2.4.8 Wiring open circuit with two repair positions

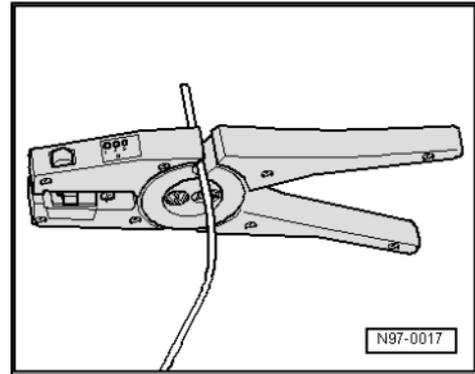
Repair position with interlinked wire.

- Place wire to be repaired to side at 2 points (about 20 cm to both sides of respective repair position).
- Remove binding around wiring harness using folding knife.

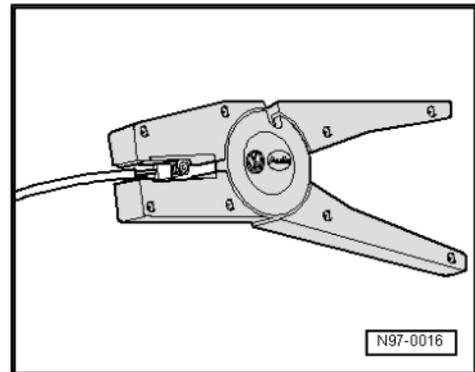




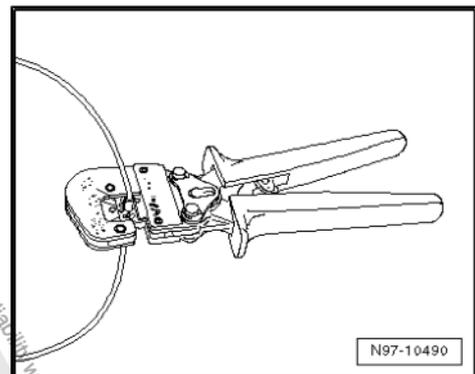
- Place yellow repair wire next to damaged wiring harness and cut repair wire to required length using wire strippers - VAS 1978/3- .
- Cut out damaged section from vehicle's own single wire.



- Strip 6 - 7 mm of insulation from ends of wire, using wire strippers - VAS 1978/3- .
- Push crimp connector onto one side of vehicle's own single wire and on other side onto repair wire.



- Crimp connector using crimping pliers - VAS 1978/1A- to join both ends of wire.
- Repeat process at other end of repair wire.



Note

- ◆ *Ensure without fail that the correct crimp recess is chosen for the crimp connectors being used.*
- ◆ *The insulation on the wires must not be crimped.*

After crimping, the crimp connector has to be shrink fitted using the hot air blower, 220 V/50 Hz - VAS 1978/14- in order to prevent any ingress of moisture.

Place shrink element for hot air blower - VAS 1978/15- on hot air blower, 220 V / 50 Hz - VAS 1978/14- .

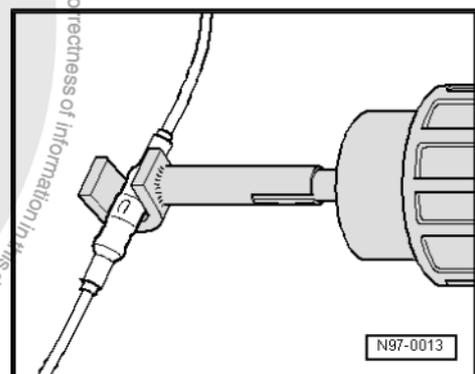
Heat up the crimp connector using the hot air blower, 220 V/ 50 Hz - VAS 1978/14- along a straight line, working from the middle outwards, until it is sealed completely and the adhesive escapes from the ends.



Caution

When shrink-fitting, take care not to damage any other wiring, plastic parts or insulating material with the hot air blower, 220 V/50 Hz - VAS 1978/14- .

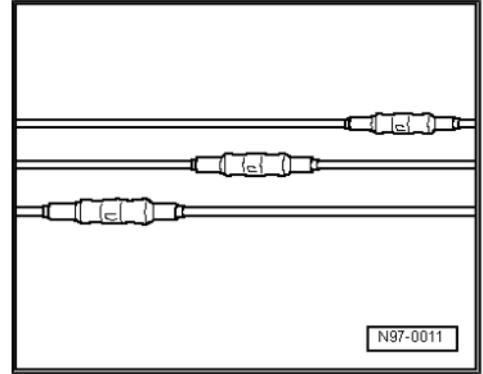
Observe → Operating instructions for hot air blower, 220 V/ 50 Hz - VAS 1978/14- !





Note

- ◆ Ensure that, where several wires have to be repaired, the crimp connectors are not directly adjacent to each other. To prevent the circumference of the wiring harness from becoming too great, position the crimp connectors so they are offset slightly.
- ◆ If the repair position was already wrapped, this section has to be wrapped again with yellow insulation tape once the repair has been carried out.
- ◆ Attach repaired wiring harness with a cable tie to prevent it from generating noise when the vehicle is in motion.



2.5 Repairs to fibre optic cables

It is very difficult to identify the exact location of the defect. Replace the damaged fibre optic cable by laying a new cable parallel to the defective fibre optic cable.



Note

- ◆ Via the menu options of the vehicle diagnostic tester "Guided Fault Finding" or "Guided Functions", it is possible to ascertain the components between which the fibre optic cable has been damaged.
- ◆ The colour "yellow" indicates a fibre optic cable that has already been repaired.

Procedure:

- Select "Guided functions" or "Guided fault finding" in the vehicle diagnostic tester ⇒ Vehicle diagnostic tester.
- Prepare fibre optic cable ⇒ [page 109](#).



Caution

Do not over-bend fibre optic cables. Minimum radius for bends is 25 mm.

Do not route fibre optic cables over sharp edges.

Make sure that the ends of the fibre optic cables are not dirty and do not touch them with your bare hands.

Do not expose fibre optic cables to heat.

It is not permissible to twist 2 fibre optic cables together or one fibre optic cable with a copper wire.

Protect connectors and connecting cables against dust. Use protective caps from the case.

⇒ ["2.5.1 Preparing fibre optic cable", page 109](#)

⇒ ["2.5.2 Detaching fibre optic cable from cable harness connector", page 114](#)

2.5.1 Preparing fibre optic cable

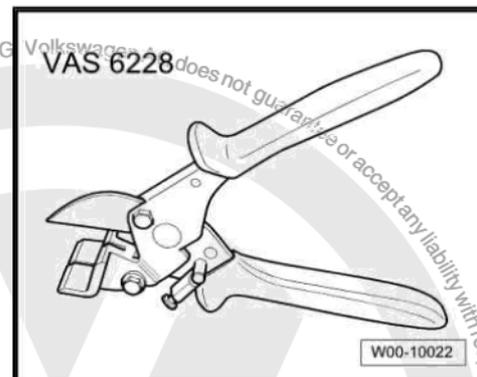
Special tools and workshop equipment required



◆ Fibre optic cable repair kit - VAS 6223A-



◆ Cutting pliers - VAS 6228-



◆ Vehicle diagnostic tester

 **Caution**

Do not over-bend fibre optic cables. Minimum radius for bends is 25 mm.

Do not route fibre optic cables over sharp edges.

Make sure that the ends of fibre optic cables are not dirty and do not touch them with your bare hands.

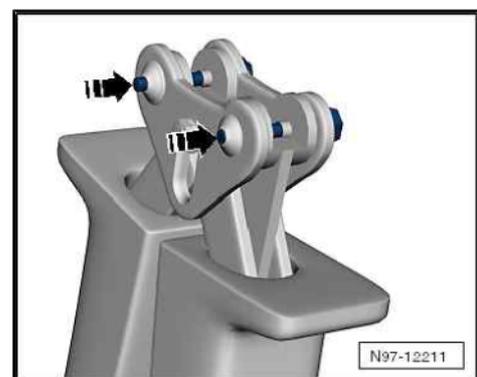
Do not expose fibre optic cables to heat.

It is not permissible to twist 2 fibre optic cables together or one fibre optic cable with a copper wire.

Protect connectors and connecting cables against dust. Use protective caps from the case.

Fitting tool adapter for fibre optic cable pliers - VAS 6223/1-

- Push out locking pins in -direction of arrow-





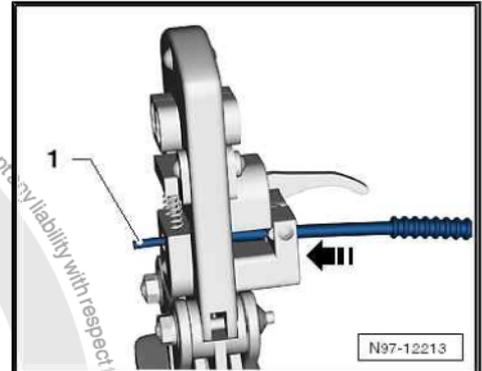
- Fit tool adapter in -direction of arrow-.
- Push back locking pins.

Cutting fibre optic cable to size

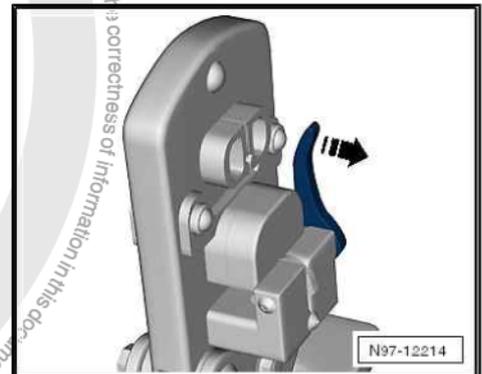


- Open fibre optic cable pliers, and insert length of fibre optic cable -1- to be cut in -direction of arrow-.
- Determine required length of fibre optic cable.
- To cut the fibre optic cable to size, close fibre optic cable pliers .

Stripping off insulation

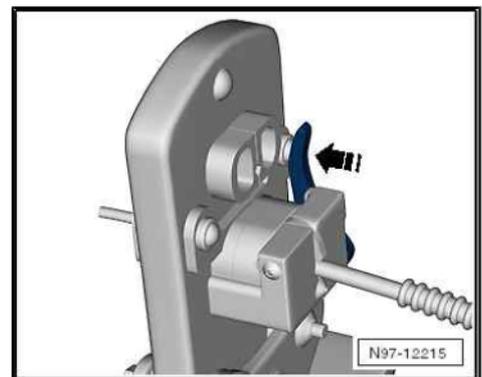


- Open fibre optic cable pliers - VAS 6223/1- .
- Push down stripping lever in -direction of arrow-.
- Insert fibre optic cable into the stripping hole.
- The fibre optic cable must be flush with the rear of the cutting pliers.



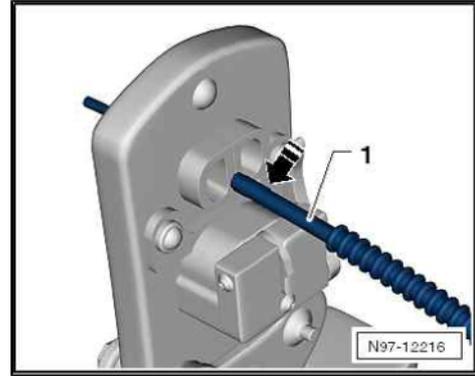
- Close fibre optic cable pliers as far possible and hold closed.
- Swing stripping lever in -direction of arrow-.
- Remove fibre optic cable.

Cutting precisely (making a clean optic surface at end of cable)





- Insert fibre optic cable -1- into the cutting hole.
- The insulation must be lying against stop of cutting station.
- Close fibre optic cable pliers - VAS 6223/1- and remove cable.

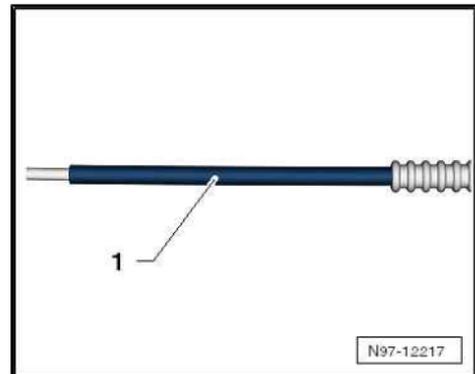


- Visually inspect cable -1- to make sure that it has been cut correctly and that there are no burrs on the cross-cut surface at end of cable.



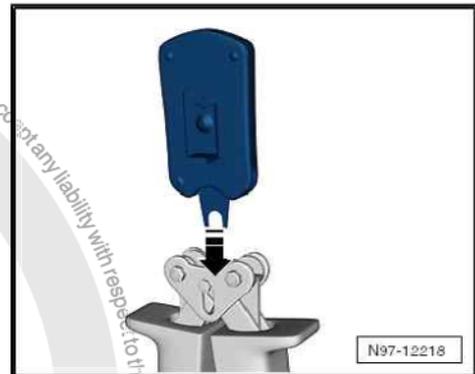
Note

- ◆ Place the fibre optic cable only on surface or material that is absolutely clean or keep it in your hand.
- ◆ Use protective caps if there is a danger that the cross-cut surface at the ends of the fibre optic cable will be soiled.

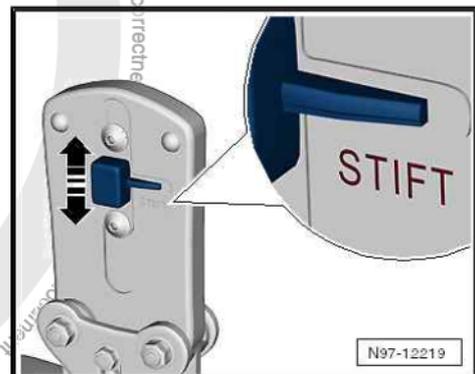


Fitting brass pin contact to fibre optic cable

- Fit tool adapter in -direction of arrow-.

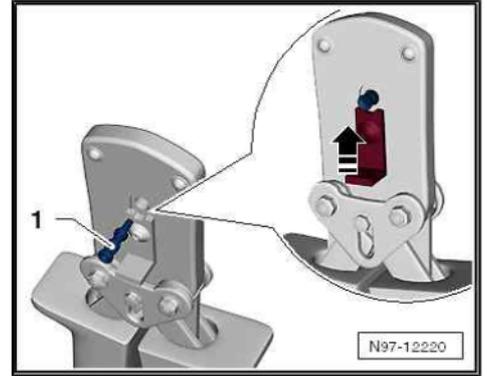


- Slide safety catch on fibre optic cable pliers in -direction of arrow- so that the word "Stift (Pin)" is visible.

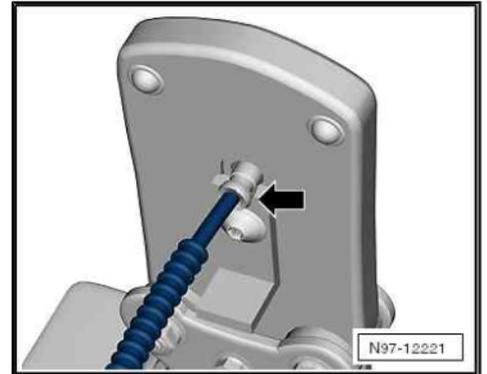




- Insert a brass pin contact -1- into the hole.
- Close locking lever on fibre optic cable pliers in -direction of arrow-.

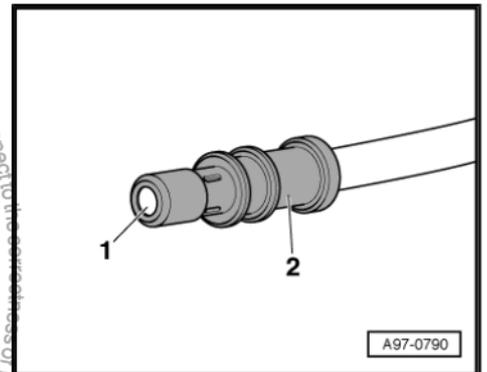


- Push fibre optic cable into brass pin contact -arrow- as far as spring-cushioned stop and close fibre optic cable pliers .
- Open fibre optic cable pliers and remove fibre optic cable together with brass pin contact.



Caution

Do not kink or excessively bend fibre optic cables (min. bending radius: 25 mm).



- Check that the brass pin contact -2- is correctly attached to fibre optic cable -1-.
- 4 crimping points must be visible on the brass connecting pin.
- Make sure that the brass pin contact cannot be pulled off fibre optic cable by hand.
- The cross-cut end surface of the fibre optic cable is 0.01 ... 0.1 mm behind the brass pin contact (visual inspection).

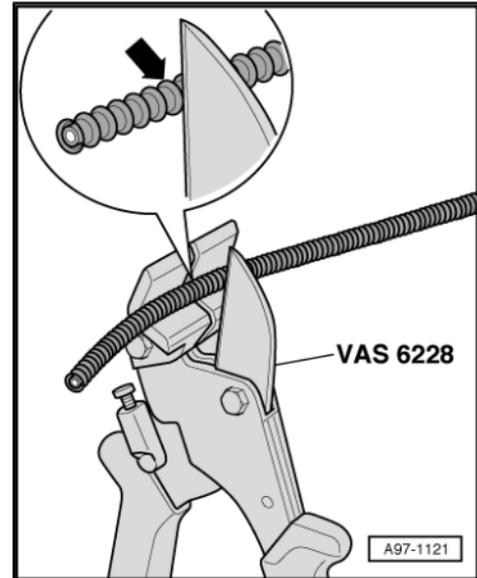
Note

- ◆ There are push-on couplings that are used to connect fibre optic cables ⇒ *Electronic Parts Catalogue* .
- ◆ Installation of the new fibre optic cable in the cable harness connector ⇒ [page 114](#) .

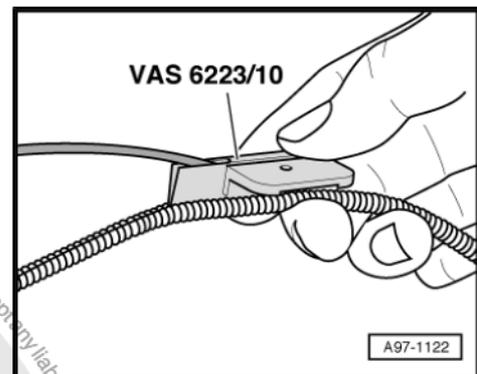
Fitting corrugated tube onto fibre optic cable



- Cut corrugated tube to a suitable length using cutting pliers - VAS 6228- .
- The corrugated tube must be cut at a crest -arrow- not in a trough.
- Use cutting pliers - VAS 6228- or a sharp knife for cutting.
- Do not cut the corrugated tube with a paper cutter.
- When the corrugated tube is installed, it must engage audibly in the housing of the fibre optic cable.



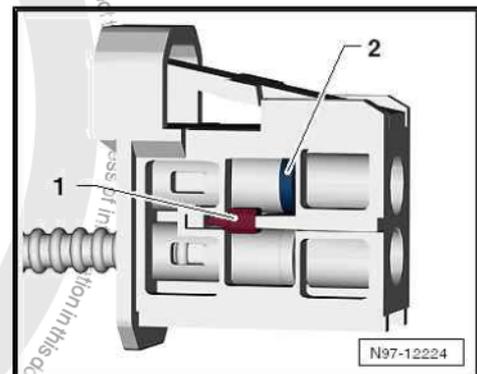
- Insert fibre optic cable into the pliers for corrugated tube installation - VAS 6223/10- .
- Position pliers in place on the groove of the corrugated tube.
- Push pliers in groove along the circumference of the corrugated tube. This causes the fibre optic cable to be inserted in the corrugated tube.



2.5.2 Detaching fibre optic cable from cable harness connector

Removing

- Pull fibre optic cable connector off the relevant control unit.
- Release locking element in fibre optic cable connector -1- by pressing it.
- Release secondary locking element -2-, using a small screwdriver.
- Remove fibre optic cable.



Caution

- ◆ Use protective caps from the case in order to protect the fibre optic cable against dust and dirt.
- ◆ Use a new housing as the secondary locking element can be damaged when the fibre optic cable is removed.
- ◆ Take note of the arrows on the basic module for the assignment of "IN" and "OUT".

Installing

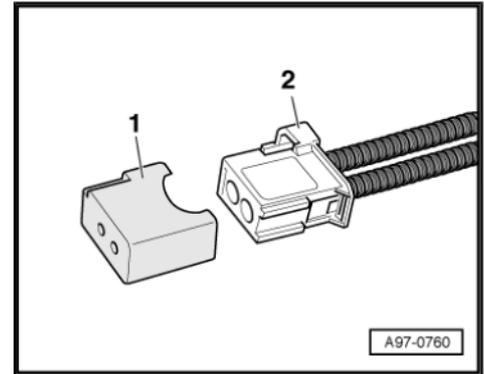
Install in the reverse order of removal, observing the following:

- Install fibre optic cable in accordance with markings.



Note

- ◆ Push corrugated pipe into connector housing until it engages audibly.
- ◆ Seal the open connector -2- for fibre optic cable with the protective cap for cable connector - VAS 6223/9- -item 1-.
- ◆ The protective cap prevents soiling and mechanical damage at the cross-cut end of the fibre optic cable so that the transmission of light is not impaired.



2.6 Repair of aerial wires

Checking the aerial wire: ⇒ [page 116](#)

Changing tool adapter: ⇒ [page 116](#)

Cutting aerial wire: ⇒ [page 116](#)

Stripping shielding: ⇒ [page 117](#)

Stripping outer sleeve: ⇒ [page 119](#)

Stripping inner insulation: ⇒ [page 120](#)

Crimping inner conductor: ⇒ [page 121](#)

Crimping outer conductor: ⇒ [page 123](#)

Special tools and workshop equipment required

- ◆ Repair set, aerial cable - VAS 6720-

The repair set, aerial cable - VAS 6720- makes it possible to attain optimal repair quality in the repair of aerial wiring RG 174 (blue) and RKT 031 (black). The set includes the respective stripping tools and crimping tools for both aerial cables. In addition, the case includes all the separate parts needed to connect the Genuine plug in nearly production quality. In this case, only the 0-coded connector (green) is required. All other connecting wires for the various infotainment systems can be found in ETKA (EL-electrical connection elements) in plate 035-XX. These various adapter aerial wires are specific to vehicle models and must always be ordered separately. All the separate parts can be found in the above-named plate for reordering. The compartments of the case are labelled with the part numbers of the consumable materials. The repair set is based on the existing adapters and pliers system of the VAS 1978B.



Note

Additional information: ⇒ *Operating manual, Repair set, aerial cable - VAS 6720-*



Checking the aerial wire:

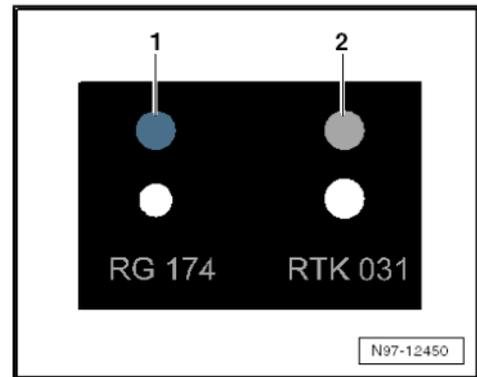
Before beginning repairs, determine which aerial wire is affected using the gauge.

- ◆ -1- System RG 174 = blue
- ◆ -2- System RTK 031 = grey

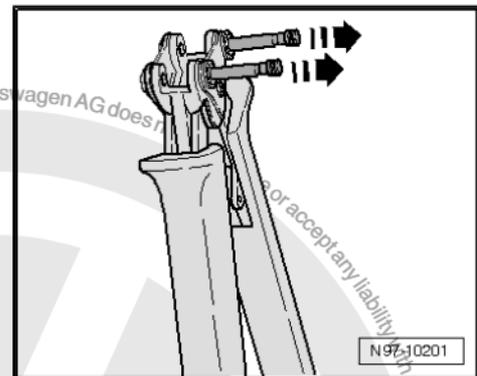
In both systems, the positioner of the adapters is colour-coded accordingly.

Changing tool adapter:

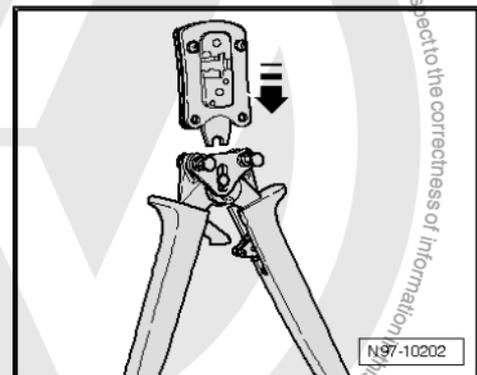
- Select appropriate adapter according to check of aerial wire ⇒ [page 116](#) .
- Open handles of pliers completely.
- Release the two locking pins -arrows- from handles of pliers and pull them out.



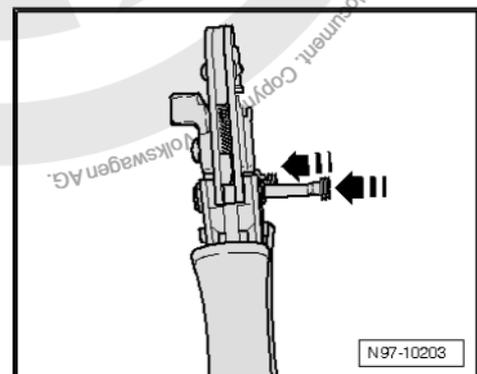
- Insert required tool adapter from above -arrow- into handles of pliers.



- Lock adapter into handles of pliers by pressing in pins -arrows-.



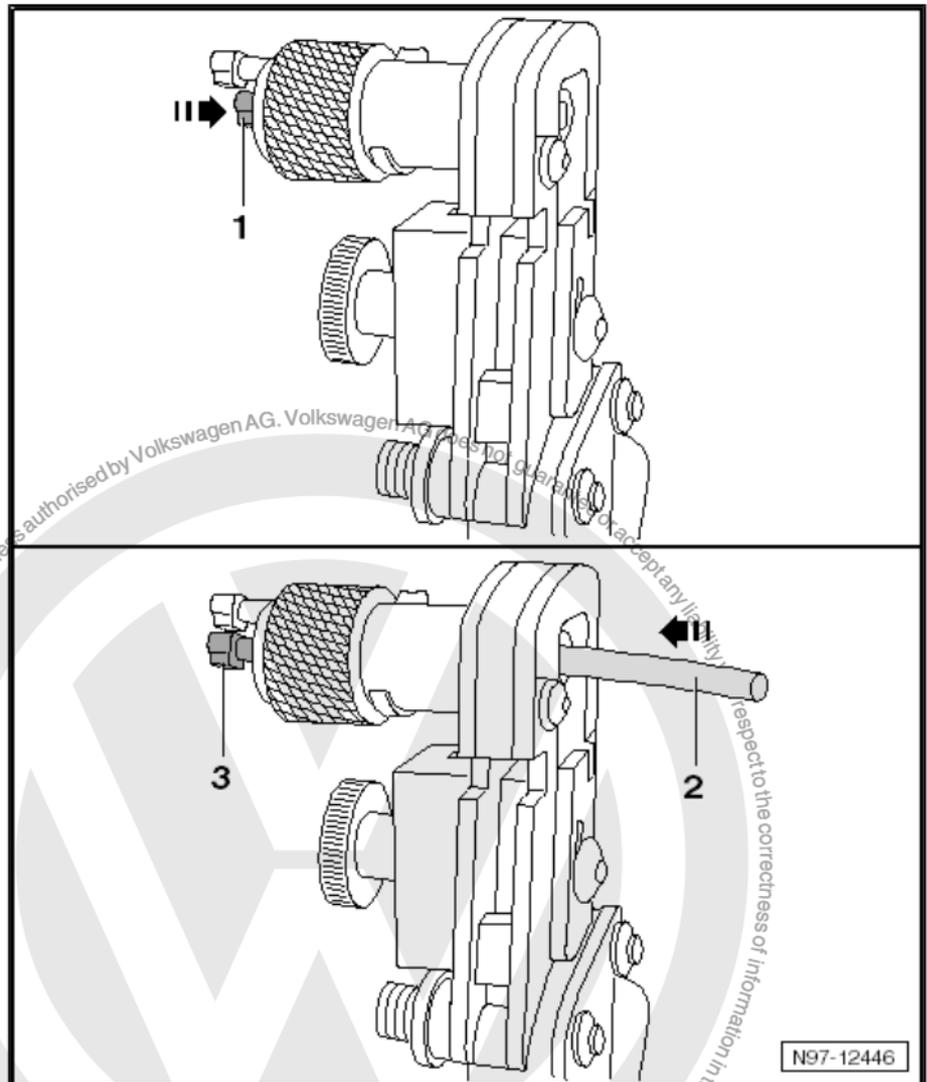
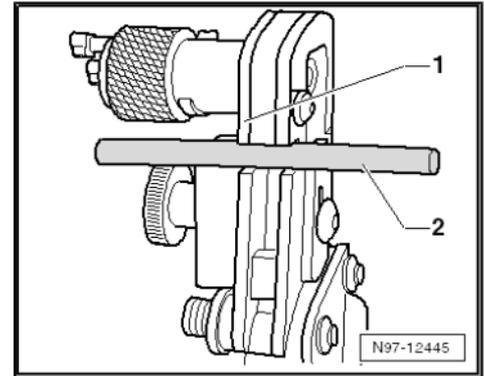
Cutting aerial wire:



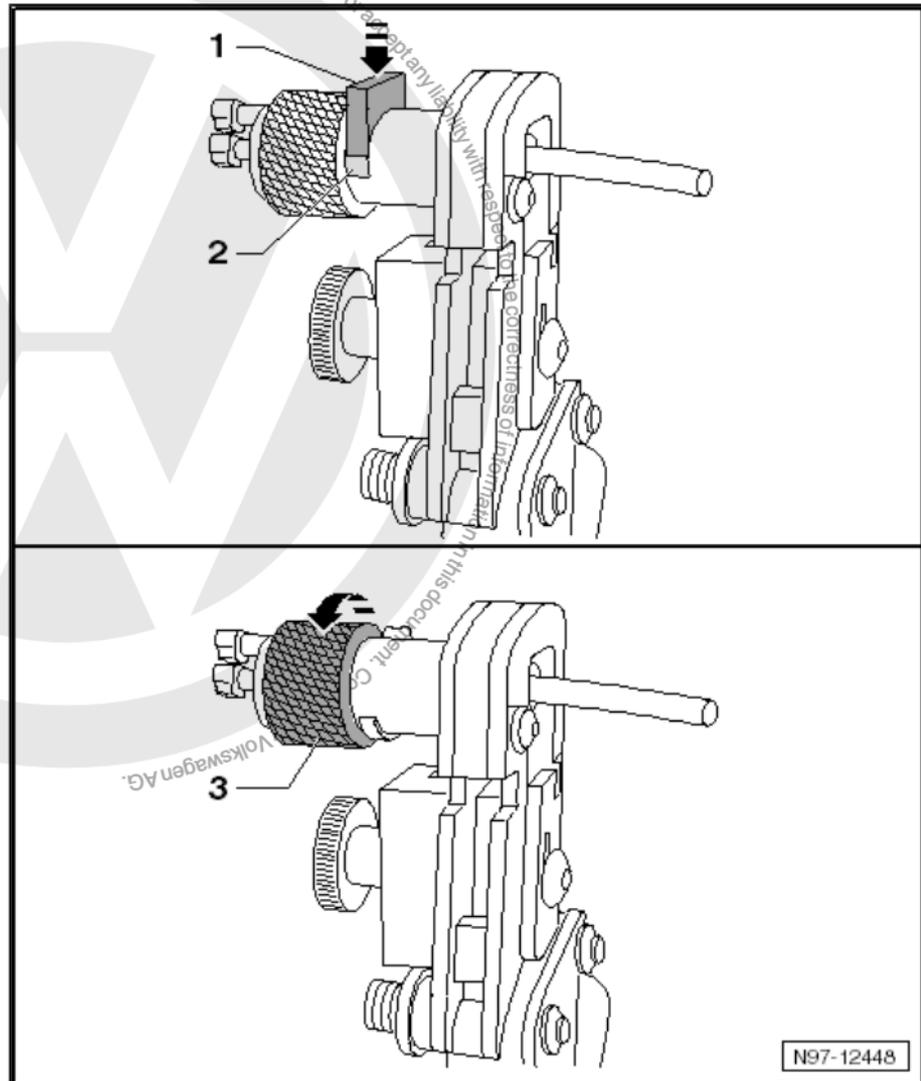


- Push aerial wire -2- into cutting mechanism -1-.
- Close tool and open it again.
- Pull aerial wire out of cutting mechanism.

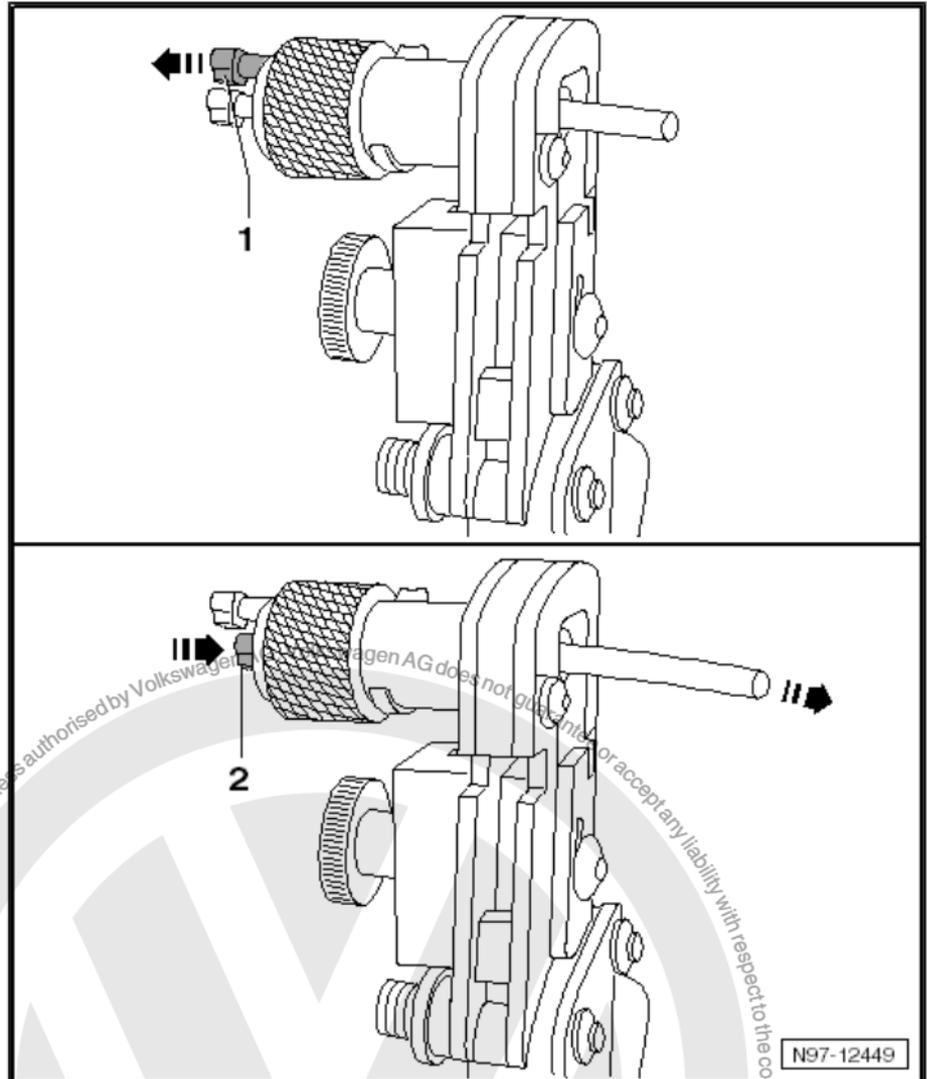
Stripping shielding:



- Push locating pin -1- into rotary cutter to stop.
- Push aerial wire -2- into rotary cutter to stop. The locating pin -3- is again entirely visible.

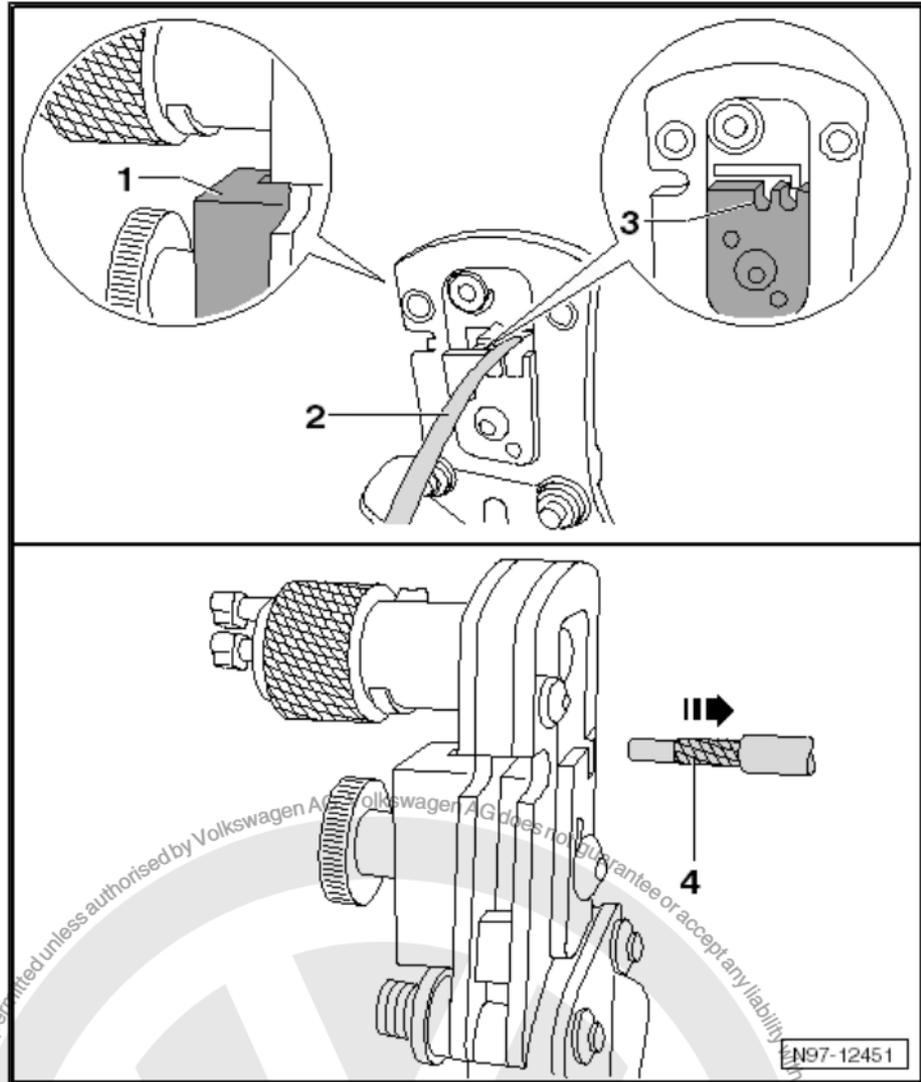


- Push blade holder -1- against shaft of rotary cutter until it engages. The gap -2- beneath the blade holder is completely closed.
- Hold aerial wire securely so that it cannot turn.
- Turn rotary cutter -3- approximately 2 times in direction of arrow until it rotates easily.



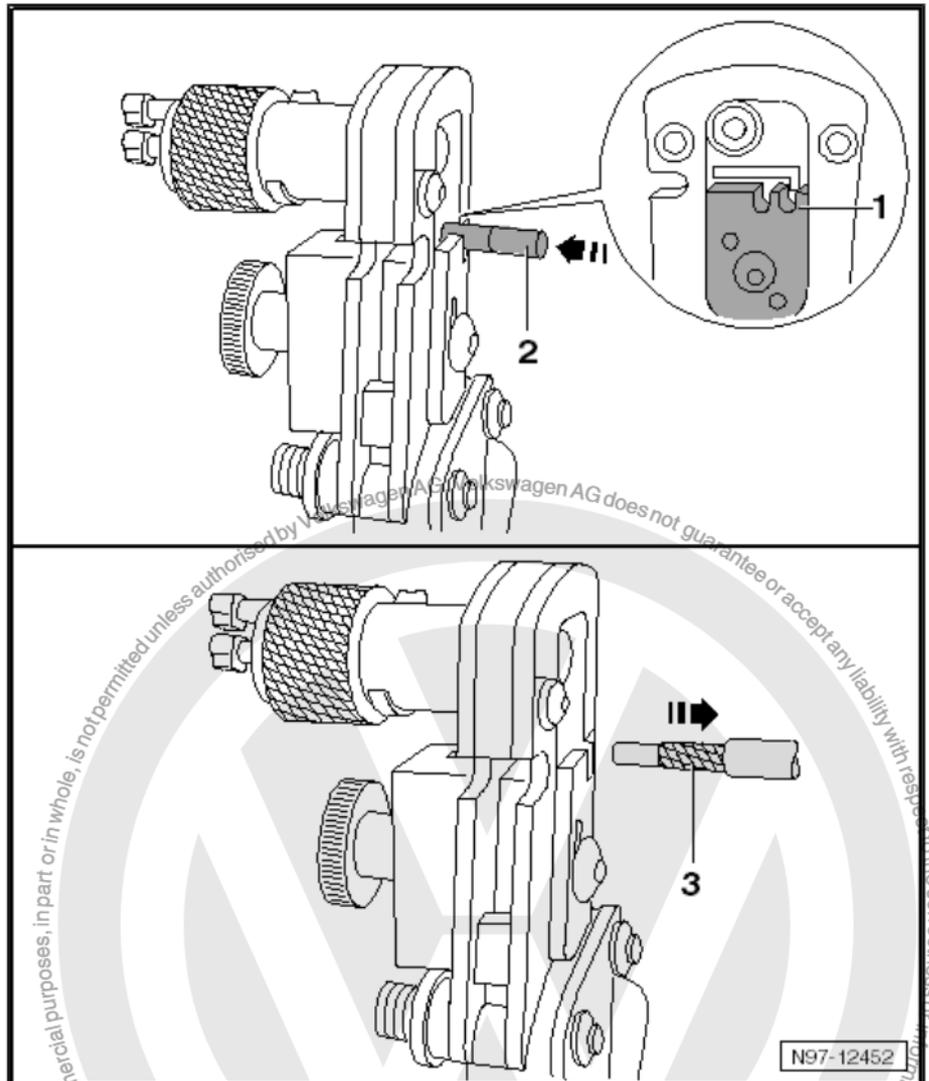
- Pull release pin -1-. The blade holder is released and separates from aerial wire.
- Push locating pin -2- into rotary cutter to stop. The aerial wire is pressed out of rotary cutter.
- Remove shielding from aerial wire.
- Remove remnants of insulation from rotary cutter.

Stripping outer sleeve:



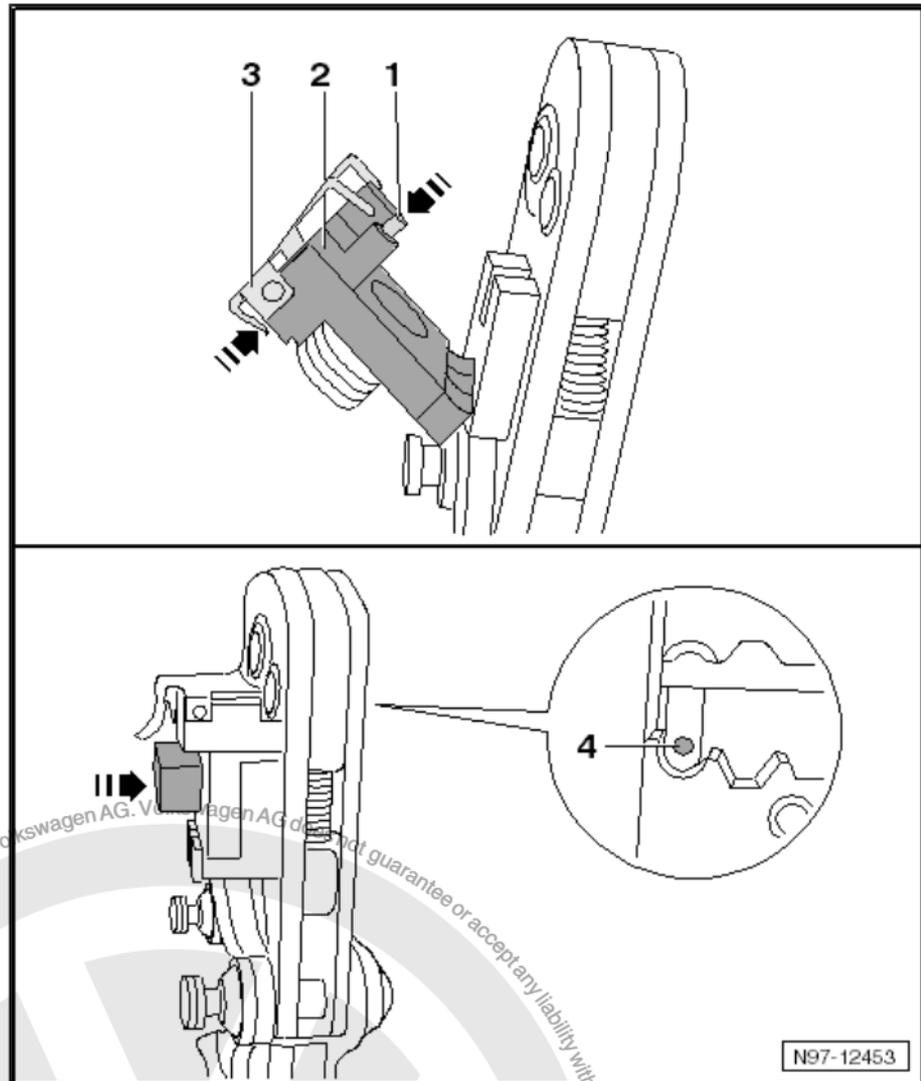
- Push aerial wire -2- through notch -3- into tool adapter to stop -1-.
- Close tool and open it again.
- Pull out aerial wire -4-.

Stripping inner insulation:

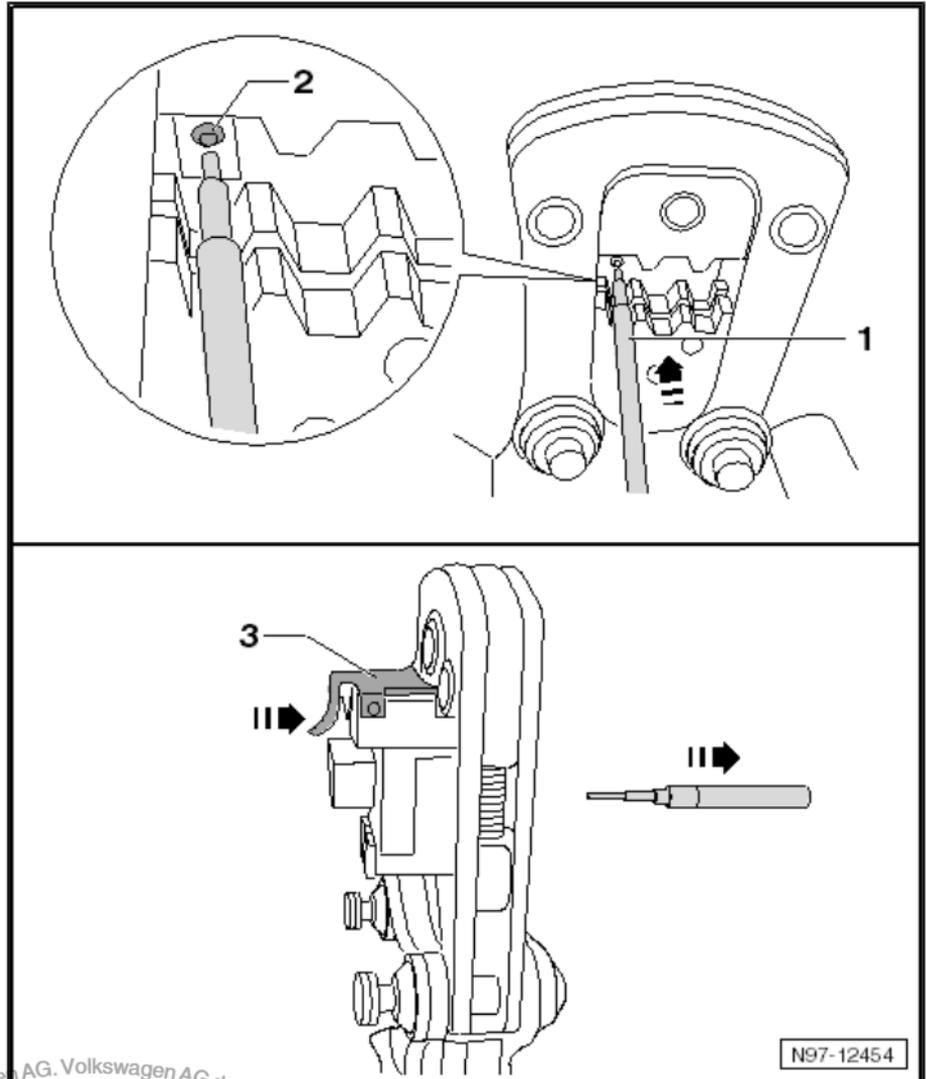


- Push aerial wire -2- through notch -1- into tool adapter to stop.
- Close tool and open it again.
- Pull out aerial wire -3-.

Crimping inner conductor:

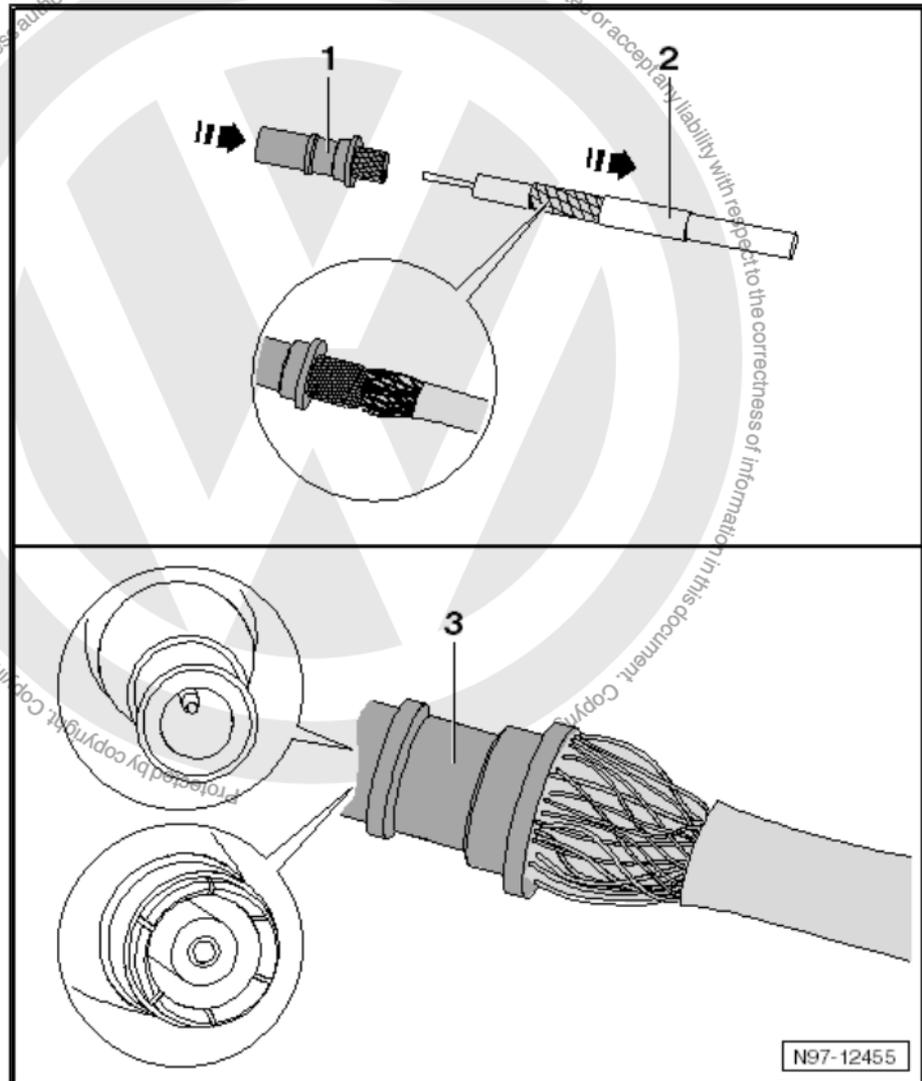


- Select appropriate adapter according to check of aerial wire
⇒ [page 116](#) ⇒ [page 116](#) .
- Tilt back swinging positioner -2-.
- Open positioning piece -3-. Positioning piece swings upwards.
- Push inner contact -1- into swinging positioner to stop and loosen positioning piece. The inner contact is fixed in place.
- Tip swinging positioner inwards. The inner contact -4- is positioned in the tool adapter.

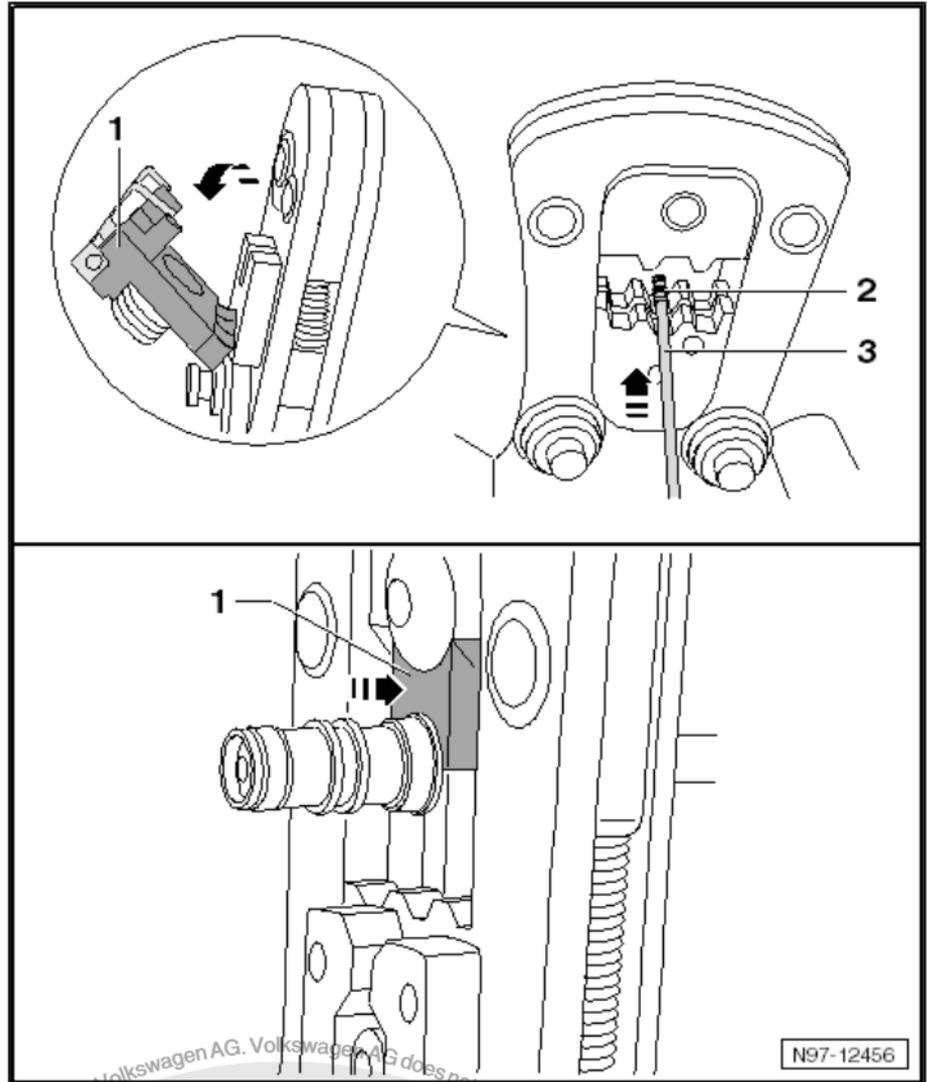


- Push aerial wire -1- into inner contact -2- in tool adapter. Hold swinging position in place while doing so.
- Close tool until it opens by itself.
- Open positioning piece -3- and pull out aerial wire.

Crimping outer conductor:



- Push sleeve -2- and outer contact -1- over inner conductor. The knurled contact part must be pushed under shielding -3- but over the aluminium foil.
- Push on outer contact -4- completely. Ensure proper seating of female connector and pin.



- Push on sleeve -3- to outer contact.
- Open tool and tilt out swinging positioner -1-.
- Position mounted outer contact -2- in tool adapter in middle notch on contact edge -4-.
- Close tool and open it again.
- Pull out aerial wire.





2.7 Repairs to contact housings and connectors

⇒ ["2.7.1 Notes on repairs to contact housings and connectors", page 126](#)

⇒ ["2.7.2 Repairs to contacts in contact housings", page 126](#)

⇒ ["2.7.3 Fitting single wire seals", page 127](#)

⇒ ["2.7.4 Repairs to contact housings using cut-and-clamp method", page 129](#)

2.7.1 Notes on repairs to contact housings and connectors

- ◆ Observe general instructions concerning repairs to vehicle electrical system.
- ◆ Allocation of the appropriate crimp contacts to the connector housings is by way of the part number stamped on the connector housing. In illustration 198 (electrical connecting elements) in the ⇒ Electronic Parts Catalogue "(ETKA)" the part numbers for the connector housings are listed in conjunction with the associated crimp contacts.
- ◆ Damaged connector housings must be renewed.
- ◆ New connector housings can be ordered via the standard procedure for replacement parts.

2.7.2 Repairs to contacts in contact housings

Procedure

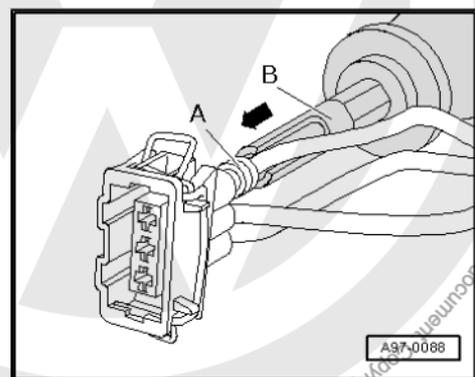
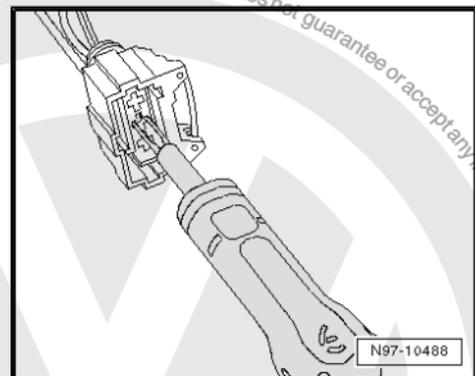
- First open or release secondary locking mechanism of connector housing.
- Release contact (primary locking mechanism) using suitable release tool.
- Pull out contact on single wire from connector housing.
- Select the yellow repair wire with the correct contact from the wiring harness repair set - VAS 1978- / wiring harness repair set - VAS 1978A- / wiring harness repair set - VAS 1978 B- .
- Place wire to be repaired from vehicle's own wiring harness to one side (about 20 cm either side of repair position).
- Remove binding around wiring harness using folding knife.
- Insert new contact of repair wire into connector housing until it is engages.
- Push single wire seal onto repair wire.



Note

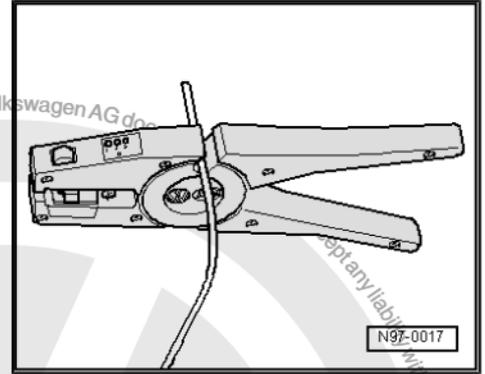
The small diameter of the single wire seal must face the connector housing.

- Push single wire seal into connector housing using correct assembly tool ⇒ [page 127](#) .

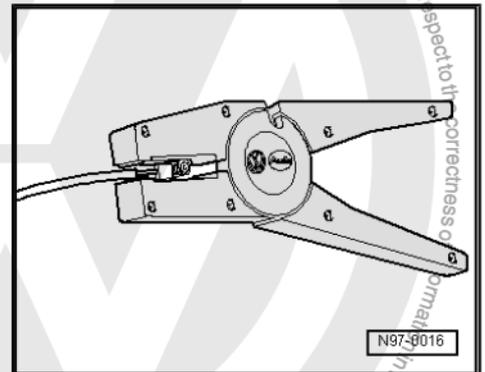




- Trim repair wire and single wire of vehicle's own wiring harness, using wire strippers - VAS 1978/3- .

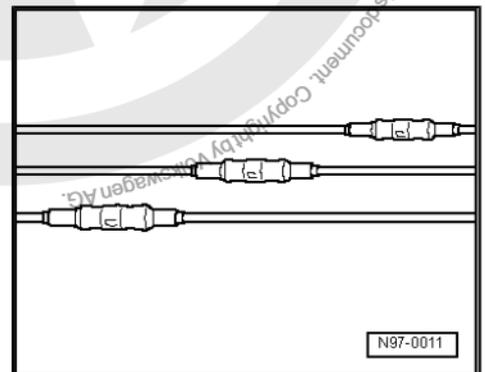


- Strip 6 - 7 mm of insulation from end of repair wire and vehicle's own single wire using wire strippers - VAS 1978/3- .
- Crimp connectors to stripped ends of repair wire and single wire of vehicle's wiring harness using crimping pliers - VAS 1978/1A- as described in chapter "Wiring open circuit with one repair position".



Note

- ◆ *Ensure that, where several wires have to be repaired, the crimp connectors are not directly adjacent to each other. To prevent the circumference of the wiring harness from becoming too great, position the crimp connectors so they are offset slightly.*
- ◆ *If the repair position was already wrapped, this section has to be wrapped again with yellow insulation tape once the repair has been carried out.*
- ◆ *Attach repaired wiring harness with a cable tie to prevent it from generating noise when the vehicle is in motion.*



2.7.3 Fitting single wire seals



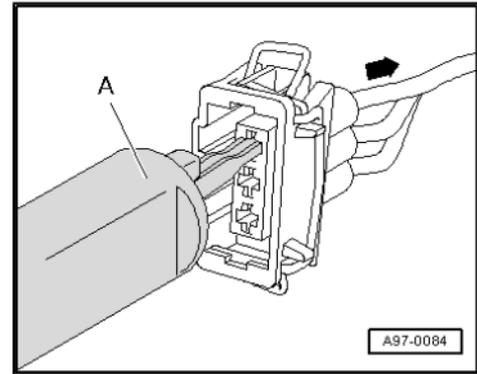
Note

- ◆ *Single wire seals prevent the ingress of moisture and dirt in the connector housing. They are installed in the engine compartment and must be reinstalled following repairs.*
- ◆ *As standard, the single wire seal is crimped together with the contact on the wire; this is not the case with the repair wires. Before crimping the repair line, the single wire seal must therefore first be pushed onto the wire.*
- ◆ *It is essential that the single wire seals are of the correct size to fit the cross section of the repair wire. The outer diameter of the single wire seal is based on the socket diameter of the connector housing. Only carry out the repair using the correct assembly tool.*

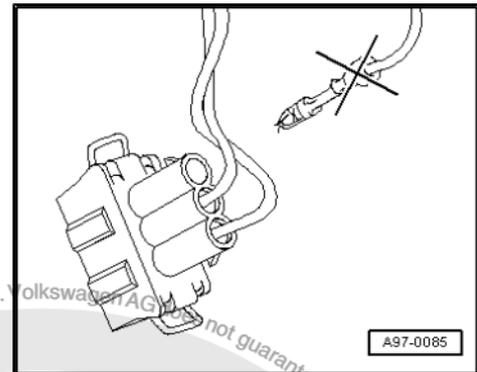


Installing the single wire seal

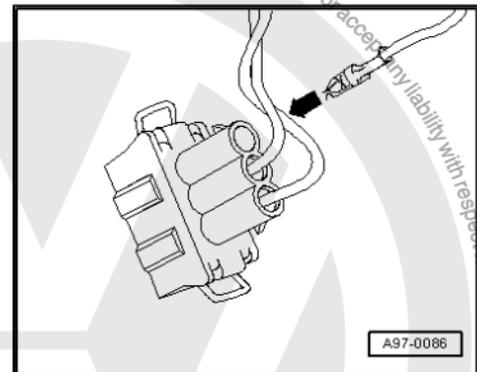
- Disengage contact locking mechanism using appropriate release tool -A- and then pull wire with single wire seal backwards -arrow- out of connector housing.



- Cut out old contact with single wire seal from vehicle's own wiring harness.



- Push repair wire with new contact into respective chamber of connector housing until it engages -arrow-.



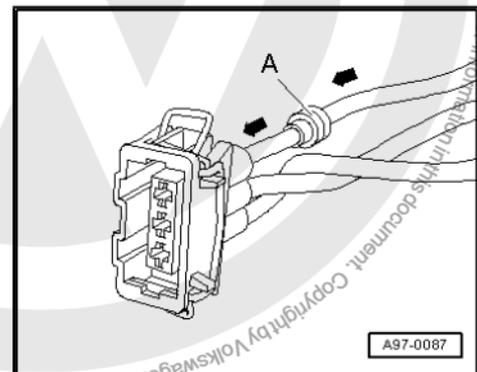
- Place the single wire seal -A- on the free end of the repair wire.



Note

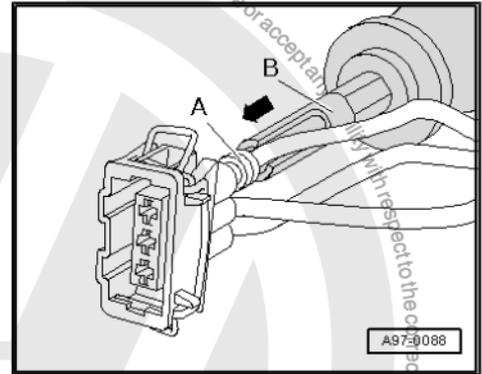
The small diameter of the single wire seal must face the connector housing.

- Push single wire seal -A- on repair wire up to connector housing -arrows-.

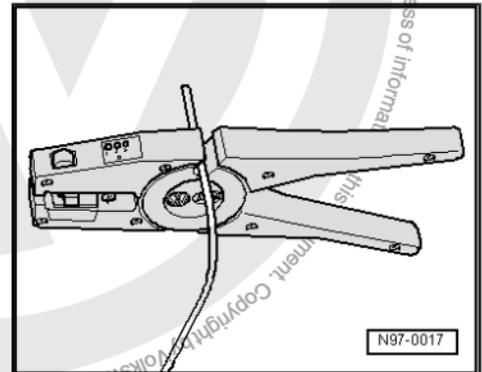




- Push single wire seal -A- fully into connector housing using respective assembly tool -B-.



- Trim repair wire and single wire of vehicle's own wiring harness accordingly using wire strippers - VAS 1978/3- .
- Crimp connectors to stripped ends of repair wire and single wire of vehicle's wiring harness using crimping pliers - VAS 1978/1A- as described in chapter "Wiring open circuit with one repair position".

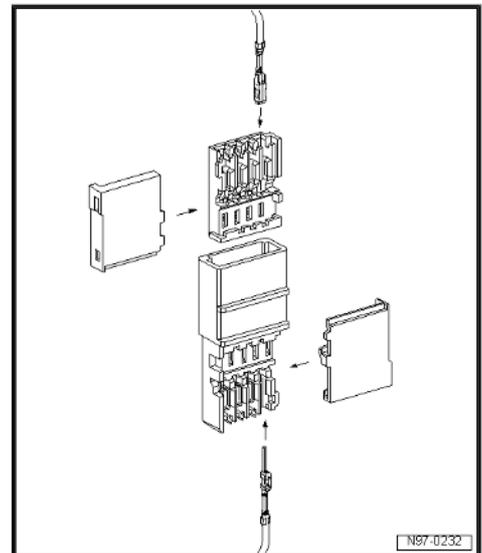


2.7.4 Repairs to contact housings using cut-and-clamp method



Note

- ◆ For technical reasons, the connector housings for the cut and clamp method can only be supplied with the cut and clamp contacts inserted.
- ◆ These contacts can be removed just like in any other connector housing if they are not needed.
- ◆ Repair wires can be supplied that already have the appropriate contacts crimped on ⇒ Electronics parts catalogue "(ETKA)".





2.8 Releasing and dismantling contact housings

⇒ [“2.8.1 Notes on releasing and dismantling contact housings”, page 130](#)

⇒ [“2.8.2 Secondary locking element”, page 130](#)

⇒ [“2.8.3 Primary locking element”, page 131](#)

⇒ [“2.8.4 Round connector systems”, page 131](#)

⇒ [“2.8.5 Flat connector systems”, page 132](#)

⇒ [“2.8.6 Special connector systems”, page 133](#)

2.8.1 Notes on releasing and dismantling contact housings

- ◆ Observe general instructions concerning repairs to vehicle electrical system.
- ◆ Always use release tools specifically intended for releasing purposes. Under no circumstances should the contacts be pulled out of the connector housings with force.
- ◆ Damaged connector housings must be renewed. New connector housings can be ordered via the standard procedure for replacement parts.
- ◆ As an aid to disengage the secondary locking elements, a small screwdriver can be used.
- ◆ The socket/connector-pin assignment can be found stamped on the secondary locking element or on the rear of the connector housing.
- ◆ For more detailed information about the locations of connectors, see ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

Allocation of the correct release tool to the respective locking devices can be gleaned from the table in the ⇒ operating instructions for -VAS 1978/35- .

2.8.2 Secondary locking element

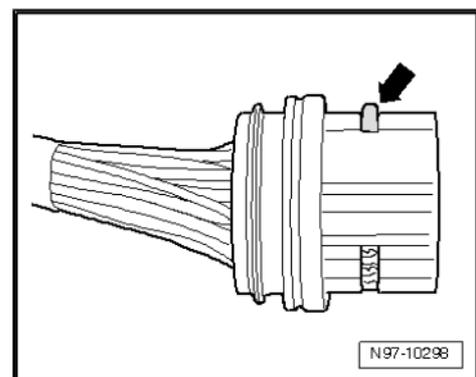
The secondary locking element is a housing catch (second line locking element) that secures all the wires in one connector housing. If a secondary locking element is fitted to a connector housing, this must always be opened or removed using the appropriate tool before releasing and pulling out individual crimp contacts.

The secondary locking element is different in colour from the rest of the connector housing. This makes it easier to identify the secondary locking element and clarifies its intended function.

The types of connector housing shown here are just a few examples to show the different functions of secondary locking element.

Example 1

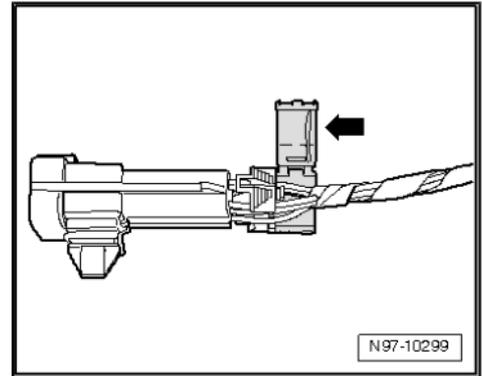
The housing catch is disengaged by removing a “toothed element” -arrow-.





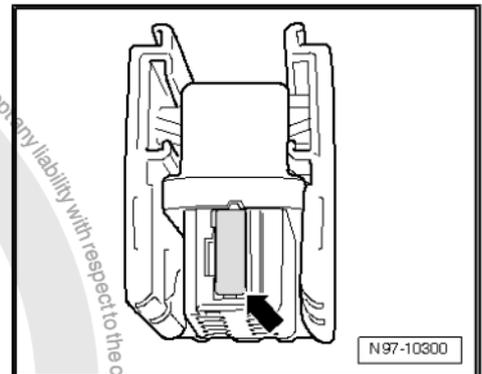
Example 2

The housing catch is disengaged by opening a "flap" -arrow-.



Example 3

The housing catch can be disengaged by detaching a "slide" -arrow-.



2.8.3 Primary locking element

The primary locking element is what fixes an individual crimp contact in the connector housing.

If necessary, any housing catches in place (secondary locking elements) must be released or removed prior to disengaging the contacts using the prescribed tool ⇒ [page 130](#) .

The types of primary locking elements shown as follows are just a few examples to show the different functions of primary locking element.

- ◆ Round connector systems ⇒ [page 131](#)
- ◆ Flat connector systems ⇒ [page 132](#)
- ◆ Special connector systems ⇒ [page 133](#)

The assignment of the correct release tool to the respective locking device is indicated by the table in the ⇒ operating instructions of -VAS 1978/35- .

2.8.4 Round connector systems

Any housing catches in place (secondary locking mechanisms) must be released or removed prior to disengaging the contacts using the prescribed tool ⇒ [page 130](#) .



- Insert corresponding connector housing release tool in release port of connector housing.
- Hold contact on wire and push into connector housing lightly -arrow-.

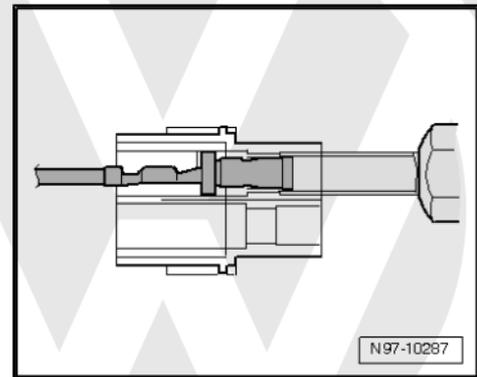
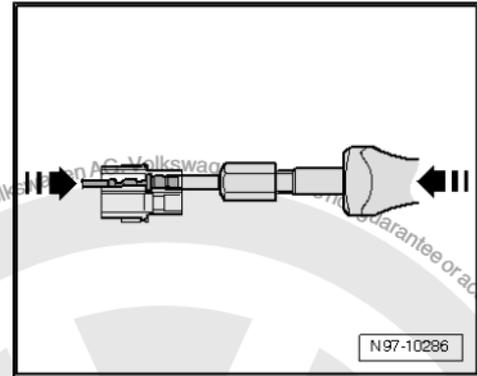


Note

By pushing the contact in the direction of the connector housing, the locking tabs of the contact are lifted up by the housing edge and can be disengaged 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.

The release tool can be pulled out of the connector housing again once the contact has been removed.



2.8.5 Flat connector systems

Any housing catches in place (secondary locking mechanisms) must be released or removed prior to disengaging the contacts using the prescribed tool ⇒ [page 130](#) .

Flat connector with one locking tab

- Insert corresponding connector housing release tool in release port of connector housing.
- Hold contact on wire and push into connector housing lightly -arrow-.



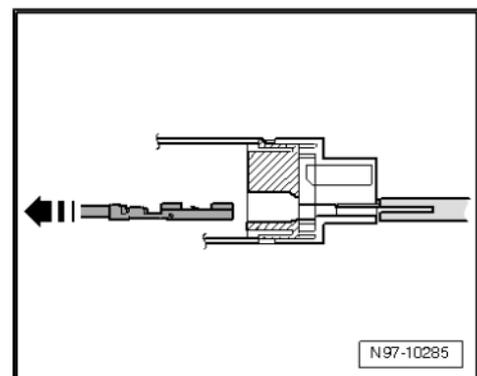
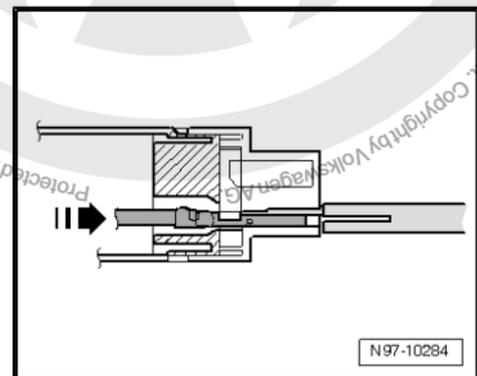
Note

By pushing the contact in the direction of the connector housing, the locking tab of the contact is lifted up by the housing edge and can be disengaged 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-.

The release tool can be pulled out of the connector housing again once the contact has been removed.

Flat connector with 2 locking tabs

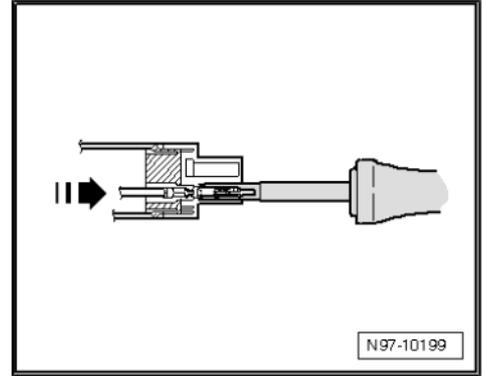




- Insert corresponding connector housing release tool in release port of connector housing.
- Hold contact on wire and push it into connector housing -arrow- as far as it will go.

i Note

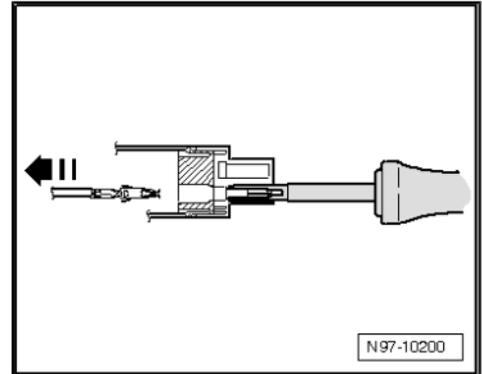
By pushing the contact in the direction of the connector housing, the locking tabs of the contact are lifted up by the housing edge and can be disengaged using the release tool.



- 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-.

The release tool can be pulled out of the connector housing again once the contact has been removed.

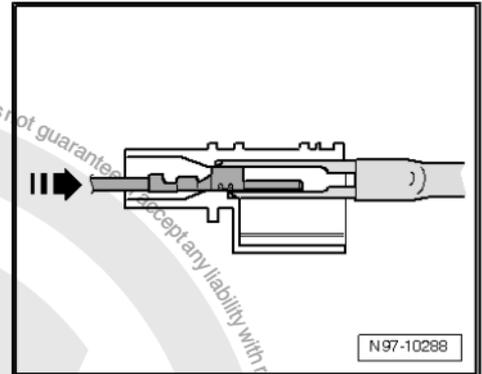
Asymmetrical



- Insert corresponding connector housing release tool in release port of connector housing.
- Hold contact on wire and push into connector housing lightly -arrow-.

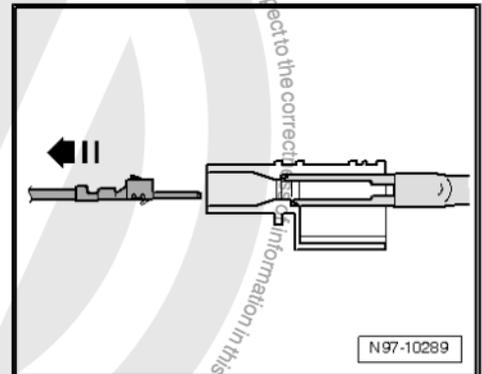
i Note

By pushing the contact in the direction of the connector housing, the locking tabs of the contact are lifted up by the housing edge and can be disengaged 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-.

The release tool can be pulled out of the connector housing again once the contact has been removed.



2.8.6 Special connector systems

Any housing catches in place (secondary locking mechanisms) must be released or removed prior to disengaging the contacts using the prescribed tool => [page 130](#).



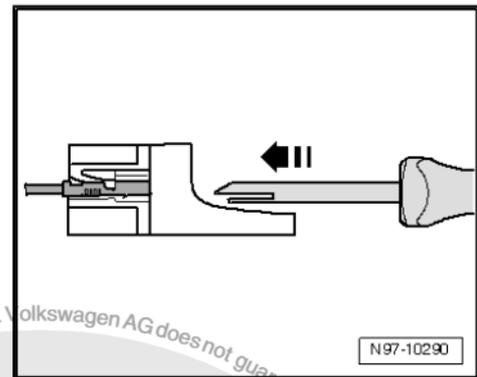
Faston contacts

- Insert corresponding connector housing release tool in release port of connector housing -arrow-.
- Hold contact on wire and push into connector housing lightly.



Note

By pushing the contact in the direction of the connector housing, the locking tabs of the contact are lifted up by the housing edge and can be disengaged using the release tool.

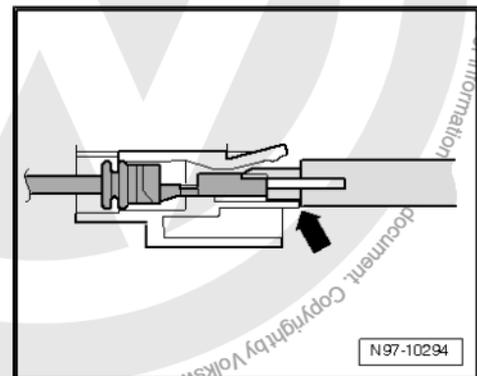
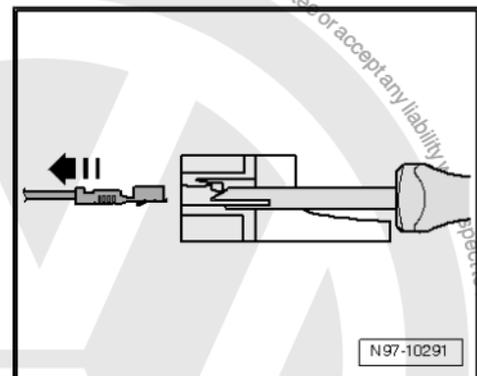


- At the same time, push the release tool in the direction of the connector housing and pull the released contact out of the connector housing -arrow-.

The release tool can be pulled out of the connector housing again once the contact has been removed.

GT 150/280 contacts

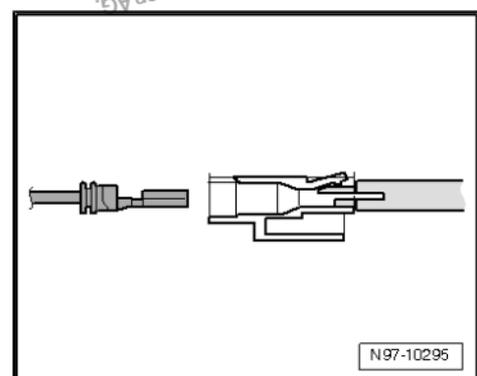
- Insert corresponding connector housing release tool into connector housing by guiding it below locking tab.
- Press the tool as far as it will go -arrow- into the connector housing.



The contact is ejected from the connector housing.

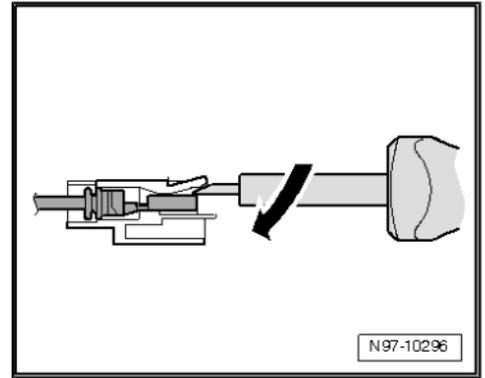
The release tool can be pulled out of the connector housing again once the contact has been ejected.

Contacts without locking tabs

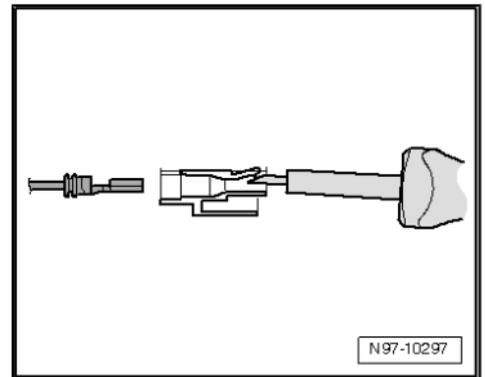




- Insert release tool under locking tab of connector housing.
- Push release tool onto stop, lifting slightly while doing so -arrow-.



The contact is ejected from the connector housing.





3 Cleaning contact surfaces

⇒ ["3.1 Contact surface cleaning set VAS 6410", page 136](#)

3.1 Contact surface cleaning set - VAS 6410-

⇒ ["3.1.1 Using the contact surface cleaning set VAS 6410", page 136](#)

⇒ ["3.1.2 Repairing ring terminals", page 136](#)

⇒ ["3.1.3 Repairing threaded connections", page 138](#)

⇒ ["3.1.4 Cleaning battery terminals", page 139](#)

⇒ ["3.1.5 Anti-corrosion treatment", page 140](#)

3.1.1 Using the contact surface cleaning set - VAS 6410-

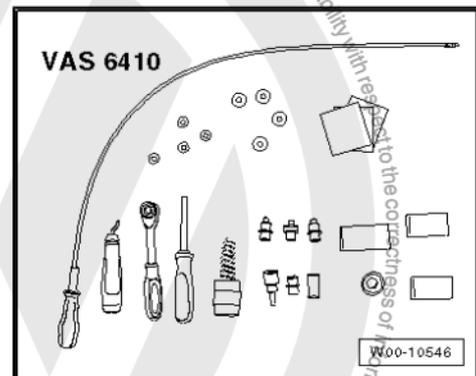
The contact surface cleaning set - VAS 6410- allows optimal repair quality to be achieved in the area of vehicle electrics. The tools allow performing repair work in the area of the sensor in wiring harnesses for threaded connections in the high-current circuit (starting and charge current). The easy-to-use contact surface cleaning set - VAS 6410- has been designed to match the structural design of the vehicles and ensures that repairs are carried out correctly.



Note

The illustrations shown here are just a few examples of repair work.

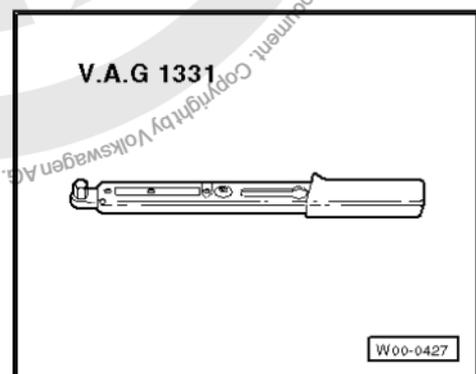
Contact surface cleaning set - VAS 6410-



3.1.2 Repairing ring terminals

Special tools and workshop equipment required

- ◆ Torque wrench - V.A.G 1331-





i Note

- ◆ *The use of penetrating fluid, contact spray or grease is prohibited since the lack of adhesion in the threads may cause a torque excess and, therefore, the breaking of the threaded connection.*
- ◆ *The grey sanding pads are suitable for light dirt and "soft surfaces". The red sanding pads are suitable for heavy dirt and "hard surfaces".*



WARNING

Danger of injury! Comply with the warning notices and safety regulations => [page 3](#)!

Procedure

- Disconnect battery - A- => Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .
- Loosen captivated nut and remove ring terminal from threaded connection.
- Check ring terminal for corrosion and dirt.
- Select matching adapter and respective sanding pad.

i Note

As an alternative, the sanding block may also be used.



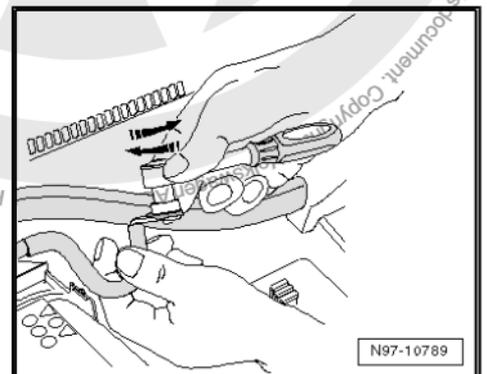
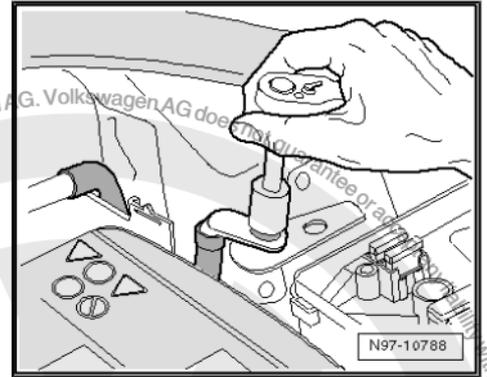
Caution

Take care not to excessively abrade the layer of tin so that the copper underneath becomes exposed. This could produce a galvanic cell which destroys metal and causes faulty repair.

i Note

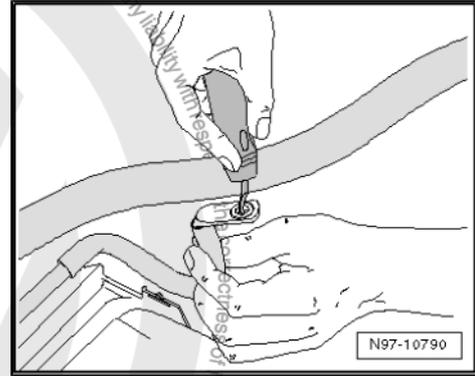
As the thickness of the tin coating may differ according to the design, the cleaning process must be performed step by step and a visual check of the ring terminal is necessary between the steps.

- Position adapter in ring terminal and remove corrosion and dirt with circular motion.
- Check ring terminal and clean with emery paper.





- Remove burring around hole of ring terminal using the deburring tool.
- Bolt on ring terminal, and tighten it to specified torque ⇒ Electrical system; Rep. gr. 97 ; Relay carriers, fuse carriers, electronics boxes; Overview of fitting locations – relay carriers, fuse carriers, electronics boxes , or ⇒ Electrical system; Rep. gr. 27 ; Battery; Assembly overview – battery .
- Apply appropriate anti-corrosion treatment to connection, ⇒ [page 140](#)
- Connect battery - A- ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .



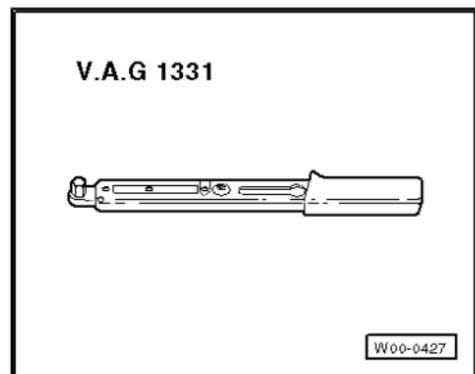
WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#) !

3.1.3 Repairing threaded connections

Special tools and workshop equipment required

- ◆ Torque wrench - V.A.G 1331-



Note

- ◆ *The use of penetrating fluid, contact spray or grease is prohibited since the lack of adhesion in the threads may cause a torque excess and, therefore, the breaking of the threaded connection.*
- ◆ *The grey sanding pads are suitable for light dirt and "soft surfaces". The red sanding pads are suitable for heavy dirt and "hard surfaces".*



WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#) !

Procedure

- Disconnect battery - A- ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .

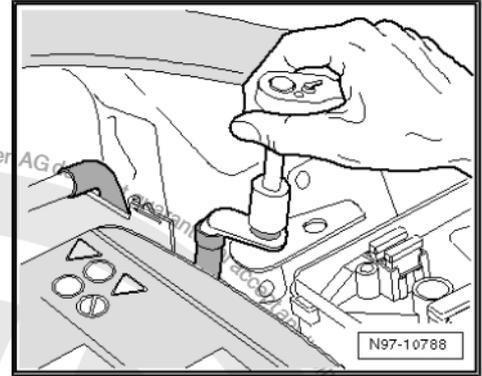


- Loosen captivated nut and remove ring terminal from threaded connection.
- Check threaded connection for corrosion and dirt.
- Select corresponding adapter and appropriate sanding pad for threaded connection.



Caution

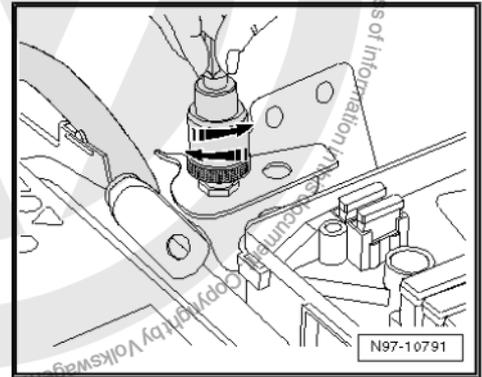
Take care not to excessively abrade the layer of tin so that the copper underneath becomes exposed. This could produce a galvanic cell which destroys metal and causes faulty repair.



Note

As the thickness of the tin coating may differ according to the design, the cleaning process must be performed step by step and a visual check of the ring terminal is necessary between the steps.

- Position adapter on threaded connection and remove corrosion and dirt with circular motion.
- Check threaded connection and clean with emery paper.
- Tighten connection and locating element to specified torque
⇒ Electrical system; Rep. gr. 97 ; Relay carriers, fuse carriers, electronics boxes; Overview of fitting locations – relay carriers, fuse carriers, electronics boxes , or ⇒ Electrical system; Rep. gr. 27 ; Battery; Assembly overview – battery .
- Apply appropriate anti-corrosion treatment to threaded connection ⇒ [page 140](#)
- Connect battery - A- ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .



WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#) !

3.1.4 Cleaning battery terminals

Special tools and workshop equipment required

- ◆ Torque wrench - V.A.G 1331-

V.A.G 1331



W00-0427



Note

The use of penetrating fluid, contact spray or grease is prohibited since the lack of adhesion in the threads may cause a torque excess and, therefore, the breaking of the threaded connection.



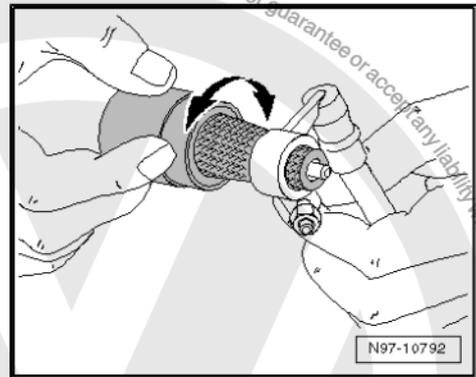
WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#)!

Procedure

- Disconnect battery - A- ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .
- Check battery terminal clamp and battery terminal for corrosion and dirt.

Clean battery terminal clamp using wire brush of battery terminal cleaner with circular movements.



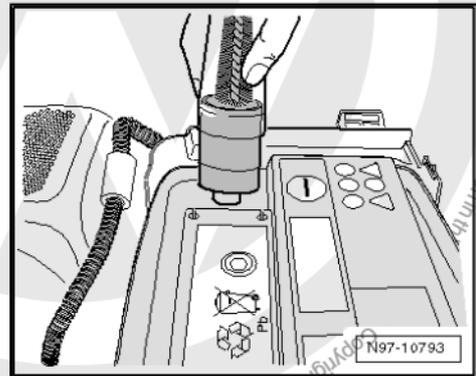
Clean battery terminal using underside of battery terminal cleaner with circular movements.



WARNING

Danger of injury! Comply with the warning notices and safety regulations ⇒ [page 3](#)!

- Connect battery - A- ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .



3.1.5 Anti-corrosion treatment



Caution

Missing anti-corrosion treatment results in damage to the on-board supply.

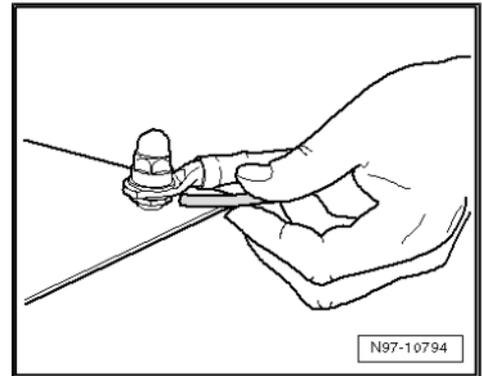


i Note

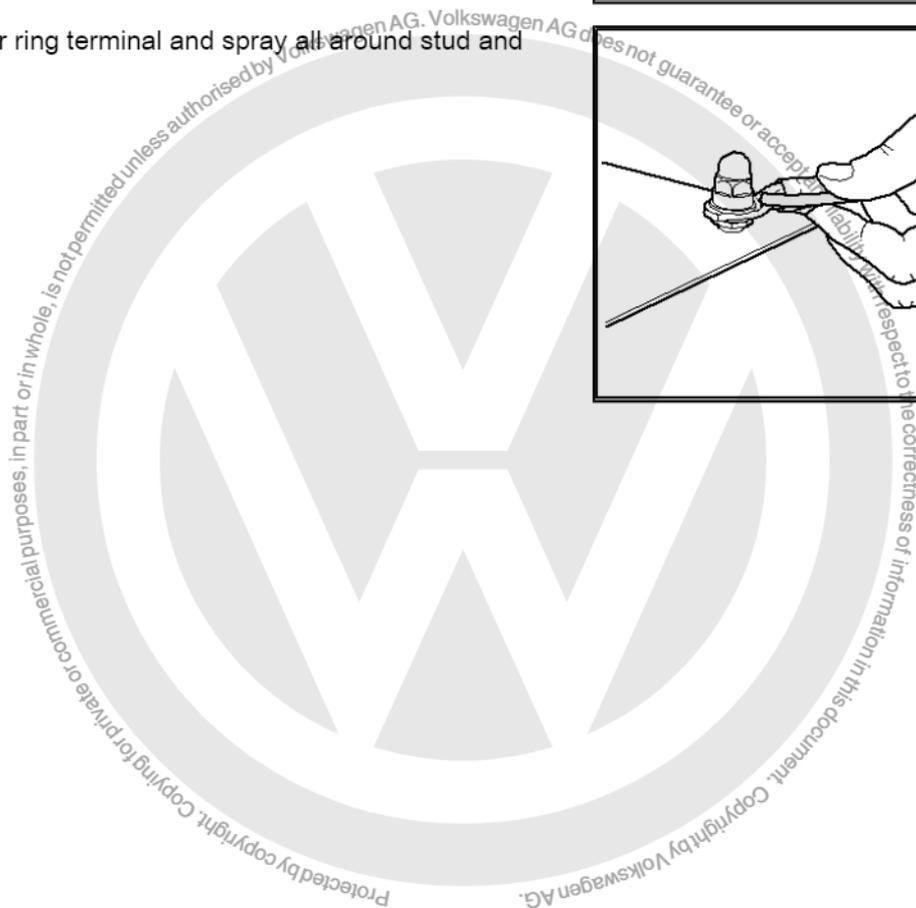
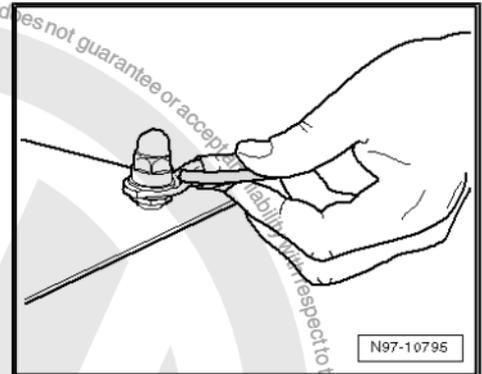
- ◆ *All threaded connections must be tightened to specified tightening torque.*
- ◆ *Use hose supplied with anticorrosive agent tin.*
- ◆ *Use protection wax for cold area.*
- ◆ *Use cavity sealing agent for warm area.*
- ◆ *The sealing agent independently reaches the respective points through capillary action.*

Procedure

- Hold nozzle under ring terminal and spray all around stud.



- Hold nozzle over ring terminal and spray all around stud and ring terminal.





4 Renewing Lambda probe

⇒ "4.1 Renewing LSF Lambda probe (4-pin)", page 142

⇒ "4.2 Renewing LSU Lambda probe (6-pin)", page 142

⇒ "4.3 Types of protective tube on uniform Lambda probes", page 143

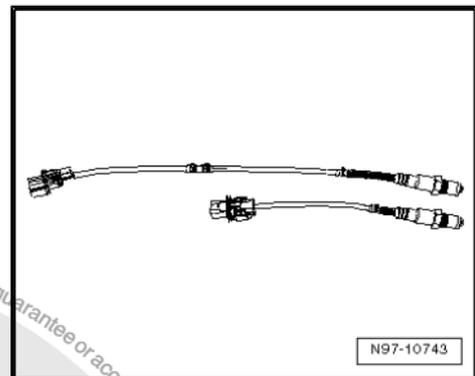
4.1 Renewing LSF Lambda probe (4-pin)

If necessary, replace attachment parts, cable ties or marking rings to match the Lambda probe to the defective Lambda probe as specified.

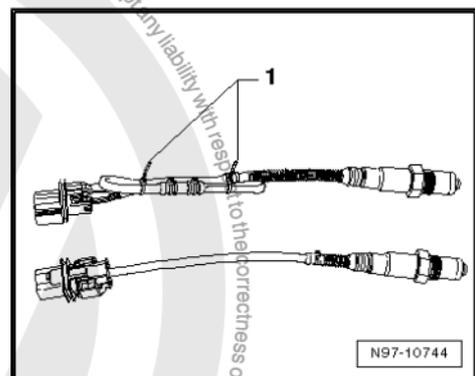
Do not repair Lambda probe wires, since this can result in malfunctions.

Procedure

- Remove defective lambda probe.
- Place both Lambda probes next to each other so that sensor housings are at same height.



- Tie back any excess in the uniform probe length (approx. 50 - 250 mm) to the size of the defective Lambda probe and secure with cable ties.
- Check that the connector housing of the Lambda probe is compatible with the onboard supply side.
- Replace onboard power supply connector with supplied connector housing of the Lambda probe ⇒ [page 126](#) .



Note

- ◆ *The connector housing should only be replaced on older vehicles. On new vehicles, the connector housing coding matches.*
 - ◆ *Bear plug assignment in mind. For reasons of clarity, respective pins in new connector housing have a colour marking.*
 - ◆ *Further notes can be found in the leaflet of the new Lambda probe.*
- Install new Lambda probe in vehicle.

4.2 Renewing LSU Lambda probe (6-pin)

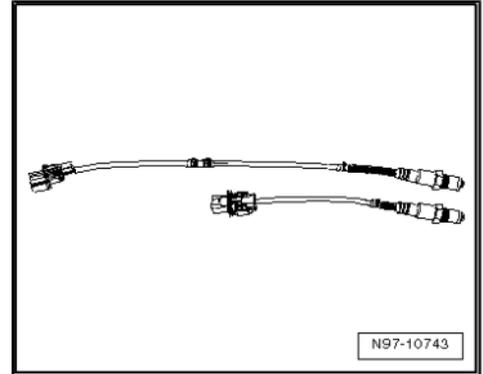
If necessary, replace attachment parts, cable ties or marking rings to match the Lambda probe to the defective Lambda probe as specified.

Do not repair Lambda probe wires, since this can result in malfunctions.

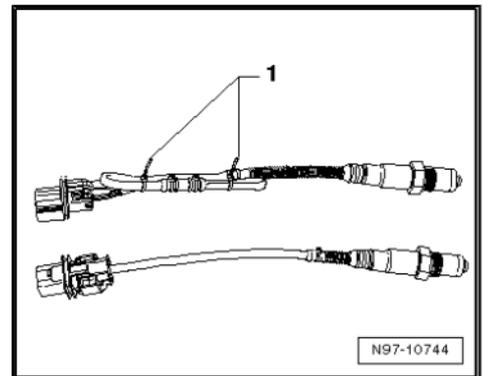


Procedure

- Remove old Lambda probe.
- Place both Lambda probes next to each other so that sensor housings are at same height.



- Tie back any excess in the uniform probe length (approx. 50 - 250 mm) to the size of the defective probe and secure with cable ties -1-.
- Install new Lambda probe in vehicle.



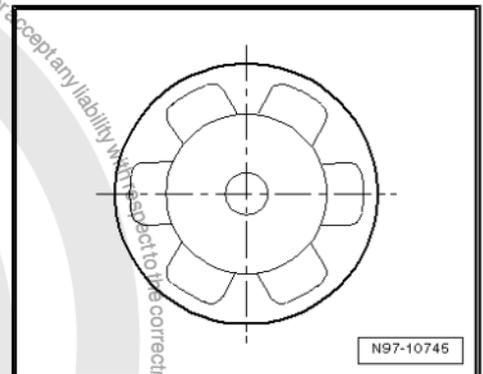
4.3 Types of protective tube on uniform Lambda probes



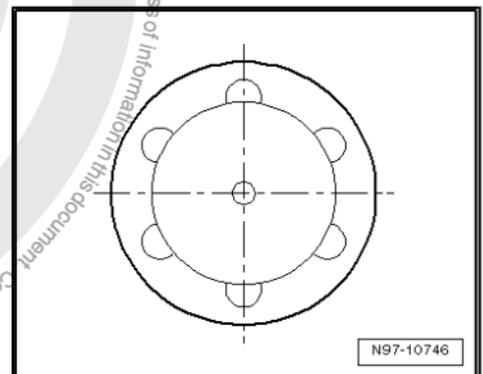
Note

In addition to identifying by way of the part number, the protective tube can also be used as a means of identification.

Type D1: 6 openings at 3.5 mm each
Only used on 4-pin LSF Lambda probes.



Type D2: 6 openings at 2 mm each
Only used on 4-pin LSF Lambda probes and 6-pin LSU Lambda probes.





Type D4: 12 openings at 1.4 mm each

Only used on 4-pin LSF Lambda probes and 6-pin LSU Lambda probes.

