



97 – Wiring

1 Vehicle diagnostic, testing and information systems



WARNING

- ◆ *During testing or measuring operations using a vehicle diagnostic information system, there is a risk of serious or even fatal injury!*
- ◆ *If the vehicle diagnostic information system 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 operations, work with a person who can operate the vehicle diagnostic and information system from one of the back seats.*



Note

- ◆ *All the operations described, e.g. adaptation, coding, etc. can be performed using the vehicle diagnostic tester.*
- ◆ *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
- Connecting vehicle diagnostic tester ⇒ [page 78](#)

1.1 Connecting vehicle diagnostic tester



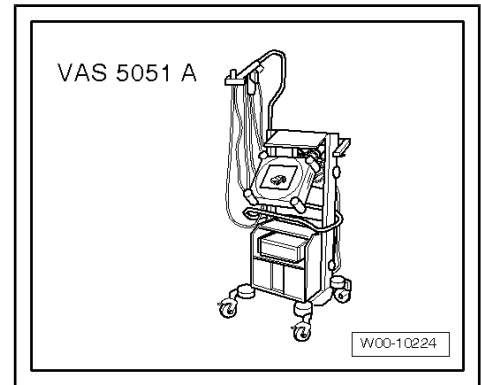
Note

Observe the latest operating instructions for vehicle diagnostic tester, which are displayed after selecting the „Administration“ and „Operating Manual“ keys.

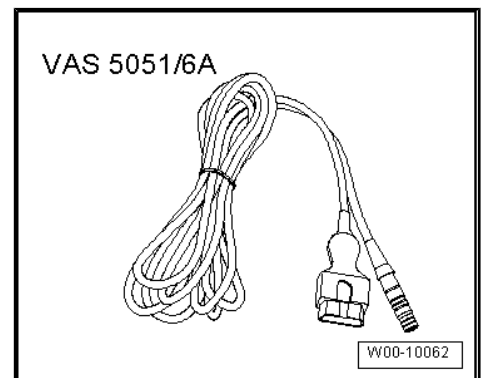
Special tools and workshop equipment required



◆ Vehicle diagnostic tester



◆ Diagnostic cable -VAS 5051/6A- (5 m)



◆ Diagnostic cable -VAS 5051/5A- (3 m)



Note

Only these cables are to be used for diagnosis, as they are the only ones fitted with CAN wiring and therefore allowing CAN diagnosis and/or CAN communication.

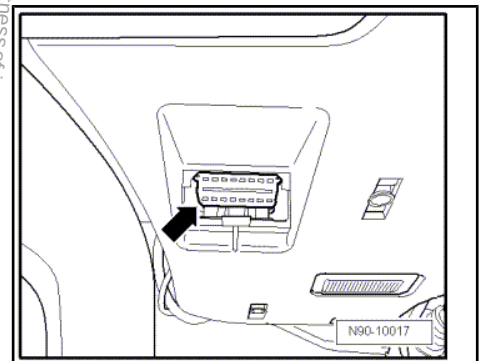
Connecting vehicle diagnostic tester :

- Apply handbrake.
- Vehicles with automatic gearbox, move selector lever to position „P“ or „N“.
- Vehicles with manual gearbox, move gearstick to neutral position.
- With ignition switched off, connect vehicle diagnostic tester using diagnostic cable -VAS 5051/6A- to diagnostic interface -arrow- in vehicle.
- Switch on ignition.
- Switch off all electrical consumers.



Note

All other and the following vehicle diagnostic, testing and information systems or vehicle diagnostic and service information systems are connected accordingly in the sequence described above.





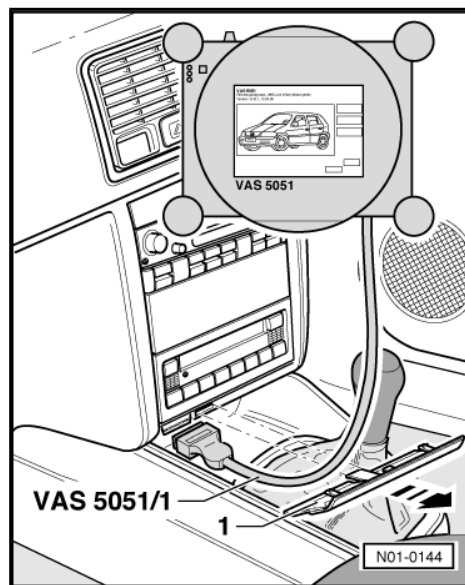
1.2 Connecting vehicle diagnostic tester Golf Model Year 1998 - 2003

- Apply handbrake.
- Vehicles with automatic gearbox, move selector lever to position „P“ or „N“.
- Vehicles with manual gearbox, move gear lever to neutral position.
- Pull out trim -1- in direction of arrow.
- With ignition switched off, connect vehicle diagnostic tester using diagnostic cable to diagnostic interface -arrow- in vehicle.
- Switch on ignition.
- Switch off all electrical consumers.



Note

All other and the following vehicle diagnosis, testing and information systems or vehicle diagnostic and service information systems are connected accordingly in the sequence described above.





2 Repairing wiring harnesses and connectors

2.1 Wiring harness repair set

2.1.1 Wiring harness repair set -VAS 1978-

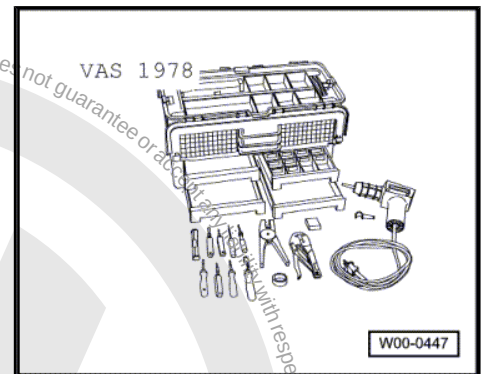
Wiring harness repair set -VAS 1978- allows optimal repair quality to be achieved in the area of vehicle electrics. Using the tools, repairs to connectors and wiring open circuits can be carried out. To do this, complete repair wire sections with contacts already crimped on are used and joined to the vehicle's own wiring harness with the aid of crimp connectors. A special set of pliers with three different crimp recesses and a hot air blower for shrinking the crimp connectors make a perfect electrical connection.



Note

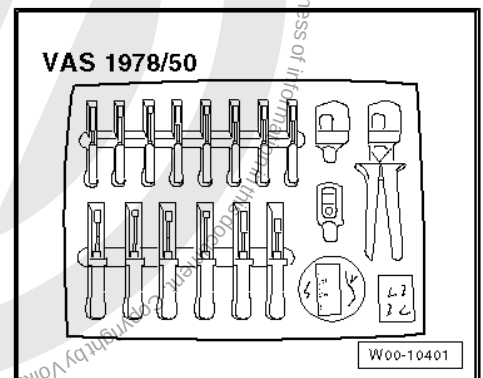
Additional information:

⇒ Operating instructions Wiring harness repair set -VAS 1978-



2.1.2 Upgrade kit -VAS 1978/50-

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 1978A-. The upgrade kit comprises of 4 assembly and 10 release tools, a new set of crimping pliers for crimp connectors with head adapter 0.35 - 2.5 mm² -VAS 1978/1-1- , 4.0 - 6.0 mm² -VAS 1978/2 A- and head adapter for JPT contacts -VAS 1978/9-1- . Also included are new stickers, a new set of operating instructions, crimp connectors for 0.35 mm² cable cross-section and a roll of black felt adhesive tape.



2.1.3 Wiring harness repair set -VAS 1978A-

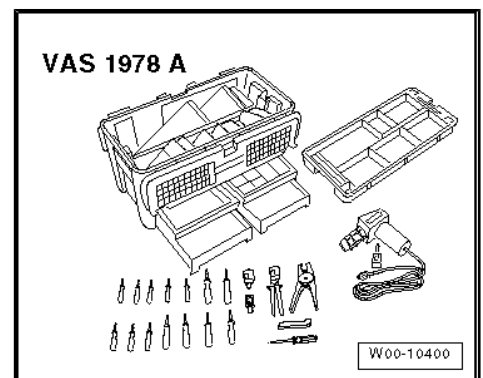
The new wiring harness repair set -VAS 1978A- allows optimal repair quality to be achieved in the area of vehicle electrics. Using the new pliers, repairs to connectors and wiring open circuits can be carried out. To do this, complete repair wire sections with contacts already crimped on are used and joined to the vehicle's own wiring harness with the aid of four different types of crimp connectors. A new set of crimping pliers with head adapters and a hot air blower for shrinking the crimp connectors make a perfect electrical connection.



Note

Additional information:

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

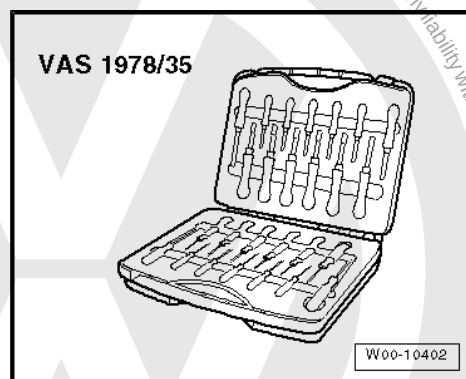




2.1.4 Release tool set -VAS 1978/35-

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

Allocation of the correct release tool to the respective locking devices can be gleaned from the table in the ➔ operating instructions of -VAS 1978/35- .

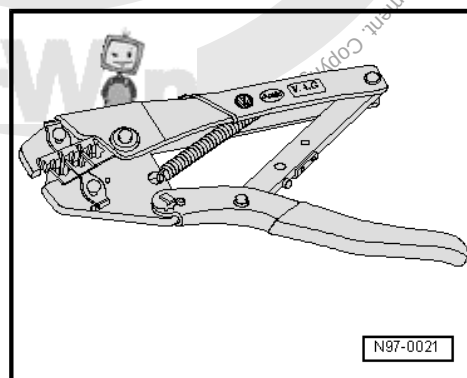


2.2 Tool descriptions

2.2.1 Special pliers with insert

The special pliers without insert -VAS 1978/1- with insert for special pliers -VAS 1978/2- is part of the wiring harness repair set -VAS 1978- and is 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 - 1.0 mm ²
Blue	Blue	1.5 mm ² - 2.5 mm ²
Yellow.	Yellow.	4.0 mm ² - 6.0 mm ²



Note

- ◆ As an alternative, the connectors can also be crimped with crimping pliers (base tool) -VAS 1978/1-2- in conjunction with head adapters -VAS 1978/1-1- or -VAS 1978/2A- ➔ [page 84](#) .
- ◆ 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.



2.2.2 Release tools for contacts

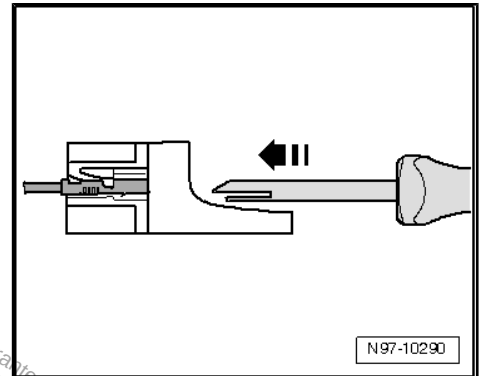
The various release tools serve as a means of detaching the different contacts from the contact housings without damage.

A selection of release tools is included in wiring harness repair set -VAS 1978- and wiring harness repair set -VAS 1978A-. The complete set of release tools is included in release tool set -VAS 1978/35- ➔ [page 82](#) .



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.



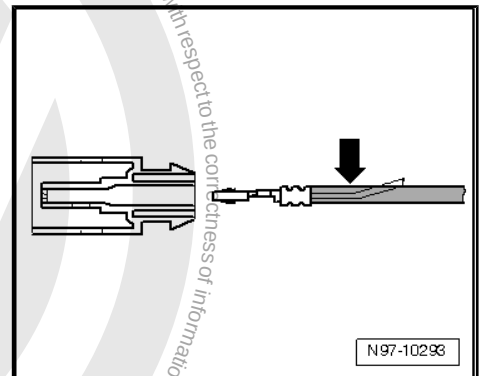
Releasing and dismantling contact housings ➔ [page 102](#) .

2.2.3 Assembly tools for single wire seals

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

Four assembly tools for single wire seals are included in each wiring harness repair set -VAS 1978 B- and previous versions.

Assembling single wire seals ➔ [page 99](#) .



2.2.4 Wire strippers -VAS 1978/3-

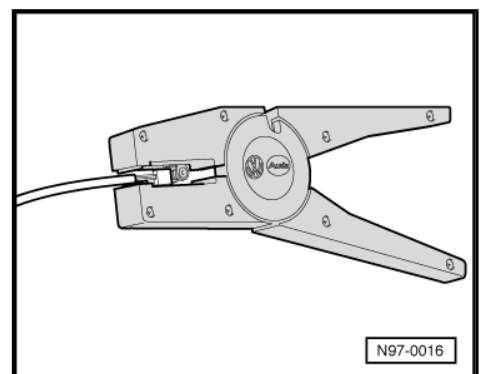
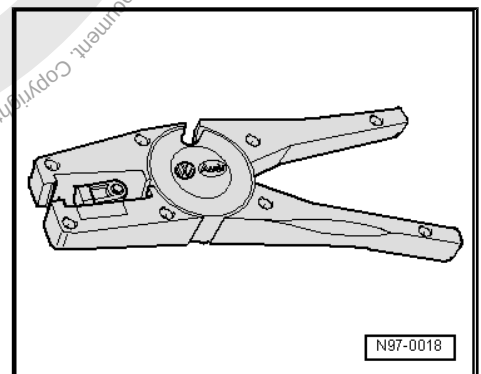
Wire strippers -VAS 1978/3- serve as a means of stripping insulation off wires and cutting wires in the correct manner.

Wire strippers -VAS 1978/3- are included in wiring harness repair set -VAS 1978 B- and previous versions.

The wire strippers have an adjustable limit stop within the pliers jaws, with which the desired length of insulation to be removed can be adjusted.

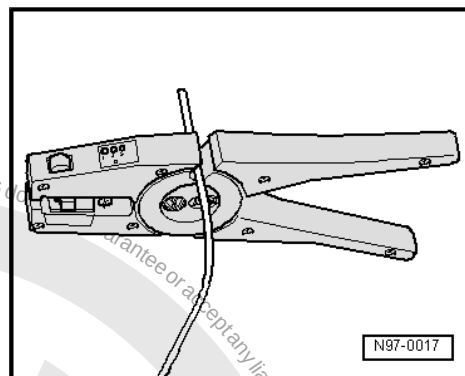
Stripping:

- Adjust the sliding limit stop in the pliers jaws to the desired length of insulation to be removed.
- 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.





- Cut the wire if necessary with the cutting part on the upper side of the wire strippers.



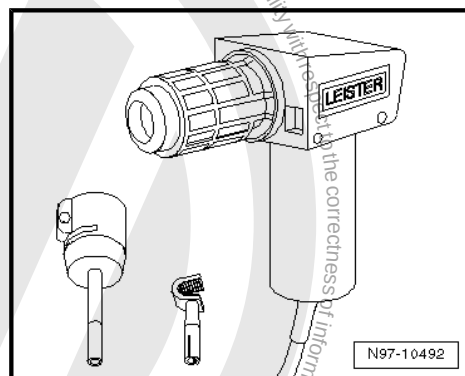
2.2.5 Hot air blower, 220 V / 50 Hz -VAS 1978/14-



Caution

When shrink-fitting, take care not to damage any other wiring, plastic parts or insulating material with the hot air blower.

Observe the operating instructions of the hot air blower without fail!



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 in order to prevent any ingress of moisture.

Hot air blower, 220 V/50 Hz -VAS 1978/14- is included in wiring harness repair set -VAS 1978 B- and previous versions.

Shrink fitting crimp connectors using hot air blower, 220 V / 50 Hz -VAS 1978/14- ➔ [page 94](#) , or ➔ [page 96](#) .

2.2.6 Crimping pliers -VAS 1978/1A-

Crimping pliers -VAS 1978/1A- or crimping pliers (base tool) -VAS 1978/1-2- together with head adapter 0.35 - 2.5 mm² -VAS 1978/1-1- or head adapter 4.0 - 6.0 mm² -VAS 1978/2A- are used to squeeze together crimp connectors from the wiring harness repair sets.

Crimping connectors using crimping pliers -VAS 1978/1A- ➔ [page 96](#) .

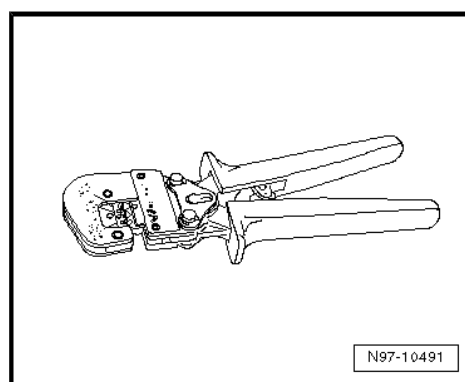
The following heads adapters are available for crimping pliers (base tool) -VAS 1978/1-2- :

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

In conjunction with head adapter for JPT contacts -VAS 1978/9-1- , the crimping pliers are used to crimp contacts to single wires during repairs to wiring with cross sections up to 0.35 mm² ➔ [page 91](#) .

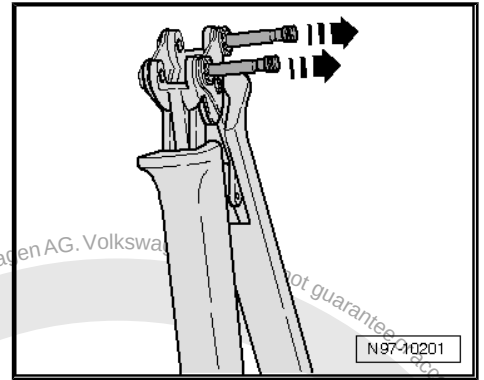
Interchanging head adapter:

- Open up the crimping pliers fully.

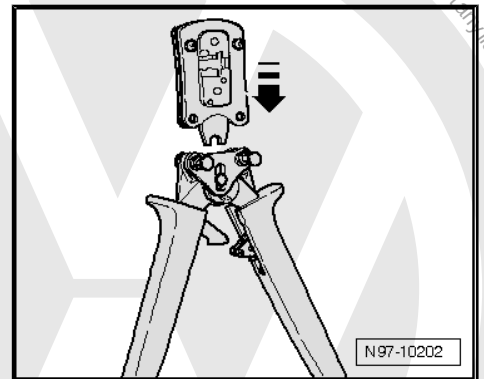




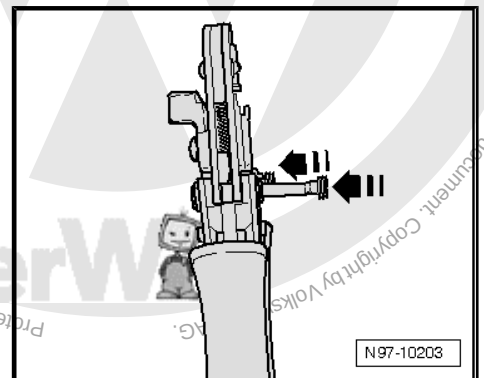
- Unclip both locking pins -arrows- from the body of the crimping pliers.



- Insert the required head adapter from above -arrow- in the body of the crimping pliers.



- Lock the head adapter by engaging the pins -arrows- in the body of the crimping pliers.



2.3 General notes concerning repairs to vehicle electrical system



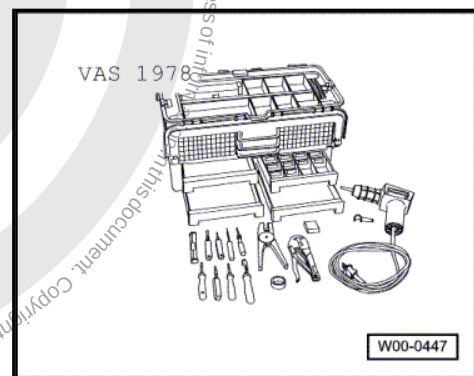
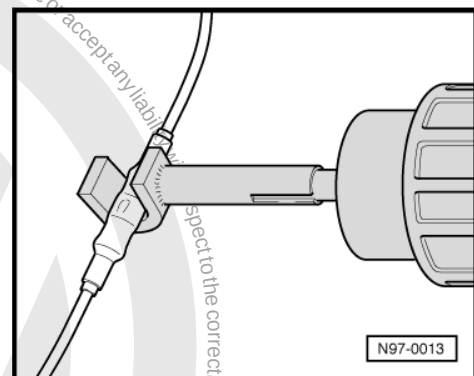
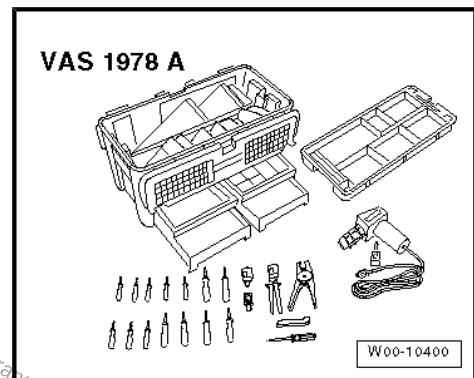
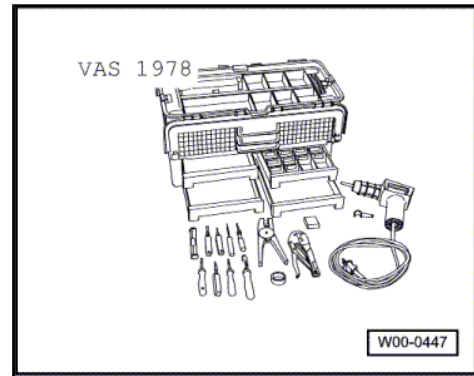
Caution

When batteries are disconnected and reconnected, the procedure described in the workshop manual must be strictly observed.



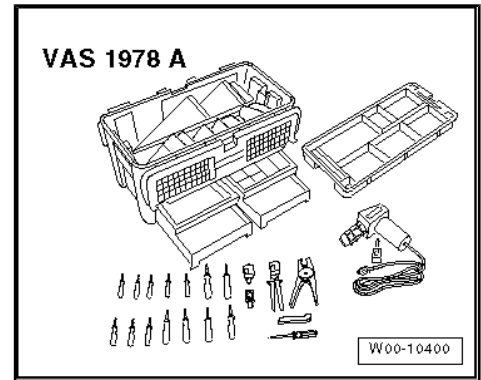
WARNING

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 the battery earth strap before working on the electrical system. Disconnecting the battery earth strap (open circuit) provides a safe working environment for repairs to the electrical system. The battery positive wire need only be disconnected for removal of the battery.
- ◆ Before starting a repair, it is important to identify and rectify the cause of damage (e.g. sharp edges on body panels, defective electrical components, corrosion, etc.).
- ◆ For additional information, e.g. 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 vehicle electrical system should be carried out using wiring harness repair set -VAS 1978 B- and previous versions only. Only use yellow wires from wiring harness repair set -VAS 1978 B- .
- ◆ 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. This indicates a previous repair.
- ◆ Crimp connectors may never be repaired. If necessary, lay wiring parallel to the defective wiring. After crimping, crimp connectors must be shrink fitted using the hot air blower in order to prevent any ingress of moisture.
- ◆ It is essential that the supplementary information is observed regarding repairs to wiring harnesses in airbag and belt tensioner systems, fibre optic cables, CAN bus lines, aerial cables and wiring with cross sections up to 0.35 mm^2 ➔ [page 91](#) .
- ◆ Carry out a function test after every repair. It may be necessary for the fault memory to be interrogated, erased and/or for the systems to be reset.
- ◆ If possible, 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.



2.4 Repairs to wiring harnesses



Note

Observe the general notes on repairs to the vehicle electrical system ➔ [page 85](#) .

Notes on repairs to airbag and belt tensioner wiring ➔ [page 88](#)

Notes on repairs to fibre optic cables ➔ [page 89](#)



Notes on repairs to CAN bus wiring ➔ [page 90](#)

Notes on replacement of aerial cables ➔ [page 90](#)

Notes on repairs to wiring with cross sections up to 0.35 mm²
➔ [page 91](#)

Notes on repair of wiring open circuit with one repair position
➔ [page 94](#)

Notes on repair of wiring open circuit with two repair positions
➔ [page 96](#)

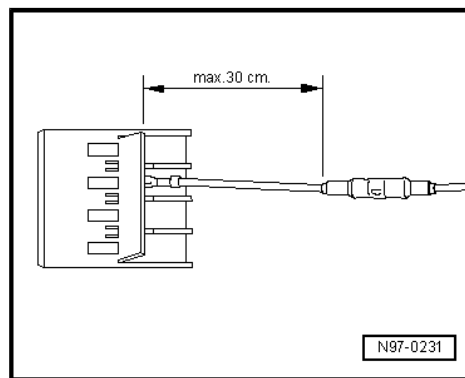
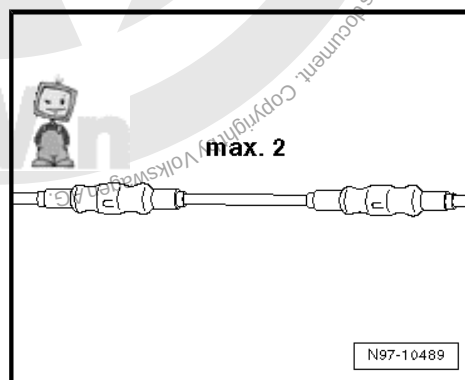
2.4.1 Notes on repairs to airbag and belt tensioner wiring

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



WARNING

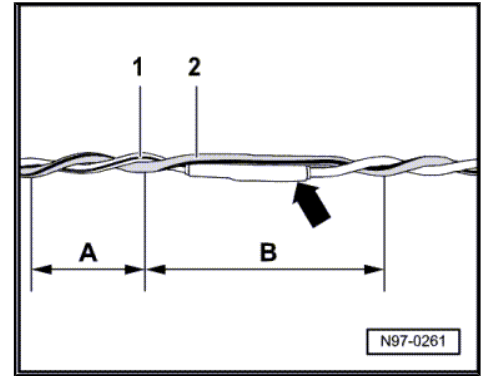
- ◆ *Airbag and seat belt tensioner can fail.*
- ◆ *Faulty repairs to the airbag and seat belt tensioning system can cause malfunctions in the passenger protection system.*
- ◆ *For repairs to airbag and belt tensioner wiring harnesses, only contacts, connectors and wiring designed specifically for this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





Note

- ◆ Wires from airbag and belt tensioner wiring harness are only allowed to be repaired using wiring harness repair set -VAS 1978 B- and previous versions.
- ◆ Observe the general notes on repairs to the vehicle electrical system ➔ [page 85](#).
- ◆ Observe vehicle stickers indicating high voltage components. Before carrying out repairs, discharge residual voltage ➔ General body repairs, interior; Rep. gr. 69; Occupant safety.
- ◆ For repairs to wiring in the airbag and belt tensioner system, a maximum of two positions may be repaired. 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 are always to be shrink-fitted when performing airbag or belt tensioner wiring harness repairs.
- ◆ Do not incorporate the repaired wiring back in the vehicle's own wiring harness and mark the area of repair clearly with yellow insulating tape.
- ◆ Repairs in the area of the airbag or belt tensioner should not be more than 30 cm from the next contact housing. Together with the yellow insulating tape, this gives a clear indication of repairs that have already been carried out.
- ◆ The wires to the triggering units (airbags) are entwined as standard with a twine spacing of $20 \text{ mm} \pm 5$. This spacing is assured for series production via industrial standard numbers for wiring pairs and it is essential that it is adhered to on the repair lengths of entwined wiring.
- ◆ 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 $A = 20 \text{ mm} \pm 5$ must be adhered to without fail.
- ◆ There must not be any section of wiring, for example in the vicinity of crimp connectors -arrow-, longer than $B = 100 \text{ mm}$ with the wires not twisted.



2.4.2 Fibre optic cables (FOC)

There is no provision for fibre optic cable repairs at Volkswagen. In the event of repairs, the entire fibre optic wiring harness must be replaced. To do this, the following safety precautions must be observed:



Note

- ◆ Avoid sharp bends in the fibre optic cable; the bend radius should be no tighter than 25 mm.
- ◆ Do not route fibre optic cables over sharp edges.
- ◆ The end pieces (lenses) must not be made dirty or touched with bare hands.
- ◆ Do not expose fibre optic cables to heat.
- ◆ Entwining two fibre optic cables or a fibre optic cable with a copper wire is not permissible.

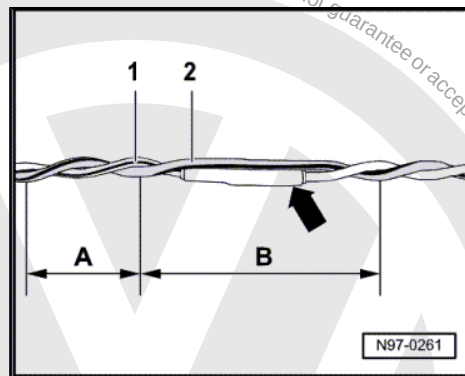


2.4.3 Repairs to CAN bus wiring

- ◆ An unshielded two-wire line -1- and -2- with a cross section of 0.35 mm² or 0.5 mm² is used for CAN bus wiring.
- ◆ The colour codes of the CAN bus wiring can be gleaned from the following table:

Powertrain CAN, high wire	Orange/black
Convenience CAN, high wire	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 entwined wires „green/yellow“ or „white/yellow“ from the electronic parts catalogue (ETKA) ⇒ Electronic parts catalogue (ETKA) .
- ◆ When repairs are performed, both 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 mm.
- ◆ There must not be any section of wiring, for example in the vicinity of crimp connectors -arrow-, longer than B = 50 mm with the wires not 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 repair concept has been developed for repair work on aerial wires. 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 must not be repaired, but if repair is required, they must be replaced only by connecting wires and adapter cables offered as genuine parts.
- ◆ Replacement parts can be found in the ⇒ Parts catalogue (ETKA): Special catalogue; Electrical connections; Genuine accessories; Subgroup 35 from illustration No. 035-20 .
- ◆ These genuine parts are suitable for all aerial wires and wire diameters which may need to be replaced.
- ◆ The connector housings for aerial wires are only available as genuine 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 models, 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 of aerial cable:

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

- 1 - Adapter cable, to radio connection. Length approx. 30 cm.
- 2 - Connecting wire, available in different lengths.
- 3 - Adapter cable, to aerial connection. Length approx. 30 cm.

Installing a new aerial cable:



Note

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

- Pull defective aerial wire connections off units.
- Determine the routing of the defective aerial wire in vehicle and measure the total length of the aerial connecting wire to be replaced.

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 of defective aerial wire.

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

- Connect adapter cables -1- and -3- to equipment in vehicle.
- Route and attach the connection line -2- in the immediate vicinity of the factory routing.



Note

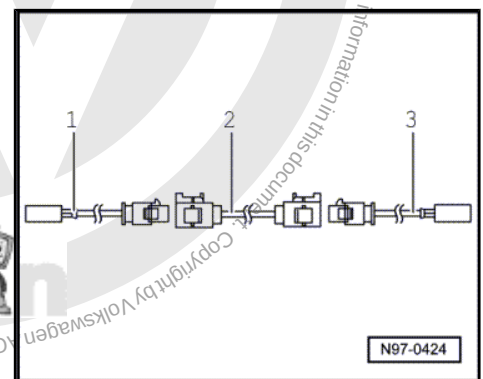
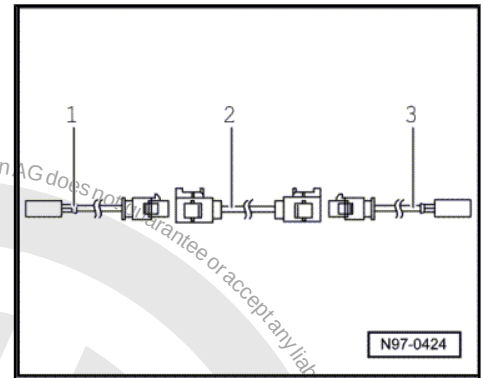
Do not kink or excessively bend aerial wires! The bending radius must not be below 50 mm.

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

2.4.5 Repairs to wiring with cross sections up to 0.35 mm²

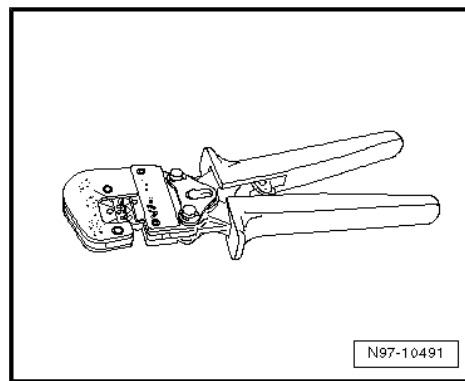
Special tools and workshop equipment required

- ◆ Crimping pliers, complete -VAS 1978/1 A-





- ◆ Head adapter 0.35 mm² - 2.5 mm² -VAS 1978/1-1-



For repairs to wiring with cross sections up to 0.35 mm², it is essential that contacts are crimped on using crimping pliers for JPT contacts -VAS 1978/9A- or crimping pliers (base tool) -VAS 1978/1-2- with attached head adapter for JPT contacts -VAS 1978/9-1- . Due to the low current strength of these wires in the micro and thousandths range, incorrectly crimped contacts cause electrical resistances and result in faults or failure in the respective system. The most common applications of these contacts are:

- ◆ Lambda probe
- ◆ Engine speed sender
- ◆ Air mass meter

With the use of crimping pliers for JPT contacts -VAS 1978/9A- or crimping pliers (base tool) -VAS 1978/1-2- with attached head adapter for JPT contacts -VAS 1978/9-1- , the correct connection between crimp contact, wire and single wire seal is assured. The tool is only to be used for the application described.



Note

Crimped to the repair wiring are normal contacts and gold-plated contacts. The repair contact must always be the same type as the contact installed in the factory.

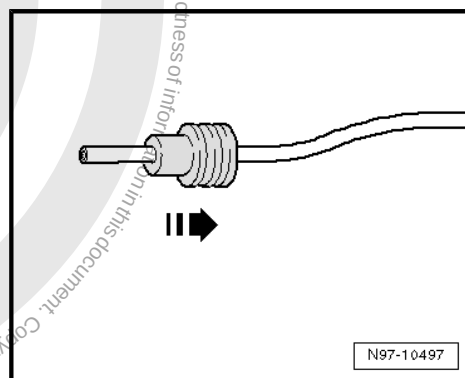
Crimping on new contact with single wire seal

- Insert head adapter for JPT contacts -VAS 1978/9-1- in crimping pliers (base tool) -VAS 1978/1-2- ➔ [page 84](#) .
- Attach the single wire seal to the repair wire.



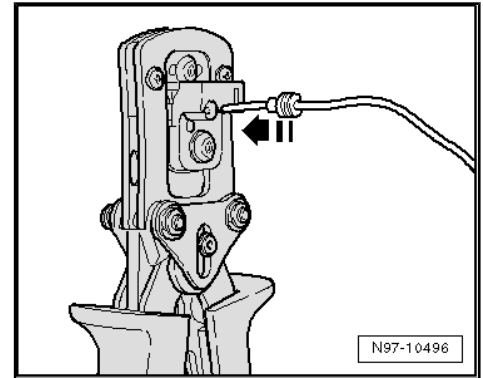
Note

When doing this, the small diameter of the single wire seal must face the contact to be crimped on.

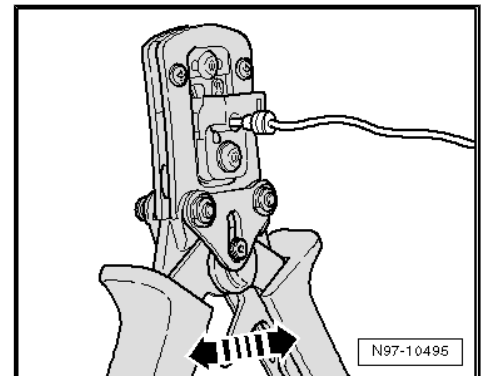




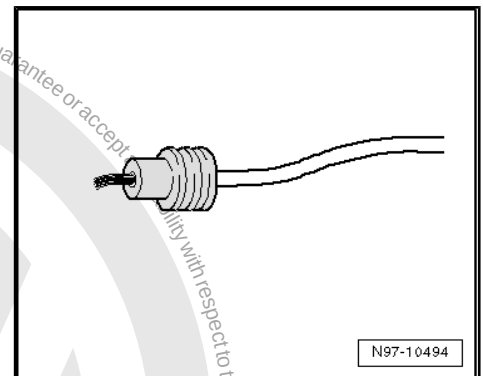
- Open the crimping pliers and insert the end of the repair wire in the opening of the crimping pliers for wire stripping.



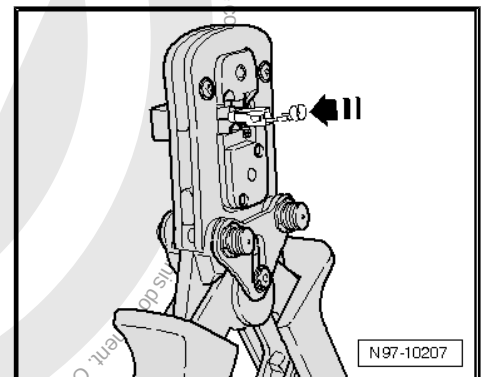
- Close the crimping pliers fully.
- Open the crimping pliers again and removed the stripped wire end.



- Push the single wire seal towards the stripped wire end until it is flush with the wiring insulation.

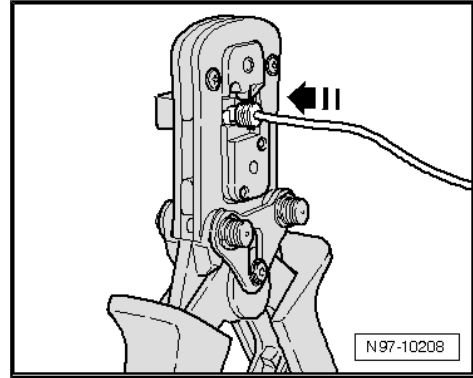


- Insert the new crimp contact in the mounting of the crimping pliers.

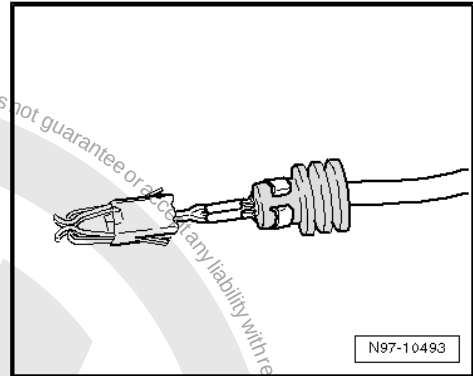




- Insert the stripped wire end with the positioned single wire seal in the crimp contact until it comes into contact with the „wire stop“.
- Crimp the contact, wire and single wire seal by closing the crimping pliers fully.
- Open the crimping pliers again and remove the successfully crimped contact.



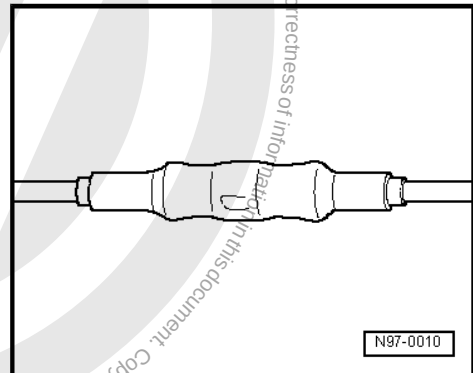
Successful crimping can be identified by clean and equal application of pressure on the wire and single wire seal in the contact and by a stamp on the rear that indicates the correct tool was used in the correct manner to carry out the crimping process.



2.4.6 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 the repair position).
- If necessary, unbind the wiring harness using the folding knife.

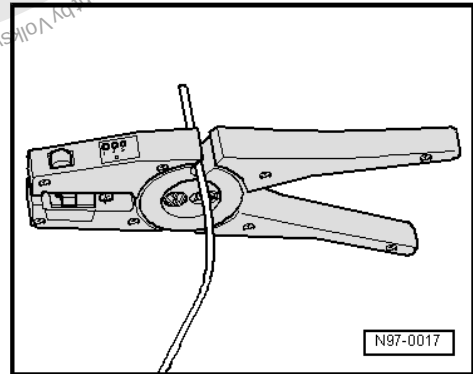


- Cut out the damaged piece of wiring using the wire strippers - VAS 1978/3- .



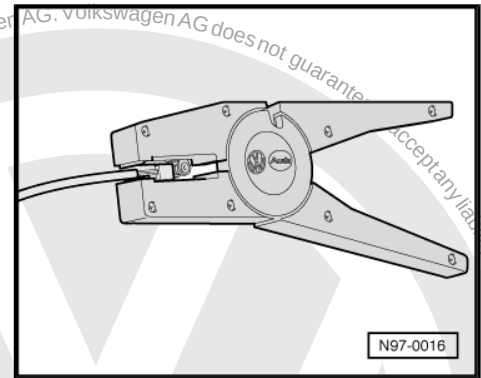
Note

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 two crimp connectors ➔ [page 96](#) .





- Strip the wire ends of insulation by 6 - 7 mm using the wire strippers.



- Push the crimp connector on both stripped wire ends of the vehicle's own single wire and crimp it on using the crimping pliers.

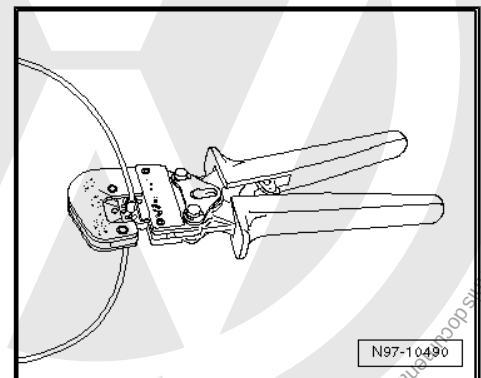


Note

- ◆ Ensure without fail that the correct crimp recess is chosen for the crimp connectors being used ⇒ [page 82](#).
- ◆ The insulation on the wires must not be crimped.

After crimping, the crimp connector has to be shrink fitted using the hot air blower in order to prevent any ingress of moisture.

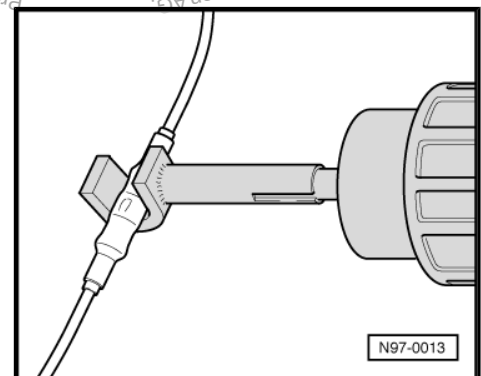
- Place shrink element for hot air blower -VAS 1978/15- on hot air blower, 220 V / 50 Hz -VAS 1978/14-.
- Heat up the crimp connector using the hot air blower along a straight line, working from the middle outwards, until it is sealed completely and the adhesive escapes from the ends.



Caution

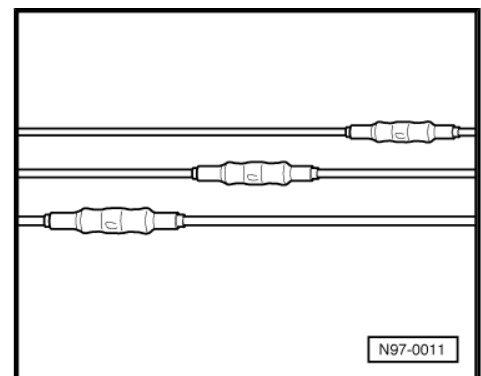
When shrink-fitting, take care not to damage any other wiring, plastic parts or insulating material with the hot air blower.

Observe the operating instructions of the hot air blower without fail!



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, if necessary, to prevent it from generating noise when the vehicle is in motion.





2.4.7 Wiring open circuit with two repair positions

Repair position with interlinked wire.

- Place the wire to be repaired to the side at two points (about 20 cm to both sides of the relevant repair position).
- If necessary, unbind the wiring harness using the folding knife.

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

- Strip the wire ends of insulation by 6 - 7 mm using the wire strippers.
- Push the crimp connector onto one side of the vehicle's own single wire and on the other side onto the repair wire.

- Crimp the connector using the crimping pliers to both wire ends.
- Repeat this procedure on the other end of the repair wire.

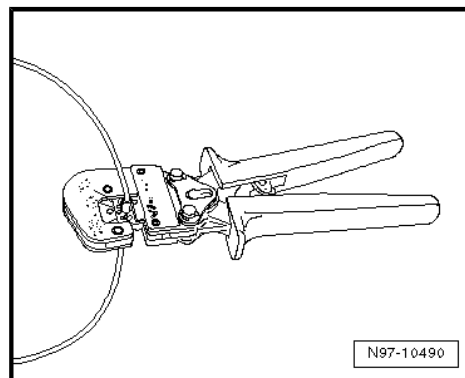
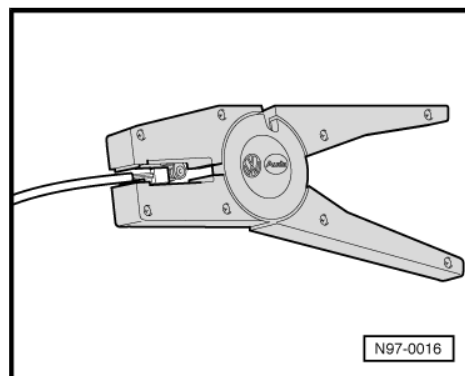
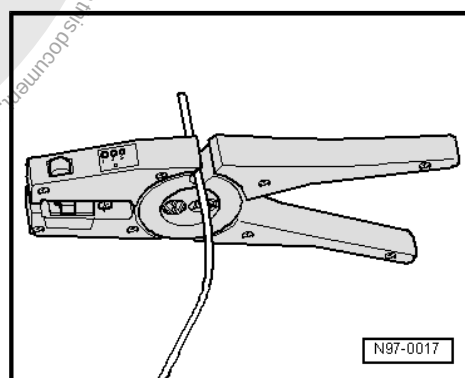
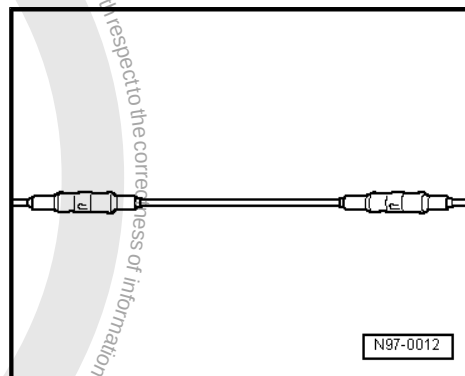


Note

- ♦ Ensure without fail that the correct crimp recess is chosen for the crimp connectors being used ➔ [page 82](#) .
- ♦ The insulation on the wires must not be crimped.

After crimping, the crimp connector has to be shrink fitted using the hot air blower 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- .





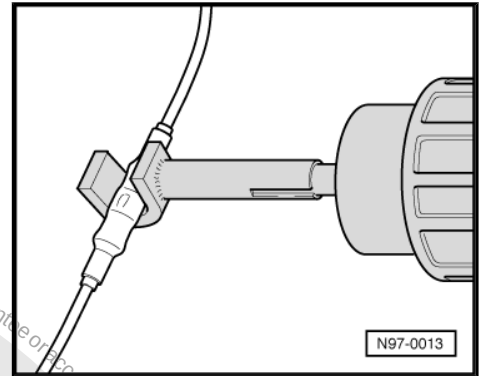
- Heat up the crimp connector using the hot air blower along a straight line, working from the middle outwards, until it is sealed completely and the adhesive escapes from the ends.



Caution

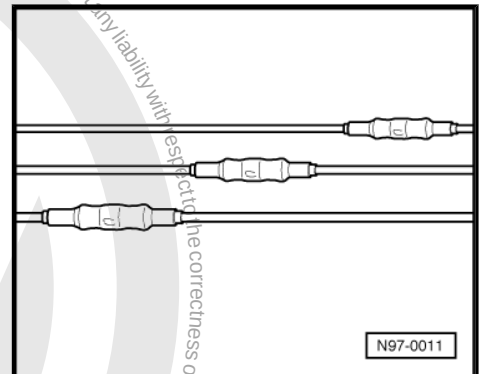
When shrink-fitting, take care not to damage any other wiring, plastic parts or insulating material with the hot air blower.

Observe the operating instructions of the hot air blower without fail!



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, if necessary, to prevent it from generating noise when the vehicle is in motion.



2.5 Repairs to contact housings and connectors

2.5.1 Notes on repairs to contact housings and connectors



Note

- ◆ Observe the general notes on repairs to the vehicle electrical system ➔ [page 85](#).
- ◆ Allocation of the appropriate crimp contacts to the contact housings is by way of the part number stamped on the contact housing. Listed in illustration 198 (electrical connecting elements) in ➔ *Electronic parts catalogue (ETKA)* are the part numbers for the contact housings in conjunction with the associated crimp contacts.
- ◆ Damaged contact housings must always be replaced.
- ◆ New contact housings can be ordered from the OTC in Kassel.

2.5.2 Repairs to contacts in contact housings

- If necessary, first open or disengage the secondary locking mechanism of the contact housing ➔ [page 102](#).



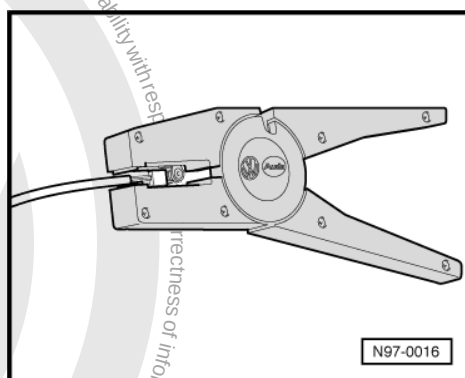
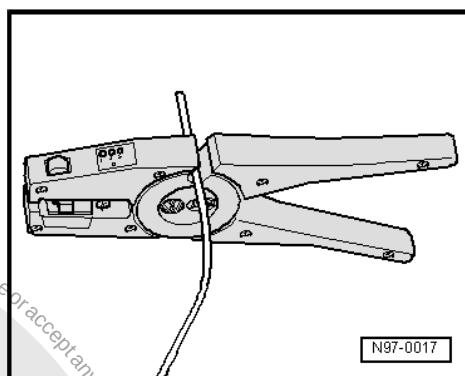
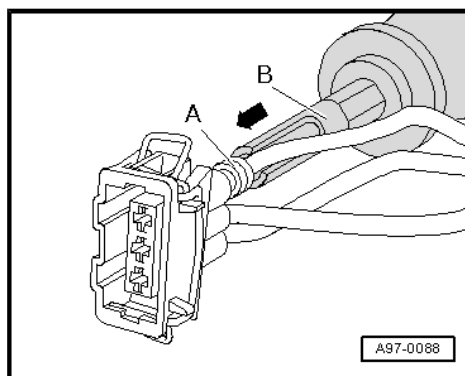
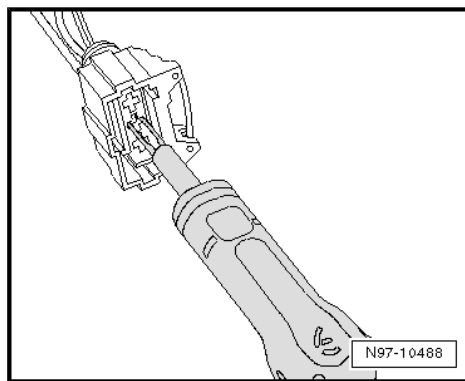
- Disengage the contact (primary locking mechanism) using the appropriate release tool ➔ [page 102](#) .
- Pull the contact by the single wire out of the contact housing.
- Select the yellow repair wire with the correct contact from the wiring harness repair set .
- Place the wire to be repaired from the vehicle's own wiring harness to one side (about 20 cm either side of the repair position).
- If necessary, unbind the wiring harness using the folding knife.
- Push the new contact of the repair wire into the contact housing until it engages.
- Slide the single wire seal onto the repair wire.



Note

The small diameter of the single wire seal must face the contact housing.

- Slide the single wire seal into the contact housing using the correct assembly tool ➔ [page 99](#) .
- Trim the repair wire and the single wire of the vehicle's own wiring harness accordingly using wire strippers -VAS 1978/3- .

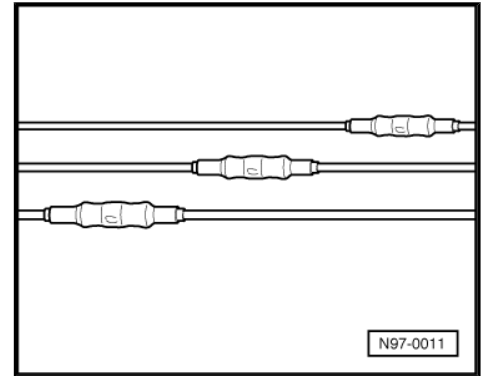


- Strip the 6 - 7 mm of insulation from the end of the repair wire and the vehicle's own single wire using the wire strippers.
- Crimp the stripped ends of the repair wire and single wire of the vehicle's own wiring harness using the crimping pliers and a crimp connector, as described in the chapter entitled „Wiring open circuits with one repair position“ ➔ [page 94](#) .



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, if necessary, to prevent it from generating noise when the vehicle is in motion.



2.5.3 Fitting single wire seals

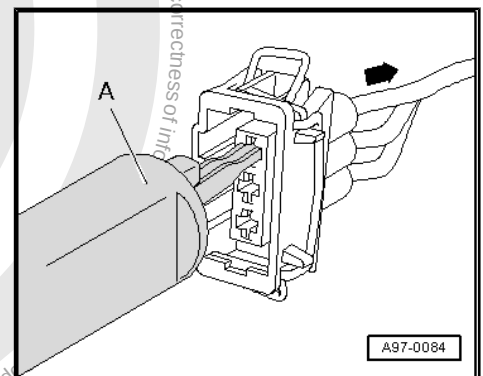


Note

- ◆ Single wire seals prevent the ingress of moisture and dirt in the contact housing. They are installed, for example, in the engine compartment and must always 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 contact housing. Only carry out the repair using the correct assembly tool.

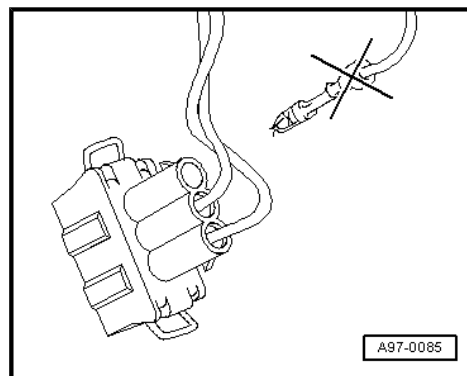
Assembling single wire seal:

- Disengage the contact locking mechanism using the appropriate release tool -A- and then pull the wire with the single wire seal backwards -arrow- out of the contact housing.

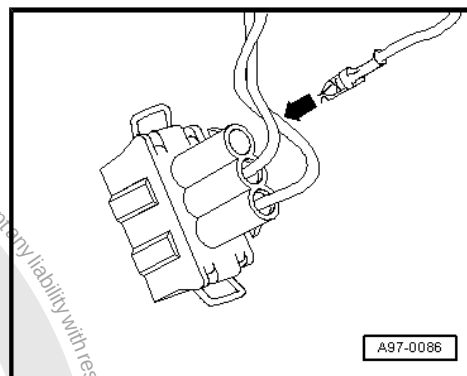




- Cut off the old contact with the single wire seal from the vehicle's own wiring harness.



- Slide the repair wire with the new contact in the respective socket of the contact housing until it engages.



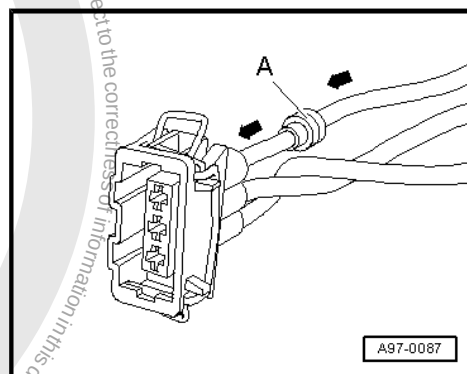
- Place the single wire seal -A- on the free end of the repair wire.



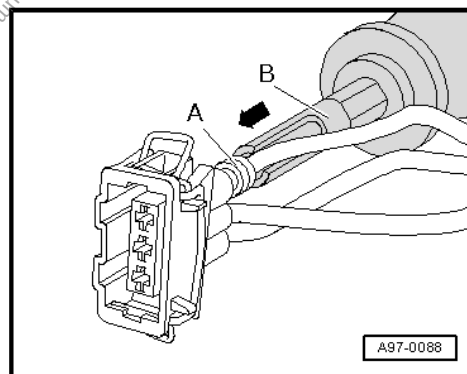
Note

The small diameter of the single wire seal must face the contact housing.

- Slide the single wire seal -A- on the repair wire until it reaches the contact housing.

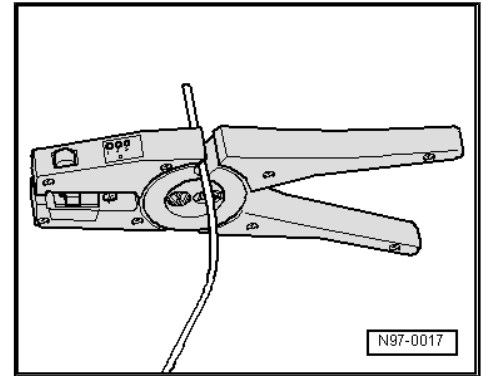


- Slide the single wire seal -A- using the respective assembly tool -B- fully into the contact housing.





- Trim the repair wire and the single wire of the vehicle's own wiring harness accordingly using wire strippers -VAS 1978/3- .
- Crimp the stripped ends of the repair wire and single wire of the vehicle's own wiring harness using the crimping pliers and a crimp connector, as described in the chapter entitled „Wiring open circuits with one repair position“ ➔ [page 94](#) .

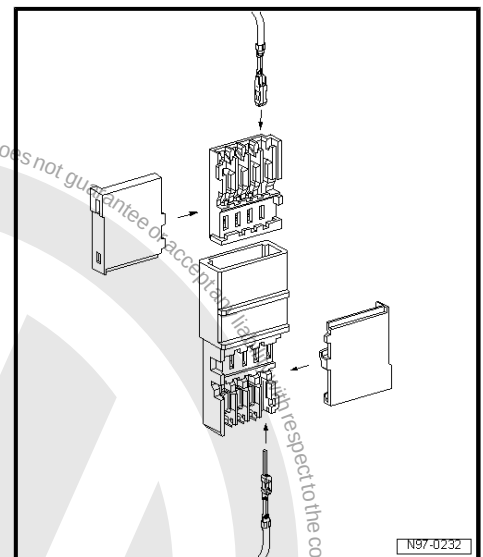


2.5.4 Repairs to contact housings using cut and clamp technique



Note

- ◆ *For technical reasons, the contact housings for cut and clamp technique can only be supplied with the cut and clamp contacts inserted.*
- ◆ *These contacts can be removed just like any other contact housing if they are not needed.*
- ◆ *Repair wires can be supplied that already have the appropriate contacts crimped on ➔ Electronics parts catalogue (ETKA) .*





2.6 Releasing and dismantling contact housings

2.6.1 Notes on releasing and dismantling contact housings



Note

- ◆ Observe the general notes on repairs to the vehicle electrical system ⇒ [page 85](#).
- ◆ To release, always use the correct release tools. Under no circumstances should the contacts be pulled out of the contact housings with force.
- ◆ Damaged contact housings must always be replaced. New contact housings can be ordered from the OTC in Kassel.
- ◆ As an aid to disengage the secondary locking mechanisms, a small screwdriver can be used.
- ◆ The socket/pin assignment can be found stamped on the secondary locking mechanism or on the rear of the contact 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 of -VAS 1978/35- .

2.6.2 Secondary locking element

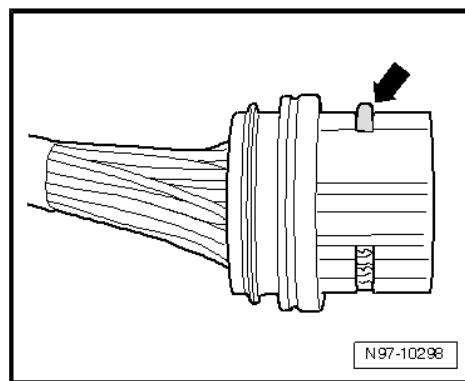
The secondary locking mechanism is a housing catch (second line locking mechanism) that secures all the wires in one contact housing. If a secondary locking mechanism is fitted to a contact housing, this must always be opened or removed using the appropriate tool before releasing and pulling out individual crimp contacts.

The secondary locking mechanism is different in colour from the rest of the contact housing. This makes it easier to identify the secondary locking mechanism and clarifies its intended function.

The types of contact housing shown here are just a few examples to show the different functions of secondary locking mechanism.

Example 1:

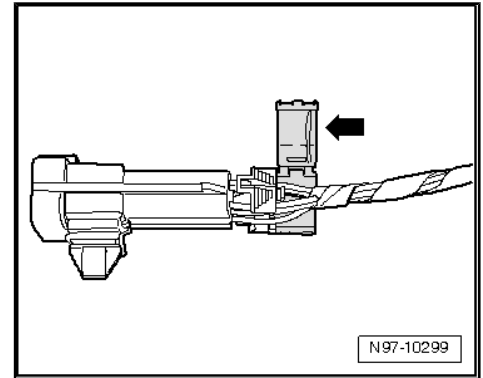
The housing catch is disengaged by removing a „toothed element“ -arrow-.





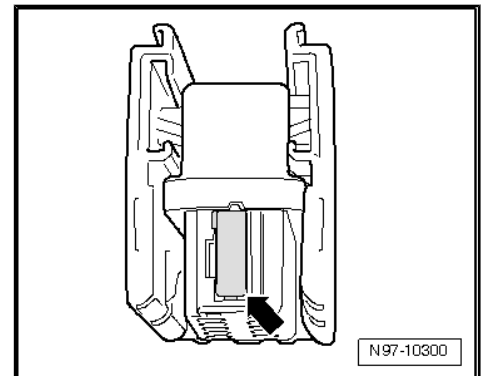
Example 2:

The housing catch is disengaged by opening a „flap“ -arrow-.



Example 3:

The housing catch can be disengaged by detaching a „slide“ -arrow-.



2.6.3 Primary locking element

The primary locking mechanism is what fixes an individual crimp contact in the contact housing.

If necessary, any housing catches in place (secondary locking mechanisms) must be released or removed prior to disengaging the contacts using the prescribed tool ⇒ [page 102](#) .

The types of primary locking mechanisms shown as follows are just a few examples to show the different functions of primary locking mechanism.

- ◆ Round connector systems ⇒ [page 103](#)
- ◆ Flat connector systems ⇒ [page 104](#)
- ◆ Special connector systems ⇒ [page 106](#)

Allocation of the correct release tool to the respective locking device can be gleaned from the table in the ⇒ operating instructions of -VAS 1978/35- .

2.6.4 Round connector systems



Note

If necessary, any housing catches in place (secondary locking mechanisms) must be released or removed prior to disengaging the contacts using the prescribed tool ⇒ [page 102](#) .



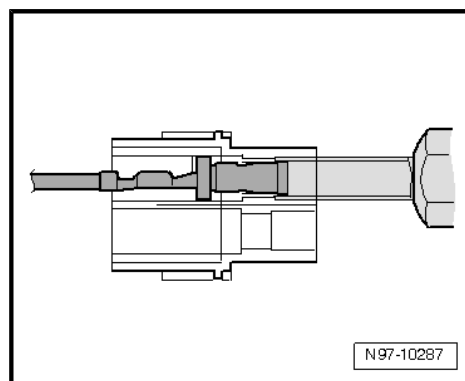
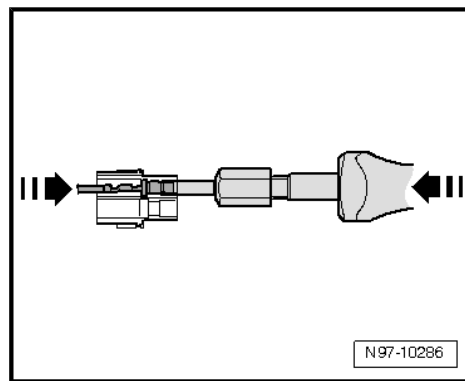
- Insert the release tool appropriate for the contact housing in the release port of the contact housing.
- Grab hold of the contact by the wire and push it lightly into the contact housing -arrow-.



Note

By pushing the contact in the direction of the contact housing, the locking tabs of the contact are lifted up by the housing edge and disengaged using the release tool.

- At the same time, push the release tool in the direction of the contact housing -arrow- and pull out the released contact from the contact housing.
- The release tool can be pulled out of the contact housing again once the contact has been removed.



2.6.5 Flat connector systems



Note

If necessary, any housing catches in place (secondary locking mechanisms) must be released or removed prior to disengaging the contacts using the prescribed tool ➔ [page 102](#) .

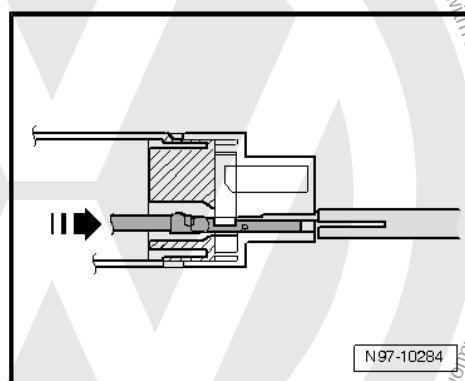
Flat connector with one locking tab:

- Insert the release tool appropriate for the contact housing in the release port of the contact housing.
- Grab hold of the contact by the wire and push it lightly into the contact housing -arrow-.



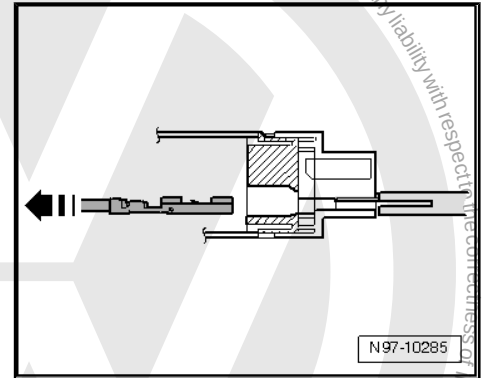
Note

By pushing the contact in the direction of the contact 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 contact housing and pull out the released contact from the contact housing -arrow-.
- The release tool can be pulled out of the contact housing again once the contact has been removed.



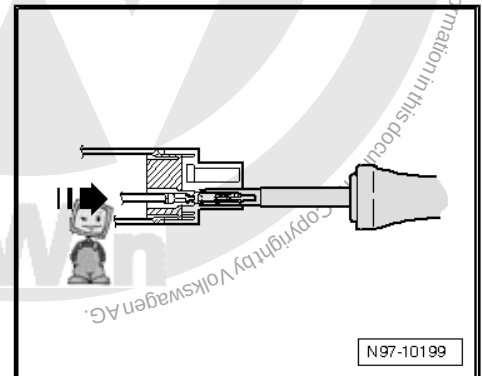
Flat connector with two locking tabs:

- Insert the release tool appropriate for the contact housing in the release port of the contact housing.
- Grab hold of the contact by the wire and push it fully into the contact housing -arrow-.

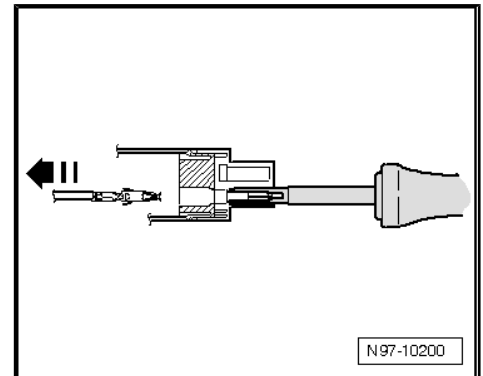


Note

By pushing the contact in the direction of the contact housing, the locking tabs of the contact are lifted up by the housing edge and disengaged using the release tool.



- At the same time, push the release tool in the direction of the contact housing and pull out the released contact from the contact housing -arrow-.
- The release tool can be pulled out of the contact housing again once the contact has been removed.



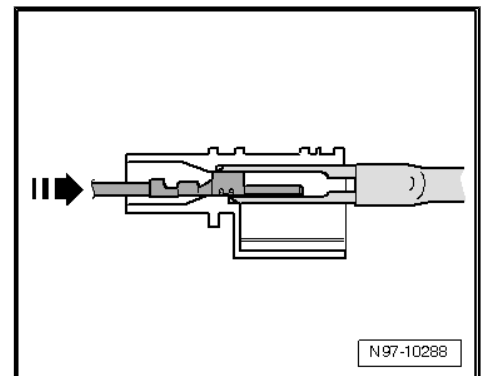
Asymmetrical:

- Insert the release tool appropriate for the contact housing in the release port of the contact housing.
- Grab hold of the contact by the wire and push it lightly into the contact housing -arrow-.



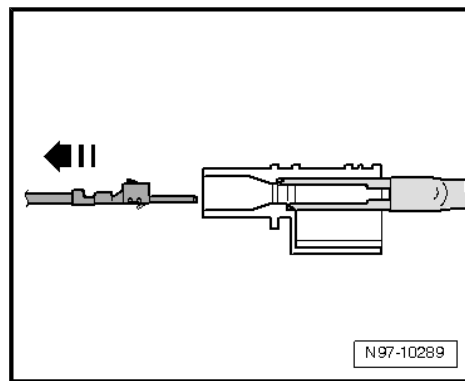
Note

By pushing the contact in the direction of the contact housing, the locking tabs of the contact are lifted up by the housing edge and disengaged using the release tool.





- At the same time, push the release tool in the direction of the contact housing and pull out the released contact from the contact housing -arrow-.
- The release tool can be pulled out of the contact housing again once the contact has been removed.



2.6.6 Special connector systems



Note

If necessary, any housing catches in place (secondary locking mechanisms) must be released or removed prior to disengaging the contacts using the prescribed tool ➔ [page 102](#).

Faston contacts:

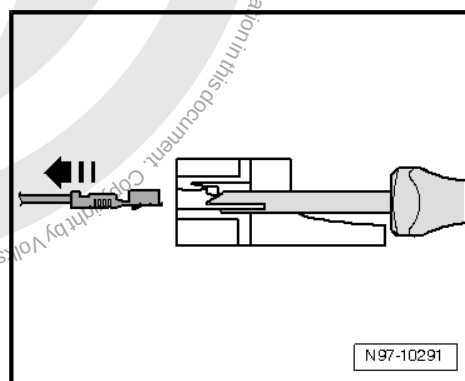
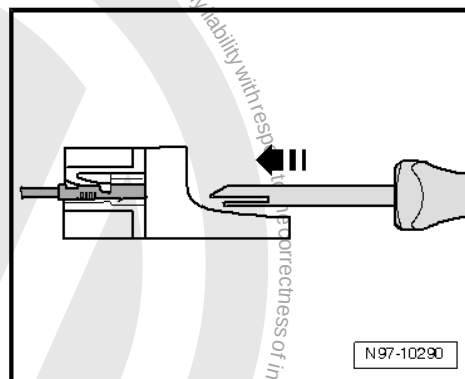
- Insert the release tool appropriate for the contact housing in the release port of the contact housing.
- Grab hold of the contact by the wire and push it lightly into the contact housing.



Note

By pushing the contact in the direction of the contact housing, the locking tabs of the contact are lifted up by the housing edge and disengaged using the release tool.

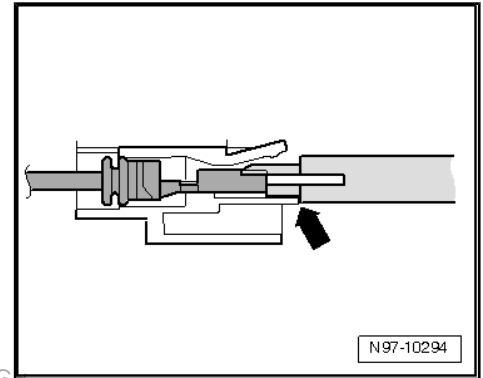
- At the same time, push the release tool in the direction of the contact housing and pull out the released contact from the contact housing -arrow-.
- The release tool can be pulled out of the contact housing again once the contact has been removed.





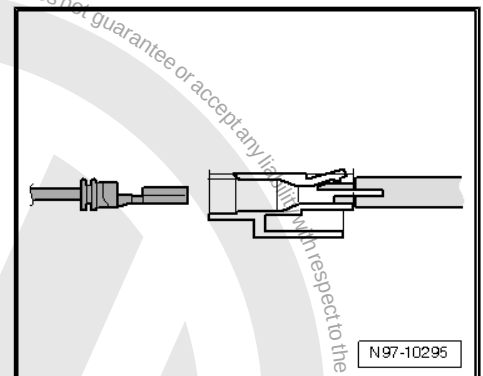
GT 150/280 contacts:

- Insert the release tool appropriate for the contact housing under the locking tab into the contact housing.
- Push the tool onto the limit stop -arrow- in the contact housing.



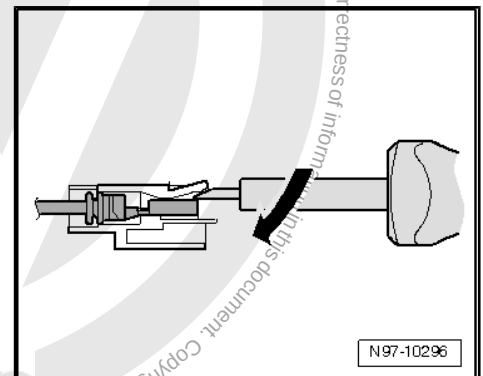
The contact is ejected from the contact housing.

- The release tool can be pulled out of the contact housing again once the contact has been ejected.

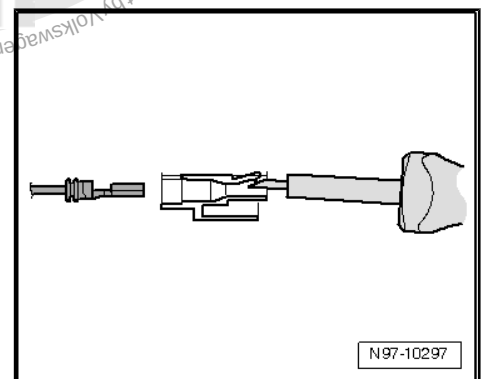


Contacts without locking tabs:

- Insert the release tool under the locking tab of the contact housing.
- Push through the release tool with a light upward movement -arrow- onto the limit stop.



The contact is ejected from the contact housing.





3 Contact surface cleaning set -VAS 6410-

3.1 Using contact surface cleaning set -VAS 6410-

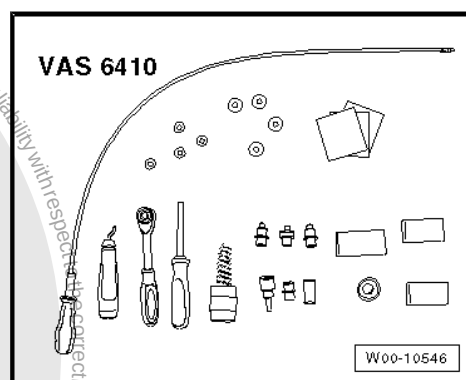
The contact surface cleaning set -VAS 6410- allows optimal repair quality to be achieved in the area of vehicle electrics. The tools allow performing repair work in the area of the sensor in wiring harnesses for threaded connections in the high-current circuit (starting and charging current). The contact surface cleaning set -VAS 6410- is adapted to the structural conditions of vehicles and ensures the process security of repair work as well as a comfortable procedure.



Note

The illustrations shown here are just a few examples of repair work.

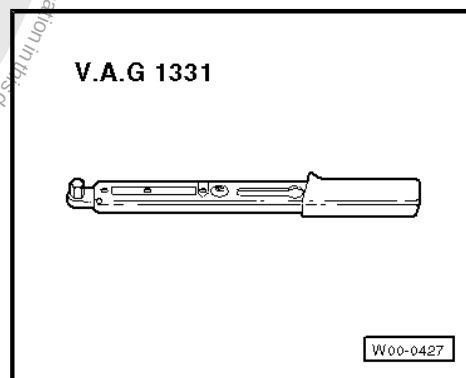
Contact surface cleaning set VAS 6410



3.1.1 Repairing ring terminals

Special tools and workshop equipment required

- ♦ VAG 1331



Note

- ♦ *The use of penetrating fluid, contact spray or grease etc. is prohibited since the missing adhesion in the threads may cause a torque excess and, therefore, the break 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! Observe warning notices and safety regulations ➔ page 2!

- Disconnect battery.
- Loosen cap nut and remove ring terminal from threaded connection.
- Check ring terminal for corrosion, dirt etc.
- Select suitable adapter and suitable sanding pad.



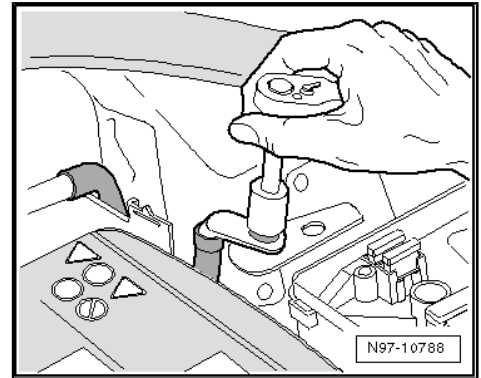
Note

As an alternative, the sanding block may also be used.



Caution

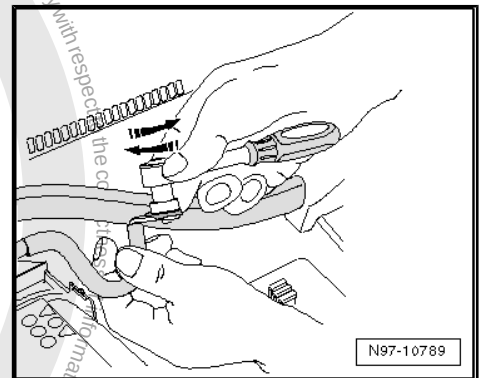
Take care not to abrade excessively the tin coating and ensure that the copper does not appear. This could produce a galvanic cell which destroys metal and causes faulty repair.



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.

- Insert adapter into ring terminal and grind off corrosion and dirt with circular movements.
- Check ring terminal and regrind if necessary.





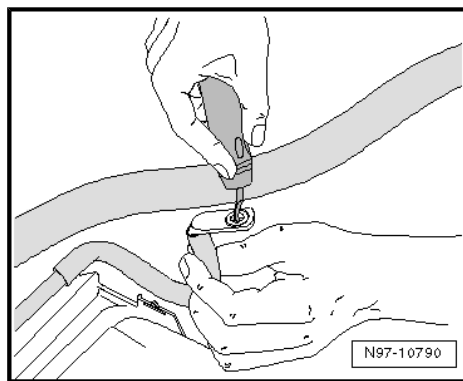
- If necessary, remove punching burr on ring terminal using the deburrer.
- Tighten ring terminal to specified torque ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.



Note

Optimum contact is ensured when the components to be secured are tightened to the specified torque after cleaning.

- Apply suitable anti-corrosion treatment to connection
⇒ [page 113](#).
- Reconnect battery.



WARNING

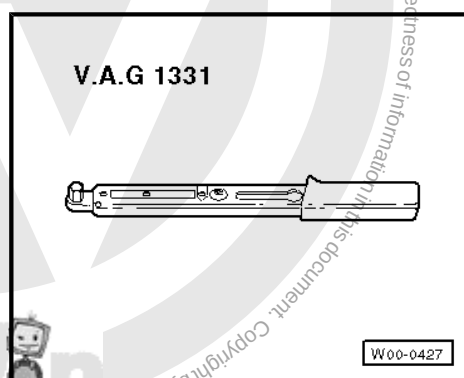
Danger of injury! Observe warning notices and safety regulations ⇒ [page 2](#)!

- Teach in electric windows again, enter radio code, set clock and, if necessary, recode control units which emit code signals.

3.1.2 Repairing threaded connections

Special tools and workshop equipment required

- ♦ VAG 1331



Note

- ♦ *The use of penetrating fluid, contact spray or grease etc. is prohibited since the missing adhesion in the threads may cause a torque excess and, therefore, the break 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! Observe warning notices and safety regulations ⇒ [page 2](#)!

- Disconnect battery.

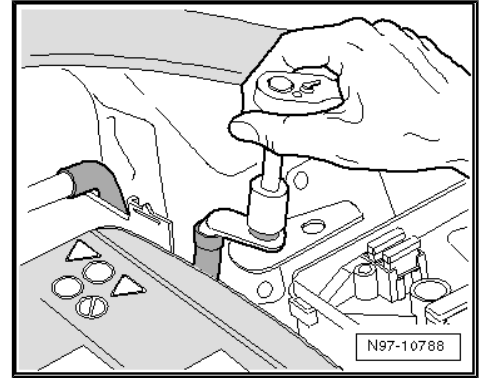


- Loosen cap nut and remove ring terminal from threaded connection.
- Check threaded connection for corrosion, dirt etc.
- Select suitable adapter and suitable sanding pad for threaded connection.



Caution

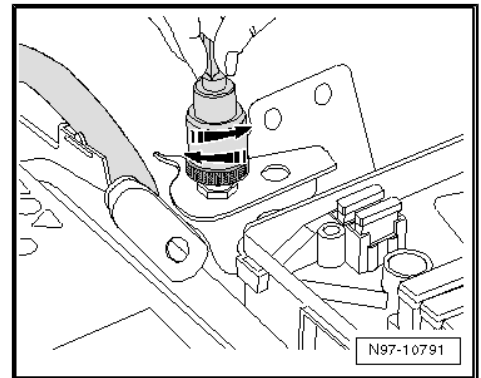
Take care not to abrade excessively the tin coating and ensure that the copper does not appear. This could produce a galvanic cell which destroys metal and causes faulty repair.



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.

- Set adapter on threaded connection and grind off corrosion and dirt with circular movements.
- Check threaded connection and regrind if necessary.
- Tighten connection and, if necessary, locating element again to specified torque ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.



Note

Optimum contact is ensured when the components to be secured are tightened to the specified torque after cleaning.

- Apply suitable anti-corrosion treatment to threaded connection ⇒ [page 113](#).
- Reconnect battery.



WARNING

Danger of injury! Observe warning notices and safety regulations ⇒ [page 2](#)!

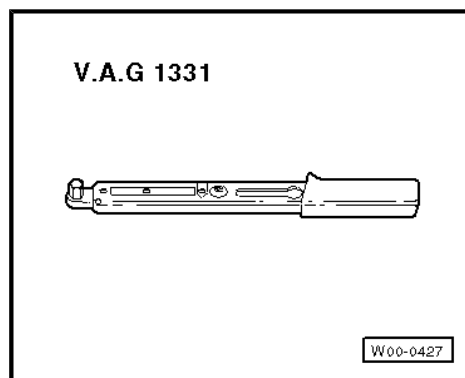
- Teach in electric windows again, enter radio code, set clock and, if necessary, recode control units which emit code signals.

3.1.3 Cleaning battery clamp and battery terminal

Special tools and workshop equipment required



♦ VAG 1331



Note

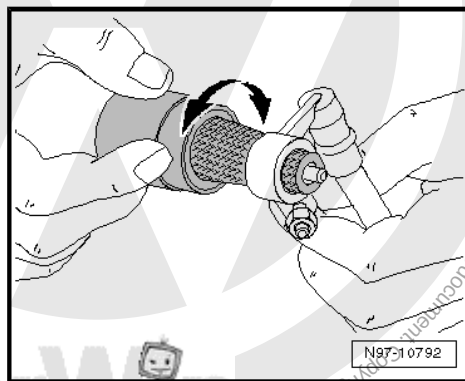
The use of penetrating fluid, contact spray or grease etc. is prohibited since the missing adhesion in the threads may cause a torque excess and, therefore, the break of the threaded connection.



WARNING

Danger of injury! Observe warning notices and safety regulations ➔ page 2!

- Disconnect battery.
- Check battery clamp and battery terminal for corrosion or dirt.
- Clean battery clamp using wire brush of battery terminal cleaner with circular movements.





- Clean battery terminal using underside of battery terminal cleaner with circular movements.



WARNING

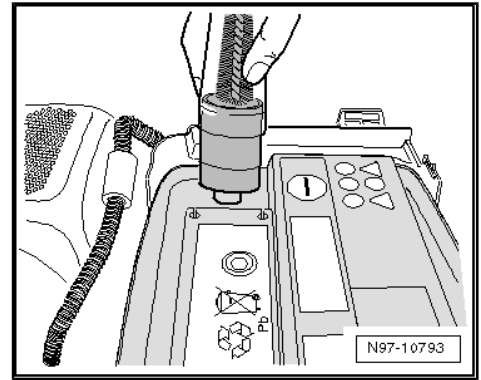
Danger of injury! Observe warning notices and safety regulations ⇒ page 2!

- Reconnect battery and tighten battery terminals to specified torque.



Note

Optimum contact is ensured when the components to be secured are tightened to the specified torque after cleaning.



3.1.4 Anti-corrosion treatment



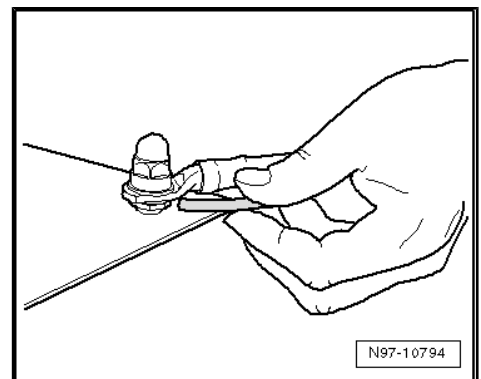
Caution

Missing anti-corrosion treatment results in damage to the on-board supply.



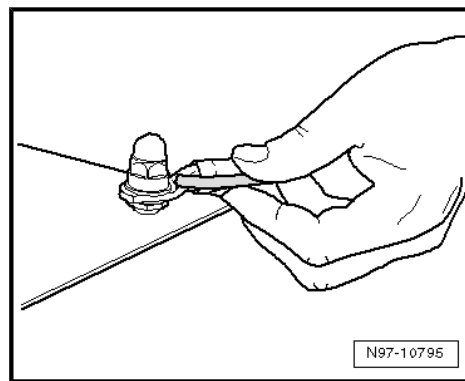
Note

- ◆ *All threaded connections must be tightened to specified torque.*
 - ◆ *Always 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.*
- Hold injector below ring terminal and spray pin all around.





- Hold injector above ring terminal and spray pin and wiring eye all around.





4 Renewing Lambda probe



Note

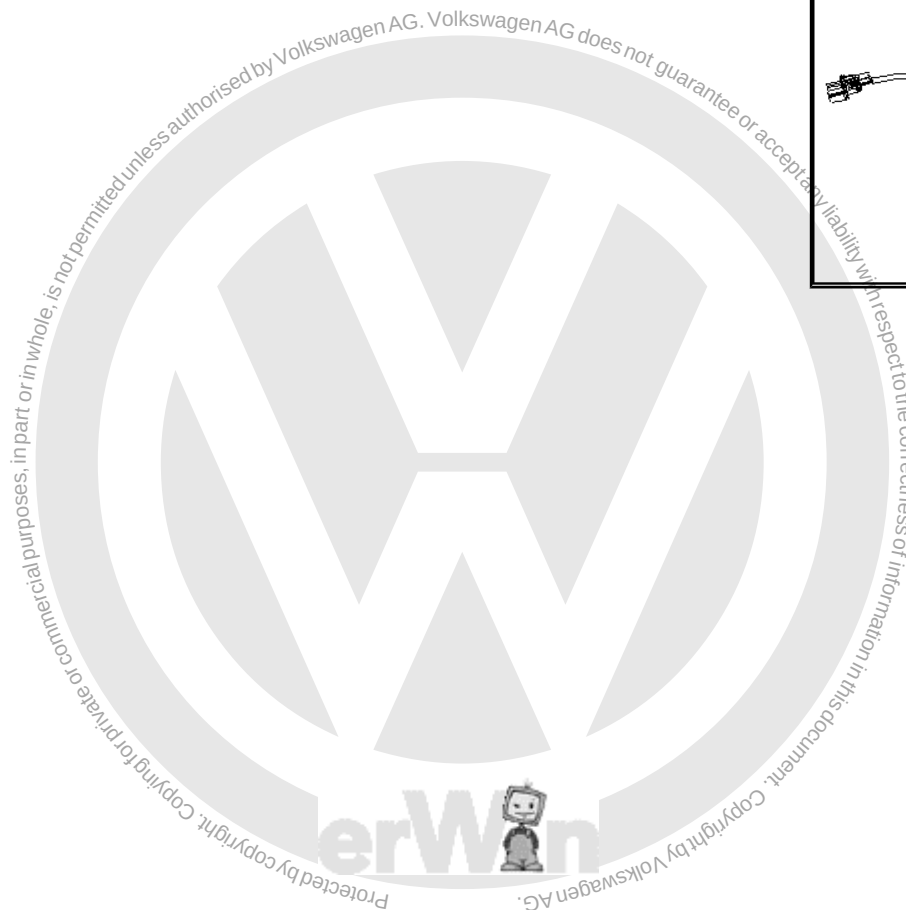
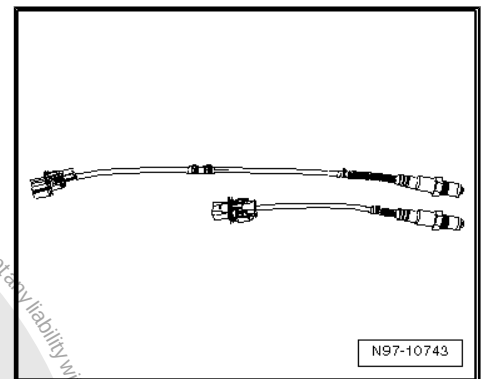
- ◆ *Do not repair lambda probe wires, since this can result in malfunctions.*
- ◆ *If necessary, replace attachment parts, cable ties or marking rings to match the uniform probe to the defective probe as specified.*
- ◆ *Identify the lambda probe by way of the protective tube as required ➔ [page 117](#).*

4.1 Renewing LSF Lambda probe (4-pin)



Note

- ◆ *If necessary, replace attachment parts, cable ties or marking rings to match the uniform probe to the defective probe as specified.*
 - ◆ *Do not repair lambda probe wires, since this can result in malfunctions.*
- Remove the defective Lambda probe.
 - Place both Lambda probes next to each other so that the sensor housings are at the same height.



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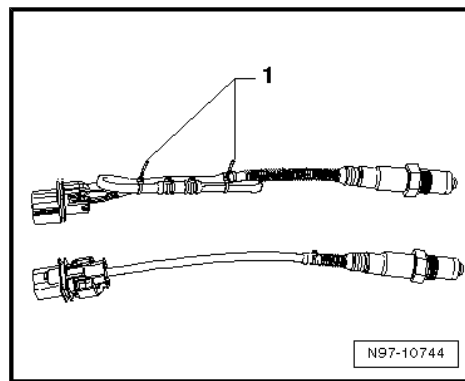


- Tie back any excess in the uniform probe length (approx. 50 - 250 mm) to the size of the defective probe and secure with cable ties -1-.
- Check that the connector housing of the Lambda probe is compatible with the onboard supply side.
- If necessary, replace the onboard supply system connector with the Lambda probe connector housing supplied
⇒ [page 97](#)



Note

- ◆ *The connector housing should only be replaced on older vehicles. On new vehicles, the connector housing coding matches.*
 - ◆ *Observe pin assignment. 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 the new Lambda probe in the vehicle.

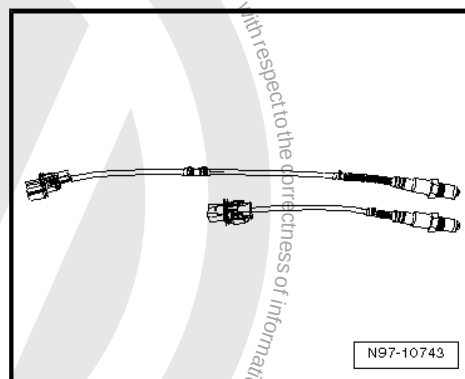


4.2 Renewing LSU Lambda probe (6-pin)



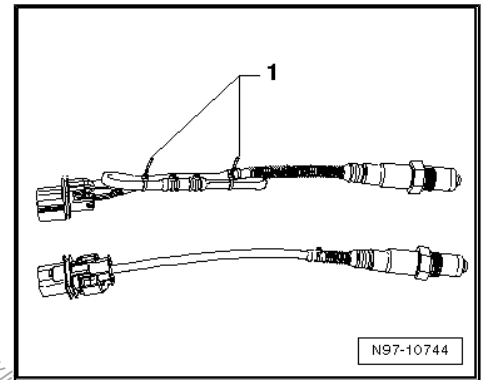
Note

- ◆ *If necessary, replace attachment parts, cable ties or marking rings to match the uniform probe to the defective probe as specified.*
 - ◆ *The wires should not be crimped or cut as otherwise the function of the Lambda probe will be impaired.*
- Remove the old Lambda probe.
 - Place both Lambda probes next to each other so that the sensor housings are at the 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 the new Lambda probe in the vehicle.



4.3 Types of protective tube on uniform Lambda probes



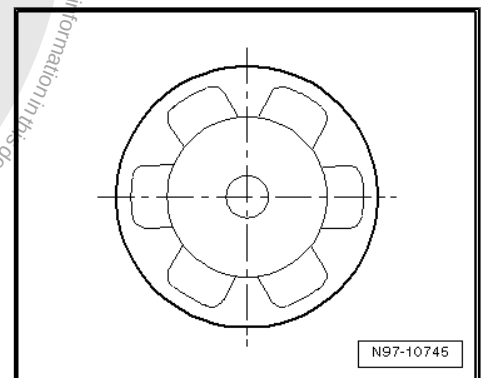
Note

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

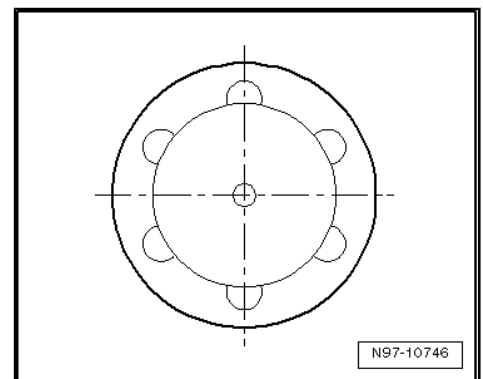
Only used on 4-pin LSF Lambda probes.

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.

