

WARNING:

The "145-146 - INSTRUCTIONS FOR REPAIR" manual refers to both models according to the following logic:

for the parts in common, the information refers to model 145, while for the parts specific to model 146 special pages, or, where necessary, whole groups, have been added.

For further details refer to the indexes (blue cards) at the beginning of each group.

INTRODUCTION

The "145-146 - Repair Instructions" Manual is composed of three volumes as follows:

- Volume I
 - Technical Data;
 - Engines;
 - Mechanical Groups.
- Volume II
 - Heating-Ventilation;
 - Bodywork.
- Volume III
 - Electric system;
 - Electrical system diagnosis.

For overhauling engines and mechanical groups refer to the following manuals:

- PA49360000000 REPAIR INSTRUCTIONS - ENGINE OVERHAUL.
- PA49420000000 REPAIR INSTRUCTIONS - OVERHAULING MECHANICAL GROUPS.

In order to facilitate consultation, the structure of the manual mirrors the functional groups already defined for the "Repair Flat-rate Manual" in use by Alfa Romeo Authorized Service Network.

The characteristic data and the tables for vehicles identification are contained in the "Technical Data" at the beginning of Volume I.

The "Model identification" tables should be consulted before carrying out repair work in order to identify the model of the vehicle, the engine size and the groups which form the vehicle.

How to use this manual

The aim of this manual is to supply the Alfa Romeo Service Personnel with a tool enabling them to rapidly identify faults and to render the corrective interventions precise and efficient.

The manual shows the procedures relative to the removal and refitting and dismantling operations and the checks relative to the various groups forming the vehicle.

The procedures are illustrated in detail as are the procedures for using the tools. An appropriate symbology and explanatory texts next to the fundamental technical drawings make a complete and rapid consultation of the manual possible.

The procedures illustrate complete component disassembly procedures and should only be carried out in their entirety when absolutely unavoidable. The procedures for "assembly" and "refitting" are normally obtained by reversing the procedure followed for disassembly or removal in reverse and only the reassembly procedures which are significantly different are illustrated.

For information relative to the electrical systems on-board the vehicle refer to section 55 "ELECTRIC SYSTEM" and to the successive 55 "ELECTRIC SYSTEM DIAGNOSIS" which gives the wiring diagrams and the description of each function, the connector tables, the location of the components, the tables for fault diagnosis and the technical data for checking the components.

All the information contained in this manual is updated at the time of publication.

Alfa Romeo reserves the right to make any modifications to its products that it deems necessary without warning. However the technical information and updates to this manual will be supplied as soon as possible.

Symbology

A specific symbology has been used in this manual to permit a rapid identification of the main technical information supplied.

The list of symbols is given below.

| | | | | |
|---|------------------------|---|---|--------------------------------|
|  | removal/disassembly |  |  | exhaust |
|  | refitting/re-assembly |  |  | Lubricate only with engine oil |
|  | tighten to the torque | |  | left-hand thread |
|  | caulk nut | |  | torque for tightening in oil |
|  | adjustment/regulation | |  | engine r.p.m. |
|  | visual check | |  | ovalization |
|  | lubricate | |  | taper |
|  | weight difference | |  | eccentricity |
|  | angular value | |  | flatness |
|  | pressure | |  | diameter |
|  | temperature | |  | linear dimension |
|  | brake system air purge | |  | parallelism |
|  | surfaces to be treated | |  | service with grease |
|  | interference | |  | heating temperature |
|  | play | |  | seal |
|  | intake | |  | service with engine oil |
| | | |  | grease |
| | | |  | CAUTION! |
| | | |  | WARNING! |

Warnings for the operator

All the operations must be carried out with the greatest care to prevent damage occurring to the vehicle or persons.

- The use of Alfa Romeo specific tools are indicated for some procedures. These tools must be used to ensure safety and to avoid damaging parts involved in the procedure.
- To free parts which are solidly stuck together, tap with an aluminium or lead mallet if the parts are of metal. Use a wooden or resin mallet for light alloy parts.
- When dismantling ensure parts are marked correctly if required.
- When refitting lubricate the parts, if necessary, to prevent seizing and binding during the initial period of operation.
- Using adhesive paper or clean rags cover those parts of the engine which, following disassembly, present openings which may allow dust or foreign material to enter.
- When refitting, the tightening torques and adjustment data must be respected.
- When substituting the main component(s) the seal rings, oil seals, flexible washers, safety plates, self-locking nuts and all worn parts must also be replaced.
- Avoid marking the internal coverings in the passenger compartment.

Substitution of groups or disconnected parts must be carried out using original spare parts only. Only in this way can the suitability and perfect operation of each organ be guaranteed.

- The words **CAUTION** and **WARNING** accompany those procedures where particular care should be taken to prevent damage occurring to people or vehicle parts.



CAUTION:
used when insufficient care could cause damage to people



WARNING:
used when insufficient care could cause damage to the vehicle or its component parts.

- The safety regulations applied to workshops should be respected. Where necessary the manual also lists the specific precautions to be taken to prevent dangerous situations from arising.



When using chemical products follow the safety indications given on the safety cards which the supplier is obliged to deliver to the user (in Italy in compliance with D.M. n.46/1992).

NOTE:

It is possible that for certain subjects were not completed in time for printing. However these subjects are given and highlighted in the indices of the single groups. It is the duty of the Technical Services to supply documentation regarding these subjects as soon as possible through updates or "Technical Bulletins".

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VOLUME I

REPAIR INSTRUCTIONS

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Alfa Romeo 

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THE FOLLOWING GROUP CONTAINS ONLY THE SPECIFIC REFERENCES TO THE 146 MODELS;
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IDENTIFICATION OF CAR VERSION

| Commercial name | 145 1.3/1.4 | 145 1.6 | 145 1.7 16V | 145 TD | 145 JTD |
|--|------------------------|---|------------------------|------------------------|----------|
| Equipment | 3-door saloon | | | | |
| Version (on identification plate) | 930 A3 | 930 A2 930 A2A <input type="checkbox"/> | 930 A1 | 930 A4 930 A4A ▲ | 930 A4B |
| Chassis (in the engine compartment, aside the upper connection of right shock absorber) | 930000 | 930000 | 930000 | 930000 | 930000 |
| Chassis ' number | 2.001.001 4.001.001 | 2.001.001 4.001.001 | 2.001.001 4.001.001 | 2.001.001 4.001.001 | - |
| Engine (code) | AR 33501 | AR 33201 | AR 33401 | AR 67501 AR 33601 ▲ | AR 32302 |
| Engine's symbol | | | 16V | TD | JTD |
| Gearbox (code) | C.802.5.16.00 | C.802.5.16.02 C.802.5.16.03 <input type="checkbox"/> | C.802.5.18.00 | C.510.5.17.63 | C.530.5 |

: Only for certain markets

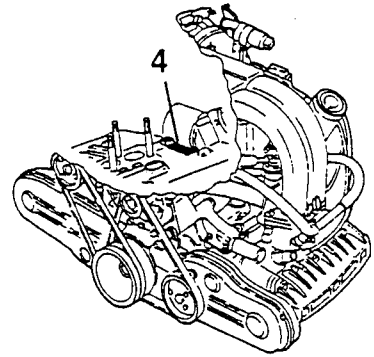
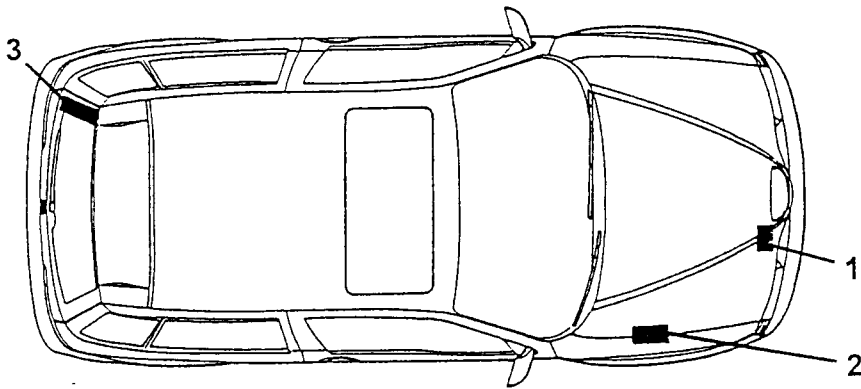
: Version with catalyst, only for certain markets.

| Commercial name | 145 | 145 1.4 T. Spark | 145 1.6 T. Spark | 145 1.8 T. Spark |
|--|--------------------------|------------------------------------|--|----------------------|
| Equipment | 3-door saloon | | | |
| Version (on identification plate) | 930 A5 | 930 A3A | 930 A2B 930 A2C <input type="checkbox"/> | 930 A1A |
| Chassis (in the engine compartment, aside the upper connection of right shock absorber) | 930000 | 930000 | 930000 | 930000 |
| Chassis ' number | 2.001.001 4.001.001 | - | - | - |
| Engine (code) | AR 67204 AR 32301 | AR 33503 | AR 67601 | AR 67106 AR 32201 |
| Engine's symbol | T. SPARK 16V | T. SPARK 16V | T. SPARK 16V | T. SPARK 16V |
| Gearbox (code) | C.510.5.21.13 C.510.5 | C.510.5.18.03 C.513.5.14.02 (1) | C.510.5.18 C.510.5.17.96 <input type="checkbox"/> | C.510.5.17.93 |

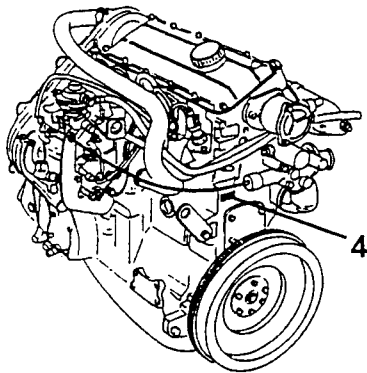
: Only for certain markets

(1): From chassis n°

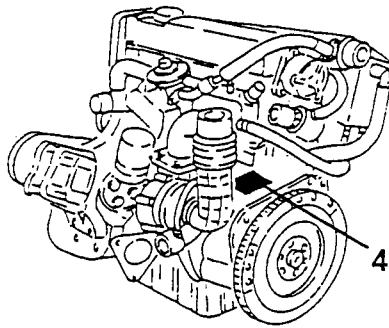
POSITIONING OF IDENTIFICATION PLATES



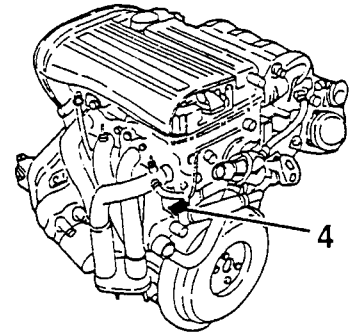
Boxer engines



1929 TD engine



1910 JTD engine

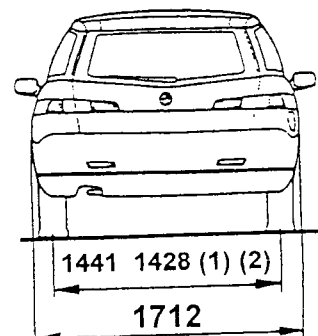
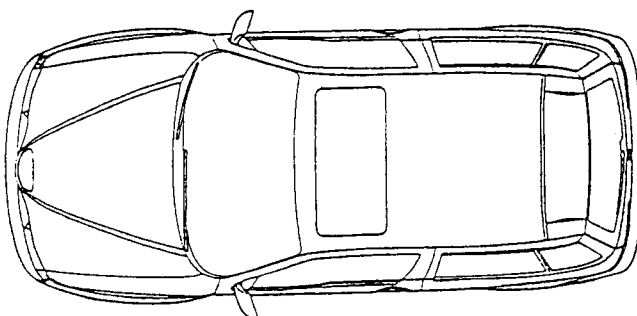
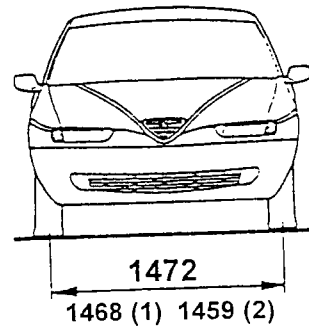
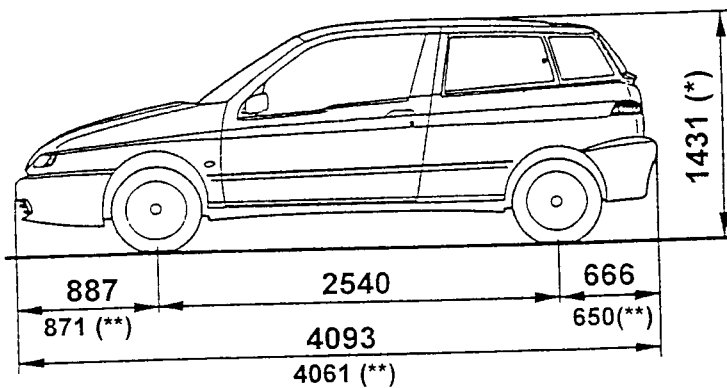



T. Spark 16V engines

- 1. Plate of summarized identification data
- 2. Body marking

- 3. ID plate of body paint
- 4. Engine marking

DIMENSIONS




(*): With exhausted car (**): For 99s versions (1): For 1.8 T. Spark version and  (2): For sporting version

SUMMARIZING PLATE OF IDENTIFICATION DATA

It is applied on the cross member of the engine bay. It includes the ID data as listed hereafter:

A. Manufacturer's name

| | | |
|--|-----------------|----|
|  P O N | A | |
| | B | |
| | C | D |
| | E | Kg |
| | F | Kg |
| | 1 - G | Kg |
| | 2 - H | Kg |
| | MOTORE - ENGINE | I |
| VERSIONE - VERSION | L | |
| N° PER RICAMBI N° FOR SPARES | M | |

B. Registration number or code

C. ID code of vehicle type

D. Number of vehicle manufacture (no. of the chassis)

E. Maximum authorized weight of the full-load vehicle

F. Maximum authorized weight at full load plus trailer

G. Maximum authorized weight on the front axle

H. Maximum authorized weight on the rear axle

I. Engine's type

L. Code of vehicle version


M. Number of spare parts

N. Correct value of grade of smoke (for Diesel engine only)

O. Supplier's code

P. Foreign producing country

Starting from the vehicle, chassis No. _____ the new ID plate is applied as follows:

| | |
|---|---------------------|
|  (E) | (F) |
| | (A) |
| | (B) |
| | (C) |
| | (C) |
| | 1 - (C) |
| | 2 - (C) |
| | MOTORE - ENGINE (D) |
| VERSIONE - VERSION (D) | |
| N° PER RICAMBI N° FOR SPARES (D) | |

A. Lines for national registration data

B. Lines where to punch the chassis number

C. Lines to indicate the max. weight authorized by different national norms

D. Lines where to indicate the version (e.g. 930A1) and possible additional data

E. Lines where to report the grade of smoke

F. Lines where to punch the manufacturer's name

ID PLATE OF BODYWORK PAINT

| | |
|---|---|
| Verniciatura originale Peinture originale/Original painting Originallackierung/Pintado original | A |
| Colori/Tinte/Colour Farben/Color | B |
| Codici/Code/Codigo | C |
| PER RITOCCHI E RIVERNICIATURE | D |

It is applied in the internal part of the rear bonnet and shows the following data:

A. Paint's manufacturer

B. Colour's name

C. Colour's code

D. Colour's code for touch-ups or repainting

WEIGHTS AND LOADS

Unit: kg

| Features | | Versions | 930 A3 | 930 A2 930 A2A | 930 A1 | 930 A4 930 A4A | 930 A4B |
|------------------------------------|--------------------------|---|--------|-------------------|--------|-------------------|------------------|
| | | Weight in running order (without driver) | | | 1140 | 1140 | 1190 |
| Maximum weight allowed | | | 1670 | 1670 | 1715 | 1765 | 1730 |
| Payload | | | 530 | 530 | 525 | 520 | 520 |
| Maximum weight allowed per axle | front | | 950 | 950 | 950 | 950 | 950 |
| | rear | | 850 | 850 | 850 | 850 | 900 |
| Towable weight | with braked trailer | | 1100 | 1100 | 1200 | 1300 1300 (*) | 1300 1300 (*) |
| | with unbraked trailer | | 350 | 350 | 350 | 350 | 350 |
| Maximum load on the ball | | | 50 | 50 | 50 | 50 | 50 |

(*): Homologated for Switzerland only.

| Features | | Versions | 930 A5 | 930 A3A | 930 A2B 930 A2C | 930 A1A |
|------------------------------------|--------------------------|---|------------------|-----------------|--------------------|-----------------|
| | | Weight in running order (without driver) | | | 1240 | 1135 |
| Maximum weight allowed | | | 1765 | 1655 | 1685 | 1715 |
| Payload | | | 525 | 520 | 520 | 520 |
| Maximum weight allowed per axle | front | | 950 | 950 | 950 | 950 |
| | rear | | 900 | 900 | 900 | 900 |
| Towable weight | with braked trailer | | 1200 1200 (*) | 1100 800 (*) | 1200 900 (*) | 1200 900 (*) |
| | with unbraked trailer | | 350 | 350 | 350 | 350 |
| Maximum load on the ball | | | 50 | 50 | 50 | 50 |

(*): Homologated for Switzerland only.

WHEELS AND TYRES

| CAR | DIMENSIONS Rims Tyres | | Pressures (bar) | | | |
|-------------------|--|--|----------------------------|------|-----------|------|
| | | | REDUCED LOAD (2 people) | | FULL LOAD | |
| | | | FRONT | REAR | FRONT | REAR |
| 930 A3 | Standard equipment | 5.5J x 14" 175/65 R14" 82T | 2.2 | 2 | 2.5 | 2.5 |
| | Optional equipment | 5.5J x 14" 185/60 R14" 82H | | | | |
| 930 A2 | Standard equipment | 5.5J x 14" 175/65 R14" 82T | 2.2 | 2 | 2.5 | 2.5 |
| | Optional equipment | 5.5J x 14" 185/60 R14" 82H (*) | | | | |
| 930 A2A | Standard equipment | 5.5J x 14" 185/65 R14" 86T | 2.2 | 2 | 2.5 | 2.5 |
| 930 A1 | Standard equipment | 5.5J x 14" 185/60 R14" 82H | 2.2 | 2 | 2.5 | 2.5 |
| 930 A4 930 A4A | Standard equipment | 5.5J x 14" 175/65 R14" 82T | 2.2 | 2.1 | 2.5 | 2.5 |
| | Optional equipment | 5.5J x 14" 185/60 R14" 82H | | | | |
| 930 A4B | Standard equipment | 5.5J x 14" 185/60 R14" 82H | 2.2 | 2.0 | 2.5 | 2.5 |
| | Optional equipment | 6J x 15" 195/55 R15" 84V | | | | |
| 930 A5 | Standard equipment | 6J x 15" 195/55 R15" 84V | 2.3 | 2.1 | 2.5 | 2 |
| 930 A3A | Standard equipment | 5.5J x 14" 6J x 15" (▲) 185/60 R14" 82H 195/55 R15" 84V (▲) | 2.2 | 2 | 2.5 | 2.5 |
| 930 A2B | Standard equipment | 5.5J x 14" 6J x 15" (▲) 185/60 R14" 82H 195/55 R15" 84V (▲) | 2.2 | 2 | 2.5 | 2.5 |
| 930 A2C | Standard equipment | 5.5J x 14" 185/60 R14" 82H | 2.2 | 2 | 2.5 | 2.5 |
| 930 A1A | Standard equipment | 6J x 15" 195/55 R15" 84V | 2.2 | 2 | 2.5 | 2.5 |
| ALL | SPARE SMALL WHEEL 4J x 15" (in steel) 4.00B x 15" (in alloy) - 115/70 R15" 90M | | 4.2 | | | |

(*) : Standard for certain markets

(▲) : For sport equipment (for versions/markets if envisaged)

WARNING: In case of continuous running in max. gears, pressures to be increased by 0.3 bar.

FLUIDS AND LUBRICANTS

| Type | Reference Group | Application | Classification | Name | |
|--------------------------|--------------------------|--------------------------------------|---|---|---|
| OIL | 10 - Engine | Engine (Supply) | - BOXER - T.SPARK 16V | API SJ SAE 10W/40 ACEA A3-96 | SELENIA 20K (1) |
| | | | 1929 TD 1910 JTD | API CD SAE 10W/40 ACEA B3-96 | SELENIA TURBODIESEL SAE 10W/40 |
| | 21 - Gearbox | Gearbox-Differential (Supply) | BOXER | API GL5 SAE 80W/90 | TUTELA W 90/M - DA |
| | | | - 1929 TD - 1910 JTD - T.SPARK 16V | SAE 75W/90 API GL - 5 | TUTELA ZC 75 SYNTH |
| | 50 - Subsidiary elements | Compressor (Supply) | BOXER | - | SANDEM SP 10 "PAG" |
| | | | 1929 TD | - | UCON RL - 488 |
| | | | 1919 JTD | - | PAG SP 20 |
| | | | T.SPARK 16V | - | NIPPONDENSO ND-9 |
| | FLUID | 10 - Engine | Cooling circuit (Supply) | - | ALFA ROMEO CLIMAFLUID SUPER PERMANENT -40°C |
| | | 18 - Clutch | Hydraulic Circuit Brakes - Clutch (Supply) | DOT 4 SAE J 1703 F | ALFA ROMEO BRAKE FLUID SUPER DOT 4 |
| | | 33 - Brakes | | | |
| | | 41 - Steering | Hydraulic Driving System (Supply) | G.M. DEXRON II | TUTELA GI/A |
| 50 - Subsidiary elements | | Conditioning circuit system (Supply) | - | RIVOIRA: SUVA R134a HOECHST-TAZZETTI: FRIGEN R134a ICI-TAZZETTI: KLEA R134a | |

(1): - In case of highly sporting use of the vehicle, it is advisable to use the engine oil **SELENIA Racing 10W/60**, which is wholly synthetical.

- In case of severe and very cold weather conditions, it is advisable to use the engine oil **SELENIA Performer 5W30, ACEA1, API SJ**.

FLUIDS AND LUBRICANTS (Continued)

| Type | Reference Group | Application | Classification | Name | |
|-----------------------------|---|---|--------------------------------|--|---|
| GREASE | 10 - Engine | Seat for intake manifold on water pump | 1929 TD | - SIL 133 MOLDGUARD | |
| | 18 - Clutch | Work seat for step bearing | BOXER | - | TUTELA MR 3 |
| | | Seat for step bearing and shaft of clutch control | - 1929 TD - T. SPARK 16V | | |
| | | Cylinder cap clutch control | | | |
| | 21 - Gearbox | External rings taper bearings pinion and differential box | BOXER | - | TUTELA MR 3 |
| | | External surface: - spacer to fix rod and gear control lever; - spacer to fix lever and fork; - guide for gear control lever | | - | TUTELA ZETA 2 |
| | | Rod bushings gearshift control and spheric of gear lever | - 1929 TD - T. SPARK 16V | - | ISECO MOLYKOTE LONGTERM N. 2 |
| | 27 - Front axle | Homokinetic couplings half shafts | | - | OPTIMOL OLISTAMOLY 2LN 584 MOLYKOTE VN 2461/C TUTELA MRM 2 |
| | 33 - Brakes | Knuckles and bushings Pedals | | - | TUTELA ZETA 2 |
| | | Seats of inductive sensors A.B.S. | | | |
| 41 - Steering | Seat of rolled bush on the support of the steering column | | - | SPCA SPAGRAPH ISECO ERGON RUBBER GREASE REINACH SFERUL B2 AR | |
| 44 - Suspensions and wheels | Flexible supports and swinging arms | | - | GREASE MOLYKOTE 7544 PG54 TUTELA MR3 | |
| | Side track rods of the steering | | - | MOLYGUARD SYL 113 | |

RELEVANT SUPPLY QUANTITIES

| Versions | | 930 A3 | 930 A2 930 A2A | 930 A1 | 930 A4 930 A4A | 930 A4B | 930 A5 | 930 A3A 930 A2B 930 A2C 930 A1A |
|----------------------------------|---|--------------------------|-------------------|-----------------------------|-------------------|--------------------------|------------|--|
| | | Supply capacities | | | | | | |
| Fuel tank | | 51 liters | | | 51/61 liters (*) | | | |
| Fuel stock | | 5 ÷ 8 liters | | | | | | |
| Engine oil | Total capacity: pan + filter + sumps + radiator | 4.7 liters | 5.2 liters | 6 liters | (**) | 5.0 liters | | |
| | Pan + filter (for recurrent replacement) | 4 liters | 4.5 liters | 5 liters | 4.2 liters | 4.4 liters | | |
| Oil for gearbox - differential | | 2.4 liters | | 2 liters | | 2 liters | | |
| Oil for hydraulic driving system | | 1.1 liters | | | 900 gr | | 1.3 liters | |
| Oil for brakes and clutch | | 0.4 kg | | 0.5 kg | 0.4 kg (▲) | 0.5 kg | | |
| Fluid for engine cooling system | | 7.8 liters | | 8.9 liters | 6.1 liters | 8.3 liters | 8.4 liters | |
| Oil for conditioning compressor | | 240 ± 15 cm ³ | | 236 ± 15 cm ³ | 130 g | 150 ± 20 cm ³ | | |
| Fluid for conditioning system | | 0.700 kg | | | (**) | | 0.700 kg | |

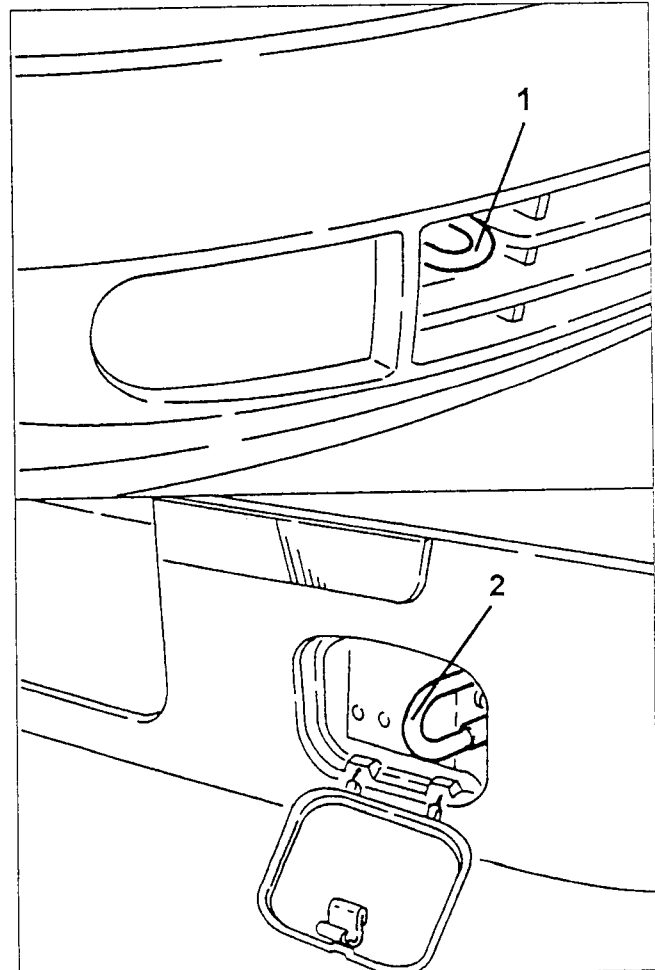
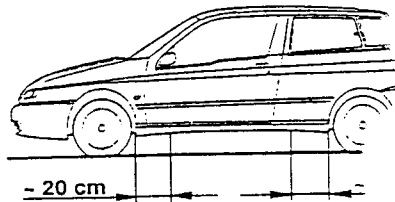
(*): For Versions/Markets
(▲): With A.B.S. = 0.54 kg

(**): Data which are not available while printing.

CAR LIFTING POINTS

With bridge or workshop autolift.

- The car is to be lifted by placing the arms' ends or the autolift as shown.



1. Front hitch

2. Rear hitch

CAR TOWING POINTS

The car is equipped with two rings, a front and a rear one, located on the right side of the bumper. The rear ring is covered by a door that can be opened by pressing on its edge. Please comply with the existing norms in matter of tow operations.

Before the towing operation, the key must be turned onto MAR position and hence is to be turned back onto STOP position without removing it; in this way the steering block will be avoided.

It is important to know that, in case of towing, there is no depression in the servo brake, it is therefore necessary to press the brake pedal with increased strength.

WEIGHTS AND LOADS

Unit: kg

| Characteristics | | Versions | 930 B2B | 930 B1A | 930 B5 |
|----------------------------------|-----------------------------|----------|---------|---------|--------|
| | | | | | |
| Kerb weight (without driver) | | | 1190 | 1215 | 1275 |
| Maximum allowed weight | | | 1710 | 1735 | 1800 |
| Useful load | | | 520 | 520 | 525 |
| Max. permissible weight per axle | front | | 950 | 950 | 950 |
| | rear | | 900 | 900 | 900 |
| Towable weight | with braked trailer | | 1200 | 1200 | 1200 |
| | with trailer without brakes | | 350 | 350 | 350 |
| Maximum load on tow hook | | | 50 | 50 | 50 |

WHEELS AND TYRES

| MODEL | Rim - Tyre SIZES | PRESSURE (bar) | | | |
|---------|-------------------------------------|-------------------------|------|-----------|------|
| | | MEDIUM LOAD (2 persons) | | FULL LOAD | |
| | | FRONT | REAR | FRONT | REAR |
| 930 B2B | 5.5J x 14" 185/60 R14" 82H | 2.2 | 2 | 2.5 | 2.5 |
| | 6J x 15" (*) 195/55 R15" 84V (*) | 2.2 | 2 | 2.5 | 2.5 |
| 930 B1A | 6J x 15" 195/55 R15" 84V | 2.2 | 2 | 2.5 | 2.5 |
| 930 B5 | 6J x 15" 195/55 R15" 84V | 2.3 | 2.1 | 2.5 | 2.5 |

(*): For Junior version (only for some versions/markets).

MODEL IDENTIFICATION

| Trade name | 145 1.3/1.4 | 145 1.6 | 145 1.7 16V | 145 TD | 145 JTD |
|---|------------------------|----------------------------------|------------------------|------------------------|-------------------|
| Trim level | 3-door saloon | | | | |
| Version (on identification label) | 930 A3 | 930 A2 930 A2A □ | 930 A1 | 930 A4 930 A4A ▲ | 930 A4B |
| Chassis (in the engine compartment to one side of the right-hand upper shock absorber attachment) | 930000 | 930000 | 930000 | 930000 | 930000 |
| Progressive chassis number | 2.001.001 4.001.001 | 2.001.001 4.001.001 | 2.001.001 4.001.001 | 2.001.001 4.001.001 | - |
| Engine (code) | AR 33501 | AR 33201 | AR 33401 | AR 67501 AR 33601 ▲ | AR 32302 |
| Engine symbol | | | 16V | TD | JTD |
| Gearbox (code) | C.802.5.16.00 | C.802.5.16.02 C.802.5.16.03 □ | C.802.5.18.00 | C.510.5.17.63 | C.530.5.XX.YY (*) |

(□): Only for some Markets

(▲): Version with catalyst only for certain Markets

(*): For future publication.

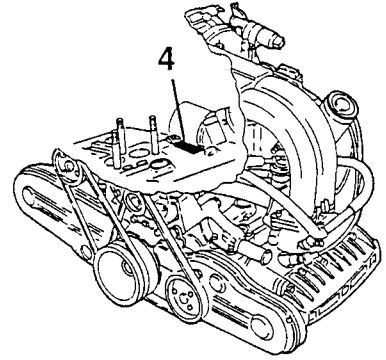
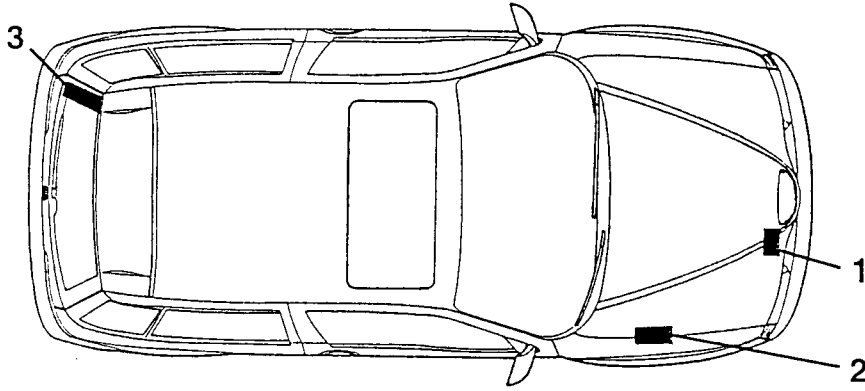
| Trade name | 145 | 145 1.4 T. Spark | 145 1.6 T. Spark | 145 1.8 T. Spark |
|---|------------------------------------|------------------------------------|-------------------------------|----------------------|
| Trim level | 3-door saloon | | | |
| Version (on identification label) | 930 A5 | 930 A3A | 930 A2B 930 A2C □ | 930 A1A |
| Chassis (in the engine compartment to one side of the right-hand upper shock absorber attachment) | 930000 | 930000 | 930000 | 930000 |
| Progressive chassis number | 2.001.001 4.001.001 | - | - | - |
| Engine (code) | AR 67204 AR 32301 | AR 33503 | AR 67601 | AR 67106 AR 32201 |
| Engine symbol | T. SPARK 16V | T. SPARK 16V | T. SPARK 16V | T. SPARK 16V |
| Gearbox (code) | C.510.5.21.13 C.510.5.XX.YY (*) | C.510.5.18.03 C.513.5.14.02 (1) | C.510.5.18 C.510.5.17.96 □ | C.510.5.17.93 |

(□): Only for some Markets

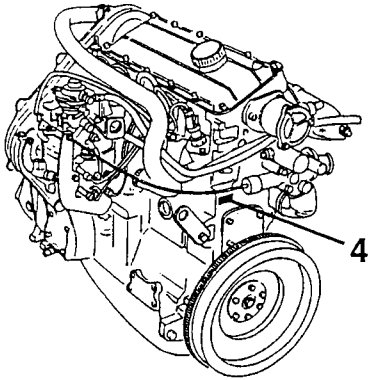
(1): From chassis no.

(*): For future publication.

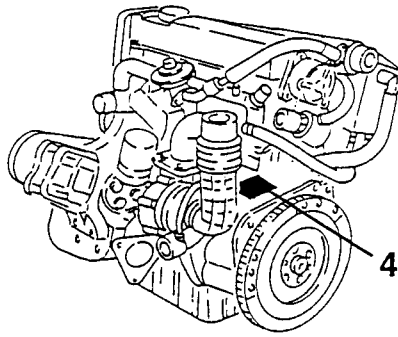
LOCATION OF IDENTIFICATION LABELS



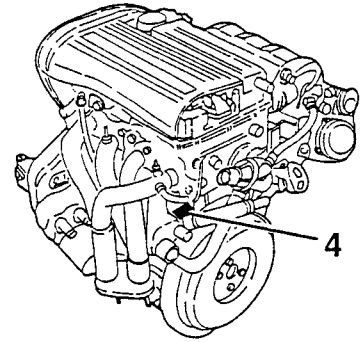
Boxer engines



1929 TD engine



1910 JTD engine

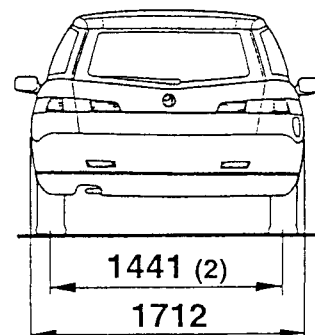
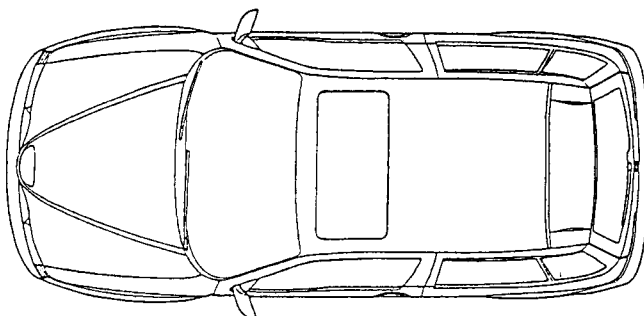
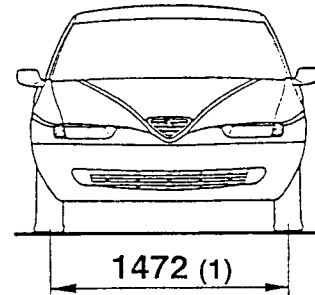
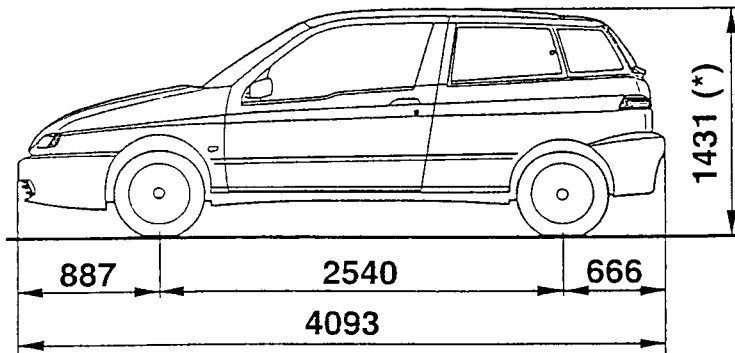


T. Spark 16V engines

- 1. Data plate
- 2. Body code

- 3. Paint identification label
- 4. Engine code

DIMENSIONS




(*): Empty vehicle

(1): 1480 for Turbodiesel versions

(2): 1428 for T. Spark 16V versions


IDENTIFICATION LABEL

This is located on the engine compartment crossmember. It contains the data listed below:

| | | |
|--|---------------------------------|----|
|  P O N | A | |
| | B | |
| | C | D |
| | E | Kg |
| | F | Kg |
| | 1 - G | Kg |
| | 2 - H | Kg |
| | MOTORE - ENGINE | I |
| | VERSIONE - VERSION | L |
| | N° PER RICAMBI N° FOR SPARES | M |

- A. Manufacturer
- B. Homologation number
- C. Vehicle identification code
- D. Chassis serial number
- E. Maximum authorized weight of fully loaded vehicle
- F. Maximum authorized weight of fully loaded vehicle plus trailer
- G. Maximum authorized weight on front axle
- H. maximum authorized weight on rear axle
- I. Engine code
- L. Vehicle version code
- M. Number for spare parts
- N. Correct smoke opacity index (for Diesel engine)
- O. Supplier code
- P. Foreign manufacturer

As from the car with chassis no. _____ the new data plate will be used:

| | | |
|---|--------------------|-----|
|  (E) | Alfa Romeo | |
| | (F) | |
| | (A) | |
| | (B) | |
| | (C) | |
| | (C) | |
| | 1 - (C) | |
| | 2 - (C) | |
| | MOTORE - ENGINE | (D) |
| | VERSIONE - VERSION | (D) |
| N° PER RICAMBI N° FOR SPARES | (D) | |

- A. Space for details of national homologation
- B. Space for punching the consecutive chassis number
- C. Space available for maximum weights authorised by various national laws
- D. Space for versions (for example 930A1) and any supplementary indications to those specified
- E. Space for smoke index
- F. Space for punching manufacturer's name

PAINT IDENTIFICATION LABEL

| | |
|---|---|
| Verniciatura originale Peinture originale/Original painting Originallackierung/Pintado original | A |
| Colore/Tinta/Colour Farbton/Color | B |
| Codice/Code/Codigo | C |
| PER RITOCCHI E RIVERNICIATURE | D |

This is located on the inner part of the luggage compartment and carries the data given below:

- A. Paint manufacturer
- B. Colour name
- C. Colour code
- D. Colour code for touch-up and respray

WEIGHTS AND LOADS

Unit: kg

| Weights and loads | | Versions | | 930 A1 | 930 A4 930 A4A | 930 A4B |
|-------------------------------------|--------------------------------|----------|-------------------|--------|-------------------|---------|
| | | 930 A3 | 930 A2 930 A2A | | | |
| Kerb weight (without driver) | | 1140 | 1140 | 1190 | 1210 | 1200 |
| Maximum allowed weight | | 1670 | 1670 | 1715 | 1730 | 1720 |
| Useful load | | 530 | 530 | 525 | 520 | 520 |
| Max. permissible weight for axle | front | 950 | 950 | 950 | 950 | 950 |
| | rear | 850 | 850 | 850 | 850 | 900 |
| Towable weight | with braked trailer | 1100 | 1100 | 1200 | 1300 | 1300 |
| | with trailer without brakes | 350 | 350 | 350 | 350 | 350 |
| Carico massimo sulla sfera | | 50 | 50 | 50 | 50 | 50 |

Unit: kg

| Weights and loads | | Versions | | 930 A2B 930 A2C | 930 A1A |
|-------------------------------------|--------------------------------|----------|---------|--------------------|---------|
| | | 930 A5 | 930 A3A | | |
| Kerb weight (without driver) | | 1240 | 1135 | 1165 | 1195 |
| Maximum allowed weight | | 1765 | 1655 | 1685 | 1715 |
| Useful load | | 525 | 520 | 520 | 520 |
| Max. permissible weight for axle | front | 950 | 950 | 950 | 950 |
| | rear | 900 | 900 | 900 | 900 |
| Towable weight | with braked trailer | 1200 | 1100 | 1200 | 1200 |
| | with trailer without brakes | 350 | 350 | 350 | 350 |
| Maximum load on tow hook | | 50 | 50 | 50 | 50 |

WHEELS AND TYRES

| MODEL | SIZES Rim Tyre | | PRESSURE (bar) | | | |
|-------------------|--|-------------------------------------|----------------------------|------|-----------|------|
| | | | MEDIUM LOAD (2 persons) | | FULL LOAD | |
| | | | FRONT | REAR | FRONT | REAR |
| 930 A3 | Standard item | 5 1/2J x 14" 175/65 R14" 82T | 2.2 | 2 | 2.5 | 2.5 |
| | Optional item | 5 1/2J x 14" 185/60 R14" 82H | | | | |
| 930 A2 | Standard item | 5 1/2J x 14" 175/65 R14" 82T | 2.2 | 2 | 2.5 | 2.5 |
| | Optional item | 5 1/2J x 14" 185/60 R14" 82H (*) | | | | |
| 930 A2A | Standard item | 5 1/2J x 14" 185/65 R14" 86T | 2.2 | 2 | 2.5 | 2.5 |
| 930 A1 | Standard item | 5 1/2J x 14" 185/60 R14" 82H | 2.2 | 2 | 2.5 | 2.5 |
| 930 A4 930 A4A | Standard item | 5 1/2J x 14" 175/65 R14" 82T | 2.2 | 2.1 | 2.5 | 2.5 |
| | Optional item | 5 1/2J x 14" 185/60 R14" 82H | | | | |
| 930 A4B | Not available at time of going to press | | | | | |
| 930 A5 | Standard item | 6J x 15" 195/55 R15" 84V | 2.3 | 2.1 | 2.5 | 2 |
| 930 A3A | Standard item | 5 1/2J x 14" 185/60 R14" 82H | 2.2 | 2 | 2.5 | 2.5 |
| 930 A2B | Standard item | 5 1/2J x 14" 185/60 R14" 82H | 2.2 | 2 | 2.5 | 2.5 |
| 930 A2C | Standard item | 5 1/2J x 14" 185/60 R14" 82H | 2.2 | 2 | 2.5 | 2.5 |
| 930 A1A | Standard item | 6J x 15" 195/55 R15" 84V | 2.2 | 2 | 2.5 | 2.5 |
| ALL | COMPACT SPARE WHEEL 4J x 15" (in steel) - 115/70 R15" 90M 4.00B x 15" (in alloy) | | 4.2 | | | |

(*): Standard item for some Markets.

WARNING: In the event of continuous driving at top speed, the pressures should be increased by 0.3 bar.

FLUIDS AND LUBRICANTS

| Type | Group ref. | Application | Classification | Name | |
|-----------------------|-----------------------|---|--|---|--|
| OIL | 10 - Engine | Engine (Refilling) | - BOXER - T. SPARK 16V | API SJ SAE 10W/40 ACEA A3-96 | SELENIA 20K |
| | | | 1929 TD 1910 JTD | API CD SAE 10W/40 ACEA B3-96 | SELENIA TURBODIESEL SAE 10W/40 |
| | 21 - Gearbox | Gearbox - differential (Refilling) | BOXER | API GL5 SAE 80W/90 | TUTELA W 90/M - DA |
| | | | - 1929 TD - 1910 JTD - T. SPARK 16V | SAE 75W/90 API GL - 5 | TUTELA ZC 75 SINT |
| | 50 - Auxiliary organs | Compressor (Refilling) | BOXER | - | SANDEM SP 10 "PAG" |
| | | | 1929 TD | - | UCON RL - 488 |
| | | | 1910 JTD | - | PAG SP 20 |
| | | | T. SPARK 16V | - | NIPPONDENSO ND-9 |
| | FLUID | 10 - Engine | Cooling circuit (Refilling) | - | ALFA ROMEO CLIMAFLUID SUPER PERMANENT - 40°C |
| | | 18 - Clutch | Brake - clutch hydraulic circuit (Refilling) | DOT 4 SAE J 1703 F | ALFA ROMEO BRAKE FLUID SUPER DOT 4 |
| 33 - Brakes | | | | | |
| 41 - Steering | | Power steering system (Refilling) | G.M. DEXRON II | TUTELA GI/A | |
| 50 - Auxiliary organs | | Air conditioning system circuit (Refilling) | - | RIVOIRA: SUVA R134a HOECHST-TAZZETTI: FRIGEN R134a ICI-TAZZETTI: KLEA R134a | |

(1): For decidedly sportive use of the car fully synthetic **SELENIA Racing 10W/60** engine oil is recommended-

FLUIDS AND LUBRICANTS (Cont.d)

| Type | Group ref. | Application | Classification | Name | |
|-----------------------------|--|--|---|---|---|
| GREASE | 10 - Engine | Housing for intake manifold on water pump | 1929 TD | - SIL 133 MOLDGUARD | |
| | 18 - Clutch | Thrust bearing seat | BOXER | - TUTELA MR 3 | |
| | | Thrust bearing seat and clutch control lever shaft | - 1929 TD - T. SPARK 16V | | |
| | | Clutch control cylinder prod | | | |
| | 21 - Gearbox | Pinion taper bearing outer rings and differential carrier | BOXER | - | TUTELA MR 3 |
| | | Outer surface: - spacer fastening rod to gearshift control lever; - spacer for fastening lever to fork; - guide for gearshift control lever | | - | TUTELA ZETA 2 ISECO MOLYKOTE LONGTERM N. 2 |
| | | Gear engagement rod bushes and gearshift lever ball | | - 1929 TD - T. SPARK 16V | |
| | 27 - Front axle | Axle shaft constant velocity joints | | - OPTIMOL - OLISTAMOLY 2LN 584 MOLYKOTE VN 2461/C TUTELA MRM 2 | |
| | 33 - Brakes | Pedal unit joints and bushes | | - | TUTELA ZETA 2 |
| | | A.B.S. inductive sensor housing | | | |
| 41 - Steering | Roller bush housing on steering column support | | - SPCA SPAGRAPH ISECO ERGON RUBBER GREASE REINACH SFERUL B2 AR | | |
| 44 - Suspensions and wheels | Wishbone flexible mounts | | - | GREASE MOLYKOTE 7544 PG54 TUTELA MR3 | |
| | Steering track rods | | - | MOLYGUARD SYL 113 | |

APPROXIMATE SERVICING CAPACITIES

| Version | | 930 A3 | 930 A2 930 A2A | 930 A1 | 930 A4 930 A4A | 930 A4B | 930 A5 | 930 A3A 930 A2B 930 A2C 930 A1A |
|------------------------------|--|--------------------------|-------------------|--------------------------|-------------------|--------------------------|------------|--|
| | | Capacity | | | | | | |
| Fuel tank | | 51 litres | | | 51/61 litres (*) | | | |
| Fuel reserve | | 5 + 8 litres | | | | | | |
| Engine oil | Total capacity: sump + filter + wells + radiator | 4.7 litres | 5.2 litres | 6 litres | (**) | 5.0 litres | | |
| | Sump + filter (for periodical replacement) | 4 litres | 4.5 litres | 5 litres | 4.2 litres | 4.4 litres | | |
| Gearbox - differential oil | | 2.4 litres | | 2 litres | | 2 litres | | |
| Power steering system oil | | 1.1 litres | | | (**) | 1.3 litres | | |
| Brake and clutch circuit oil | | 0.4 kg | | 0.5 kg | (**) | 0.5 kg | | |
| Engine cooling system fluid | | 7.8 litres | | 8.9 litres | (**) | 8.3 litres | 8.4 litres | |
| Conditioner compressor oil | | 240 ± 15 cm ³ | | 236 ± 15 cm ³ | 130 g | 150 ± 20 cm ³ | | |
| Air conditioner system fluid | | 0.700 kg | | | (**) | 0.700 kg | | |

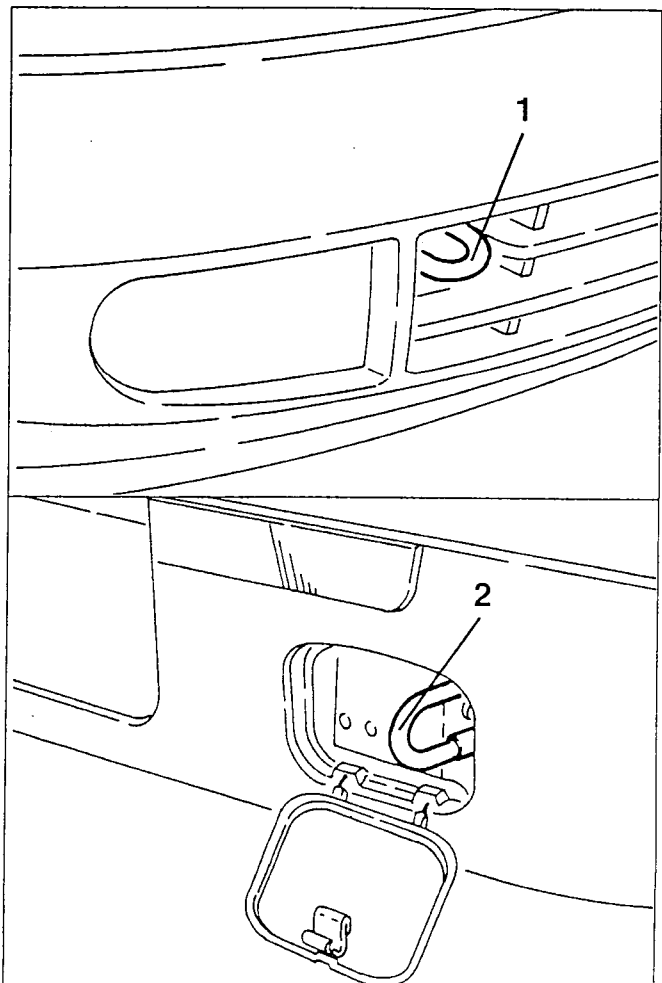
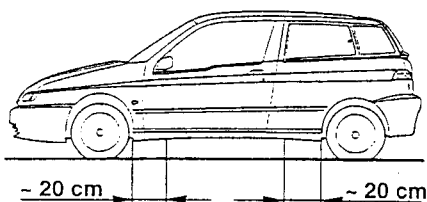
(*): For Versions/Markets

(**): Not available at time of going to press.

CAR LIFTING POINTS

Using an arm lift or workshop jack.

- The car should be raised setting the ends of the arms or the jack in the areas illustrated.



1. Front tow hook

2. Rear tow hook

CAR TOW POINTS

The car has two rings, one at the front and one at the rear, on the right-hand side of the bumpers.

The rear ring is covered by a lid that is opened by pushing on the edge.

Always strictly adhere to local regulations on the subject of towing.

Before towing, the ignition switch of the towed car should be turned to MAR and then to STOP without removing it; this will prevent the steering from locking.

Remember that when the car is towed, the vacuum is not created in the servobrake system, therefore, considerably greater pressure on the brake pedal is required.

THE FOLLOWING TORQUE WRENCH SETTINGS REFER TO JOIN/DISJOIN OPERATIONS OF 1910 JTD MOTORIZATION, FOR THOSE OF "ENGINE OVERHAULING" REFER TO PAGE 41

Group 00 - Engine maintenance

| Part | Nm | kgm |
|---|---------|-----------|
| Clamping screws of driving shaft pulley | 21 ÷ 26 | 2.1 ÷ 2.7 |
| Clamping nut of driving belt tightener | 43 ÷ 53 | 4.4 ÷ 5.4 |

Group 10 - Engine

| Part | | Nm | kgm |
|---|-----|---------|-----------|
| Clamping nuts of half shafts | | 36 ÷ 44 | 3.6 ÷ 4.5 |
| Clamping nuts of the righthand shock absorber to the wheel post | | 67 ÷ 74 | 6.8 ÷ 7.5 |
| Clamping screws of the middle half shaft | | 8 ÷ 10 | 0.8 ÷ 1.0 |
| Oil discharge cover of gearbox/differential | | 16 ÷ 26 | 1.6 ÷ 2.7 |
| Clamping screws of the gearbox/differential group to the engine | M10 | 37 ÷ 45 | 3.8 ÷ 4.6 |
| | M12 | 68 ÷ 84 | 6.9 ÷ 8.5 |
| Clamping screws of clutch group | | 19 ÷ 23 | 1.9 ÷ 2.3 |
| Clamping screws of the driving shaft pulley | | 21 ÷ 26 | 2.1 ÷ 2.7 |
| Temperature sensor of the engine cooling fluid | | 17 ÷ 21 | 1.7 ÷ 2.1 |
| Joints of pressure pump pipes to the fuel manifold - manifold's side/pressure pump's side | | 26 ÷ 32 | 2.7 ÷ 3.3 |

Group 10 - Feed engine

| Part | Nm | kgm |
|--|---------|-----------|
| Clamping screws of the driving shaft pulley | 21 ÷ 26 | 2.1 ÷ 2.7 |
| Clamping nut of the tightener of the driving belt | 43 ÷ 53 | 4.4 ÷ 5.4 |
| Joints of pressure pump pipes to the fuel's manifold - manifold's side/pressure pump side | 26 ÷ 32 | 2.7 ÷ 3.3 |
| Clamping nuts of the pressure pump | 26 ÷ 32 | 2.7 ÷ 3.3 |
| Clamping nut of the control pulley and pressure pump | 43 ÷ 53 | 4.4 ÷ 5.4 |
| Pipes joints of the fuel manifold to electroinjectors - electroinjector's side/manifold's side | 19 ÷ 23 | 1.9 ÷ 2.3 |
| Electroinjectors' clamping nuts | 26 ÷ 32 | 2.7 ÷ 3.3 |
| Fuel temperature sensor | 13 ÷ 16 | 1.3 ÷ 1.6 |
| Clamping nuts of the multistage centrifugal blower (turbosupercharger) | 21 ÷ 26 | 2.1 ÷ 2.7 |

THE FOLLOWING TORQUE WRENCH SETTINGS REFER TO JOIN/DISJOIN OPERATIONS OF 1910 JTD MOTORIZATION, FOR THOSE OF "ENGINE OVERHAULING" REFER TO PAGE 41

Group 00 - Engine maintenance

| Part | Nm | kgm |
|---|---------|-----------|
| Clamping screws of driving shaft pulley | 21 ÷ 26 | 2.1 ÷ 2.7 |
| Clamping nut of driving belt tightener | 43 ÷ 53 | 4.4 ÷ 5.4 |



Group 10 - Engine

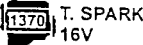
| Part | | Nm | kgm |
|---|-----|---------|-----------|
| Clamping nuts of half shafts | | 36 ÷ 44 | 3.6 ÷ 4.5 |
| Clamping nuts of the righthand shock absorber to the wheel post | | 67 ÷ 74 | 6.8 ÷ 7.5 |
| Clamping screws of the middle half shaft | | 8 ÷ 10 | 0.8 ÷ 1.0 |
| Oil discharge cover of gearbox/differential | | 16 ÷ 26 | 1.6 ÷ 2.7 |
| Clamping screws of the gearbox/differential group to the engine | M10 | 37 ÷ 45 | 3.8 ÷ 4.6 |
| | M12 | 68 ÷ 84 | 6.9 ÷ 8.5 |
| Clamping screws of clutch group | | 19 ÷ 23 | 1.9 ÷ 2.3 |
| Clamping screws of the driving shaft pulley | | 21 ÷ 26 | 2.1 ÷ 2.7 |
| Temperature sensor of the engine cooling fluid | | 17 ÷ 21 | 1.7 ÷ 2.1 |
| Joints of pressure pump pipes to the fuel manifold - manifold's side/pressure pump's side | | 26 ÷ 32 | 2.7 ÷ 3.3 |

Group 10 - Feed engine

| Part | Nm | kgm |
|--|---------|-----------|
| Clamping screws of the driving shaft pulley | 21 ÷ 26 | 2.1 ÷ 2.7 |
| Clamping nut of the tightener of the driving belt | 43 ÷ 53 | 4.4 ÷ 5.4 |
| Joints of pressure pump pipes to the fuel's manifold - manifold's side/pressure pump side | 26 ÷ 32 | 2.7 ÷ 3.3 |
| Clamping nuts of the pressure pump | 26 ÷ 32 | 2.7 ÷ 3.3 |
| Clamping nut of the control pulley and pressure pump | 43 ÷ 53 | 4.4 ÷ 5.4 |
| Pipes joints of the fuel manifold to electroinjectors - electroinjector's side/manifold's side | 19 ÷ 23 | 1.9 ÷ 2.3 |
| Electroinjectors' clamping nuts | 26 ÷ 32 | 2.7 ÷ 3.3 |
| Fuel temperature sensor | 13 ÷ 16 | 1.3 ÷ 1.6 |
| Clamping nuts of the multistage centrifugal blower (turbosupercharger) | 21 ÷ 26 | 2.1 ÷ 2.7 |

CLUTCH

| | | Boxer engines | Turbodiesel engines | | T. Spark 16V engines |
|---------------------------------------|-----------------|-----------------|---|---|----------------------------------|
| | | |  TD |  JTD | |
| Thickness of the plate | New | 7.1 ÷ 7.7 mm | 7.1 ÷ 7.7 mm | - | 7.1 ÷ 7.7 mm 6.7 ÷ 7.3 mm (*) |
| | Almost worn out | 6.1 mm | 6.1 mm | - | 6.3 mm 5.9 mm (*) |
| Cylinder cap stroke of clutch control | | 16.15 ÷ 18.2 mm | 13.5 mm | 13.5 mm | - |

(*): Specific for engine  T. SPARK 16V with gearbox C.513.5

GEARBOX

RATIOS (Specific for Boxer and Turbodiesel engines)

| | Gear | Ratio | Inserted gearshift | Gear ratio | Total ratio |
|----------------------|---------|--------------------|--------------------|------------|-------------|
| 930 A3 (before mod.) | C.802.5 | 9/37 1 : 4.111 | 1^ | 1 : 3.545 | 1 : 14.576 |
| 930 A2 (before mod.) | | | 2^ | 1 : 2.050 | 1 : 8.428 |
| 930 A1 (before mod.) | | | 3^ | 1 : 1.323 | 1 : 5.437 |
| | | | 4^ | 1 : 1.027 | 1 : 4.222 |
| | | | 5^ | 1 : 0.854 | 1 : 3.509 |
| | | | RM | 1 : 3.091 | 1 : 12.707 |
| 930 A3 (after mod.) | C.802.5 | 10/43 1 : 4.3 | 1^ | 1 : 3.545 | 1 : 15.246 |
| | | | 2^ | 1 : 2.050 | 1 : 8.815 |
| | | | 3^ | 1 : 1.323 | 1 : 5.687 |
| | | | 4^ | 1 : 1.027 | 1 : 4.416 |
| | | | 5^ | 1 : 0.854 | 1 : 3.671 |
| | | | RM | 1 : 3.091 | 1 : 13.291 |
| 930 A2 (after mod.) | C.802.5 | 11/45 1 : 4.091 | 1^ | 1 : 3.545 | 1 : 14.503 |
| | | | 2^ | 1 : 2.050 | 1 : 8.387 |
| | | | 3^ | 1 : 1.323 | 1 : 5.412 |
| | | | 4^ | 1 : 1.027 | 1 : 4.201 |
| | | | 5^ | 1 : 0.854 | 1 : 3.494 |
| | | | RM | 1 : 3.091 | 1 : 12.645 |
| 930 A2A | C.802.5 | 9/35 1 : 3.888 | 1^ | 1 : 3.545 | 1 : 13.782 |
| | | | 2^ | 1 : 2.050 | 1 : 7.970 |
| | | | 3^ | 1 : 1.323 | 1 : 5.143 |
| | | | 4^ | 1 : 1.027 | 1 : 3.992 |
| | | | 5^ | 1 : 0.854 | 1 : 3.320 |
| | | | RM | 1 : 3.091 | 1 : 12.017 |
| 930 A4 | C.510.5 | 18/57 1 : 3.166 | 1^ | 1 : 3.909 | 1 : 12.376 |
| | | | 2^ | 1 : 2.238 | 1 : 7.085 |
| | | | 3^ | 1 : 1.440 | 1 : 4.559 |
| | | | 4^ | 1 : 1.029 | 1 : 3.258 |
| | | | 5^ | 1 : 0.794 | 1 : 2.514 |
| | | | RM | 1 : 3.909 | 1 : 12.376 |

ROLLING TORQUES (Specific for Boxer engines)

| | | |
|--------------------|---------------------|----------------|
| False pinion: | for reused bearings | 0.29 ÷ 0.59 Nm |
| | for new bearings | 1.17 ÷ 1.47 Nm |
| Pinion with gears: | for reused bearings | 0.39 ÷ 0.69 Nm |
| | for new bearings | 1.27 ÷ 1.57 Nm |

RATIOS (Specific for T. Spark engines)

| | Gearbox | Ratios | Inserted gearshift | Gear ratio | Total ratio |
|---------|---------|--------------------|--------------------|------------|-------------|
| 930 A5 | C.510.5 | 16/57 1 : 3.562 | 1^ | 1 : 3.545 | 1 : 12.631 |
| | | | 2^ | 1 : 2.238 | 1 : 7.973 |
| | | | 3^ | 1 : 1.520 | 1 : 5.415 |
| | | | 4^ | 1 : 1.156 | 1 : 4.119 |
| | | | 5^ | 1 : 0.946 | 1 : 3.370 |
| | | | RM | 1 : 3.909 | 1 : 13.926 |
| 930 A3A | C.510.5 | 15/58 1 : 3.866 | 1^ | 1 : 3.909 | 1 : 15.112 |
| | | | 2^ | 1 : 2.238 | 1 : 8.652 |
| | | | 3^ | 1 : 1.520 | 1 : 5.876 |
| | | | 4^ | 1 : 1.156 | 1 : 4.469 |
| | | | 5^ | 1 : 0.919 | 1 : 3.553 |
| | | | RM | 1 : 3.909 | 1 : 15.112 |
| 930 A3A | C.513.5 | 15/59 1 : 3.933 | 1^ | 1 : 3.909 | 1 : 15.374 |
| | | | 2^ | 1 : 2.238 | 1 : 8.802 |
| | | | 3^ | 1 : 1.520 | 1 : 5.978 |
| | | | 4^ | 1 : 1.156 | 1 : 4.546 |
| | | | 5^ | 1 : 0.919 | 1 : 3.614 |
| | | | RM | 1 : 3.909 | 1 : 15.374 |
| 930 A2B | C.510.5 | 16/57 1 : 3.562 | 1^ | 1 : 3.909 | 1 : 13.924 |
| | | | 2^ | 1 : 2.238 | 1 : 7.972 |
| | | | 3^ | 1 : 1.520 | 1 : 5.414 |
| | | | 4^ | 1 : 1.156 | 1 : 4.118 |
| | | | 5^ | 1 : 0.971 | 1 : 3.459 |
| | | | RM | 1 : 3.909 | 1 : 13.924 |
| 930 A2C | C.510.5 | 17/57 1 : 3.353 | 1^ | 1 : 3.909 | 1 : 13.107 |
| | | | 2^ | 1 : 2.238 | 1 : 7.504 |
| | | | 3^ | 1 : 1.520 | 1 : 5.096 |
| | | | 4^ | 1 : 1.156 | 1 : 3.876 |
| | | | 5^ | 1 : 0.971 | 1 : 3.256 |
| | | | RM | 1 : 3.909 | 1 : 13.107 |
| 930 A1A | C.510.5 | 15/56 1 : 3.733 | 1^ | 1 : 3.909 | 1 : 14.592 |
| | | | 2^ | 1 : 2.238 | 1 : 8.354 |
| | | | 3^ | 1 : 1.520 | 1 : 5.674 |
| | | | 4^ | 1 : 1.156 | 1 : 4.315 |
| | | | 5^ | 1 : 0.946 | 1 : 3.531 |
| | | | RM | 1 : 3.909 | 1 : 14.592 |

DIFFERENTIAL (Specific for 1929 Turbodiesel and T. Spark 16V engines)

Bearings preloading (unloaded) = 0.12 mm

Play between crown wheels and side pinions ≤ 0.10 mm

RATIOS (Specific for 99s models)

TO BE PUBLISHED SOON

WHITE

BRAKES

BRAKE DISC







| | | FRONT | | | REAR |
|----------------------------------|------|-------------------|---------------|-------------------|-------------|
| | | Suction brake (*) | Suction brake | Non-suction brake | |
| Diameter | (mm) | 284 | 257 | 257 | 240 |
| Limit utilisation thickness | (mm) | 20.2 | 18.2 | 10.2 | 9.2 |
| Minimum thickness after grinding | (mm) | 21.1 | 19.1 | 11.1 | 10.1 |
| Nominal thickness | (mm) | 21.8 ÷ 22.1 | 19.8 ÷ 20.1 | 11.8 ÷ 12.1 | 10.8 ÷ 11.1 |

(*): Specific for engines  T. SPARK 16V  T. SPARK 16V

BRAKE PADS

| | FRONT | REAR |
|--|---|--------|
| Limit utilisation thickness of friction brake shoe | 1.5 mm (Shown by a sensor for brake pads wear) | 1.5 mm |

REAR BRAKE DRUMS

| | BOXER ENGINES  T.S. 16V  T.S. 16V |  T.S. 16V  T.S. 16V  TD  JTD |
|-----------------------------|---|---|
| Nominal diameter | 228.7 mm | 203 mm |
| Max diameter after grinding | 229.1 mm | - |
| Limit utilisation thickness | 230 mm | - |

REAR DRUM BRAKE SHOES

| | |
|---|--------|
| Limit utilisation thickness of friction gaskets | 1.5 mm |
|---|--------|

ENTRFRER OF INDUCTIVE SENSORS - A.B.S. PHONIC WHEELS

| | |
|--------------|---------------|
| Front wheels | 0.3 ÷ 1.05 mm |
| Rear wheels | 0.2 ÷ 1.15 mm |

FRONT SUSPENSIONS

HELICAL SPRINGS (Specific for Boxer and T. Spark 16V engines)

| Engines | Boxer 8V | Boxer 16V | 1970 T. SPARK 16V | | 1370 T. SPARK 16V | 1598 1747 T. SPARK 16V |
|-------------------|----------|-----------|-------------------|------------|-------------------|------------------------|
| | | | Before mod. | After mod. | | |
| Wire's diameter | 13.8 mm | 13.8 mm | 13.8 mm | 13.7 mm | 13.7 mm | 13.8 mm |
| Internal diameter | 150 mm | 150 mm | 150 mm | 150 mm | 150 mm | 150 mm |
| Loose length | 366 mm | 369 mm | 384 mm | 370 mm | 384 mm | 386.5 mm |

NOTICE: Helical springs are divided according to hardness classification and marked with different paint colours so to be easily detected. In case of replacement of one or both springs, check that the new springs are marked with the same colour of the replaced ones.

SHOCK ABSORBERS (Specific for Boxer and T. Spark 16V engines)

| | Boxer | T. Spark 16V |
|---------------|--------|--------------|
| Stem diameter | 22 mm | 22 mm |
| Stroke | 145 mm | 167 mm |

STABILIZER BAR (Specific for Boxer and T. Spark 16V engines)

| | | |
|--------------|-------|-----------|
| Bar diameter | 22 mm | 23 mm (*) |
|--------------|-------|-----------|

(*): Specific for engines  T. SPARK 16V  T. SPARK 16V

HELICAL SPRINGS (Specific for Turbodiesel engines)

| Versions | Conditioned | Non-conditioned |
|-------------------|-------------|-----------------|
| Wire's diameter | 14 mm | 13.8 mm |
| Internal diameter | 150 mm | 150 mm |
| Loose length | 416 mm | 386 mm |

NOTICE: Helical springs are divided according to hardness classification and marked with different paint colours so to be easily detected. In case of replacement of one or both springs, check that the new springs are marked with the same colour of the replaced ones.

SHOCK ABSORBERS (Specific for Turbodiesel engines)





| | |
|---------------|--------|
| Stem diameter | 22 mm |
| Stroke | 155 mm |

STABILIZER BAR (Specific for Turbodiesel engines)

| | |
|--------------|-------|
| Bar diameter | 23 mm |
|--------------|-------|

REAR SUSPENSIONS

HELICAL SPRINGS

| | BOXER TURBODIESEL |  T. SPARK 16V |  T. SPARK 16V |   T. SPARK 16V |
|-------------------|----------------------|---|---|---|
| Wire's diameter | 12.3 mm | 12.1 mm | 12.6 mm | 12.1 mm |
| Internal diameter | 100 mm | 100 mm | 100 mm | 100 mm |
| Loose length | 305 mm | 305 mm | 299 mm | 295 mm |

NOTICE: Helical springs are divided according to hardness classification and marked with different paint colours so to be easily detected. In case of replacement of one or both springs, check that the new springs are marked with the same colour of the replaced ones.

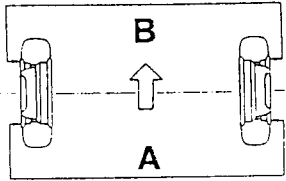
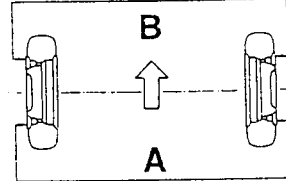
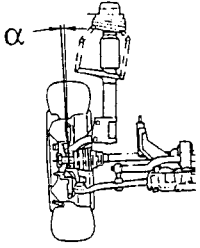
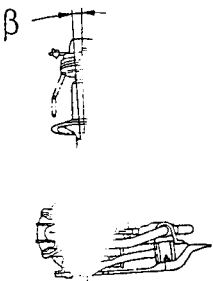
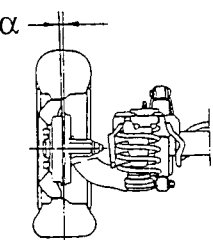
SHOCK ABSORBERS

| | |
|---------------|---------|
| Stem diameter | 11.5 mm |
| Stroke | 96.5 mm |

STABILIZER BAR

| | |
|--------------|-------|
| Bar diameter | 16 mm |
|--------------|-------|

WHEELS' POSITIONS AND CHARACTERISTIC ANGLES (*)

| Features | Versions | Boxer | Turbodiesel 1.4 T.Spark 16V 1.6 T.Spark 16V | 1.8 T.Spark 16V 2.0 T.Spark 16V |
|--|---|--------------------|---|------------------------------------|
| Front position (B - A) | See GROUP 44 | 40 ± 5 mm | -13 ± 5 mm | -26 ± 5 mm |
| Rear position (C - D) | See GROUP 44 | 7 ± 5 mm | -2 ± 5 mm | -2 ± 5 mm |
| Toe-in/Toe-out front wheels (A - B) |  | 3.5 ± 1 mm | -1 ± 1 mm 0 ± 1 mm (●) | 0 ± 1 mm |
| Toe-in rear wheels (A - B) |  | | -0.5 ± 2 mm 2.0 ± 2 (▲) | |
| Camber of front wheels "α" |  | $-1^\circ \pm 20'$ | $-1^\circ 10' \pm 20'$ | $-1^\circ 30' \pm 20'$ |
| Caster "β" |  | | $2^\circ 40' \pm 30'$ | |
| Camber of rear wheels "α" |  | | $-1^\circ \pm 20'$ $-45' \pm 30'$ (▲) | |

(*): Values measured in running gear (with prescribed supplies) and with tyres with prescribed pressure.

(●): Specific for JUNIOR versions

(▲): From chassis number 4.058.043 - 2.076.237.

WARNINGS

To keep the car in good operating conditions, the following recommendations should be adhered to carefully:

Every 500 kms (or when refuelling) check:

- the engine oil level;
- the level of the fluid in the coolant circuit;
- the level of the brake/clutch fluid;
- the presence of water in the fuel filter (turbodiesel versions only);
- the level of the fluid in the windscreen wiper/washer system.

Engine oil and filter

To be changed at the specified intervals.
At all events, they must be changed once a year.

Air cleaner

If the car is habitually used on dusty roads, the air cleaner should be changed more often than specified.

Fuel filter (TD versions only)

The different degree of purity of the fuel may make it necessary to change the filter at shorter intervals than those foreseen.

Irregular functioning of the engine or reduced performance levels may indicate the need to change the fuel filter.

Brake pads

Wear of the front brake pads is indicated by the turning on of a warning light on the instrument cluster. When changing the front pads, also check the rear ones.

However, depending on the use of the car, the rear pads might not need to be changed immediately, in which case, you are recommended to check them at a later stage.

Brake and clutch fluid

The brake fluid is hygroscopic, i.e. it absorbs moisture.

To avoid braking faults, the brake fluid must be changed every two years, regardless of the mileage.

Battery

During hot weather, check the electrolyte level frequently.

Dust and/or pollen filter (if fitted)

Once a year, preferably at the beginning of warm weather, check the conditions of the pollen filter. If the vehicle is used mainly in town, on motorways or dusty roads it is advisable to check the filter more frequently. Failure to change the filter can considerably reduce the performance of the air conditioner system.

Anti-freeze

It is advisable to top up with Alfa Romeo Climaf fluid Super Permanent -40°C Alfa Romeo to conserve the protective properties of the mixture.

Checking exhaust smoke

For the turbodiesel versions, this check must be carried out every 10,000 km.

Notes

Under special driving conditions (e.g. on roads sprinkled with antifreeze salt and/or corrosive substances, rough road surfaces, etc.) often check the boots of the axle shafts and steering box, and clean and lubricate joints, hinges, door catches, bonnet catch, etc.)

When forced to use fuel, lubricants and/or fluids in general with characteristics other than those specified by the manufacturer (in emergencies), replace the fluids and corresponding filters at the earliest opportunity.

**WARNING:**

THE FOLLOWING MAINTENANCE TABLE IS VALID FROM JULY 1996.

| Operations to have carried out at the km shown | km x 1.000 | | | | | | | | |
|---|------------|----|----|----|-----|-----|-----|-----|-----|
| | 20 | 40 | 60 | 80 | 100 | 120 | 140 | 160 | 180 |
| Check tyre conditions and wear | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Check operation of front disk brake pad wear indicator | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Check conditions of rear disk brake pad wear | | ● | | ● | | ● | | ● | |
| Check conditions and wear of rear drum brake linings | | | ● | | | ● | | | ● |
| Check intactness of boots for axle shafts, power steering, joint caps and check tightness of brake and fuel pipes | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Check the tension and if necessary adjust accessories drive belt (except engines with automatic tensioners) | | ● | | ● | | ● | | ● | |
| Visually check conditions of trapezoidal and/or Poly-V accessory drive belts | | ● | | ● | | ● | | ● | |
| Check handbrake lever stroke | | ● | | ● | | ● | | ● | |
| Check/adjust valve clearance (Specific for turbodiesel engine) | ● | ● | | ● | | ● | | ● | |
| Check exhaust emissions (petrol engines) | | ● | | ● | | ● | | ● | |
| Check smoke opacity (Turbodiesel engines) | | ● | | ● | | ● | | ● | |
| Check operation of evaporative system | | | | ● | | | | ● | |
| Change the fuel filter (petrol engines) | | | | ● | | | | ● | |
| Change the fuel filter (Turbodiesel engines) | | ● | | ● | | ● | | ● | |
| Change the air cleaner cartridge (petrol engines) | | ● | | ● | | ● | | ● | |
| Change the air cleaner cartridge (Turbodiesel engines) | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Check and if necessary top up fluid levels (brake, hydraulic clutch, power steering, windscreen wiper, battery, engine coolant, etc.) | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Change the timing gear drive belt (at 80,000 km for Boxer engines) | | | | | | ● | | | |
| Change the spark plugs (T. Spark 16V and Boxer 16V engines) | | | | | ● | | | | |
| Change the spark plugs (Boxer 8V engines) | | ● | | ● | | ● | | ● | |
| Check operation of engine control system (through diagnosis socket) | | ● | | ● | | ● | | ● | |
| Check the gearbox and differential oil level | | | | ● | | | | ● | |
| Change the engine oil (*) (every 10,000 km for turbodiesel engines) | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Changing the engine oil filter (every 10,000 km for turbodiesel engines) | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Change the brake fluid (or every 24 months) | | | ● | | | ● | | | ● |
| Change the pollen filter (or every 12 months) | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Check conditions of timing gear belt (chloroprene rubber belts only) | | | | ● | | | | | |

(*): In any case every 18 months in the event of lower mileage.

WARNING

Perfect performance and the life of every car are strictly linked to the use made of it and above all to the care with which normal maintenance operations are carried out, for which, as a result of product evolution, new programming criteria have been adopted.

The interval between scheduled maintenance coupons is 20.000 km; 10.000 km for Turbodiesel versions.

It is however wise to remember that the car needs routine care such as for instance systematically checking and if necessary topping up the level of fluids, checking the tyre pressure, etc.

You are reminded that correct vehicle maintenance is certainly the best way to keep the car's performance levels and safety features unchanged over the years while respecting the environment and at low running costs.

Engine oil

If the car is used in one of the following particularly exacting conditions:

- trailer towing
- dusty roads
- short (less than 7-8 km) repeated journeys with an outside temperature below zero
- engine frequently run at idle speed or long distance driving at low speed (or in the case of prolonged inactivity); it is advisable to change the engine oil more frequently than specified.

Battery

It is advisable to have the battery charge checked preferably at the onset of winter to avoid the possibility of freezing of the electrolyte.

This check should be carried out if the car is prevalently used for short journeys, or if it is fitted with services that absorb current permanently when the ignition key is engaged, especially if fitted in the after market.

**Fuel oil filter
(only Turbodiesel versions)**

The differing degree of purity of fuel oil in commerce may make it necessary to change the fuel oil filter more frequently than specified.

Dust and/or pollen filter (if fitted)

If the vehicle is used frequently in dusty or heavily polluted environments it is advisable to change the filtering element more frequently.

The failure to change the filter may considerably reduce the effectiveness of the climate control system.

Antifreeze

Topping up is recommended with Climafluid Super Permanent -40°C Alfa Romeo in order to preserve the protective characteristics of the mixture.



WARNING:
THE FOLLOWING SERVICE PLAN IS VALID FROM APRIL 1997
FOR T. SPARK 16V AND 1929 TD VERSIONS.

| Operations to be performed at the km shown | km x 1.000 | | | | | | | | |
|--|------------|----|----|----|-----|-----|-----|-----|-----|
| | 20 | 40 | 60 | 80 | 100 | 120 | 140 | 160 | 180 |
| Check tyre wear and conditions | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Check front disc brake pad wear sensor operation | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Check rear disc brake pad conditions | | ● | | ● | | ● | | ● | |
| Check rear drum brake seal conditions are wear | | | ● | | | ● | | | ● |
| Check intactness of drive shaft protective bellows, power steering and steering joint caps and check tightness of brake and fuel feed system pipes | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Check and, if required, adjust accessory belt tension (excluding engines with automatic take-up devices) | | ● | | ● | | ● | | ● | |
| Check counter-rotating shaft belt conditions (where relevant) | | ● | | ● | | | | ● | |
| Inspect accessory belt conditions | | ● | | ● | | ● | | ● | |
| Check handbrake stroke | | ● | | ● | | ● | | ● | |
| Check/adjust tappet clearance (specific for turbodiesel engine) | | ● | | ● | | ● | | ● | |
| Check exhaust emissions (petrol engines) | | ● | | ● | | ● | | ● | |
| Check smokiness (turbodiesel engine) | | ● | | ● | | ● | | ● | |
| Check evaporation system operation | | | | ● | | | | ● | |
| Replace fuel filter (petrol engines) | | | | ● | | | | ● | |
| Replace fuel filter (turbodiesel engine) | | ● | | ● | | ● | | ● | |
| Replace air cleaner cartridge (petrol engines) | | ● | | ● | | ● | | ● | |
| Replace air cleaner cartridge (turbodiesel engine) | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Check and, if required, top up fluid levels (brakes, hydraulic clutch, power steering, windscreen washer, battery, engine coolant, etc.) | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Check timing belt conditions | | | | ● | | | | | |
| Replace timing belt | | | | | | ● | | | |
| Replace counter-rotating shaft belt (where relevant) | | | | | | ● | | | |
| Replace spark plugs | | | | | ● | | | | |
| Check engine control system operation (by means of diagnostic socket) | | ● | | ● | | ● | | ● | |
| Check gearbox and differential oil level | | | | ● | | | | ● | |
| Change engine oil (*) (every 10.000 km for turbodiesel version) | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Change engine oil filter (every 10.000 km for turbodiesel version) | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Change brake fluid (or every 24 months) | | | ● | | | ● | | | ● |
| Replace pollen filter (or every 12 months) | ● | ● | ● | ● | ● | ● | ● | ● | ● |

(*): Or every 18 months in the event of lower mileage.

WARNINGS

Attain to the following instructions integrating the Service Schedule to ensure correct vehicle operation:

Every 500 km (or when refuelling) check:

- engine oil level;
- coolant level;
- brake/clutch fluid level;
- powered steering fluid level;
- battery electrolyte level;
- tyre pressure;
- windscreen washer, rear window washer and headlight washer (where relevant) liquid level;
- the presence of water in the fuel filter (TD versions only); if required, bleed the filter.

Engine oil

If the vehicle is mainly used in any of the following especially demanding circumstances:

- towing a trailer
 - dusty roads
 - short repeated trips (less than 7-8 km) with outside temperature below zero
 - frequent engine idling or driving long distances at low speed (or long vehicle storage)
- we recommend you change the oil more frequently than shown in the Service Schedule.

Air cleaner

If the vehicle is used mainly on dusty roads, the air cleaner will need to be replaced more frequently than prescribed.

Brake pads

Worn brake pads are signalled by means of a warning light on the instrument panel.

In vehicles equipped with a front brake pad wear sensors only, check the rear brake pads when the front pads are replaced. According to the vehicle use, however, the rear brake pads may not require immediate replacement. In this case, we recommend checking the rear brake pads later in time.

Brake/clutch fluid

The brake fluid is hygroscopic, i.e. it absorbs moisture. To avoid braking problems, change the brake fluid every 24 months, regardless of the mileage.

Battery

Check battery charge at the beginning of winter to avoid electrolyte freezing. Check the level more frequently if the vehicle is mainly used for short trips or if it is equipped with units which run off the battery when the ignition key is removed, especially if these unit were installed after-market.

Climate control system (where relevant)

Climate control system efficiency

To keep the system ship-shape, just turn it on once a fortnight, even in winter, for a few minutes.

For vehicles equipped with ECON function automatic climate control systems, turn the system off occasionally, as this system works without starting the compressor. In this way, operation will be ensured in summer or in hot weather with normal vehicle use. In intermediate seasons, check the ECON function is not on and press the TEMP button until the message LO appears on the display indicating the temperature required in the passenger compartment.

In the summer and before correct climate control system, check system efficiency.

Have the climate control system serviced and the coolant gas circuit recharged at an Alfa Romeo Dealership exclusively. The use of different types of gasses, in fact, can damage the system components beyond repair and is an environmental hazard.

**Pollen and/or dust filters
(where fitted)**

If the vehicle is used mainly in built-up areas or on dusty roads, the filter may need to be replaced more often than shown in the Service Schedule.

The climate control system efficiency can be compromised if the filter is not replaced adequately.

**Diesel fuel filter
(turbo diesel versions only)**

The various degrees of purity of diesel fuel on the market may lead to replacing the diesel oil filter more frequently than shown in the Service Schedule.

Anti-freeze

We recommend you top up with Climafluid Super Permanent -40°C Alfa Romeo to preserve the protective features of the mixture.

Notes

In certain conditions of use (e.g. roads sprinkled with ice melting salt and/or corrosive substances, badly surfaced roads, etc.), check the drive shaft and steering unit bellows often. Also check lubrication of joints, hinges, door and lid locks, etc.

If, in the event of an emergency, lubricant and/or fluids not responding to the manufacturer's specifications are used, we recommend changing the fluid and filters in the specific circuit as soon as possible.



ATTENTION:
THE FOLLOWING MAINTENANCE GRID IS TO BE APPLIED STARTING FROM 98 MODELS
FOR THE FOLLOWING VERSIONS : T. SPARK 16V AND 1910 JTD

| Operations to be performed at the kms shown | Km X 1.000 | | | | | | | | |
|--|------------|----|----|----|-----|-----|-----|-----|-----|
| | 20 | 40 | 60 | 80 | 100 | 120 | 140 | 160 | 180 |
| Check tyres' conditions and wear | • | • | • | • | • | • | • | • | • |
| Check functioning of wear sensor for front brake pads | • | • | • | • | • | • | • | • | • |
| Check conditions of rear brake pads | | • | | • | | • | | • | |
| Check conditions and wear of rear drum brake shoes | | | • | | | • | | | • |
| Check integrity of half shafts'bellows,power steering, joint's caps and pipes' seal of braking and fuel system | • | • | • | • | • | • | • | • | • |
| Visual check of belts' conditions and accessories' controls | | | • | | | | | | • |
| Check of the handbrake lever stroke | | • | | • | | • | | • | |
| Check/Adjustment of valves' play (Specific for turbodiesel engines) | | • | | • | | • | | • | |
| Check of exhaust emissions (petrol engines) | | • | | • | | • | | • | |
| Check of smoke grade (turbodiesel engines) | | • | | • | | • | | • | |
| Check functioning of the antievaporative system | | | | • | | | | • | |
| Replacement of fuel filter (turbodiesel engines) | | • | | • | | • | | • | |
| Replacement of the air filter cartridge(petrol engines) | | • | | • | | • | | • | |
| Replacement of the air filter cartridge(turbodiesel engines) | • | • | • | • | • | • | • | • | • |
| Check and refill the fluids' level (brakes, hydraulic clutch, power steering, wipers, battery, engine cooling, etc.) | • | • | • | • | • | • | • | • | • |
| Replacement of the driving belt | | | | | | • | | | |
| Replacement of the control belt of the counterrotating shafts (if foreseen) | | | | | | • | | | |
| Replacement of spark plugs | | | | | • | | | | |
| Check of functioning of engine control systems | | • | | • | | • | | • | |
| Check gearbox/differential oil level | | | | • | | | | • | |
| Replacement of engine oil (*) (every 10,000 km for turbodiesel engines) | • | • | • | • | • | • | • | • | • |
| Replacement of engine oil filter (every 10,000 km for turbodiesel engines) | • | • | • | • | • | • | • | • | • |
| Replacement of brakes' fluid (or every 24 months) | | | • | | | • | | | • |
| Replacement of anti-pollen filter (or every 12 months) | • | • | • | • | • | • | • | • | • |

(*): However every 18 months in case of lower km covered.

WARNING

To achieve the best performance of the car it is necessary to comply with the maintenance agenda shown in the Scheduled Maintenance Plan and, besides, to stick to the following recommendations:

Every 1,000 km or before long travels it is advisable to check and eventually to refill:

- the engine oil level;
- the cooling fluid level;
- the brakes/clutch fluid level;
- the power steering fluid level;
- the battery fluid level;
- the tyres' pressure;
- the fluid level of the wipers, rear window, etc.;
- the possible presence of water in the fuel filter (only for TD versions); if necessary, the filter should be drained.

Engine oil

In case the car is mainly used under just one of the following severe conditions:

- trailer towing
 - dusty roads
 - short (less than 7-8 km) but repeated tracts at an outside temperature below 0°
 - frequently running slow engine or long-distance driving at low speed (or in case of long lasting inactivity)
- it is advisable to replace the engine oil more frequently than shown in the Scheduled Maintenance Plan.

Air filter

If usually driving onto dusty roads, the replacement of the air filter should be performed more frequently than shown.

Brake pads

Brake pads are subjected to a different grade of utilisation and wear according to using conditions and driving approach.

In case the pilot lamp of the front brake pads is on, check immediately the thickness of the pads.

As the car is equipped with a wear sensor scanning only the front lefthand brake pad, it is important to check also the front righthand brake pad and the rear brake pads as well.

Maybe the latter do not require immediate replacement; so it is advisable to check them again after a short range of time.

Brakes/Clutch fluid

The brakes' fluid is hygroscopic, i.e. it does absorb humidity.

In order to avoid braking failures it is important to replace it every 24 months apart from the km covered.

Battery

It is advisable to check the charging status of the battery especially at the beginning of the cold season so to avoid the freezing of the electrolyte.

This check is to be performed more frequently if the car is mainly used for short-range driving or if equipped with continuous absorption users with the key out, especially if applied in after market.

Air-Conditioner (if foreseen)**Efficiency of the air-conditioning system**

In order to keep the air-conditioning system at its best, it is sufficient to let it work every 15 days, even during winter time, by starting the compressor for a few minutes.

Before summertime, it is advisable to have the system checked for its efficiency.

For the maintenance of the air-conditioning system and for the possible refilling of the cooling gas circuit, please refer exclusively to the Authorized Alfa Romeo Assistance Centers, as the use of a different gas could cause unrepairable damage to the system's parts and hurts the environment.

Anti-dust/Anti-pollen filter

(only for cars equipped with air-conditioning system)

Check the filter's conditions at least once a year, better at the beginning of the summer, at your Authorized Alfa Romeo Assistance Center.

In case of frequent use of the car in dusty / polluted environment, it is advisable to check the system more frequently than prescribed by the Scheduled Maintenance Plan; more precisely, the filtering part must be replaced if there is a decreased air quantity flowing into the passenger compartment.

In case of non-replacement, the efficiency of the air-conditioning system could be remarkably diminished.

Diesel fuel filter (only for turbodiesel versions)

The variety of the purity of the marketed Diesel fuel could require the replacement of the Diesel fuel filter at more frequent intervals than prescribed by the Scheduled Maintenance Plan.

Antifreeze

It is advisable to perform the refilling with Climaf fluid Super Permanent -40°C Alfa Romeo so to preserve the protecting features of the mixture.

Rubber hoses

The flexible rubber hoses of the braking system, the power steering, the fuel system, the feeding system, etc. must be carefully checked.

Wheels

Check the tyres' pressure (including the spare wheel's) periodically and before long travels.

The pressure check should be performed before starting the car.

Check periodically that the tread's depth complies with the minimum value envisaged by the law.

WARNING: Some tyres are equipped with wear indicators; their replacement must be performed as soon as the indicators are perceivable on the tread.

Check periodically that the tyres do not have or show cuts, blowings or uneven wear of the tread.

In case of accidental puncture, stop the car immediately and replace the tyre so to avoid damage to the tyre itself, its rim, the suspensions and the steering.

The wheels (rims and tyres) supplied by the manufacturer are the most appropriate for the car's features and do guarantee the highest safety and comfort standard under normal driving conditions.

Before replacing the rims or the tyres, refer to the table showing the types allowed.

In any case, stick to the rim-tyre matching of the original supply.

In case of replacement, use only new tyres and avoid uncontrolled ones.

Remarks

Under particular using conditions (e.g. on roads with anti-ice salt on, in case of ravelled roads, etc.) check the bellows of the half shafts and the steering box frequently; besides, perform the cleaning and the lubrication of joints, hinges, locking hooks, etc.

In case of use of lubricants and/or fluids without the required properties specified by the manufacturer, it is advisable to replace the filter and the fluids concerned as soon as possible.

BOXER ENGINES' MAINTENANCE

REPLACEMENT OF ENGINE OIL AND FILTER



ATTENTION:

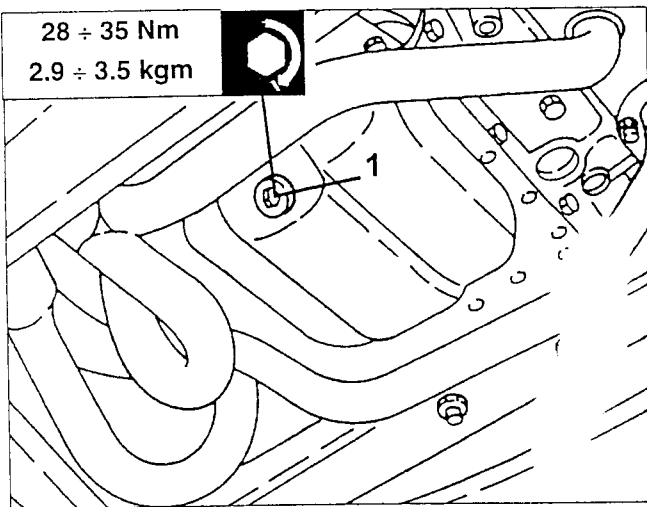
Engine oil can hurt the skin : avoid direct contact as much as possible. Should contact occur, wash thoroughly with soap and water.

- With warm engine, remove the refilling cap.
 - Pull out the control indicator of oil level.
 - Lift the car.
1. Unscrew the discharge cap and let the oil drain out completely into a proper container.



ATTENTION:

During the cap removal, be cautious: the oil could be hot.



ATTENTION:

Do not waste the oil into the environment: it cause pollution.

- Operating from underneath the car with the proper wrench, unblock the oil filter and remove it.
- Clean the discharge cap and screw it with its own gasket according to the prescribed torque.
- Damp with oil the gasket of the new filter and screw it by hand.
- Lower the car.
- Supply the engine with the oil as prescribed.
- Check with the oil indicator the correct oil level.



ATTENTION:

The check of the oil level is to be performed with the car in flat position. An oil level surpassing the MAX notch can cause excessive evaporation of the oil itself and hence a pressure loss.

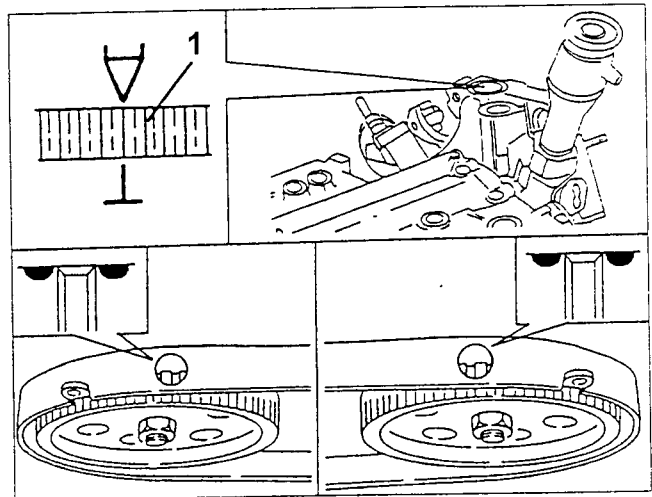
- Mount the refilling cap again and let the engine run for about 2 minutes; stop the engine and wait for a few minutes.
- Check the oil level and be sure there are no leakages.

ATTENTION: During refilling operations be careful to avoid accidental oil leaking in the alternator's louvers; this may cause severe damage and fire danger.

REPLACEMENT OF THE TRANSMISSION CONTROL BELTS

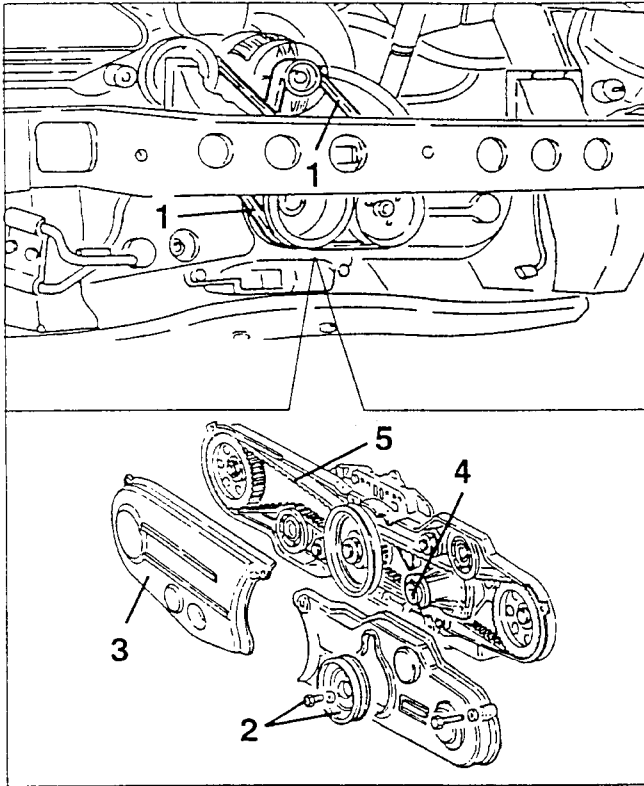
Specific for Boxer 8V engine

- Disconnect the battery terminal (-).
 - Remove the electrofan for the engine cooling (see GROUP 10).
 - Remove the sleeve for filter 's air intake.
 - Disconnect the wires from the spark plugs and remove the plugs.
1. Check the engine timing.

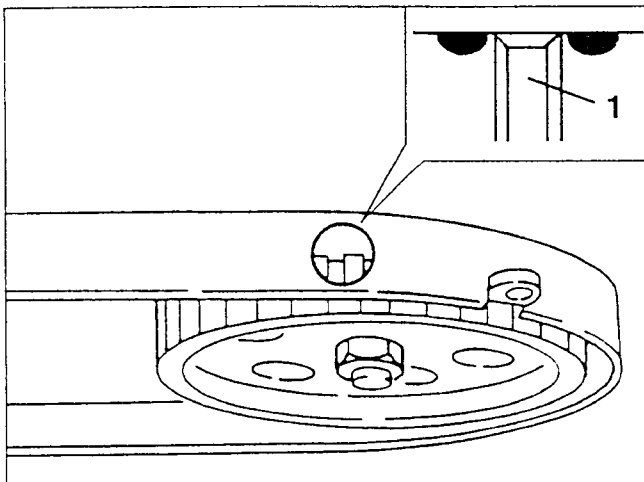


1. Loosen the clamping screws and bolts concerned, hence remove the control belt of the hydrodrive pump and the control belt of the alternator-water pump group.
2. Unscrew the clamping screws and remove the pulley of the water pump.
3. Unscrew the clamping screws and remove the covers of the transmission belts.
4. Loosen the clamping nut of the righthand belt-tightener, hence press onto the guide pulley so to win against the spring's load and block the clamping nut.

5. Remove the right timing belt firstly from the camshaft pulley and then from the crankshaft pulley. - Repeat the above procedure to remove the left-hand belt.



1. Turn the camshaft so that the tooth and the two adjacent milling marks on the timing pulley can be seen through the special hole on the rear cover.

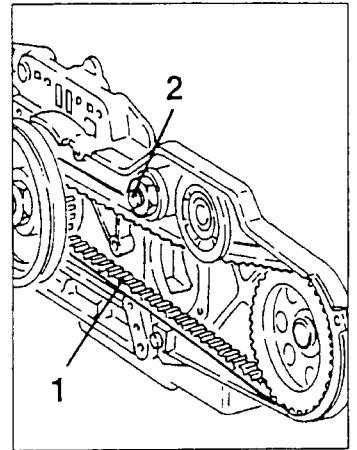


- Turn the crankshaft until the notch "T" on the flywheel is aligned with the fixed reference.
1. Fit the left-hand timing belt.

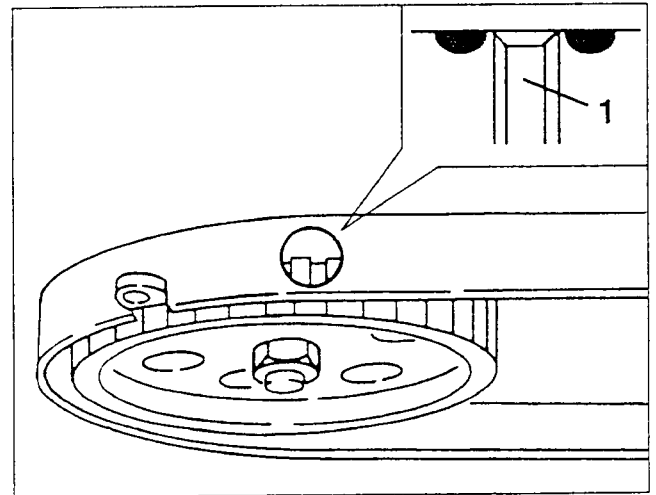
WARNING:

The belt should be keyed with the belt drive section opposed to the tensioned tensioners.

2. Slacken the nut fastening the belt tensioner so that it can exert the pressure impressed by the spring on the belt, then tighten the nut.



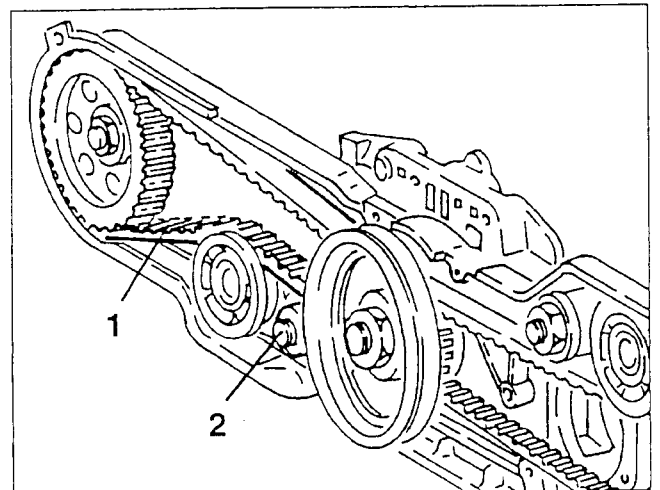
1. Turn the right camshaft until the tooth and the two adjacent marks milled on the timing pulley can be seen through the special hole on the rear cover.
- Turn the crankshaft to take the piston in cylinder no.



1 to the T.D.C. in the bursting stroke.

1. Fit the right-hand timing belt.

2. Slacken the nut fastening the belt tensioner so that it can exert the pressure impressed by the spring on the belt, then tighten the nut.





WARNING:

The pulley tends to turn away from the correct position as the camshaft interacts with the inlet valve of cylinder no. 3.

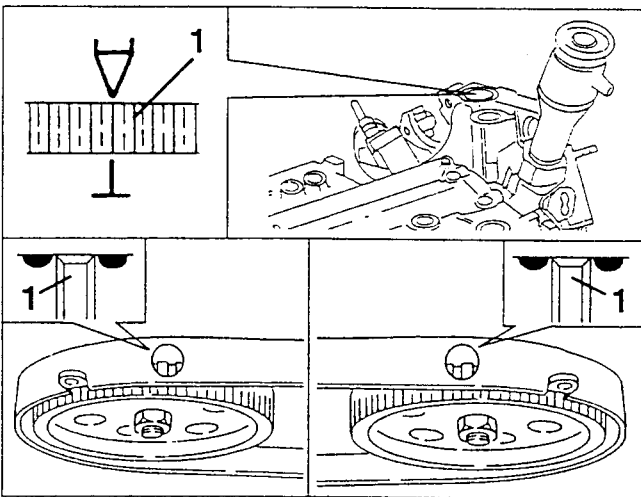
For this reason, use the special ratchet wrench N° 1.822.008.000 (A.5.0195) to keep the pulley in the correct position for fitting the belt.



WARNING:

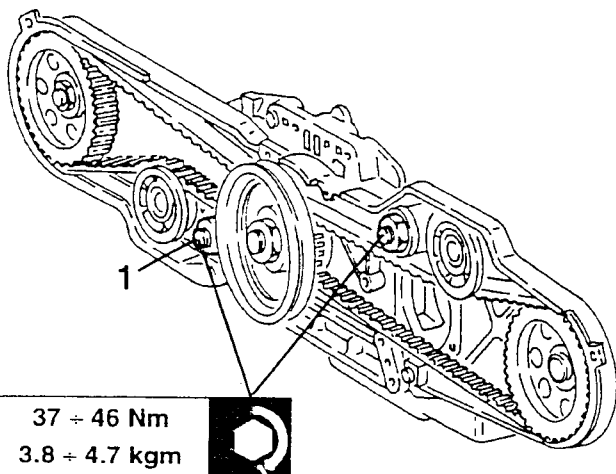
During this operation do not exert pressure on the belt tensioner to avoid changing the load foreseen for it.

- Turn the crankshaft a few times in its direction of rotation to allow the belts to take their final position.
- 1. Check the engine timing.



- Turn the crankshaft by 90° in its direction of rotation, until the notch "●" on the flywheel is aligned with the fixed reference.

1. Slacken the right-hand belt tensioner nut, then tighten it to the specified torque.



- Turn the crankshaft by 360° in its direction of rotation until the notch "●" on the flywheel is aligned with the fixed reference.

- Proceed as described for tightening the left-hand belt tensioner.

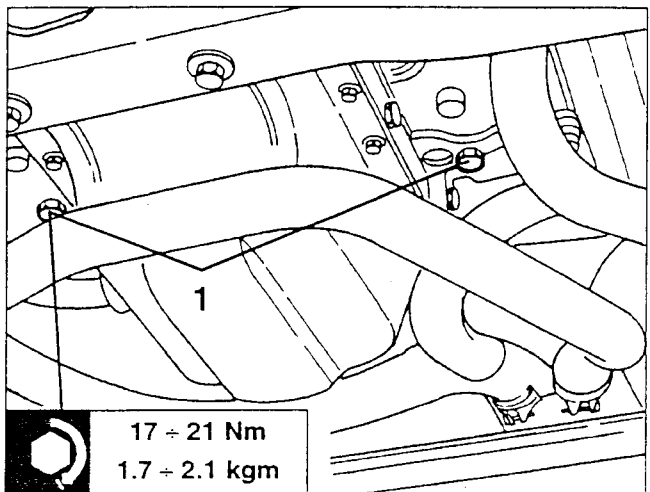
- Upon completion of the operations described, check that the timing reference marks coincide.
- Complete refitting operations reversing the sequence described for removal.

CHANGING THE TIMING GEAR DRIVE BELTS

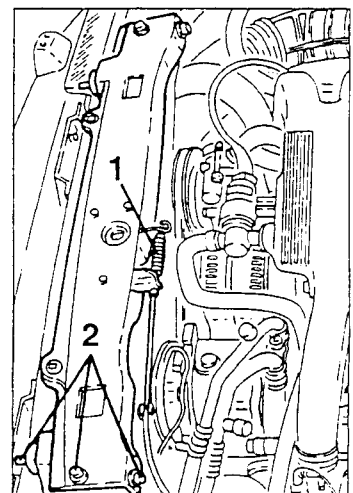
Specific for 16V

- Disconnect the battery (-) terminal.
- Drain the fluid from the air conditioning system (see GROUP 50).
- 1. Unscrew the two plugs under the crankcase and drain the coolant fluid into a suitable recipient.

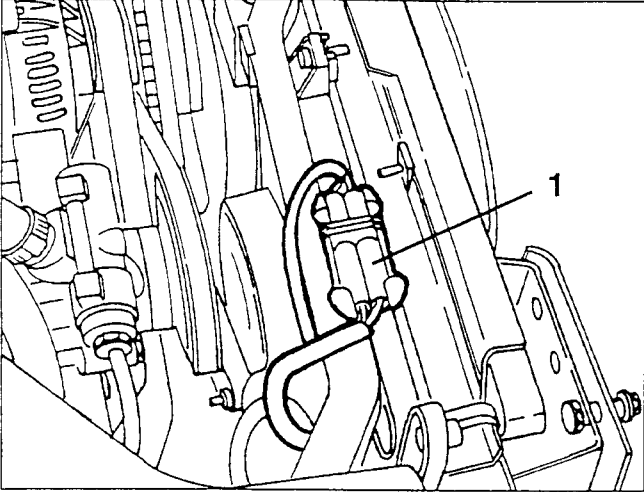
The anti-freeze mixture used as coolant fluid can damage the paintwork: therefore avoid touching painted components.



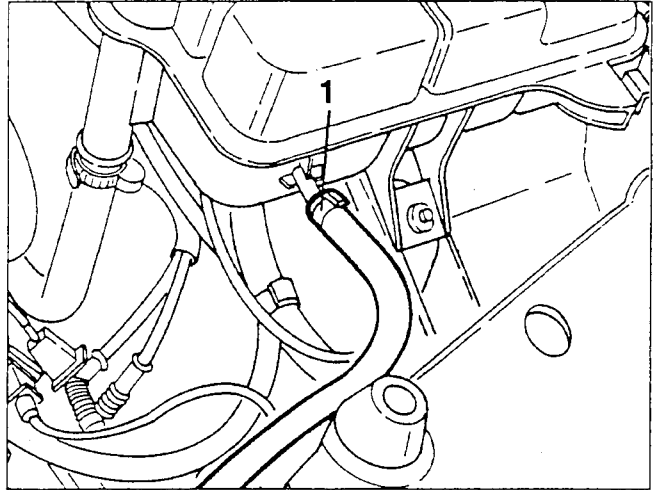
- Remove the radiator grille and the front bumper (see GROUP 70).
- 1. Disconnect the bonnet opening cable from the lock.
- 2. Slacken the fastening screws and remove the radiator upper cross-member.



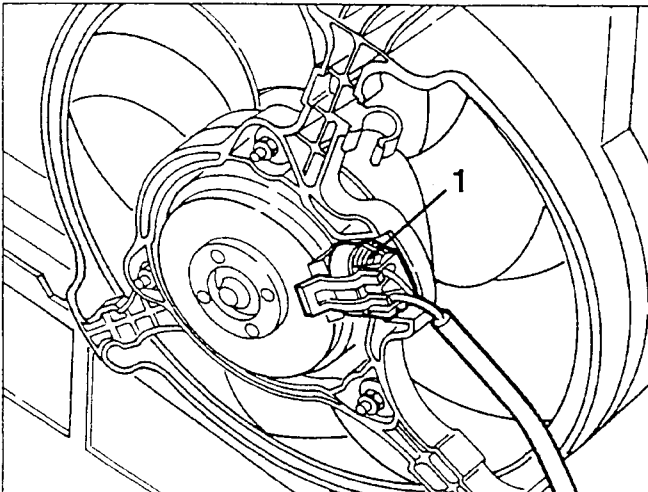
1. Remove the electrical connection withdrawing it from the support above the cooling radiator.



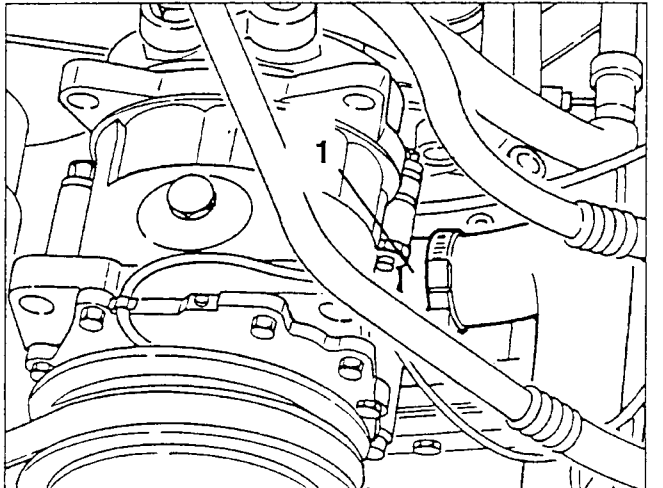
1. Disconnect the radiator connection pipe from the header tank.



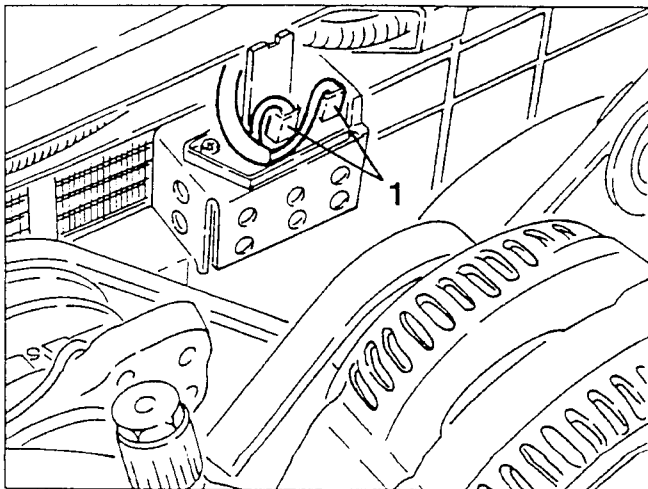
1. Disconnect the electrical connections supplying the cooling fans.



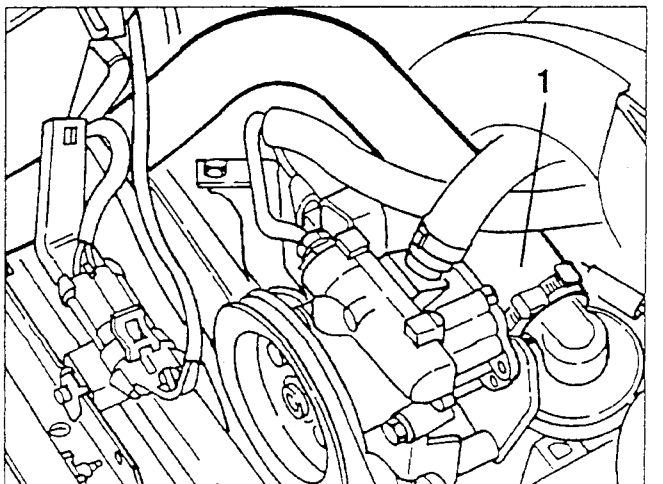
1. Disconnect the radiator coolant outlet sleeve from the connection on the crankcase.



1. Disconnect the electrical connections from the cooling fan speed coil.

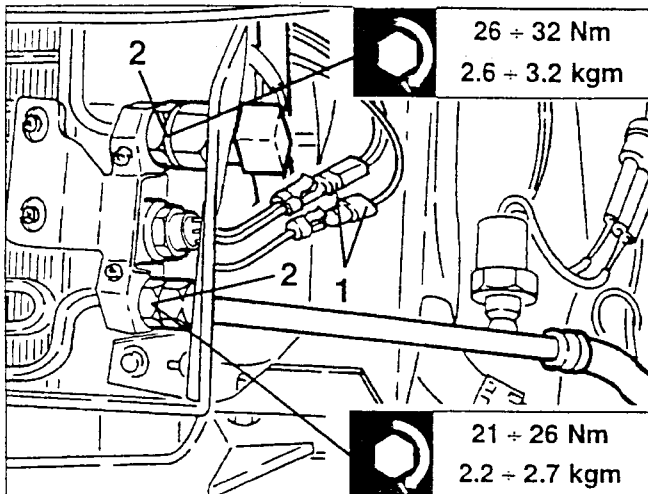


1. Disconnect the radiator coolant delivery pipe from the thermostatic cup.

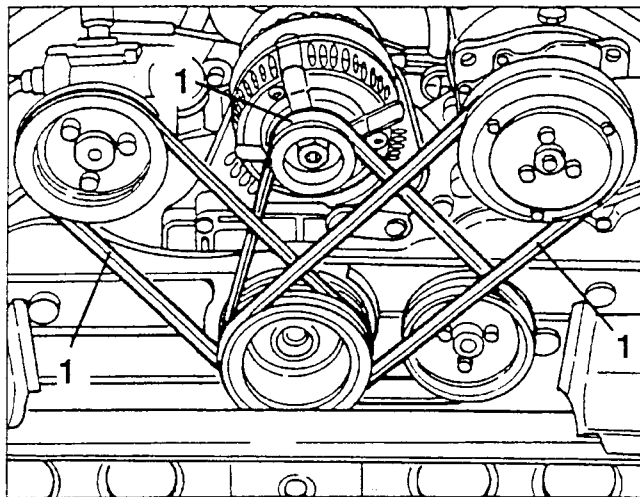


- Free the electrical cables from the radiator.

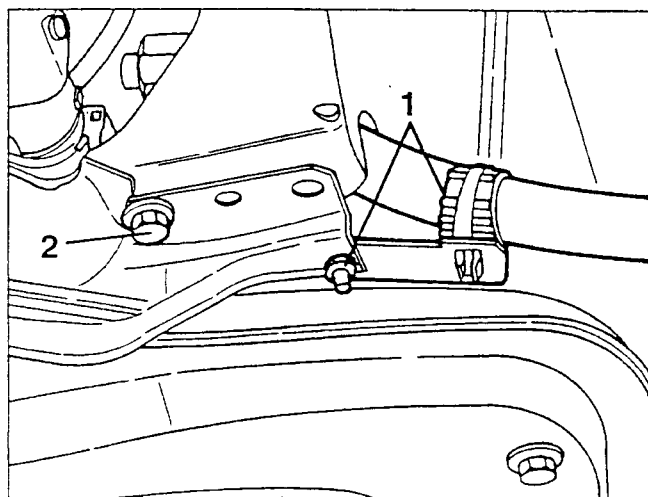
1. Disconnect the two electrical connections of the fan control thermal contact.
2. Disconnect the fluid inlet and outlet hoses from the conditioner condenser.



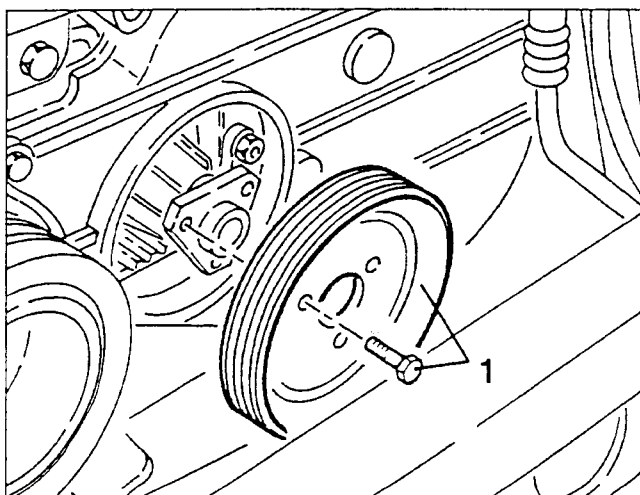
1. Slacken the fastening screws and bolts concerned, then remove the conditioner compressor drive belt, the power steering pump drive belt and the alternator - water pump drive belt.



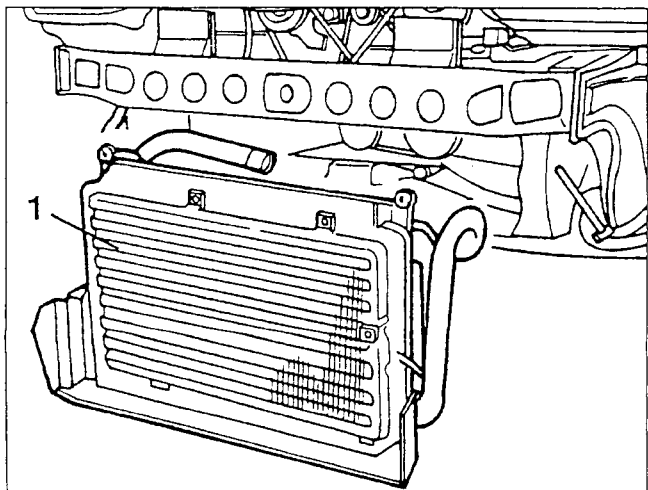
1. Free the R134A hose from the lower crossmember.
2. Slacken the screws fastening the lower crossmember.



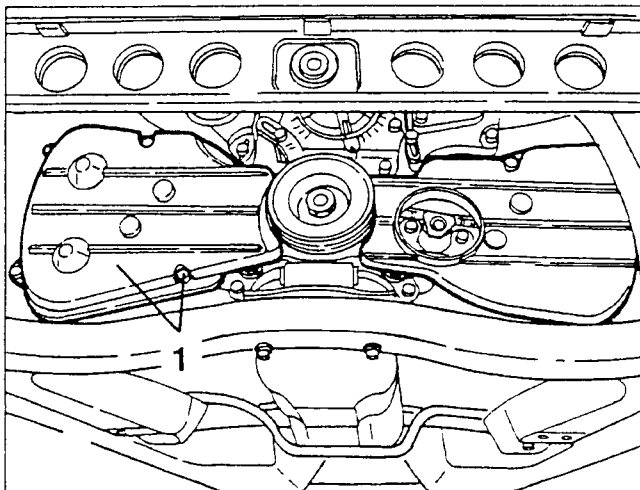
1. Slacken the three fastening screws and remove the water pump pulley.



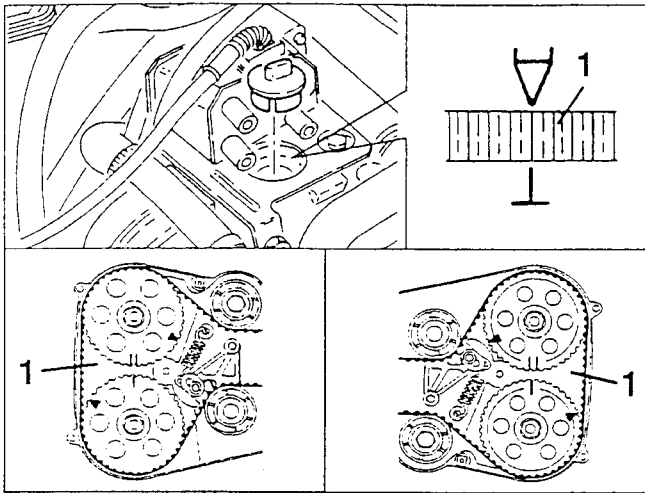
1. Remove the crossmember complete with radiator, condenser and electric fans.



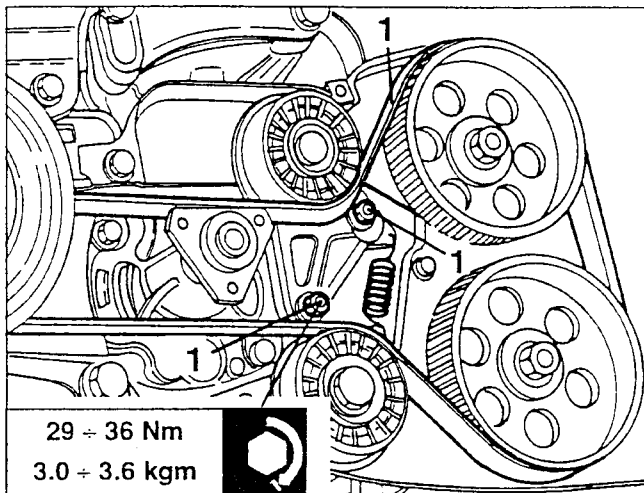
1. Slacken the fastening screws and remove the timing belt covers.



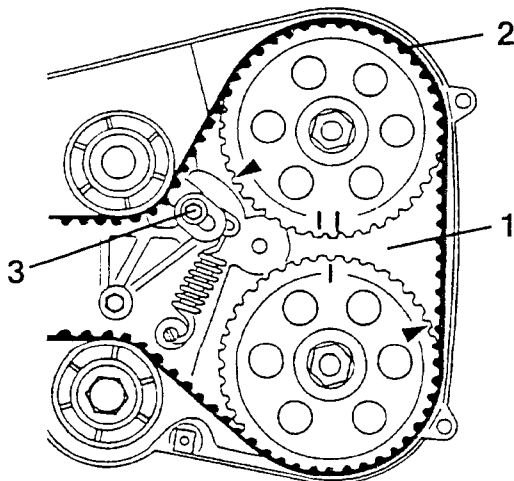
- Remove the spark plugs.
- 1. Check the valve gear timing.



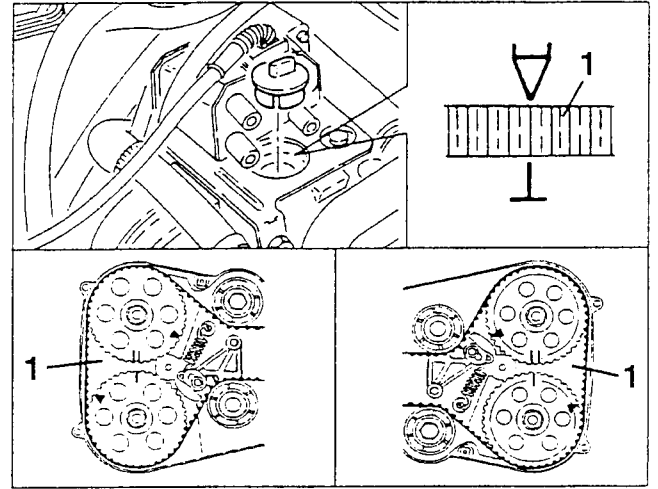
- 1. Slacken the nuts fastening the belt tensioner and remove the timing belts.



- 1. Turn the left head camshafts until the notches coincide.
- Turn the crankshaft until the notch "T" on the flywheel is aligned with the fixed reference.
- 2. Fit the left-hand timing belt.
- 3. Slacken the belt tensioner fastening nut so that it exerts the the load impressed by the spring on the belt.

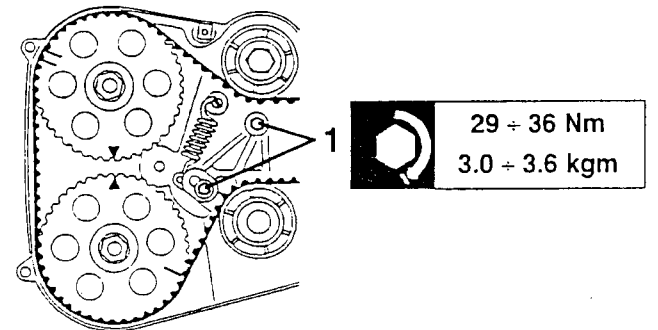


- Repeat the previous operations for assembling and timing the right-hand belt.
- Turn the crankshaft a few times in its direction of rotation, to all the belt to take its final position.
- 1. Check the valve gear timing.



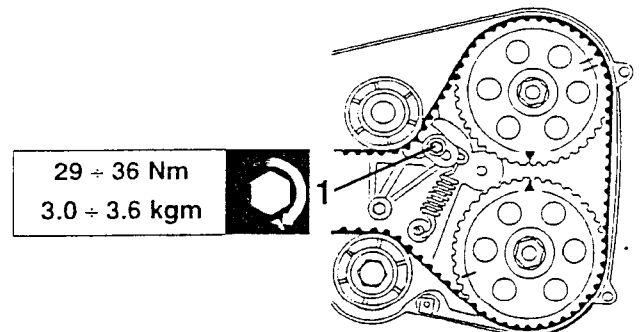
- Turn the crankshaft by 90° until the notch "●" on the flywheel is aligned with the fixed reference and the notches "▲" on the right head timing pulley are aligned.

- 1. Slacken the nuts fastening the right belt tensioner to settle it, then tighten them to the specified torque.



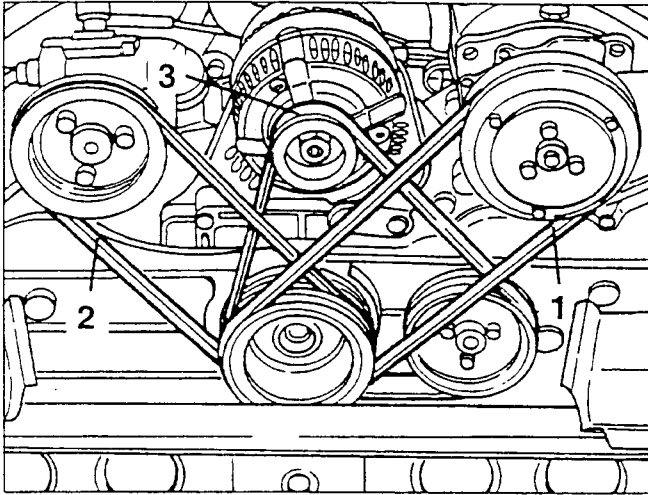
- Turn the crankshaft by 360° until the notch "●" on the flywheel is aligned with the fixed reference and the notches "▲" on the left head timing pulleys are aligned.

- 1. Slacken the nuts fastening the left belt tensioner to settle it, then tighten them to the specified torque.



- Turn the crankshaft a few times then check again that the timing references coincide.

AUXILIARY COMPONENT BELTS



1. Conditioner compressor drive belt
2. Power steering drive belt
3. Alternator - water pump drive belt

NOTE: When checking the belt tension, check that the belts are intact, and that they are free of:

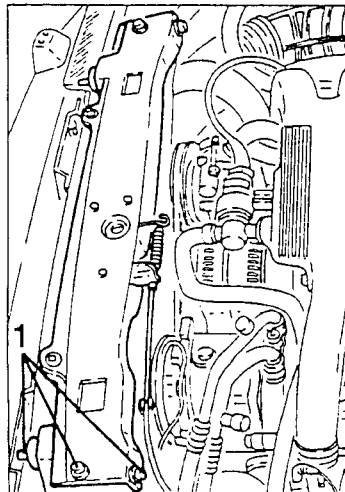
- cuts
 - cracks
 - material surface wear (smooth and shiny)
 - dry or stiff parts (lack of adherence).
- In the event of one of the above defects, change the belt.

The contact of the belts with oil or solvents can damage the elasticity of the actual belt rubber and reduce its adherence.

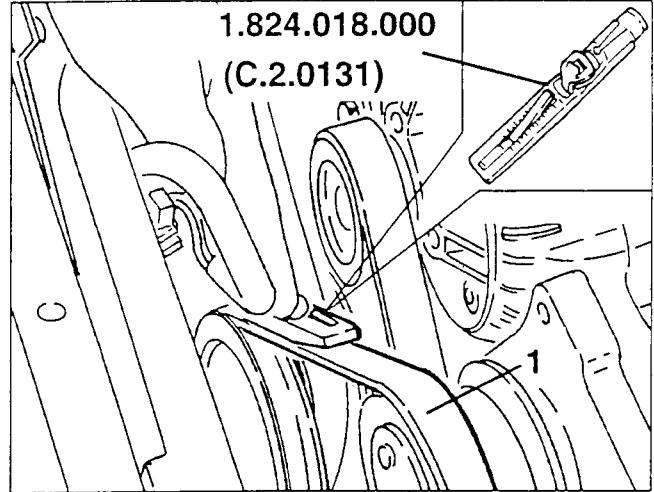
Conditioner compressor drive belt

Checking and tensioning

- Remove the radiator grille (see GROUP 70).
- 1. Slacken the screws fastening the upper radiator crossmember, then move it to one side without disconnecting the lock control cable.



1. Working as illustrated, measure the belt tension using tool N° 1.824.018.000 (C.2.0131).



- Check that the tensioning values measured with the tool are within the specified limits.

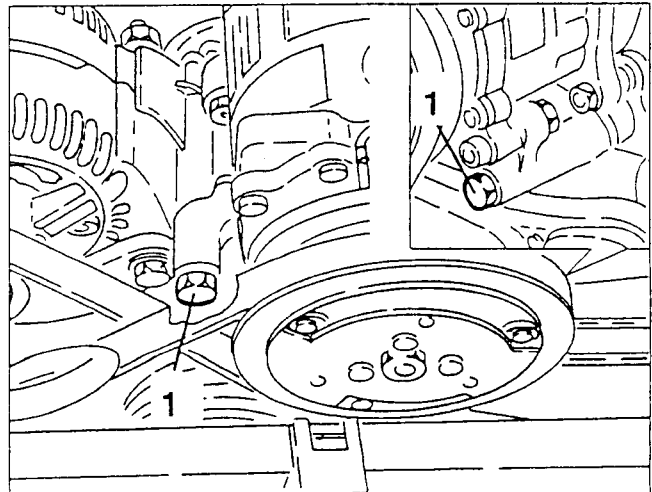
Tensioning of trapezoidal drive belt "AV13" for conditioner compressor

| | |
|--------------|-------------|
| At assembly | 500 ÷ 650 N |
| Retensioning | 350 ÷ 450 N |

NOTE: The belt may be retensioned after a brief running- in period, proceeding as follows:

- bring the engine to the normal operating temperature
- turn the engine off and allow it to cool down
- retension the belt to the specified limit.

- If the belt tensioning is incorrect, proceed as follows:
- 1. Slacken the two bolts fastening the conditioner compressor.



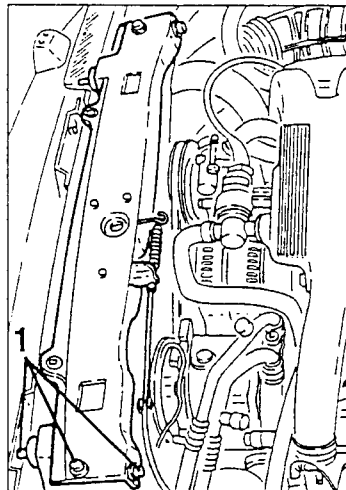
- Move the compressor to one side and tighten the fastening bolt from the slotted side and check the belt tension.
- If the tension is correct also tighten the remaining fastening bolt.
- Adapt the procedure suitably when changing the conditioner compressor belt.

- The belt may be retensioned after a brief running-in period, proceeding as follows:
- bring the engine to the normal operating temperature
 - turn the engine off and allow it to cool down
 - retension the belt to the specified limit.

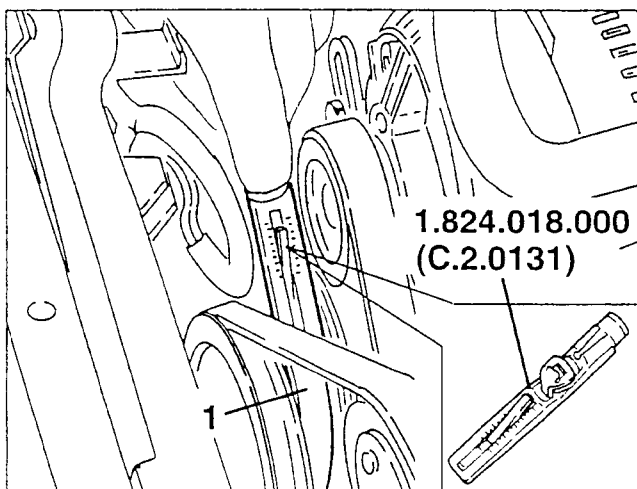
Power steering pump drive belt

Checking and tensioning

- Remove the radiator grille (see GROUP 70).
- 1. Slacken the screws fastening the upper radiator crossmember, then move it to one side without disconnecting the lock control cable.



1. Working as illustrated, measure the tension of the belt using tool N° 1.824.018.000 (C.2.0131).

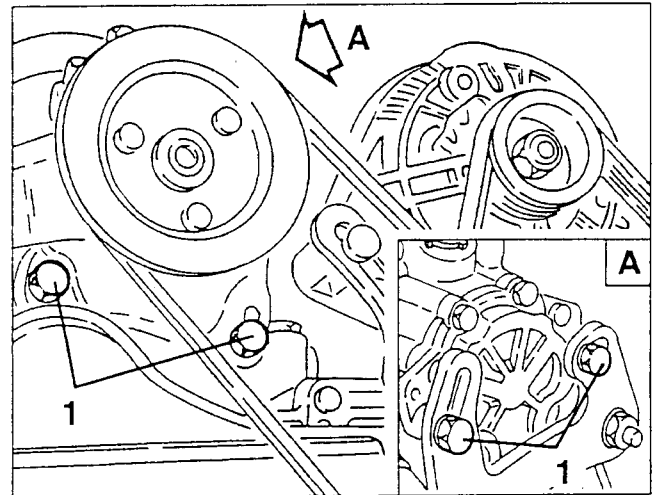


- Check that the tensions measured using the tool are within the specified limits.

Tensioning of trapezoidal drive belt "AV10" for power steering pump

| | |
|--------------|-------------|
| At assembly | 400 ÷ 550 N |
| Retensioning | 280 ÷ 370 N |

- If the tension found is incorrect, proceed as follows:
- 1. Slacken the four screws fastening the power steering pump.

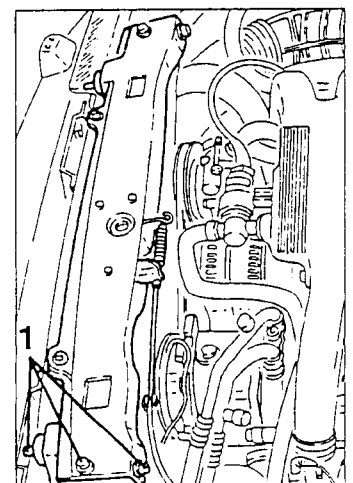


- Move the compressor to one side and temporarily tighten the fastening screws on the slots and check the belt tension.
- If the tension is correct, definitively tighten all the power steering pump fastening screws.
- Suitably adapt the above procedure to change the power steering pump drive belt.

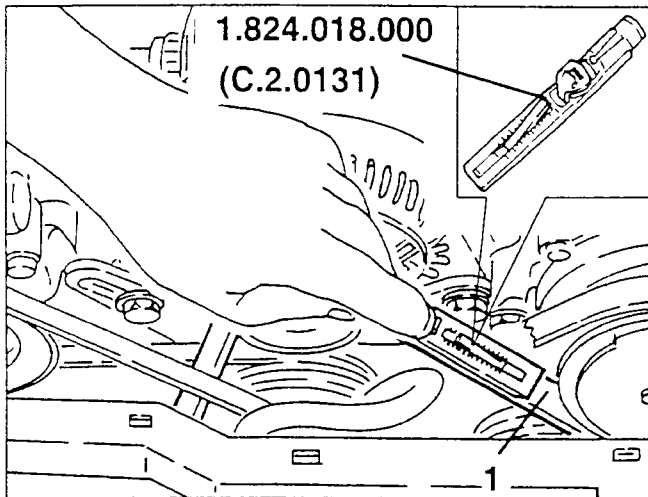
Alternator - water pump drive belt

Checking and tensioning

- Remove the radiator grille (see GROUP 70).
- 1. Slacken the screws fastening the upper radiator crossmember, then move it to one side without disconnecting the lock control cable.



1. Working as illustrated, measure the tension of the belt using tool N° 1.824.018.000 (C.2.0131).



- Check that the tensions measured using the tool are within the specified limits.

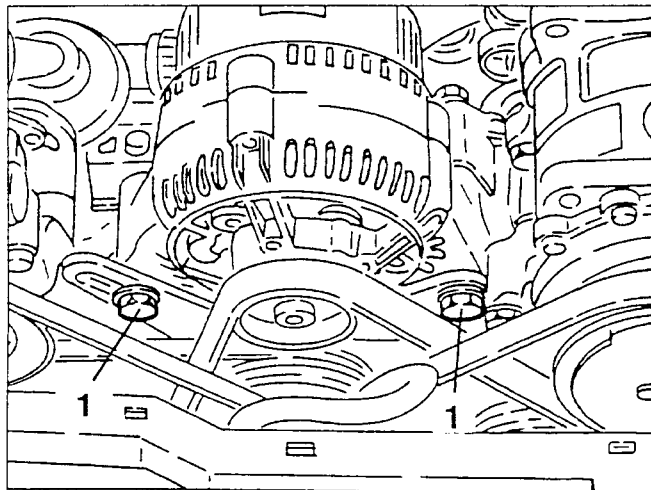
Tensioning the drive belt "Poly V" for alternator & water pump

| | |
|--------------|-------------|
| At assembly | 520 ÷ 670 N |
| Retensioning | 300 ÷ 450 N |

The belt may be retensioned after a brief running-in period, proceeding as follows:

- bring the engine to the normal operating temperature
- turn the engine off and allow it to cool down
- retension the belt to the specified limit.

- If the tension found is incorrect, proceed as follows:
1. Slacken the two alternator fastening bolts.

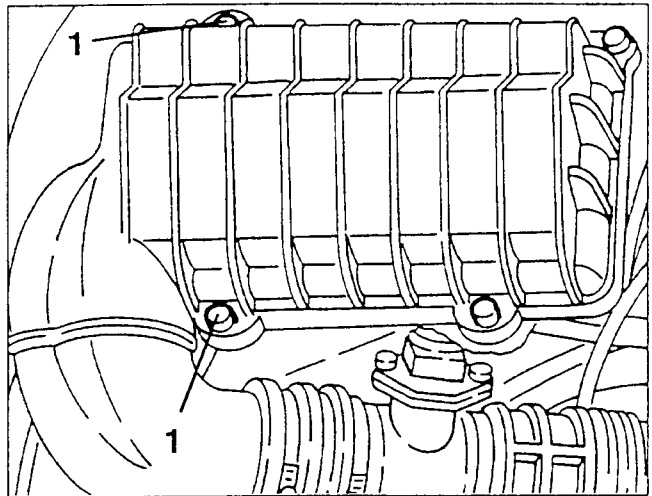


- Move the alternator to one side and tighten the fastening bolt from the slotted side and check the belt tension.

- If the tension is correct also tighten the remaining fastening bolt.
- Suitably adapt the above procedure to change the alternator - water pump drive belt.

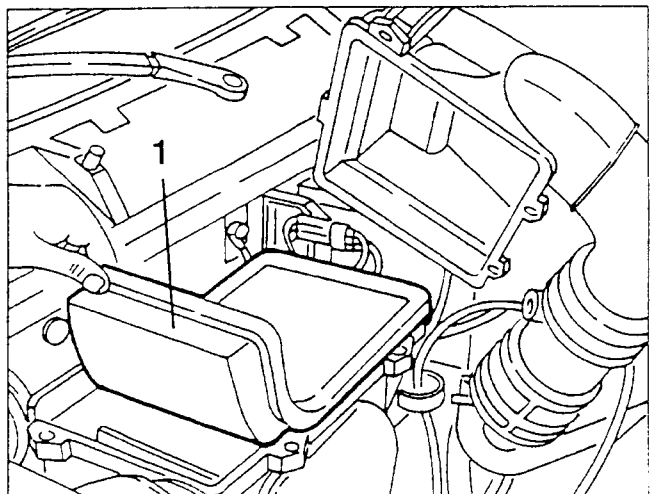
CHANGING THE AIR CLEANER CARTRIDGE

1. Slacken the four screws fastening the air cleaner cover.



1. Raise the air cleaner cover just enough to remove the filtering element.

Any filter cleaning operation might damage it, thereby jeopardising the correct operation of the engine supply system.



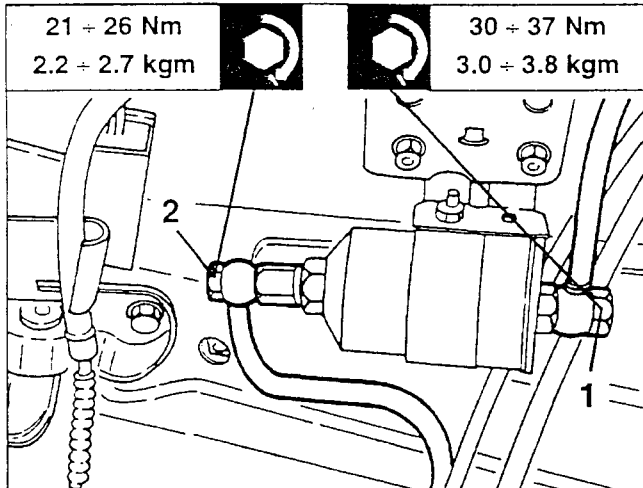
- Carefully clean the air cleaner cartridge container.
- Install a new air cleaner cartridge.
- Refit the cover and fasten with the corresponding screws.

NOTE: If the cleaner shows traces of oil, check for possible leaks in the entire air circuit.

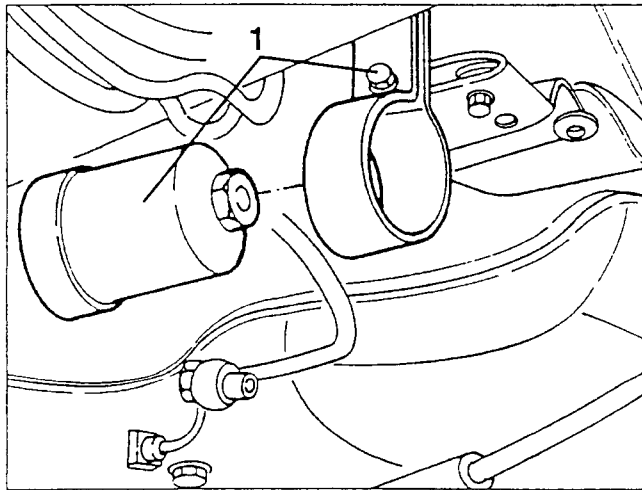
CHANGING THE FUEL FILTER

- Set the car on a lift and raise it.

1. Disconnect the fuel inlet pipe connection from the filter.
2. Disconnect the fuel outlet pipe connection from the filter.



1. Slacken the fastening clamp and remove the fuel filter.

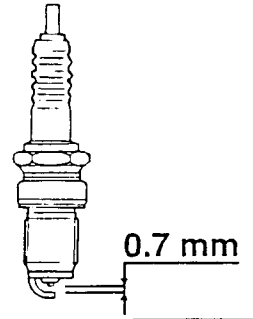


- Install the new filter reversing the sequence described for removal and taking care to:
- change the copper gaskets of the connections;
- assemble the filter with the arrow stamped on it pointing in the direction of the flow of the fuel.

CHECKING AND CHANGING SPARK PLUGS

The standard spark plugs fitted to the engine are of the surface discharge type with four points and a centre electrode, for the 8 Valve engines and with one point and centre electrode, for the 16 Valve engine.

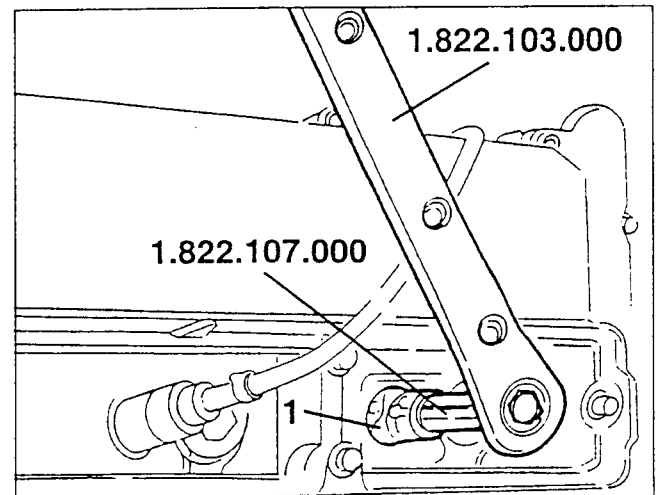
The former requires no routine gap adjustment, while the gap to be adhered to for the latter is shown in the table.



| Spark plugs | |
|-------------|-------------|
| 8 valves | LODGE 25 HL |
| 16 valves | NGK PFR 6B |

- With the engine cold disconnect the spark plug cables.
- Blow inside the spark plug openings to remove any impurities.

1. Slacken and remove the spark plugs.
For the 1712 16 Valve engine use tools N° 1.822.103.000 and N° 1.822.107.000.



- Check the spark plugs for dirt and the ceramic insulation for cracks. In this case, replace the spark plugs.

WARNING:

The use of spark plugs with different characteristics or sizes than those specified can cause serious damage to the engine and change the level of harmful emission at the exhaust.

WARNING:

A dirty or worn out spark plug is often the sign of a failure in the engine supply system.

For example:

- Traces of carbon dust: incorrect mixture, air cleaner very dirty.
- Spots of oil: oil leaking from the piston rings.
- Formation of ash: presence of aluminium materials, contained in the oil.

- Burnt electrodes: overheating due to unsuitable fuel, defects in the valves;
- High electrode wear: harmful additives in the fuel or in the oil, pinging in the cylinder head, overheating.

- When installing, lubricate the thread with engine oil and tighten the spark plugs to the following torque:

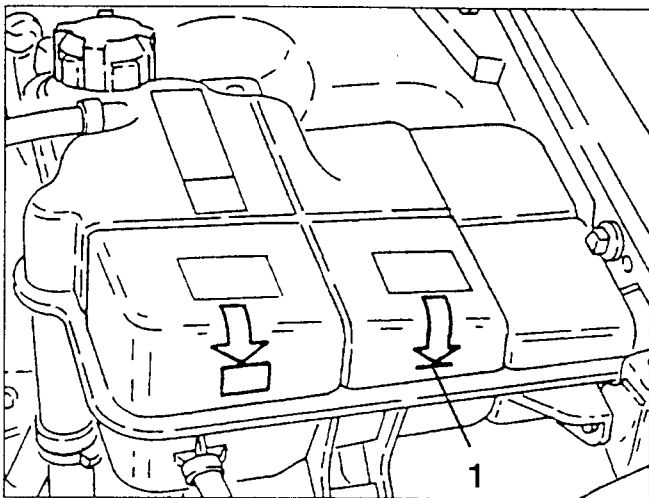


25 ÷ 30 Nm
2.5 ÷ 3.1 kgm

CHECKING THE LEVEL AND CHANGING THE COOLANT

Checking

1. With the engine cold, check that the level of the coolant in the header tank is between the MIN and MAX marks.



Draining and replenishing

- Set the car on a lift.
- Slacken and remove the header tank plug.



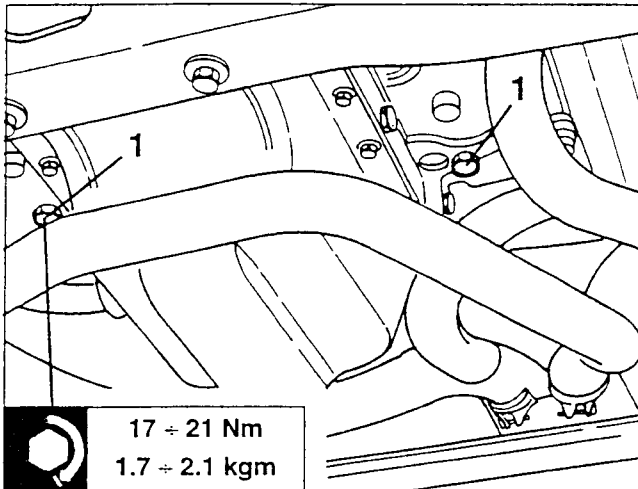
WARNING:
Absolutely never remove the header tank plug when the engine is warm!

- Raise the car.

1. Slacken the two plugs under the crankcase and drain the coolant into a suitable recipient.



WARNING:
The anti-freeze mixture used as coolant can harm the paintwork: therefore avoid any contact with painted components.



17 ÷ 21 Nm
1.7 ÷ 2.1 kgm

- Refit the drain plugs and check that all the fastening clamps of the engine cooling system hoses are firmly tightened.

- Fill the header tank up to the MAX mark. The type and indicative quantity of the coolant are given in the table below:

| | |
|---|------------|
| Alfa Romeo Climafluid Permanent -40°C | 6.7 litres |
|---|------------|

- Start the engine and bring it to normal operating temperature so that the thermostat opens to release the amount of residual air in the circuit.

- With the engine cold, top up to the level indicated on the header tank.

- Retighten the pressurised cap on the header tank.



WARNING:
It is unwise to mix anti-freeze fluids of different types or brands!
Never use antirust additives: this might not be compatible with the anti-freeze in use!.

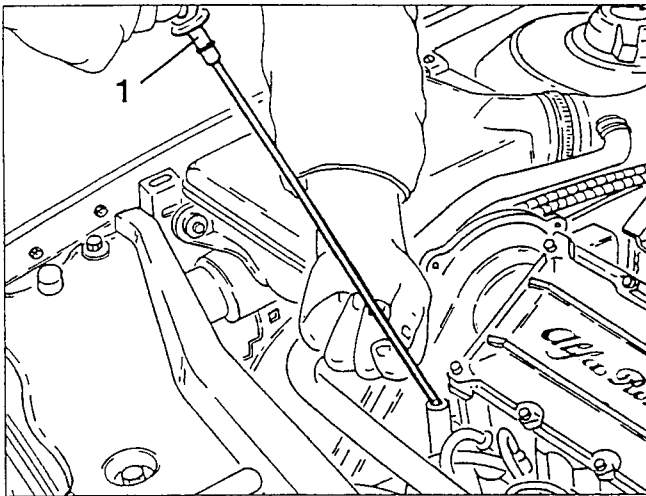
TURBODIESEL 1929 ENGINE SERVICING

CHANGING ENGINE OIL AND FILTER

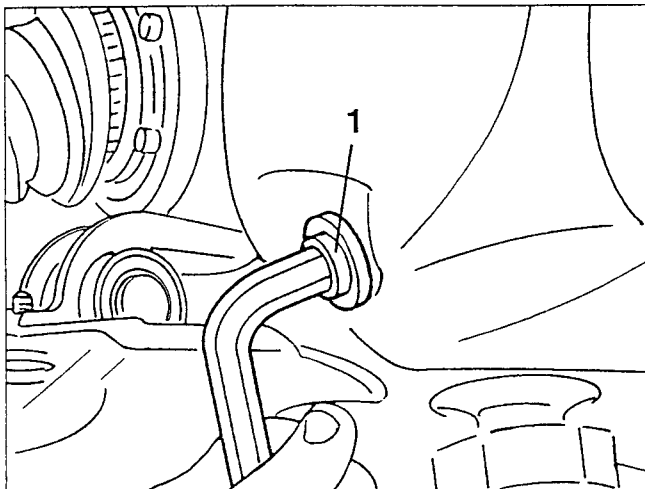


IMPORTANT:
Engine oil is harmful: avoid all contacts with your skin. In the event of contact, wash the effected part with soap and water.

- When the engine is hot, remove the filler cap.
- 1. Remove the dipstick.

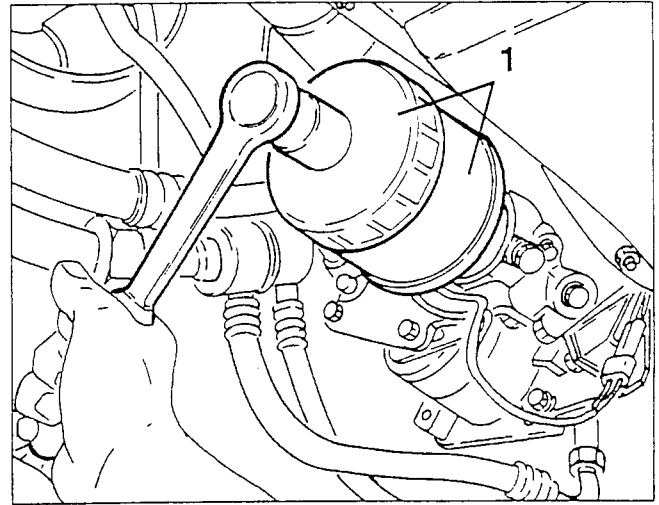


- 1. Remove the drain cap and drain completely collecting the oil in a suitable container.



IMPORTANT:
Dispose of oil appropriately. Waste oil is an environmental hazard.

- 1. Remove the oil filter with a suitable tool.

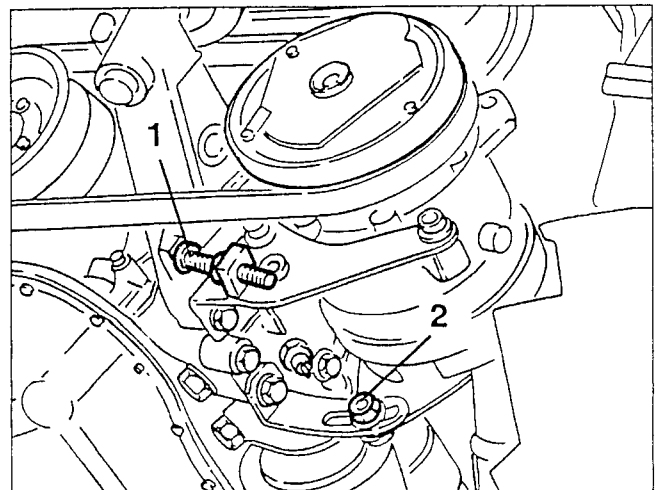


- Clean the drain cap and screw it back with its seal.
- Dampen the new filter seal with oil and screw it back by hand.
- Fill the engine with oil of the prescribed type and in the prescribed quantity.
- Check the oil level with the vehicle standing on level ground.**
- Oil level over the MAX notch can cause excessive oil evaporation and drops in oil pressure.**
- Refit the filler cap and idle the engine for approximately 2 minutes. Wait for a few minutes.
- Check the oil level. Check there are no leaks.

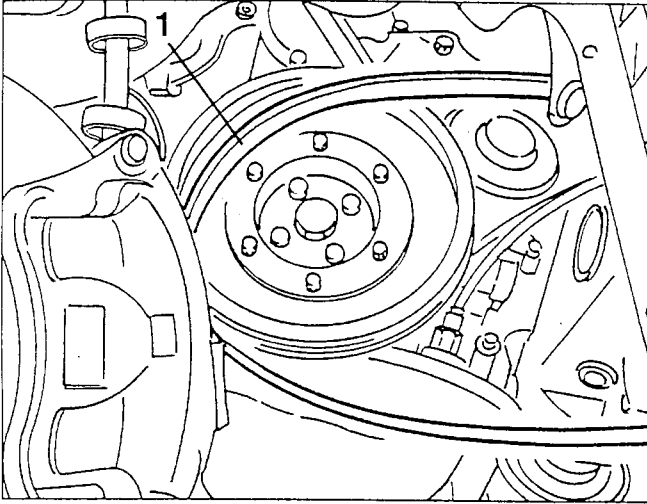
IMPORTANT: When topping up, be careful not to drip oil on the alternator ventilation slots. This could seriously damage the alternator and be a fire risk.

REPLACING TIMING BELT (To engine no. 1762797)

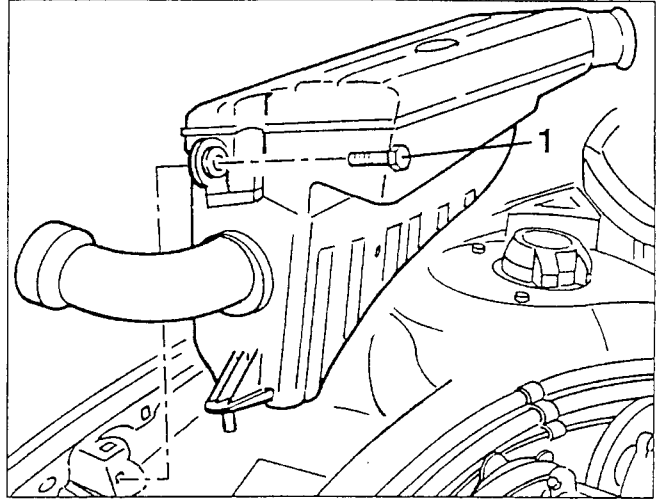
- Remove the front right-hand wheel and spray guard.
- 1. Turn the micro-metric tension device to release belt tension.
- 2. Remove the compressor fastening screws.



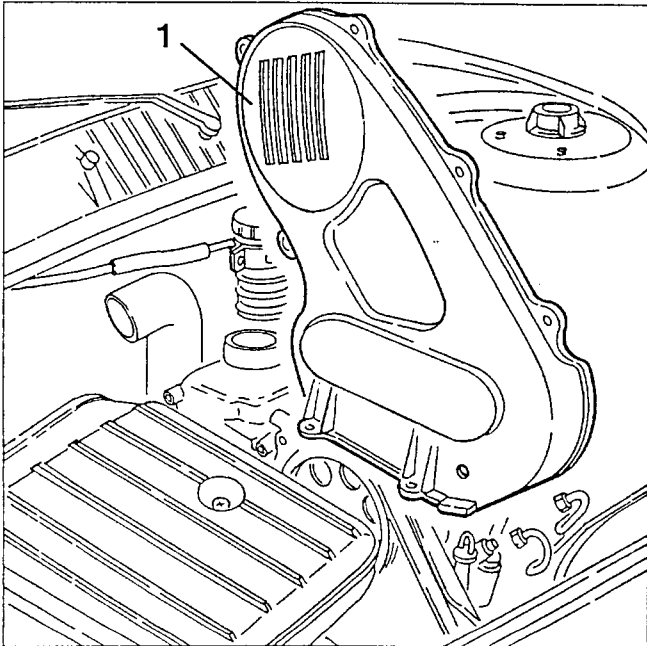
1. Remove the compressor drive belt from the auxiliary components driving pulley.



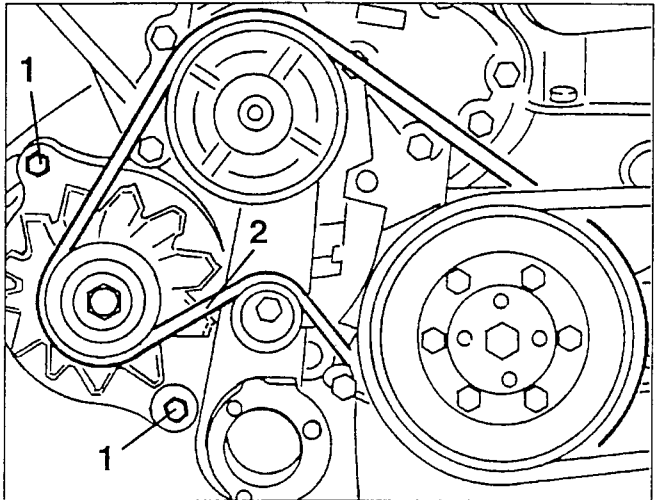
1. Slacken the fastening screws and remove the complete air cleaner.



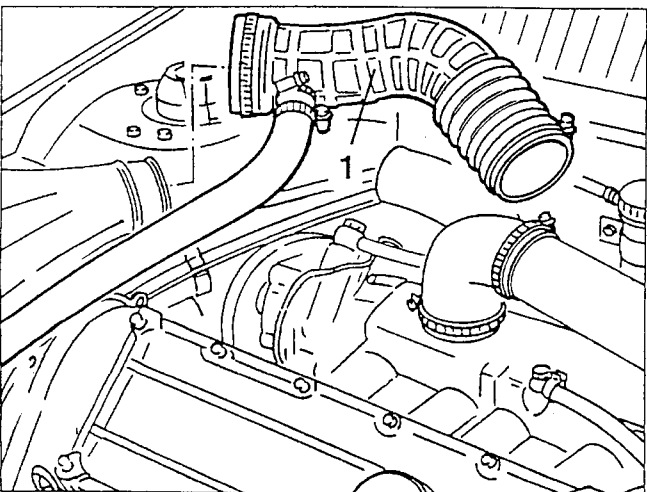
1. Remove the timing belt front cover.



1. Slacken the two alternator fastening bolts.
2. Remove the alternator - water pump drive belt.

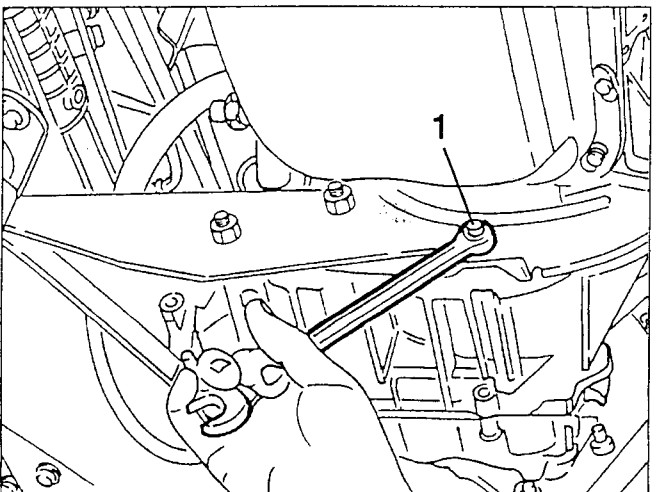


1. Remove the air intake corrugated sleeve and move it to one side without disconnecting the oil vapour recirculation hose.

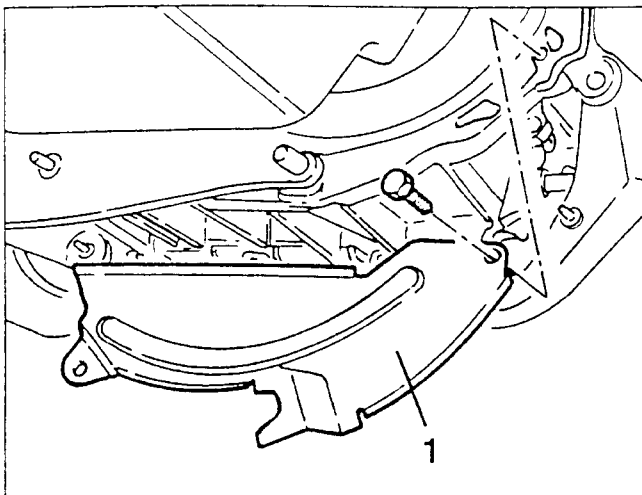


- Raise the car.

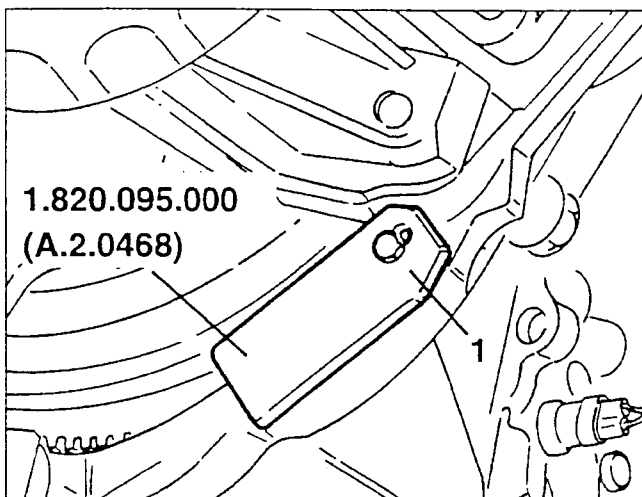
1. Slacken the front nut fastening the gearbox to its support bracket.



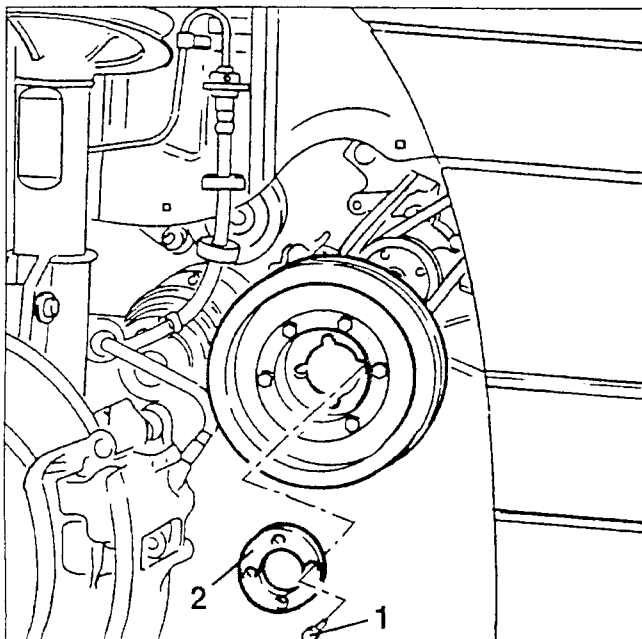
1. Slacken the fastening screws and remove the flywheel cover.



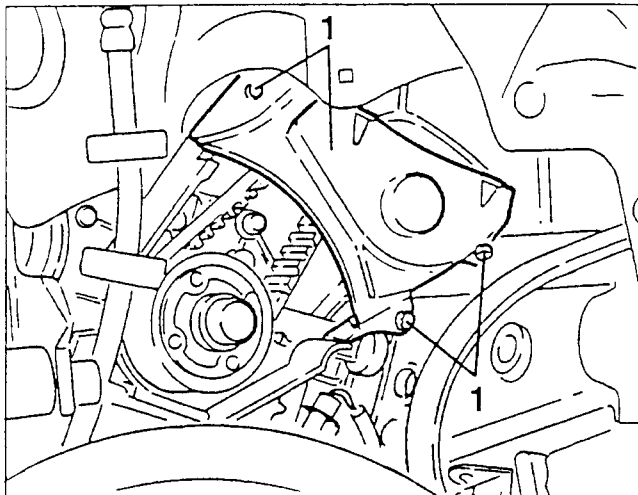
1. Install the tool for holding the flywheel N° 1.820.095.000 (A.2.0468).



1. Slacken the fastening screws and remove the auxiliary components belt driving pulley.
2. Retrieve the spacer.

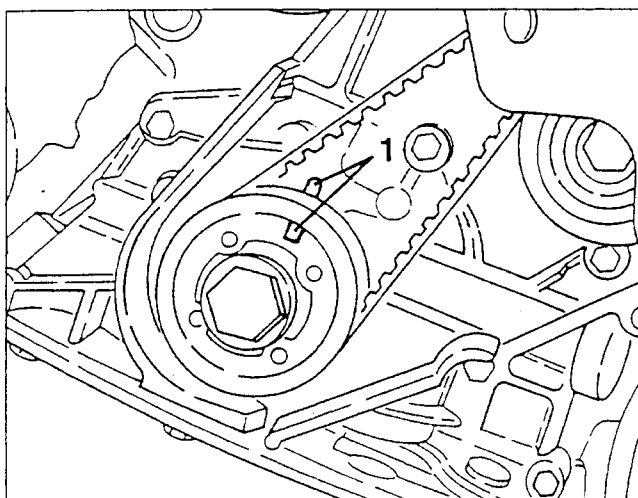


1. Slacken the fastening screws and remove the timing belt lower cover.



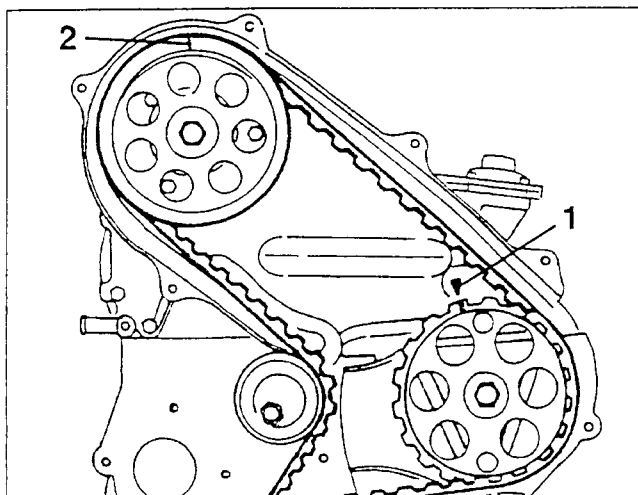
- Remove the tool for holding the flywheel installed previously.

1. Check that the notch on the pulley is aligned with the relief on the front cover.

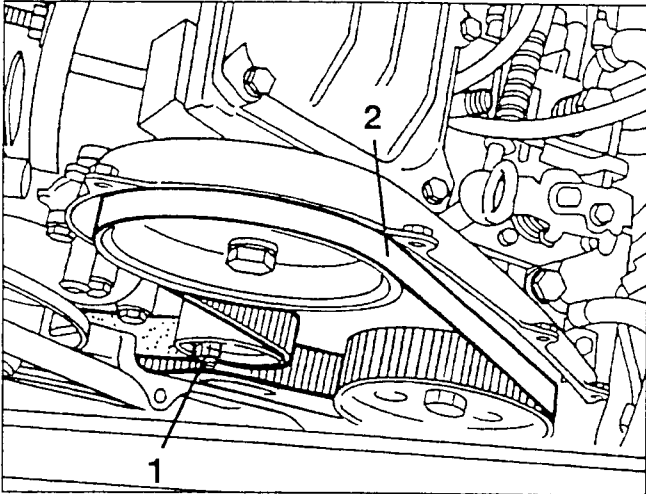



1. Check that the notch etched on the pulley is aligned with the relief on the rear cover.

2. Check that the notch etched on the pulley is aligned with the hole on the rear cover.




1. Slacken the screw fastening the timing belt guide pulley.
2. Remove the timing belt.

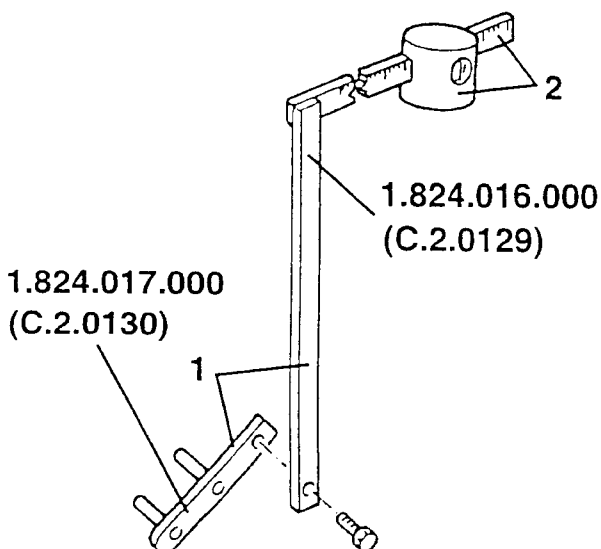


 Refit reversing the sequence described for removal and observing the following instructions:


- Make sure that the first cylinder is in the bursting stroke, checking the alignment of the notches on the timing belt pulleys with the corresponding references.
- Install the timing belt making sure that the teeth are correctly coupled on all the pulleys.

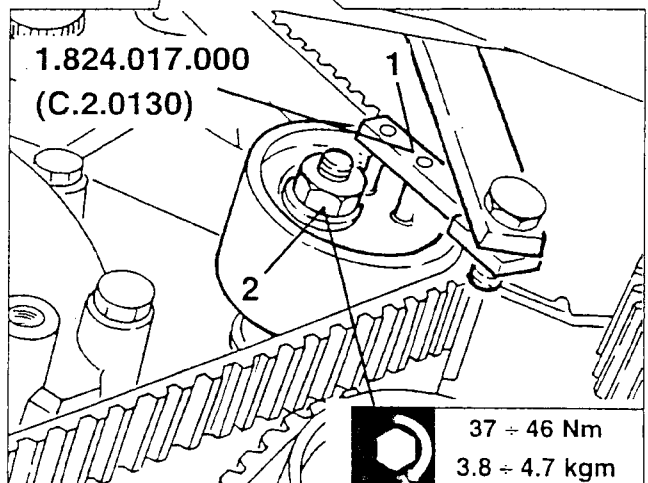
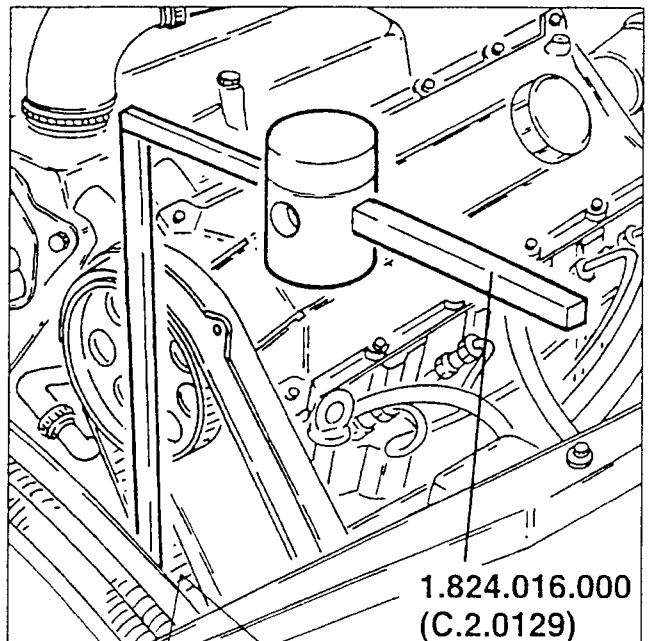
 **WARNING:**
To avoid harming the structure of the fibres forming the belt, never bend it sharply when assembling.

1. On tool N° 1.824.016.000 (C.2.0129) install support N° 1.824.017.000 (C.2.0130).
2. Position the weight with the knurled part, at a distance of 120 mm on the millimetred rod and lock it.



1. Install the resulting tool on the belt tensioner, as illustrated, and adjusting the joint, set the millimetred rod to horizontal.
 - Settle the toothed belt turning the crankshaft twice in its direction of rotation.
2. Tighten the belt tensioner fastening nut to the specified torque.

 **WARNING:**
During the last phase, the millimetred rod might move from its horizontal position; in this case, working on the belt tensioner, it is necessary to restore the original position of the millimetred rod and repeat the operation.

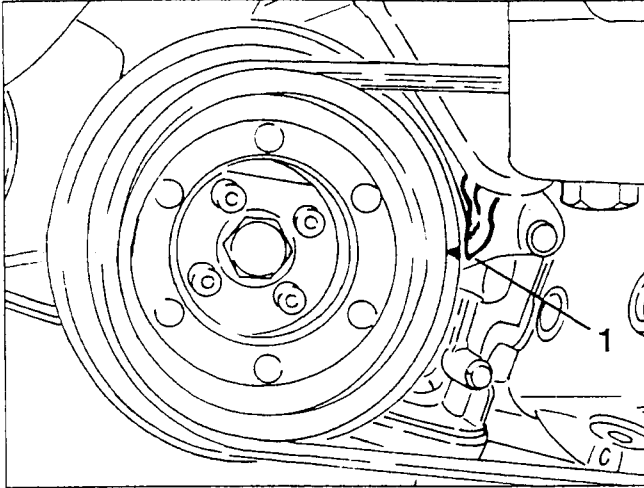


- Remove the belt tensioning tools.
- Tension the auxiliary component drive belts (see specific paragraphs).

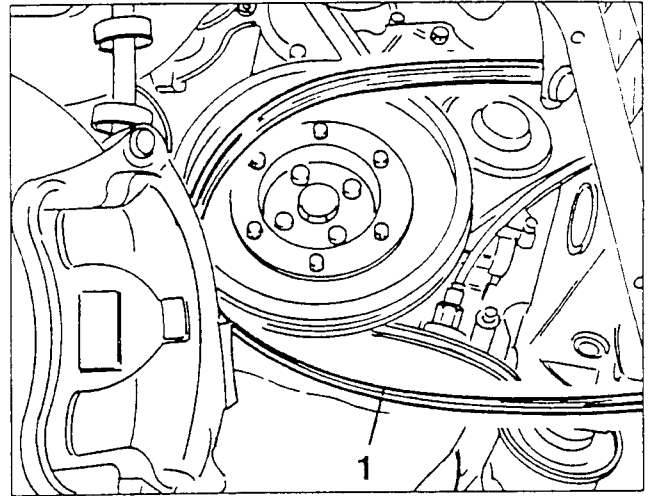
CHANGING THE TIMING GEAR DRIVE BELT (From engine no.1762798)

- Remove the right front wheel and mud flap.

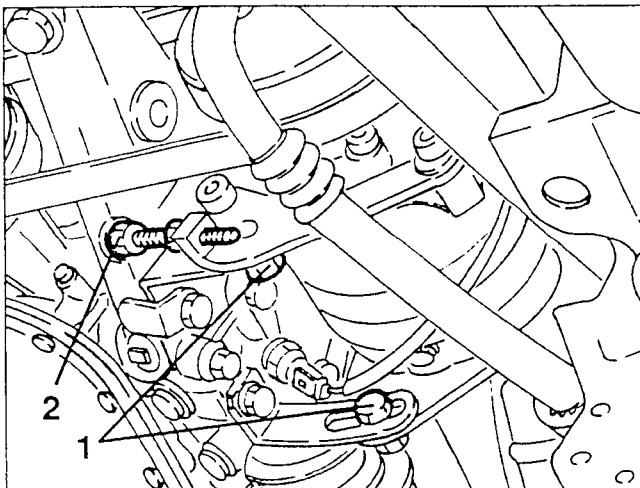
1. Turn the engine in its direction of rotation until the notch on the auxiliary components drive pulley coincides with the relief on the timing gear belt lower cover (engine timed).



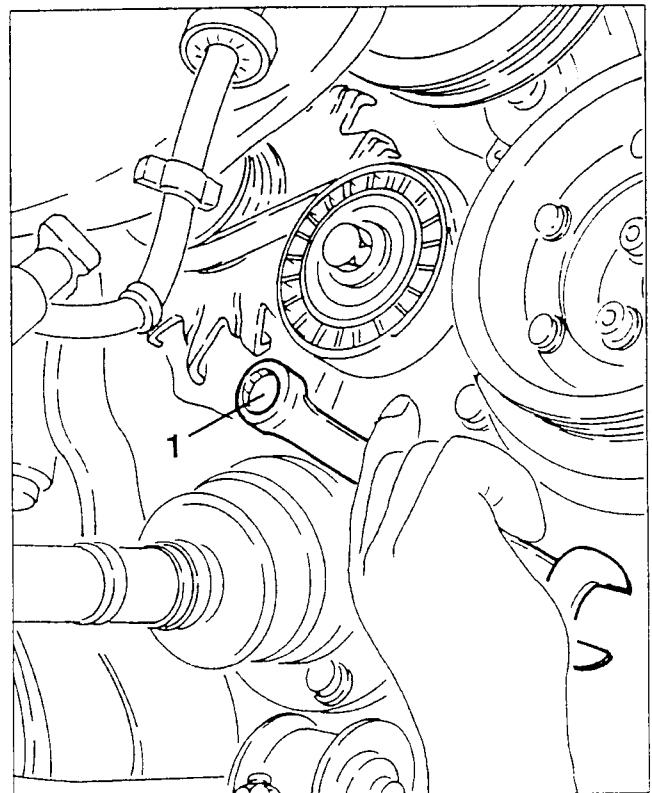
1. Prise conditioner compressor drive belt off the auxiliary components drive pulley.



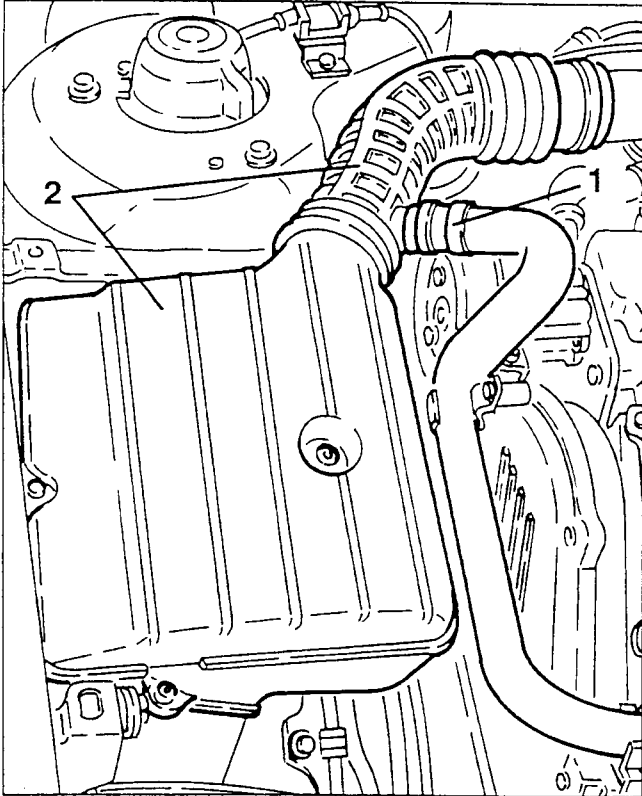
1. Loosen the two conditioner compressor fastening screws.
2. Working on the micrometric tensioner, slacken the tension of the conditioner compressor drive belt.



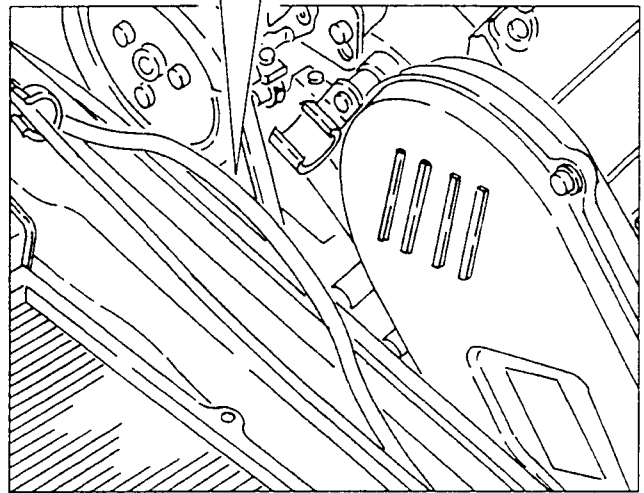
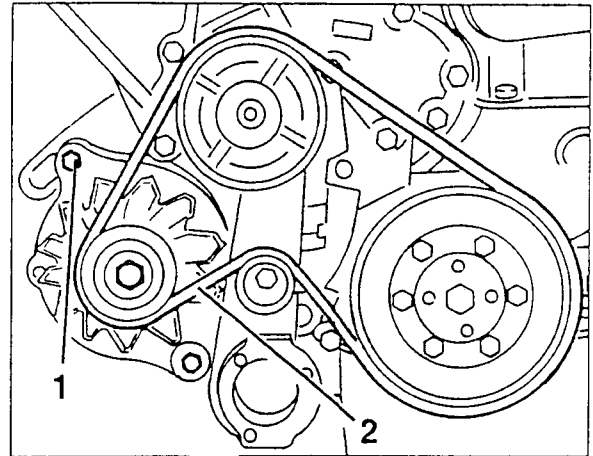
1. Loosen the alternator lower fastening bolt.



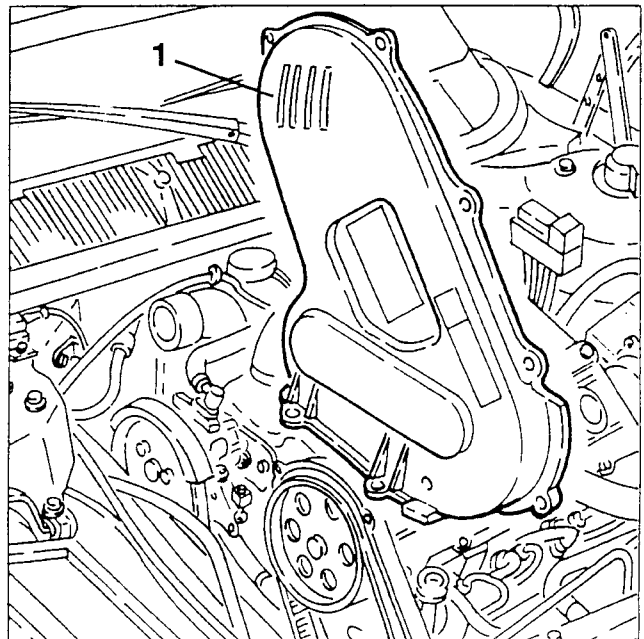
1. Lower the car, then disconnect the oil vapour recirculation pipe from the air intake corrugated sleeve.
2. Slacken the fastening screws, loosen the clamp, then remove the air cleaner cover complete with corrugated sleeve.



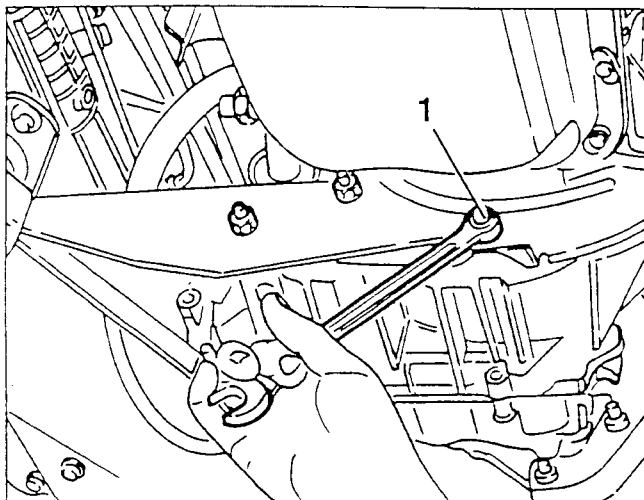
1. Loosen the upper alternator fastening screw.
2. Prise and remove the alternator - water pump drive belt.



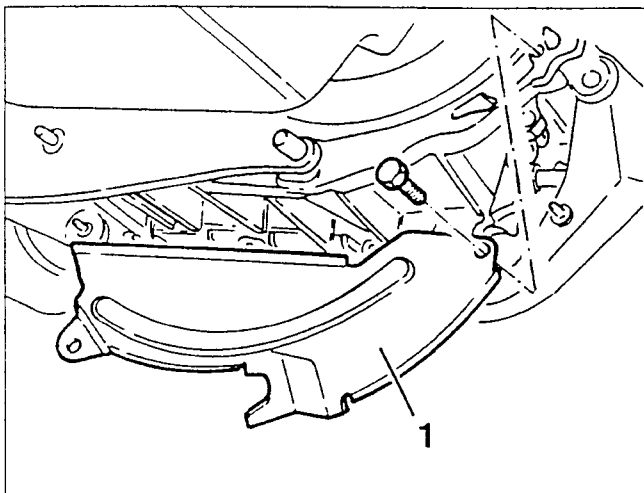
1. Slacken the fastening screws and remove the timing gear belt cover.



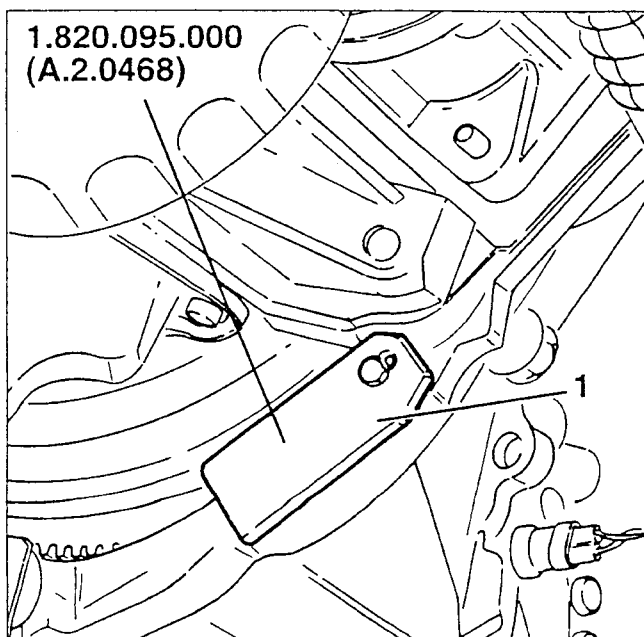
1. Raise the car and slacken the front nut fastening the gearbox to its support bracket.



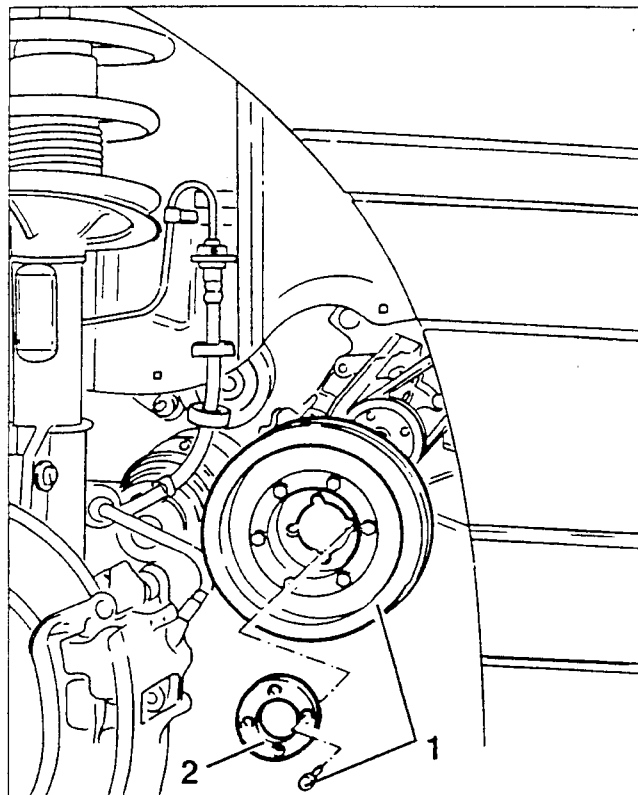
1. Slacken the fastening screws and remove the flywheel guard.



1. Install flywheel stopper tool no. 1.820.095.000 (A.2.0468).

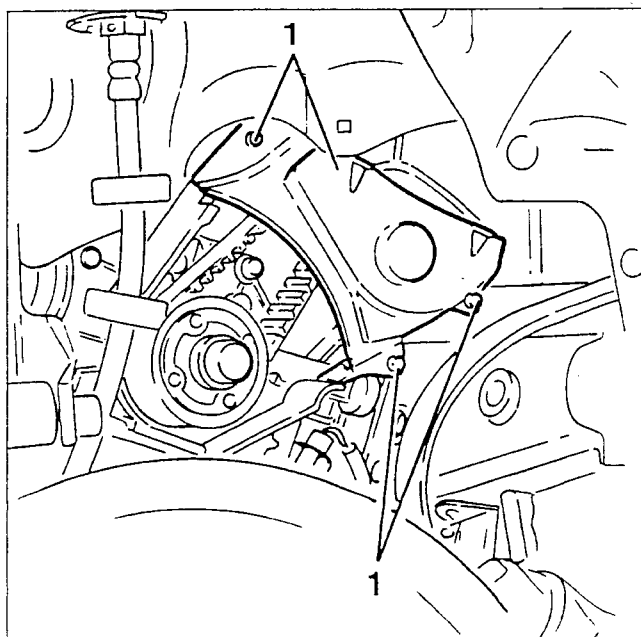


1. Slacken the fastening screws and remove the auxiliary components belt drive pulley.
2. Retrieve the spacer.



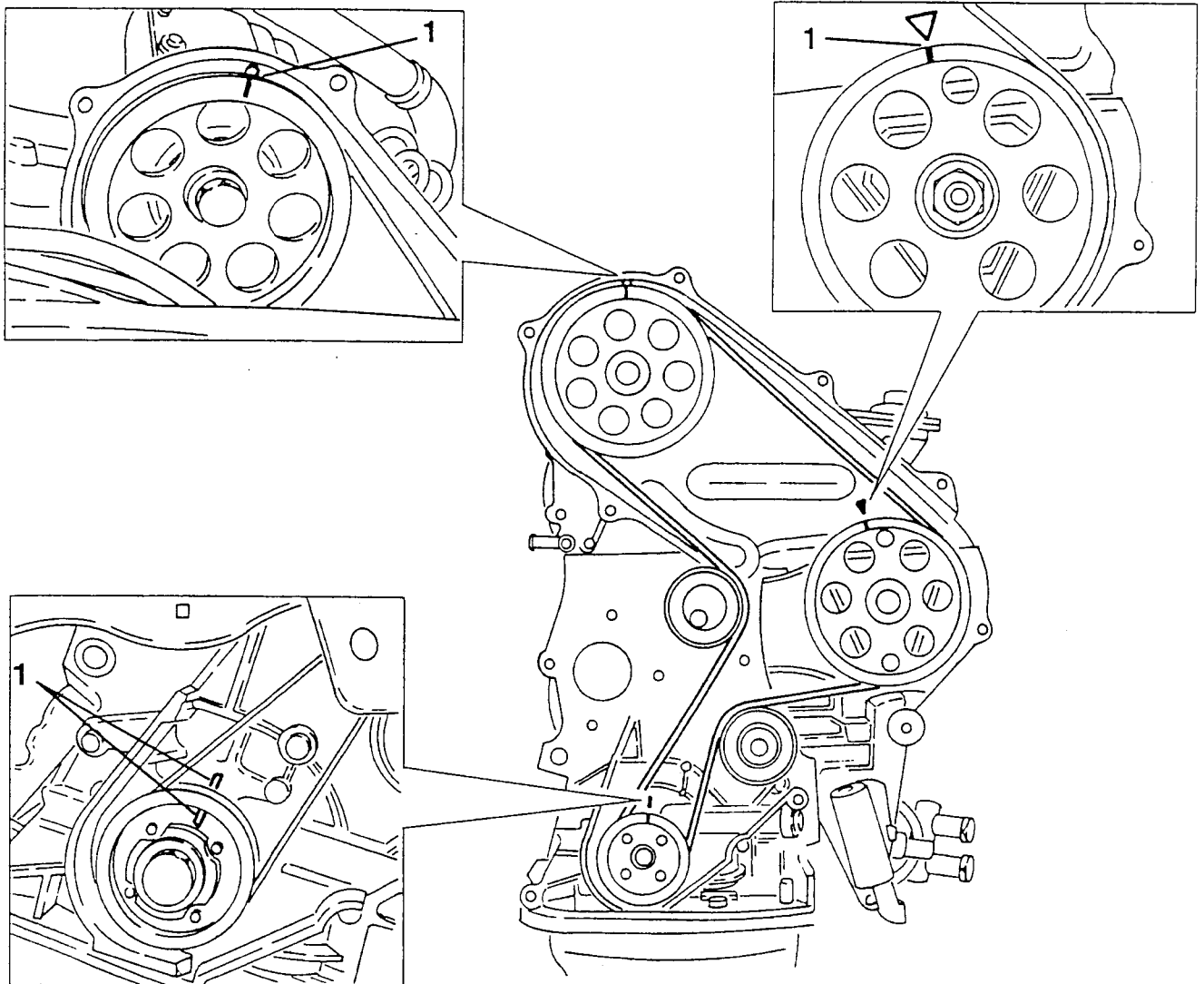
- Remove the flywheel stopper tool no. 1.820.095.000 (A.2.0468) installed previously.

1. Slacken the fastening screws and remove the timing gear belt lower cover.

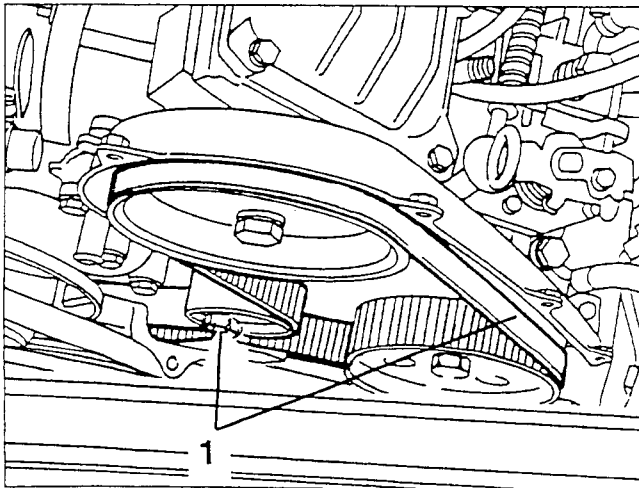


1. Check that the notches on the three pulleys coincide with the three fixed notches on the engine as illustrated.
This way the engine is in the T.D.C. position on the 1st cylinder and the camshaft is in the bursting stroke also on the 1st cylinder.

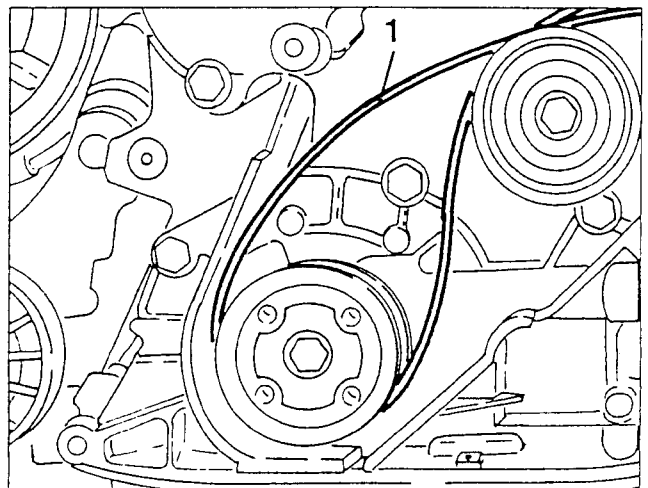
NOTE: - The camshaft pulley is slotted, therefore in this condition, the notch on it does not necessarily coincide with the fixed one.
- There are two notches stamped on the injection pump drive pulley, for timing check alignment with the yellow notch.



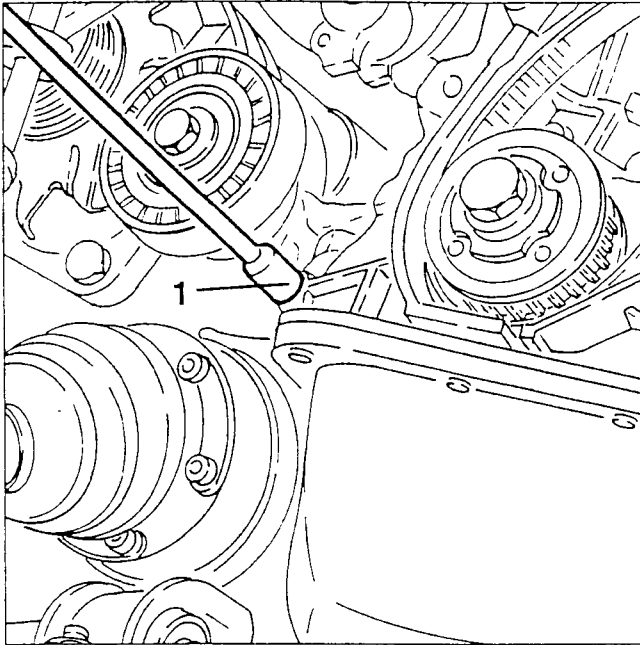
1. Loosen the belt tensioner nut, then prise and remove the timing gear drive belt.



1. Install a new timing gear drive belt on the corresponding drive pulley.

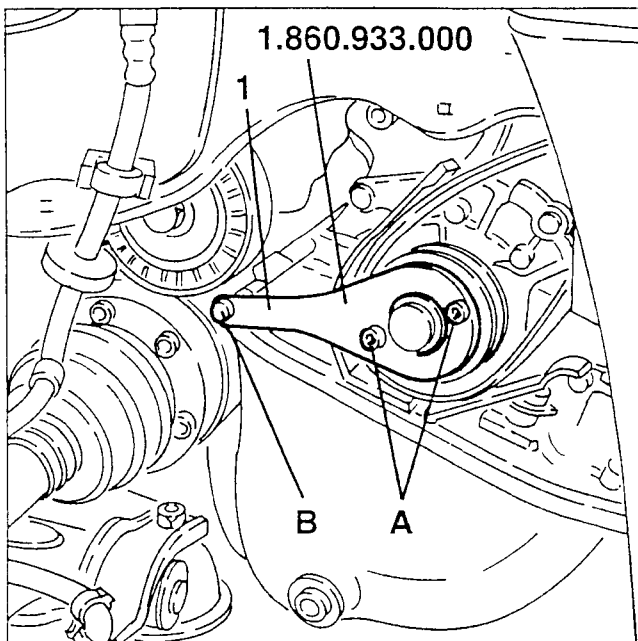


1. Slacken and remove the screw fastening the front cover to the crankcase.



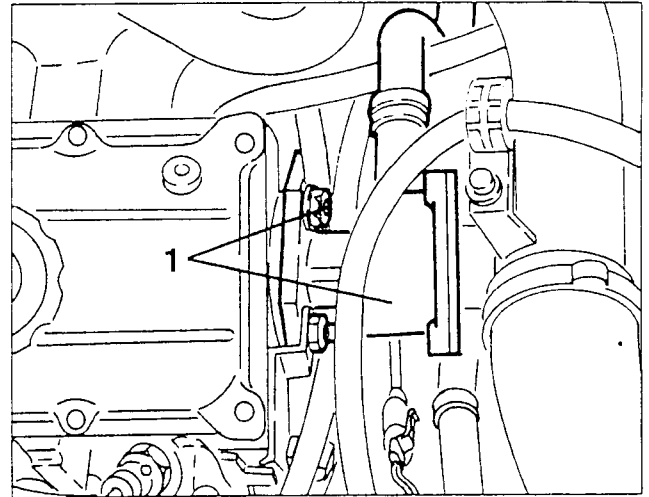
1. Position tool no. 1.860.933.000 for positioning the 1st cylinder at T.D.C.

The tool must be coupled to the timing gear belt drive pulley and fastened to it using screws (A). Using screw (B) it should also be positioned at the front crankcase cover (this way the angular position of the tool guarantees positioning of the 1st cylinder at T.D.C. in the bursting stroke).



- Re-check that the timing notches are still aligned as described previously.

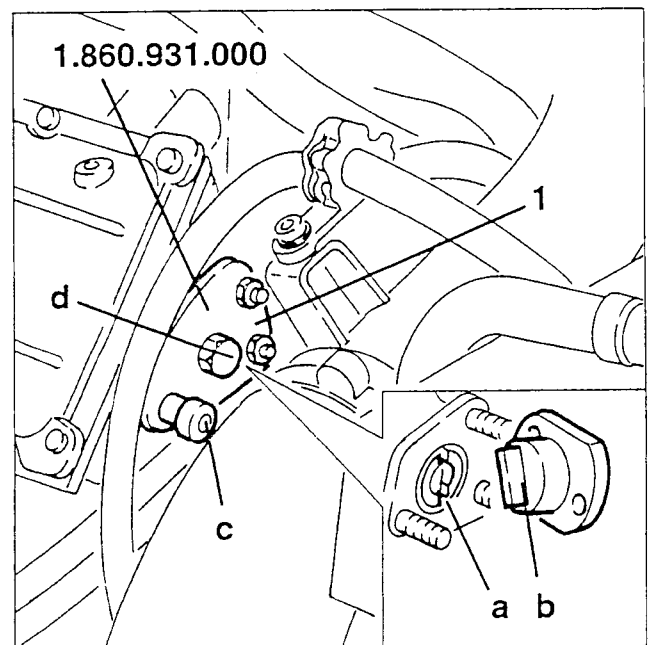
1. Lower the car, slacken the fastening nuts and remove the servobrake vacuum pump from the cylinder head.



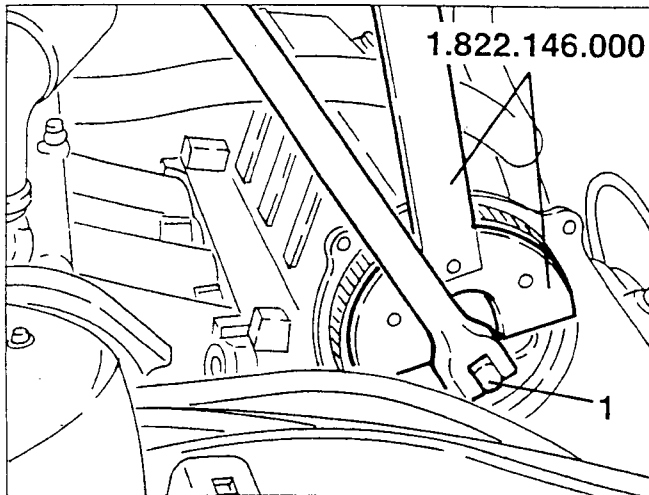
1. Position tool no. 1.860.931.000 for timing the camshaft, coupling groove (a) of the camshaft with relief (b) of the tool.

- Fasten the tool to the cylinder head positioning dowel (c) as illustrated.

NOTE: The dowel must be centred on the tool, if not, use a wrench on the hexagon (d) and centre the dowel on the tool with tiny movements.

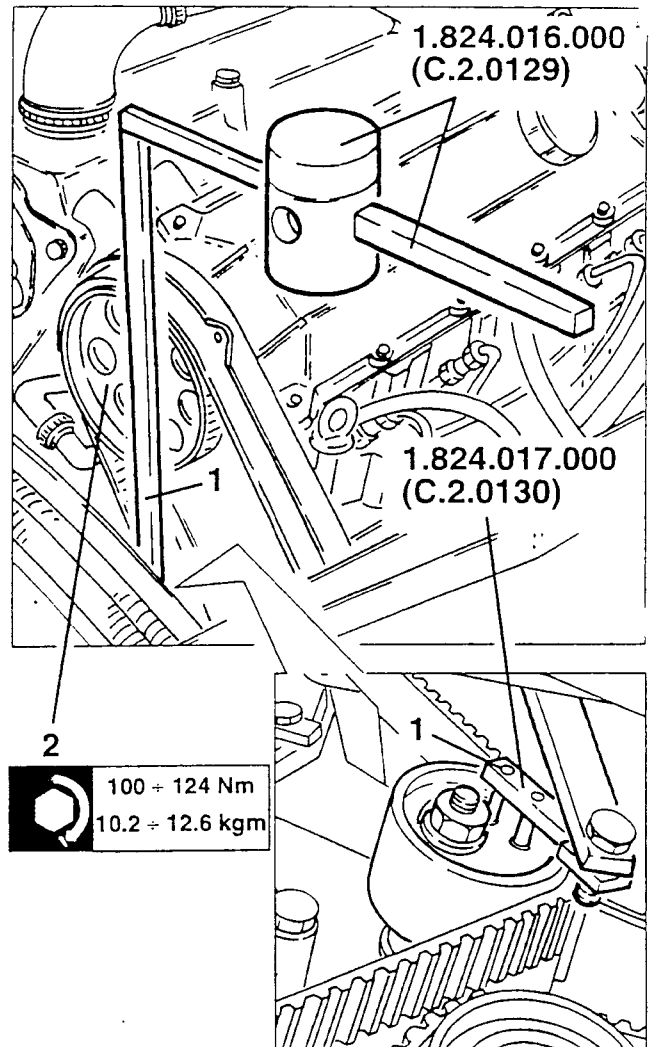


1. Using tool no. 1.822.146.000 slacken the screw fastening the camshaft drive pulley.



- Complete assembly of the camshaft drive pulley starting from camshaft drive pulley and continuing counter-clockwise.

NOTE: Check that the injection pump notch coincides with the fixed one on the rear cover.



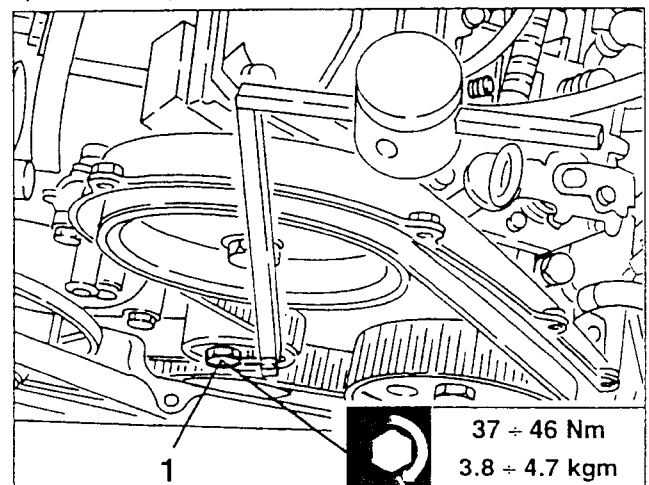
- Remove the tools installed previously for timing and locating the T.D.C.

- Settle the toothed belt turning the crankshaft twice in its direction of rotation.

1. Tighten the belt tensioner fastening nut to the specified torque.

1. Install tools no. 1.824.017.000 (C.2.0130) and no. 1.824.016.000 (C.2.0129) on the belt tensioner for tensioning timing gear belt as illustrated positioning the weight, complete with knurled piece, at a distance of 120 mm on the graduated rod.

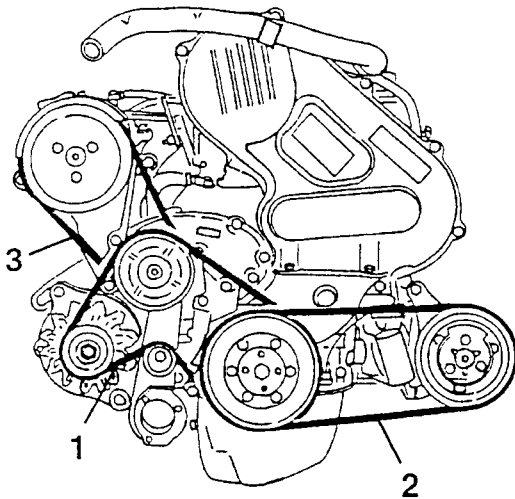
2. Tighten the camshaft drive pulley fastening screw to the specified torque using the same tools as previously.



- Remove the tools used for tensioning the belt.

- Complete refitting reversing the sequence followed for removal.

AUXILIARY COMPONENT BELTS



- 1. Alternator - water pump drive belt
- 2. Conditioner compressor drive belt
- 3. Power steering pump drive belt

NOTE:

When checking the belt tension, also check that the belt is intact and free of:

- cuts
- cracks
- material surface wear (smooth and shiny).
- dry or stiff parts.

In the event of one of the above defects, change the belt.



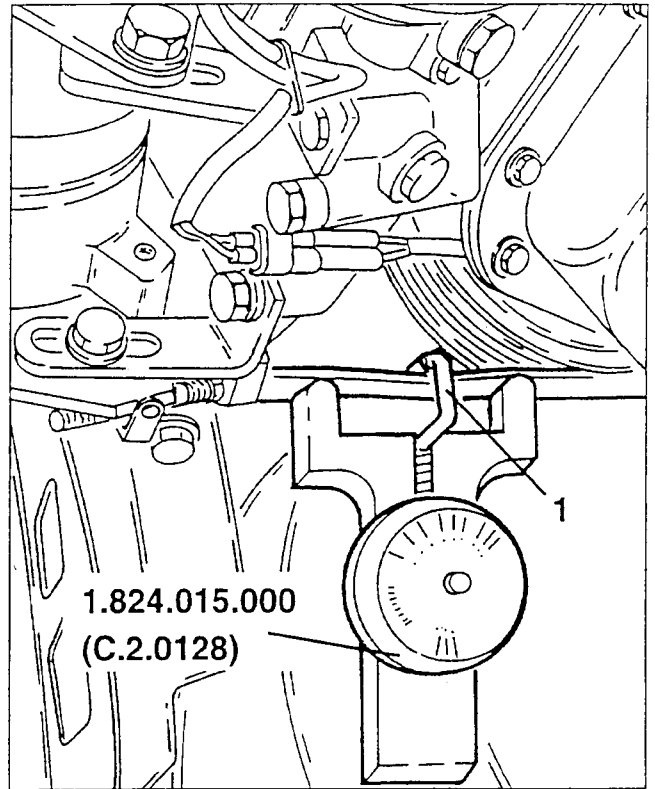
WARNING:

The contact of the belts with oil or solvents can damage the elasticity of the actual belt and reduce its adherence.

Conditioner compressor drive belt

Checking and tensioning

- Set the car on a lift and raise it.
- 1. Working as illustrated, measure the belt tension using tool N° 1.824.015.000 (C.2.0128).



- Check that the tensioning values measured with the tool are within the specified limits.

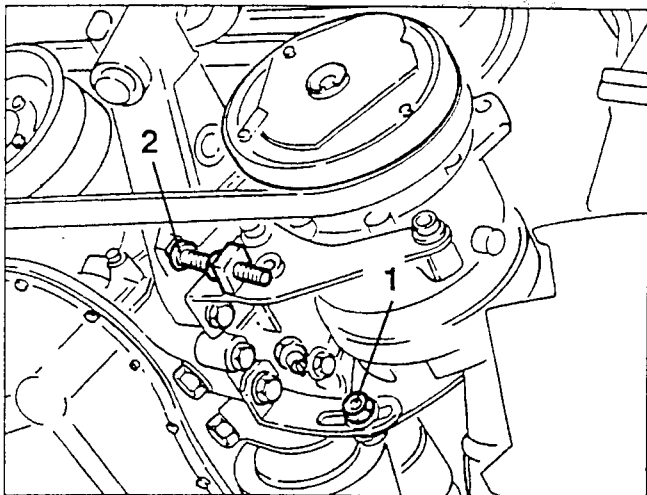
| Tension of trapezoidal belt "AV10" for conditioner compressor drive | |
|---|-------------|
| At assembly | 400 ÷ 550 N |
| Retensioning | 280 ÷ 370 N |

NOTE: The belt may be retensioned after a brief running-in period, proceeding as follows:

- bring the engine to normal operating temperature
- turn off the engine and wait for it to cool down
- retension the belt to the specified value.

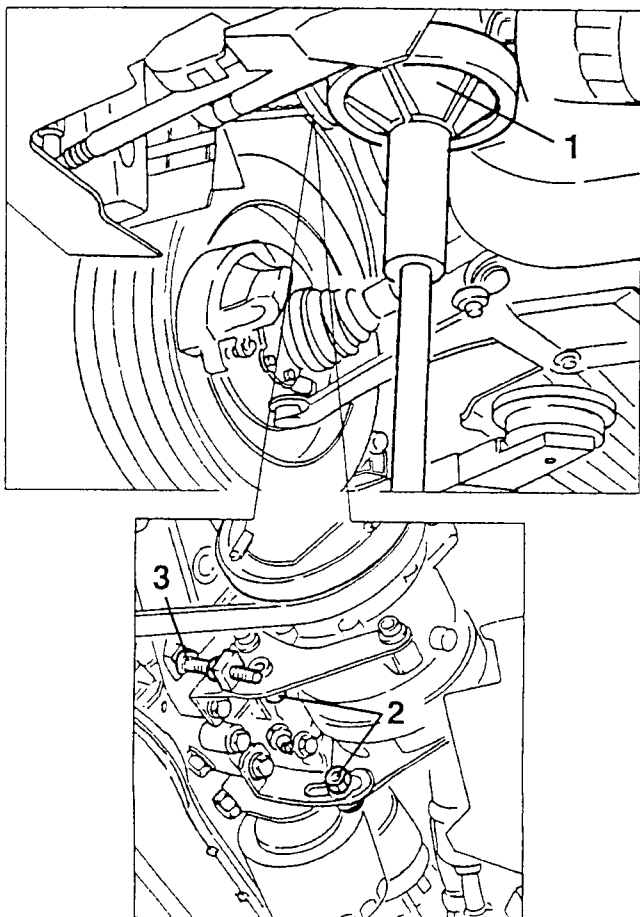
- If the belt tensioning is incorrect, proceed as follows.

1. Slacken the conditioner compressor fastening screws.
 2. Tension the belt correctly using the micrometric tensioner.
- Tighten the conditioner compressor fastening screws.

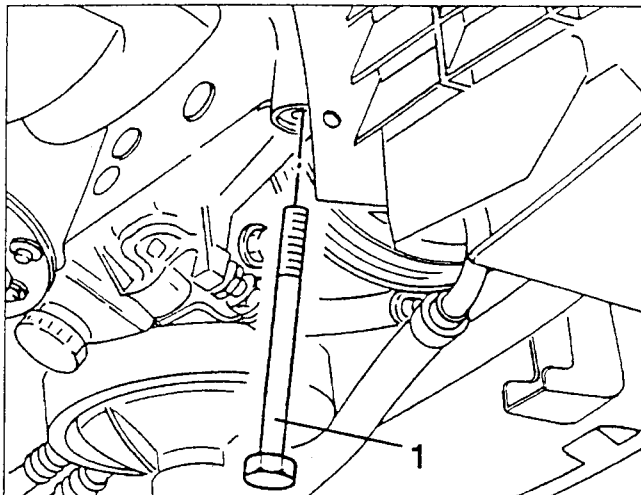


Changing the belt

1. Set a hydraulic jack underneath the engine as illustrated.
2. Slacken the conditioner compressor fastening screws.
3. Slacken the belt tension using the micrometric tensioner.



1. Slacken the screw fastening the oil filter support and injection pump to the engine flexible mount on the timing gear side.

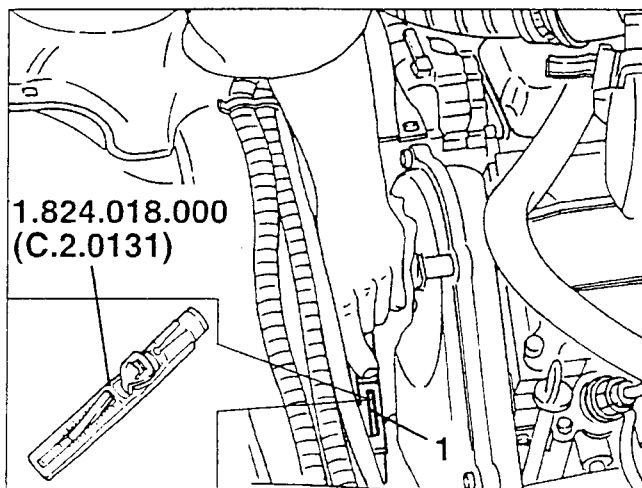


- Lower the hydraulic jack just enough to bring the compressor belt out from the engine mount and remove it.
- Install a new belt reversing the procedure described for removal and tension it following the procedure given in the previous paragraph.

Alternator - water pump drive belt

Checking and tensioning

- Slacken the screws fastening the air cleaner and turn it over without disconnecting the sleeves.
1. Working as illustrated, measure the tension of the belt using tool N° 1.824.018.000 (C.2.0131).



Tension of belt "POLY-VK5" for alternator - water pump drive

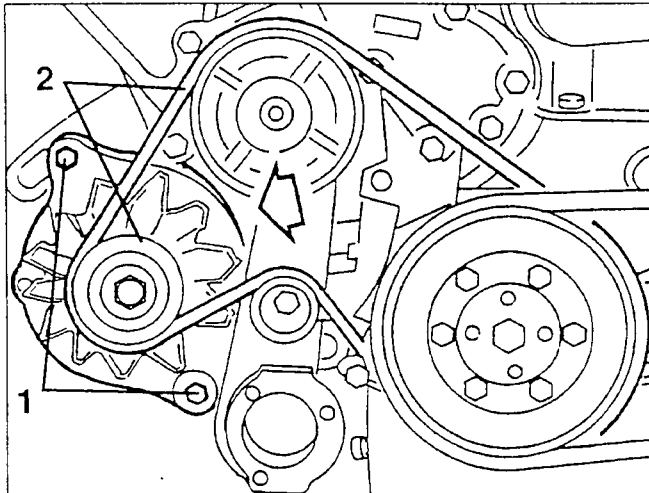
| | |
|--------------|-------------|
| At assembly | 400 ÷ 450 N |
| Retensioning | 300 ÷ 350 N |

NOTE:

The belt may be retensioned after a brief running-in period, proceeding as follows:

- bring the engine to normal operating temperature
- run the engine for about 10 minutes
- turn off the engine and wait for it to cool down
- retension the belt to the specified value.

- If the tension found is incorrect, proceed as follows:
 1. Slacken the two alternator fastening bolts.
 2. Move the alternator to one side to increase the belt tension.
- Tighten the upper alternator fastening bolt and check the belt tension.
- If the belt tension is correct also tighten the lower bolt fastening the alternator to the support bracket.
- Refit the air cleaner.

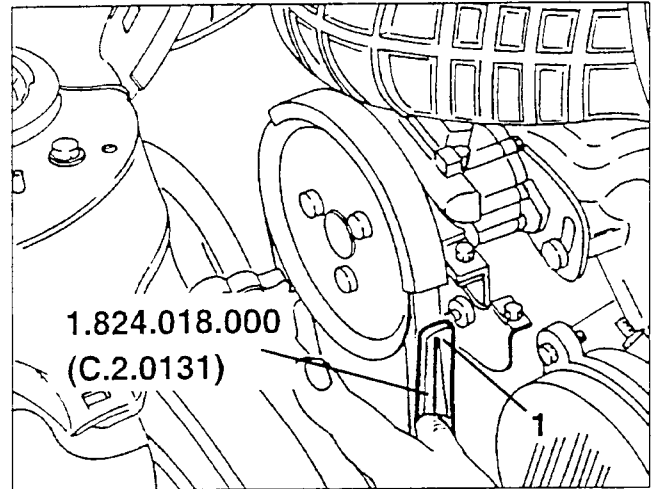
**Replacement**

- Set the car on a lift and raise it.
- Slacken the fastening screws and remove the lower engine guard.
- Remove the conditioner compressor drive belt from the pulley.
- Lower the car.
- Slacken the screws fastening the air cleaner and turn it over without removing the sleeves.
- Slacken the two alternator fastening bolts (See "Checking and tensioning") and remove the belt.
- Install a new belt reversing the procedure described for removal and tension it following the procedure given in the previous paragraph.
- Complete re-assembly taking care to tension the conditioner compressor belt (see specific paragraph).

Power steering pump drive belt

- Slacken the air cleaner fastening screws and turn it over without disconnecting the sleeves.

1. Working as illustrated, measure the belt tension using tool N° 1.824.018.000 (C.2.0131).

**Tension of belt "POLY-VK5" for power steering drive**

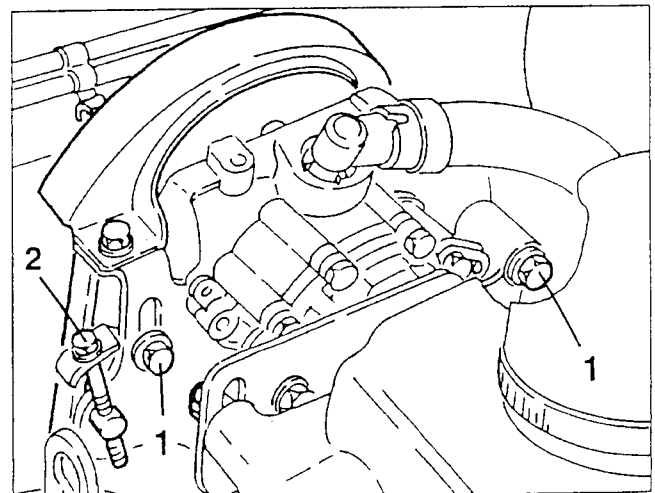
| | |
|--------------|-------------|
| At assembly | 400 ÷ 450 N |
| Retensioning | 300 ÷ 350 N |

NOTE:

The belt may be retensioned after a brief running-in period, proceeding as follows:

- bring the engine to normal operating temperature;
- run the engine for about 10 minutes;
- turn off the engine and wait for it to cool down;
- retension the belt to the specified value.

- If the tension found is incorrect, proceed as follows:
 1. Slacken the power steering pump fastening screws.
 2. Tension the belt correctly using the micrometric tensioner.

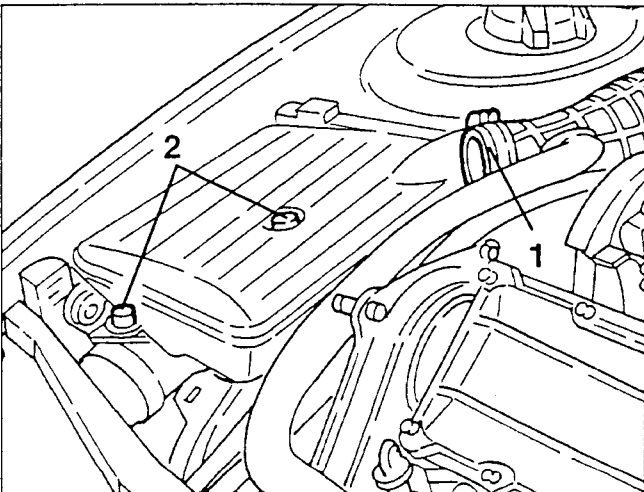


Replacement

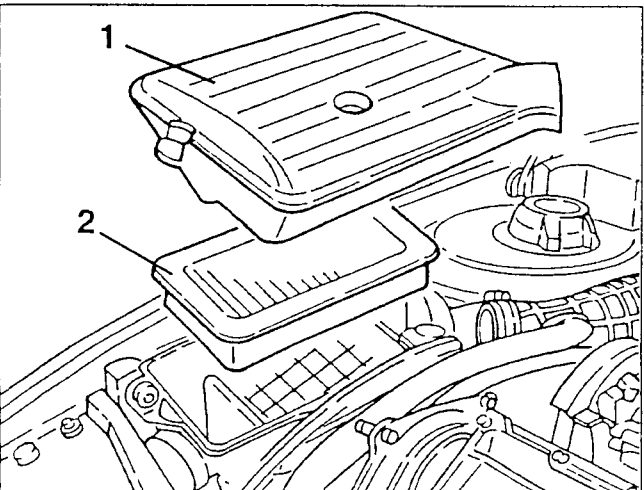
- Remove the alternator - water pump drive belt (see specific paragraph).
- Remove the power steering pump cover.
- Slacken the power steering pump fastening screws (see "Checking and tensioning").
- Lessen the tension of the power steering pump drive belt using the micrometric tensioner screw, then remove it.
- Install a new belt reversing the procedure described for removal and tension it following the procedure given in the previous paragraph.
- Complete refitting operations and tension the alternator - water pump drive belt and the conditioner compressor drive belt (see specific paragraphs).

CHECKING/CHANGING THE AIR CLEANER CARTRIDGE

1. Disconnect the corrugated sleeve from the air cleaner cover.
2. Slacken the air cleaner cover fastening screws.



1. Remove the air cleaner cover.
2. Remove the air cleaner cartridge.

**WARNING:**

Any filter cleaning operation might damage it, thereby jeopardising the correct operation of the engine supply system.

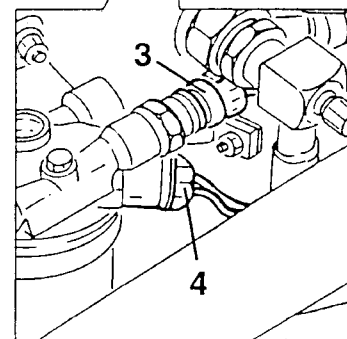
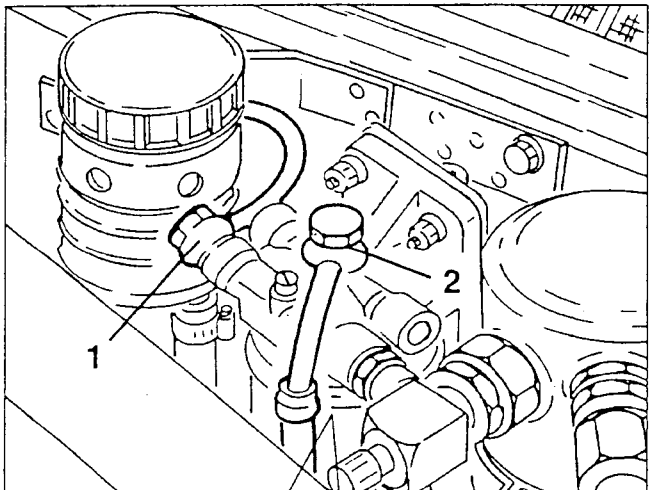
- Carefully clean the air cleaner cartridge container.
- Check the conditions of the cartridge and if necessary install a new one.
- Refit the cover and fasten with the corresponding screws.
- Connect the corrugated sleeve to the air cleaner cover.

NOTE:

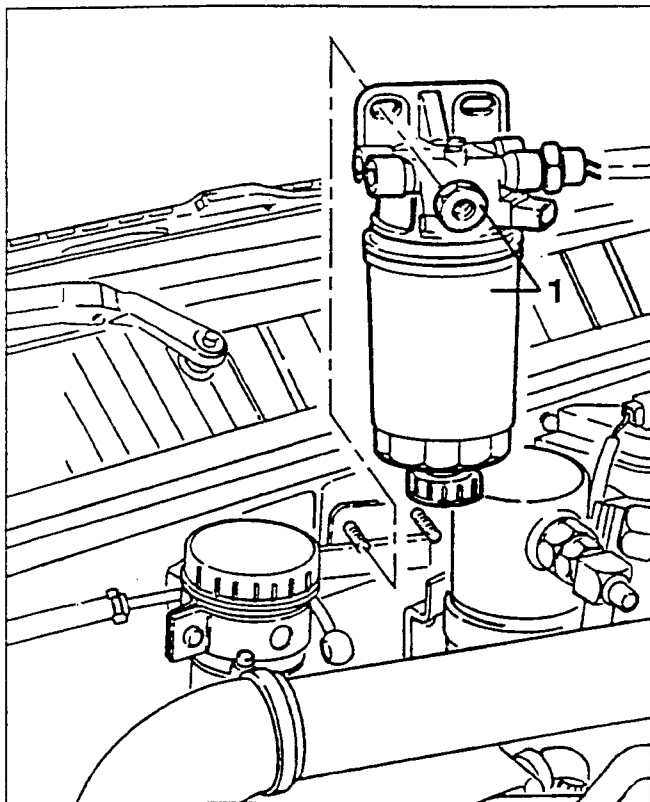
If the cleaner shows traces of oil, check for possible leaks in the entire air circuit.

CHANGING THE FUEL FILTER CARTRIDGE

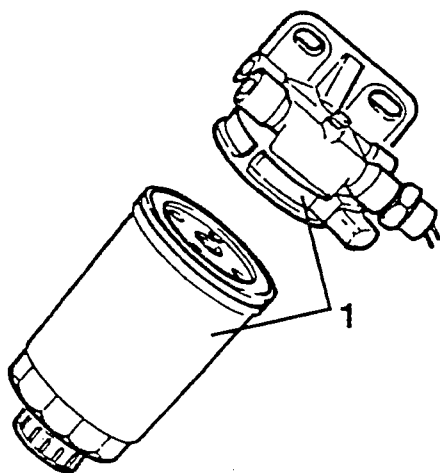
- Disconnect the battery (-) terminal.
1. Disconnect the connection of the tank fuel delivery hose from the filter.
 2. Disconnect the connection of the fuel delivery hose to the injection pump from the filter.
 3. Disconnect the electrical connection from the fuel warming device control sensor.
 4. Disconnect the electrical connection for supplying the fuel warming device.



1. Slacken the two fastening nuts and remove the complete fuel filter.



1. On the bench slacken the fuel cartridge together with its support seal.



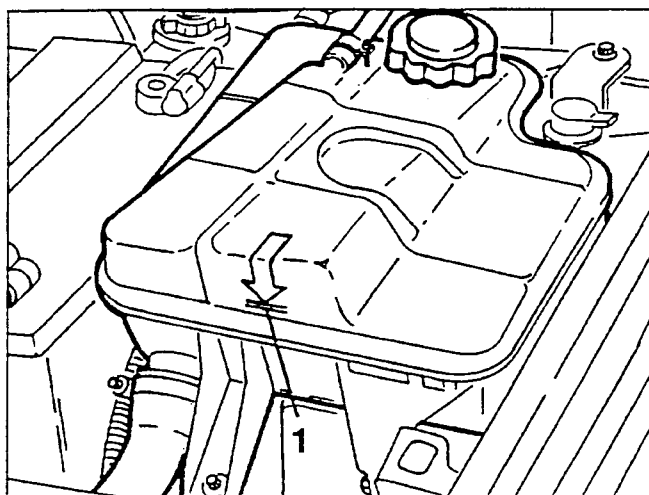
- Install a new cartridge with seal on the fuel filter support.
- Refit by reversing the procedure followed for removal.

- Purge air from the fuel supply system (see GROUP 10).

CHECKING THE LEVEL AND CHANGING THE ENGINE COOLANT FLUID

Checking

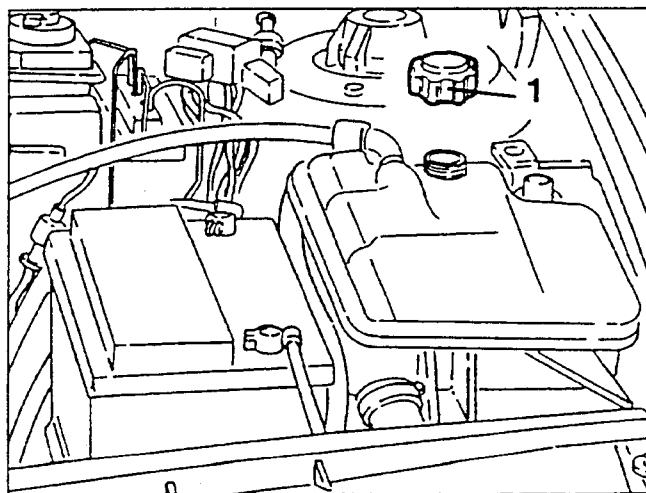
1. With the engine cold check that the level of the coolant in the header tank reaches the notch marked by the arrow and if necessary, top up with the specified fluid.



Draining and replenishing

1. Slacken and remove the header tank plug.

Absolutely never remove the header tank plug when the engine is warm!



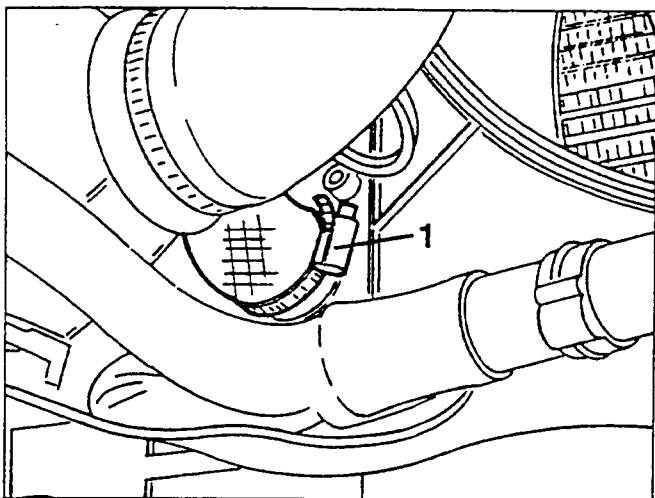
- Raise the car.

1. Drain the engine coolant fluid into a suitable recipient disconnecting the fluid outlet sleeve from the radiator.



WARNING:

The anti-freeze mixture used as coolant can harm the paintwork: therefore avoid any contact with painted components.



- Reconnect the sleeve to the radiator and any pipes that have been disconnected, checking that all the hose clamps are firmly tightened.

- Fill the header tank up to the mark.

- The type and indicative quantity of the coolant are given in the table below:

| | |
|---|------------|
| Alfa Romeo Climafluid Permanent -40°C | 8.9 litres |
|---|------------|

- Start the engine and bring it to normal operating temperature so that the thermostat opens to release the amount of residual air in the circuit.

- With the engine cold, top up to the level indicated on the header tank.

- Retighten the pressurized cap on the header tank.



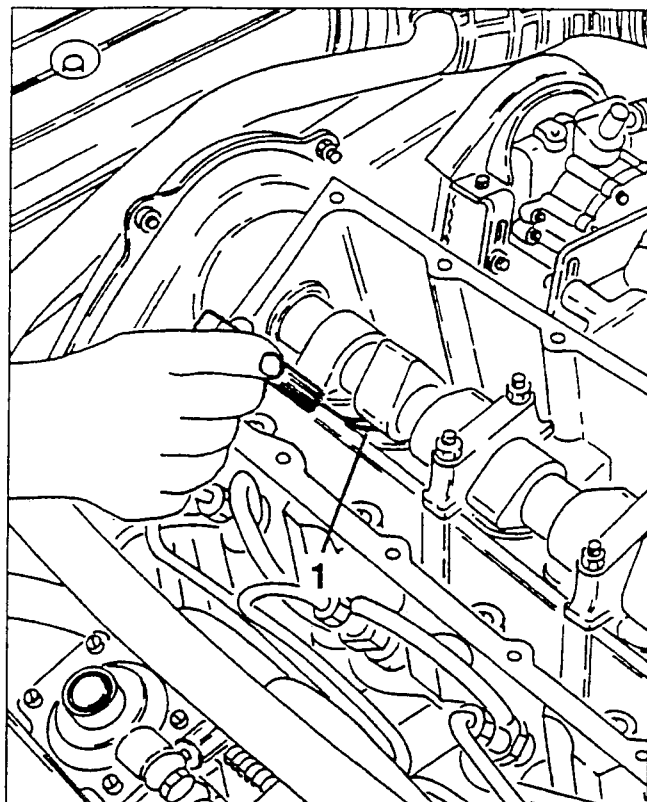
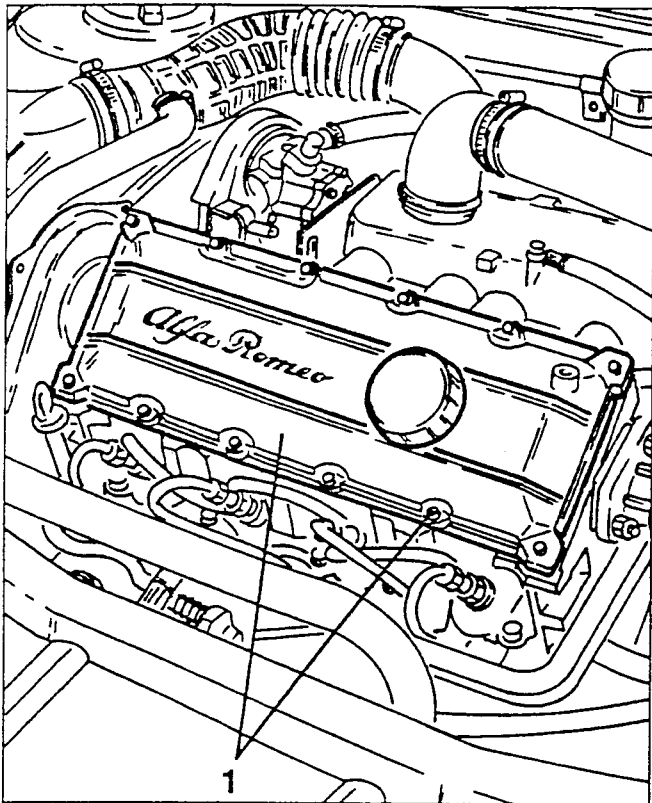
WARNING:

It is unwise to mix anti-freeze fluids of different types or brands!

Never use antirust additives: this might not be compatible with the anti-freeze in use!

CHECKING AND ADJUSTING VALVE CLEARANCE

1. Unscrew the screws and remove the timing cover.
- Remove the gasket.



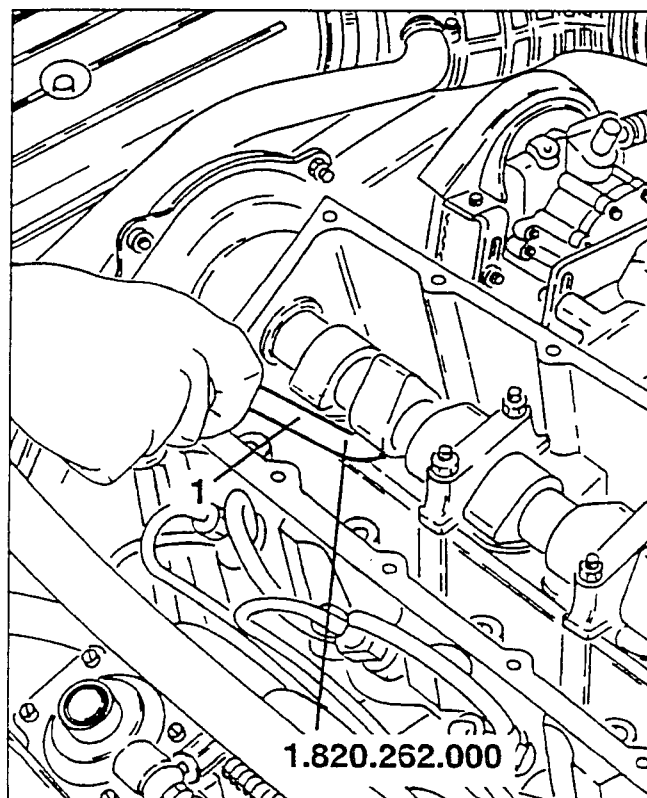
- If the valve clearance does not fall within the prescribed limits, proceed as follows:
- 1. Using the pressure lever N° 1.820.262.000 lower the tappets.

- Rotate the camshaft so that the intake and exhaust valves are in the closed position.

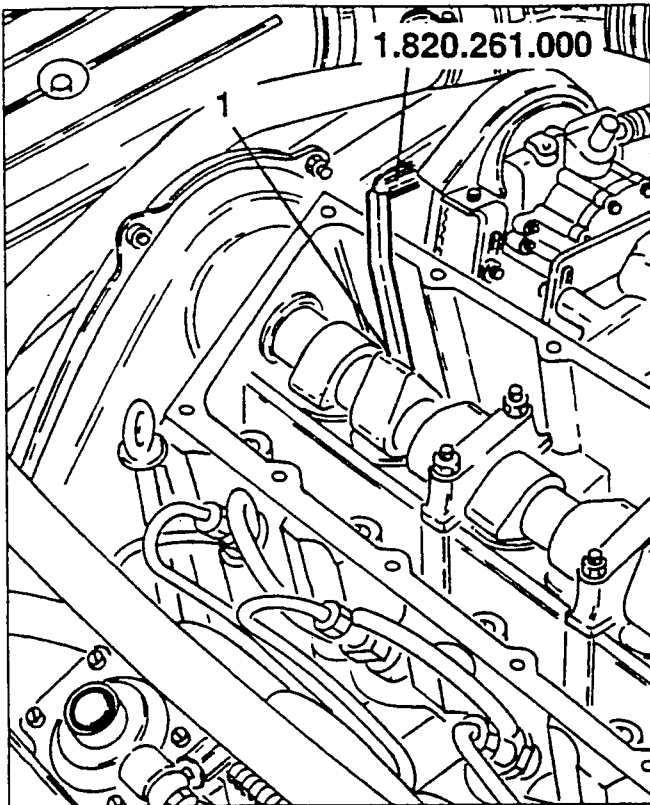
1. When the engine is cold, check that the clearance between the cam heel radius and the tappet falls within the prescribed limits.



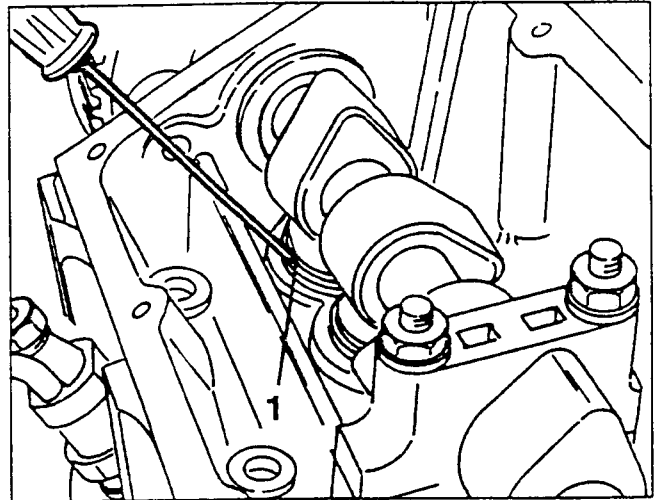
| Operating valve clearance (when engine is cold) | |
|--|--------------------|
| Intake | 0.30 ± 0.05 mm |
| Exhaust | 0.35 ± 0.05 mm |



1. Position tappet support tool N° 1.820.261.000 and turn the notches on the edge of the tappet to facilitate the subsequent extraction of the regulating plate to be replaced.



1. Extract and remove the tappet regulating plate.



- Replace the plate removed beforehand with another which has the correct thickness to reset the correct valve clearance, then repeat the above mentioned operations for the remaining valves.

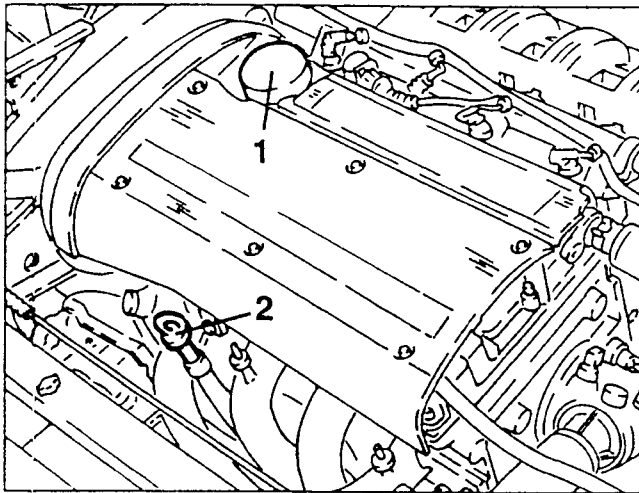
MAINTENANCE

1970 T. SPARK 16V ENGINE

CHANGING THE ENGINE OIL AND FILTER

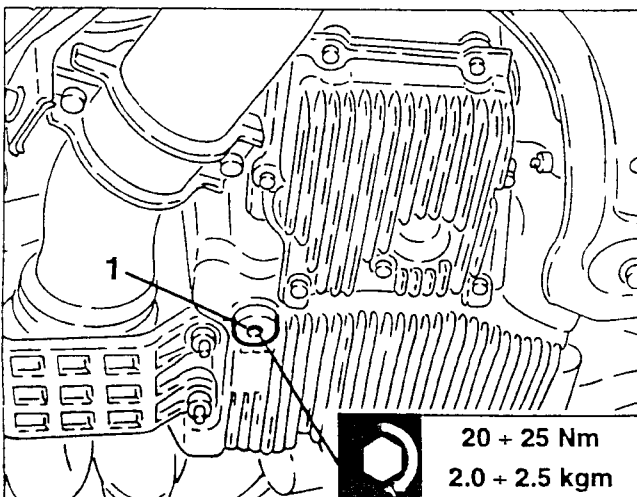
WARNING:
Engine oil is harmful to the skin: minimise contact of the oil with the skin; if this does occur wash with soap and water.

1. With the engine warm, remove the filler cap.
2. Withdraw the dipstick.



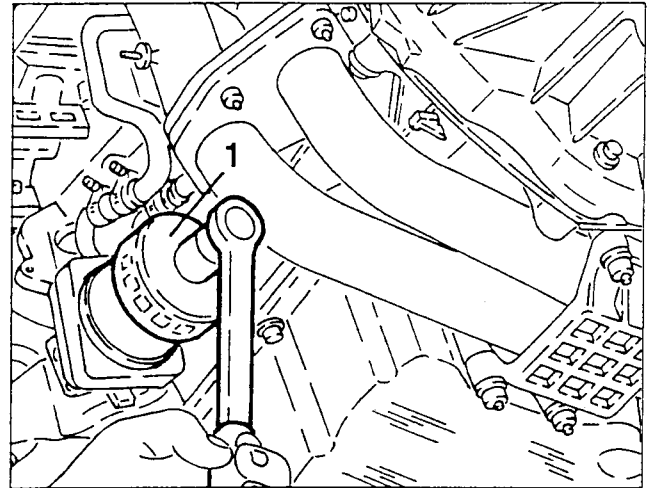
- Raise the car.
1. Remove the drain plug and drain off all the oil into a suitable recipient.

WARNING:
Be very careful when removing the drain plug; the oil might be very hot.



WARNING:
Never discard the oil in the environment as indiscriminate dumping causes pollution.

1. Working from underneath the car with the appropriate wrench, release the oil filter and remove it.



- Clean the drain plug and tighten it with the seal to the specified torque.
- Moisten the seal of the new filter and screw it on tightening fully by hand.
- Lower the car.
- Replenish the engine with oil of the type and in the quantity specified.
- Check that the oil level is correct with the dipstick.

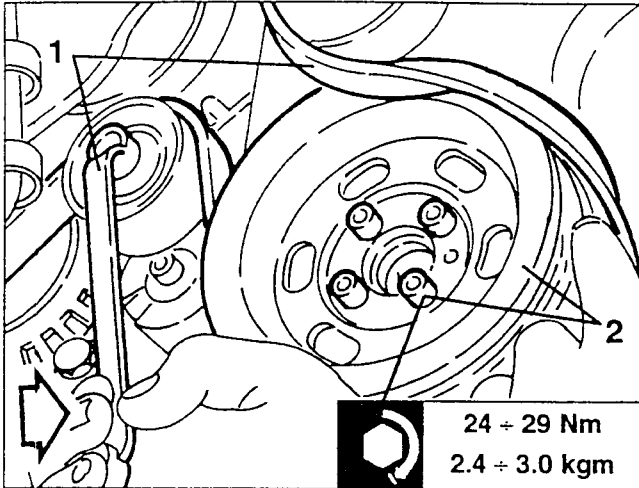
WARNING:
The oil level should be checked with the car on level ground.
The oil level above the MAX mark can cause the oil to evaporate and loss of pressure.

- Refit the filler cap, run the engine for appr. 2 minutes at idle speed, turn off the engine and wait for a few minutes.
- Check the oil level and make sure there are no leaks.

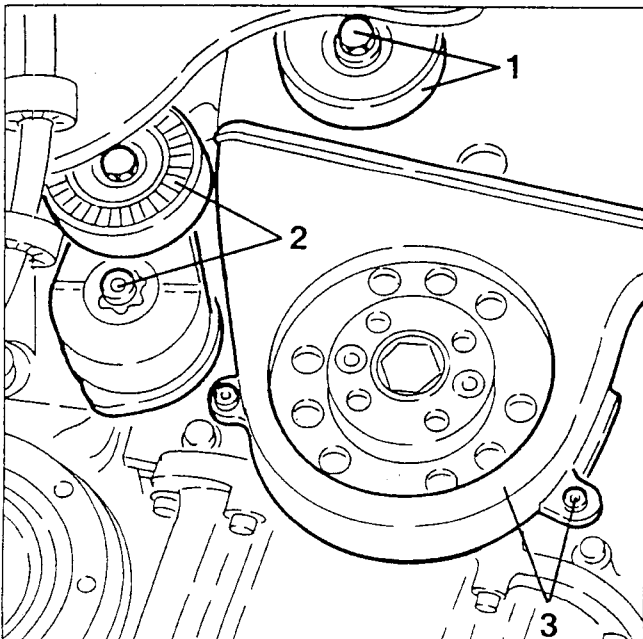
WARNING:
When refilling with oil, great care should be taken to prevent engine oil dripping into the alternator ventilation holes, as this could seriously damage the alternator and may cause fire.

CHANGING THE TIMING GEAR BELT (For engines with counter-rotating shafts)

- Set the car on a lift.
 - Disconnect the battery (-) terminal.
 - Remove the right front wheel and mud flap.
1. Working as illustrated on the guide pulley, slacken the tension of the auxiliary components control belt and remove it.
 2. Slacken the four fastening screws and remove the auxiliary components control belt.

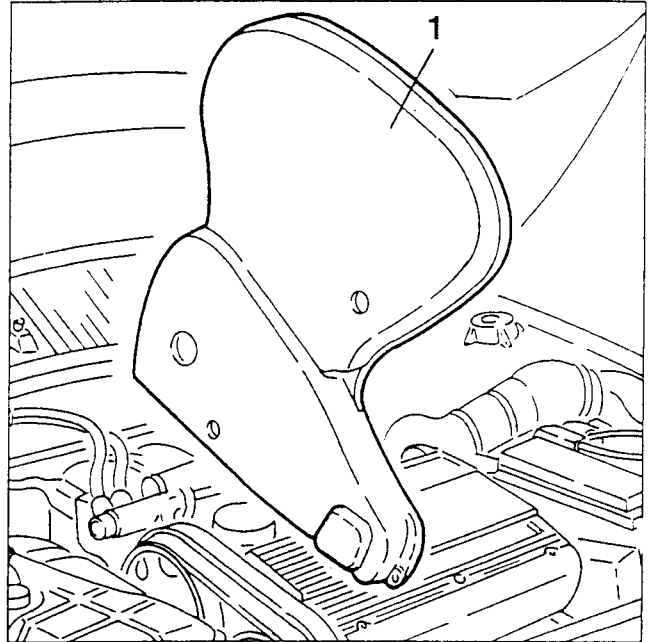


1. Slacken the fastening screw and remove the auxiliary components control belt guide pulley.
2. Slacken the fastening screw and remove the auxiliary components belt tensioner.
3. Slacken the fastening screws and remove the timing belts and counter-rotating shafts lower guard.

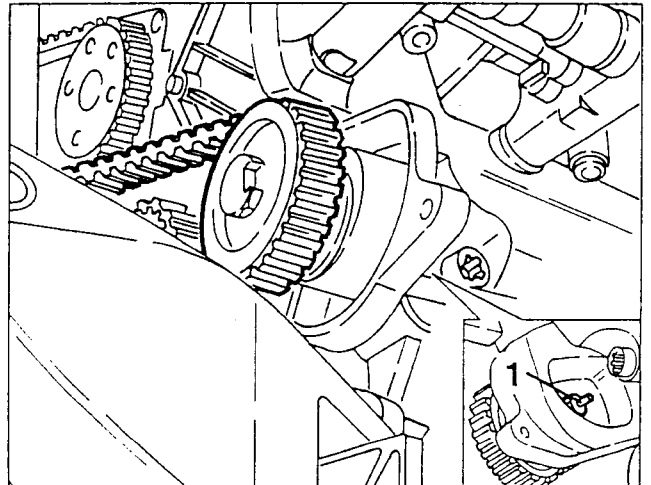


- Slacken the lower screws of the timing belts and counter-rotating shafts upper guard.

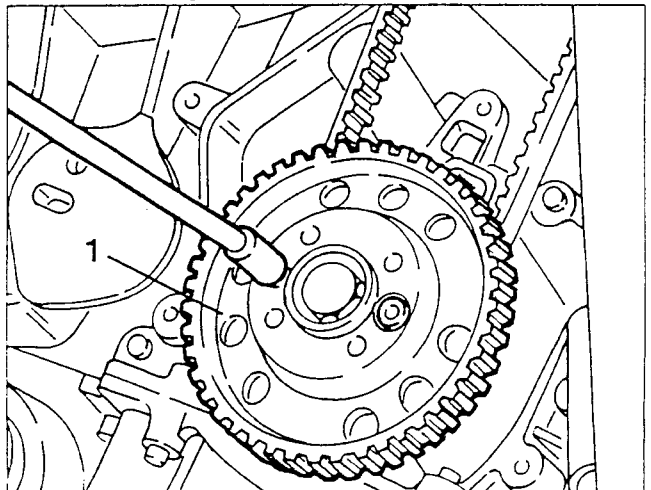
1. Lower the car, slackening the remaining fastening screws and remove the upper guard.



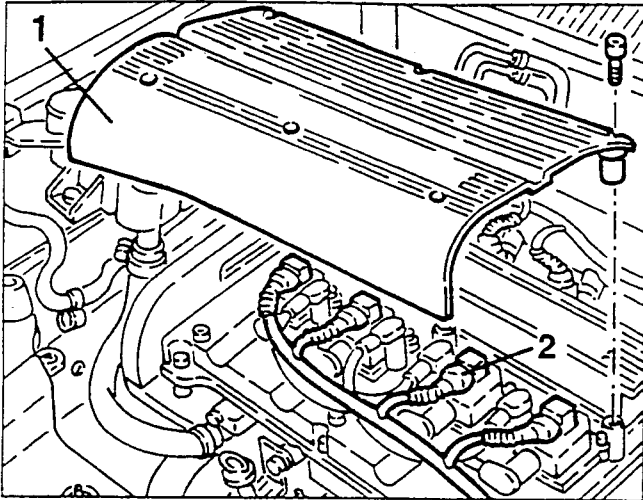
1. Slacken the tension of the counter-rotating shafts belt loosening the nut fastening the corresponding belt tensioner, then remove the belt.



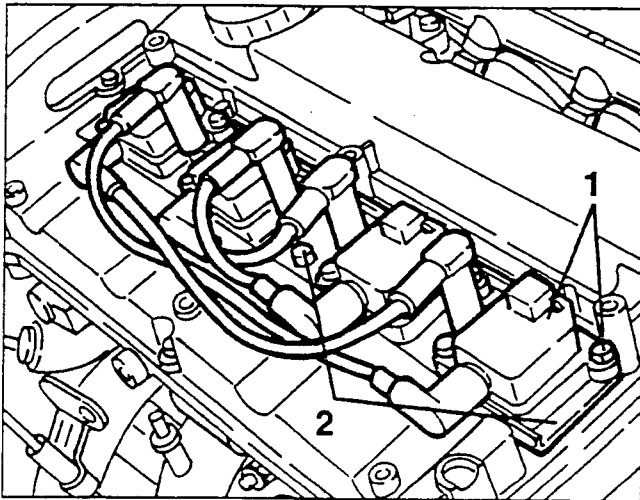
1. Slacken the two fastening screws and remove the counter-rotating shafts driving pulley.



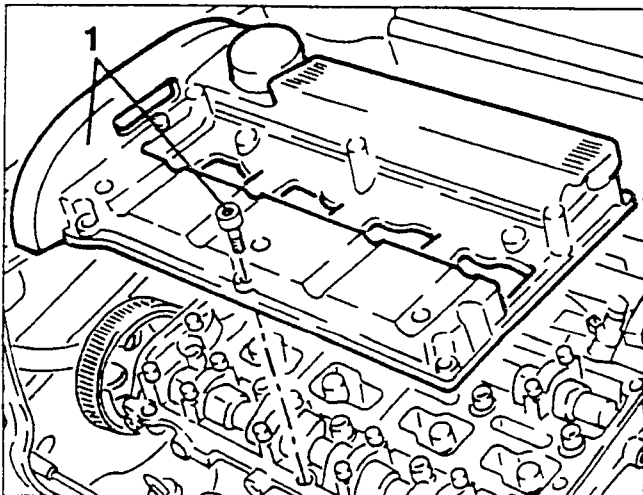
1. Slacken the fastening screws and remove the cover of the ignition coils.
2. Disconnect the electrical connections from the ignition coils.



1. Slacken the fastening screws and remove the ignition coils.
2. Slacken the fastening screws and remove the ignition coils support bracket.

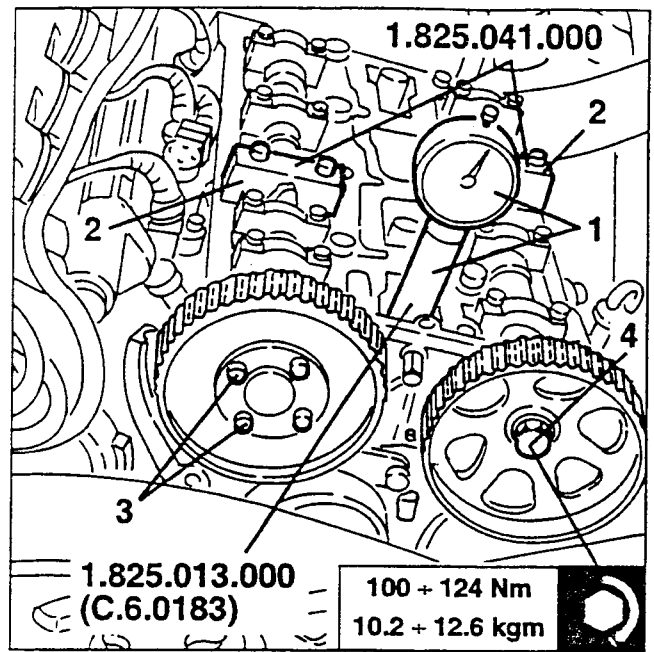


1. Slacken the fastening screws and remove the cylinder head cover complete with seal.

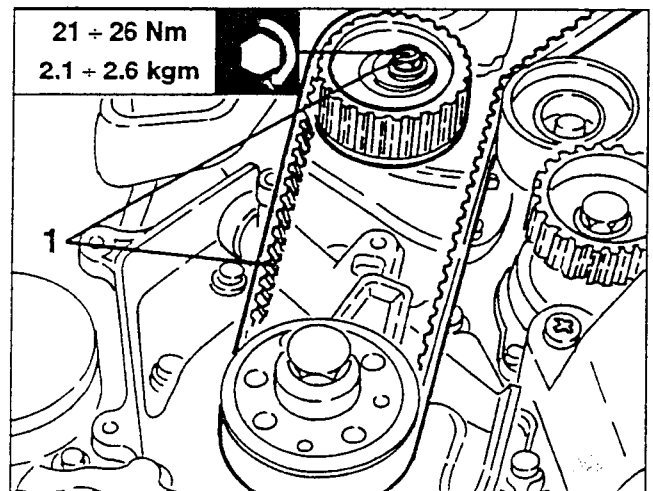


1. Install tool no. 1.825.013.000 (C.6.0183) fitted with dial gauge in the seat of the first cylinder spark plug. - Turn the crankshaft in its direction of rotation, until the piston of the 1st cylinder reaches the T.D.C. in the bursting stroke.

2. Remove the camshaft caps illustrated and in their place install templates no. 1.825.041.000 tightening the fastening screws to a maximum torque of 10 Nm (1 kgm) and ensuring correct coupling with the cams.
3. Slacken the four screws fastening the camshaft pulley on the intake side.
4. Slacken the screw fastening the timing pulley on the exhaust side.



1. Working on the timing belt tensioner slacken the tension of the belt, then remove it.

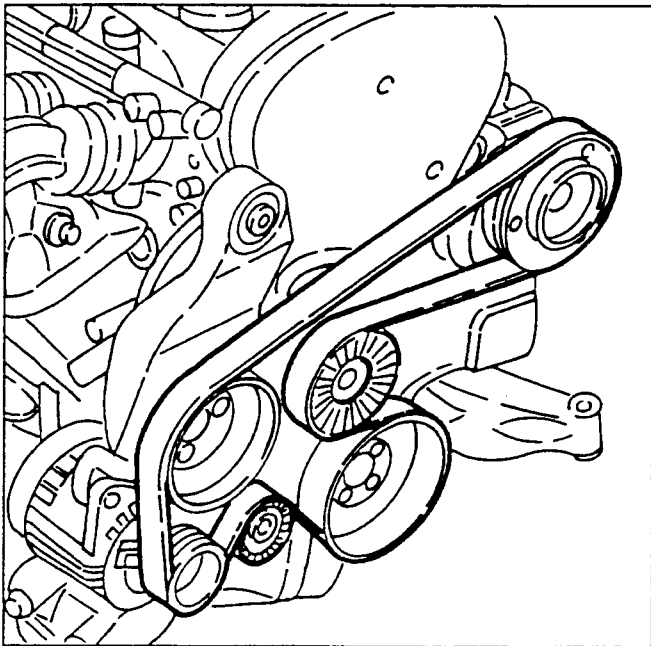


- Install a new timing belt proceeding as described in GROUP 10 - ENGINE OVERHAULING paragraph "Assembly of timing belt and checking timing".

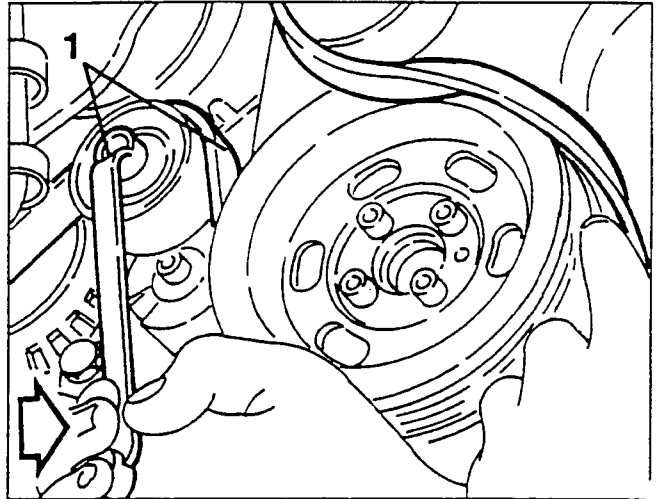
- Install the counter-rotating shafts control belt proceeding as described in GROUP 10 - ENGINE OVERHAULING paragraph "Assembly of counter-rotating shafts control belt and timing".
- Complete re-assembly reversing the sequence followed for removal.

AUXILIARY COMPONENT BELT

The auxiliary components of the engine are driven by a single Poly V belt. This belt is tensioned by an automatic tensioner; therefore checking the tension is unnecessary.



1. Proceeding as illustrated on the guide pulley, slacken the tension of the auxiliary components drive belt and remove it.



- Install a new belt reversing the sequence followed for removal.

CHANGING THE AIR CLEANER CARTRIDGE



WARNING:
Any filter cleaning operation might damage it, thereby adversely affecting the correct operation of the engine.

Replacement

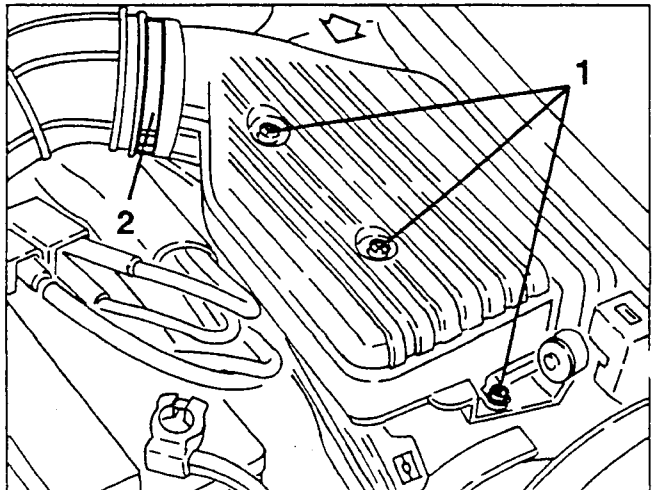
- Set the car on a lift.
- Remove the right front wheel and mud flap.
- Check visually that the belt is intact and that it is free of:
 - cuts
 - cracks
 - material surface wear (smooth and shiny)
 - dry or stiff parts (lack of adherence).

In the event of one of the above defects, change the belt.

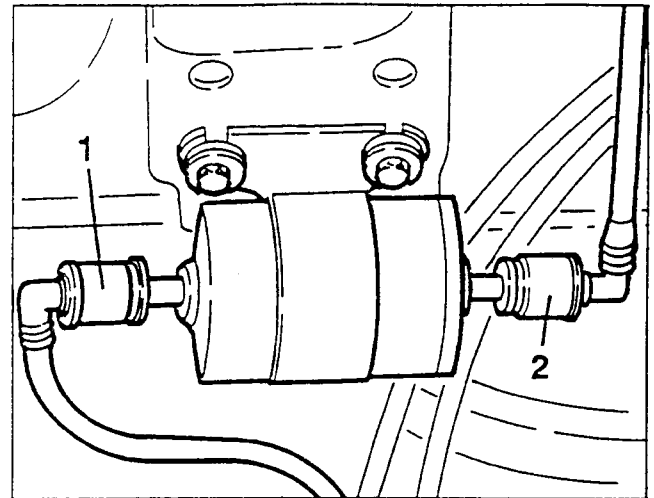
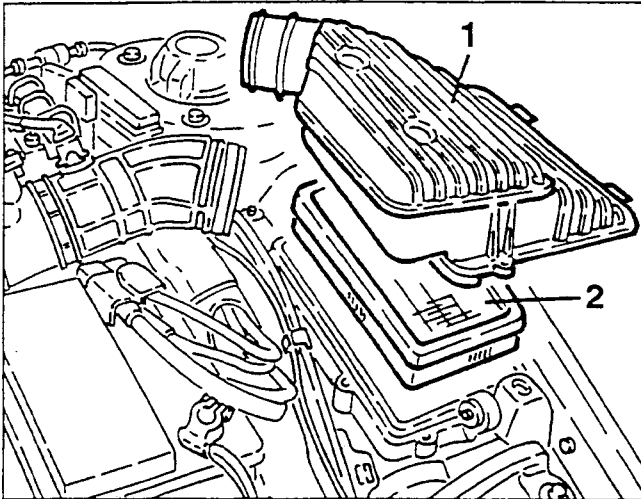


WARNING:
The contact of the belt with oil or solvents can damage the elasticity of the actual belt rubber and reduce its adherence.

1. Slacken the four air cleaner cover fastening screws.
2. Slacken the clamp fastening the air cleaner cover to the corrugated sleeve.



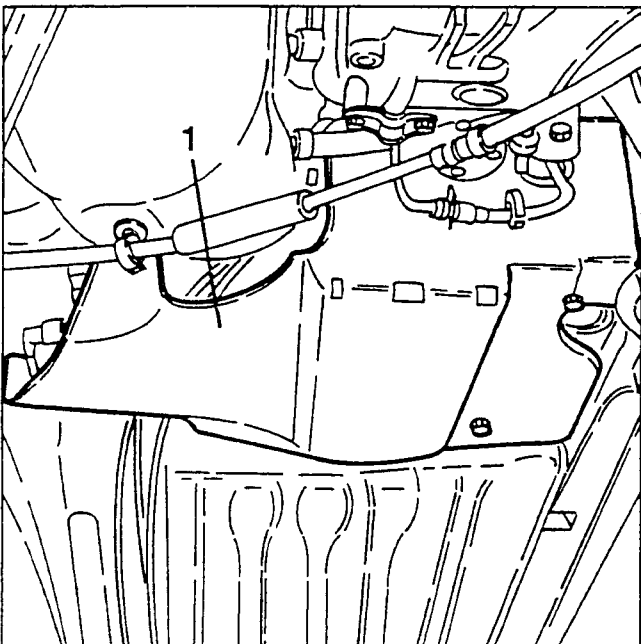
1. Remove the air cleaner cover.
2. Remove the air cleaner cartridge.



- Install the new filter so that the arrow stamped on it points in the direction of the flow of fuel.

REPLACEMENT THE FUEL FILTER

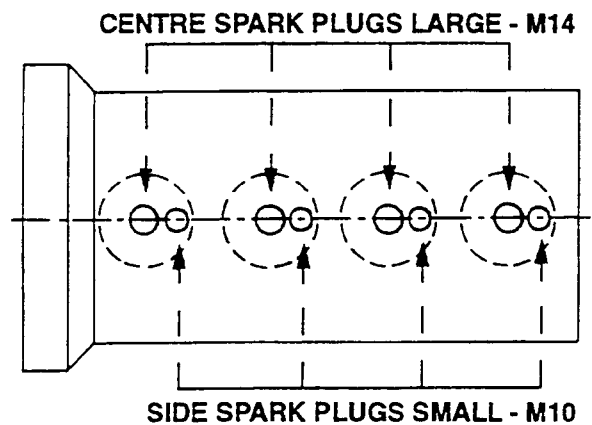
- Set the car on a lift and raise it.
- 1. Slacken the fastening screws and remove the plastic cover to gain access to the fuel filter.



1. Disconnect the connections of the fuel inlet and outlet pipes from the filter (for disconnecting operations see specific paragraph).
 2. Slacken the two screws fastening the support bracket, then remove it complete with fuel filter.
- Separate the fuel filter from the support bracket on the bench.

CHECKING AND CHANGING SPARK PLUGS

The standard spark plugs are of the surface discharge type with one point and a centre electrode. In order to operate correctly, the gap between the electrodes must be correct. The spark plugs are positioned in the bursting chamber asymmetrically and they differ in size as illustrated below.



| Spark plugs | |
|----------------------------------|-----------|
| Centre spark plugs (large - M14) | NGK PFR6B |
| Side spark plugs (small - M10) | NGK PMR7A |

- With the engine cold, remove the spark plugs, firstly blowing inside the spark plug openings to remove any impurities and traces of dirt.

- Check the spark plugs for dirt and the ceramic insulation for breaks. In this case replace the spark plugs.

WARNING:

The use of spark plugs with different characteristics or sizes than those specified can cause serious damage to the engine and change the level of harmful emission at the exhaust.

WARNING:

A dirty or worn out spark plug is often the sign of a failure in the engine supply system.

For example:

- Traces of carbon dust: incorrect mixture, air cleaner very dirty.
- Spots of oil: oil leaking from the piston rings.
- Formation of ash: presence of aluminium materials, contained in the oil.
- Burnt electrodes: overheating due to unsuitable fuel, defects in the valves.
- High electrode wear: harmful additives in the fuel or in the oil, pinging in the cylinder head.
- Etc.

- When installing, tighten the spark plugs to the following torque:

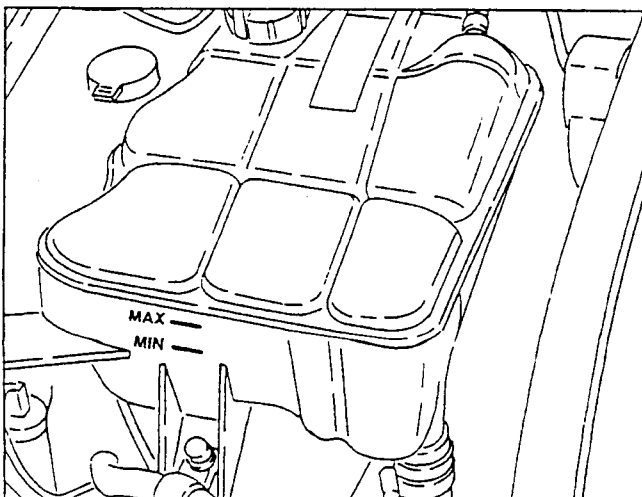


| | |
|----------------------------|-----------------------------|
| Centre spark plugs (large) | 25 + 35 Nm 2.5 ÷ 3.6 kgm |
| Side spark plugs (small) | 10 + 12 Nm 1 + 1.2 kgm |

CHECKING THE LEVEL AND CHANGING THE ENGINE COOLANT FLUID

Checking

- With the engine cold, check that the level in the coolant in the header tank is between the MIN and MAX marks.



Draining and replenishing

- Set the car on a lift.
- Slacken and remove the header tank plug.



WARNING:

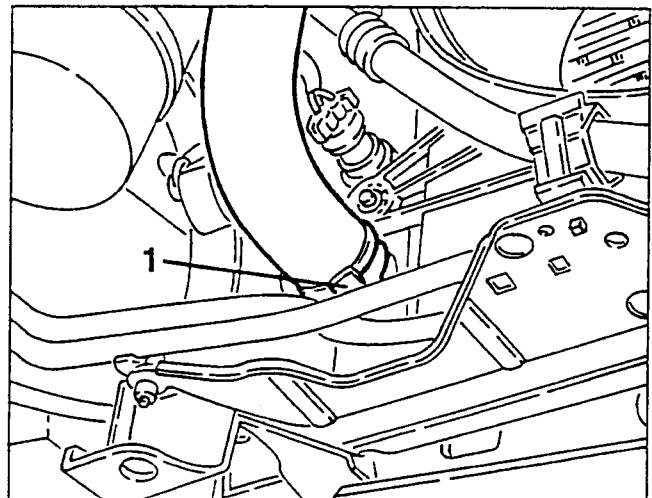
Absolutely never remove the header tank plug when the engine is hot!

- Raise the car.
- 1. Slacken the radiator outlet hose and drain the coolant into a suitable recipient.



WARNING:

The anti-freeze mixture used as coolant can harm the paintwork: therefore avoid any contact with painted components.



- Reconnect the sleeve to the radiator and any disconnected pipes, checking that all the clamps are firmly tightened.
- Fill the header tank to the MAX mark with fluid of the specified type and quantity.
- Start the engine and bring it to normal operating temperature so that the thermostat opens to release the amount of residual air in the circuit.
- With the engine cold, top up to the MAX mark on the header tank.
- Retighten the pressurised cap on the header tank.



WARNING:

It is unwise to mix anti-freeze fluids of different types or brands!
Never use antirust additives: they might not be compatible with the anti-freeze in use!

ENGINES MAINTENANCE



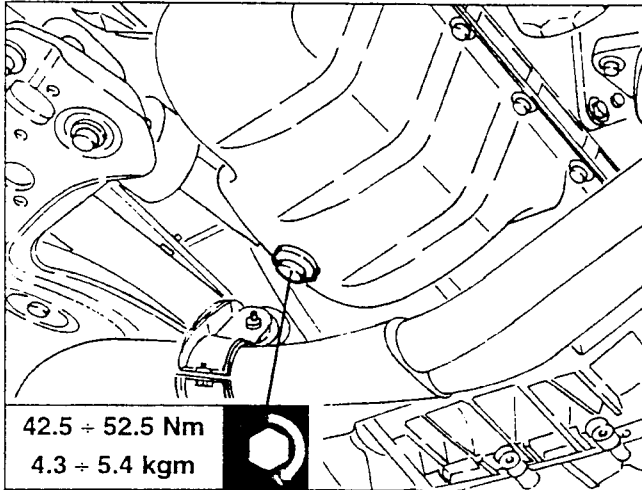
T.SPARK 16V

Below the differences compared with the 1970 T.Spark 16V are given.

Reference should be made to the above engine for items not mentioned here.

CHANGING THE ENGINE OIL AND FILTER

Proceed as described for the 1970 T.Spark 16V engine bearing in mind that for the 1370 T.Spark 16V engine a sheet metal oil sump has been used instead of the aluminium one, as illustrated.

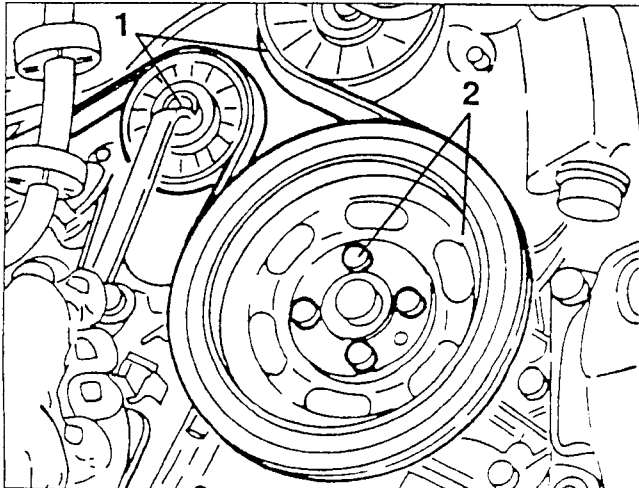


CHANGING THE TIMING GEAR DRIVE BELT (For engines without counter-rotating shafts)

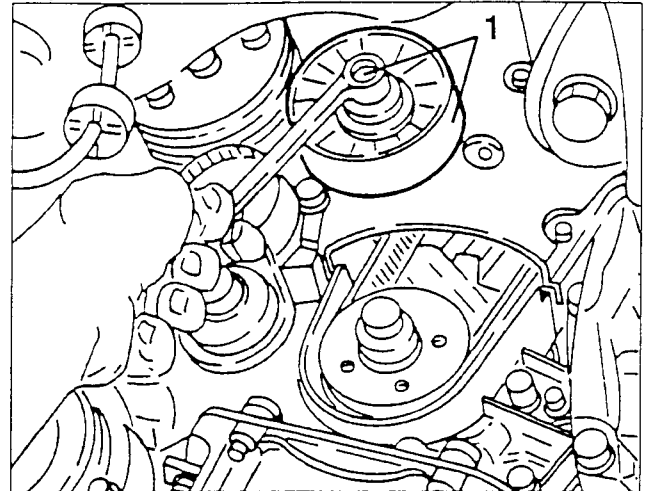
- Set the car on a lift.
- Disconnect the battery (-) terminal.
- Remove the right front wheel and mud flap.

1. Working as illustrated on the guide pulley, slacken the tension of the auxiliary components drive belt and prise it off.

2. Slacken the four fastening screws and remove the auxiliary components drive pulley.

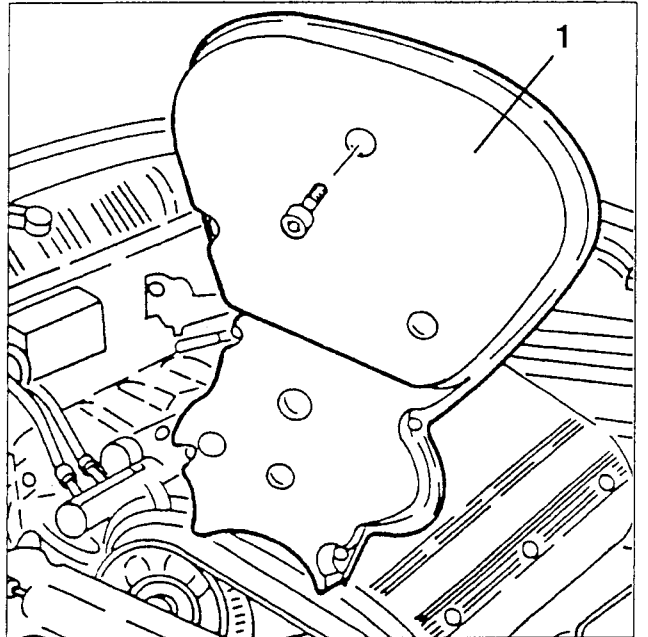


1. Slacken the fastening screw and remove the auxiliary components drive belt guide pulley.



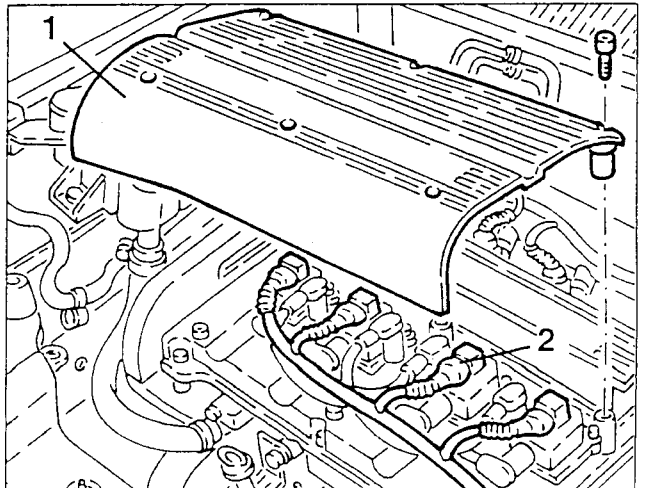
- Slacken the lower fastening screws of the timing gear drive belt guard.

1. Lower the car, slacken the remaining fastening screws and remove the upper guard.

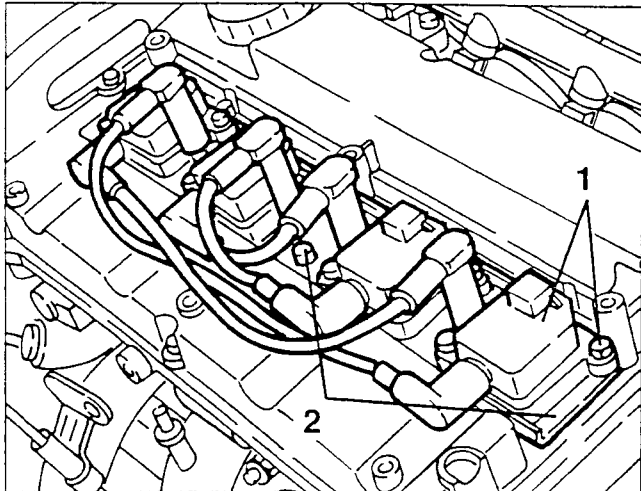


1. Slacken the fastening screws and remove the ignition coil cover.

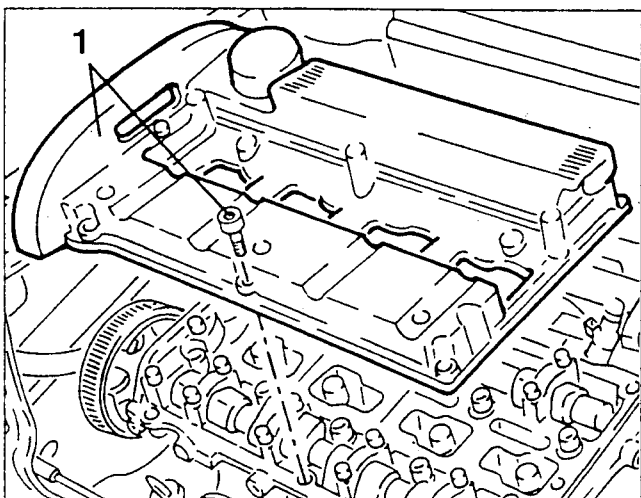
2. Disconnect the electrical connections from the ignition coils.



1. Slacken the fastening screws and remove the ignition coils.
2. Slacken the fastening screws and remove the ignition coil support bracket.



1. Slacken the fastening screws and remove the cylinder head cover complete with seals.

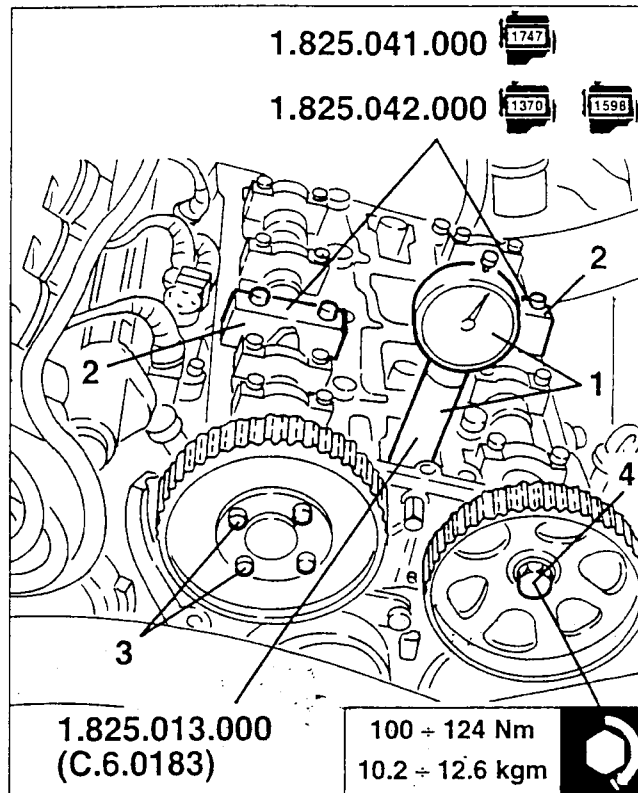


1. Install tool no. 1.825.013.000 (C.6.0183) fitted with dial gauge in the spark plug adaptor of the first cylinder.

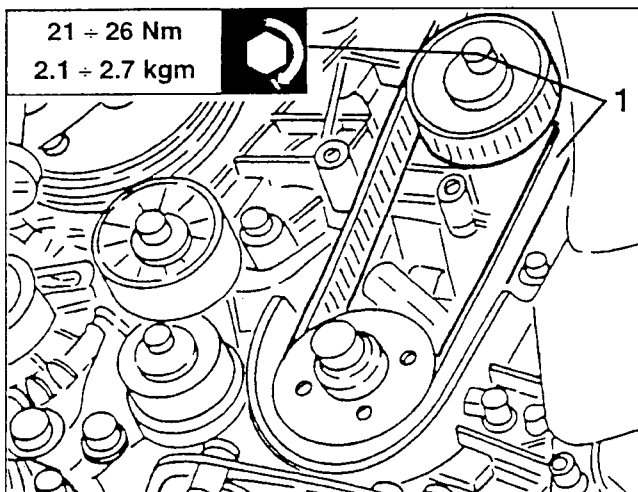
- Turn the crankshaft in its normal direction of rotation, until the piston of the 1st cylinder reaches T.D.C. in the bursting stroke.

2. Remove the camshaft caps illustrated and in place of them install the templates, tightening the fastening screws to a maximum torque of 10 Nm (1 kgm) and making sure they mate correctly with the cams.

3. Slacken the four screws fastening the intake side timing gear pulley.
4. Slacken the screw fastening the exhaust side timing gear pulley.



1. Working on the timing gear belt tensioner, slacken the tension of the belt, then remove it.



- Install a timing gear drive belt as described in the volume "ENGINE OVERHAULING" in paragraph "Assembling the timing gear drive belt and checking valve gear timing".

- Complete reassembly reversing the sequence followed for removal.

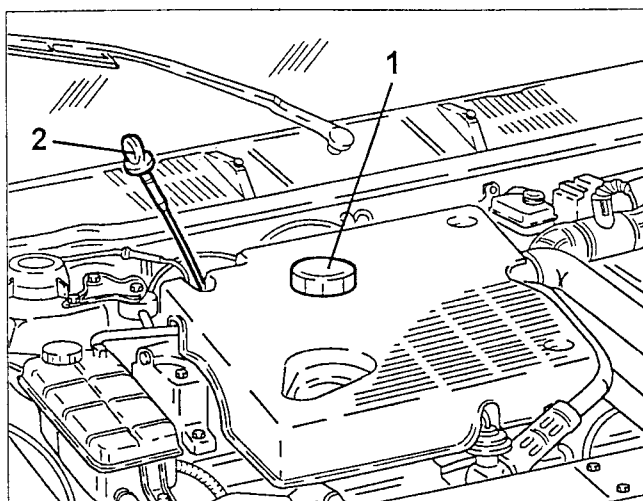
ENGINE MAINTENANCE

1910 JTD

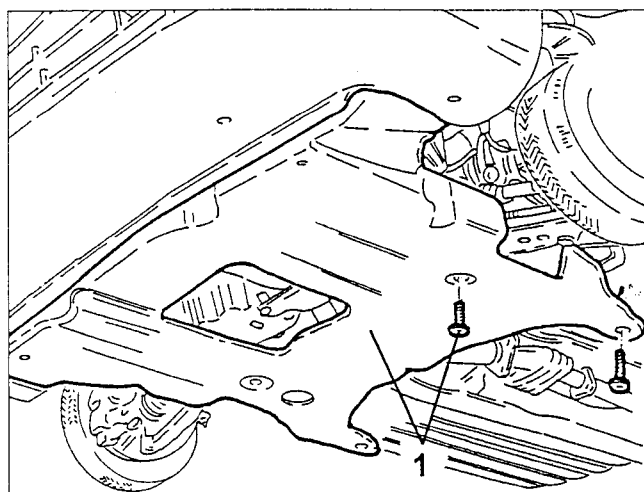
REPLACEMENT OF ENGINE OIL AND FILTER

ATTENTION: The engine oil hurts the skin. Avoid contact as much as possible. Should contact occur, wash thoroughly with soap and water.

- Place the car onto the carlift.
- 1. At warm engine, remove the refilling cap.
- 2. Pull out the level indicator of the engine oil.



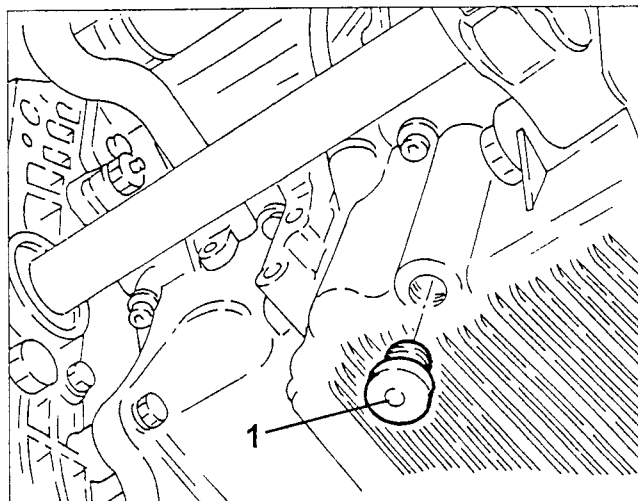
- Lift the car.
- 1. Unscrew the clamps and remove the under-engine protection.



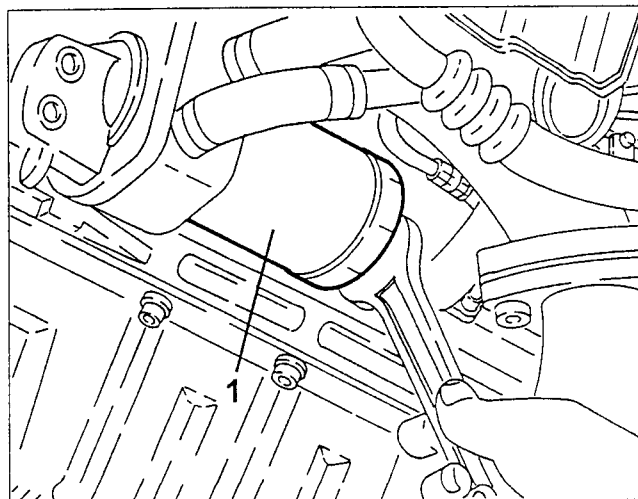
1. Unscrew the discharge cap and let the oil drain out completely into a proper container.

ATTENTION: During the removal of the discharge cap be cautious: the oil could be hot.

ATTENTION: Do not waste the oil into the environment: it causes pollution.



1. Operating from underneath the car and with the appropriate wrench, unblock the oil filter and remove it.



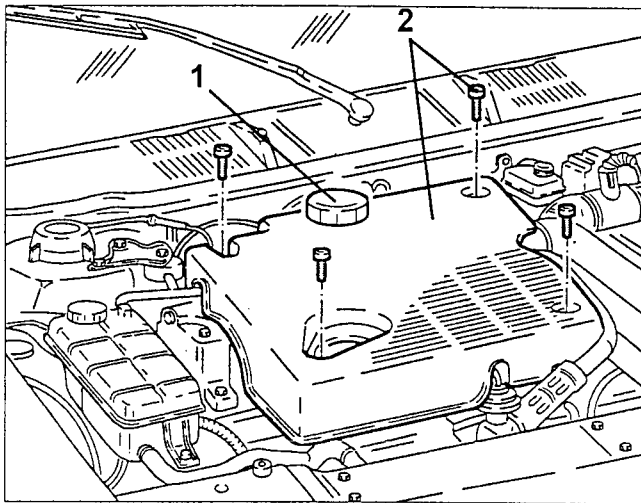
- Clean the discharge cap and screw it with its gasket according to the prescribed torque.
- Damp with the engine oil the gasket of the new filter and screw it by hand.
- Lower the car.
- Supply the engine with oil of the prescribed type and quantity.

ATTENTION: During refilling operations, be careful to avoid accidental oil leaking into the alternator's louvers; this may cause severe damage and fire danger.

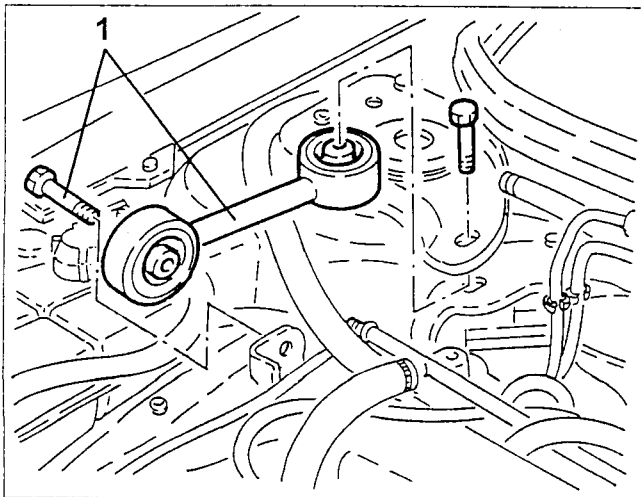
- Check the correct oil level with the oil indicator.
- NOTICE: The check of the oil level is to be performed with the car in flat position.**
- The oil level surpassing the MAX notch may cause excessive evaporation of the oil itself and hence a pressure loss.**
- Mount the refilling cap back, let the engine run for about 2 minutes, stop the engine and wait for a few minutes.
- Check the oil level and be sure there are no oil leakages.
- Mount the under-engine protection and clamp it.
- Move the car from the carlift.

REPLACEMENT OF THE TRANSMISSION CONTROL BELT

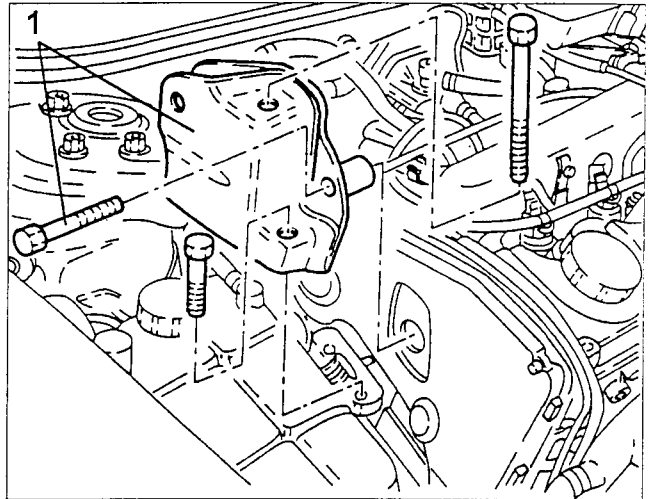
- Place the car onto the carlift.
- 1. Remove the supply cap of the engine oil.
- 2. Unscrew the clamping screws and remove the engine cover.
- Mount the supply cap of the engine oil back.



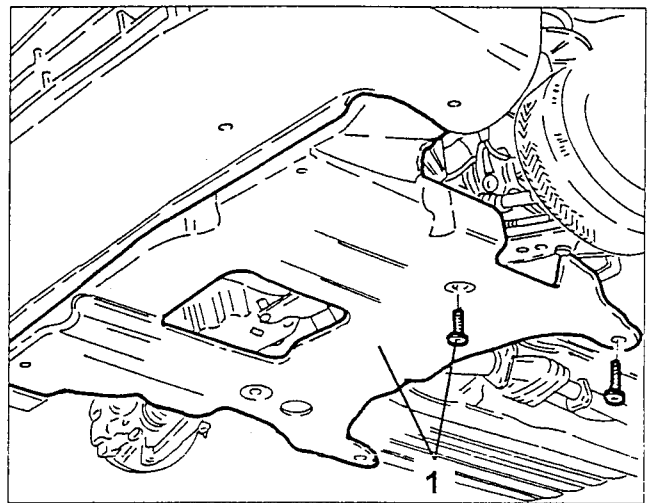
- 1. Unscrew the clamping screws and remove the reaction tightener of the motor propeller group.



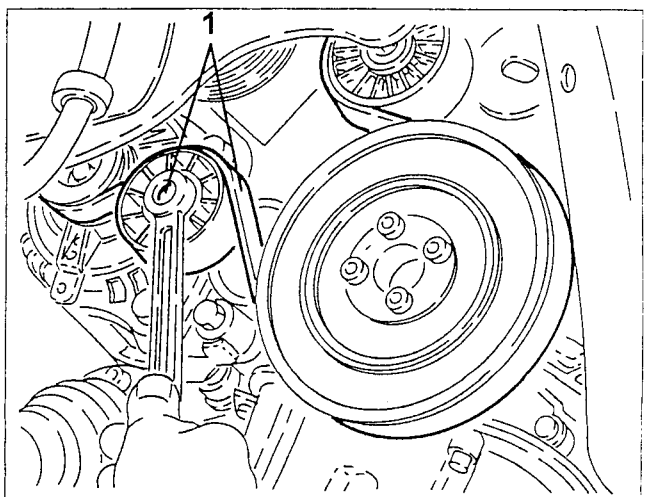
- 1. Unscrew the clamping screws and remove the bracket onto the engine's side which supports the reaction tightener.



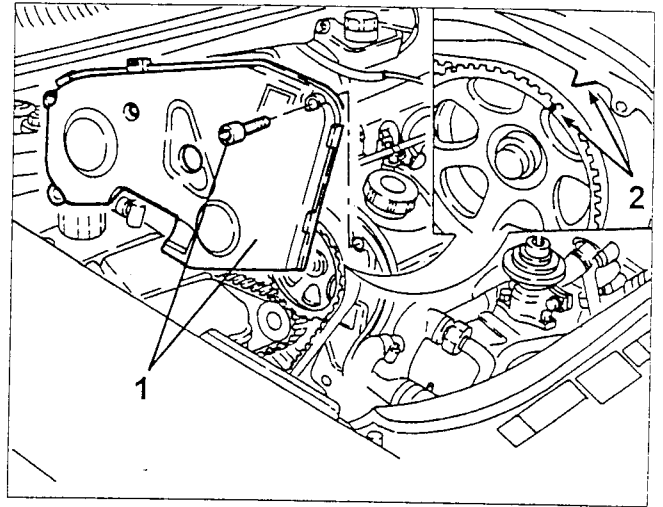
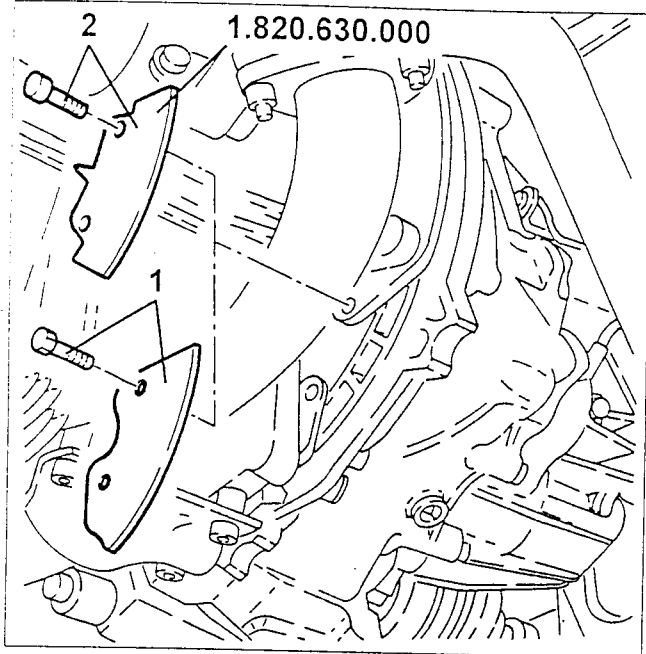
- Remove the front righthand wheel and the corresponding fender.
- 1. Unscrew the clamps and remove the under-engine protection.



- 1. By acting on the tightener as shown in the figure, loosen the tension of the engine belt and remove it.

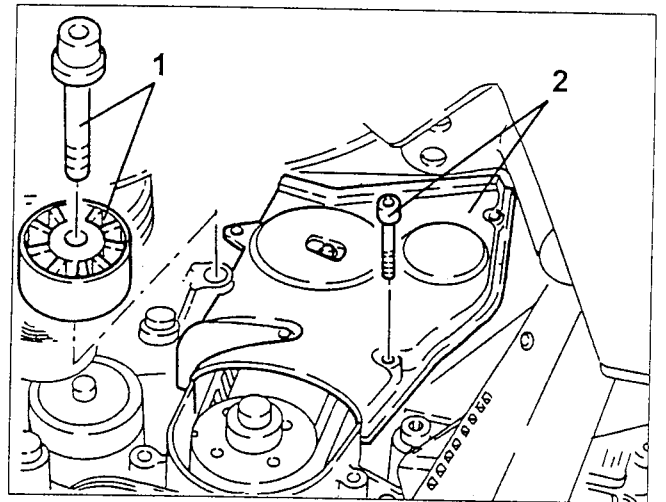
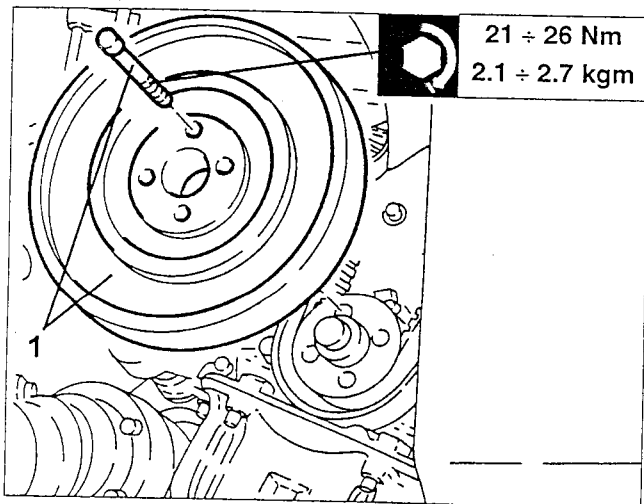


1. Unscrew the screws and remove the lower protection of the engine flywheel.
2. Mount the tool to stop the flywheel N° 1.820.630.000.

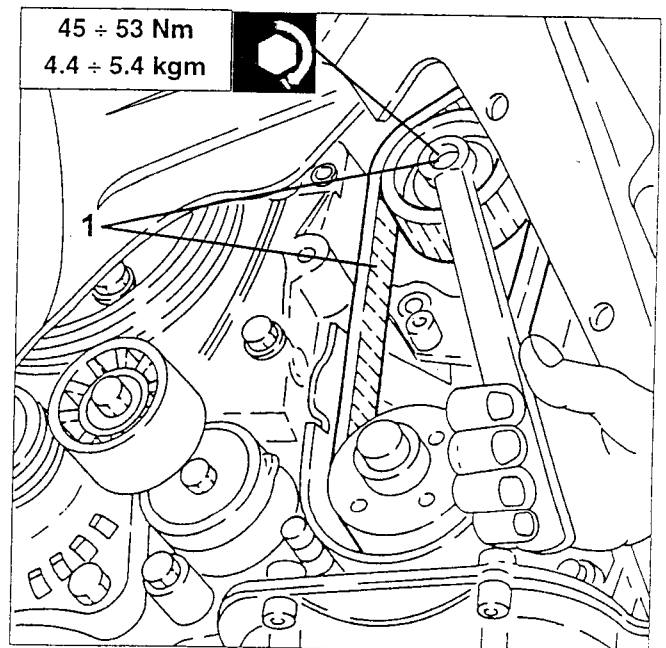


1. Unscrew the clamping screw and remove the fixed tightener of the engine belt.
2. Unscrew the clamping screws and remove the lower protection of the transmission belt.

1. Unscrew the clamping screws and remove the driving shaft pulley.

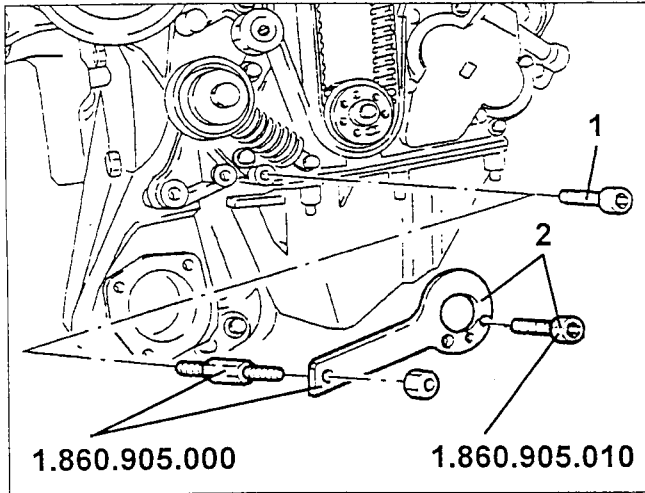


1. Loosen the clamping nut of the tightener of the transmission belt and hence remove the transmission belt itself.

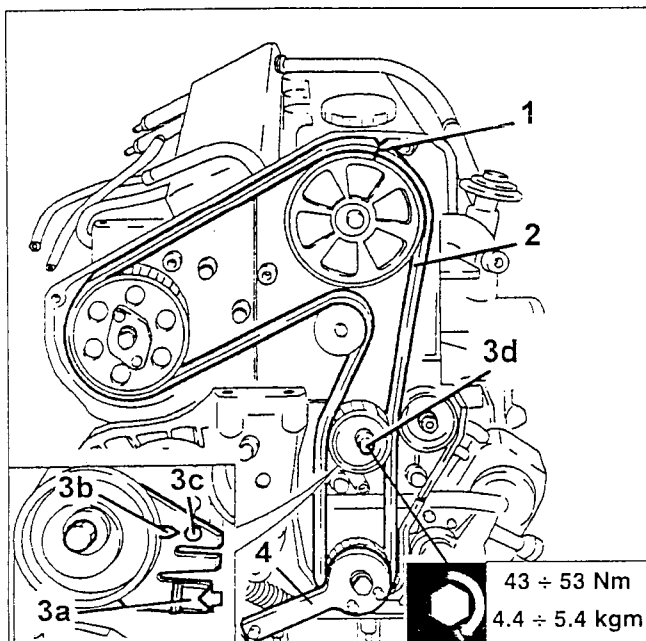


1. Unscrew the clamping screws and remove the upper protection of the transmission belt.
2. By acting onto the screw of the transmission pulley, make the driving shaft rotate till the timing references are aligned (1° cylinder at the TDC).

1. Remove the clamping screw of the front cover of the cylinder block as shown in the figure.
- Mount provisionally a new transmission belt onto the pulley.
2. Mount the tool N° 1.860.905.000 and clamp it with the calibrated screw N° 1.860.905.010.



1. Check the collimation of the timing references.
2. Insert the transmission belt completely.
3. With a screwdriver in the hole (3a) move the pointer of the tightener (3b) till to the reference hole (3c) and in this position block the nut (3d) of the tightener according to the prescribed torque.
4. Remove the tools for the engine timing.
- Tighten the screw of the cylinder block front cover which had been previously removed.

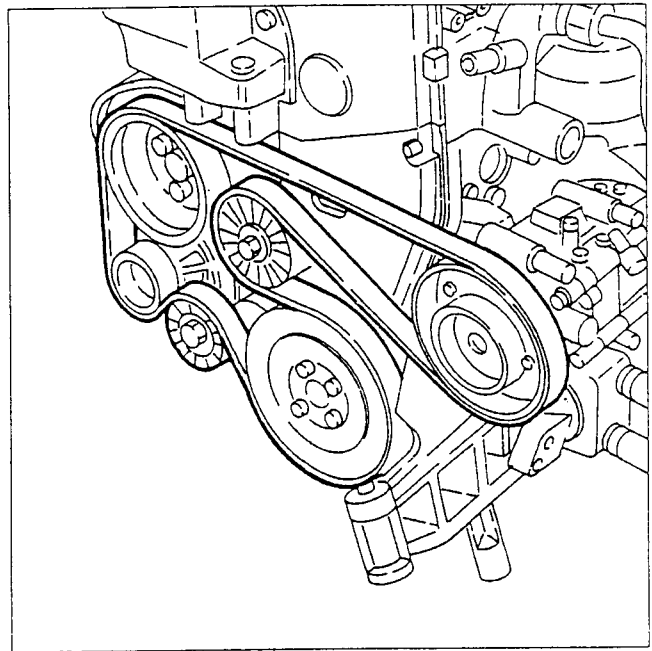


- Make the driving shaft perform two revs.
- Check again the collimation of the timing references and the tightening references onto the transmission tightener.
- Complete the reattachment by performing the reverse procedure applied for the detachment.

AUXILIARY MEMBERS' BELT

The command to the auxiliary members of the engine is transmitted through a single belt of the Poly V type.

The tightening of the above-mentioned belt occurs through an automatic tightener: therefore the tightening check is not required.

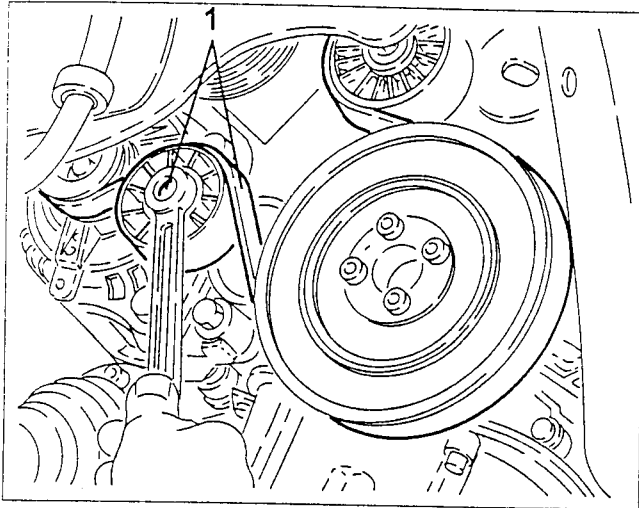


Replacement

- Place the car onto the carlift.
- Remove the front righthand wheel and corresponding fender.
- Visually check the integrity of the belt and in particular the absence of cuts, cracks, surface wear and tear of the material and of dried and stiffened parts. In case just one of the above-mentioned defects may occur, replace the belt.

ATTENTION: The contact of the belt with oil or solvents can damage the elasticity of the belt rubber and reduce its adhesion.

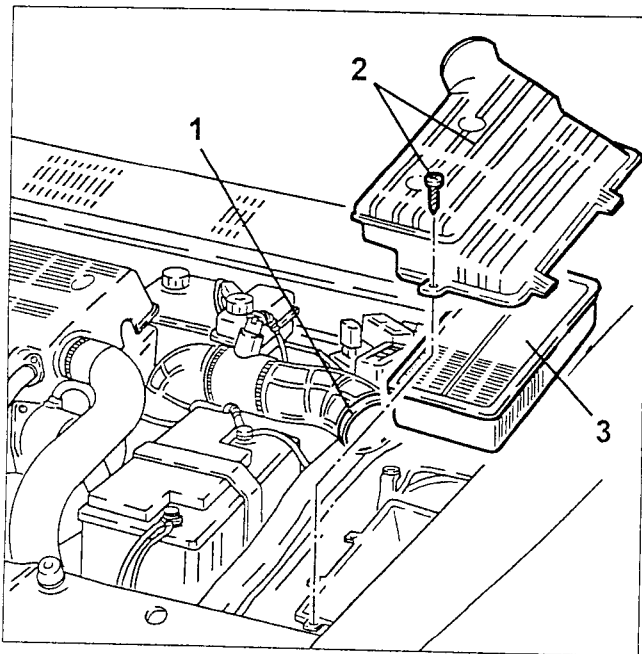
1. By acting onto the tightener as shown in the figure, loosen the tightening of the belt of the engine members and remove it.



- Mount a new belt following the reverse procedure.

REPLACEMENT OF THE AIR FILTER CARTRIDGE

1. Loosen the hose clamp of the corrugated sleeve to the air filter cover.
2. Unscrew the clamping screws and remove the air filter cover.
3. Remove the air filter cartridge.



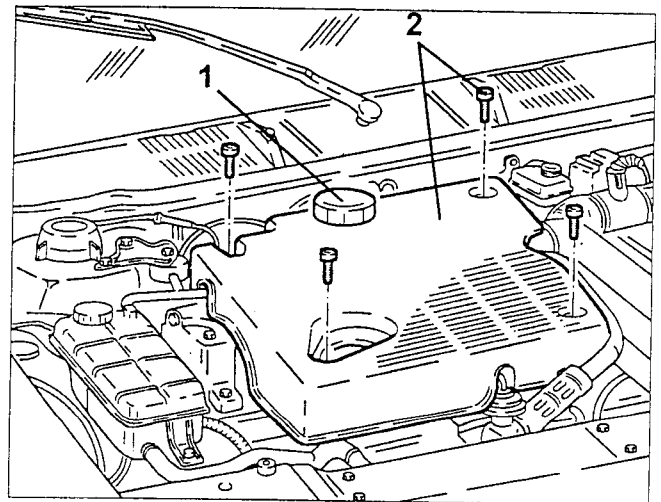
WARNING: Any cleansing operation of the filter can damage it and hurt the correct functioning of the engine feeding system.

- Clean thoroughly the container of the air filter cartridge.
- Check the conditions of the cartridge and, if necessary, replace it.
- Mount the cover of the air filter and fix it with the corresponding screws.
- Tighten the hose clamp of the corrugated sleeve to the cover of the air filter.

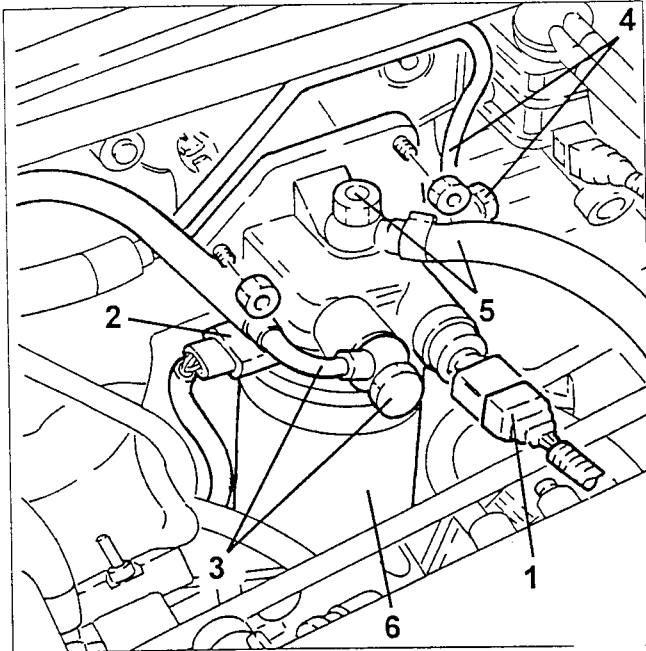
REPLACEMENT OF THE FUEL FILTER CARTRIDGE

- Be sure the key is onto the "STOP" position, hence disconnect the battery terminal (-).

1. Remove the supply cap of the engine oil.
2. Unscrew the clamping screws and remove the engine cover.



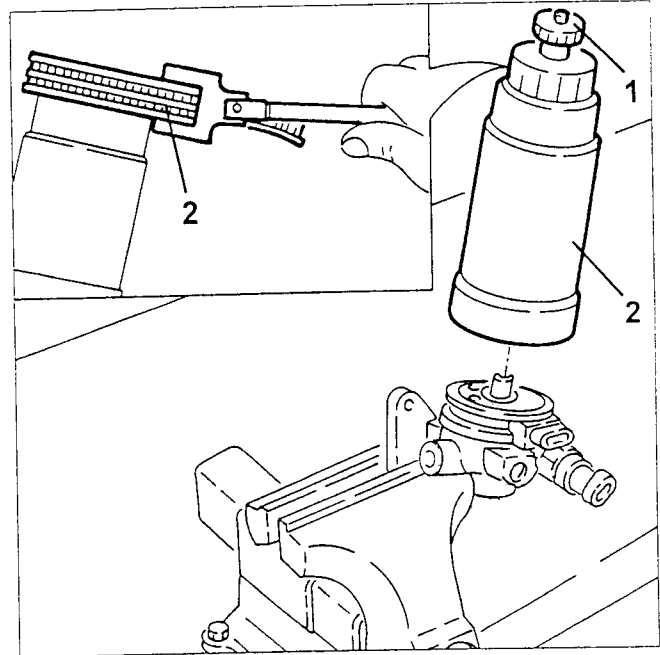
1. Disconnect the electrical connection from the thermal switch for the fuel heater.
2. Disconnect the electrical connection from the fuel pre-heating device.
3. Unscrew the pipe and disconnect the fuel pipe from the fuel filter.
4. Unscrew the pipe and disconnect the pipe to the pressure pump from the fuel filter.
5. Unscrew the pipe and disconnect the pipe to the return manifold from the fuel filter.
6. Unscrew the clamping nuts and remove the complete fuel filter.



- Place the complete fuel filter with the corresponding protection jaws.

1. Remove the water discharge cap from the fuel filter.
2. Unscrew and remove the filtering element of the fuel filter by means of the correct tool.

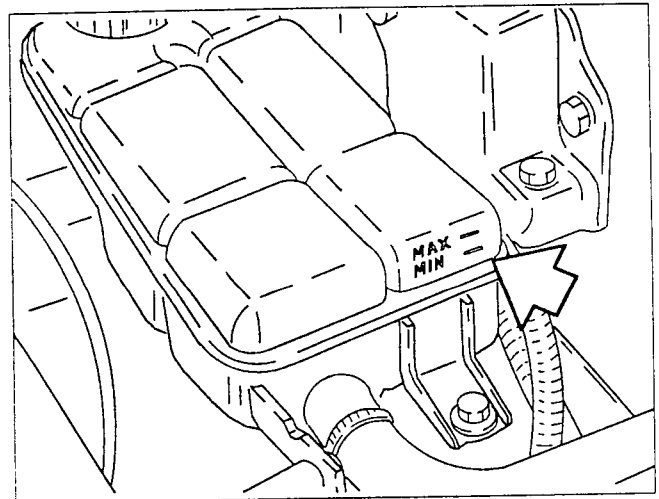
WARNING: While re-mounting, tighten the filtering element completely by hand.



LEVEL CHECKING AND REPLACEMENT OF THE ENGINE COOLING FLUID

Check

- Visually check that the level of the cooling fluid is included between the MIN and MAX values.

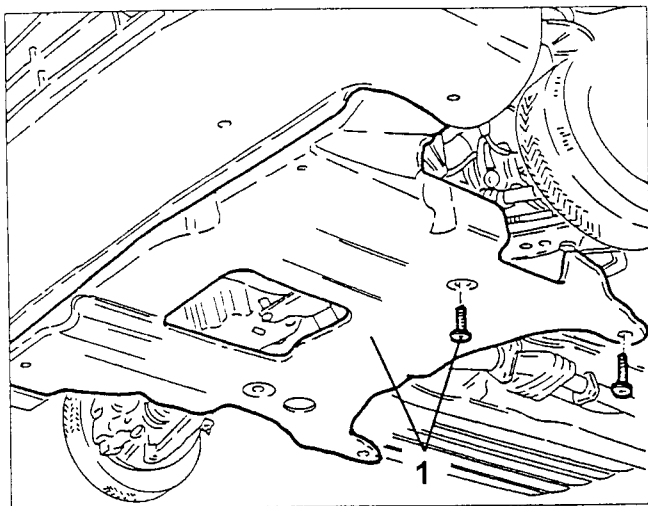


Replacement

- Place the car onto the carlift.
- Unscrew and remove the cap of the expanding tank.

ATTENTION: Do not remove the cap of the expanding tank if the engine is still warm.

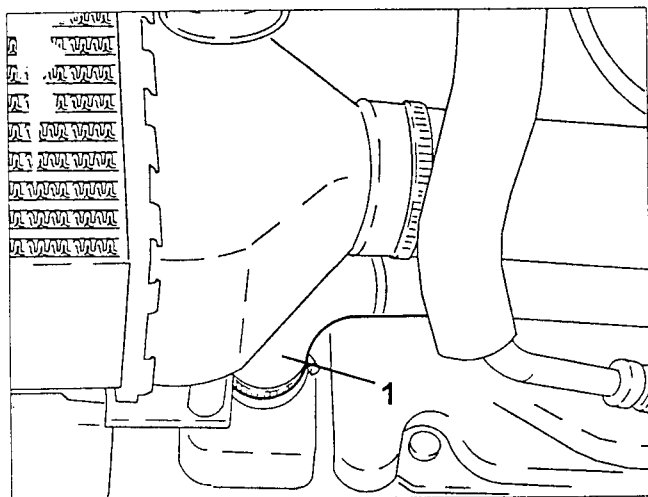
1. Unscrew the clamps and remove the under-engine protection.



1. Drain the engine cooling fluid by disconnecting the fluid outlet manifold from the radiator.

NOTICE: Collect the engine cooling fluid into a container.

WARNING: the anti-freezing mixture used as engine cooling fluid damages the paint: avoid contact with painted parts.



- Connect the manifold to the radiator back as well as all pipes disconnected; check the tightening of all hose clamps.

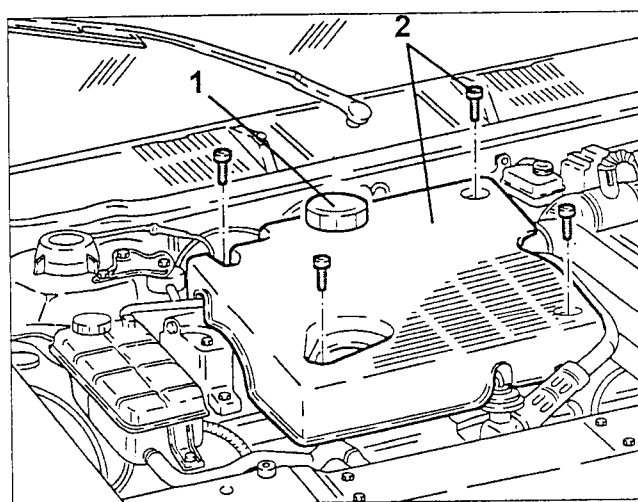
- Supply with the fluid prescribed and according to the type and quantity shown up to the MAX notch of the expanding tank.
- Start the engine and bring it to the running temperature so that the thermostat's opening may release the residual air quantity left in the circuit.
- At cold engine, refill up to the MAX notch of the expanding tank.
- Screw the cap of the pressurized expanding tank.

WARNING: Do not mix anti-freezing fluids of different kind or brand.

Do not use anti-rust additives: they may be incompatible with the anti-freeze used.

CHECK AND ADJUSTMENT OF THE VALVES' PLAY

- Place the car onto the carlift.
- Remove the front righthand wheel and the corresponding fender.
- 1. Remove the supply cap of the engine oil.
- 2. Unscrew the clamping screws and remove the engine cover.
- Mount the supply cap of the engine oil back.



1. Unscrew the clamping screws and remove the tappets' cover.

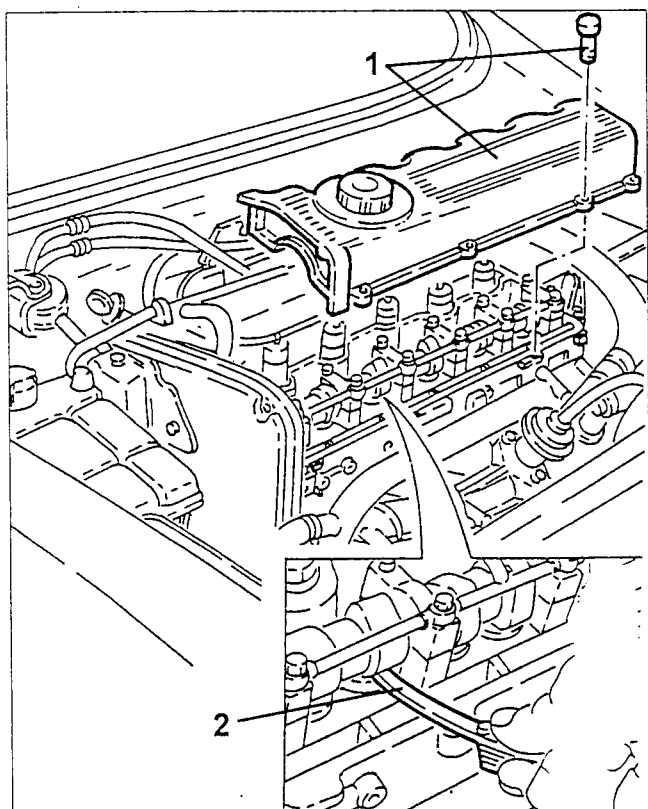
- Act onto the clamping screw of the transmission pulley with the right wrench so to close the valves.

2. At cool engine, check with a thickness gauge that the valves' play is included among the prescribed values (valves are in the closed position).

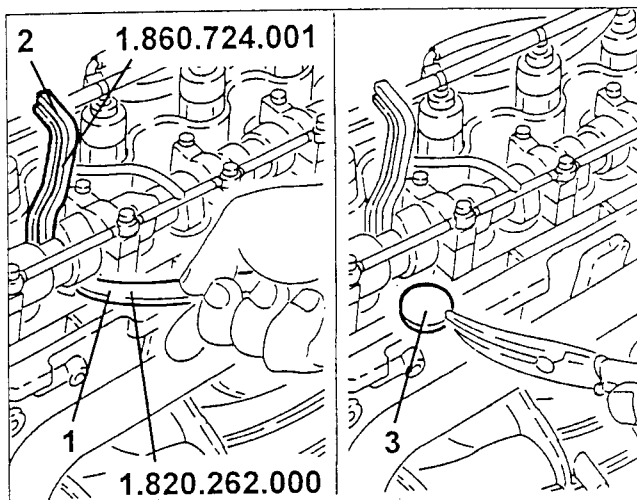


Valves' play (at cool engine)

| | |
|---------|----------------|
| Intake | 0.25 ÷ 0.35 mm |
| Exhaust | 0.30 ÷ 0.40 mm |



- Remove the tool to hold the tappet lowered.
- Repeat the same procedure as to the remaining valves.



- If the valves' play is not included, act as follows :

1. Lower the tappet concerned with the lever N° 1.820.262.000.

2. Mount the tool N° 1.860.724.001 to hold the tappet lowered, hence remove the lever.

NOTICE: Move the notches on the tappet's edge so to ease further adjustment of the plug nut to be replaced.

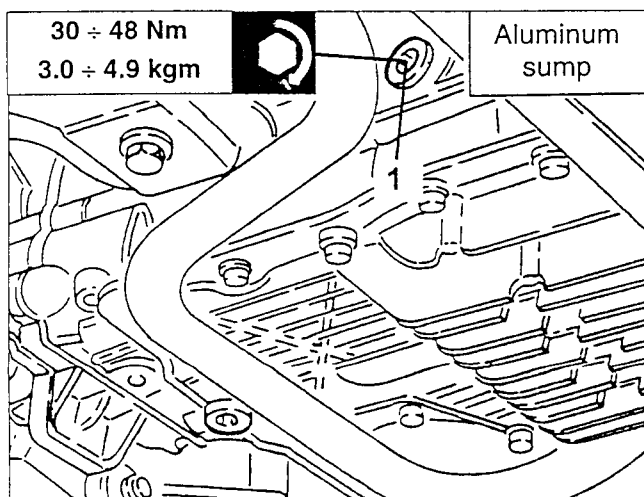
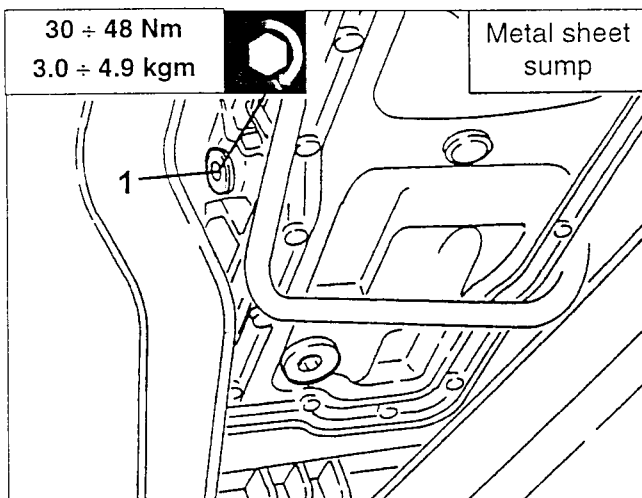
3. Remove the plug nut for the adjustment of the valves' play and replace it with a new one of the correct thickness.

MAINTENANCE OF MECHANICAL GROUPS

OIL LEVEL CHECKING AND OIL REPLACEMENT OF THE GEARBOX-DIFFERENTIAL

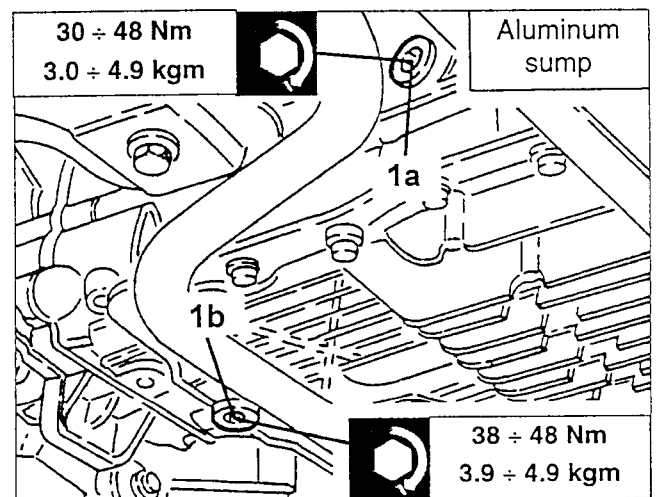
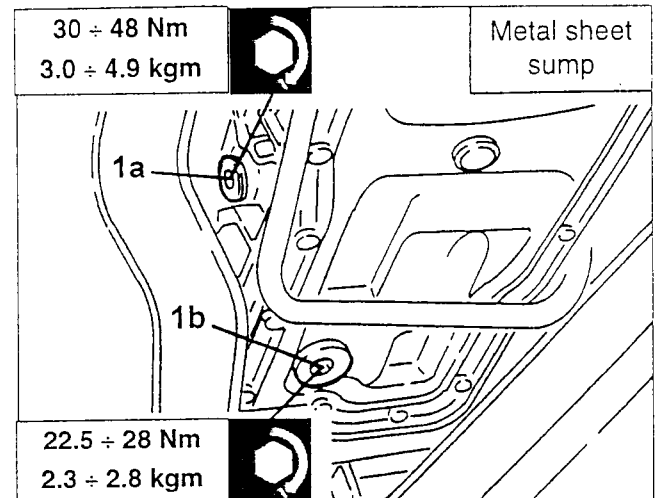
Oil level checking (Specific for Boxer engines)

- Place the car onto the carlift.
- 1. Unscrew the supply cap and check that the oil level touches the lower edge of the hole.
- If necessary, refill up to the prescribed level.
- Screw the supply cap tightening it according to the prescribed torque.



Oil replacement (Specific for Boxer engines)

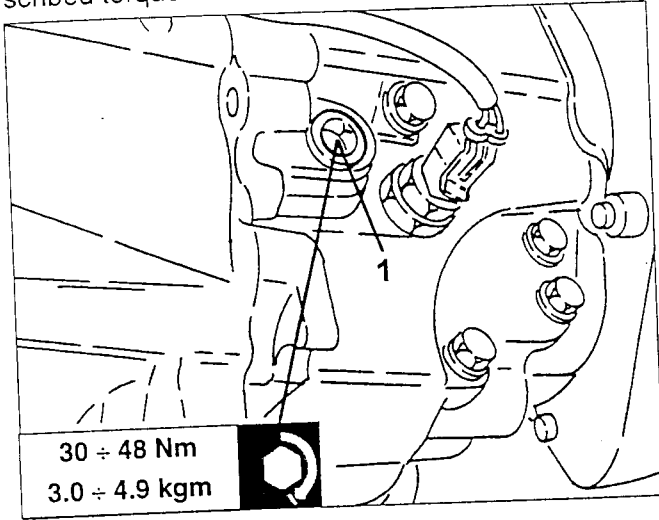
- Place the car onto the carlift.
- 1. Unscrew the supply cap (1a) and the discharge cap (1b), hence let the oil drain out completely.



- Clean the discharge cap and screw it back according to the prescribed torque.
- Introduce oil of the type and in the quantity prescribed through the filling hole.
- Check that the level touches the lower edge of the hole, hence clean the supply cap and screw it back according to the prescribed torque.

Oil level checking (Specific for 1929 Turbodiesel and T.Spark 16V engines)

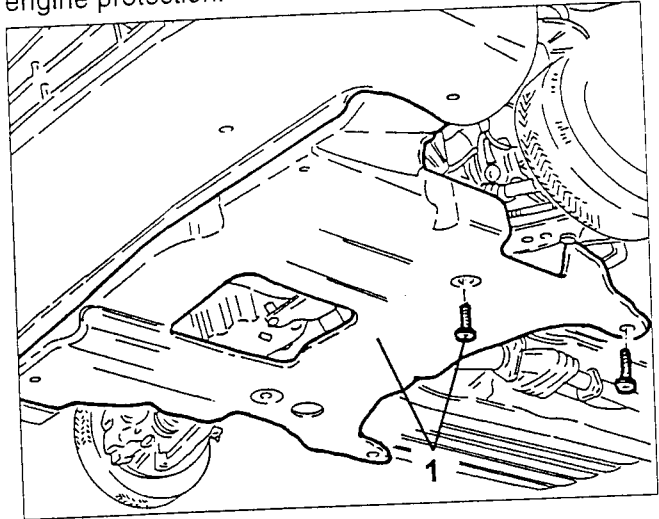
- Place the car onto the carlift.
- 1. Unscrew the supply cap and check that the oil level touches the lower edge of the hole.
- If necessary, refill up to the prescribed level.
- Screw the supply cap back according to the prescribed torque.



- Clean the discharge cap and screw it back according to the prescribed torque.
- Introduce oil of the type and the quantity prescribed through the filling hole.
- Check that the level touches the lower edge of the hole, hence clean the supply cap and screw it back according to the prescribed torque.

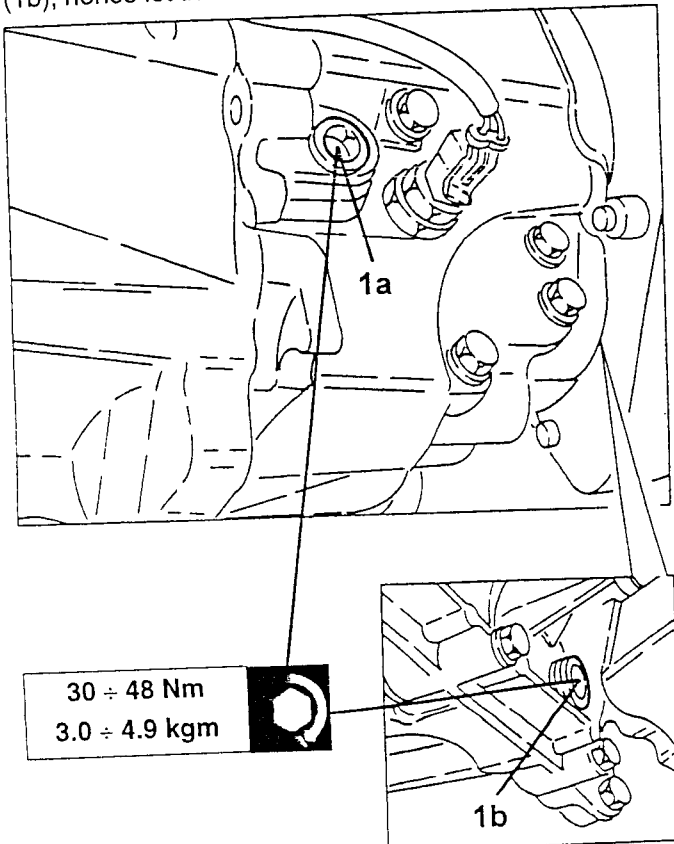
Oil level checking (Specific for 1910 JTD engine)

- Place the car onto the carlift.
- 1. Unscrew the clamps and remove the under-engine protection.

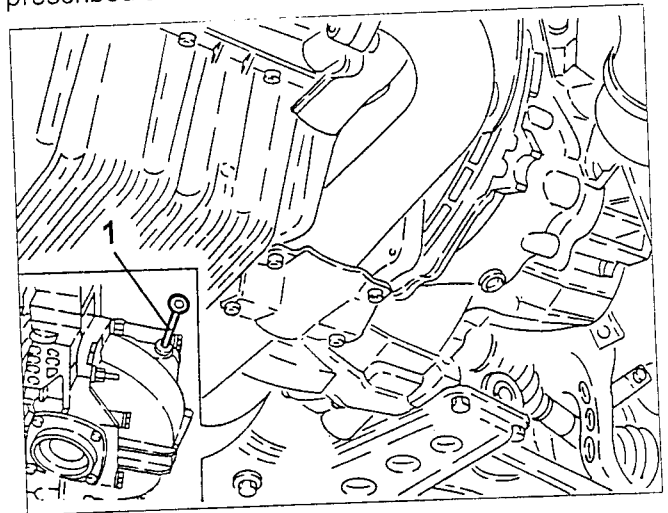


Oil replacement (Specific for 1929 Turbodiesel and T. Spark 16V engines)

- Place the car onto the carlift.
- 1. Unscrew the supply cap (1a) and the discharge cap (1b), hence let the oil drain out completely.



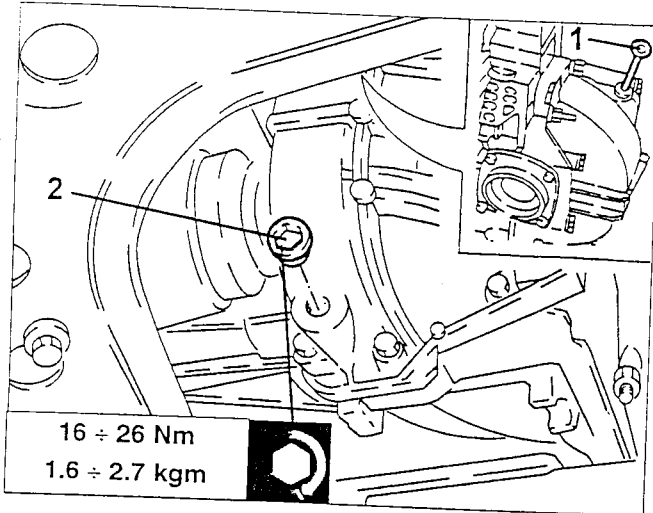
1. With the appropriate stem, check that the oil level of the mechanical gearbox with differential matches with the reference value on the stem itself.
- If necessary, refill the oil level by introducing the prescribed oil.



- Check the oil level again, hence insert the checking stem.
- Mount the under-engine protection and clamp it.
- Remove the oil from the carlift.

Oil replacement (Specific for 1910 JTD engines)

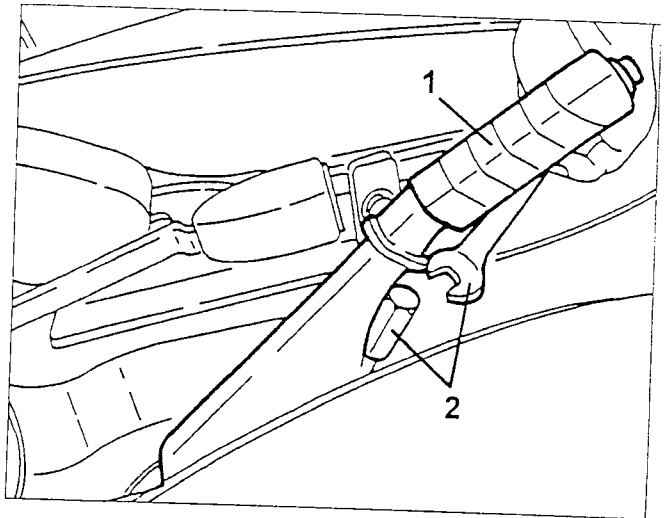
- Place the car onto the carlift.
- Unscrew the clamps and remove the under-engine protection.
- 1. Remove the oil checking stem.
- 2. Unscrew the discharge cap, hence let the oil drain out completely.



- Clean the discharge cap and crew it back according to the prescribed torque.
- Supply with oil of the type and in the quantity prescribed.
- Check with the stem that the oil level of the mechanical gearbox with differential matches with the reference values shown on the stem.
- Insert the checking stem back.
- Mount the under-engine protection and clamp it.
- Remove the car from the carlift.

CHECKING OF THE PARKING BRAKE STROKE

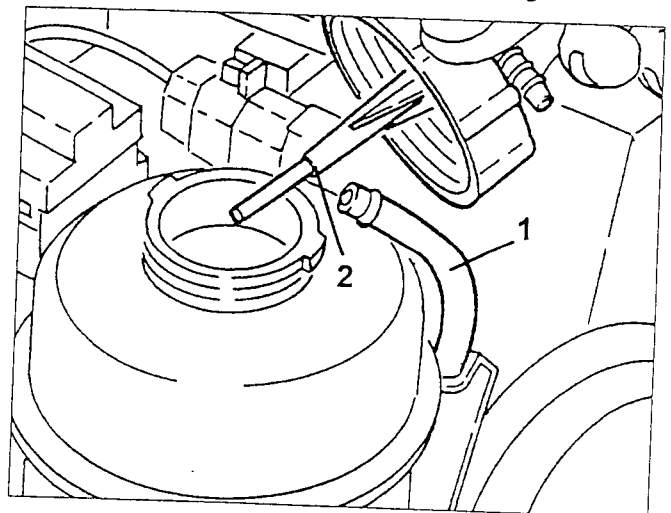
1. Shift the control lever onto the third/fourth release of the the toothed sector and holding the lever in this position, check if the wheels are blocked.
 2. In case they are not, screw the adjustment nut till the rear wheels are blocked.
- By acting onto the control lever with a force of about 27 Kg, check that the number of releases onto the toothed sector is equal to 3.
 - Check that the wheels are loosened if the lever is not inserted.



CHECKING OF THE OIL LEVEL OF THEHYDRAULIC TORQUE CONVERTER (Specific for Boxer engines)

ATTENTION: The oil level checking is to be performed with the car in flat position.

- With the engine off, clean the cover of the hydro-drive tank and the surrounding area.
- 1. Disconnect the breather pipe from the tank cover.
- 2. Remove the cover and check that the level matches the upper notch on the checking stem.

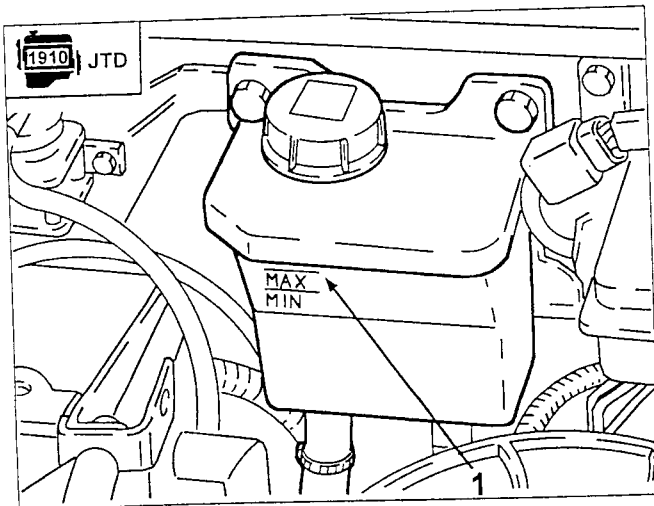
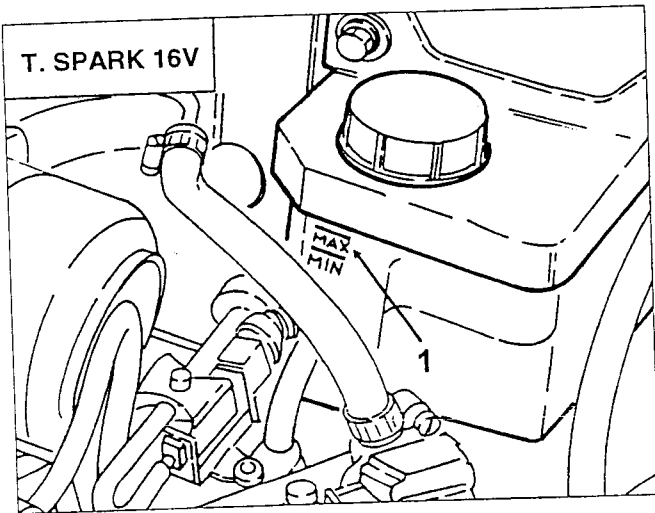
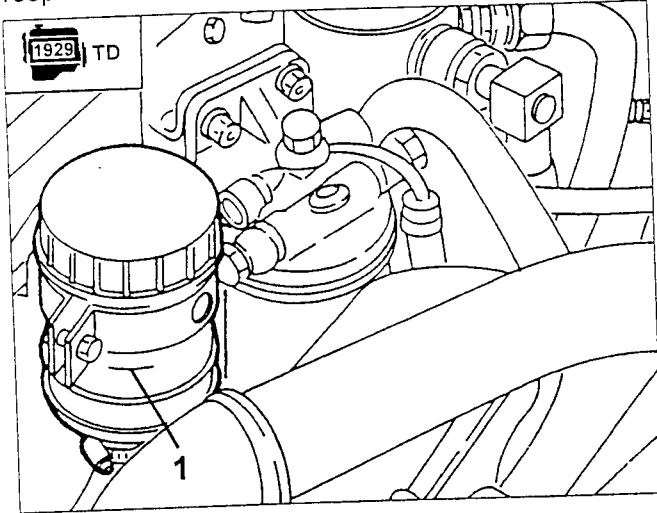


- If necessary, refill with the prescribed oil and as follows:

- Start the engine and wait for the oil level to stabilise.
- With running engine, rotate the steering wheel more times and completely.
- Refill till the level corresponds to the MAX level, hence screw the cover back and insert the breather pipe.

CHECKING OF THE OIL LEVEL OF THE HYDRAULIC TORQUE CONVERTER (Specific for Turbodiesel and T. Spark 16V engines)

1. With the engine off, check that the oil level corresponds to the MAX notch shown onto the tank.



- If necessary, refill with the prescribed oil and as follows:

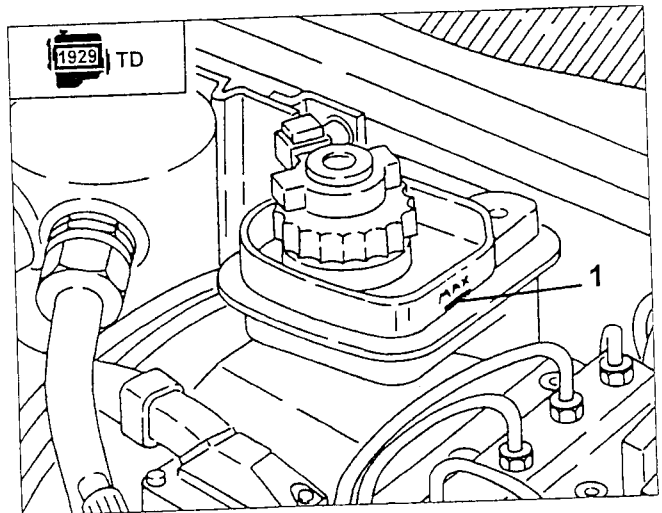
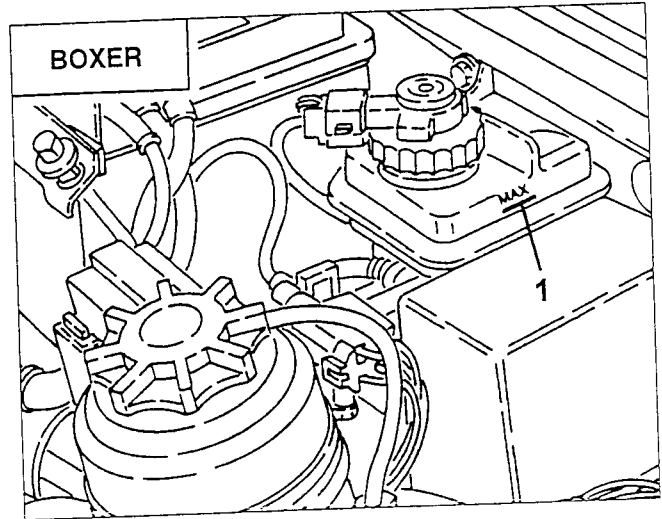
- Start the engine and wait for the oil level to stabilise.
- With running engine, rotate the steering wheel more times and completely.
- Refill till the level corresponds to the MAX level, hence screw the cover back.

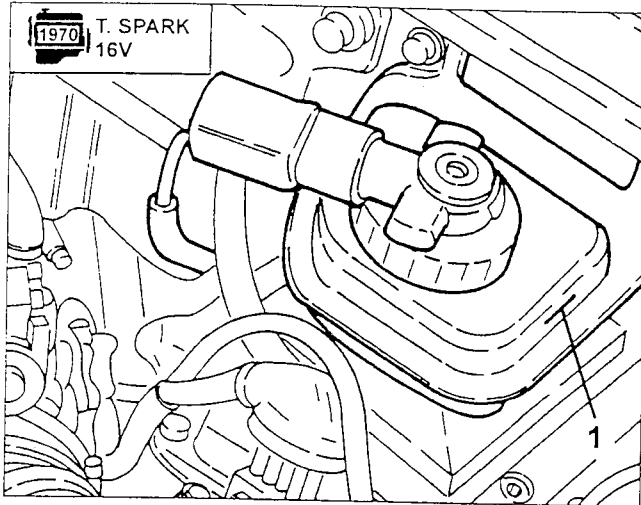
CHECKING OF THE LEVEL AND REPLACEMENT OF THE BRAKES-CLUTCH FLUID

Oil level checking

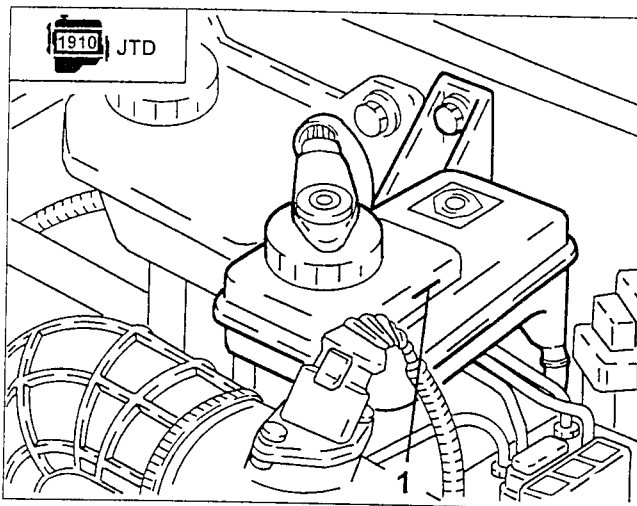
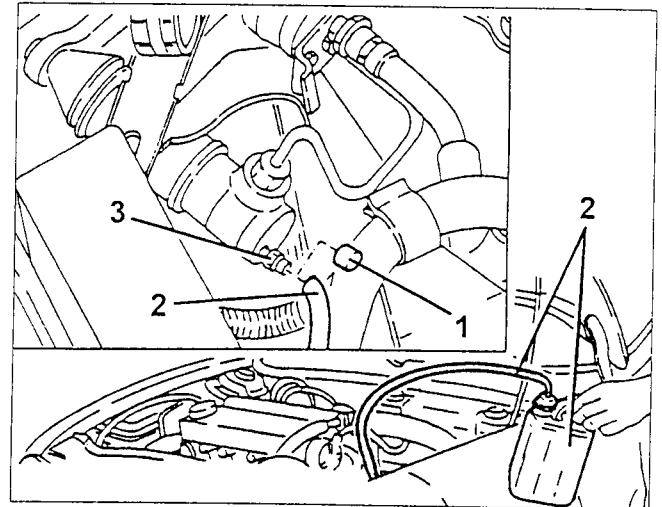
ATTENTION: The checking is to be performed with the car in flat position.

1. Check that the oil level in the tank corresponds to the MAX reference notch shown on the tank.





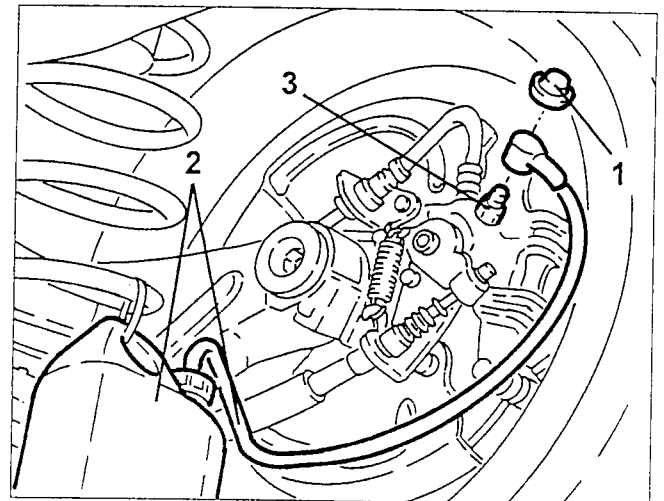
3. Open the drain valve onto the cylinder.
- Press the clutch pedal till to empty the circuit completely.



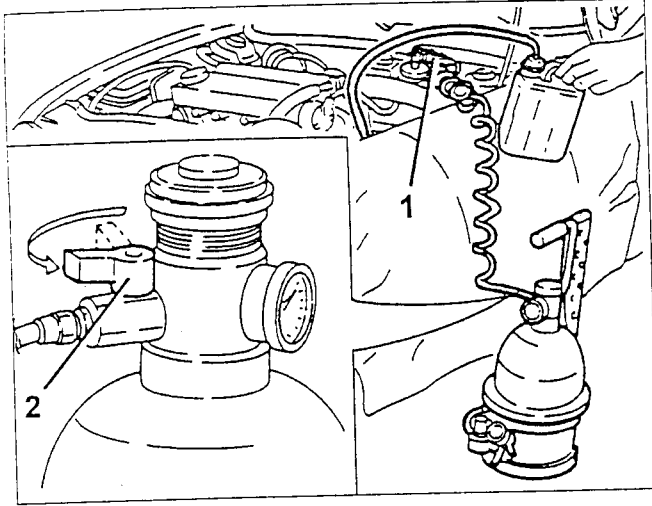
1. Remove the protection cover from the drain valve on the caliper.
2. Connect the recovery device (pipe and tank), to the drain valve on the caliper.
3. Open the drain valve onto the caliper
- Press the brake pedal till to discharge the whole fluid.
- Repeat the procedure for the remaining calipers.

Oil replacement

- Place the car onto the carlift.
 - Remove the battery (see GROUP 55).
 - Remove the battery basket (see GROUP 55).
 - Suck the brakes-clutch fluid from the tank by means of a syringe.
1. Remove the protection cap from the drain valve on the cylinder.
 2. Connect the recovery device (pipe and tank) to the drain valve onto the cylinder.



1. Connect the equipment to the tank of the brakes-clutch fluid.
2. Slowly open the tank tap and supply the brakes-clutch with the fluid prescribed.



- Wait till the air contained in the hydraulic systems of brakes-clutch goes out completely.
- Close the drain valves and mount the corresponding protection caps.
- Remove the devices for fluid recovery.
- Remove the equipment.
- Mount the battery basket (see GROUP 55).
- Mount the battery (see GROUP 55).
- Remove the car from the carlift.

IDENTIFICATION OF CAR VERSIONS

| Commercial name | 146 1.3/1.4 | 146 1.6 | 146 1.7 16V | 146 TD | 146 JTD |
|--|------------------------|---|------------------------|------------------------|----------|
| Equipment | 5-door saloon | | | | |
| Version (on identification plate) | 930 B3 | 930 B2 930 B2A <input type="checkbox"/> | 930 B1 | 930 B4 930 B4A ▲ | 930 B4B |
| Chassis (in the engine compartment, aside the upper connection of right shock absorber) | 930000 | 930000 | 930000 | 930000 | 930000 |
| Chassis ' number | 2.001.001 4.001.001 | 2.001.001 4.001.001 | 2.001.001 4.001.001 | 2.001.001 4.001.001 | - |
| Engine (code) | AR 33501 | AR 33201 | AR 33401 | AR 67501 AR 33601 ▲ | AR 32302 |
| Engine's symbol | | | 16V | TD | JTD |
| Gearbox (code) | C.802.5.16.00 | C.802.5.16.02 C.802.5.16.03 <input type="checkbox"/> | C.802.5.18.00 | C.510.5.17.63 | C.530.5 |

(): Only for certain markets

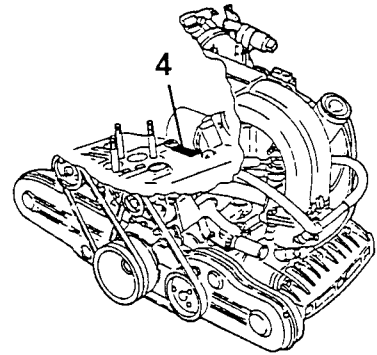
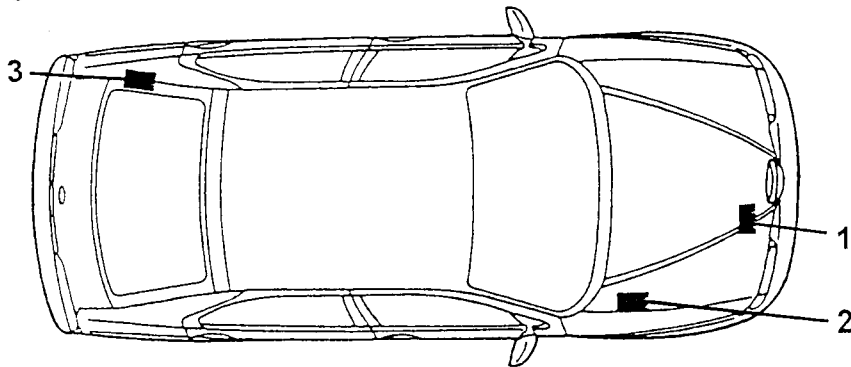
(▲): Version with catalyst, only for certain markets.

| Commercial Name | 146 2.0 <i>ti</i> | 146 1.4 T. Spark | 146 1.6 T. Spark | 146 1.8 T. Spark |
|--|--------------------------|------------------------------------|--|----------------------|
| Equipment | 5-door saloon | | | |
| Version (on identification plate) | 930 B5 | 930 B3A | 930 B2B 930 B2C <input type="checkbox"/> | 930 B1A |
| Chassis (in the engine compartment, aside the upper attachment of the right shock absorber) | 930000 | 930000 | 930000 | 930000 |
| Chassis Number | 2.001.001 4.001.001 | - | - | - |
| Engine (code) | AR 67204 AR 32301 | AR 33503 | AR 67601 | AR 67106 AR 32201 |
| Engine symbol | T. SPARK 16V | T. SPARK 16V | T. SPARK 16V | T. SPARK 16V |
| Gearbox (code) | C.510.5.21.13 C.510.5 | C.510.5.18.03 C.513.5.14.02 (1) | C.510.5.18 C.510.5.17.96 <input type="checkbox"/> | C.510.5.17.93 |

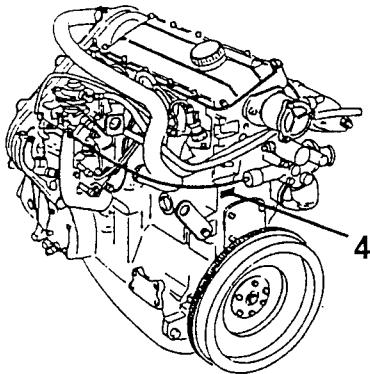
(): Only for certain markets

(1): Starting from the chassis n°

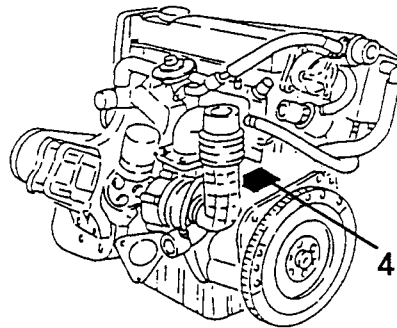
POSITIONING OF THE ID PLATES



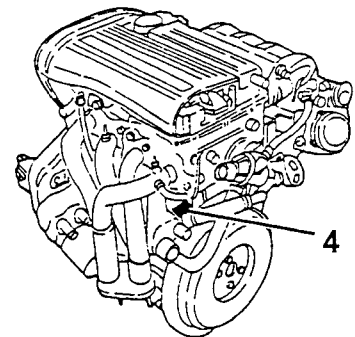
Boxer engines



1929 TD engine



1910 JTD engine

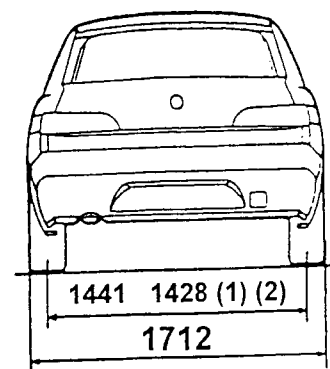
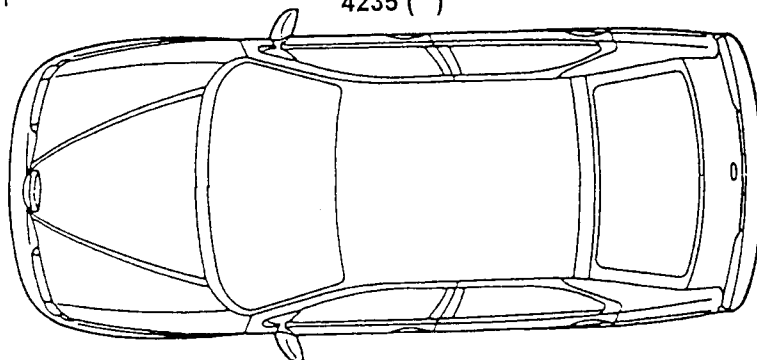
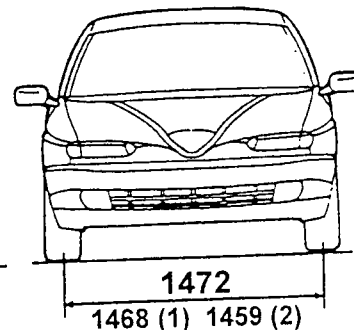
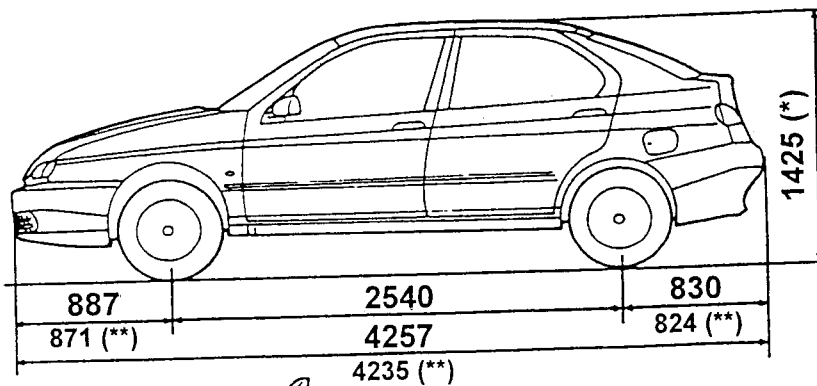


T. Spark 16V engines

- 1. ID plate
- 2. Bodywork punching

- 3. ID Plate of bodywork paint
- 4. Engine punching

DIMENSIONS



(*): Unloaded car (**) : For 99s models
PA49300000011

(1): For 1.8 T. Spark and 20 ti versions (2): For sporting equipment

WEIGHTS AND LOADS

Unit: kg

| Features | | Versions | 930 B3 | 930 B2 930 B2A | 930 B1 | 930 B4 930 B4A | 930 B4B |
|---------------------------------|-------------------------|--|--------|-------------------|--------|-------------------|----------|
| | | Weight in running order (without driver) | | | 1175 | 1175 | 1225 |
| Maximum weight allowed | | | 1705 | 1705 | 1745 | 1765 | 1765 |
| Payload | | | 530 | 530 | 520 | 520 | 520 |
| Maximum weight allowed per axle | front | | 930 | 930 | 930 | 930 | 930 |
| | rear | | 870 | 870 | 870 | 870 | 870 |
| Towable weight | with braked trailer | | 1100 | 1100 | 1200 | 1300 | 1300 (*) |
| | With non-braked trailer | | 350 | 350 | 350 | 350 | 350 |
| Maximum load onto the ball | | | 50 | 50 | 50 | 50 | 50 |

(*): Homologated for Switzerland only.

| Features | | Versions | 930 B5 | 930 B3A | 930 B2B 930 B2C | 930 B1A |
|---------------------------------|-------------------------|--|------------------|-----------------|--------------------|-----------------|
| | | weight in running order (without driver) | | | 1275 | 1160 |
| Maximum weight allowed | | | 1800 | 1680 | 1710 | 1735 |
| Payload | | | 525 | 520 | 520 | 520 |
| Maximum weight allowed per axle | front | | 950 | 950 | 950 | 950 |
| | rear | | 900 | 900 | 900 | 900 |
| Towable weight | with braked trailer | | 1200 1200 (*) | 1100 800 (*) | 1200 900 (*) | 1200 900 (*) |
| | with non-braked trailer | | 350 | 350 | 350 | 350 |
| Maximum load onto the ball | | | 50 | 50 | 50 | 50 |

(*): Homologated for Switzerland only.

WHEELS AND TYRES

| CAR | DIMENSIONS Rims Tyres | | PRESSURES (bar) | | | |
|-------------------|-----------------------------|--|----------------------------|------|-----------|------|
| | | | REDUCED LOAD (2 people) | | FULL LOAD | |
| | | | FRONT | REAR | FRONT | REAR |
| 930 B3 | Standard equipment | 5.5J x 14" 175/65 R14" 82T | 2.2 | 2 | 2.5 | 2.5 |
| | Optional equipment | 5.5J x 14" 185/60 R14" 82H | | | | |
| 930 B2 | Standard equipment | 5.5J x 14" 175/65 R14" 82T | 2.2 | 2 | 2.5 | 2.5 |
| | Optional equipment | 5.5J x 14" 185/60 R14" 82H (*) | | | | |
| 930 B2A | Standard equipment | 5.5J x 14" 185/65 R14" 86T | 2.2 | 2 | 2.5 | 2.5 |
| 930 B1 | Standard equipment | 5.5J x 14" 185/60 R14" 82H | 2.2 | 2 | 2.5 | 2.5 |
| 930 B4 930 B4A | Standard equipment | 5.5J x 14" 175/65 R14" 82T | 2.2 | 2.1 | 2.5 | 2.5 |
| | Optional equipment | 5.5J x 14" 185/60 R14" 82H | | | | |
| 930 B4B | Standard equipment | 5.5J x 14" 6J x 15" (▲) 185/60 R14" 82H 195/55 R15" 84V (▲) | 2.2 | 2.0 | 2.5 | 2.5 |
| 930 B5 | Standard equipment | 6J x 15" 195/55 R15" 84V | 2.3 | 2.1 | 2.5 | 2.5 |
| 930 B3A | Standard equipment | 5.5J x 14" 185/60 R14" 82H | 2.2 | 2 | 2.5 | 2.5 |
| | | 6J x 15" 195/50 R15" 82V 195/55 R15" 84V (▲) | | | | |
| 930 B2B | Standard equipment | 5.5J x 14" 185/60 R14" 82H | 2.2 | 2 | 2.5 | 2.5 |
| 930 B2C | | 6J x 15" 195/55 R15" 84V (▲) | | | | |
| 930 B1A | Standard equipment | 6J x 15" 195/55 R15" 84V | 2.2 | 2 | 2.5 | 2.5 |
| ALL | SPARE SMALL WHEEL | | 4.2 | | | |
| | 4J x 15" (in steel) | - | | | | |
| | 4.00B x 15" (in alloy) | 115/70 R15" 90M | | | | |

(*) : Standard equipment for certain markets

(▲) : For sporting equipment (for versions/markets if envisaged)

WARNING: In case of continuous running at high speed, pressures are to be increased by 0.3 bar.

SUPPLY QUANTITIES

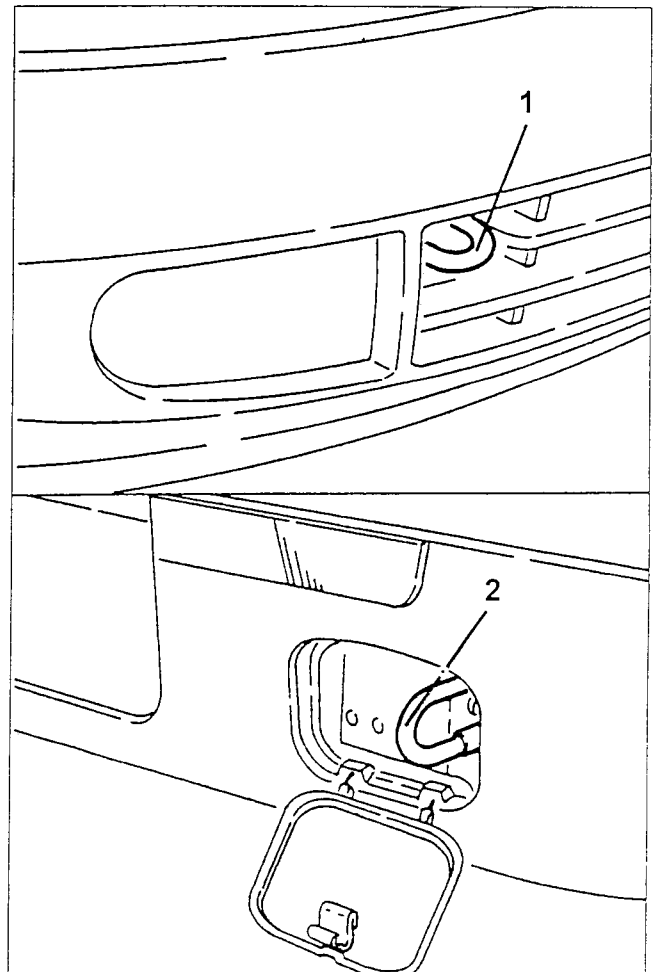
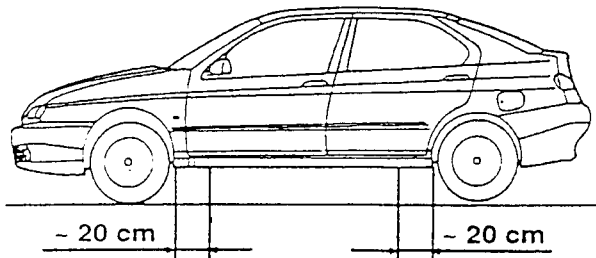
| Supply Quantity | | Versions | | | | | | |
|--------------------------------|---|--------------------------|-------------------|-----------------------------|-------------------|--------------------------|------------|--|
| | | 930 B3 | 930 B2 930 B2A | 930 B1 | 930 B4 930 B4A | 930 B4B | 930 B5 | 930 B3A 930 B2B 930 B2C 930 B1A |
| Fuel tank | | 51 liters | | | 51/61 liters (*) | | | |
| Fuel stock | | 5 ÷ 8 liters | | | | | | |
| Engine oil | Total capacity: pan + filter + sumps + radiator | 4.7 liters | 5.2 liters | 6 liters | (**) | 5.0 liters | | |
| | Pan + filter (for periodic replacement) | 4 liters | 4.5 liters | 5 liters | 4.2 liters | 4.4 liters | | |
| Gearbox-differential oil | | 2.4 liters | | 2 liters | | 2 liters | | |
| Hydraulic torque converter oil | | 1.1 liters | | | 900 gr | | 1.3 liters | |
| Brakes/clutch oil | | 0.4 kg | | 0.5 kg | 0.4 kg (▲) | 0.5 kg | | |
| Engine cooling fluid | | 7.8 liters | | 8.9 liters | 6.1 liters | 8.3 liters | 8.4 liters | |
| Conditioning compressor oil | | 240 ± 15 cm ³ | | 236 ± 15 cm ³ | 130 g | 150 ± 20 cm ³ | | |
| Conditioning system fluid | | 0.700 kg | | | (**) | | 0.700 kg | |

(*): For versions /Markets
(▲): With A.B.S. = 0.54 kg

(**): Data which are not available while printing

CAR'S LIFTING POINTS

Either with a bridge or with a carlift.
- The car is to be lifted as shown.



1. Front pintle

2. Rear pintle

CAR'S TOWING POINTS

The car is equipped with two rings, one on the front and one on the back, located on the righthand side of the bumper.

the rear ring is covered by a door that can be opened by pressing on its edge.

Comply with the law provisions disciplining towing operations.

Before towing, the key is to be turned onto MAR position and hence turned back onto STOP position without taking it out; in this way the steering blocking is avoided.

It is necessary to remember that, in case of towing, there is no depression in the servo brake and it is therefore necessary to press the brake pedal more strongly.

GEARBOX

RATIOS (Specific for Boxer and Turbodiesel engines)

| | Gearbox | Ratio | Inserted gearshift | Gearbox ratio | Total ratio |
|----------------------|---------|--------------------|--------------------|---------------|-------------|
| 930 B3 (before mod.) | C.802.5 | 9/37 1 : 4.111 | 1^ | 1 : 3.545 | 1 : 14.576 |
| 930 B2 (before mod.) | | | 2^ | 1 : 2.050 | 1 : 8.428 |
| | | | 3^ | 1 : 1.323 | 1 : 5.437 |
| 930 B1 (before mod.) | | | 4^ | 1 : 1.027 | 1 : 4.222 |
| | | | 5^ | 1 : 0.854 | 1 : 3.509 |
| | | | RM | 1 : 3.091 | 1 : 12.707 |
| 930 B3 (after mod.) | C.802.5 | 10/43 1 : 4.3 | 1^ | 1 : 3.545 | 1 : 15.246 |
| | | | 2^ | 1 : 2.050 | 1 : 8.815 |
| | | | 3^ | 1 : 1.323 | 1 : 5.687 |
| | | | 4^ | 1 : 1.027 | 1 : 4.416 |
| | | | 5^ | 1 : 0.854 | 1 : 3.671 |
| | | | RM | 1 : 3.091 | 1 : 13.291 |
| 930 B2 (after mod.) | C.802.5 | 11/45 1 : 4.091 | 1^ | 1 : 3.545 | 1 : 14.503 |
| 930 B1 (after mod.) | | | 2^ | 1 : 2.050 | 1 : 8.387 |
| | | | 3^ | 1 : 1.323 | 1 : 5.412 |
| | | | 4^ | 1 : 1.027 | 1 : 4.201 |
| | | | 5^ | 1 : 0.854 | 1 : 3.494 |
| | | | RM | 1 : 3.091 | 1 : 12.645 |
| 930 B2A | C.802.5 | 9/35 1 : 3.888 | 1^ | 1 : 3.545 | 1 : 13.782 |
| | | | 2^ | 1 : 2.050 | 1 : 7.970 |
| | | | 3^ | 1 : 1.323 | 1 : 5.143 |
| | | | 4^ | 1 : 1.027 | 1 : 3.992 |
| | | | 5^ | 1 : 0.854 | 1 : 3.320 |
| | | | RM | 1 : 3.091 | 1 : 12.017 |
| 930 B4 | C.510.5 | 18/57 1 : 3.166 | 1^ | 1 : 3.909 | 1 : 12.376 |
| 930 B4A | | | 2^ | 1 : 2.238 | 1 : 7.085 |
| | | | 3^ | 1 : 1.440 | 1 : 4.559 |
| | | | 4^ | 1 : 1.029 | 1 : 3.258 |
| | | | 5^ | 1 : 0.794 | 1 : 2.514 |
| | | | RM | 1 : 3.909 | 1 : 12.376 |

RATIOS (Specific for T. Spark engines)

| | Gearbox | Ratio | Inserted Gearshift | Gearbox ratio | Total ratio |
|---------|---------|--------------------|----------------------------------|--|--|
| 930 B5 | C.510.5 | 17/57 1 : 3.353 | 1^ 2^ 3^ 4^ 5^ RM | 1 : 3.545 1 : 2.238 1 : 1.520 1 : 1.156 1 : 0.946 1 : 3.909 | 1 : 11.886 1 : 7.504 1 : 5.096 1 : 3.876 1 : 3.172 1 : 13.107 |
| 930 B3A | C.510.5 | 15/58 1 : 3.866 | 1^ 2^ 3^ 4^ 5^ RM | 1 : 3.909 1 : 2.238 1 : 1.520 1 : 1.156 1 : 0.919 1 : 3.909 | 1 : 15.112 1 : 8.652 1 : 5.876 1 : 4.469 1 : 3.553 1 : 15.112 |
| 930 B3A | C.513.5 | 15/59 1 : 3.933 | 1^ 2^ 3^ 4^ 5^ RM | 1 : 3.909 1 : 2.238 1 : 1.520 1 : 1.156 1 : 0.919 1 : 3.909 | 1 : 15.374 1 : 8.802 1 : 5.978 1 : 4.546 1 : 3.614 1 : 15.374 |
| 930 B2B | C.510.5 | 16/57 1 : 3.562 | 1^ 2^ 3^ 4^ 5^ RM | 1 : 3.909 1 : 2.238 1 : 1.520 1 : 1.156 1 : 0.971 1 : 3.909 | 1 : 13.924 1 : 7.972 1 : 5.414 1 : 4.118 1 : 3.459 1 : 13.924 |
| 930 B2C | C.510.5 | 17/57 3 : 3.353 | 1^ 2^ 3^ 4^ 5^ RM | 1 : 3.909 1 : 2.238 1 : 1.520 1 : 1.156 1 : 0.971 1 : 3.909 | 1 : 13.107 1 : 7.504 1 : 5.096 1 : 3.876 1 : 3.256 1 : 13.107 |
| 930 B1A | C.510.5 | 16/57 1 : 3.562 | 1^ 2^ 3^ 4^ 5^ RM | 1 : 3.909 1 : 2.238 1 : 1.520 1 : 1.156 1 : 0.971 1 : 3.909 | 1 : 13.924 1 : 7.972 1 : 5.414 1 : 4.118 1 : 3.459 1 : 13.924 |

RATIOS (Specific for 99s models)

TO BE PUBLISHED SOON

TORQUE WRENCH SETTINGS

Group 70 - Bodywork

| Part | Nm | kgm |
|-------------------------------------|---------|-----------|
| Clamping nut for front safety belts | 34 ÷ 42 | 3.5 ÷ 4.3 |
| Clamping screws for rear bumper | 16 ÷ 20 | 1.6 ÷ 2.0 |

SPECIFIC EQUIPMENT**Group 70 - Bodywork**

| | |
|---------------|--|
| 1.822.152.000 | Wrench to align the rear bumper |
| 1.823.008.001 | Tool for the gasket guide of the rear window |

Group 00 - Boxer engines maintenance

| Part | Nm | kgm |
|---|---------|-----------|
| Oil sump drain plug | 28 ÷ 35 | 2.9 ÷ 3.5 |
| Nuts fastening timing gear belt tensioner (8 valves) | 37 ÷ 46 | 3.8 ÷ 4.7 |
| Coolant fluid drain plugs (16 valves) | 17 ÷ 21 | 1.7 ÷ 2.1 |
| Union fastening compressor/condenser pipe on condenser | 26 ÷ 32 | 2.6 ÷ 3.2 |
| Union fastening condenser/evaporator pipe on evaporator | 21 ÷ 26 | 2.2 ÷ 2.7 |
| Nuts fastening timing gear belt tensioner (16 valves) | 29 ÷ 36 | 3.0 ÷ 3.6 |
| Fuel outlet union from filter | 21 ÷ 26 | 2.2 ÷ 2.7 |
| Fuel filter inlet union | 30 ÷ 37 | 3.0 ÷ 3.8 |
| Spark plugs | 25 ÷ 30 | 2.5 ÷ 3.1 |

Group 00 - 1929 Turbodiesel engine maintenance

| Part | Nm | kgm |
|--|-----------|-------------|
| Nut fastening timing gear belt tensioner | 37 ÷ 46 | 3.8 ÷ 4.7 |
| Screw fastening camshaft drive pulley | 100 ÷ 124 | 10.2 ÷ 12.6 |

Group 00 - T. Spark 16V engine maintenance

| Part | Nm | kgm |
|---|-----------------------|-------------|
| Oil sump drain plug (for aluminium sump) | 20 ÷ 25 | 2.0 ÷ 2.5 |
| Oil sump drain plug (for sheet metal sump) | 42.5 ÷ 52.5 | 4.3 ÷ 5.4 |
| Screws fastening auxiliary components drive belt pulley | 24 ÷ 29 | 2.4 ÷ 3.0 |
| Screw fastening exhaust side camshaft pulley | 100 ÷ 124 | 10.2 ÷ 12.6 |
| Nut fastening timing gear belt tensioner | 21 ÷ 26 | 2.1 ÷ 2.6 |
| Spark plugs | Central (large - M14) | 25 ÷ 35 |
| | Side (small - M10) | 10 ÷ 12 |

Group 00 - Mechanical unit maintenance

| Part | Nm | kgm |
|---|-----------|-----------|
| Gearbox oil filler plug (Boxer versions) | 30 ÷ 48 | 3.0 ÷ 4.9 |
| Gearbox oil drain cap for sheet metal sumps (Boxer versions) | 22.5 ÷ 28 | 2.3 ÷ 2.8 |
| Gearbox oil drain cap for aluminium sumps (Boxer versions) | 38 ÷ 48 | 3.9 ÷ 4.9 |
| Gearbox oil filler/drain cap (1929 Turbodiesel and T. Spark 16V versions) | 30 ÷ 48 | 3.0 ÷ 4.9 |
| Relief screws on brake calipers | 6 ÷ 7 | 0.6 ÷ 0.8 |

Group 10 - Boxer 8 Valve engines

| Part | Nm | kgm |
|--|---------|-----------|
| Screw fastening rpm and T.D.C. sensor | 8 ÷ 10 | 0.8 ÷ 1.0 |
| Screws fastening pressure plate to flywheel | 19 ÷ 23 | 1.9 ÷ 2.4 |
| Screws fastening water pump inlet union on crankcase | 20 ÷ 24 | 2.0 ÷ 2.5 |
| Nuts fastening intake manifolds to heads | 20 ÷ 24 | 2.0 ÷ 2.5 |
| Screws fastening camshaft drive pulleys | 67 ÷ 71 | 6.5 ÷ 7.2 |
| Screws fastening water pump | 20 ÷ 24 | 2.0 ÷ 2.5 |

(Continued)

(Continued)

| Part | Nm | kgm |
|---|-----------|-------------|
| Nut fastening crankshaft pulley | 119 ÷ 147 | 12.1 ÷ 15.0 |
| Screws fastening oil sump | 8 ÷ 10 | 0.8 ÷ 1.0 |
| Sump oil drain plug | 28 ÷ 35 | 2.9 ÷ 3.5 |
| Screws fastening oil pump to rear cover | 20 ÷ 24 | 2.0 ÷ 2.5 |
| Screws fastening front cover to crankcase | 20 ÷ 24 | 2.0 ÷ 2.5 |
| Screws fastening engine flywheel (in oil) | 97 ÷ 107 | 9.9 ÷ 10.9 |
| Screws fastening rear cover to crankcase | 20 ÷ 24 | 2.0 ÷ 2.5 |
| Screws fastening connecting rod caps | 53 ÷ 58 | 5.4 ÷ 5.9 |
| Upper screws fastening main bearing caps (in oil) | 67 ÷ 74 | 6.8 ÷ 7.5 |
| Side screws fastening main bearing caps (in oil) | 41 ÷ 50 | 4.2 ÷ 5.1 |
| Screws fastening cylinder heads to crankcase (in oil) | 91 ÷ 101 | 9.3 ÷ 10.3 |
| Screws fastening camshaft supports | 20 ÷ 24 | 2.0 ÷ 2.5 |
| Nuts fastening timing gear belt tensioner | 37 ÷ 46 | 3.8 ÷ 4.7 |
| Minimum engine oil pressure warning light sensor | 34 ÷ 42 | 3.5 ÷ 4.3 |
| Screws joining oil pump casing to support | 8 ÷ 10 | 0.8 ÷ 1.0 |
| Screws fastening front flexible mount to engine | 38 ÷ 47 | 3.9 ÷ 4.8 |

Group 10 - 16 Valve Boxer engine

| Part | Nm | kgm |
|---|-----------|-------------|
| Screws fastening pressure plate to engine flywheel | 19 ÷ 23 | 1.9 ÷ 2.4 |
| Screw fastening rpm sensor | 9 ÷ 10 | 0.8 ÷ 1.0 |
| Screws fastening water pump inlet union on crankcase | 20 ÷ 24 | 2.0 ÷ 2.5 |
| Nuts fastening drive shaft supports | 6 ÷ 8 | 0.6 ÷ 0.8 |
| Nuts fastening camshaft drive pulleys | 76 ÷ 84 | 7.7 ÷ 8.6 |
| Screws fastening water pump | 20 ÷ 24 | 2.0 ÷ 2.5 |
| Nut fastening crankshaft pulley | 219 ÷ 242 | 22.3 ÷ 24.6 |
| Screws fastening oil pump to rear cover | 20 ÷ 24 | 2.0 ÷ 2.5 |
| Nuts fastening intake bodies | 20 ÷ 24 | 2.0 ÷ 2.5 |
| Screws fastening front cover to crankcase | 20 ÷ 24 | 2.0 ÷ 2.5 |
| Screws fastening engine flywheel (in oil) | 97 ÷ 107 | 9.9 ÷ 10.9 |
| Screws fastening rear cover to crankcase | 20 ÷ 24 | 2.0 ÷ 2.5 |
| Screws fastening camshaft caps | 20 ÷ 24 | 2.0 ÷ 2.5 |
| Screws fastening connecting rod caps | 53 ÷ 58 | 5.4 ÷ 5.9 |
| Upper screws fastening main bearing caps (in oil) | 67 ÷ 74 | 6.8 ÷ 7.5 |
| Side screws fastening main bearing caps (in oil) | 41 ÷ 50 | 4.2 ÷ 5.1 |
| Screws fastening cylinder heads to crankcase (in oil) | 91 ÷ 101 | 9.3 ÷ 10.3 |
| Nuts fastening belt tensioner to head | 29 ÷ 36 | 3.0 ÷ 3.6 |

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| Part | Nm | kgm |
|--|---------|-----------|
| Nuts fastening timing gear belt fixed guides to supports | 47 ÷ 58 | 4.8 ÷ 5.9 |
| Screws fastening timing gear belt fixed guide supports to cylinder heads | 20 ÷ 24 | 2.0 ÷ 2.5 |
| Engine oil minimum pressure warning light sensor | 34 ÷ 42 | 3.5 ÷ 4.3 |
| Screws joining oil pump casing to support | 8 ÷ 10 | 0.8 ÷ 1.0 |
| Oil sump drain plug | 28 ÷ 35 | 2.9 ÷ 3.5 |
| Screws fastening front engine flexible mount | 38 ÷ 47 | 3.9 ÷ 4.8 |
| Screws fastening cylinder head covers | 8 ÷ 10 | 0.8 ÷ 1.0 |

Group 10 - 1929 Turbodiesel engine

| Part | Nm | kgm | |
|--|-----------|-------------|-----------|
| Screws fastening main bearing caps to crankcase (in oil) | 96 ÷ 119 | 9.8 ÷ 12 | |
| Screws fastening flywheel to crankshaft (with fixer) | 121 ÷ 149 | 12.3 ÷ 15.2 | |
| Screws fastening connecting rod caps (in oil) | 25 + 50° | 2.6 + 50° | |
| Nut fastening timing gear belt tensioner to crankcase | 37 ÷ 46 | 3.8 ÷ 4.7 | |
| Screw fastening timing gear belt guide to crankcase | 37 ÷ 46 | 3.8 ÷ 4.7 | |
| Screw and nuts fastening injection pump to its support | 21 ÷ 26 | 2.1 ÷ 2.6 | |
| Nut fastening injection pump drive pulley | 43 ÷ 53 | 4.3 ÷ 5.3 | |
| Upper screw fastening oil filter support and injection pump to crankcase | 83 ÷ 103 | 8.5 ÷ 10.5 | |
| Lower screws fastening oil filter support and injection pump to crankcase | 60 ÷ 75 | 6.2 ÷ 7.6 | |
| Screw fastening camshaft drive pulley to crankshaft (lefthand thread) | 181 ÷ 200 | 18.4 ÷ 20.3 | |
| Engine oil minimum pressure sensor to oil filter support and injection pump | 27 ÷ 34 | 2.8 ÷ 3.4 | |
| Screw fastening water pump to crankcase | 21 ÷ 26 | 2.2 ÷ 2.7 | |
| Nuts fastening turbocharger to exhaust manifold | 34 ÷ 42 | 3.5 ÷ 4.3 | |
| Air boost maximum pressure warning light switch to intake box | 26 ÷ 32 | 2.6 ÷ 3.2 | |
| Fuel delivery unions from injection pump to injectors | 26 ÷ 32 | 2.6 ÷ 3.2 | |
| Screw fastening oil vapour separator to crankcase | 17 ÷ 21 | 1.7 ÷ 2.1 | |
| Nuts fastening alternator support bracket and layshaft to crankcase | M8 | 21 ÷ 26 | 2.2 ÷ 2.7 |
| | M10 | 43 ÷ 53 | 4.3 ÷ 5.3 |
| Screw fastening alternator support bracket and layshaft to crankcase | 43 ÷ 53 | 4.3 ÷ 5.3 | |
| Union fastening overpressure pipe for flow limiter to injection pump and to intake box | 13 ÷ 16 | 1.3 ÷ 1.6 | |
| Nuts fastening exhaust manifold and intake box to cylinder head | 21 ÷ 26 | 2.2 ÷ 2.7 | |
| Screw fastening camshaft drive pulley | 100 ÷ 124 | 10.2 ÷ 12.6 | |

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| Part | Nm | kgm |
|---|-----------|-------------------------------|
| Bushes fastening precombustion chambers to cylinder head | 100 ÷ 124 | 10.2 ÷ 12.6 |
| Nuts fastening camshaft caps to cylinder head | 16 ÷ 20 | 1.7 ÷ 2.0 |
| Nuts fastening front and rear camshaft bearings and servobrake vacuum pump to cylinder head | 16 ÷ 20 | 1.7 ÷ 2.0 |
| KSB enable thermal switch to thermostatic cup | 9 ÷ 11 | 0.9 ÷ 1.1 |
| Thermostatic sensor for automatic fast idle device to thermostatic cup | 26 ÷ 32 | 2.6 ÷ 3.2 |
| Injector to cylinder head | 47 ÷ 58 | 4.8 ÷ 5.9 |
| Glow plugs to cylinder head | 13 ÷ 16 | 1.3 ÷ 1.6 |
| Cylinder head tightening | | |
| Inner screws | | 100 Nm (10.2 kgm) |
| Tighten the screws to a torque of: | | 90° |
| Turn all screws by an angle of: | | 90° |
| Complete tightening with a further angle of: | | 26 ÷ 32 Nm (2.6 ÷ 3.2 kgm) |
| Outer screws | | |
| Tighten the screws to a torque of (1): | | |

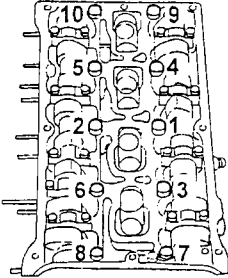
(1): No particular tightening sequence is necessary.

Group 10 - T. Spark 16V engines

| Part | Nm | kgm |
|---|-----------|-------------|
| Screws fastening main bearing caps (in oil) | 96 ÷ 119 | 9.8 ÷ 12.1 |
| Screws fastening engine flywheel | 121 ÷ 149 | 12.3 ÷ 15.2 |
| Screws fastening connecting rod caps (in oil) (1370 T. Spark 16V) | 25 + 50° | 2.5 + 50° |
| Screws fastening connecting rod caps (in oil) (1598 - 1747 - 1970 T. Spark 16V) | 25 + 60° | 2.5 + 60° |
| Screws fastening auxiliary components belt drive pulley | 24 ÷ 29 | 2.4 ÷ 3.0 |
| Screw fastening timing gear drive belt pulley (lefthand) | 340 ÷ 378 | 34.7 ÷ 38.5 |
| Screws fastening water pump | 17 ÷ 21 | 1.7 ÷ 2.1 |
| Engine oil minimum pressure warning light sensor | 25 ÷ 31 | 2.5 ÷ 3.2 |
| Screws fastening counter-rotating shaft front covers | 6 ÷ 7 | 0.6 ÷ 0.7 |
| Screws fastening oil sump | M6 | 7 ÷ 9 |
| | M8 | 21 ÷ 26 |
| Oil sump drain plug | 17 ÷ 21 | 1.7 ÷ 2.1 |
| Screws fastening oil pump | 6 ÷ 8 | 0.6 ÷ 0.8 |
| Screws fastening E.G.R. valve | 17 ÷ 21 | 1.7 ÷ 2.1 |
| Nuts fastening intake box to cylinder head | 17 ÷ 21 | 1.7 ÷ 2.1 |
| Screw fastening exhaust side camshaft pulley | 100 ÷ 124 | 10.2 ÷ 12.6 |

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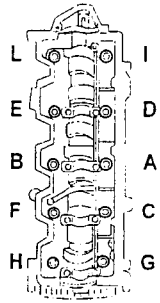
| Part | | Nm | kgm |
|--|--|-----------------|-----------|
| Nut fastening timing gear belt tensioner | | 21 ÷ 26 | 2.1 ÷ 2.6 |
| Nuts fastening exhaust manifolds to cylinder heads | | 17 ÷ 21 | 1.7 ÷ 2.1 |
| Screws fastening thermostatic cup to cylinder head | | 17 ÷ 21 | 1.7 ÷ 2.1 |
| Screws fastening camshaft caps (in oil) | | 13 ÷ 16 | 1.3 ÷ 1.6 |
| Spark plugs | Central (large - M14) | 25 ÷ 35 | 2.5 ÷ 3.6 |
| | Side (small - M10) | 10 ÷ 12 | 1.0 ÷ 1.2 |
| Engine coolant fluid temperature gauge transmitter and maximum temperature warning light contact | | 25 ÷ 31 | 2.5 ÷ 3.2 |
| Cylinder head tightening | | | |
| Approach all the screws to a torque of: |  | 20 | 2.0 |
| Tighten the screws to a preliminary torque of: | | 40 | 4.1 |
| Turn all the screws by an angle of: | | 90° + 90° + 90° | |

Group 10 - 1910 JTD engine

| Part | Nm | kgm |
|--|-----------|-------------|
| Fittings fastening pressure pump pipes to fuel manifold | 26 ÷ 32 | 2.7 ÷ 3.3 |
| Exhaust manifold fastening nuts | 21 ÷ 26 | 2.1 ÷ 2.7 |
| Tappet cover fastening screws | 8 ÷ 10 | 0.8 ÷ 1.0 |
| Front and rear crankcase sump fastening screws | 7 ÷ 9 | 0.7 ÷ 0.9 |
| Side crankcase sump fastening screws | 21 ÷ 26 | 2.1 ÷ 2.7 |
| Drive toothed pulley fastening screws (left-handed) | 306 ÷ 378 | 31.2 ÷ 38.5 |
| Engine flywheel fastening screws | 136 ÷ 168 | 13.9 ÷ 17.1 |
| Front crankcase cover fastening screws | 8 ÷ 10 | 0.8 ÷ 1.0 |
| Engine oil pressure minimum pressure warning light sensor | 19 ÷ 23 | 1.9 ÷ 2.3 |
| Rear crankcase sump fastening screws | 8 ÷ 10 | 0.8 ÷ 1.0 |
| Fittings fastening fuel manifold to injectors on injector side | 19 ÷ 23 | 1.9 ÷ 2.3 |
| Fittings fastening fuel manifold to injectors manifold side | 26 ÷ 32 | 2.7 ÷ 3.3 |
| Vacuum fastening screws | 21 ÷ 26 | 2.1 ÷ 2.7 |
| Thermostat fastening screws | 21 ÷ 26 | 2.1 ÷ 2.7 |
| Driven toothed pulley fastening screws | 102 ÷ 126 | 10.4 ÷ 12.8 |
| Coolant pump fastening screw | 21 ÷ 26 | 2.1 ÷ 2.7 |
| Injector fastening nuts | 26 ÷ 32 | 2.7 ÷ 3.3 |
| Glow plugs | 13 ÷ 16 | 1.3 ÷ 1.6 |

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| Part | | Nm | kgm |
|--|---|-----------------|------------------|
| Camshaft bearing fastening screws | | 13 ÷ 16 | 1.3 ÷ 1.6 |
| Main bearing fastening screws | | 24 ÷ 26 + 100° | 2.5 ÷ 2.7 + 100° |
| Connecting rod bearing fastening screws | | 24 ÷ 26 + 60° | 2.5 ÷ 2.7 + 60° |
| Timing belt take-up fastening nut | | 45 ÷ 52 | 4.3 ÷ 5.3 |
| Cylinder head tightening | | | |
| Tighten screws to the preliminary torque of: |  | 65 | 6.6 |
| Turn all screws by: | | 90° + 90° + 90° | |

Group 10 - Engine supply (Boxer engines)

| Part | Nm | kgm |
|--|---------|-----------|
| Fuel filter inlet union | 30 ÷ 37 | 3.0 ÷ 3.8 |
| Fuel filter outlet union | 21 ÷ 26 | 2.2 ÷ 2.7 |
| Union connecting fuel distributor manifold to pressure regulator | 24 ÷ 29 | 2.4 ÷ 3.0 |
| Nut fastening fuel pressure regulator | 48 ÷ 60 | 4.9 ÷ 6.1 |
| Nut fastening dash pot | 9 ÷ 12 | 1.0 ÷ 1.2 |
| Lambda sensor | 43 ÷ 53 | 4.3 ÷ 5.4 |
| Screw fastening rpm sensor | 8 ÷ 10 | 0.8 ÷ 1.0 |
| Screws/nuts fastening intake bodies (Specific for 16V) | 20 ÷ 24 | 2.0 ÷ 2.5 |

Group 10 - Engine supply (1929 Turbodiesel engine)

| Part | Nm | kgm |
|--|---------|-----------|
| Nut fastening timing gear belt tensioner guide | 37 ÷ 46 | 3.8 ÷ 4.7 |
| Nuts fastening intake box to cylinder head | 21 ÷ 26 | 2.2 ÷ 2.7 |
| Nuts fastening exhaust manifold to cylinder head | 21 ÷ 26 | 2.2 ÷ 2.7 |
| Nuts fastening turbocharger to exhaust manifold | 34 ÷ 42 | 3.5 ÷ 4.3 |

Group 10 - Engine supply (T. Spark 16V engines)

| Part | Nm | kgm |
|---|-----------|-------------|
| Screws fastening auxiliary components belt drive pulley | 24 ÷ 29 | 2.4 ÷ 3.0 |
| Nut fastening timing gear belt tensioner | 21 ÷ 26 | 2.1 ÷ 2.7 |
| Screw fastening exhaust side camshaft pulley | 100 ÷ 124 | 10.2 ÷ 12.6 |

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| Part | Nm | kgm |
|--|---------|-----------|
| Screws fastening E.G.R. valve | 17 ÷ 21 | 1.7 ÷ 2.1 |
| Engine coolant fluid temperature sensor (NTC) | 12 ÷ 15 | 1.2 ÷ 1.5 |
| Screws fastening intake box to cylinder head | 17 ÷ 21 | 1.7 ÷ 2.1 |
| Nuts fastening exhaust manifold to cylinder head | 17 ÷ 21 | 1.7 ÷ 2.1 |

Group 10 - Engine cooling (Boxer engines)

| Part | Nm | kgm |
|--|---------|-----------|
| Fan control thermal contact | 23 ÷ 37 | 2.3 ÷ 3.8 |
| Screws fastening water pump to crankcase | 20 ÷ 24 | 2.0 ÷ 2.5 |
| Screws fastening water pump pulley | 8 ÷ 10 | 0.8 ÷ 1.0 |
| Screw fastening thermostating unit | 20 ÷ 24 | 2.0 ÷ 2.5 |
| Screws fastening water pump inlet union to crankcase | 20 ÷ 24 | 2.0 ÷ 2.5 |

Group 10 - Engine cooling (1929 Turbodiesel engine)

| Part | Nm | kgm |
|--|---------|-----------|
| Automatic fast idle device thermostatic sensor | 26 ÷ 32 | 2.6 ÷ 3.2 |
| Cold injection advance automatic device thermal switch (KSB) | 9 ÷ 11 | 0.9 ÷ 1.1 |

Group 10 - Engine cooling (T. Spark 16V engines)

| Part | Nm | kgm |
|---|-----------|-------------|
| Screws fastening auxiliary components drive belt pulley | 24 ÷ 29 | 2.4 ÷ 3.0 |
| Nut fastening timing gear belt tensioner | 21 ÷ 26 | 2.1 ÷ 2.7 |
| Screw fastening exhaust side camshaft pulley | 100 ÷ 124 | 10.2 ÷ 12.6 |

Group 18 - Clutch (Boxer versions)

| Part | Nm | kgm |
|---|---------|-----------|
| Screws fastening pressure plate to engine flywheel | 19 ÷ 23 | 1.9 ÷ 2.4 |
| Clutch circuit pipe unions on control cylinder and on pump | 17 ÷ 19 | 1.7 ÷ 1.9 |
| Nuts fastening clutch pump to pedal unit | 13 ÷ 21 | 1.3 ÷ 2.1 |
| Intermediate union for pipe connecting clutch pump-cylinder | 17 ÷ 19 | 1.7 ÷ 1.9 |

Group 18 - Clutch (1929 Turbodiesel version)

| Part | Nm | kgm |
|---|---------|-----------|
| Screws fastening pressure plate to engine flywheel | 20 ÷ 25 | 2.1 ÷ 2.6 |
| Screws fastening clutch control cylinder to gearbox cover | 13 ÷ 16 | 1.3 ÷ 1.6 |
| Nuts fastening clutch pump to pedal unit | 13 ÷ 21 | 1.3 ÷ 2.1 |
| Clutch circuit pipe union on pump | 17 ÷ 19 | 1.7 ÷ 1.9 |
| Clutch circuit pipe union on control cylinder | 17 ÷ 19 | 1.7 ÷ 1.9 |
| Screws fastening thrust bearing sleeve | 7 ÷ 9 | 0.7 ÷ 0.9 |

Group 18 - Clutch (T. Spark 16V versions)

| Part | Nm | kgm |
|---|---------|-----------|
| Screws fastening pressure plate to engine flywheel | 20 ÷ 25 | 2.1 ÷ 2.6 |
| Screws fastening thrust bearing sleeve | 7 ÷ 9 | 0.7 ÷ 0.9 |
| Screws fastening clutch control cylinder to gearbox cover | 13 ÷ 16 | 1.3 ÷ 1.6 |
| Clutch circuit pipe union on control cylinder | 17 ÷ 19 | 1.7 ÷ 1.9 |

Group 21 - Gearbox - Differential (Boxer versions)

| Part | Nm | kgm |
|---|-----------|-------------|
| Screws fastening gearbox - differential rear cover | 20 ÷ 25 | 2.1 ÷ 2.6 |
| Gearbox oil filler cap | 30 ÷ 48 | 3.1 ÷ 4.9 |
| Gearbox oil drain plug (sheet metal sump) | 22.5 ÷ 28 | 2.3 ÷ 2.8 |
| Gearbox oil drain plug (aluminium sump) | 31 ÷ 38 | 3.1 ÷ 3.9 |
| Screw fastening reversing shaft to gearbox | 19 ÷ 23 | 1.9 ÷ 2.4 |
| Nut locking gears pack on bevel pinion | 224 ÷ 248 | 22.9 ÷ 25.3 |
| Screw fastening oil cup on main shaft | 81 ÷ 89 | 8.3 ÷ 9.1 |
| Reversing light switch | 40 ÷ 49 | 4.1 ÷ 5.0 |
| Screw fastening 1st and 2nd gear engagement lever | 25 ÷ 27 | 2.5 ÷ 2.8 |
| Screw fastening 1st, 2nd, 3rd and 4th gear fork on gearshift control rods | 21 ÷ 23 | 2.1 ÷ 2.4 |
| Screws fastening differential supports to gearbox differential | 38 ÷ 47 | 3.9 ÷ 4.8 |
| Screws fastening crown wheel to differential carrier | 100 ÷ 110 | 10.2 ÷ 11.2 |
| Nut fastening gearshift control bar to upper U-bolt on gearbox cover | 34 ÷ 42 | 3.5 ÷ 4.3 |
| Nut fastening gearshift control bar to lower U-bolt on gearbox cover | 19 ÷ 23 | 1.9 ÷ 2.4 |
| Screw fastening rear support plug for gearshift control bar | 19 ÷ 23 | 1.9 ÷ 2.4 |
| Nut fastening gearshift control bar to gearshift lever | 8 ÷ 10 | 0.8 ÷ 1.0 |
| Nut fastening gearshift control lever to support | 3.4 ÷ 4.2 | 0.34 ÷ 0.42 |
| Nuts fastening gearbox - differential to rear engine cover | 39 ÷ 48 | 4.0 ÷ 4.9 |
| Screws fastening differential side axle shaft to flange | 38 ÷ 42 | 3.9 ÷ 4.3 |

Group 21 - Gearbox - Differential (1929 Turbodiesel version)

| Part | Nm | kgm |
|--|-------------|-------------|
| Nut fastening spring for clicking gearshift control rods into position | 19.5 ÷ 31.5 | 1.98 ÷ 3.21 |
| Screw fastening rear cover bearing retainer plate to gearbox | 21 ÷ 26 | 2.2 ÷ 2.7 |
| Screw fastening cover on gearbox support connection to engine | 9 ÷ 11 | 0.9 ÷ 1.1 |
| Screw fastening gearbox to connection to engine support | 21 ÷ 26 | 2.2 ÷ 2.7 |
| Screw fastening reversing shaft | 29 ÷ 36 | 2.9 ÷ 3.6 |

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| Part | Nm | kgm |
|--|-----------|-----------|
| Locknut for main and transmission shaft for fastening 5th gear | 100 ÷ 124 | 10 ÷ 13 |
| Screw fastening gearshift control forks | 15 ÷ 19 | 1.6 ÷ 1.9 |
| Screw fastening lever on gear engagement and shift control shaft | 21 ÷ 26 | 2.2 ÷ 2.7 |
| Screw fastening support for reverse control lever | 9 ÷ 11 | 0.9 ÷ 1.1 |
| Screw fastening bush for gear control shaft | 9 ÷ 11 | 0.9 ÷ 1.1 |
| Screw fastening differential crown wheel | 75 ÷ 92 | 7.6 ÷ 9.4 |
| Screw fastening flange retaining differential carrier to gearbox | 21 ÷ 26 | 2.2 ÷ 2.7 |
| Screw fastening tachometric support | 8 ÷ 13 | 0.8 ÷ 1.3 |
| Magnetic threaded taper plug for draining gearbox oil | 30 ÷ 48 | 3.0 ÷ 4.9 |
| Magnetic threaded taper plug for filling gearbox oil | 30 ÷ 48 | 3.0 ÷ 4.9 |
| Screw fastening right differential shaft support | 7 ÷ 11 | 0.7 ÷ 1.1 |
| Threaded taper plug for 1st and 2nd rod seat on gearbox | 13 ÷ 21 | 1.3 ÷ 2.1 |
| Screw fastening support for gearshift lever | 10 ÷ 16 | 1 ÷ 1.6 |
| Screw fastening differential side joint to flange | 40 ÷ 52 | 4.1 ÷ 5 |
| Screw fastening intermediate axle shaft | 8 ÷ 10 | 0.8 ÷ 1.0 |
| Reversing light switch screw | 20 ÷ 32 | 2.0 ÷ 3.2 |
| Nut for stud on gearbox support for connection to engine | 68 ÷ 84 | 6.9 ÷ 8.6 |
| Screw with spring washer for fastening flywheel cover to gearbox connection support | 7 ÷ 8 | 0.7 ÷ 0.9 |
| Screw fastening starter motor to gearbox support | 19 ÷ 23 | 1.9 ÷ 2.4 |
| Nut fastening supply cable to starter motor | 9 ÷ 11 | 0.9 ÷ 1.1 |
| Screw fastening upper gearbox to engine connection support | 68 ÷ 84 | 6.9 ÷ 8.6 |
| Screw fastening upper gearbox to engine connection support and power unit lifting hook | 47 ÷ 58 | 4.8 ÷ 5.9 |
| Screw fastening lower gearbox to engine connection support | 47 ÷ 58 | 4.8 ÷ 5.9 |
| Screw fastening gearshift control lever support to floor | 5 ÷ 8 | 0.5 ÷ 0.8 |
| Screw for fastening lower selection and engagement rod to gearshift control lever | 19 ÷ 23 | 1.9 ÷ 2.4 |
| Self-locking nut for pin fastening intermediate transmission | 10 ÷ 16 | 1 ÷ 1.6 |
| Self-locking nut fastening engagement tie-rod head to intermediate lever | 10 ÷ 16 | 1 ÷ 1.6 |
| Self-locking nut for screw fastening selection transmission on gearbox | 13 ÷ 16 | 1.3 ÷ 1.6 |

Group 21 - Gearbox - Differential (T. Spark 16V versions with gearbox C.510.5)

| Part | Nm | kgm |
|--|---------|-----------|
| Screws and nuts fastening gearbox - engine | 75 ÷ 92 | 7.6 ÷ 9.4 |
| Gearbox-differential oil drain plug | 30 ÷ 48 | 3.1 ÷ 4.9 |
| Bolts fastening wishbones to wheel uprights | 67 ÷ 74 | 6.8 ÷ 7.5 |
| Screws fastening power steering to front crossmember | 43 ÷ 47 | 4.4 ÷ 4.8 |
| Front nuts fastening gearbox controls support | 16 ÷ 25 | 1.6 ÷ 2.5 |

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| Part | Nm | kgm |
|---|-----------|------------|
| Rear centre screws fastening the suspension crossmember to the body | 77 ÷ 95 | 7.8 ÷ 9.7 |
| Rear side screws fastening the suspension crossmember to the body | 92 ÷ 113 | 9.4 ÷ 11.5 |
| Front screws fastening the suspension crossmember to the body | 92 ÷ 113 | 9.4 ÷ 11.5 |
| Bolts fastening transmission axle shaft to gearbox | 40 ÷ 52 | 4.1 ÷ 5.3 |
| Screws fastening starter motor | 20 ÷ 25 | 2.0 ÷ 2.6 |
| Bolts fastening transmission axle shaft to intermediate shaft | 67 ÷ 76 | 6.8 ÷ 7.7 |
| Bolts fastening uprights to wheel hubs | 36 ÷ 44 | 3.7 ÷ 4.5 |
| Screws fastening intermediate shaft to its support | 8 ÷ 10 | 0.8 ÷ 1.0 |
| Lockring for main and transmission shafts for fastening 5th gear | 100 ÷ 124 | 10 ÷ 13 |
| Screws fastening gearshift control forks | 15 ÷ 19 | 1.6 ÷ 1.9 |
| Bolt fastening rear bearing retainer plate to gearbox | 21 ÷ 26 | 2.2 ÷ 2.7 |
| Screw fastening reversing shaft | 29 ÷ 36 | 2.9 ÷ 3.6 |
| Screws fastening differential carrier retainer flange to gearbox | 21 ÷ 26 | 2.2 ÷ 2.7 |
| Screws fastening reverse gear fork support bracket | 9 ÷ 11 | 0.9 ÷ 1.1 |
| Screws fastening control lever to gearbox | 21 ÷ 26 | 2.2 ÷ 2.7 |
| Screws fastening gearbox rear cover | 21 ÷ 26 | 2.2 ÷ 2.7 |
| Screws fastening gear engagement device support bracket | 10 ÷ 16 | 1.0 ÷ 1.6 |
| Screws fastening crown wheel to differential carrier | 75 ÷ 92 | 7.6 ÷ 9.4 |
| Screws fastening gearbox side differential carrier seal cover | 21 ÷ 26 | 2.2 ÷ 2.7 |

Group 21 - Gearbox - Differential (T. Spark 16V version with gearbox C.513.5)

| Part | Nm | kgm |
|---|-------------|-------------|
| Screws fastening rear cover | 24 ÷ 26 | 2.4 ÷ 2.6 |
| Lockrings fastening main and transmission shafts | 112 ÷ 124 | 11.4 ÷ 12.6 |
| Screw fastening rear bearing retainer plate | 24 ÷ 26 | 2.4 ÷ 2.6 |
| Devices for positioning gearshift control rods | 28.5 ÷ 31.5 | 2.9 ÷ 3.2 |
| Screw fastening reversing shaft | 32 ÷ 36 | 3.3 ÷ 3.6 |
| Screws fastening differential carrier seal cover | 46 ÷ 51 | 4.7 ÷ 5.2 |
| Screws fastening gearbox cover | 24 ÷ 26 | 2.4 ÷ 2.6 |
| Screws fastening reverse intermediate gear control fork | 10 ÷ 11 | 1.0 ÷ 1.1 |
| Screws fastening gearshift control forks | 24 ÷ 26 | 2.4 ÷ 2.6 |
| Screws fastening crown wheel to differential carrier | 65 ÷ 72 | 6.7 ÷ 7.4 |

Group 27 - Axle shafts (Boxer versions)

| Part | Nm | kgm |
|---|-----------|-------------|
| Screws fastening axle shaft CV joint gearbox side | 38 ÷ 42 | 3.9 ÷ 4.3 |
| Nut fastening axle shaft to wheel hub | 266 ÷ 294 | 27.1 ÷ 30.0 |

**Group 27 - Axle shafts
(1929 Turbodiesel and T. Spark 16V versions)**

| Part | Nm | kgm |
|---|---------|-----------|
| Screws fastening axle shaft CV joint differential side to flange | 36 ÷ 44 | 3.6 ÷ 4.5 |
| Screws fastening intermediate axle shaft flange | 8 ÷ 10 | 0.8 ÷ 1.0 |
| Screws fastening damping mass halves to left axle shaft (Specific for T. Spark 16V version) | 5 ÷ 8 | 0.5 ÷ 0.8 |

Group 33 - Brakes

| Part | Nm | kgm |
|---|-----------------------------|-----------|
| Stiff brake pipe unions on brake pump | 13 ÷ 15 | 1.4 ÷ 1.5 |
| Nuts fastening servobrake to pedal unit | 10 ÷ 16 | 1 ÷ 1.6 |
| Screws fastening brake caliper support plate | 45 ÷ 46 | 4.6 ÷ 5.7 |
| Screws fastening brake caliper support plate | with piece in "Drilloc" (*) | |
| | M6 | 57 |
| | M8 | 10.5 |
| Screws fastening brake calipers (*) | 31 ÷ 38 | 3.1 ÷ 3.9 |
| Screws with centering pins for brake disks | 5 ÷ 13 | 0.6 ÷ 1.3 |
| Unions between brake system stiff pipes and hoses | 13 ÷ 15 | 1.4 ÷ 1.5 |
| Hose unions to brake calipers | 15 ÷ 19 | 1.6 ÷ 1.9 |
| Relief screw on brake calipers | 4 ÷ 6 | 0.4 ÷ 0.6 |
| Screws with centering pins for rear brake drums | 5 ÷ 13 | 0.6 ÷ 1.3 |
| Screws fastening handbrake lever to support | 24 ÷ 29 | 2.4 ÷ 3.0 |
| Screws fastening support for running handbrake cable | 8 ÷ 9 | 0.8 ÷ 1 |
| Screws fastening braking load proportioning valve to bracket | 6 ÷ 7 | 0.6 ÷ 0.8 |
| Brake stiff pipe unions on braking load proportioning valve | 13 ÷ 15 | 1.4 ÷ 1.5 |
| Screw for braking load proportioning valve adjustment bracket | 20 ÷ 25 | 2.1 ÷ 2.6 |
| Brake stiff pipe unions on A.B.S. | 13 ÷ 15 | 1.4 ÷ 1.5 |

(*): To be replaced at each tightening.

Group 41 - Steering system (Boxer versions)

| Part | Nm | kgm |
|---|-----------|-------------|
| Nut fastening steering wheel to steering column | 43 ÷ 53 | 4.3 ÷ 5.3 |
| Screws fastening power steering box to battery sidemember | 21 ÷ 26 | 2.2 ÷ 2.7 |
| Screws fastening track rods to power steering box | 105 ÷ 116 | 10.6 ÷ 11.8 |
| Screws fastening lower steering column to power steering box pinion | 19 ÷ 23 | 1.9 ÷ 2.4 |
| Union fastening oil inlet pipe to power steering box | 38 ÷ 42 | 3.9 ÷ 4.3 |
| Union fastening oil outlet pipe from power steering box | 29 ÷ 32 | 2.9 ÷ 3.2 |
| Nut fastening track rod ball pin to shock absorber coupling | 34 ÷ 42 | 3.5 ÷ 4.3 |
| Screws fastening track rod adjustment union | 15 ÷ 19 | 1.6 ÷ 1.9 |
| Union fastening oil outlet pipe from power steering pump | 48 ÷ 53 | 4.8 ÷ 5.4 |

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| Part | Nm | kgm |
|--|---------|-----------|
| Adjustable guide locking device nut (to be tightened with lever in locked position) | 30 ÷ 37 | 3 ÷ 3.8 |
| Screws fastening upper steering column to body | 21 ÷ 26 | 2.2 ÷ 2.7 |

Group 41 - Steering system (1929 Turbodiesel and T. Spark 16V versions)

| Part | Nm | kgm |
|--|---------|-----------|
| Nut fastening steering wheel to steering column | 43 ÷ 53 | 4.3 ÷ 5.3 |
| Screws fastening power steering box to sidemember | 43 ÷ 47 | 4.4 ÷ 4.8 |
| Screws fastening upper steering column to body | 5 ÷ 8 | 0.5 ÷ 0.8 |
| Screw fastening lower steering column to power steering box pinion | 15 ÷ 19 | 1.6 ÷ 1.9 |
| Union fastening oil inlet pipe to power steering box | 38 ÷ 42 | 3.9 ÷ 4.3 |
| Union fastening oil outlet pipe from power steering box | 29 ÷ 32 | 2.9 ÷ 3.2 |
| Nut fastening track rod ball pin to wheel upright | 30 ÷ 37 | 3 ÷ 3.8 |
| Nuts fastening track rods | 30 ÷ 37 | 3 ÷ 3.8 |
| Union fastening oil outlet pipe from power steering pump | 48 ÷ 53 | 4.8 ÷ 5.4 |
| Adjustable guide locking device nut (to be tightened with lever in locked position) | 30 ÷ 37 | 3 ÷ 3.8 |

Group 44 - Front suspension (Boxer versions)

| Part | Nm | kgm |
|--|-------------------------|---------------|
| Nut fastening track rod to coupling on shock absorber | 34 ÷ 42 | 3.5 ÷ 4.3 |
| Bolts fastening shock absorber to wheel upright | 67 ÷ 74 | 6.8 ÷ 7.5 |
| Centre nut retaining helical spring to shock absorber | 95 ÷ 105 | 9.7 ÷ 10.7 |
| Screws fastening shock absorber to body | 34 ÷ 42 | 3.5 ÷ 4.3 |
| Nut fastening axle shaft to wheel hub | before change (1 caulk) | 266 ÷ 294 |
| | after change (2 caulks) | 67 ÷ 74 + 62° |
| Screws fastening brake calipers | 45 ÷ 56 | 4.6 ÷ 5.7 |
| Bolt fastening wishbone to wheel upright | 67 ÷ 74 | 6.8 ÷ 7.5 |
| Nut fastening stabiliser bar connecting rod to wishbone | 26 ÷ 33 | 2.7 ÷ 3.3 |
| Screws fastening wishbone to chassis | 67 ÷ 74 | 6.8 ÷ 7.5 |
| Screws fastening engine support frame crossmember | 67 ÷ 74 | 6.8 ÷ 7.5 |
| Lambda sensor | 43 ÷ 53 | 4.3 ÷ 5.3 |
| U-bolt nuts fastening stabiliser bar to chassis | 26 ÷ 32 | 2.6 ÷ 3.2 |
| Screws fastening power unit support frame to flexible mounts | 26 ÷ 32 | 2.6 ÷ 3.2 |
| Front screws fastening power unit support frame to body | 68 ÷ 84 | 6.9 ÷ 8.6 |
| Rear screws fastening power unit support frame to body | 114 ÷ 126 | 11.6 ÷ 12.8 |

**Group 44 - Front suspension
(1929 Turbodiesel and T. Spark 16V versions)**

| Part | | Nm | kgm |
|---|-------------------------|---------------|-----------------|
| Bolts fastening shock absorber to wheel upright | | 67 ÷ 74 | 6.8 ÷ 7.5 |
| Centre nut retaining helical spring to shock absorber | | 95 ÷ 105 | 9.7 ÷ 10.7 |
| Screws fastening shock absorber to body | | 34 ÷ 42 | 3.5 ÷ 4.3 |
| Nut fastening track rod to wheel upright | | 30 ÷ 37 | 3.0 ÷ 3.8 |
| Bolt fastening wishbone to wheel upright | | 67 ÷ 74 | 6.8 ÷ 7.5 |
| Nut fastening connecting rod to stabiliser bar | | 43 ÷ 53 | 4.3 ÷ 5.4 |
| Nut fastening stabiliser bar connecting rod to wishbone | | 26 ÷ 33 | 2.7 ÷ 3.3 |
| Screws fastening U-bolts joining wishbone to sidemember | | 68 ÷ 73 | 6.9 ÷ 7.4 |
| Front screws fastening sidemember to body | | 92 ÷ 113 | 9.4 ÷ 11.6 |
| Rear screws fastening sidemember to body | N° 4 central | 77 ÷ 95 | 7.8 ÷ 9.6 |
| | N° 2 side | 102 ÷ 126 | 10.4 ÷ 12.9 |
| Screws fastening steering box to sidemember | | 43 ÷ 47 | 4.4 ÷ 4.8 |
| Nuts fastening U-bolts joining stabiliser bar to sidemember | | 34 ÷ 42 | 3.5 ÷ 4.3 |
| Nut fastening axle shaft to wheel hub | before change (1 caulk) | 266 ÷ 294 | 27.1 ÷ 30.0 |
| | after change (2 caulks) | 67 ÷ 74 + 62° | 6.8 ÷ 7.5 + 62° |

Group 44 - Rear suspension

| Part | | Nm | kgm |
|--|--|-----------|-------------|
| Nut fastening rear hub pin | | 266 ÷ 294 | 27.1 ÷ 30.0 |
| Lower bolt fastening shock absorber | | 75 ÷ 92 | 7.6 ÷ 9.4 |
| Upper bolt fastening shock absorber | | 48 ÷ 59 | 4.9 ÷ 6.0 |
| Screw fastening stabiliser bar support U-bolts to longitudinal arm | | 24 ÷ 29 | 2.4 ÷ 3.0 |
| Screw fastening stabiliser bar to longitudinal arm | | 48 ÷ 59 | 4.9 ÷ 6.0 |
| Bolt fastening longitudinal arm to stiff axle | | 143 ÷ 158 | 14.5 ÷ 16.1 |
| Screws fastening stiff axle support pads to body | | 92 ÷ 113 | 9.4 ÷ 11.6 |

Group 44 - Wheel

| Part | | Nm | kgm |
|---|--|----------|------------|
| Screws fastening wheels (with sheet metal rims) | | 83 ÷ 103 | 8.5 ÷ 10.5 |
| Screws fastening wheel (with alloy rims) | | 83 ÷ 103 | 8.5 ÷ 10.5 |

**Group 50 - Climate control
(Specific for Boxer and 1929 Turbodiesel versions)**

| Part | | Nm | kgm |
|---|--|---------|-----------|
| Female connector fastening evaporator/drier filter pipe on evaporator | | 34 ÷ 42 | 3.5 ÷ 4.3 |

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| Part | Nm | kgm |
|---|---------|-----------|
| Male connector fastening evaporator/drier filter pipe on drier filter | 34 ÷ 42 | 3.5 ÷ 4.3 |
| Female connector fastening drier filter/compressor pipe on drier filter | 34 ÷ 42 | 3.5 ÷ 4.3 |
| Screws fastening inlet and outlet pipe flange on compressor | 21 ÷ 26 | 2.2 ÷ 2.7 |
| End nut fastening compressor/condenser pipe on coupling flange on compressor (only for Boxer engines) | 21 ÷ 26 | 2.2 ÷ 2.7 |
| Female connector fastening compressor/condenser pipe on condenser | 26 ÷ 32 | 2.6 ÷ 3.2 |
| Female connector fastening condenser/evaporator pipe on condenser | 21 ÷ 26 | 2.2 ÷ 2.7 |
| Female connector fastening condenser/evaporator pipe on evaporator | 21 ÷ 26 | 2.2 ÷ 2.7 |
| Intermediate connector on which expansion valve is inserted | 21 ÷ 26 | 2.2 ÷ 2.7 |

Group 50 - Climate control (Specific for T. Spark 16V versions)

| Part | Nm | kgm |
|---|-----------|-----------|
| Female connector fastening condenser/evaporator pipe on evaporator | 17 ÷ 19 | 1.7 ÷ 1.9 |
| Female connector fastening evaporator/drier filter pipe on evaporator | 40 ÷ 44 | 4.1 ÷ 4.5 |
| Male connector fastening evaporator/drier filter pipe on drier filter | 40 ÷ 44 | 4.1 ÷ 4.5 |
| Female connector fastening drier/filter compressor pipe on drier filter | 40 ÷ 44 | 4.1 ÷ 4.5 |
| Intermediate pipe connector on which expansion valve is inserted | 17 ÷ 19 | 1.7 ÷ 1.9 |
| Three-level pressure switch | 7.5 ÷ 8.5 | 0.8 ÷ 0.9 |
| Screw fastening compressor electromagnetic joint hub | 11 ÷ 16 | 1.1 ÷ 1.6 |
| Minimum pressure switch | 7.5 ÷ 8.5 | 0.8 ÷ 0.9 |

Group 50 - Climate control (Specific for '97 versions)

| Part | Nm | kgm |
|---|-------|-----------|
| Screws fastening coolant fluid inlet and outlet pipes from drier filter, evaporator, compressor and condenser | 5 ÷ 6 | 0.5 ÷ 0.6 |
| Four-level pressure switch | 7 ÷ 8 | 0.7 ÷ 0.8 |

Group 55 - Electric system (Boxer versions)

| Part | Nm | kgm |
|-------------------------------|---------|-----------|
| Spark plugs | 25 ÷ 30 | 2.5 ÷ 3.1 |
| Bolts fastening starter motor | 39 ÷ 48 | 4 ÷ 4.9 |

Group 55 - Electric system (1929 Turbodiesel version)

| Part | Nm | kgm |
|--------------------------------|---------|-----------|
| Glow plugs | 13 ÷ 16 | 1.3 ÷ 1.6 |
| Screws fastening starter motor | 19 ÷ 23 | 1.9 ÷ 2.4 |

Group 55 - Electric system (T. Spark 16V versions)

| Part | Nm | kgm |
|--------------------------------|-----------------------|-----------|
| Spark plugs | Central (large - M14) | 25 ÷ 35 |
| | Side (small - M10) | 10 ÷ 12 |
| Screws fastening starter motor | 20 ÷ 25 | 2.0 ÷ 2.6 |

Group 70 - Body

| Part | Nm | kgm |
|---|---------|-----------|
| Screw fastening bonnet hinges to body | 16 ÷ 20 | 1.7 ÷ 2.0 |
| Screw fastening bonnet hinges to bonnet | 6 ÷ 7 | 0.6 ÷ 0.8 |
| Bonnet lock pin | 20 ÷ 25 | 2.1 ÷ 2.6 |
| Screw fastening bonnet lock safety device | 7 ÷ 8 | 0.7 ÷ 0.9 |
| Nut fastening bonnet pad to body | 30 ÷ 37 | 3.0 ÷ 3.8 |
| Screw fastening door hinges to body | 38 ÷ 47 | 3.9 ÷ 4.8 |
| Screw fastening door lock striker | 15 ÷ 19 | 1.6 ÷ 1.9 |
| Screw fastening door lock device | 6 ÷ 8 | 0.7 ÷ 0.8 |
| Nut fastening boot hinges to body | 4 ÷ 5 | 0.4 ÷ 0.5 |
| Screw fastening boot lid to body | 6 ÷ 8 | 0.7 ÷ 0.8 |
| Screw fastening hinges to boot lid | 6 ÷ 7 | 0.6 ÷ 0.8 |
| Screw fastening boot lid lock striker to body and lock to boot lid | 4 ÷ 5 | 0.4 ÷ 0.5 |
| Screw fastening dashboard crossrail | 31 ÷ 38 | 3.1 ÷ 3.9 |
| Screw fastening front wheel arch | 6 ÷ 8 | 0.7 ÷ 0.8 |
| Screw fastening lower front wheel arch | 4 ÷ 5 | 0.4 ÷ 0.5 |
| Screw fastening door check rods | 3 ÷ 4 | 0.3 ÷ 0.4 |
| Screw fastening headlamp holder crossrail | 20 ÷ 25 | 2.1 ÷ 2.6 |
| Screw fastening front/rear tow hook | 20 ÷ 25 | 2.1 ÷ 2.6 |
| Ski rack screw | 6 ÷ 8 | 0.7 ÷ 0.8 |
| Screw fastening headlamp container to sidemember | 6 ÷ 7 | 0.6 ÷ 0.8 |
| Nut fastening complete wheel arch to side panel | 4 ÷ 5 | 0.4 ÷ 0.5 |
| Screw fastening headlamp crossrail to lower wheel arch piece | 20 ÷ 25 | 2.1 ÷ 2.6 |
| Screw fastening mobile crossrail complete | 26 ÷ 32 | 2.6 ÷ 3.2 |
| Screw fastening power steering and battery crossrail connection bracket | 20 ÷ 25 | 2.1 ÷ 2.6 |
| Screw fastening power steering and battery crossrail | 20 ÷ 25 | 2.1 ÷ 2.6 |

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| Part | Nm | kgm |
|--|---------|-----------|
| Screw fastening front seat belt runner | 34 ÷ 42 | 3.5 ÷ 4.3 |
| Screw fastening front seat belt reel | 34 ÷ 42 | 3.5 ÷ 4.3 |
| Screw fastening front seat belt connection | 34 ÷ 42 | 3.5 ÷ 4.3 |
| Screws fastening seat belt connection to front seats | 34 ÷ 42 | 3.5 ÷ 4.3 |
| Screw fastening front seat belt height adjustment device | 17 ÷ 21 | 1.7 ÷ 2.1 |
| Screw fastening rear seat belt reel | 34 ÷ 42 | 3.5 ÷ 4.3 |
| Screw fastening rear seat belt runner | 34 ÷ 42 | 3.5 ÷ 4.3 |
| Screw fastening rear seat belt lower connections | 34 ÷ 42 | 3.5 ÷ 4.3 |
| Screws fastening outer pretensioner arming bracket for front seat belt | 3.5 | 0.35 |

General

Special tools play an important part in the maintenance of cars, since it is essential to ensure accurate, reliable and quick service.

It should be noted that the times scheduled for the various operations have been calculated assuming the use of these tools.

This manual lists and illustrates the special tools made expressly by the Manufacturer of overhauling, maintenance and repair operations on the car.

The tool identification code is formed of a new number with 10 figures and an old number with 1 letter and 5 figures:

Ex: 1.820.088.000
(A.2.0461)

Tools made recently only have the new number. The service network will be able to supply particular special tools, following the procedure already used c/o single Alfa Romeo Dealers.

Below we are listing the special tools used.

Group 00 - Boxer engines maintenance

| | |
|--------------------------|---|
| 1.822.103.000 | Ratchet wrench for removing/refitting spark plugs |
| 1.822.107.000 | Box wrench for removing/refitting spark plugs |
| 1.824.018.000 (C.2.0131) | Tool for checking belt tension |

Group 00 - 1929 Turbodiesel engine maintenance

| | |
|--------------------------|--|
| 1.820.095.000 (A.2.0468) | Flywheel stopper (to be used in the car) |
| 1.820.261.000 | Tappet cup retainer tool |
| 1.820.262.000 | Lever for changing tappet plates |
| 1.824.015.000 (C.2.0128) | Tool for checking belt tension |
| 1.824.016.000 (C.2.0129) | Rod for tightening timing gear belts |
| 1.824.017.000 (C.2.0130) | End piece for tensioning timing gear belt |
| 1.824.018.000 (C.2.0131) | Tool for checking belt tension |
| 1.860.931.000 | Tool for timing camshaft (from engine no. 1762798) |
| 1.860.933.000 | Tool for positioning 1st cylinder at T.D.C. (from engine n° 1762798) |

Group 00 - T. Spark 16V engines maintenance

| | |
|--------------------------|--|
| 1.825.013.000 (C.6.0183) | Tool for checking T.D.C. |
| 1.825.041.000 | Templates for timing camshafts (for 1970 - 1747 engines) |
| 1.825.042.000 | Templates for timing camshafts (for 1370 - 1598 engines) |

Group 10 - 8 Valve Boxer engines

| | |
|--------------------------|---|
| 1.820.012.000 (A.2.0195) | Support for overhauling cylinder heads |
| 1.820.016.000 (A.2.0226) | Support fork for overhauling cylinder heads |
| 1.820.059.000 (A.2.0378) | Flywheel stopper |
| 1.820.609.000 (R.4.0145) | Engine supports for overhauling on stand |
| 1.820.611.000 (R.4.0156) | Tool for removing/refitting power unit |

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| | |
|-----------------------------|---|
| 1.821.001.000 (A.3.0103) | Support for disassembling/reassembling valves |
| 1.821.053.000 (A.3.0311) | Puller tool for valve guide |
| 1.821.054.000 (A.3.0312) | Installing tool for valve guide |
| 1.821.055.000 (A.3.0314) | Installing tool for camshaft oil seal |
| 1.821.056.000 (A.3.0321) | Support for disassembling/reassembling valves |
| 1.821.058.000 (A.3.0324) | Lever for disassembling/reassembling valves |
| 1.821.063.000 (A.3.0337) | Installing tool for rear crankshaft oil seal |
| 1.821.064.000 (A.3.0338) | Installing tool for front crankshaft oil seal |
| 1.821.087.000 (A.3.0402) | Puller tool for crankshaft bush |
| 1.821.110.000 (A.3.0469) | Installing tool for valve guide oil seal |
| 1.822.008.000 (A.5.0195) | Counter-torque for camshaft pulleys |
| 1.822.010.000 (A.5.0198) | Wrench for cylinder head fastening screws |

Group 10 - 16 Valve Boxer engine

| | |
|-----------------------------|--|
| 1.820.012.000 (A.2.0195) | Support for overhauling cylinder heads |
| 1.820.016.000 (A.2.0226) | Support fork for overhauling cylinder heads |
| 1.820.059.000 (A.2.0378) | Flywheel stopper |
| 1.820.206.000 | Counter-torque for removing/refitting camshaft pulleys |
| 1.820.207.000 | Reaction plate for disassembling cylinder head valves |
| 1.820.609.000 (R.4.0145) | Engine supports for overhauling on stand |
| 1.820.611.000 (R.4.0156) | Tool for removing/refitting power unit |
| 1.821.001.000 (A.3.0103) | Support for disassembling/reassembling valves |
| 1.821.058.000 (A.3.0324) | Lever for disassembling/reassembling valves |
| 1.821.063.000 (A.3.0337) | Installing tool for rear crankshaft oil seal |
| 1.821.064.000 (A.3.0338) | Installing tool for front crankshaft oil seal |
| 1.821.104.000 (A.3.0450) | Installing tool for crankshaft bush |

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| | |
|-----------------------------|---|
| 1.821.176.000 (A.3.0641) | Puller tool for valve guide |
| 1.821.204.000 | Installing tool for front camshaft oil seals |
| 1.821.205.000 | Cage for disassembling/reassembling valves |
| 1.821.206.000 | Installing tool for valve guide oil seal |
| 1.821.207.000 | Installing tool for valve guide |
| 1.821.208.000 | Puller tool for valve guide oil seal |
| 1.822.101.000 | Extension wrench for slackening/screwing cylinder head fastening screws |

Group 10 - 1929 Turbodiesel engine

| | |
|-----------------------------|--|
| 1.820.012.000 (A.2.0195) | Base for cylinder head support tool |
| 1.820.145.000 (R.4.0178) | Engine support brackets |
| 1.820.225.000 | Support for removing/refitting power unit |
| 1.820.228.000 | Flywheel stopper (to be used on the bench) |
| 1.820.229.000 | Flange for removing timing gear drive pulley |
| 1.820.233.000 | Bracket for removing/refitting power unit |
| 1.820.253.000 | Support base for dial gauge for measuring precombustion chamber protrusions/recesses |
| 1.820.257.000 | Support for disassembling/reassembling valves |
| 1.820.258.000 | Cylinder head support tool |
| 1.820.261.000 | Retainer tool for tappet cups |
| 1.820.262.000 | Levers for changing tappet plates |
| 1.820.267.000 | Tool for disassembling valves |
| 1.820.277.000 | Graduated disk for angle torque tightening |
| 1.820.283.000 | Support (camshaft side) for removing/refitting power unit |
| 1.820.284.000 | Support for disassembling/reassembling valves |
| 1.820.286.000 | Retainer tool for injection pump pulley for slackening or tightening fastening nut |
| 1.820.287.000 | Retainer tool for camshaft during disassembly or reassembly of side supports |
| 1.821.058.000 (A.3.0324) | Lever for disassembling/reassembling valves |
| 1.821.122.000 (A.3.0520) | Cage for disassembling/reassembling valves |
| 1.821.161.000 (A.3.0617) | Mallet for removing timing gear drive pulley |
| 1.821.169.000 (A.3.0633) | Puller tool for track rod pins |
| 1.821.171.000 (A.3.0635) | Oil seal tool support grip |
| 1.821.176.000 (A.3.0641) | Puller tool for valve guide |
| 1.821.177.000 (A.3.0642) | Installing tool for valve guide |

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| | |
|-----------------------------|--|
| 1.821.203.000 | Installing tool for front crankshaft oil seal |
| 1.821.206.000 | Installing tool for valve guide seal cap |
| 1.821.208.000 | Puller tool for valve guide seal cap |
| 1.821.227.000 | Installing tool for rear crankshaft oil seal |
| 1.821.232.000 | Puller tool for injection pump drive pulley |
| 1.822.127.000 | Wrench for disassembling/reassembling injectors |
| 1.822.128.000 | Wrench for disassembling/reassembling precombustion chamber fastening bushes |
| 1.824.016.000 (C.2.0129) | Rod for tensioning timing gear belt |
| 1.824.017.000 (C.2.0130) | End piece for tensioning timing gear belt |
| 1.825.022.000 (C.6.0201) | Support tool for dial gauge for checking injection pump timing |
| 1.828.004.000 | Valve guide alesator |

Group 10 - T. Spark 16V engines

| | |
|-----------------------------|---|
| 1.820.011.000 (A.2.0192) | Valve supporting tool |
| 1.820.012.000 (A.2.0195) | Cylinder head supporting tool |
| 1.820.049.000 (A.2.0359) | Valve supporting tool nut |
| 1.820.145.000 (R.4.0178) | Engine bench brackets |
| 1.820.225.000 | Engine removal/refitting support |
| 1.820.258.000 | Cylinder head support |
| 1.820.267.000 | Valve removal/refitting shim |
| 1.820.277.000 | Scaled disc for angle tightening torque |
| 1.820.286.000 | Counter-torque pulleys for counter-rotating shafts |
| 1.820.617.000 | Crankshaft counter-torque pulley (for pre-modification engines) |
| 1.820.618.000 | Crankshaft rotating adapter |
| 1.820.619.000 | Crankshaft rear oil seal centring disc |
| 1.820.623.000 | Engine removal/refitting supports |
| 1.820.624.000 | Flywheel lock (for use on bench) |
| 1.820.626.000 | Ram fitting |
| 1.820.630.000 | Flywheel lock (for post-modification engine) |
| 1.821.058.000 (A.3.0324) | Valve removal/refitting lever |
| 1.821.124.000 (A.3.0522) | Valve removal/refitting support |
| 1.821.175.000 (A.3.0640) | Engine silent-block damper connecting rod extractor/taker-in |

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| | |
|-----------------------------|---|
| 1.821.176.000 (A.3.0641) | Valve guide extractor |
| 1.821.205.000 | Valve removal/refitting rack |
| 1.821.206.000 | Valve guide oil seal taker-in |
| 1.821.208.000 | Valve guide oil seal extractor |
| 1.821.228.000 | Camshaft oil seal taker-in on exhaust side |
| 1.821.247.000 | Crankshaft front oil seal and counter-rotating shaft oil seals taker-in |
| 1.821.251.000 | Counter-rotating shaft oil seal taker-in |
| 1.821.252.000 | Camshaft oil seal taker-in on intake side |
| 1.821.254.000 | Valve guide taker-in |
| 1.822.144.000 | Six-groove tool for oil sump removal/refitting |
| 1.822.145.000 | Six-groove tool for oil sump removal/refitting |
| 1.822.146.000 | Pulley support tool |
| 1.822.147.000 | Timing variator tool |
| 1.822.149.000 | Timing belt tension tool |
| 1.822.154.000 | Counter-rotating shaft belt tension tool |
| 1.822.155.000 | Timing pulley tool on intake side |
| 1.822.156.000 | Timing pulley tool on exhaust side |
| 1.825.013.000 (C.6.0183) | TDC check tool |
| 1.825.041.000 | Camshaft timing template (for 1970 - 1747 engines) |
| 1.825.042.000 | Camshaft timing template (for 1370 - 1598 engines) |
| 1.840.206.000 | Ram |

Group 10 - 1910 JTD engine

| | |
|---------------|--|
| 1.820.012.000 | Cylinder head overhaul support |
| 1.820.253.000 | Comparator support |
| 1.820.257.000 | Valve removal/refitting support |
| 1.820.258.000 | Cylinder head overhaul support |
| 1.820.262.000 | Tappet lowering lever |
| 1.820.267.000 | Valve removal/refitting shim |
| 1.820.503.000 | Comparator support |
| 1.820.618.000 | Crankshaft rotation flange |
| 1.820.619.000 | Crankshaft rear oil seal centring taker-in |
| 1.821.053.000 | Valve guide taker-in |
| 1.821.058.000 | Valve removal/refitting lever |
| 1.821.178.000 | Valve guide oil seal taker-in |
| 1.821.205.000 | Valve removal/refitting rack |
| 1.821.208.000 | Valve guide oil seal taker-in |
| 1.821.228.000 | Camshaft front oil seal taker-in |
| 1.821.247.000 | Crankshaft front oil seal taker-in |

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| | |
|---------------|---|
| 1.821.254.000 | Valve guide taker-in |
| 1.822.144.000 | Crankcase sump front and rear screw driver |
| 1.822.145.000 | Crankcase sump side screw driver |
| 1.822.146.000 | Driven toothed pulley anti-torque |
| 1.822.156.000 | Driven toothed pulley anti-torque |
| 1.860.846.000 | Flywheel lock tool |
| 1.860.905.000 | Engine timing template |
| 1.860.942.000 | Angle tightening goniometer |
| 1.860.724.001 | Lever to keep tappets down |
| 1.860.814.001 | Valve guide oil seal fastener |
| 1.860.821.001 | Connecting rod small end extractor/taker-in |
| 1.861.001.139 | Overhaul bench engine brackets |
| 1.870.671.000 | Diesel fuel feed pipe wrench |
| 1.870.672.000 | Diesel injector fitting wrench |

Group 10 - Engine supply (Boxer 8 Valve engines)

| | |
|-----------------------------|--|
| 1.822.135.000 | Tool for slackening fuel pump cover lockring |
| 1.824.110.000 (C.2.0056) | Plug for fluxing test |

Group 10 - Engine supply (Boxer 16V engine)

| | |
|-----------------------------|---|
| 1.822.135.000 | Tool for slackening fuel pump cover lockring |
| 1.824.002.000 (C.2.0014) | Four column vacuum meter for aligning and synchronising intake bodies |
| 1.824.110.000 (C.2.0056) | Plug for fluxing test |

Group 10 - Engine supply (1929 Turbodiesel engine)

| | |
|-----------------------------|--|
| 1.820.098.000 (A.2.0471) | Tool for checking "WASTE-GATE" overpressure valve |
| 1.820.286.000 | Retainer tool for injection pump pulley for slackening or tightening fastening nut |
| 1.821.167.000 (A.3.0631) | Wrench for slackening/tightening fuel suction device fastening lockring on tank |
| 1.821.232.000 | Puller tool for injection pump pulley |
| 1.822.127.000 | Wrench for disassembling/reassembling injectors |
| 1.824.016.000 (C.2.0129) | Rod for tensioning timing gear belt |
| 1.824.017.000 (C.2.0130) | End piece for tensioning timing gear belt |
| 1.825.022.000 (C.6.0201) | Support tool for dial gauge for checking injection pump timing |

Group 10 - Feed engine (T. Spark 16V engines)

| | |
|---------------|--|
| 1.820.079.000 | Tool for entrefer |
| 1.821.167.000 | Tool to unscrew the locking ring of the fuel pump cover (Specific for engines with injection - ignition system M1.5.5) |
| 1.822.135.000 | Tool to unscrew the locking ring of the fuel pump cover (Specific for engines with injection - ignition system M2.10.4) |
| 1.822.146.000 | Support for pulleys' wrenches |
| 1.822.156.000 | Pulley wrench for distribution |
| 1.822.161.000 | Wrench to remove tachimetric sensor |
| 1.860.955.000 | Gauge |
| 1.860.955.001 | Kit to check fuel pressure |
| 1.860.955.003 | Kit to check fuel pressure |
| 1.870.684.000 | Connector to release fuel system pressure |

Group 18 - Clutch (Boxer versions)

| | |
|---------------|-------------------------------|
| 1.820.059.000 | Flywheel stop |
| 1.820.108.000 | Centering tool of clutch disc |

Group 18 - Clutch (1929 Turbodiesel version)

| | |
|---------------|-------------------------------|
| 1.820.126.000 | Centering tool of clutch disc |
| 1.820.228.000 | Flywheel stop |

Group 18 - Clutch (T. Spark 16V versions)

| | |
|---------------|---|
| 1.820.124.000 | Centering tool of clutch disc (Specific for 1370 T. SPARK 16V with gearbox C.513.5 from the chassis nu°) |
| 1.820.126.000 | Centering tool of clutch disc |
| 1.820.624.000 | Flywheel stop |

Group 21 - Gearbox - Differential (Boxer version)

| | |
|---------------|---|
| 1.820.017.000 | Half rings to extract the internal guide of the pinion's rear bearing |
| 1.820.020.000 | Checking support of preload of the pinion's bearing |
| 1.820.021.000 | Tool to block the pinion |
| 1.820.024.000 | Extracting plate of spacer and internal guide of the pinion's bearing |
| 1.820.030.000 | Spacer to check preload of the pinion's bearings |
| 1.820.037.000 | Countertorque to join/disjoin the clamping screw of the primary shaft |
| 1.820.106.000 | Support to compare and determine the pinion's position |
| 1.820.107.000 | Pinion to determine the generator |

(Continued)

| | |
|-----------------------------|--|
| 1.820.146.000 (R.4.0189) | Support of gearbox - differential group for overhauling |
| 1.820.152.000 (C.5.0125) | Disc to check the bearings' preload |
| 1.820.208.000 | Support to join/disjoin gearbox-differential from the car |
| 1.820.226.000 | Support to join/disjoin gearbox-differential |
| 1.820.239.000 | Crosspiece supports to join/disjoin gearbox-differential |
| 1.820.581.000 | Crosspiece supports for the engine to join/disjoin gearbox-differential |
| 1.820.607.000 | Brackets couple to join/disjoin the gearbox |
| 1.821.034.000 (A.3.0290) | Mobile extractor of internal guides of the bearings in the differential box |
| 1.821.035.000 (A.3.0291) | Extractor of bushing and splash oil guard of the primary shaft |
| 1.821.036.000 (A.3.0292) | Introducing tool of the bearings' external guides |
| 1.821.037.000 (A.3.0293) | Extracting/introducing tool of the bearing's locking ring and ring odometer onto the differential shaft |
| 1.821.038.000 (A.3.0294) | Introducing tool of splash oil guard onto gearshifts control lever |
| 1.821.039.000 (A.3.0295) | Extracting plate of the differential shaft from its support |
| 1.821.040.000 (A.3.0296) | Extracting/introducing tool of external guide of the pinion's rear bearing and extractor of pinion/primary shaft |
| 1.821.041.000 (A.3.0297) | Extracting/introducing tool of the external guide of the pinion's front bearing |
| 1.821.042.000 (A.3.0298) | Extractor of the bearing locking ring of the differential shaft and odometer |
| 1.821.043.000 (A.3.0299) | Extractor of the bearing internal guide of the differential support |
| 1.821.044.000 (A.3.0300) | Introducing tool of the primary shaft and gear of the 5 th speed |
| 1.821.045.000 (A.3.0302) | Extracting/introducing tool of the bearing from the half axle hub |
| 1.821.046.000 (A.3.0303) | Guide to mount control lever pawls of 3 rd - 4 th and R.M. shifts |
| 1.821.047.000 (A.3.0304) | Guide to mount control lever pawls of 1 st - 2 nd and R.M. shifts |
| 1.821.048.000 (A.3.0305) | Introducing tool of internal guides of bearings onto the hubs of the differential box |
| 1.821.050.000 (A.3.0307) | Introducing tool of the bearing onto the primary shaft and the phonic wheel onto the primary shaft |
| 1.821.051.000 (A.3.0308) | Introducing tool of the shaft bushing |
| 1.821.052.000 (A.3.0309) | Introducing tool of the gearshift control lever pawls |
| 1.821.057.000 (A.3.0322) | Extracting/introducing tool of the flexible pins of the gearshift control lever |

(continued)

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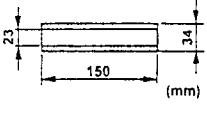
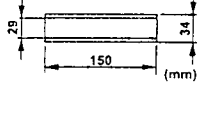
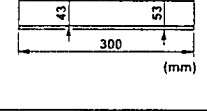
| | |
|--------------------------------------|---|
| 1.821.098.000 (A.3.0429) | Puller tool for gearshift control and selection rod oil seal |
| 1.821.099.000 (A.3.0430) | Installing tool for differential axle shaft cover oil seal |
| 1.821.107.000 (A.3.0452) | Puller tool for PTO shaft oil seal |
| 1.821.108.000 (A.3.0453) | Installing tool for PTO shaft oil seal |
| 1.821.114.000 (A.3.0490) | Puller tool for removing 4th speed gear from main shaft |
| 1.821.115.000 (A.3.0491) | Puller/installing tool for main shaft rear bearing |
| 1.821.116.000 (A.3.0492) | Puller tool for removing 4th speed gear from main shaft |
| 1.821.117.000 (A.3.0495) | Puller tool for 5th speed driving gear |
| 1.821.118.000 (A.3.0500) | Puller tool for main shaft rear bearing |
| 1.824.006.001 ÷ 006 (C.2.0037) | Weight for checking bearing preload (100gr - 150 gr - 200 gr - 300 gr - 1000 gr - 2000 gr) |
| 1.825.005.000 (C.6.0161) | Reference for defining pinion position dimension |
| 1.825.006.000 (C.6.0162) | Tool for checking pinion position |

Group 21 - Gearbox - Differential (1929 Turbodiesel and T. Spark 16V versions)

| | |
|---------------|---|
| 1.820.017.000 | Half rings for: - removing main shaft 4th speed driven gear - main shaft disassembly |
| 1.820.019.000 | Plate for removing transmission shaft 2nd and 3rd speed driven gears |
| 1.820.022.000 | Half plates for inserting main shaft front bearing inner race |
| 1.820.024.000 | Plate for supporting half rings and removing transmission shaft 1st speed driven gear |
| 1.820.085.000 | Tool for defining differential bearing shims |
| 1.820.146.000 | Gearbox support plate on rotary stand |
| 1.820.208.000 | Support for removing/refitting gearbox (Specific for Turbodiesel version) |
| 1.820.226.000 | Engine support |
| 1.820.227.000 | Brackets for removing/refitting gearbox |
| 1.820.229.000 | Flange for removing differential flange |
| 1.820.239.000 | Support for engine gearbox |
| 1.820.581.000 | Engine support crossrail |
| 1.820.623.001 | Support for removing/refitting gearbox (Specific for T. Spark 16V engines) |
| 1.821.003.000 | Drift for removing differential support bearing outer race |
| 1.821.028.000 | Installing tool for differential support bearing outer race |

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| | |
|--|--|
| 1.821.034.000 | Puller tool for differential bearings |
| 1.821.047.000 | Installing tool for 1st - 3rd - 5th speed control rod safety pawls |
| 1.821.049.000 | Half plates for installing main shaft rear bearing |
| 1.821.050.000 | Installing tool for 4th speed driven gear |
| 1.821.062.000 | Installing tool for differential bearings |
| 1.821.092.000 | Installing tool for 1st speed driven gear |
| 1.821.117.000 | Puller tool for removing main and transmission shaft front bearing inner race |
| 1.821.161.000 | Mallet for removing differential flange |
| 1.821.170.000 | Installing tool for differential carrier oil seal gearbox side |
| 1.821.171.000 | Grip for installing tools |
| 1.821.225.000 | Installing tool for differential carrier oil seal engine side |
|  | Installing tool for: main shaft front bearing inner race |
|  | Installing tool for: transmission and main shaft rear bearing |
|  | Installing tool for: synchroniser hub and transmission shaft 2nd and 3rd speed gears |

Group 21 - Gearbox - Differential (1370 T. Spark 16V version with gearbox C.513.5 from chassis no.)

| | |
|-----------------------------|--|
| 1.820.019.000 (A.2.0240) | Half plates for disassembling main and transmission shafts |
| 1.820.022.000 (A.2.0247) | Half plates for reassembling main shaft |
| 1.820.047.000 (A.2.0349) | Plate for disassembling main and transmission shafts |
| 1.820.085.000 (A.2.0458) | Tool for defining differential bearing shims |
| 1.820.146.000 (R.4.0189) | Gearbox support tool for disassembly on overhauling stand |
| 1.820.226.000 | Power unit support |
| 1.820.239.000 | Support for power unit |
| 1.820.581.000 | Power unit support crossrail |
| 1.820.605.000 | Half rings for disassembling main and transmission shafts |
| 1.820.623.000 | Support bracket for removing/refitting gearbox |

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| | |
|-----------------------------|---|
| 1.821.034.000 (A.3.0287) | Puller tool for differential support roller bearing outer race - gearbox cover side |
| 1.821.037.000 (A.3.0293) | Installing tool for components on transmission shaft |
| 1.821.049.000 (A.3.0306) | Half plates for disassembling main and transmission shafts |
| 1.821.092.000 (A.3.0412) | Installing tool for components on main shaft |
| 1.821.117.000 (A.3.0495) | Puller tool for transmission shaft front bearing inner race |
| 1.837.432.100 | Installing tool for components on transmission shaft |
| 1.860.917.000 | Puller/installing tool for differential support bearings |
| 1.860.978.000 | Support for removing/refitting front suspension crossmember |
| 1.870.007.000 | Grip for installing/puller tools |
| 1.875.017.000 | Tool for disassembling differential bearings |
| 1.875.018.000 | Tool for assembling differential bearings |

Group 27 - Axle shafts

| | |
|---------------|--|
| 1.820.082.000 | Pliers for installing joint boot fastening clamps |
| 1.820.084.000 | Pliers for installing joint boot fastening clamps |
| 1.821.161.000 | Mallet |
| 1.821.165.000 | Puller tool for CV joint |
| 1.860.996.000 | Installing tool for bearing on axle shaft (Specific for 1370 T. SPARK 16V with gearbox C.513.5 from chassis no.) |
| (*) | Half plates for removing axle shaft bearing (Specific for 1370 T. SPARK 16V with gearbox C.513.5 from chassis no.) |

(*): Not available at time of going to press.

Group 33 - Brakes

| | |
|---------------|---|
| 1.820.610.000 | Tool for retaining rear drum brake cylinder piston |
| 1.821.034.000 | Tool for adjusting position of front brake caliper piston |
| 1.822.108.000 | Tool for moving back rear brake caliper piston |

Group 41 - Steering system

| | |
|-----------------------------|---------------------------------------|
| 1.821.169.000 (A.3.0633) | Puller tool for steering side rod pin |
|-----------------------------|---------------------------------------|

Group 44 - Front suspension (Boxer versions)

| | |
|---------------|--|
| 1.820.047.002 | Plate for removing bearing inner race from wheel hub |
| 1.820.089.000 | Tool for front suspension spring compression |

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(Continued)

| | |
|-----------------------------|---|
| 1.820.223.000 | Half rings for removing bearing inner race from wheel hub |
| 1.820.226.000 | Engine support |
| 1.820.238.000 | Plate for front suspension spring compression |
| 1.820.239.000 | Supports for engine support crossrail |
| 1.820.247.000 | Tool for retaining front shock absorber stem |
| 1.820.581.000 | Engine support crossrail |
| 1.820.608.000 | Blocks for front suspension spring compression |
| 1.820.622.000 | Tool for angle torque tightenings |
| 1.821.045.000 | Tool for removing bearing outer race from wheel upright |
| 1.821.051.000 | Tool for: - removing wheel hub from upright - removing bearing inner race from wheel hub |
| 1.821.149.000 | Support for removing bearing outer race from wheel upright |
| 1.821.169.000 (A.3.0633) | Tool for disconnecting steering rod ball joint from wheel upright |
| 1.821.209.000 | Tool for: - inserting bearing in wheel upright - inserting hub in wheel upright |
| 1.822.134.000 | Wrench for slackening and tightening front shock absorber fastening nut |

Group 44 - Front suspension (1929 Turbodiesel and T. Spark 16V versions)

| | |
|-----------------------------|---|
| 1.820.047.002 | Plate for removing bearing inner race from wheel hub |
| 1.820.089.000 | Tool for front suspension spring compression |
| 1.820.223.000 | Half rings for removing bearing inner race from wheel hub |
| 1.820.238.000 | Plate for front suspension spring compression |
| 1.820.247.000 | Retainer ring for front shock absorber stem |
| 1.820.608.000 | Blocks for front suspension spring compression |
| 1.821.045.000 | Tool for removing bearing outer race on wheel upright |
| 1.821.051.000 | Tool for: - removing wheel hub from upright - removing bearing inner race from wheel hub |
| 1.821.149.000 | Support for removing bearing outer race from wheel upright |
| 1.821.169.000 (A.3.0633) | Tool for disconnecting steering rod ball joint from wheel upright |
| 1.821.209.000 | Tool for: - inserting bearing in wheel upright - inserting hub in wheel upright |
| 1.822.134.000 | Wrench for slackening and tightening front shock absorber fastening nut |

Group 44 - Rear suspension

| | |
|---------------|---|
| 1.822.003.000 | Tool for removing/refitting rear stiff axle |
|---------------|---|

Group 50 - Air-conditioning

| | |
|---------------|---|
| 1.822.111.000 | Socket wrench for pipe joints of cooling fluid |
| 1.822.112.000 | Box wrench for pipe joints of cooling fluid |
| 1.822.113.000 | Wrench for pipe joints of cooling fluid |
| 1.822.115.000 | Pin wrench for pipe joints of cooling fluid |
| 1.822.132.000 | Ratchet wrench to join/disjoin control motor of outer air door/ blow-by |
| 1.822.136.000 | Inserts to join/disjoin control motor of outer air door/blow-by |

Group 55 - Electrical system

| | |
|---------------|---|
| 1.822.103.000 | Ratchet wrench to join/disjoin spark plugs (Specific for Boxer 16V engine) |
| 1.822.107.000 | Socket wrench to join/disjoin spark plugs (Specific for Boxer 16V engine) |
| 1.822.138.000 | Wrench for locking nut of pulley alternator |

Group 70 - Bodywork

| | |
|---------------|---|
| 1.822.120.000 | Wrench for hinges' locking screws |
| 1.822.137.000 | Wrench to adjust side mobile glass |
| 1.832.010.000 | Blade to seal-cut glasses |
| 1.823.014.000 | Shaving knife for plastic elements |
| 1.823.015.000 | Shaving knife for plastic buttons |
| 1.823.019.000 | Blade to seal-cut glasses |
| 1.823.020.001 | 6-mm diameter pin for roof mounting |
| 1.823.020.002 | 8-mm pins for roof-mounting |
| 1.823.021.000 | Blade to seal-cut glasses |
| 1.823.022.000 | Blade to seal-cut glasses |
| 1.823.023.000 | Blade to seal-cut glasses |
| 1.823.025.000 | Inserts to remove plastic buttons |
| 1.823.027.000 | Bodywork protection plate from sealing cut of glasses |

THE FOLLOWING TOOLS REFER TO JOINING/DISJOINING OPERATIONS OF THE 1910 JTD VERSION, AS TO THE TOOLS FOR "ENGINE OVERHAULING" REFER TO PAGE 57

Group 00 - Engine maintenance

| | |
|---------------|------------------------------------|
| 1.820.262.000 | Lever to lower the tappets |
| 1.820.630.000 | Flywheel stop |
| 1.860.724.001 | Lever to hold the tappets lowered |
| 1.860.905.000 | Template for engine timing |
| 1.860.905.010 | Calibrated screw for engine timing |

Group 10 - Engine

| | |
|---------------|---|
| 1.820.225.000 | Base to join/disjoin boost engine |
| 1.820.630.000 | Flywheel stop |
| 1.822.144.000 | Spanner to unscrew/crew front and rear screws of the block sump |
| 1.822.145.000 | Spanner to unscrew/screw side screws of the block sump |
| 1.822.156.000 | Countertorque of the toothed pulley of the pipe |
| 1.825.215.000 | Thrust bearing extractor |
| 1.860.910.002 | Support to join/disjoin the boost engine |
| 1.860.942.000 | Goniometer for angle tightening of the cylinder head screws |
| 1.870.671.000 | Hexagon ring wrench for Diesel fuel feeding joints |
| 1.870.644.000 | Support to join/disjoin the boost engine |
| 1.870.644.001 | Support to join/disjoin the boost engine |

Group 10 - Feed engine

| | |
|---------------|--|
| 1.820.630.000 | Flywheel stop |
| 1.822.135.000 | Tool to remove the locking ring of the pump with level indicator control |
| 1.822.138.000 | Wrench to tighten the nut of the control pulley of the pressure pump |
| 1.860.954.002 | Extractor of the control pulley of the pressure pump |
| 1.870.671.000 | Hexagon ring wrench for Diesel fuel feeding joints |

Group 21 - Gearbox - Differential

| | |
|---------------|---|
| 1.820.124.000 | Centering to mount the clutch disc |
| 1.820.226.000 | Support of the boost engine group |
| 1.820.229.000 | Flange to extract differential flange |
| 1.820.239.000 | Small blocks to support the boost engine group |
| 1.820.581.000 | Crosspiece to support the boost engine group |
| 1.820.624.000 | Flywheel stop |
| 1.821.161.000 | Beater to extract the differential flange |
| 1.821.170.000 | Tool to introduce oil splash guard on the differential flange |
| 1.821.171.000 | Handgrip to introduce oil splash guard on the differential flange |
| 1.860.978.000 | Support to join/disjoin the crosspiece of front suspensions |
| 1.870.644.000 | Support to join/disjoin the gearbox |
| 1.870.644.001 | Support to join/disjoin the gearbox |
| 1.870.651.000 | Support brackets of the boost engine group |
| 1.870.668.000 | Extractor of the handgrip of the gearbox control lever |
| 1.870.974.000 | Spacer for bowden adjustment of the gearbox control |

MAINTENANCE OPERATIONS

Maintenance operations consist of checking and maintaining the efficiency of some parts of the vehicle which are believed to undergo wear and tear following their normal utilisation. Here follows the table showing the maintenance operations to be performed at given km intervals.



WARNINGS:

Precautions to be respected before the operations. The engine bay contains many moving parts, high temperature elements and high voltage wires which could be dangerous.

Carefully stick to the following indications:

- Switch the engine off and let it cool down.

Do not smoke or use unprotected flames. The presence of fuel may cause fire.

- Check the presence of fire extinguishers.



ATTENTION:

THE FOLLOWING MAINTENANCE GRID IS VALID TILL JUNE 1996.

| Operations to be performed at the km shown | | Km x 1.000 | | | | | | | | | |
|--|----------------------|-----------------|----|----|----|-----|-----|-----|-----|-----|-----|
| | | 20 | 40 | 60 | 80 | 100 | 120 | 140 | 160 | 180 | 200 |
| Replace engine oil and Filter (each year) check the lubricating circuit | Petrol versions | • | • | • | • | • | • | • | • | • | • |
| | Turbodiesel versions | EVERY 10.000 km | | | | | | | | | |
| Check the valves' play (not for engines with hydraulic tappets) | | | • | | • | | • | | • | | • |
| Replace control transmission belts | | | | | | | • | | | | |
| Check conditions of trapezoidal belts | | | • | | • | | • | | • | | • |
| Check conditions of Poly V belts | | | | | • | | | | • | | |
| Replace air filter cartridge | | | • | | • | | • | | • | | • |
| Replace fuel filter cartridge (turbodiesel versions) | | | • | | • | | • | | • | | • |
| Replace fuel filter cartridge (petrol version) | | | | | • | | | | • | | |
| Check functioning of oxygen sensor of exhaust Gases (lambda probe) | | | | | • | | | | • | | |
| Replace spark plugs (petrol version) | Boxer 8V | | • | | • | | • | | • | | • |
| | Boxer 16V | | | | | | • | | | | • |
| | T. Spark 16V | | | | | | • | | | | • |
| Replace antifreezing mixture | | | | | • | | | | • | | |
| Check oil level of gearbox/differential | | | | | • | | | | • | | |
| Check integrity of protecting bellows of half shafts, power steering and steering joints' caps | | | • | | • | | • | | • | | • |
| Check fuel and braking system's seal | | | • | | • | | • | | • | | • |
| Check parking brake stroke | | | • | | • | | • | | • | | • |
| Check oil level of the hydraulic torque converter | | | • | | • | | • | | • | | • |

PROTECTIVE PRODUCTS

| SUPPLIER | NAME | USE |
|----------|----------------------------|---|
| AREXONS | 1090 | Electrically-weldable protective products |
| BOSTON | -- | |
| GELSON | 2inc coat 2014 | |
| TEROSON | 2inc spray 11719N | |
| 3 M | Wed through seller 8625 | |
| AREXONS | -- | High thickness electrically-weldable products |
| BOSTON | -- | |
| GELSON | G 600 | |
| TEROSON | Teromix 6700 | |
| 3 M | 8625 | |
| AREXONS | Ferox 4144/5/6/7 | Oxide converters for boxed sections |
| BOSTON | -- | |
| GELSON | -- | |
| TEROSON | -- | |
| 3 M | 888 1E Protectiv | |
| AREXONS | Oto-boxed 1032 - 1033 | Protective waxes for inside boxed sections |
| BOSTON | Scudo car 700 CR | |
| GELSON | from 20351 to 20364 | |
| TEROSON | Terotex HV200 - HV400 | |
| 3 M | Protectiv 888 1 E | |

SEALANTS

| SUPPLIER | NAME | USE |
|----------|-------------------------------------|--|
| AREXONS | -- | Preformed sealant to be applied for cracks of above 2 mm |
| BOSTON | SOPL | |
| GELSON | G 600 - Gummigel | |
| TEROSON | Terostat II - 18123 | |
| 3 M | Preformed sealant from 8572 to 8574 | |
| AREXONS | Polyurethan 006 (1070) | Sealant for seams on bonnets and doors |
| BOSTON | Nex VS - B880 - 770 | |
| GELSON | Gelflex 336 - 339 | |
| TEROSON | Terostat 9120 (1K PUR) | |
| 3 M | Polyurethan Sealant from 8680 | |

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| SUPPLIER | NAME | USE |
|----------|-------------------------------------|---|
| AREXONS | -- | Preformed sealant to be applied for cracks of over 2 mm |
| BOSTON | SOPL | |
| GELSON | G 600 - Gummigel | |
| TEROSON | Terostat II - 18123 | |
| 3 M | Preformed sealant from 8572 to 8574 | |
| AREXONS | Polyurethan 006 (1070) | Sealant for seams on doors and bonnets |
| BOSTON | Nex VS - B880 - 770 | |
| GELSON | Gelflex 336 - 339 | |
| TEROSON | Terostat 9120 (1K PUR) | |
| 3 M | Polyurethan Sealant from 8680 | |

PRODUCTS FOR UNDERBODY PROTECTION

| SUPPLIER | NAME | USE |
|----------|--|---|
| AREXONS | Oto body 1037 - 1075 1080 - 1085 | P.V.C. sound and gravel proofing spray-on product (hidden areas) |
| BOSTON | Scudo car A1000 A3000 | |
| GELSON | Side scudex underbody da 20729 a 20764 | |
| TEROSON | Terotrend - 9320 | |
| 3 M | Polyurethan with two components 8660 | |
| AREXONS | Oto body 1031 - 1037 - 1075 | P.V.C. sound and gravel proofing spray-on product (visible areas) |
| BOSTON | Scudo car CR 700 | |
| GELSON | Side scudex 20721 a 20764 | |
| TEROSON | Terotex super 9320 - 3000 | |
| 3 M | Body seal 8860 | |
| AREXONS | Sound deadener 1033 | Bituminous protective wax for underbody |
| BOSTON | -- | |
| GELSON | Gel protex da 20300 a 20352 | |
| TEROSON | Terotex wax | |
| 3 M | Body seal 8860 | |

SOUNDPROOFING PRODUCTS

| SUPPLIER | NAME | USE |
|----------|---------------------------|--|
| AREXONS | - | Heat bonded soundproofing materials for car interior |
| BOSTON | - | |
| GELSON | Vibragel 20650 | |
| TEROSON | Terodem SP 100 - 300 | |
| 3 M | - | |
| AREXONS | - | Glued soundproofing materials for car interior |
| BOSTON | 8821 | |
| GELSON | Vibragel 20635 | |
| TEROSON | Terodem SP 200 | |
| 3 M | - | |
| AREXONS | - | Preformed soundproofing carpeting materials for car interior |
| BOSTON | - | |
| GELSON | Vibrafelt 20640 | |
| TEROSON | - | |
| 3 M | - | |
| AREXONS | - | Soundproofing product for foam treatment of boxed sections |
| BOSTON | Schiuma fix | |
| GELSON | Gel - foam 30750 | |
| TEROSON | Terostat schiuma pu spray | |
| 3 M | Polyschiuma 300 | |

ONE-LEVEL PRESSURE SWITCH SETTING

| | |
|--------------------------|----------------|
| Contact opening pressure | 1.8 ± 0.07 bar |
| Contact closing pressure | 3 ÷ 3.5 bar |







3-LEVEL PRESSURE SWITCH SETTING (TRINARY)

| | All models except T. Spark 16V and 1910 JTD | T. Spark 16V (with M2.10.3 injection - ignition system) |
|----------|--|--|
| 1. Level | Contact opening 2.2 ÷ 2.7 bar | Contact opening 2.45 ± 0.25 bar |
| | Contact closing 2.26 ÷ 2.94 bar | Contact closing 2.85 ± 0.50 bar |
| 2. Level | Contact closing 14.2 ÷ 16.18 bar | Contact closing 15.2 ± 0.98 bar |
| | Differential 3.92 ± 0.98 bar | Contact opening 11.28 ± 1.99 bar |
| 3. Level | Contact opening 25 ÷ 30 bar | Contact opening 25 ÷ 30 bar |
| | Differential 6 ± 2 bar | Contact closing 17 ÷ 26 bar |

4-LEVEL PRESSURE SWITCH SETTING

| | T. Spark 16V (with M2.10.4 and M1.5.5 injection - ignition system) 1910 JTD | |
|----------|--|-----------------|
| 1. Level | Contact opening | 2.45 ± 0.35 bar |
| | Contact closing | max 3.5 bar |
| 2. Level | Contact opening | 15 ± 1 bar |
| | Contact closing | 11 ± 2 bar |
| 3. Level | Contact opening | 20 ± 1.2 bar |
| | Contact closing | 16 ± 2.2 bar |
| 4. Level | Contact opening | 28 ± 2 bar |
| | Contact closing | 22 ± 4 bar |

COMPRESSOR

| |  TD |  JTD |    T. SPARK 16V |  T. SPARK 16V |
|---|--|---|--|---|
| Make and type | HARRISON V5 | SANDEN SD7V16 | NIPPONDENSO TV 14SC | NIPPONDENSO TV 12SC |
| Cylinders number | 5 | (*) | - | - |
| Cylinders diameter | 36.8 mm | (*) | - | - |
| Stroke | 28.4 mm | (*) | - | - |
| Theoretic capacity | 151 cm ³ at rev (max) | (*) | - | - |
| Max revolutions number | 7000 rpm | (*) | - | - |
| Deflector vanes number | - | (*) | 2 | 2 |
| Deflector vanes length/depth | - | (*) | 72.5 mm / 38.5 mm | 72.5 mm / 38.5 mm |
| Theoretic capacity | - | (*) | 127 cm ³ /rev | 127 cm ³ /rev |
| Working voltage electromagnetic coupling | 12 V | (*) | 12 V | 12 V |
| Absorbed power from electromagnetic coupling | - | (*) | 40 W (min) | 40 W |
| Working current electromagnetic coupling | 4.2 A | (*) | 2.2 A (min) | 2.2 A (max) |

(*) : Not available when this publication was sent to print.

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Alfa Romeo 

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WARNING:

The "145-146 - INSTRUCTIONS FOR REPAIR" manual refers to both models according to the following logic:

for the parts in common, the information refers to model 145, while for the parts specific to model 146 special pages, or, where necessary, whole groups, have been added.

For further details refer to the indexes (blue cards) at the beginning of each group.

INTRODUCTION

The "145-146 - Repair Instructions" Manual is composed of three volumes as follows:

- Volume I
 - Technical Data;
 - Engines;
 - Mechanical Groups.
- Volume II
 - Heating-Ventilation;
 - Bodywork.
- Volume III
 - Electric system;
 - Electrical system diagnosis.

For overhauling engines and mechanical groups refer to the following manuals:

- PA493600000000 REPAIR INSTRUCTIONS - ENGINE OVERHAUL.
- PA494200000000 REPAIR INSTRUCTIONS - OVERHAULING MECHANICAL GROUPS.

In order to facilitate consultation, the structure of the manual mirrors the functional groups already defined for the "Repair Flat-rate Manual" in use by Alfa Romeo Authorized Service Network.

The characteristic data and the tables for vehicles identification are contained in the "Technical Data" at the beginning of Volume I.

The "Model identification" tables should be consulted before carrying out repair work in order to identify the model of the vehicle, the engine size and the groups which form the vehicle.

How to use this manual

The aim of this manual is to supply the Alfa Romeo Service Personnel with a tool enabling them to rapidly identify faults and to render the corrective interventions precise and efficient.

The manual shows the procedures relative to the removal and refitting and dismantling operations and the checks relative to the various groups forming the vehicle.

The procedures are illustrated in detail as are the procedures for using the tools. An appropriate symbology and explanatory texts next to the fundamental technical drawings make a complete and rapid consultation of the manual possible.

The procedures illustrate complete component disassembly procedures and should only be carried out in their entirety when absolutely unavoidable. The procedures for "assembly" and "refitting" are normally obtained by reversing the procedure followed for disassembly or removal in reverse and only the reassembly procedures which are significantly different are illustrated.

For information relative to the electrical systems onboard the vehicle refer to section 55 "ELECTRIC SYSTEM" and to the successive 55 "ELECTRIC SYSTEM DIAGNOSIS" which gives the wiring diagrams and the description of each function, the connector tables, the location of the components, the tables for fault diagnosis and the technical data for checking the components.











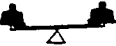















All the information contained in this manual is updated at the time of publication.

Alfa Romeo reserves the right to make any modifications to its products that it deems necessary without warning. However the technical information and updates to this manual will be supplied as soon as possible.

Symbology

A specific symbology has been used in this manual to permit a rapid identification of the main technical information supplied.

The list of symbols is given below.

| | | | | |
|---|------------------------|---|---|--------------------------------|
|  | removal/disassembly |  |  | exhaust |
|  | refitting/re-assembly |  |  | Lubricate only with engine oil |
|  | tighten to the torque | |  | left-hand thread |
|  | caulk nut | |  | torque for tightening in oil |
|  | adjustment/regulation | |  | engine r.p.m. |
|  | visual check | |  | ovalization |
|  | lubricate | |  | taper |
|  | weight difference | |  | eccentricity |
|  | angular value | |  | flatness |
|  | pressure | |  | diameter |
|  | temperature | |  | linear dimension |
|  | brake system air purge | |  | parallelism |
|  | surfaces to be treated | |  | service with grease |
|  | interference | |  | heating temperature |
|  | play | |  | seal |
|  | intake | |  | service with engine oil |
| | | |  | grease |
| | | |  | CAUTION! |
| | | |  | WARNING! |

Warnings for the operator

All the operations must be carried out with the greatest care to prevent damage occurring to the vehicle or persons.

- The use of Alfa Romeo specific tools are indicated for some procedures. These tools must be used to ensure safety and to avoid damaging parts involved in the procedure.
- To free parts which are solidly stuck together, tap with an aluminium or lead mallet if the parts are of metal. Use a wooden or resin mallet for light alloy parts.
- When dismantling ensure parts are marked correctly if required.
- When refitting lubricate the parts, if necessary, to prevent seizing and binding during the initial period of operation.
- Using adhesive paper or clean rags cover those parts of the engine which, following disassembly, present openings which may allow dust or foreign material to enter.
- When refitting, the tightening torques and adjustment data must be respected.
- When substituting the main component(s) the seal rings, oil seals, flexible washers, safety plates, self-locking nuts and all worn parts must also be replaced.
- Avoid marking the internal coverings in the passenger compartment.

Substitution of groups or disconnected parts must be carried out using original spare parts only. Only in this way can the suitability and perfect operation of each organ be guaranteed.

- The words **CAUTION** and **WARNING** accompany those procedures where particular care should be taken to prevent damage occurring to people or vehicle parts.



CAUTION:
used when insufficient care could cause damage to people



WARNING:
used when insufficient care could cause damage to the vehicle or its component parts.

- The safety regulations applied to workshops should be respected. Where necessary the manual also lists the specific precautions to be taken to prevent dangerous situations from arising.



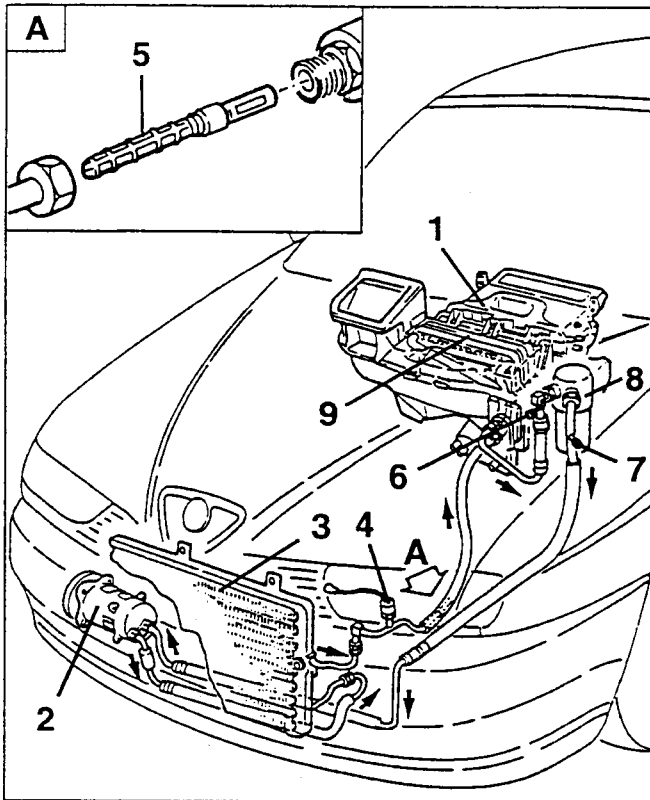
When using chemical products follow the safety indications given on the safety cards which the supplier is obliged to deliver to the user (in Italy in compliance with D.M. n.46/1992).

NOTE:

It is possible that for certain subjects were not completed in time for printing.

However these subjects are given and highlighted in the indices of the single groups.

It is the duty of the Technical Services to supply documentation regarding these subjects as soon as possible through updates or "Technical Bulletins".

SYSTEM

1. Heating and ventilation unit
2. Compressor
3. Condenser
4. Three-level pressure switch (trinary)
5. Expansion valve
6. Needle valve for charging/draining R134a on the low pressure pipe
7. Needle valve for charging/draining R134a on the low pressure pipe
8. Drier filter
9. Evaporator

DESCRIPTION

The heating and ventilation system is of the manual type with air conditioner.

The system can be represented by three sections:

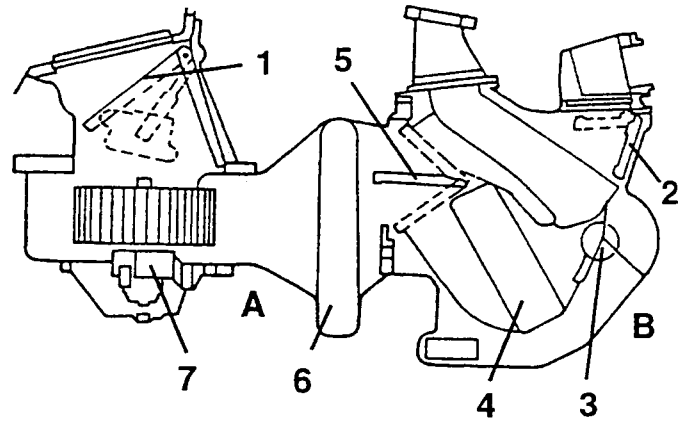
- a unit comprising the air ducting system and the heater - distributor unit.
- a closed circuit that generates cold (air conditioner).
- a control unit for certain functions of the system.

DUCTING SYSTEM AND HEATER - DISTRIBUTOR UNIT

Two types have been adopted, one described and illustrated in the various procedures with the words "two bowden" and in the other "three bowden". The variations in relation to the preceding type are given in a specific paragraph.

The assembly comprising the ducting system (A) and the heater- distributor unit (B) is shown in diagram form in cross-section in the figure below.

The ducting system (A) can in turn be divided into two parts, a lower and an upper section; one end of the latter is suitably shaped to be connected with the opening in the services box.



1. Outside air/recirculation vent
2. Upper distribution vent
3. Lower distribution vent
4. Heater radiator
5. Mixing vent
6. Evaporator
7. Fan

In the upper front section, in line with the outside air inlet, there is a second opening that communicates with the passenger compartment (air inlet for the recirculation function).

Between the two air inlet openings, inside the ducting system, there is a motorised flap which is duly directed to shut off one of the two openings. The flap is controlled through a leverage by an electric actuator (motor) fastened on the outside of the system.

Inside, opposite the air inlets there is the evaporator which represents the cooler.

The fan is fitted in the lower section in correspondence of the air inlets and it operates at different speeds.

Two bowdens are connected on the lefthand side of the heating- distributor unit which are operated by the controls and suitably direct the lower, upper and air mixing and distribution flaps and they also control the position of the tap fitted on the heater radiator inlet.

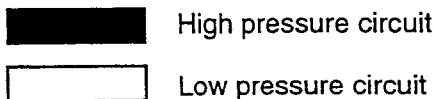
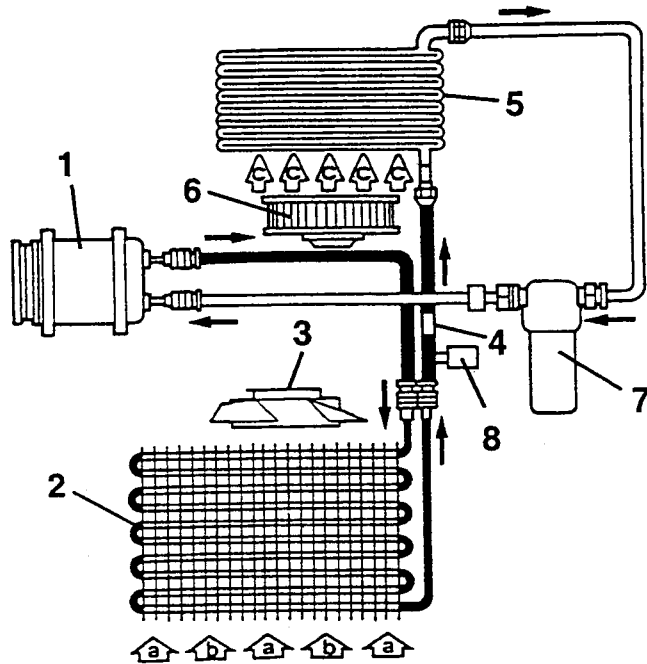
AIR CONDITIONING CIRCUIT

The circuit shown in diagram form in the figure below mainly comprises the following parts:

- a compressor fitted on the engine, which draws in the cooling liquid from the evaporator;
- a condenser, fitted in front of the engine cooling radiator (high pressure circuit);
- an evaporator in the ducting system;
- a drier filter.

The above parts are connected to one another by suitable hoses. On the hose connecting the condenser to the evaporator a three-level pressure switch has been fitted and this is the only part of the system with control and safety functions.

An expansion valve has also been inserted in the same hose.



- Flow of air to cool the condenser leading from the front grille when the vehicle is on the move.
- Flow of air to cool the condenser generated by the corresponding fan when the car is at a standstill or travelling slowly (queues).
- Flow of air for the evaporator generated by the corresponding fan installed in the heater - distributor unit.

- Compressor
- Condenser
- Condenser fan
- Expansion valve
- Evaporator
- Evaporator fan
- Drier filter
- Three-level pressure switch (trinary)

The air conditioner unit cools and dehumidifies the air before it reaches the passenger compartment. It operates according to a common refrigeration cycle containing R134a fluid exploiting the change from liquid to gas and viceversa to absorb and release a considerable amount of heat.

During operation, two pressure levels are created which are maintained on one side by the compressor and on the opposite side by the expansion valve at the evaporator inlet. Two needle valves are fitted on the hoses for charging and draining the system.

The refrigerating fluid leaves the compressor as a gas at high temperature and high pressure. It then enters the condenser where it is cooled and comes out as a liquid.

The expansion valve located on the evaporator inlet atomizes the fluid and lowers its pressure which leads to a decrease in its temperature.

The fluid which is still in a liquid state enters the evaporator where it is vapourized absorbing heat from the air directed onto the fins of the fan.

The air in contact with the cold walls of the evaporator loses a high percentage of its humidity which, when condensed is drained outside the car through a special drainage tube.

The fluid in a gaseous state leaves the evaporator and passes into the drier filter which absorbs any particles of water which, if allowed to continue around the circuit would freeze and block the expansion valve reducing or eliminating the efficiency of the cycle.

A three-level pressure switch is inserted in the high pressure circuit of the refrigerating fluid near the drier and controls the turning on and off of the compressor.

Refrigerating fluid

For the above air conditioning system the new **ecological fluid R134a** is used which does not contain chlorofluorocarbon (CFC), one of the chemical agents that causes the reduction of the ozone layer of the atmosphere.

The systems working with R134a are readily distinguished by the wording "R134a" printed on its main components.



Refrigerating fluid R134a cannot be mixed with the Freon 12 used in the conditioning systems of the previous cars; therefore, NEVER USE FREON 12 FOR ANY REASON WHATSOEVER for the conditioners with R134a.

All the components of the system are specifically for the use of R134a and ARE NOT INTERCHANGEABLE with those of the cars using R12.

The draining/recovery station is specifically for R134a fluid.

(Refer to the specific Tool Bulletins for further details).

CONTROL UNIT

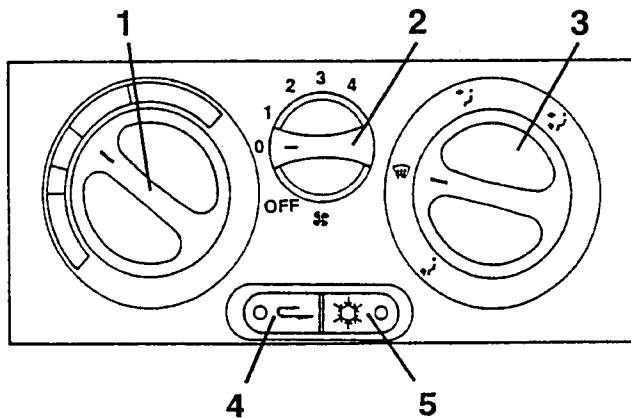
Positioned on the right-hand side of the upper cross-member this momentarily deactivates the air conditioning system under some conditions of engine operation where the engine is required to deliver maximum power to the wheels thus eliminating the absorption of power by the compressor (for example, during overtaking, rapid acceleration etc.).

The control unit activates the following operating logic, or rather, two different operating logics at low and at high rpm.

- below 2000 rpm, as soon as the full load contact closes, the compressor electromagnetic joint is de-energized and it is re-connected as soon as the switch opens;

- above 2000 rpm the compressor supply is cut off for only 8 sec. after which it is restored.

a thermal contact is fitted on the thermostatic cup which cuts off the compressor if the engine temperature reaches over 111°C.

CONTROL PANEL**1. Air temperature adjustment knob**

The heating is shut off when the knob is turned completely to the left; the temperature of the air is gradually increased turning the knob rightwards: maximum heating is obtained when the knob is turned completely to the right.

2. Fan control knob

When this is on 0 the fan is shut off; to switch it on, turn it clockwise and set it on the speed required.

The flow of air to the passenger compartment can be shut off setting the above knob to the OFF position.

3. Air flow distribution control knob

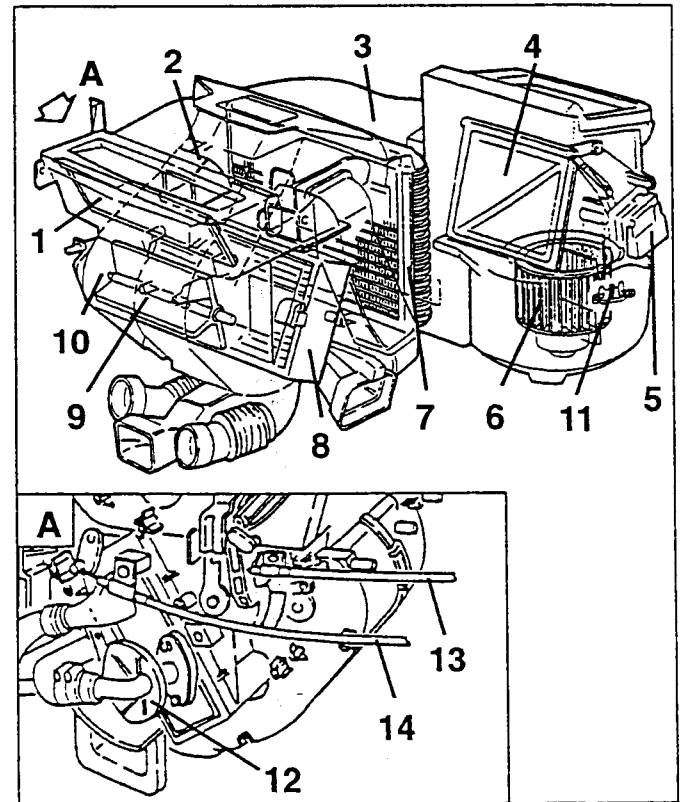
This distributes the air flow among the different vents.

4. Outside air or recirculation control button

When this is pressed it shuts off the outside air inlet and admits recirculation air.

5. Air conditioning control button

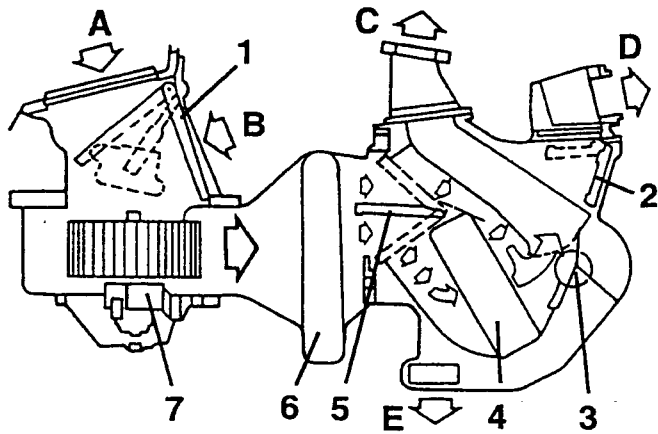
This is pressed to turn on the manual air conditioner.

IDENTIFICATION AND LOCATION OF THE COMPONENTS IN THE DUCTING SYSTEM AND HEATER - DISTRIBUTOR UNIT

1. Upper distribution vent
2. Mixing vent
3. Ducting system
4. Outside air/recirculation flow adjustment vent
5. Electric actuator for outside air/recirculation flow adjustment vent
6. Electric fan
7. Evaporator
8. Heater radiator
9. Lower distribution vent
10. Heater-distributor unit
11. Fan speed resistance
12. Heater radiator coolant inlet tap
13. Distribution vents control cable
14. Mixing vent and heater radiator inlet tap control cable

PATH OF THE AIR IN THE DUCTING SYSTEM AND HEATER-DISTRIBUTOR UNIT

The flow of outside air (A), see diagram below, is ducted to the heater-distributor unit passing through the motorized adjustment flap (1), the fan (7) and the evaporator (6) where, if the conditioner is operating, it is cooled and dehumidified. When the recirculation function is activated the flow of air (B) leads directly from the passenger compartment.



- A. Outside air flow
- B. Recirculation air flow
- C. Air flow from windscreen vents
- D. Air flow from front, centre and side vents
- E. Air flow from vents front and rear seat foot level
- 1. Outside air and recirculation air flow adjustment flap
- 2. Upper distribution vent
- 3. Lower distribution vent
- 4. Heater radiator
- 5. Mixing vent
- 6. Evaporator
- 7. Electric fan

Depending on the position of the mixing vent (5), the flow of air leading from the evaporator (6) is all sent to the distribution vents (2 and 3) or it passes either partially or totally through the heater radiator (4) and then to the distribution ports (2 and 3).

Depending on the position of the upper (2) and lower (3) distribution vents, the flow of air is directed to the various outlets and vents.

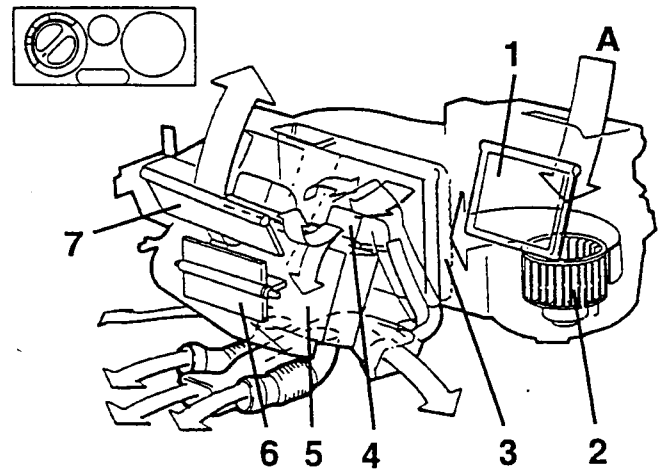
Generally, the fan is used with recirculation air under the following two conditions:

- when the environment outside the car is polluted (queues, tunnels, etc.);
- when it is necessary to lower the temperature in the passenger compartment quickly (prolonged parking in direct sunlight during the summer months).

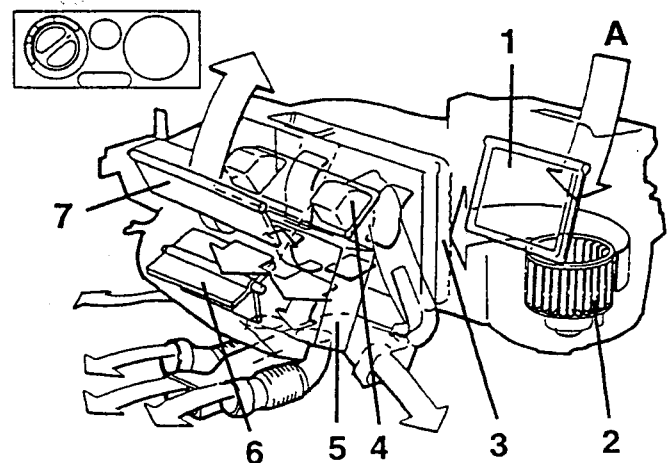
VIEWS OF THE AIR DISTRIBUTION FLOWS IN THE AIR DUCTING SYSTEM AND HEATER-DISTRIBUTOR UNIT

In the following diagrams the outside air/recirculation adjustment vent is shown in the position for admitting outside air (A).

Coldest position: the flow of outside air (A), passes through the fan (2), reaches the evaporator (3), finds the mixing vent (4) in the position that shuts off the heater radiator (5), so it wholly by-passes it and reaches the lower distribution vent (6) and the upper one (7) from where it is directed to the various vents and outlets depending on the position of the distribution knob.

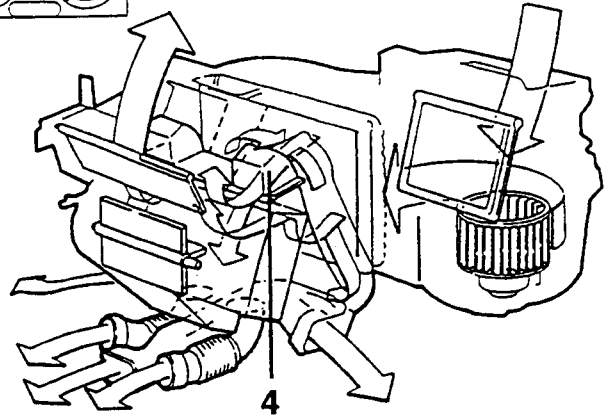
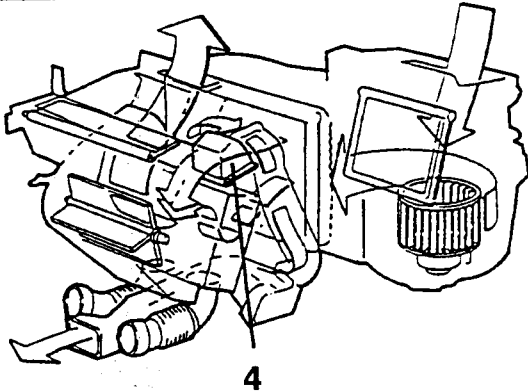


Warmest position: the flow of outside air (A), passes through the fan (2), reaches the evaporator (3), and finds the mixing flap (4) which directs it wholly onto the heater radiator (5), it reaches the lower distribution vent (6) and the upper one (7) from where it is directed to the various vents and outlets in the passenger compartment depending on the position of the distribution knob.

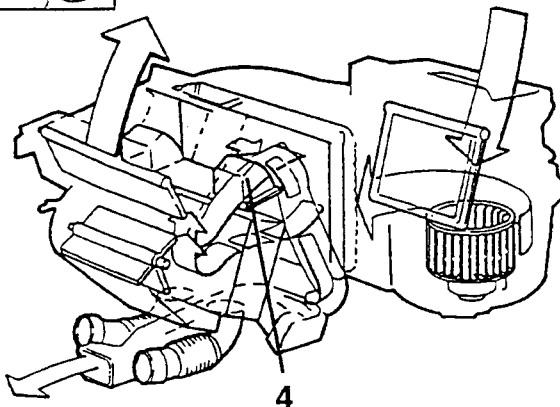
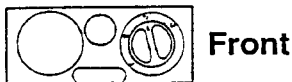
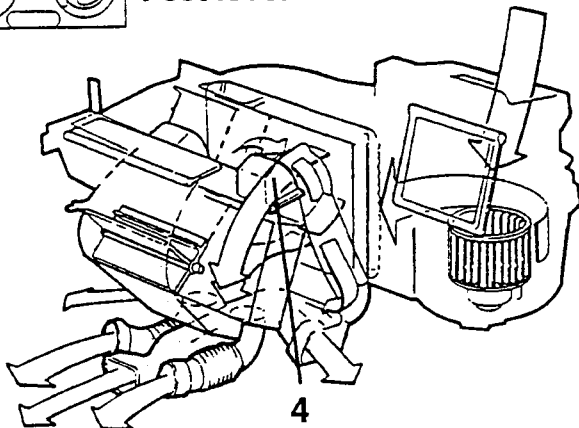
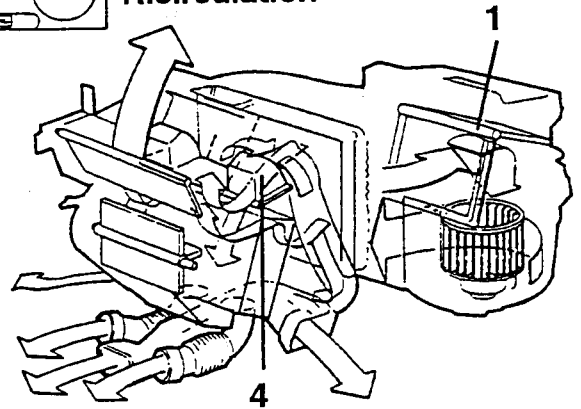


Distribution of the air flow in relation to the positions of the air distribution control knob

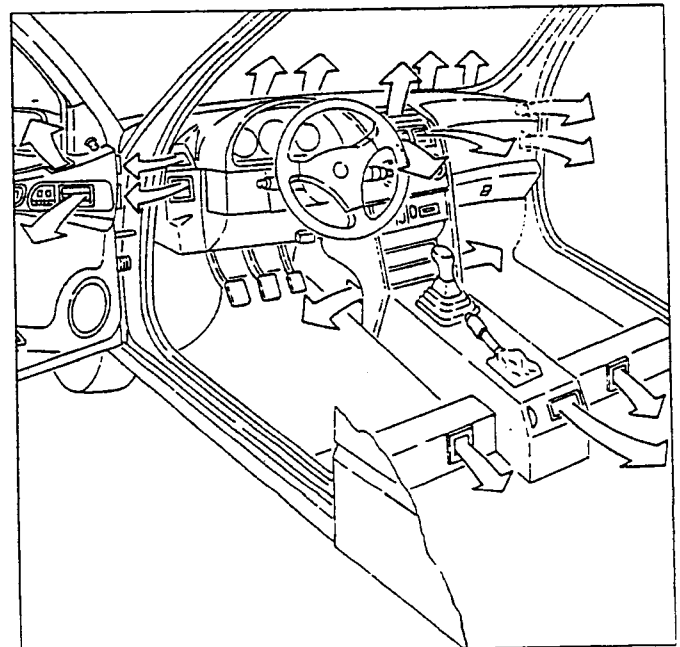
In the following diagrams the mixing vent (4) is shown in an intermediate position between warmest and coldest extremes (mixed air).



In the following diagram the mixing vent (4) is still shown in the mixed air condition and the recirculation flap (1) completely shutting off the outside air (recirculation air inlet (B)).



AIR FLOW DISTRIBUTION IN THE PASSENGER COMPARTMENT



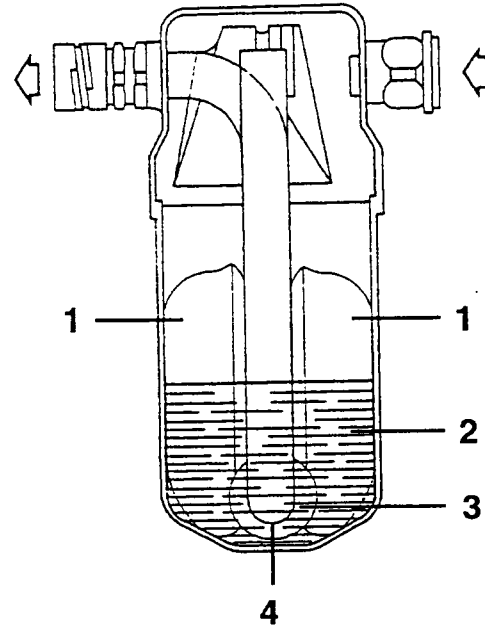
DESCRIPTION OF THE MAIN COMPONENTS OF THE AIR CONDITIONING SYSTEM

EVAPORATOR

The evaporator is the second heat exchanger of the system and it is formed of aluminium pipes with aluminium fins which increase the heat exchange surface. The evaporator inlet and outlet ducts are welded to the assembly of pipes which forms it. The evaporator is chemically treated to protect it from corrosion. It is the cooling element of the system and it can be crossed by either air leading from the passenger compartment (recirculated) which is always colder and dehumidified, or by outside air to change the air inside the passenger compartment.

As the temperature of the outside or recirculated air that crosses the evaporator is always higher than that of the R134a at low pressure and temperature inside it, this causes evaporation and the change to gas (still at low pressure).

At the same time, the air around the fins of the evaporator is cooled and dehumidified. The humidity that condenses on the evaporator fins is collected and drained off the car.



1. SILICAGEL sachets
2. R134a refrigerant in the liquid state
3. Filter
4. Hole for oil return to the compressor

DRIER FILTER

The drier filter shown schematically in cross-section, is connected by a pipe to the evaporator outlet from which it receives the R134a (mostly in the gaseous state with a minimal quantity of liquid) and the antifreeze oil.

The drier filter carries out different tasks, foremostly that of a separator between the refrigerant in gas state and that in liquid form.

It also acts as a reserve reservoir in which a large amount of the R134a is stored (in the liquid state) in the circuit.

It also serves as a drier through two sachets of SILICAGEL located in the lower section of the filter, which dry any particles of humidity in the system.

For this reason, these accumulators should be carefully stored in a dry place and kept completely sealed until the time of installation.

In the lower section of the shaped pipe which is located inside the accumulator and communicates with its outlet union, there is a hole which serves to ensure that the antifreeze oil returns to the compressor. On this shaped pipe near the oil hole, there is a metal mesh filtering ring.

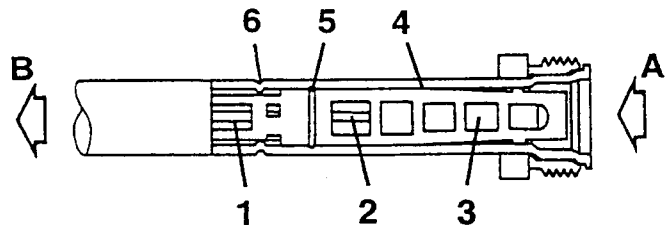
EXPANSION VALVE

The expansion valve, which may be more aptly called an expansion tube, is inserted in the evaporator inlet duct.

This valve, shown in the diagram below, is cylindrical in shape and made from plastic except for the inside of the tube which is metal.

The initial and final sections of the valve are made of very fine metal netting with very small meshes which serve as filters, while the tube has a determinate inside diameter, calibrated to admit the necessary volume of refrigerant fluid when the compressor is operating.

On the outside of the valve there is a rubber ring which seals the inner surface of the evaporator inlet duct.



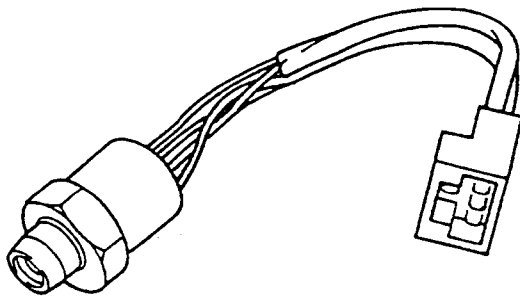
1. Outlet net filter
2. Expansion tube
3. Inlet filter net
4. Evaporator inlet duct
5. Seal ring (O-Ring)
6. Expansion valve retainment rolling

The expansion tube separates the high pressure side of the system from the low pressure side and after it the high pressure R134a in the liquid state leading from the condenser expands, lowering the pressure and temperature without changing its state. When the compressor is turned off, the refrigerant on the high pressure side flows through the expansion tube to the low pressure side until the two pressures are levelled; this reduces the amount of torque required to re-start the compressor.

THREE-LEVEL PRESSURE SWITCH (TRINARY)

The purpose of the three-level pressure switch is to operate the condenser and radiator fan when the car is at a standstill or moving slowly in a queue and the R134a needs to be condensed by forced ventilation as the flow of air caused when the car is travelling at speed fails to be generated.

It also has the task of de-energizing the electromagnetic joint of the compressor pulley when the pressure (high pressure side), reaches dangerous limits despite the action of the condenser and radiator fan or due to a failure, or when, due to a leak or because the outside temperature is below 10°C (and the thermal load is not enough to evaporate the R134a), the pressure is below 2,5 bar.



CONDENSER

The condenser is a heat exchanger formed of copper or aluminium pipes with aluminium fins which increase the thermal exchange surface.

The R134a in gaseous state crossing the coils of the condenser changes to the liquid state (on average at a temperature of 60°C). Insufficient thermal exchange in the system increases the pressure in the system and prevents the complete condensation of the R134a: thus the expansion valve would still receive

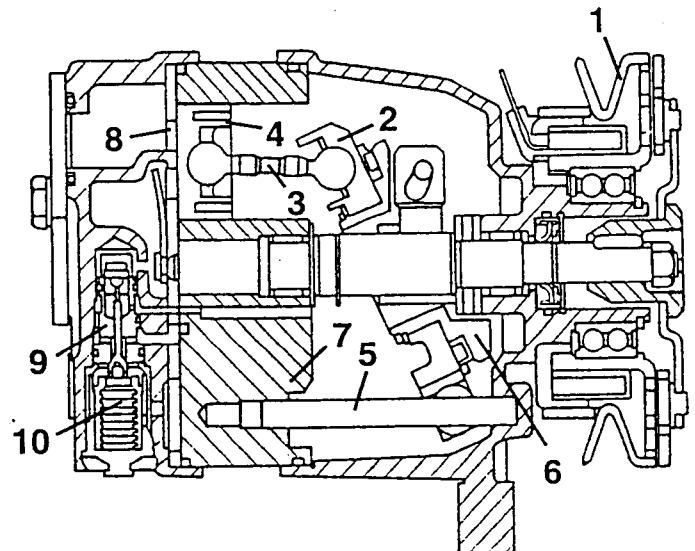
gassy fluid that would considerably reduce the cooling capability of the system.

The condenser is lapped by the air produced as the car travels forward or by the air produced by the special fan when the car is at a standstill or moving slowly in a queue.

COMPRESSOR

The variable-displacement HARRISON V5 compressor shown in diagram form below comprises:

- a block (7) in which the liners on which the pistons (4) run are machined.
- a unit formed of a shaft on which a tilting plate (6) is fitted, on which, by the interposition of roller bearings, a disk (2) rotates guided by a pin (5) integral with the five connecting rods (3) which operate the pistons (4)
- a cylinder head in which the intake and delivery manifolds and the adjustment valve seat (9) are machined
- a plate (8), interposed between the block and the cylinder head on which the intake and delivery valves are machined
- a pulley assembly with electromagnetic joint (1).



1. Pulley with electromagnetic joint
2. Disk
3. Connecting rod
4. Pistons
5. Disk guide pin
6. Sloping plate
7. Block
8. Plate with intake and delivery valves
9. Adjustment valve
10. Adjustment valve control bellows

The reciprocating motion needed to make the pistons run in their liners is obtained through the rotary motion of the tilting plate (6) while the changed displacement depends on the stroke of the pistons and is obtained by the changing of the angle of inclination of the control disk (2) of the connecting rods (3).

The inclination of this plate depends on the pressure difference between the intake duct and the inside of the compressor. This difference is detected by the bellows (10) and causes the actuation of the adjustment valve (9) and the consequent movement of the disk (2)

When the need for conditioned air is high, the adjustment valve (9) sets itself to disclose a gap that connects the intake side with the inside of the compressor; since in this case there is no pressure difference, the compressor works at the highest displacement corresponding to the positioning of the disk as described in the previous section.

When the need for air is lower, the valve sets itself to connect the delivery section with the block and it simultaneously annuls the passage between the latter and the intake side activated previously.

The angle of inclination of the disk carrying the connecting rods is determined by the balance of the two pressures.

A slight difference between the intake pressure and the pressure in the compressor creates a resulting force on the pistons which causes the disk to tilt on its fulcrum pin.

The vertical position of the disk corresponds to displacement of almost nil, thus R134a compression close to zero.

In the compressor when the piston moves away from the head during its stroke it generates a vacuum in the space above.

The difference in pressure causes the R134a in gas state to open the intake valve and fill the cylinder. As soon as the piston begins its stroke towards the head, the intake valve closes and the R134a is compressed until its pressure opens the exhaust valve (delivery).

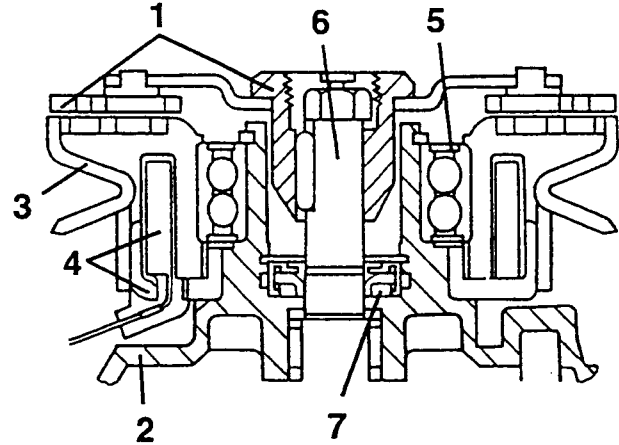
The R134a is at pressure of between $9,81 \div 19,6$ bar ($10 \div 20$ kg/cm²) and a temperature of $80^\circ \div 100^\circ\text{C}$ can therefore be sent to the condenser.

TRANSMISSION OF MOTION TO THE COMPRESSOR

The rotary motion required to operate the compressor is developed thanks to the presence of the pulley/electromagnetic joint assembly shown in the diagram which is formed of the following:

- a plate (1) keyed onto the compressor shaft (6)

- a rotor unit with pulley (3) turning on ball bearings (5)
- an electromagnet (4) controlled by the activation of the air conditioning system.



1. Disk keyed onto the compressor shaft
2. Front compressor support
3. Rotor unit with pulley
4. Electromagnet
5. Ball bearings
6. Compressor shaft
7. Seal

When the air conditioning system is not operating, the pulley (3) operated by the connection belt with the crankshaft idles on the bearing (5) keyed onto the front compressor support (2).

When the air conditioning system is turned on, an electric signal energizes the electromagnet which attracts the disk (1) against the pulley (3) which causes the compressor shaft to turn.

The result is the special feature of this system compared with conventional rotary types, which is the possibility of not requiring the continual engagement/disengagement of the electromagnetic joint, resulting in excessive stresses on same, to activate the compressor.

In fact, the latter, always rotating, alters its operating condition by changing, as described previously, the displacement according to the amount of conditioned air required.

CAUTIONS FOR REMOVAL AND REFITTING

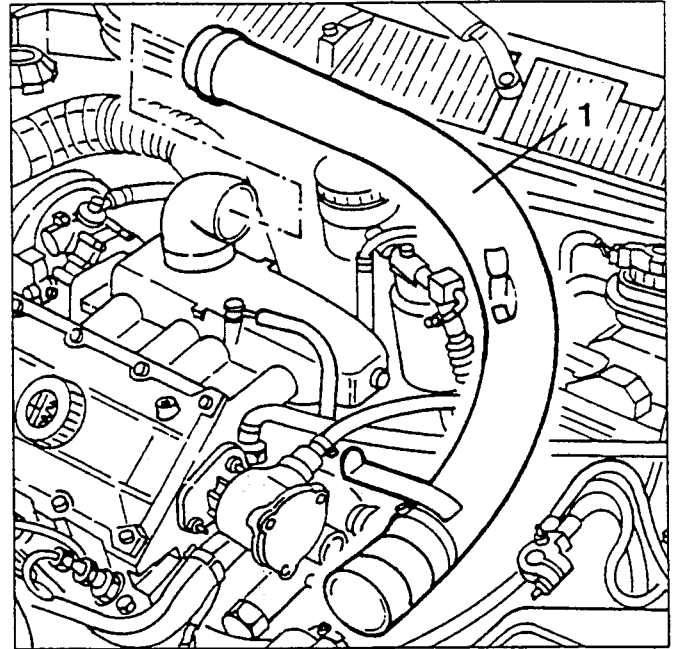
During servicing operations, when the components of the air conditioning system are disconnected, suitably plug the disconnected unions to prevent any damp and dirt from getting into the system.

When refitting the pipe unions always change their O-rings.

Lubricate the threads of the pipe unions with the specified antifreeze oil and tighten them to the specified torque.

In the event of oil leaks from the system during servicing operations top up the system taking account of the estimated amount lost due to leaks.

1. Slacken the fastening clamp and remove the stiff air inlet pipe.



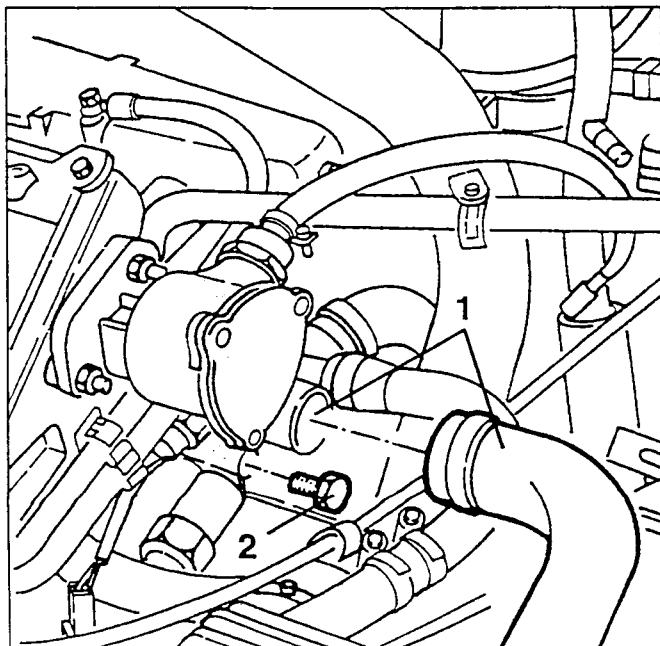
DUCTING ASSEMBLY AND HEATER - DISTRIBUTOR UNIT (TWO BOWDEN)

REMOVAL/REFITTING

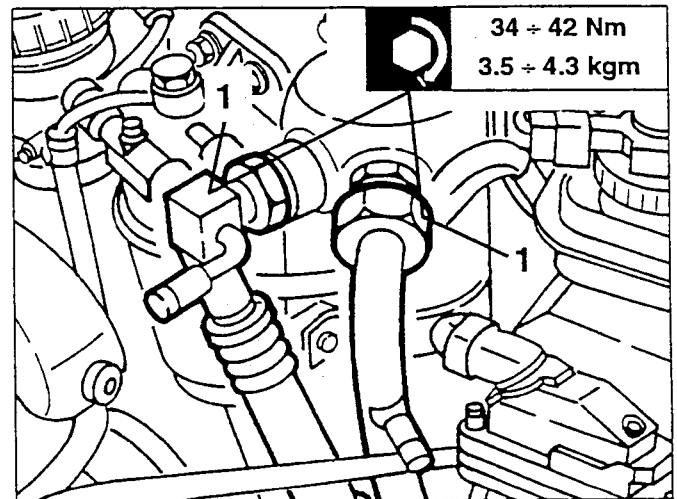
- Drain the fluid from the air conditioning system (see the specific paragraph).

- Remove the battery (see GROUP 55).

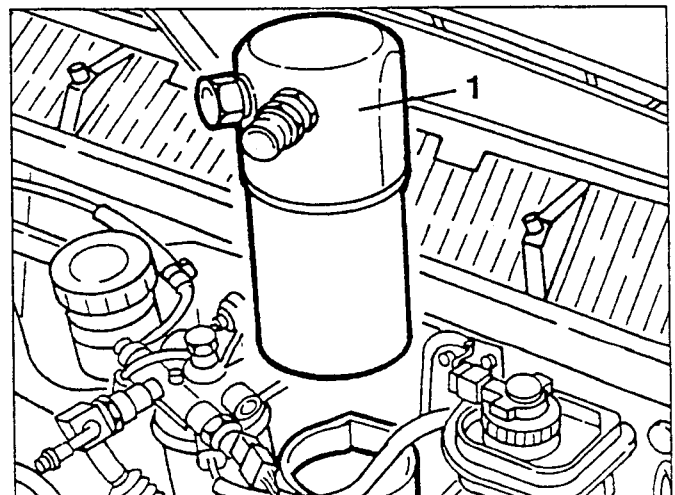
1. Disconnect the radiator delivery sleeve from the thermostatic cup and recover the coolant that flows out.
2. Slacken the screw fastening the stiff air inlet pipe.



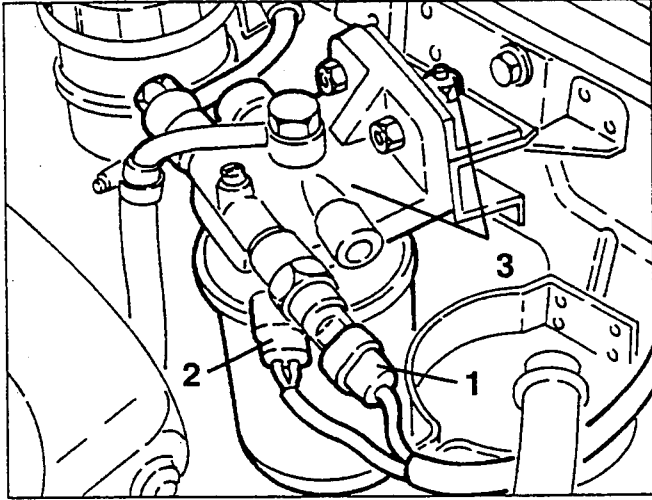
1. Disconnect the refrigerant fluid inlet and outlet pipes from the drier filter.



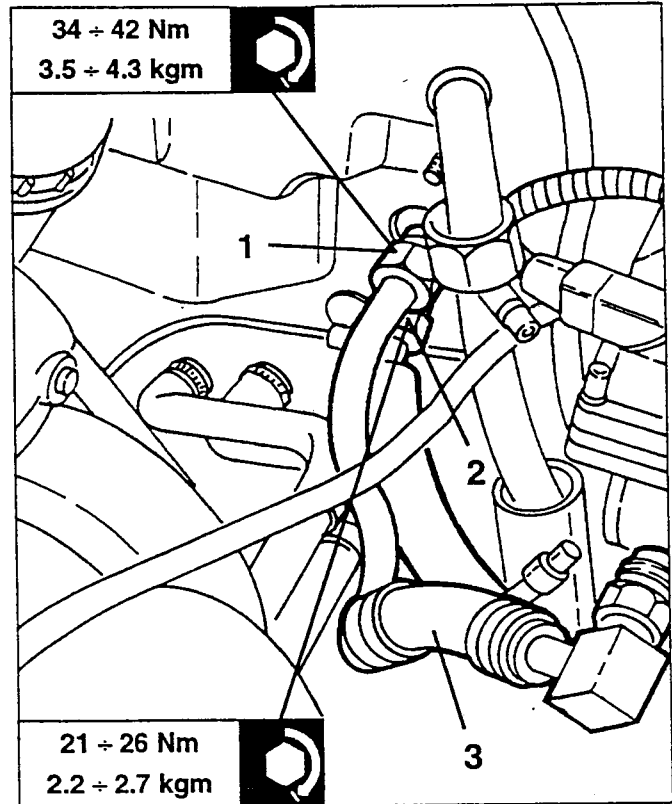
1. Slacken the support clamp and remove it slipping it off upwards.



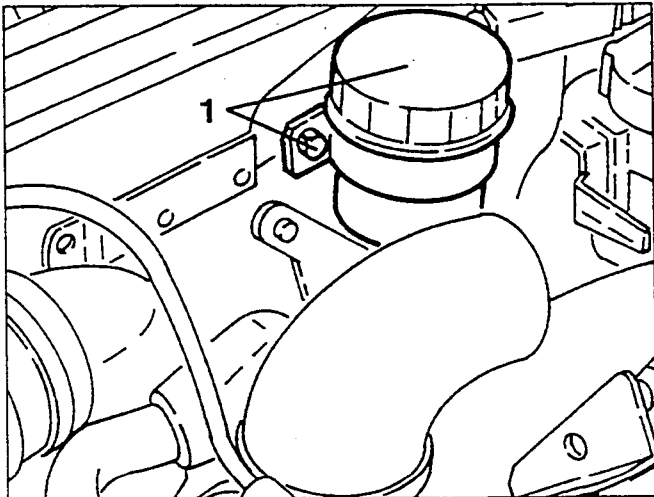
1. Disconnect the electrical connection of the fuel pre-heating device control sensor.
2. Disconnect the electrical connection of the supply to the fuel pre-heating device.
3. Slacken the fuel filter fastening nut, then move it to one side without disconnecting the pipes.



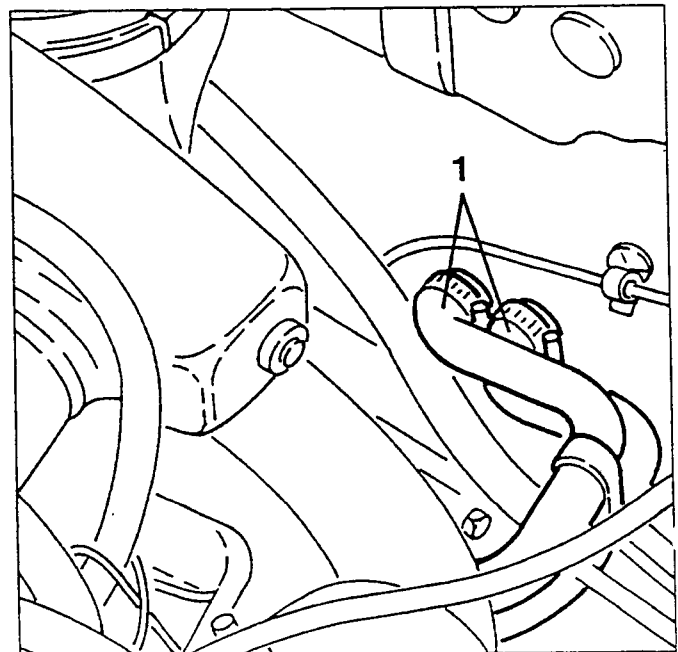
1. Using wrenches N° 1.822.112.000 and N° 1.822.115.000 disconnect the fluid outlet pipe from the evaporator.
2. Using wrenches N° 1.822.111.000 and N° 1.822.113.000 disconnect the fluid inlet pipe from the evaporator.
3. Retrieve the evaporator connection pipe to the drier filter.



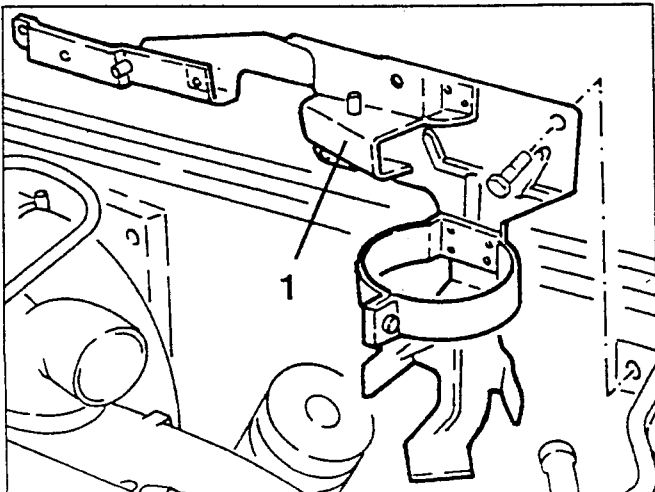
1. Slacken the power steering reservoir nut, then move it to one side without disconnecting the pipes.



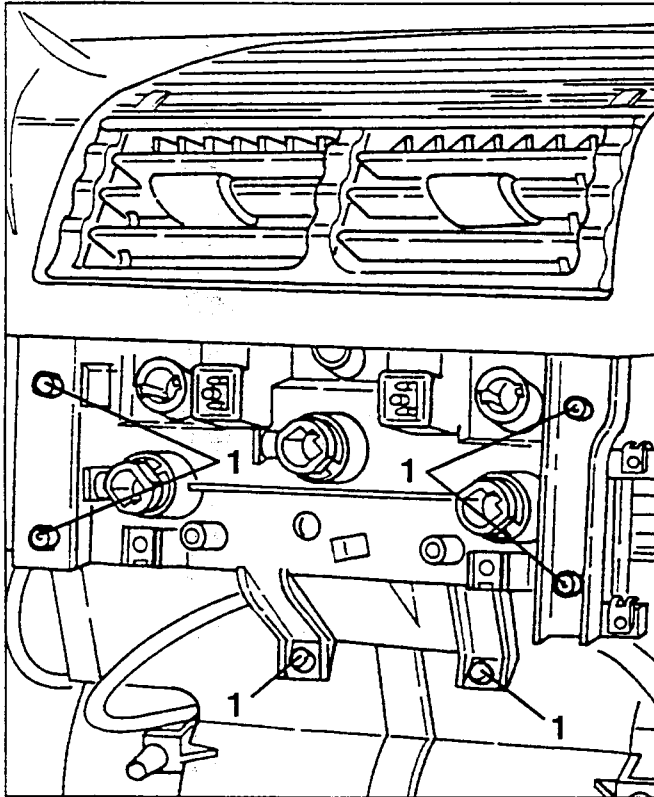
1. Disconnect the two engine coolant radiator delivery and return pipes.



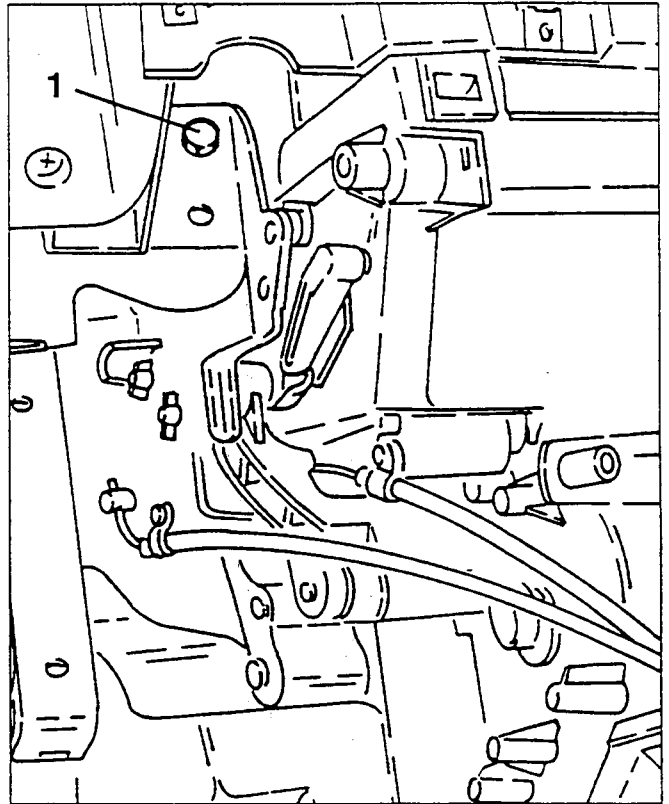
1. Slacken the four fastening screws and remove the support bracket.



- Remove the lower part of the dashboard and the centre console (see GROUP 70).
- 1. Slacken the fastening screws and lower the heating and ventilation controls.

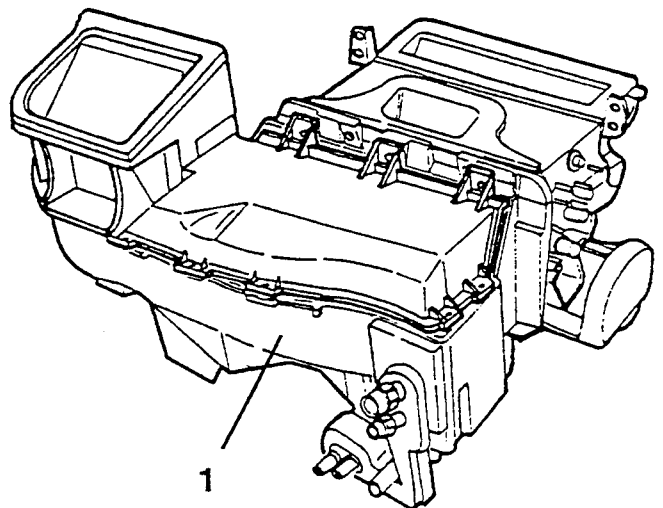
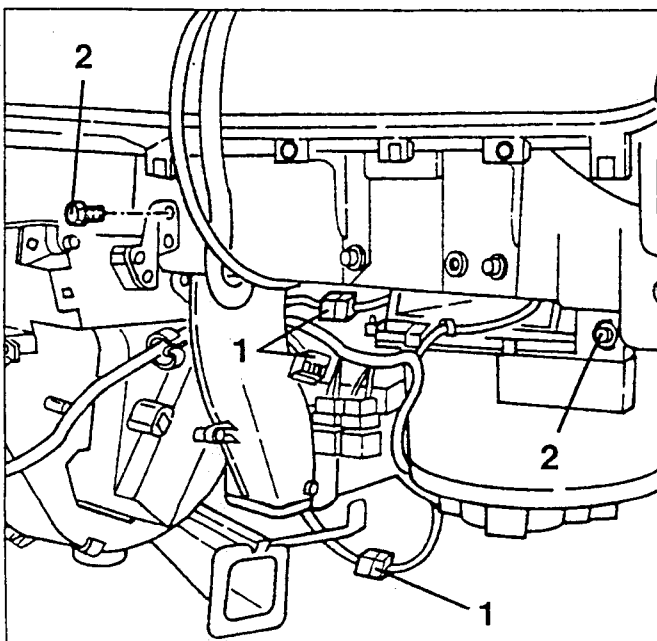


- 1. Slacken the screw fastening the heating and ventilation unit on the lefthand side.



- 1. Remove the heating and ventilation unit.

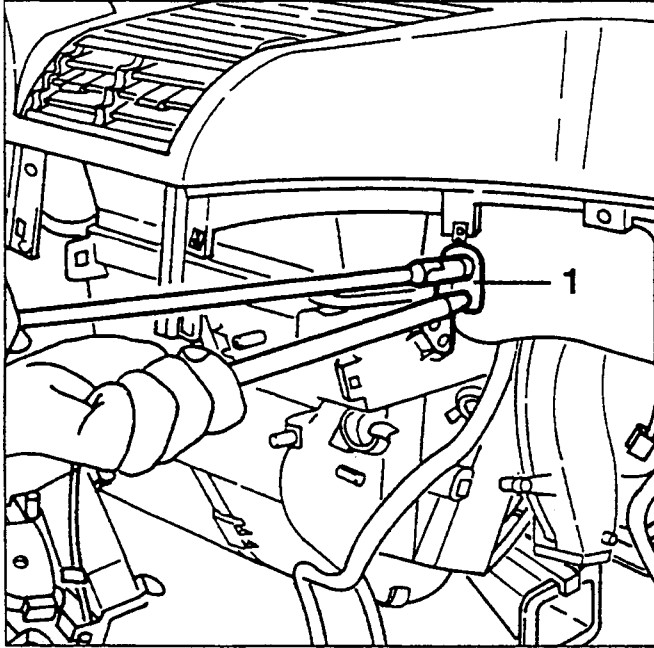
- Remove the two sections of the air flow duct to the rear passenger face level (see GROUP 70).
- 1. Disconnect the electrical connections of the heating and ventilation unit.
- 2. Slacken the three screws fastening the heating and ventilation unit on the righthand side.



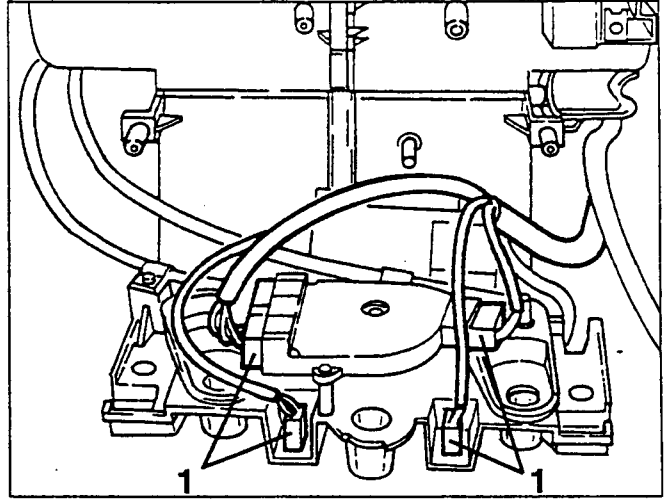
To refit the heating and ventilation unit, reverse the sequence followed for removal, adhering to the following instructions:

- Coat the mouth of the heater, water drain pipes and conditioning pipes with vaseline.
- Assemble the unit taking care to insert the above pipes correctly in the passage holes.

1. Use a centering pin positioned as shown, and centre the group before fixing it.

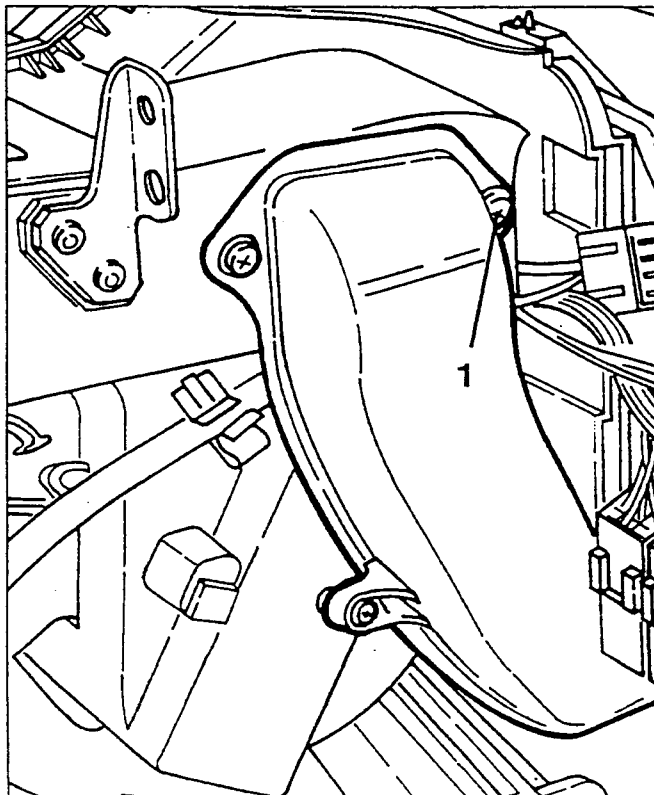


1. Disconnect the four electrical connections from the heating and ventilation controls.

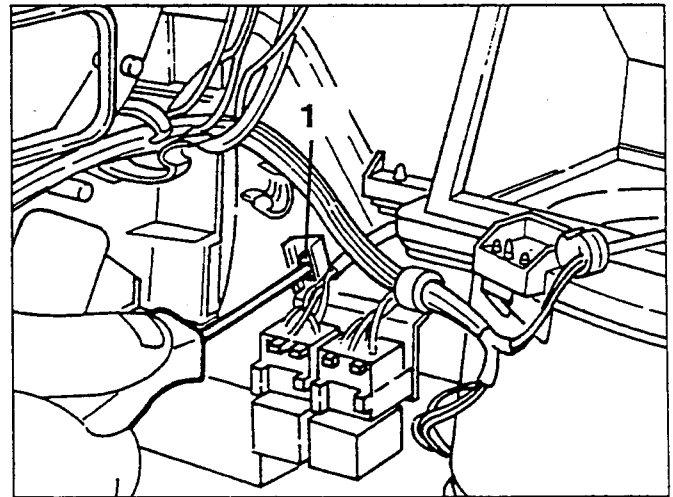


DIS-ASSEMBLY

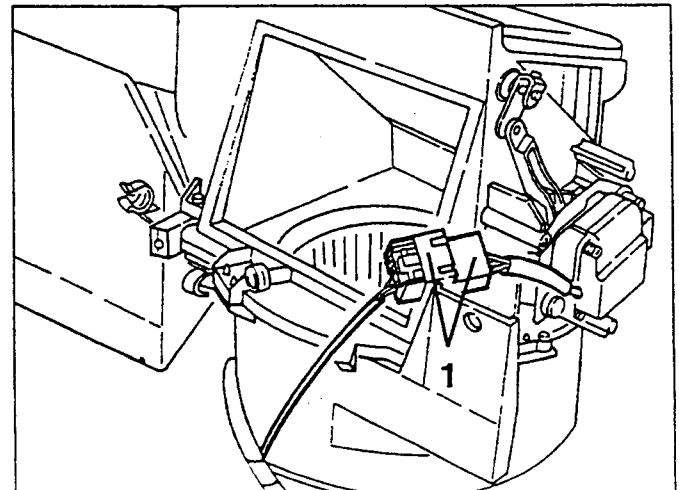
1. Slacken the three fastening screws and remove the air delivery duct to the rear passenger area.



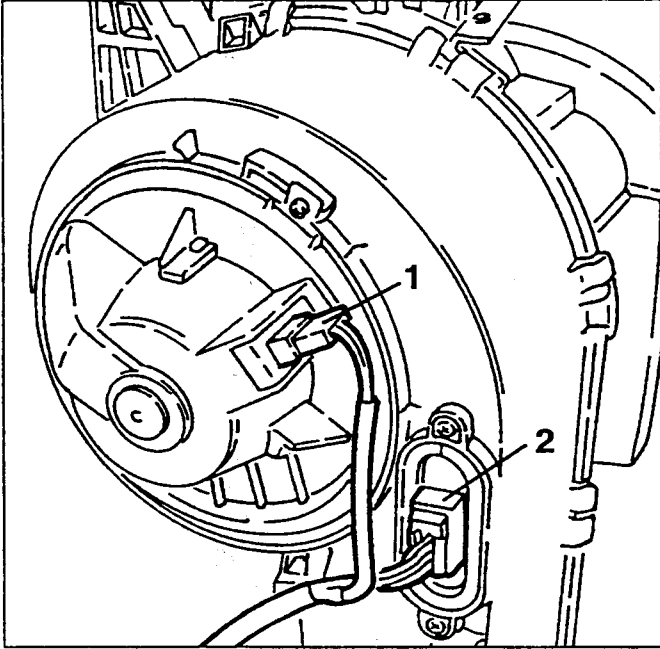
1. Slacken the screw fastening the relay switch support bracket.



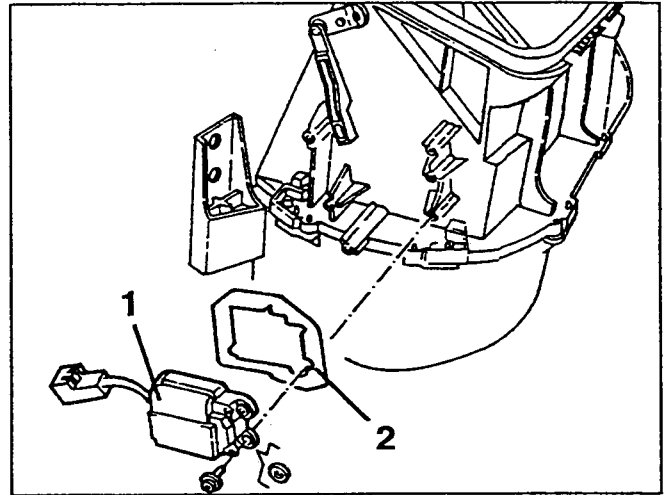
1. Disconnect the electrical connection of the outside air/recirculation mixing vent control motor.



1. Disconnect the electrical connection from the fan.
2. Disconnect the electrical connection from the fan resistance, then remove the cable loom freeing it of the cable clamps.

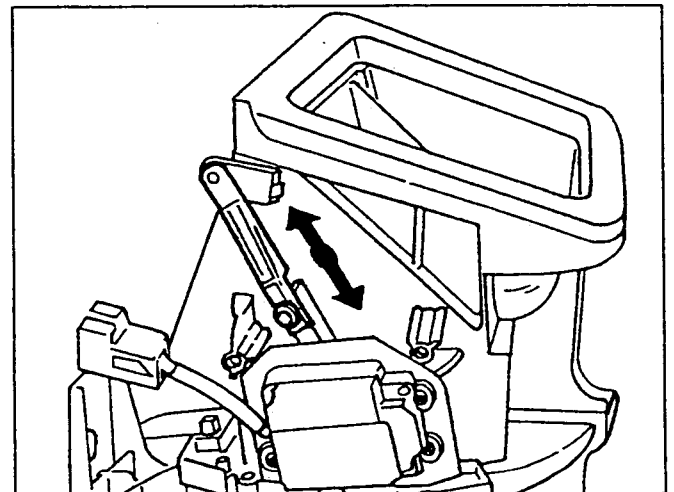
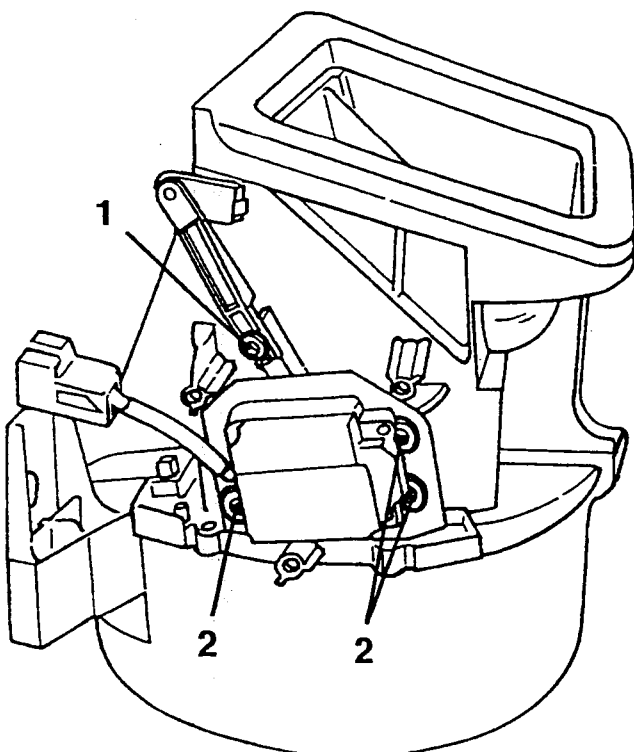


1. Remove the outside air/recirculation mixing vent motor complete with the grommets on the fastening hole.
2. Retrieve the rear plate.

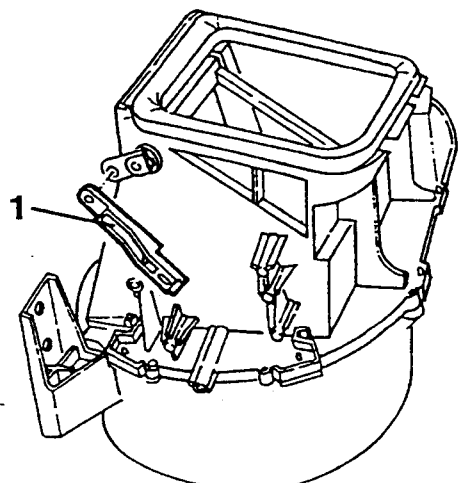


When refitting, adjust opening and closing of the outside air/recirculation mixing vent acting on the control tie-rod as shown in the figure.

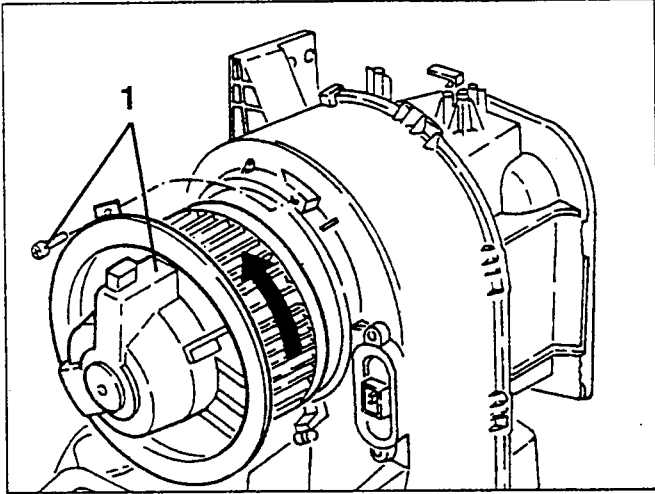
1. Slacken the screw fastening the outside air/recirculation mixing vent control motor tie-rod.
2. Slacken the three screws fastening the outside air/recirculation mixing vent motor.



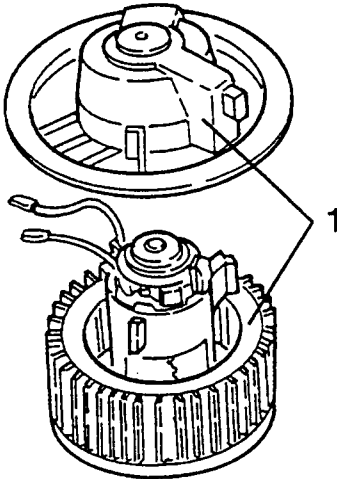
1. Remove the outside air/recirculation mixing vent control tie-rod.



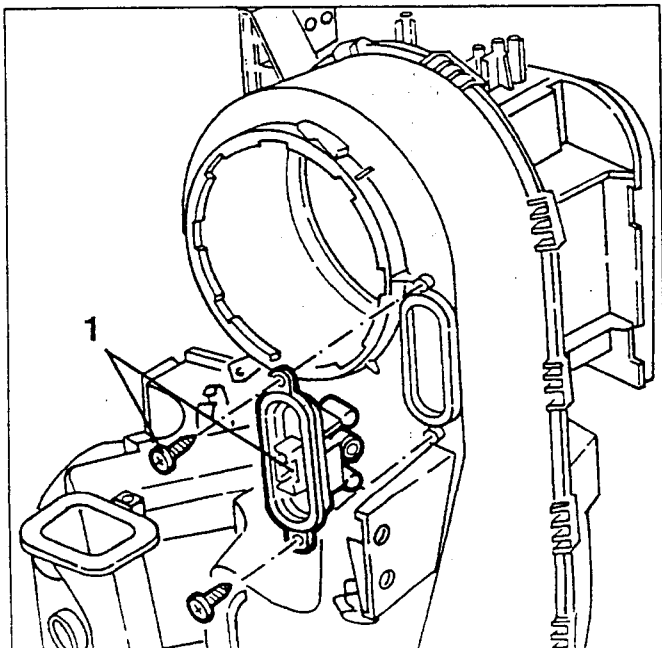
1. Slacken the screw fastening the electric fan, turn it as shown in the figure, then remove it.



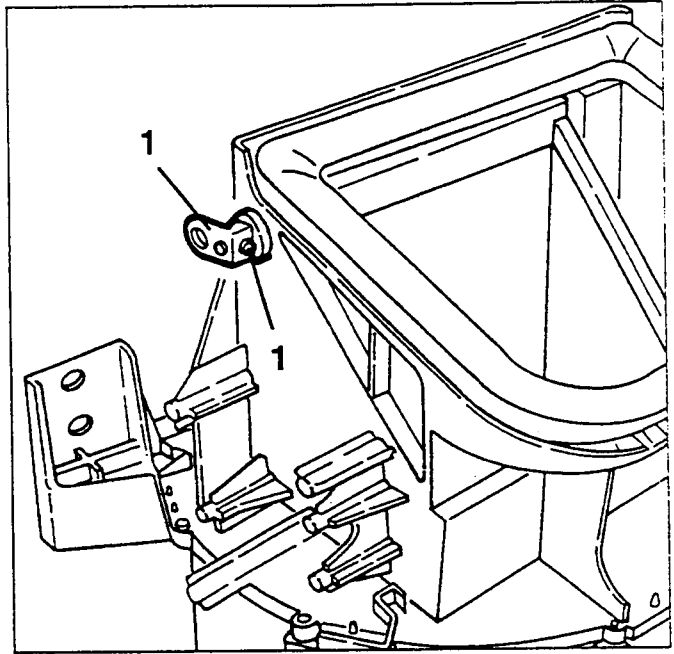
1. Separate the fan from the cover releasing the three rubber catches and removing the two electric cables.



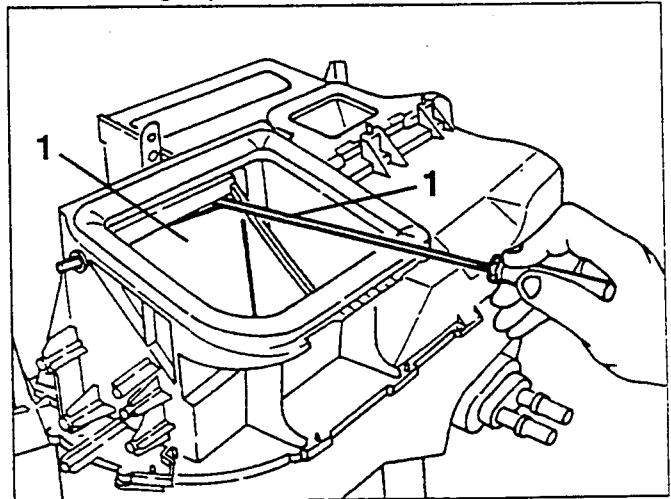
1. Slacken the two fastening screws and remove the fan resistance.



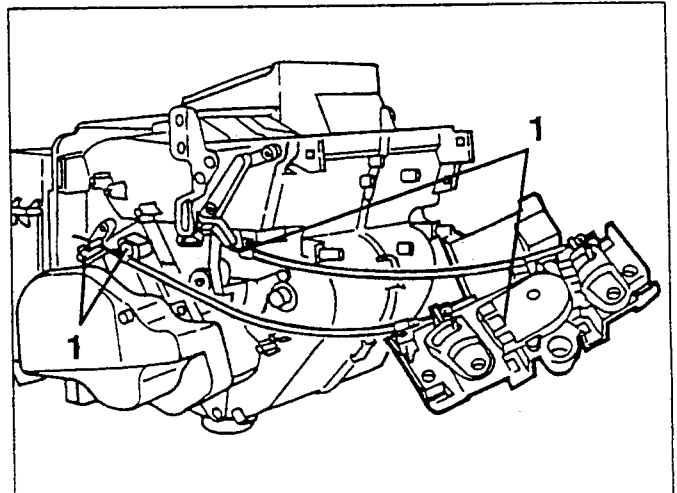
1. Slacken the fastening screw and remove the hook connecting the outside air/recirculation vent control tie-rod.



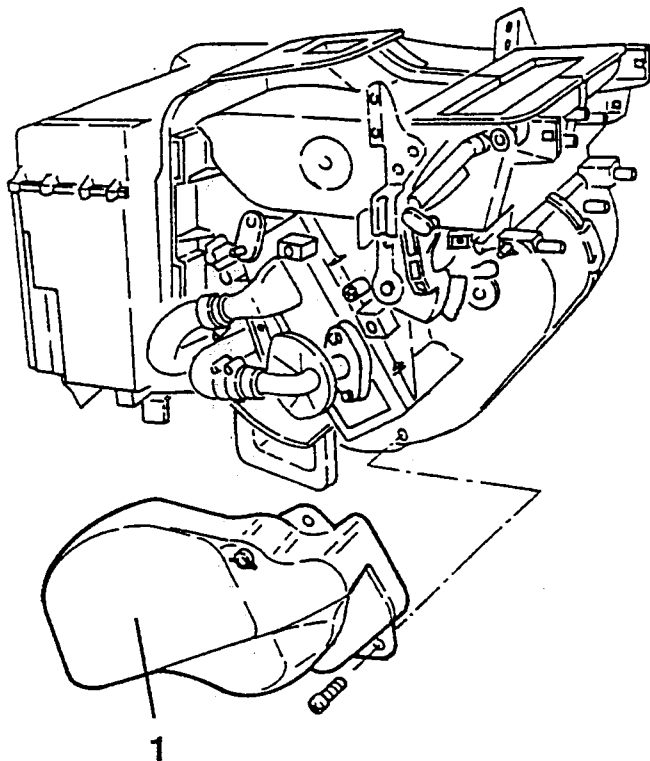
1. Release the outside air/recirculation vent from the two fastening clips and remove it.



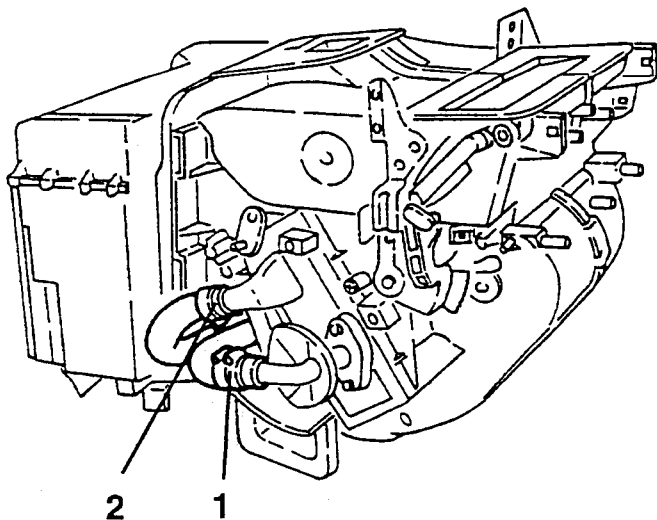
1. Disconnect the two control cables from the heating and ventilation unit and remove them complete with the control units.



1. Slacken the two fastening screws and remove the protection of the coolant fluid pipes at the heater radiator.

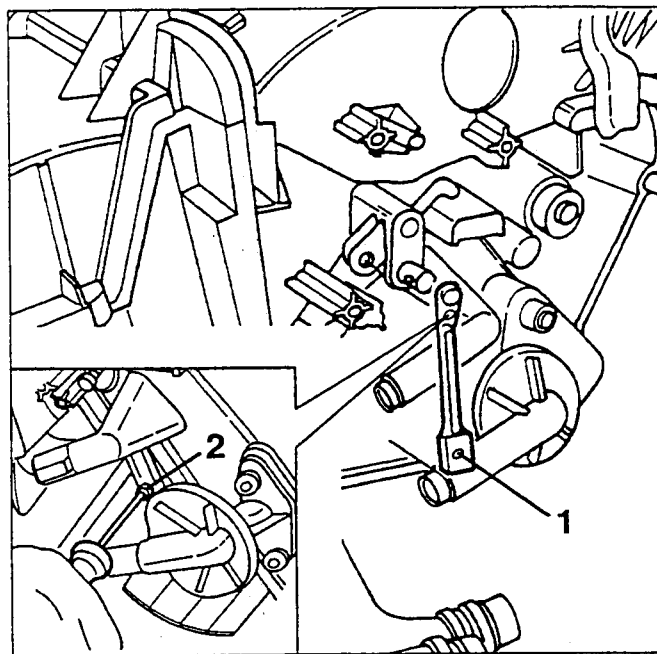


1. Disconnect the coolant fluid inlet pipe from the tap on the radiator.
2. Disconnect the coolant fluid outlet pipe from the tap on the radiator.

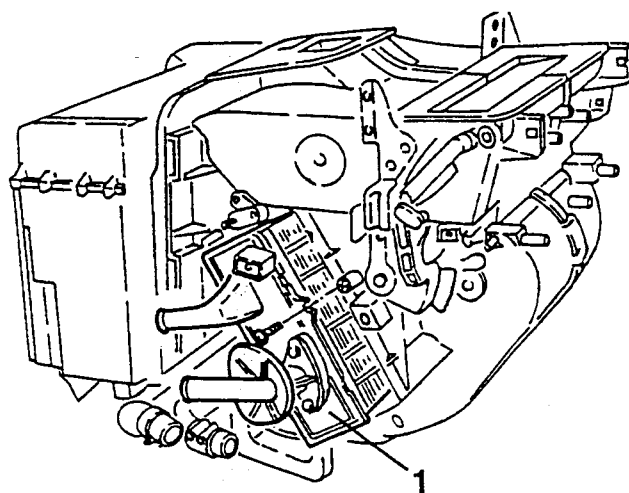


1. Slacken the screw fastening the control tie-rod for the coolant radiator inlet tap.

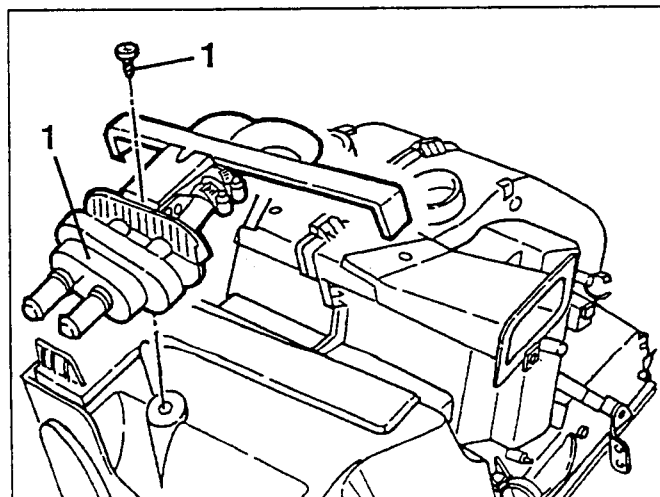
2. Disconnect the tie-rod and remove it.



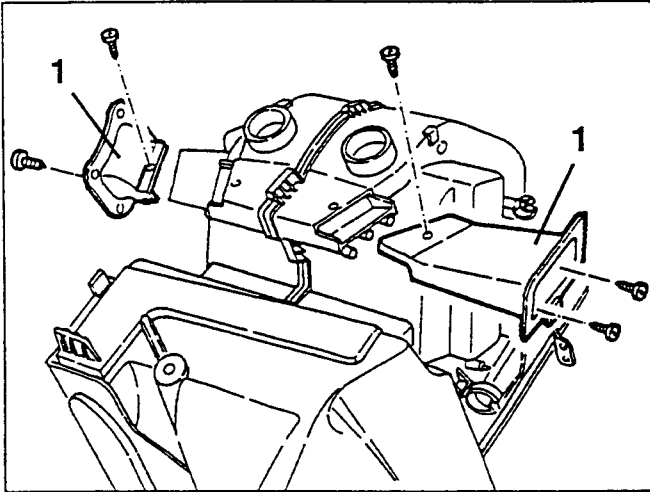
1. Slacken the two fastening screws and take out the heater radiator.



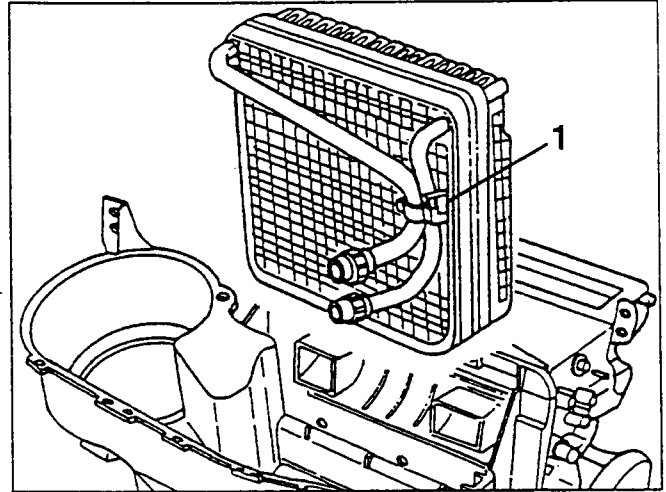
1. Slacken the fastening screw and remove the heater coolant delivery and return pipes.



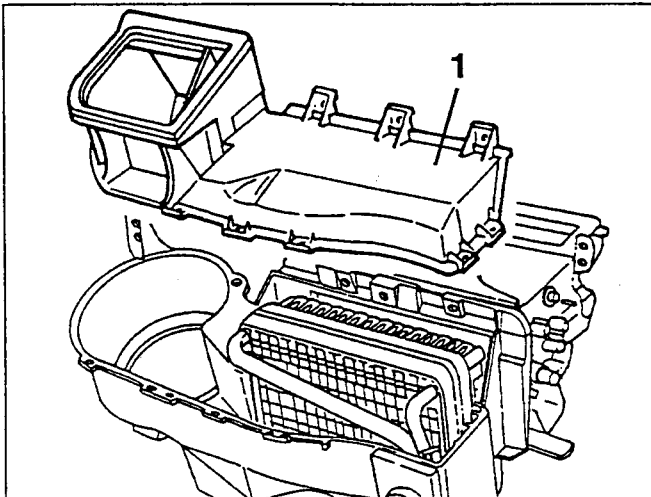
1. Slacken the fastening screws and remove the air delivery ducts to the feet.



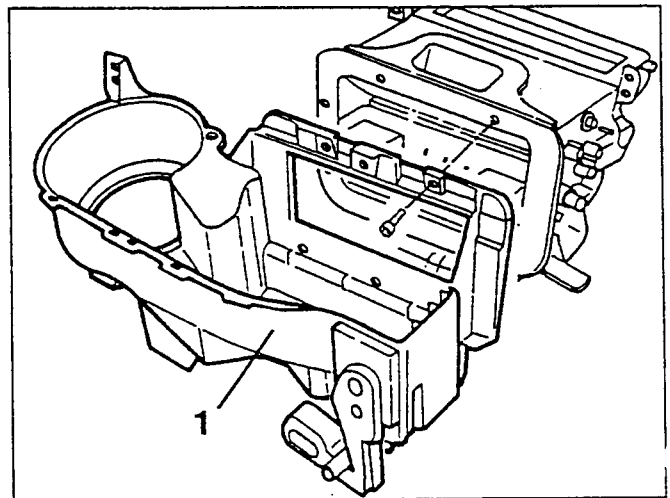
1. Remove the evaporator slipping the pipes out of their seals.



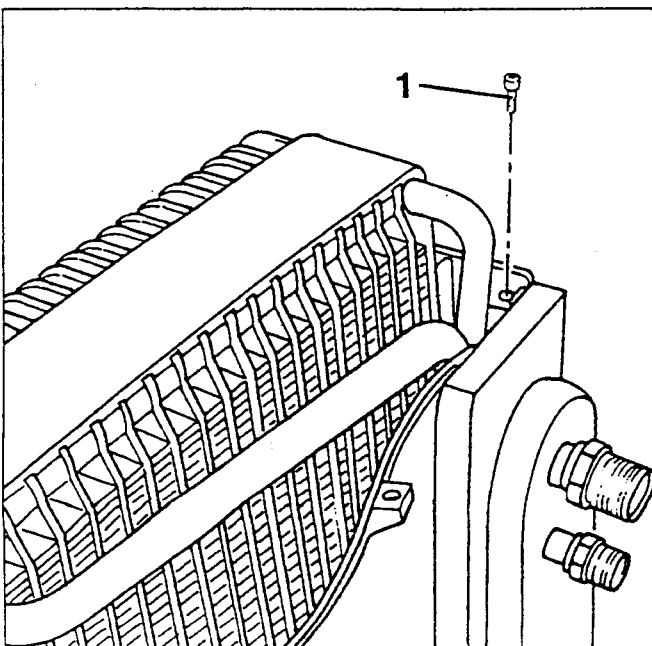
1. Slacken the fastening screws and remove the heater upper half box releasing it from its catches.



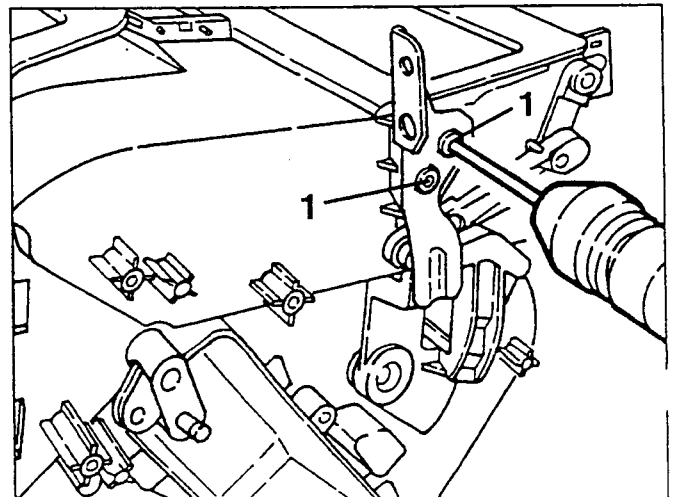
1. Slacken the fastening screws and remove the heater lower half box releasing it from its catches.




1. Slacken the evaporator fastening screw.

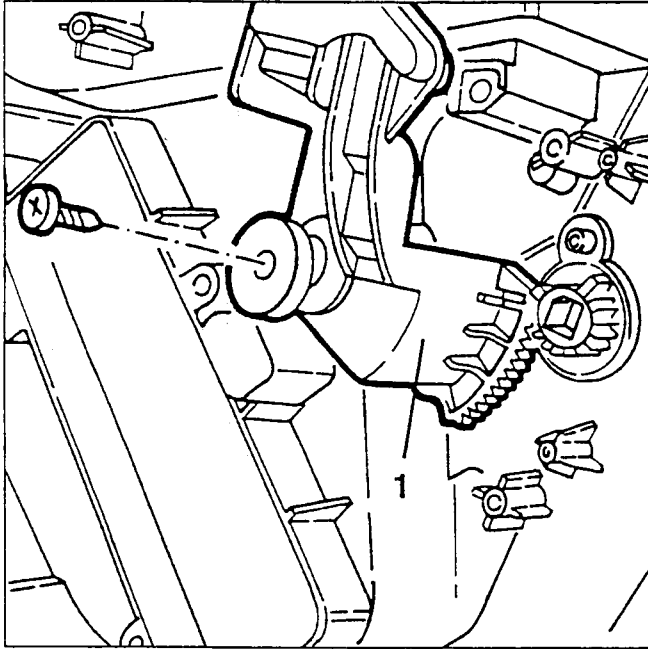


1. Using a drill knock off the two rivets fastening the heating and ventilation unit support bracket.

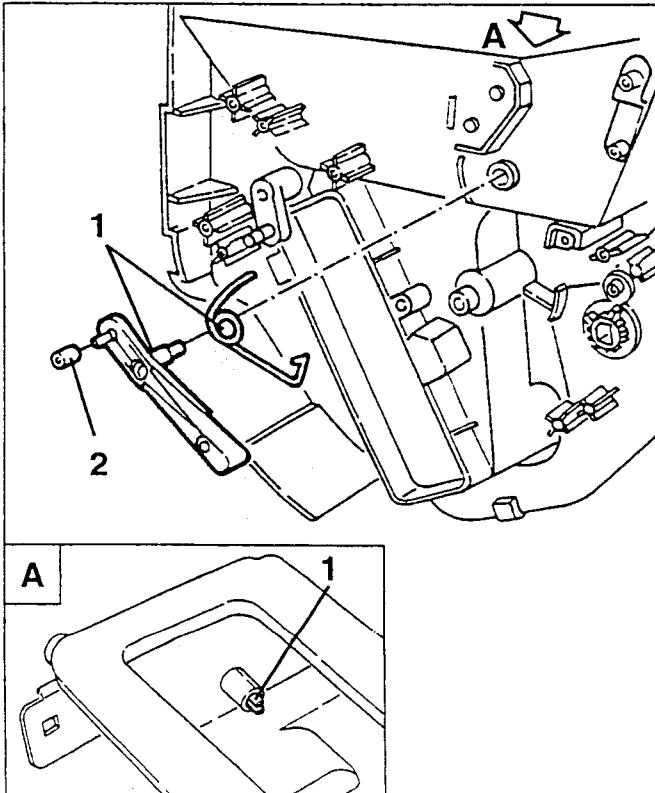


1. Slacken the fastening screw and remove the air distribution vent control leverage.

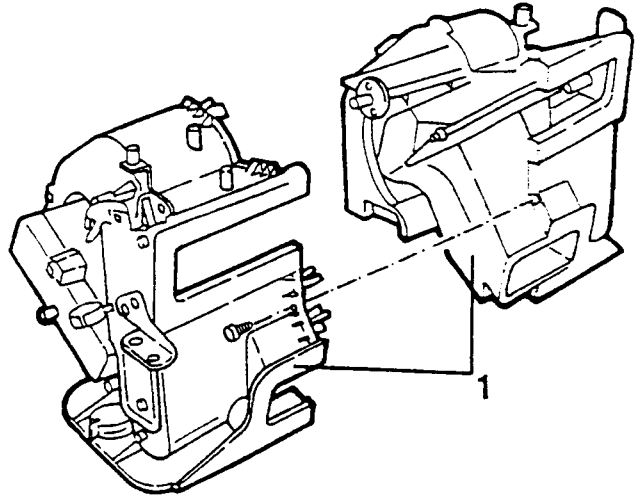
 When refitting the leverage make sure that the two notches stamped on the gears coincide.



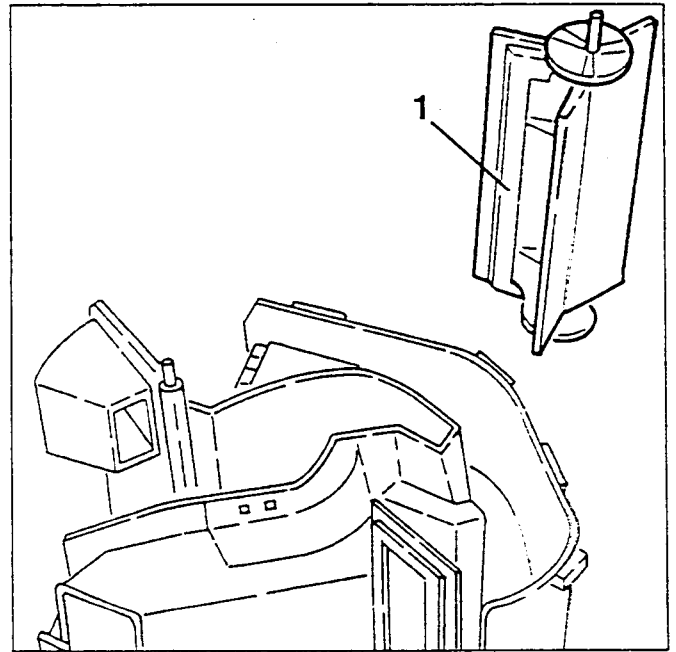
1. Release the clamps of the fastening pin and remove the tie-rod complete with air distribution vent control spring.
2. Retrieve the spacer.



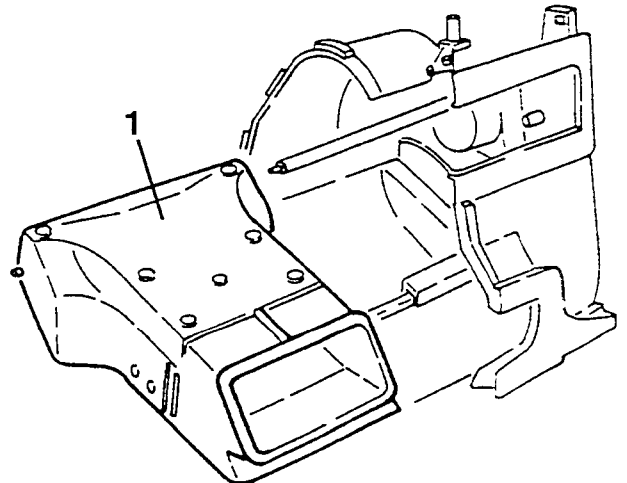
1. Slacken the fastening screws and dis-assemble the half boxes releasing the fastening clamps.



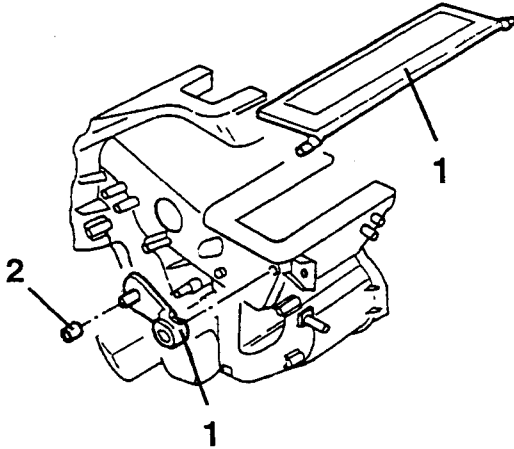
1. Remove the lower distribution vent.



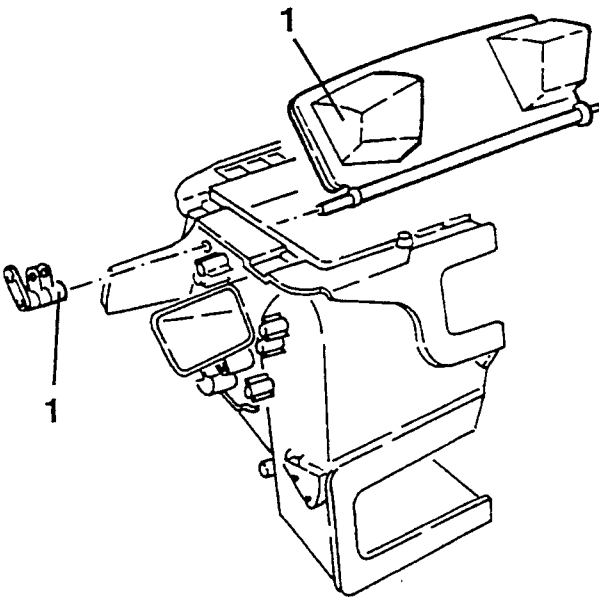
1. Remove the air duct.



1. Remove the fastening leverage and retrieve the upper distribution vent.
2. Retrieve the spacer.



1. Remove the fastening leverage and retrieve the air mixing vent.

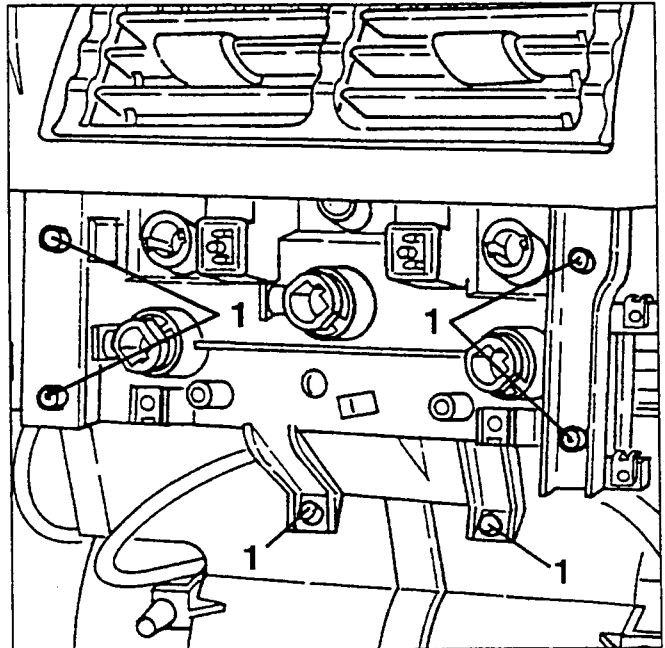


HEATING AND VENTILATION UNIT CONTROLS (TWO BOWDEN)

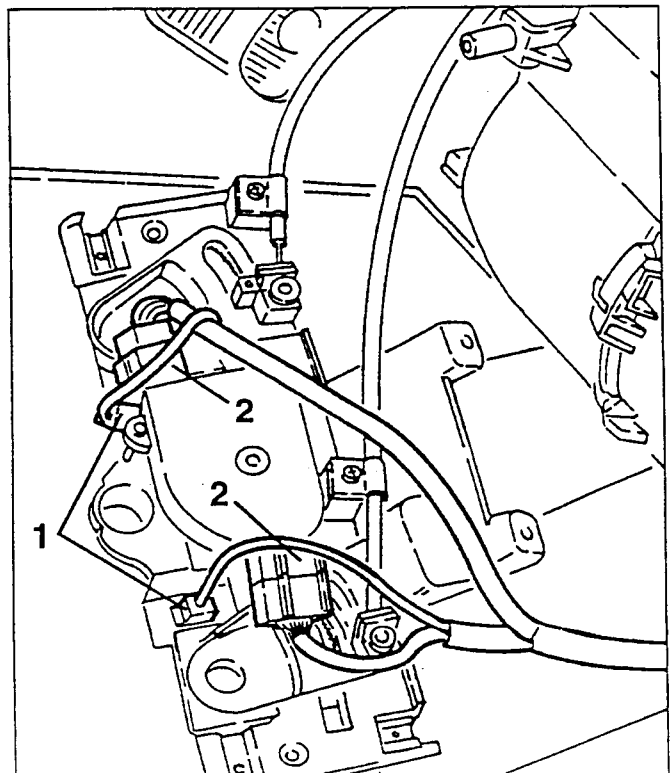
REMOVAL/REFITTING

- Remove the lower part of the dashboard (see GROUP 70).

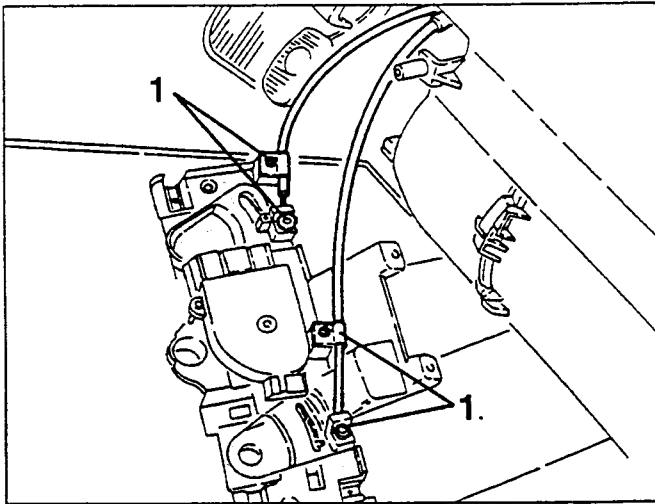
1. Slacken the screws fastening the heater control unit and take it out of its housing.



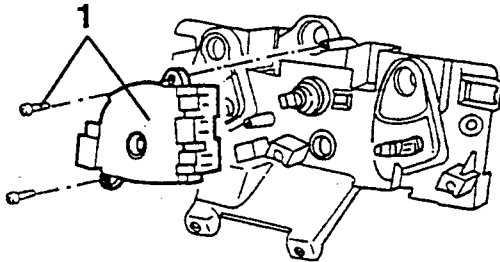
1. Disconnect the two electrical connections for the heater control unit lighting.
2. Disconnect the two electrical connections from the fan speed switch.



1. Remove the fastening washers, slacken the clamp screws and remove the two vent control cables.



1. Slacken the fastening screws and remove the fan speed switch.

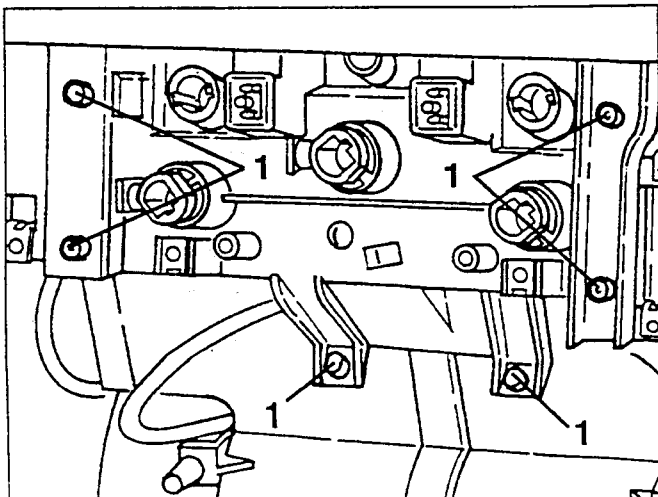


HEATING AND VENTILATION UNIT VENT CONTROL CABLES (TWO BOWDEN)

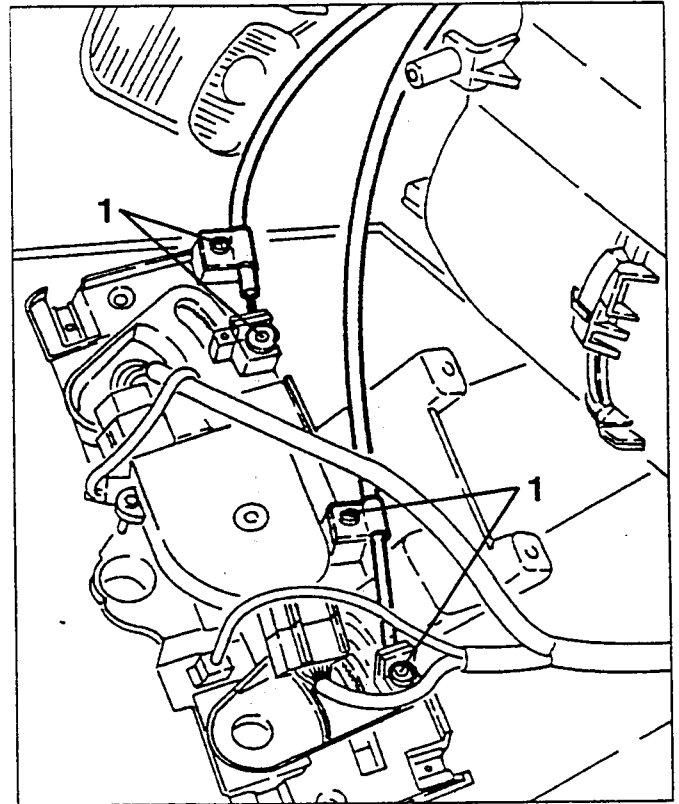
REMOVAL/REFITTING

- Remove the lower part of the dashboard (see GROUP 70).

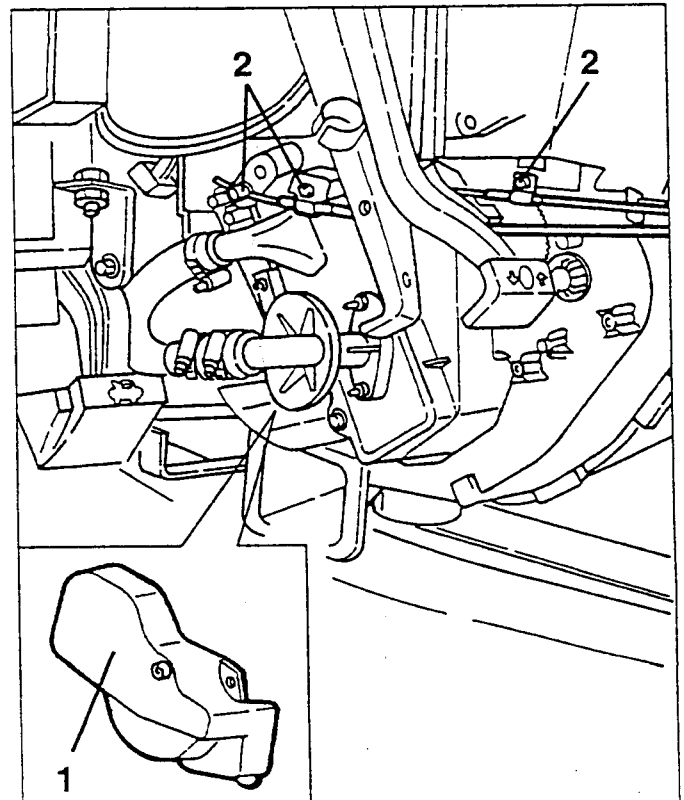
1. Slacken heater control unit fastening screws and remove it from its housing.



1. Remove the fastening washers, slacken the clamp screws and disconnect the two vent control cables from the control unit.

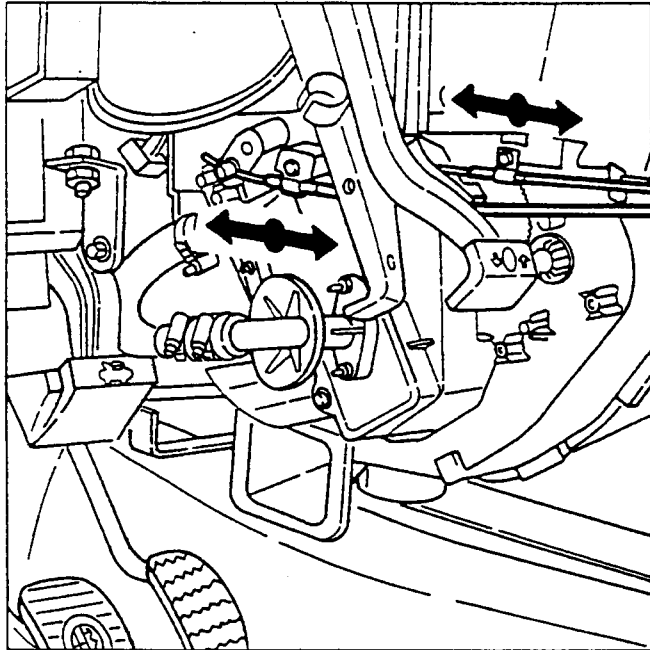


1. Slacken the two fastening screws and remove the coolant hose guard.
2. Slacken the screws fastening the sheaths to the heating and ventilation unit and remove the vent control cables.

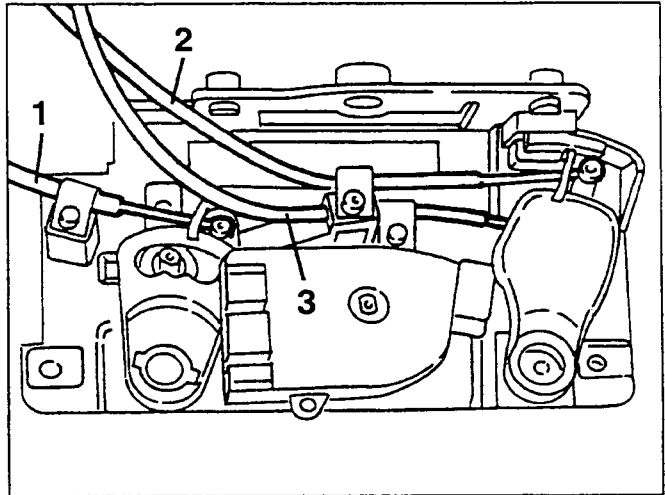




Refit the control cables adjusting them as shown in the illustration before fastening them from the radiator side.



b) For the above variation the command group is also varied, three bowdens being connected instead of two.

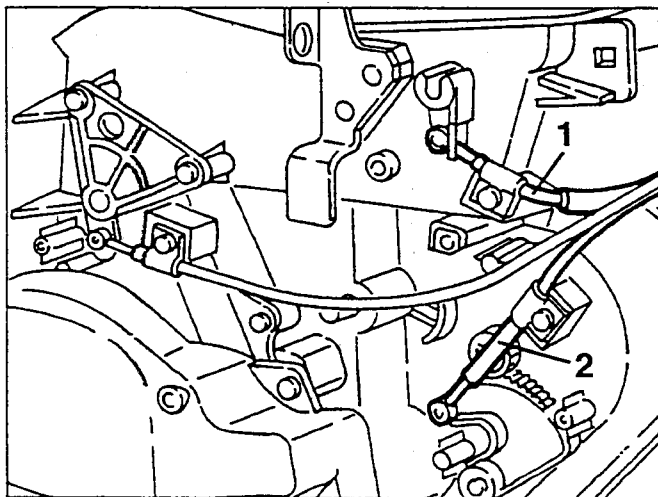


1. Mixing gate command bowden
2. Upper distribution gate command bowden
3. Lower distribution gate command bowden

DUCTING ASSEMBLY AND HEATER - DISTRIBUTOR UNIT (THREE BOWDEN)

This varies from the "two bowden" versions regarding in relation to the following:

a) The adoption of two front bowden rather than one for the movement of the two air distribution gates and consequent elimination of the transmission levers.

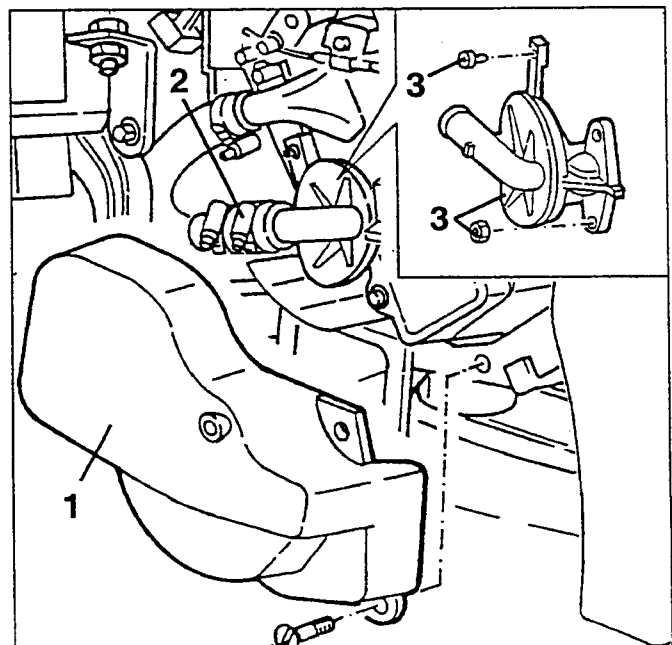


1. Upper distribution gate command bowden
2. Lower distribution gate command bowden

RADIATOR COOLANT INLET TAP

REMOVAL/REFITTING

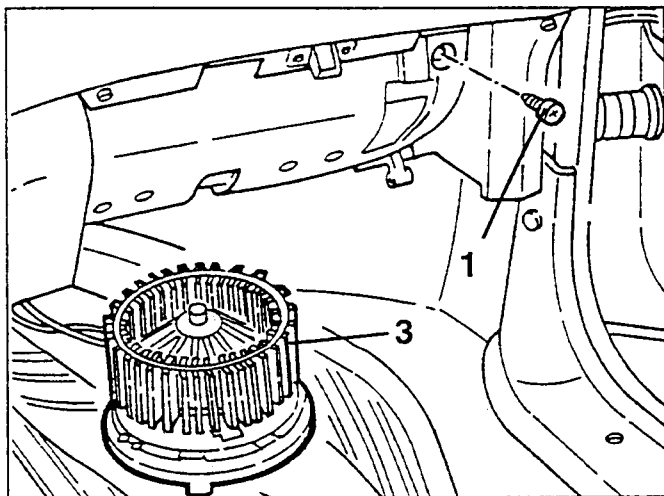
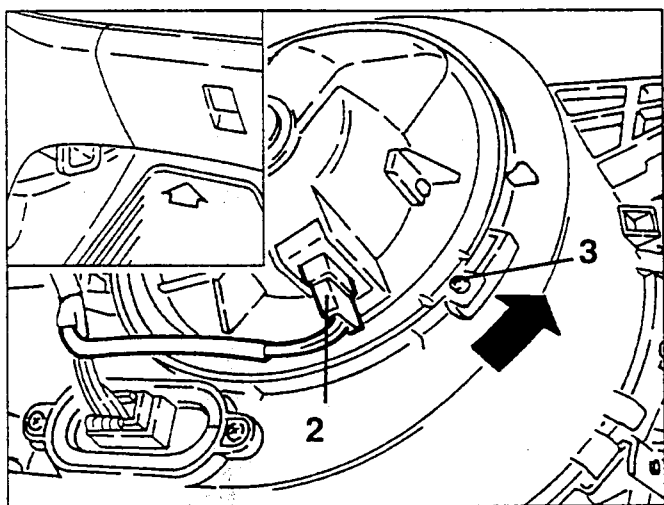
- Remove the valve unit cover (see GROUP 70).
- 1. Slacken the two fastening screws and remove the protection for the coolant pipes at the radiator.
- 2. Disconnect the coolant inlet pipe from the tap and recover the fluid.
- 3. Slacken the tie-rod fastening screw, the two tap fastening nuts and remove it.



ELECTRIC FAN

REMOVAL/REFITTING

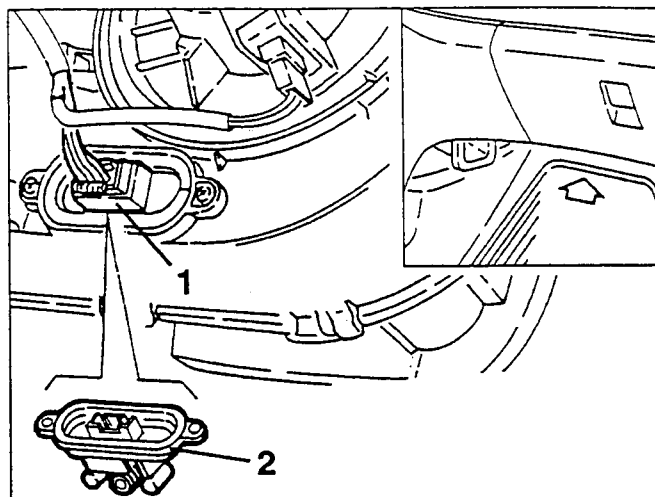
- Disconnect the battery (-) terminal.
- Remove the glove box (SEE GROUP 70).
- 1. Slacken the lower screw fastening the dashboard to be able to remove the fan.
- 2. Disconnect the electrical connection of the fan.
- 3. Slacken the fan fastening screw, turn it as shown in the figure, then remove it raising the mat.



FAN RESISTANCE

REMOVAL/REFITTING

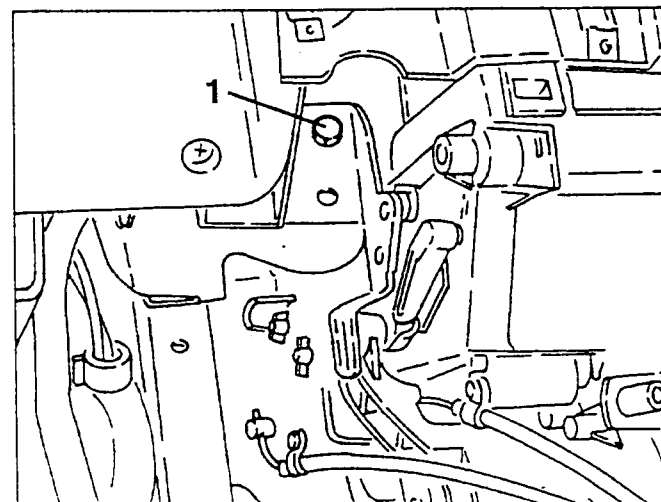
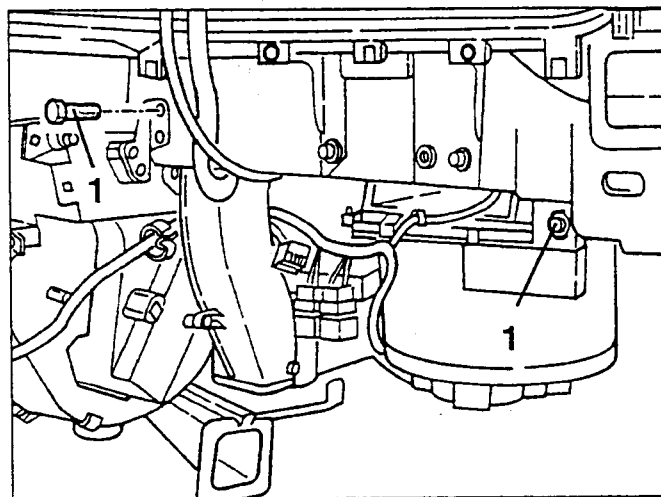
- Disconnect the battery (-) terminal.
- 1. Disconnect the electrical resistance from the fan.
- 2. Slacken the two fastening screws and remove the fan resistance.



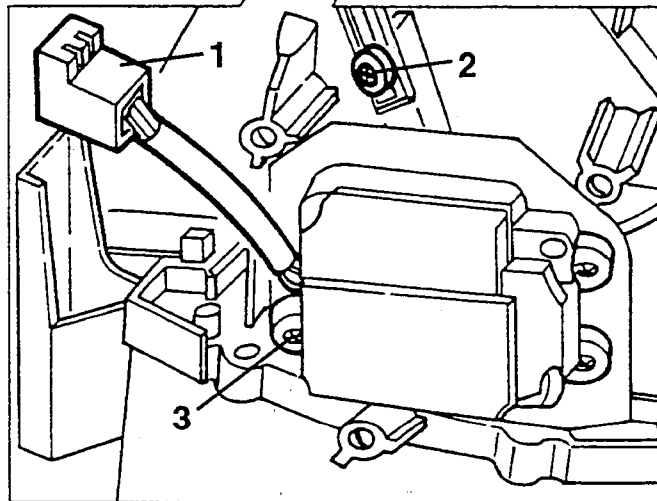
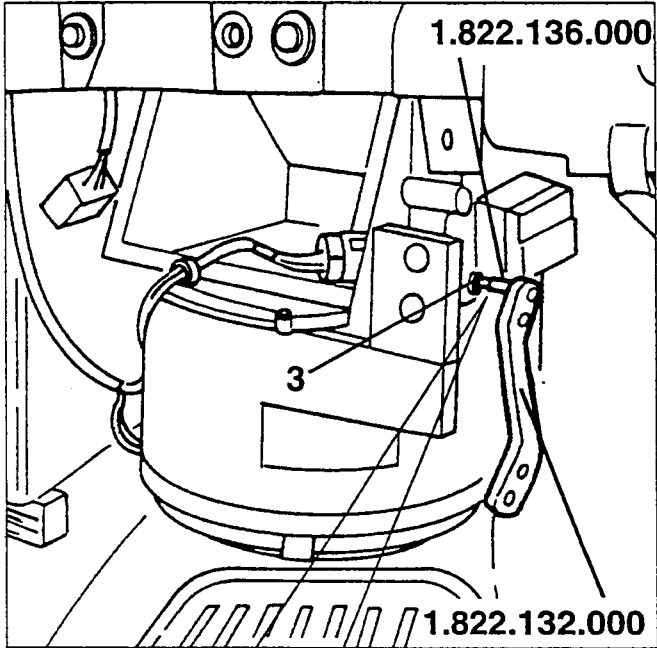
OUTSIDE AIR/RECIRCULATION VENT CONTROL MOTOR

REMOVAL/REFITTING

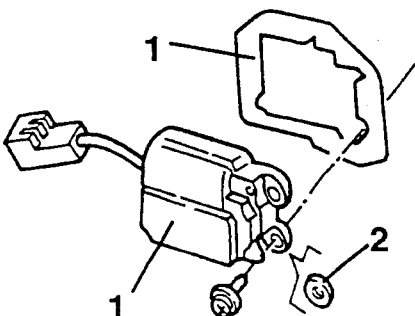
- Remove the lower part of the dashboard (SEE GROUP 70).
- 1. Slacken the four screws fastening the heating and ventilation unit to gain access to the motor.



1. Disconnect the electrical connection of the outside air/recirculation vent control motor.
2. Slacken the screw fastening the outside air/recirculation vent control motor.
3. Slacken the three cross-slotted screws fastening the motor using wrench N° 1.822.132.000 with bit N° 1.822.136.000



1. Remove the outside air/recirculation vent control motor complete with grommets on the fastening holes.
2. Retrieve the rear plate.

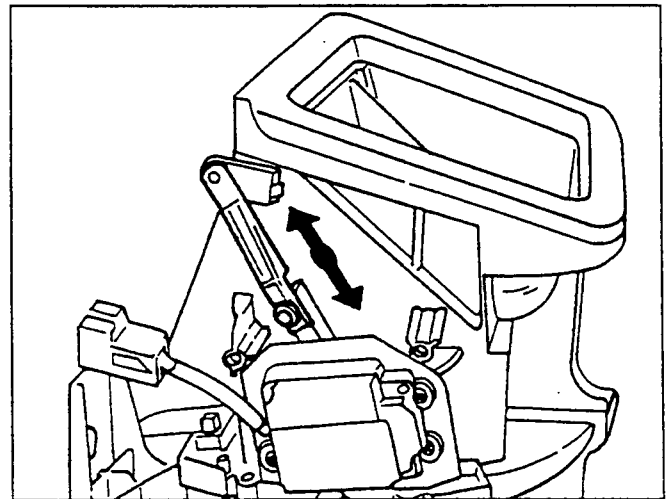


- When refitting replace the cross-slotted screws for fastening the motor with Allen screws to be tightened with wrench N° 1.822.132.000 and bit N° 1.822.136.000



When refitting check:

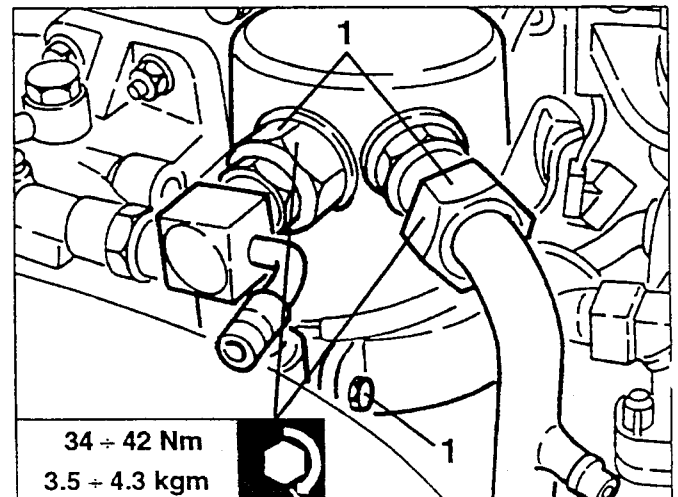
- the correct positioning of the grommets in the motor fastening holes;
- the correct closing of the outside air/recirculation vent through the corresponding control button, if necessary adjust the position of the vent acting on the control tie-rod as illustrated.



DRIER FILTER

REMOVAL/REFITTING

- Drain the freon from the conditioning system (see the specific paragraph).
- 1. From the drier filter disconnect the fluid inlet and outlet pipes.
- 2. Slacken the bolt fastening the clamp and remove the drier filter.



34 ÷ 42 Nm
3.5 ÷ 4.3 kgm

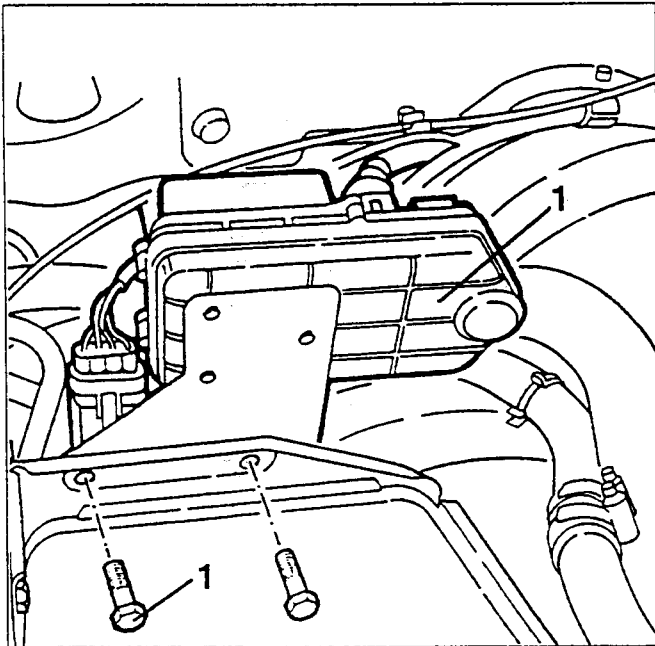
EXPANSION VALVE

REMOVAL/REFITTING

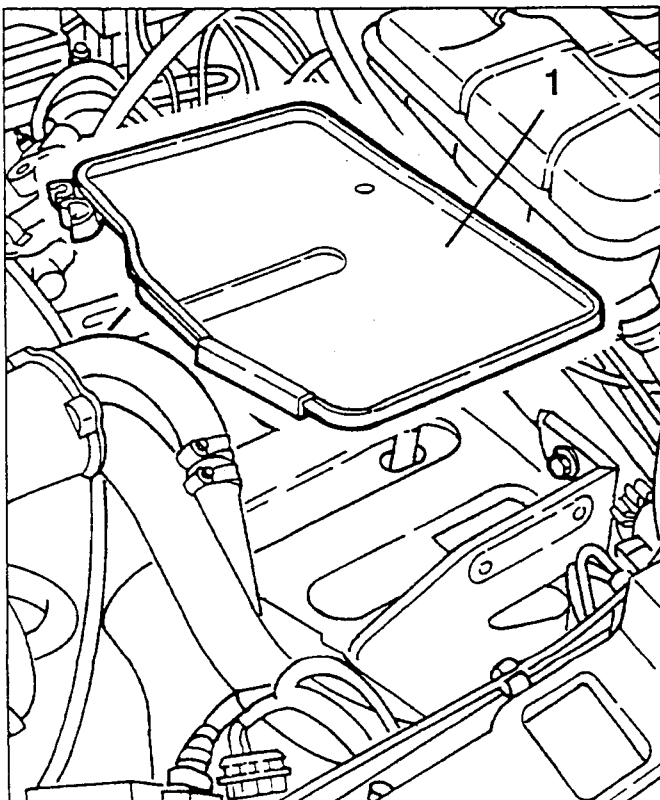
- Drain the fluid from the conditioning system (see the specific paragraph).

- Remove the battery (see GROUP 70).

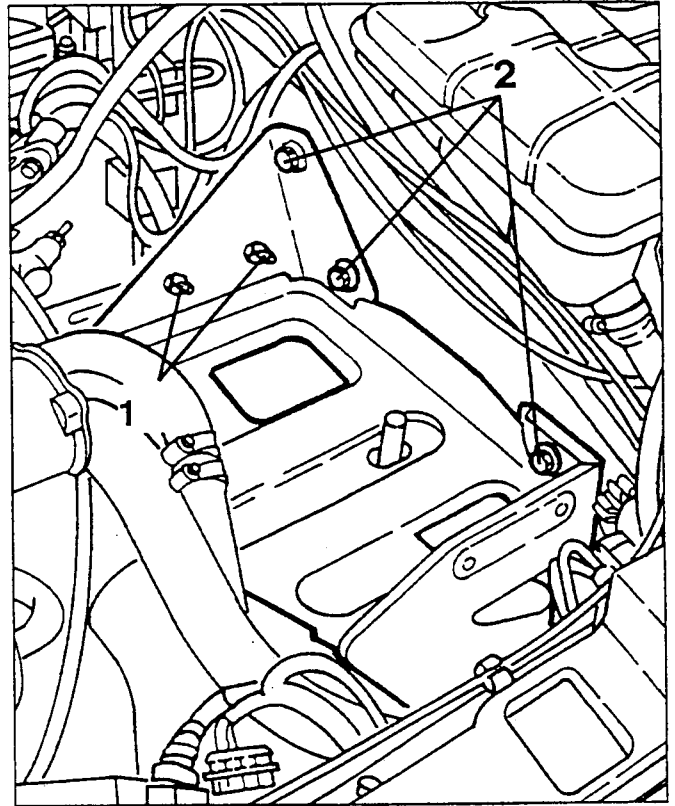
1. Slacken the two screws fastening the support for the relays and connections to the battery, then move it sideways.



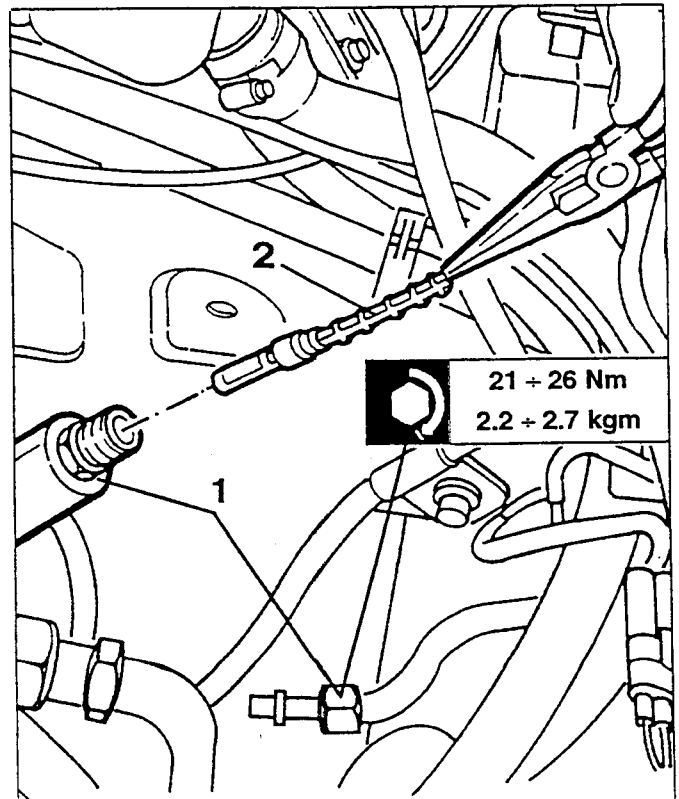
1. Remove the battery acid drain tray.



1. Slacken the two nuts fastening the support bracket for the glow plug control unit to the battery support.
2. Slacken the four fastening screws and remove the battery support.



1. Slacken the intermediate union of the fluid delivery pipe from the condenser to the evaporator.
2. Remove the expansion valve.

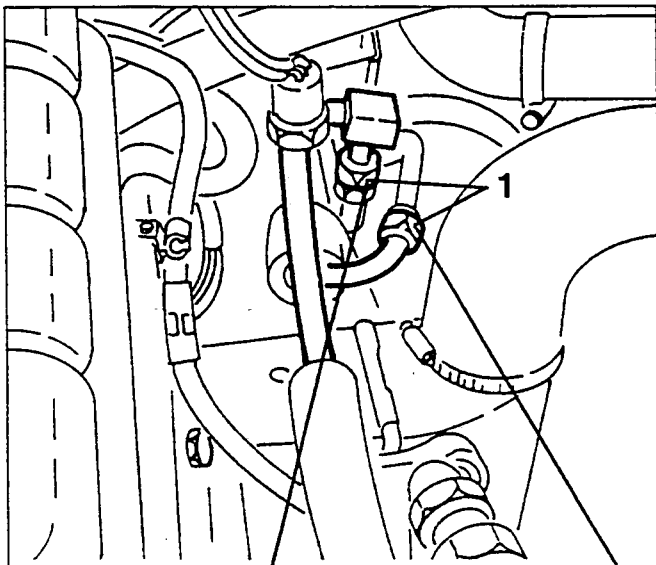


CONDENSER

REMOVAL/REFITTING

- Set the car on a lift.
- Drain the fluid from the conditioning system (see the specific paragraph).
- Remove the radiator grille and the front bumper (see GROUP 70).
- Remove the battery (see GROUP 55).
- Follow the first three steps described in the "EXPANSION VALVE" paragraph.

1. From the condenser disconnect the freon inlet and outlet pipe unions.



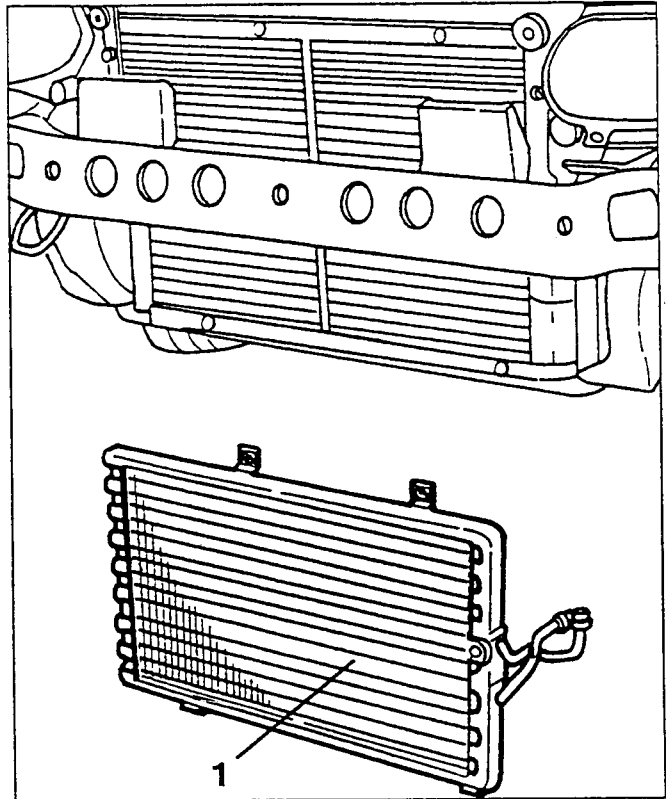
21 ÷ 26 Nm
2.2 ÷ 2.7 kgm



26 ÷ 32 Nm
2.6 ÷ 3.2 kgm



1. Remove the condenser pulling it downwards.

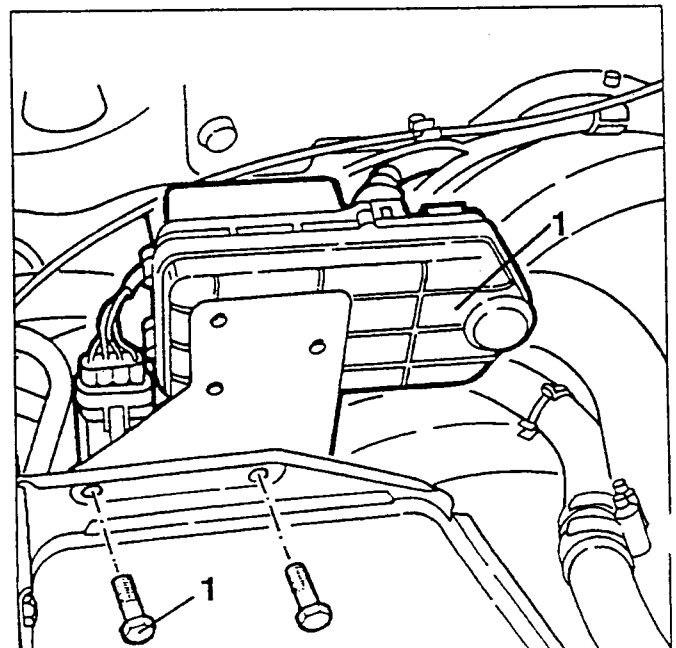
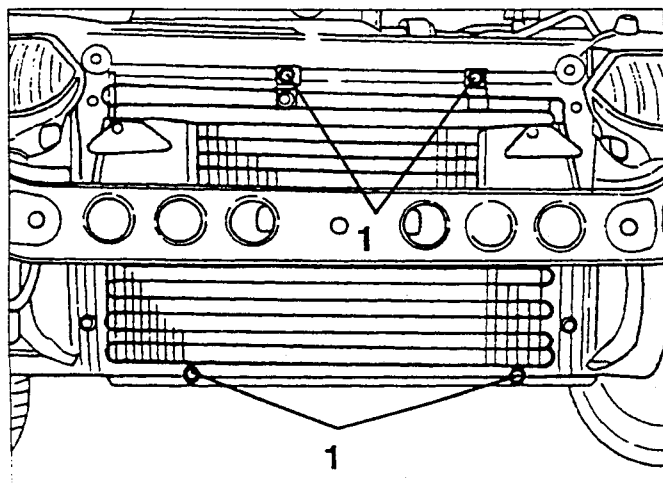


THREE-LEVEL PRESSURE SWITCH (TRINARY)

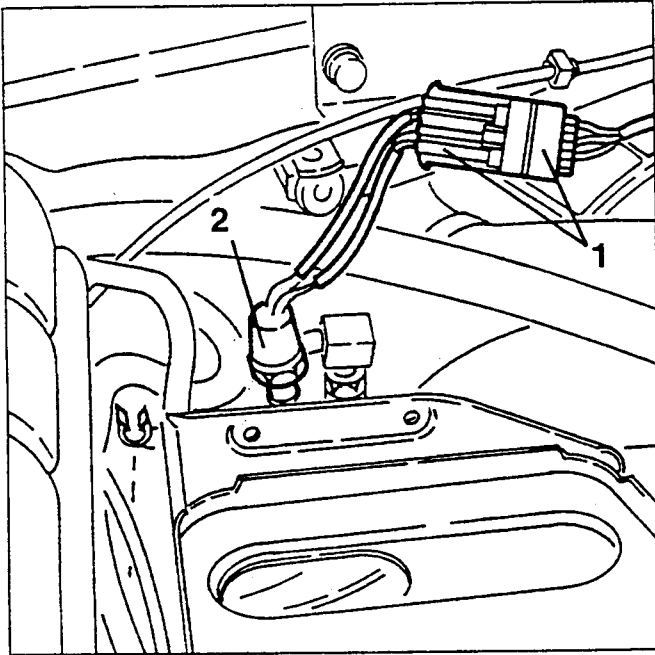
REMOVAL/REFITTING

- Remove the battery (see the specific group).
- 1. Slacken the two screws fastening the support for the relays and connections to the battery, then move it sideways.

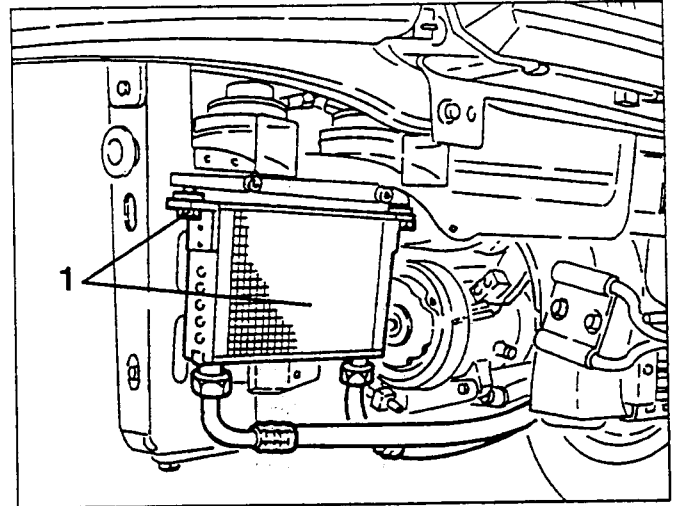
- Raise the car.
- 1. Slacken the four screws fastening the condenser to the radiator.



1. Disconnect the electrical connection of the three-level pressure switch.
2. Slacken and remove the three-level pressure switch.



1. Slacken the two fastening nuts and move the engine oil radiator sideways without disconnecting the pipes.

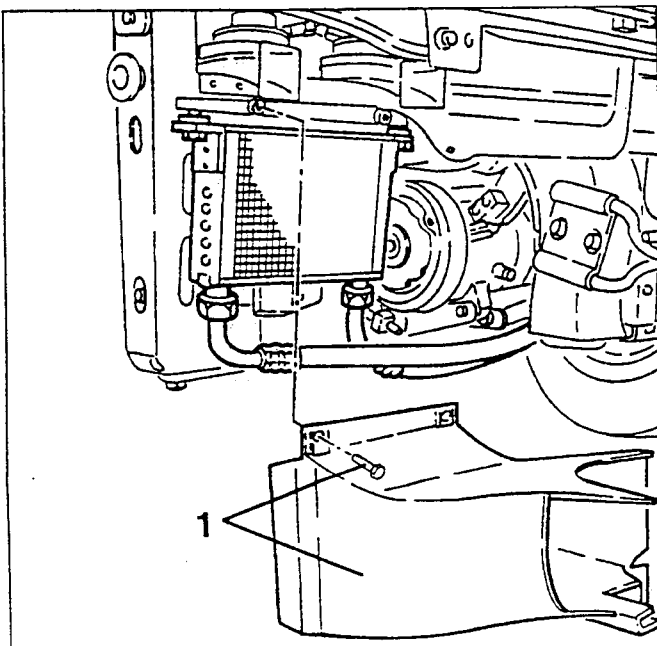
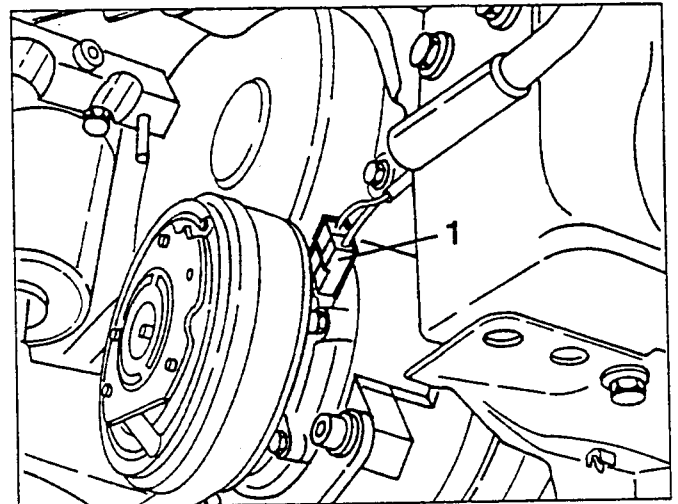


COMPRESSOR

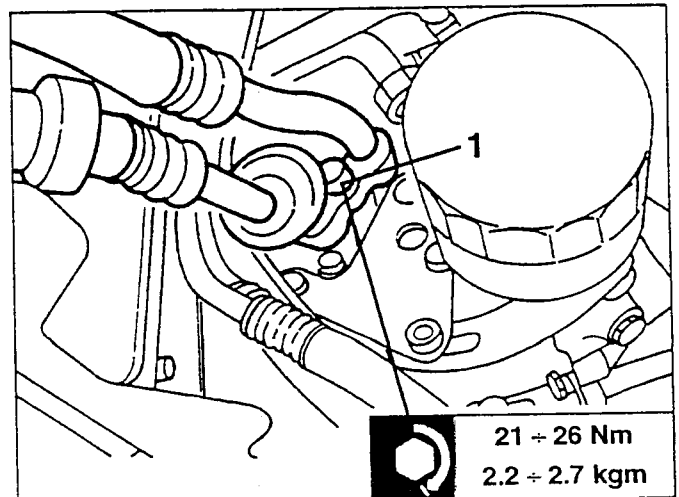
REMOVAL/REFITTING

- Set the car on a lift.
 - Drain the fluid from the conditioning system (see specific paragraph).
 - Remove the radiator grille and front bumper (see GROUP 70).
 - Raise the car.
1. Slacken the fastening screws and remove the air ducting system to the engine oil radiator.

1. Disconnect the two electrical connections from the conditioner compressor.

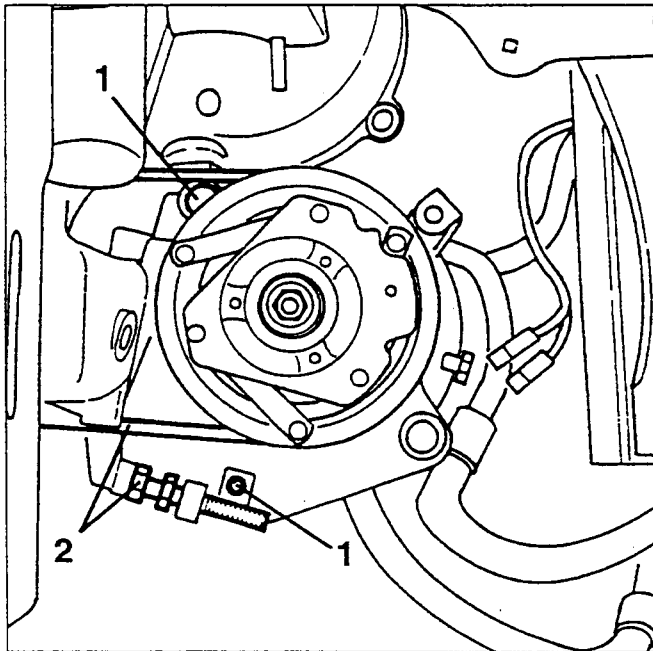


1. Slacken the fastening screw and disconnect the two freon pipes from the compressor.

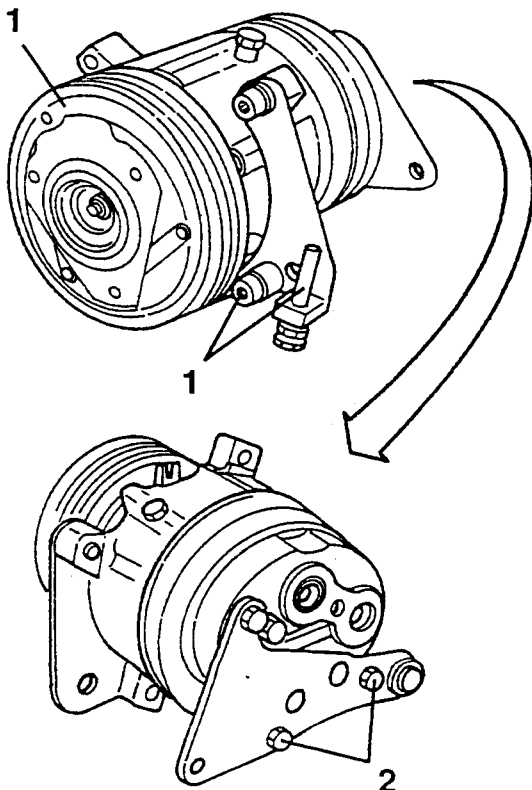


21 ÷ 26 Nm
2.2 ÷ 2.7 kgm

1. Slacken the compressor fastening bolts.
2. Working on the micrometric screw for tensioning the drive belt, after loosening the locknut, relieve the belt tension and take it off the compressor.



1. Completely unscrew the bolts loosened previously and remove the compressor complete with bracket.
2. On the bench slacken the fastening screws and separate the brackets from the compressor.



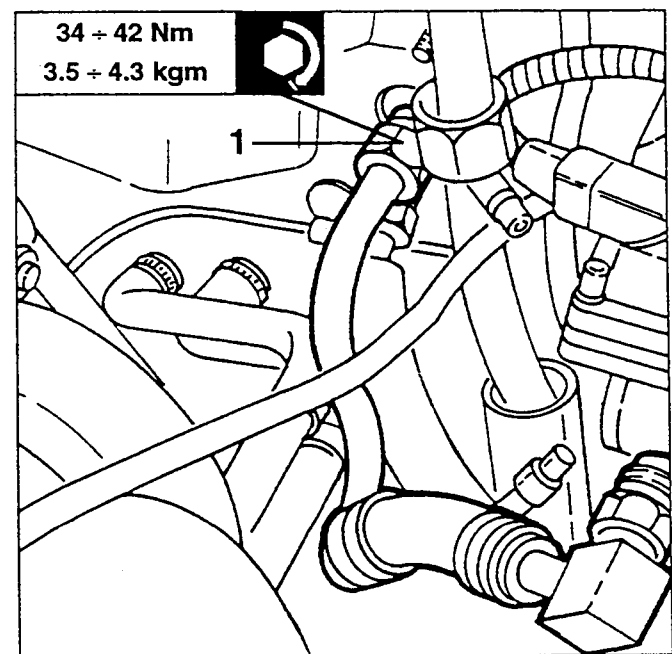
- When refitting, tension the conditioner compressor drive belt (see GROUP 00).

PIPING FROM EVAPORATOR TO DRIER FILTER

REMOVAL/REFITTING

- Drain the fluid from the conditioning system (see specific paragraph)
- Remove the battery (see GROUP 55).
- Follow the first seven steps described in the "DUCTING ASSEMBLY AND HEATER - DISTRIBUTOR UNIT" paragraph.

1. Using wrenches N° 1.822.112.000 and N° 1.822.115.000 disconnect the pipe in question from the evaporator and remove it.

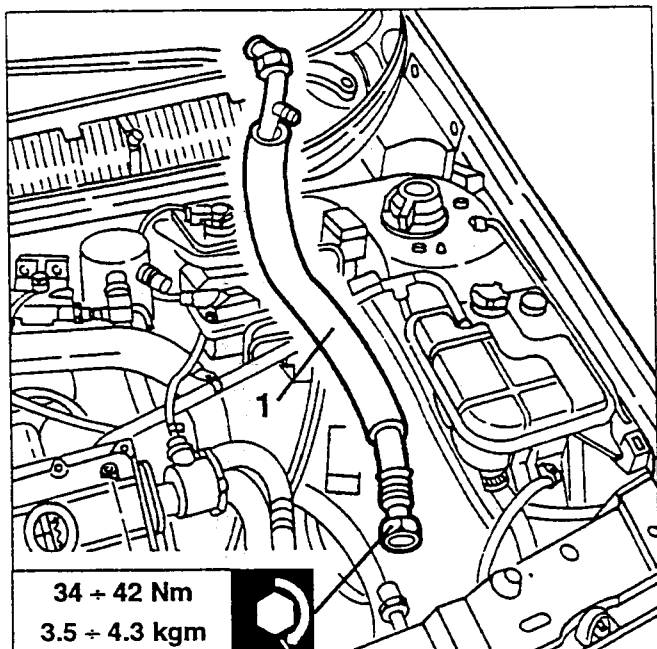


PIPE FROM DRIER FILTER TO COMPRESSOR

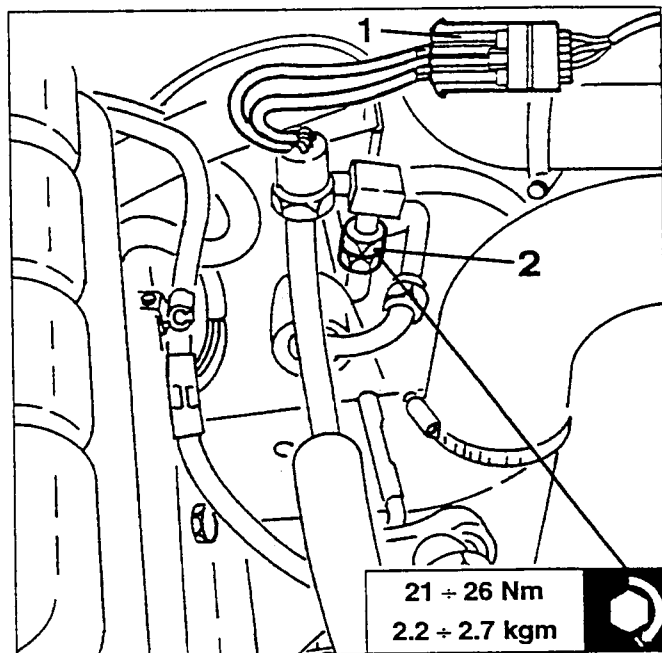
REMOVAL/REFITTING FIRST SECTION

- Drain the fluid from the conditioning system (see specific paragraph).
- Remove the battery (see GROUP 55).
- Follow the first three steps described in the "EXPANSION VALVE" paragraph.

1. Disconnect the two unions of the section of pipe in question and remove it.



1. Disconnect the electrical connection of the three-level pressure switch.
2. Disconnect the union of the pipe in question from the condenser.

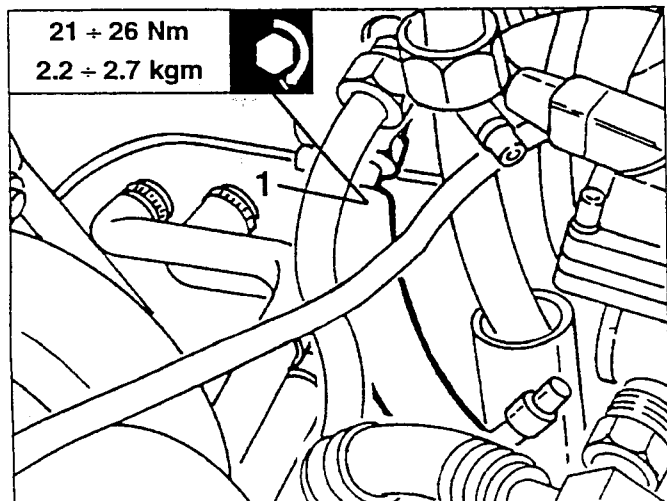


PIPE FROM CONDENSER TO EVAPORATOR

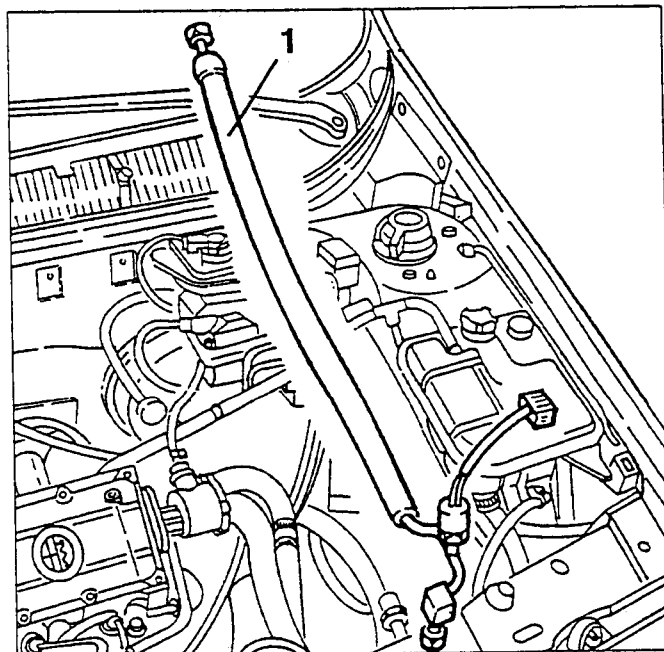
REMOVAL/REFITTING

- Drain the fluid from the conditioning system (see specific paragraph).
- Remove the battery (see GROUP 55).
- Follow the first seven steps described in the "DUCTING ASSEMBLY AND HEATER - DISTRIBUTOR UNIT" paragraph.
- Follow the first three steps described in the "EXPANSION VALVE" paragraph.

1. Using wrenches N° 1.822.111.000 and N° 1.822.113.000 disconnect the union of the pipe in question from the evaporator



1. Remove the pipe in question complete with three-level pressure switch and expansion valve.



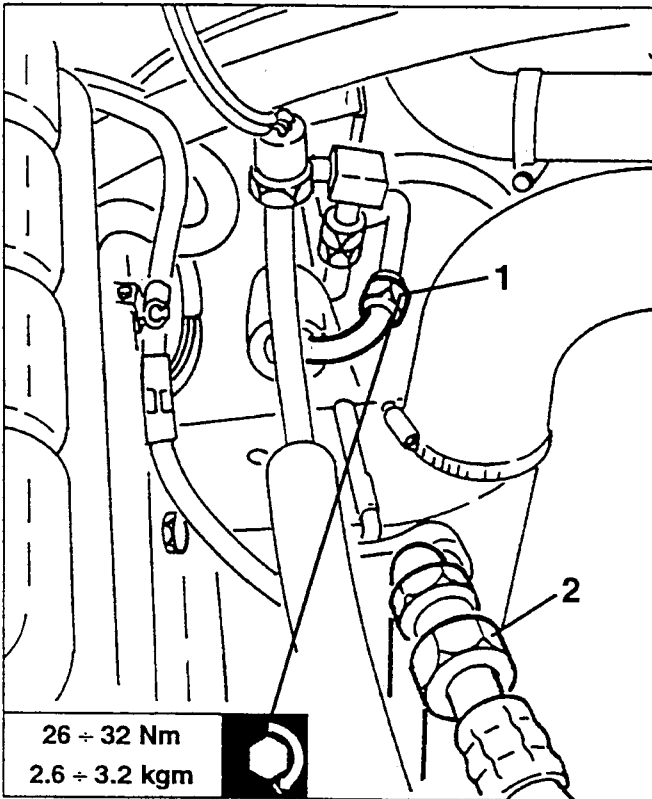
COMPRESSOR SIDE PIPES

REMOVAL/REFITTING

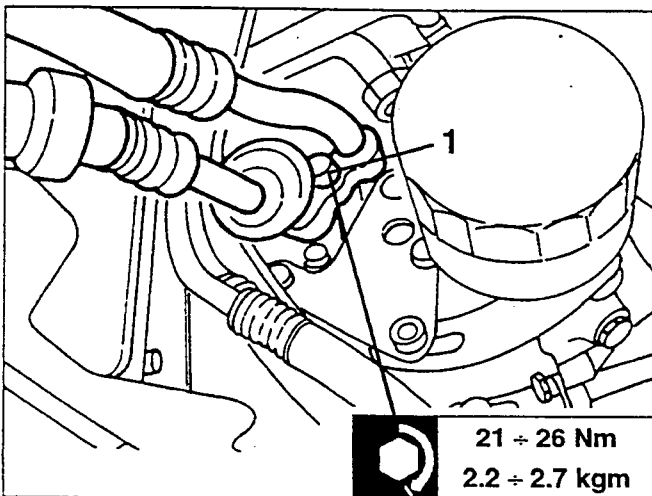
- Set the car on a lift.
- Drain the fluid from the conditioning system (see specific paragraph).

- Remove the radiator grille and front bumper (see GROUP 70).
- Follow the first three steps described in the "EXPANSION VALVE" paragraph.

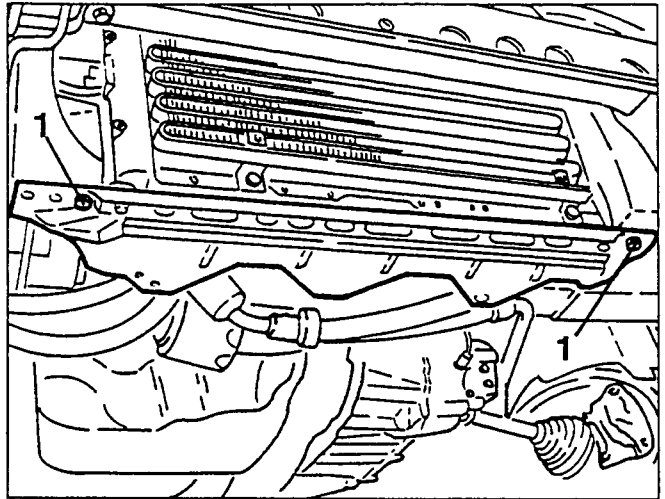
1. Disconnect the union of the pipes in question from the condenser.
2. Disconnect the intermediate union of the pipes in question.



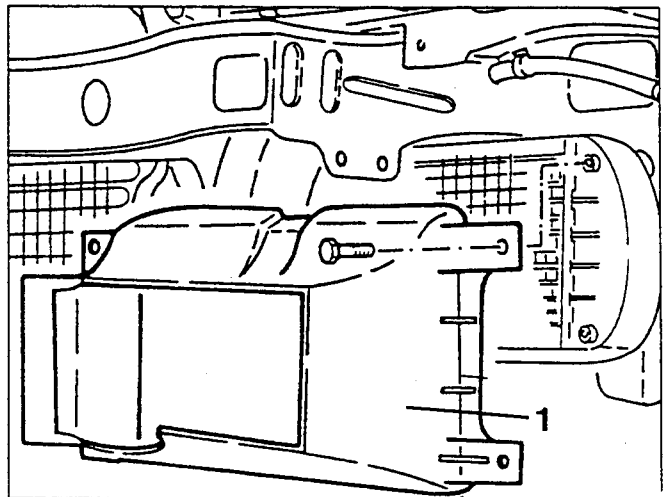
- Raise the car.
- 1. Slacken the fastening screw and disconnect the pipes in question from the compressor.



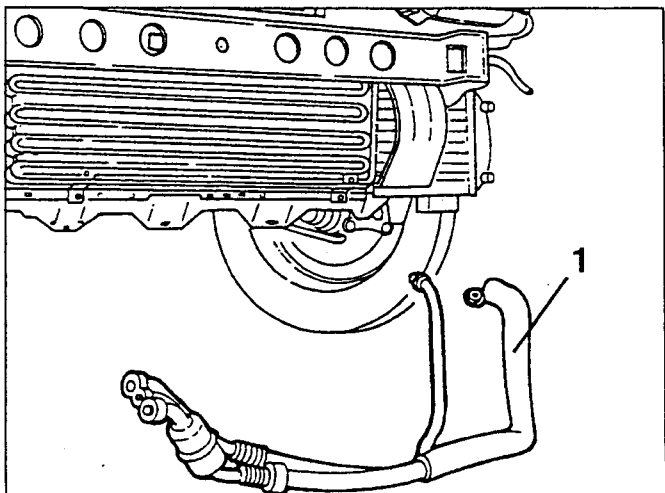
1. Slacken the fastening nuts and remove the lower radiator cross rail.



1. Slacken the fastening screws and remove the air ducting system from the intercooler.



1. Remove the pipes in question.

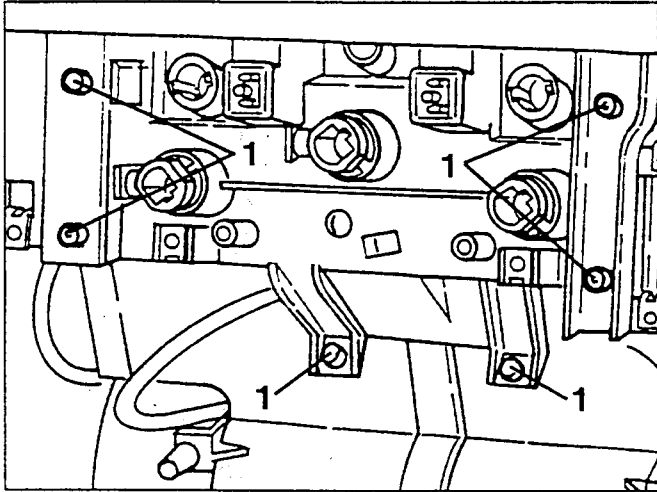


HEATER RADIATOR

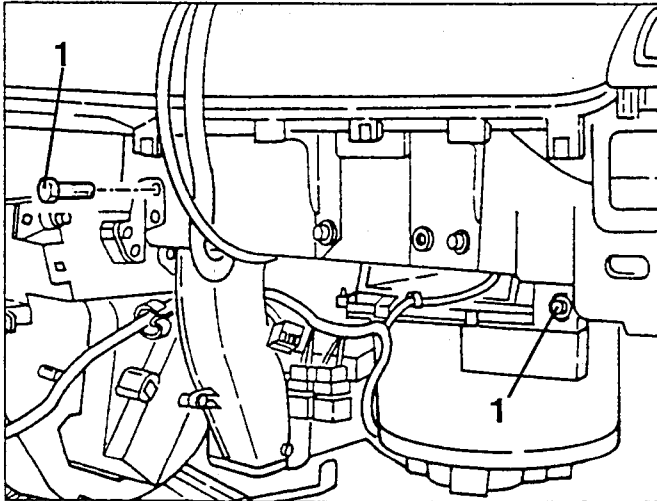
REMOVING/REFITTING

- Remove the lower part of the dashboard and the centre console (see GROUP 70).

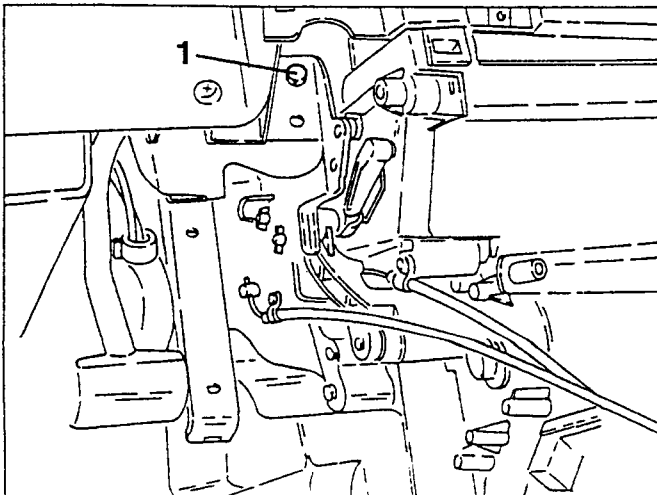
1. Slacken the fastening screws and lower the controls.



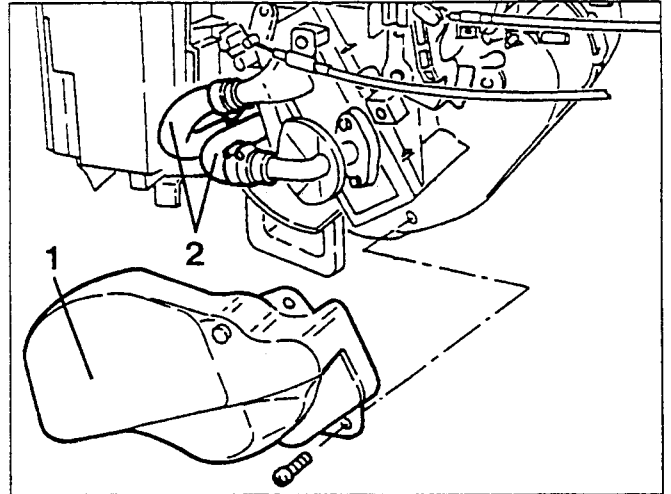
1. Slacken the three screws fastening the heating and ventilation unit on the righthand side.



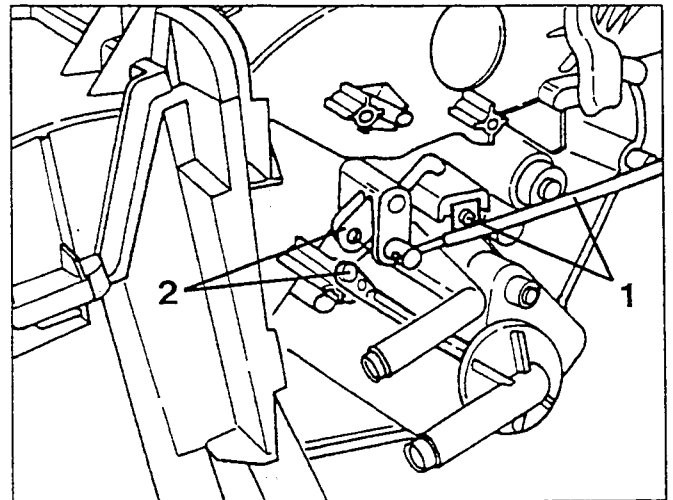
1. Slacken the screw fastening the heating and ventilation unit on the lefthand side.



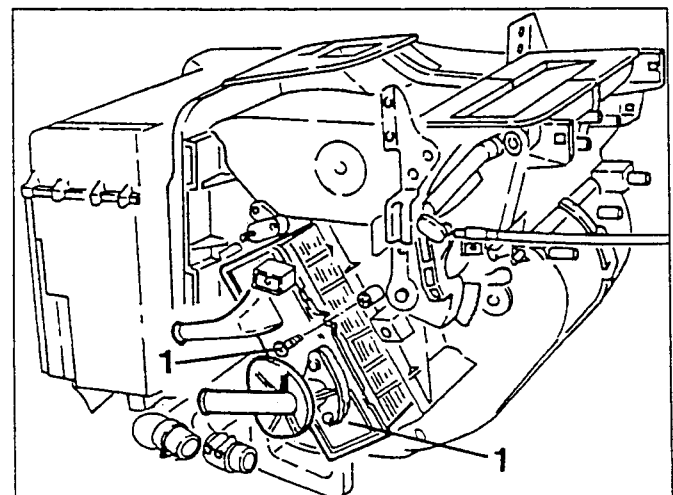
1. Slacken the fastening screws and remove the coolant pipe guard.
2. Disconnect the coolant fluid inlet and outlet pipes.



1. Remove the mixing port-coolant fluid inlet cock control cable.
2. Disconnect the fluid inlet cock control rod at the top.



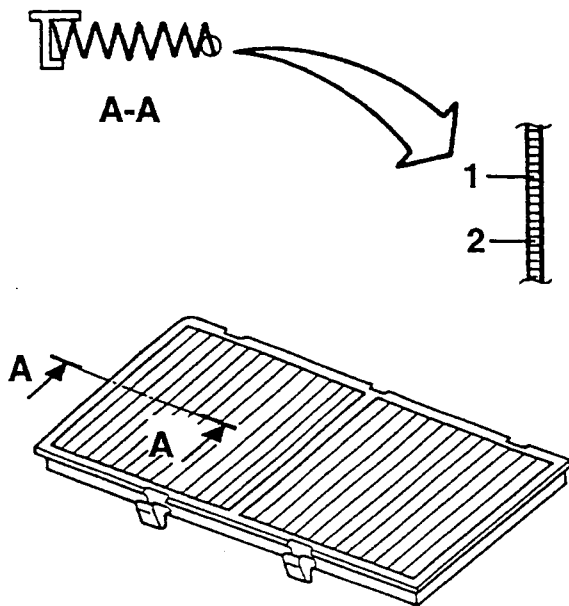
1. Move the unit enough to slacken the two fastening screws and take out the heater radiator.



POLLEN FILTER (upon request for the Versions /Markets for which it is foreseen)

The heating and ventilation unit may be fitted with a special dust/pollen filter formed of polyester fibres outside and electrostatically charged polycarbonate fibres inside (see figure).

This filter combines the mechanical filtering action of the air with an electrostatic effect so that the outside air admitted to the passenger compartment is cleaned and free of contaminants such as dust, pollen, etc., on condition of course, that the door windows are shut.



1. Polycarbonate fibres
2. Polyester fibres (non woven fabric)

NOTE:

The conditions of the filtering element should be checked once a year, preferably at the beginning of the warm season. It should be checked more frequently when the car is usually used in town or dusty areas.

REMOVAL/REFITTING

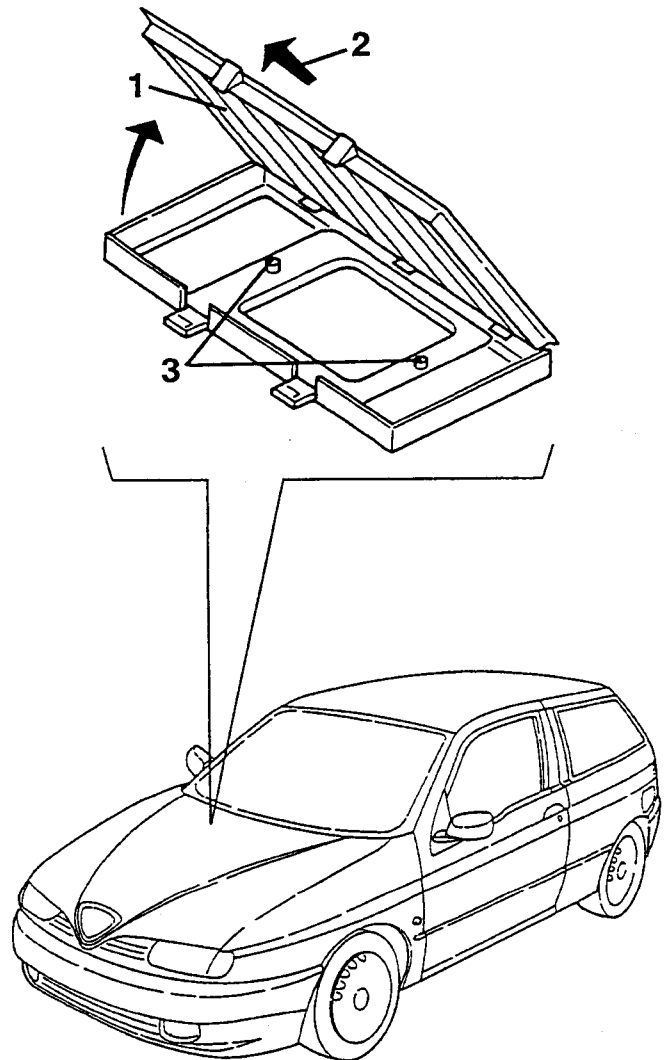


WARNING:

The failure to replace the filter or its incorrect installation can considerably reduce the effectiveness of the heating and ventilation system.

- Remove the air intake grille (see GROUP 70).

1. Raise the filtering element that is snap fastened by two hooks.
2. Remove the filtering element complete with frame; remove the element from the frame and replace it with a new one.
3. If necessary, remove the filtering element housing, slackening the two screws fastening it to the panel beneath.



LOCATING LEAKS IN THE SYSTEM

Check that all the unions are tightened. If leaking persists, check the presence of the O-rings on the unions, then add a certain amount of R134a to the system (appr. 200 gr.), find the leak using a leak detector, then drain the fluid and mend the leak. Use one of the leak detectors described in the special Tool Bulletins.

EMPTYING THE SYSTEM- RECOVERING THE REFRIGERANT FLUID

The safety rules given in the introduction must be adhered to. It is especially important to bear in mind the following:



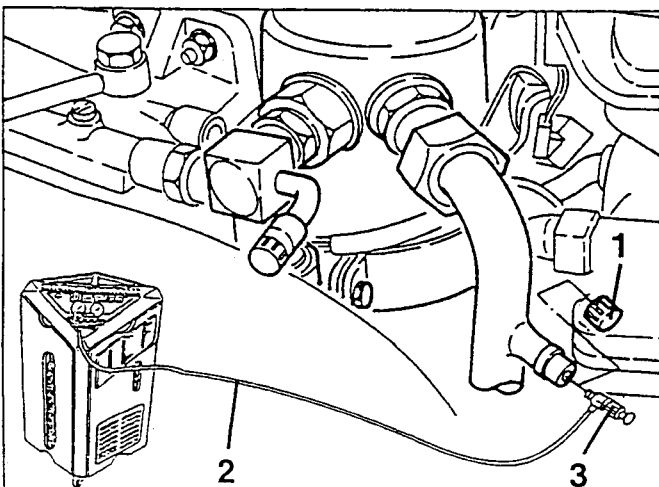
Any refrigerant fluid R134a spilt accidentally from the system or from the draining and recovery equipment can become toxic if very close to flames or in the presence of certain metals (magnesium and aluminium for example) in the form of fine particles or dust. It is therefore wise to work without free flames and in well-aired environments with the extractor system operating.

Avoid prolonged contact of the skin with refrigerant fluid R134a during evaporation as the low temperature (appr. -30°C) it reaches at the end of expansion can cause cold "burns". It is therefore wise to use leather or thick fabric gloves.

The eyes must absolutely be protected from contact with the fluid as the very low temperature can cause serious harm to them.

Discharge of the refrigerant fluid to the atmosphere is an environmental hazard. Only use the specific equipment specified in the Tool Bulletins and described below for draining R143a from the system.

1. Slacken and remove the plug of the valve on the low pressure pipe.
2. Connect the drainage pipe to the drainage/recovery station.
3. Fit the special quick coupling pipe provided with the R143a recovery equipment on the valve and completely drain the fluid from the system, following the directions given in the instructions for the equipment.



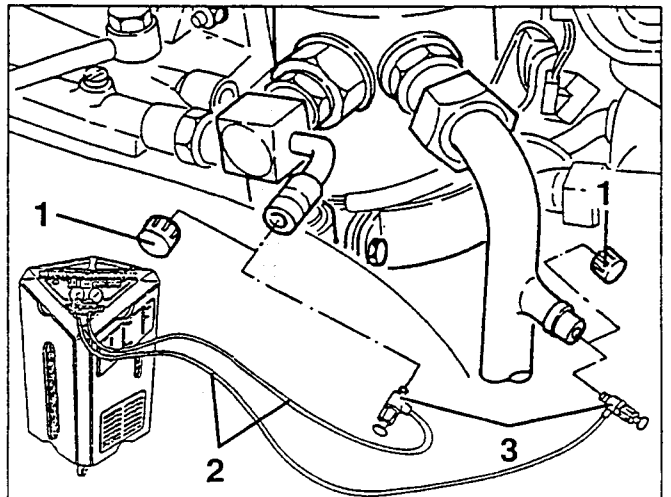
RECHARGING THE REFRIGERANT FLUID

1. Slacken and remove the caps from the rapid coupling valves located on the low pressure hoses.
2. Connect the drainage pipe to the refrigerant fluid drainage/recovery station.

WARNING:

Adhere to the technical specifications (see GROUP 00) for the quantity of R134a to be used for recharging.

3. Connect the high and low pressure union pipes to the corresponding quick coupling valves and begin the R134a recharging procedure following the directions in the instructions of the equipment.



R134a is a fluid which, if used with suitable care, is harmless for both persons and cars: however, as it is kept under pressure, it is subject to physical transformations which can make it harmful if it is not kept under perfect control. Therefore, the following warnings must be strictly adhered to.

The coolant is normally stored in metal cylinders: never expose the cylinders to sunlight for prolonged lengths of time, an increase in temperature increases the pressure that could exceed the safety limit.

During cold weather, difficulty is likely in transfer from the metal cylinder to the charging station due to the low pressure in the cylinder: in this case, before transferring, leave the cylinder for about twenty minutes in a heated place at temperatures not exceeding 35°C, and never using a free flame to warm the cylinder. Never leave the charging station cylinder completely full for long lengths of time.

Before recharging the system, top up the compressor with the oil removed during drainage (see the following paragraph).

To top up the lubricating oil in the conditioner compressors for R134a, only use the quantity and type of oil specified.

When recharging refrigerant fluid R134a only use the special equipment described in the specific Tool Bulletins.

TOPPING-UP THE OIL LEVEL IN THE COMPRESSOR

NOTE:

The compressor oil level should only be topped up when presumably a considerable amount has been leaked due to damage or disconnections of the conditioning unit components or when the system is drained/recharged.

In the event of operations in the engine compartment involving leaving the pipes of the system exposed to the air for more than six hours, topping up is insufficient and the compressor lubricating oil needs to be changed completely, proceeding as described in the following point C (after washing the system - see the specific paragraph).

To top up the oil level only use oil of the type specified in the specifications (see GROUP 00).

A) "SLOW" SYSTEM DRAINING - In case of Routine Maintenance

When draining the system using the equipment described previously, the compressor oil removed is collected in a special graduated container.

- Before recharging the refrigerant fluid, top the system up with the quantity marked on the container, plus 15 cm³.

- Use a syringe to send the oil through the special hole on the evaporator outlet pipe.

B) "QUICK" SYSTEM DRAINING (In under 5 minutes)

In the case of Accidental Breakages

Under these circumstances it is not possible to determine the exact quantity of the oil lost. Replace it as described above, in all cases with 50 cm³ of oil.

N.B.: if for some reason, the compressor is removed and refitted follow the description given in point C.

C) DRAINAGE FOLLOWED BY REMOVAL AND REFITTING OF THE COMPRESSOR

- Drain the R134a fluid from the conditioning system.
- Remove the compressor (see the specific paragraph).

- Remove the plug from the oil drainage/charging hole and drain off all the oil contained in the compressor (N.B. turn the compressor a few times by hand to send all the oil out).

- Refill with oil of the specified type and quantity given in the specifications (see GROUP 00).

- Re-assemble the compressor on the car.

- Recharge the system.

N.B.:

When the compressor is replaced with a new one it is not necessary to top up the system because the compressor supplied as spare is already provided with the specified amount of oil.

WASHING THE SYSTEM



In the event of damage or breakage of the compressor or of other components of the system, the system should

be accurately washed.

Washing should also be carried out to remove any damp if the pipes are left open exposed to the atmosphere for over six hours during operations in the engine compartment.

Proceed as follows:

- If the compressor has suffered damage that might have caused the presence of metal in the pipes, the connection pipes (unions) to the compressor should be blown with compressed air.

- Fill with 1.5 ÷ 2 kg of R134a on the high pressure side - red tap.

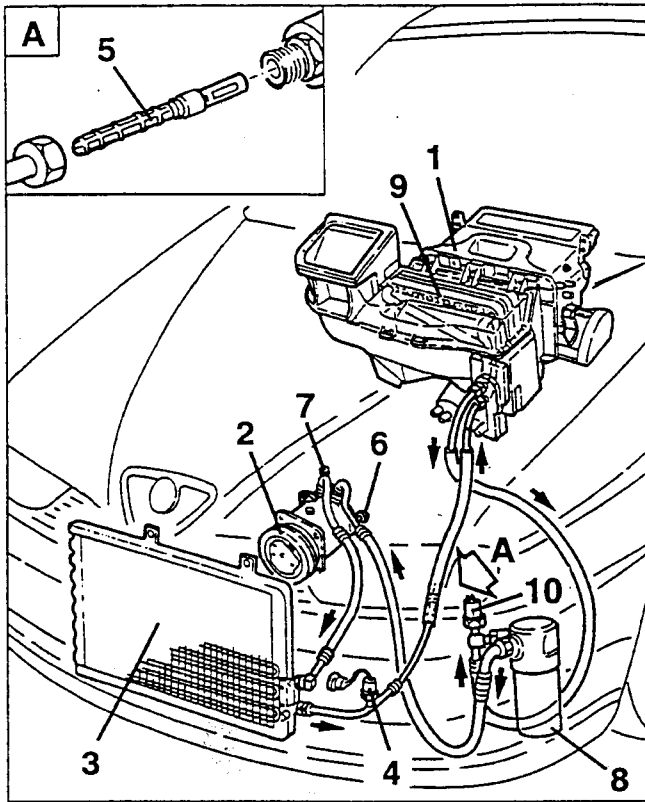
- Carry out recovery operations from the low pressure side.

- Fill a second time with 1.5 ÷ 2 kg of R134a (use the same fluid).

- Connect the system with the special drainage/recovery system described previously.

- After washing, change the drier filter and clean the filter of the expansion valve (when fitted).

- Recharge the system as described previously.

SYSTEM

1. Heating and ventilation Unit
2. Compressor
3. Condenser
4. Three-level pressure switch (trinary)
5. Expansion valve
6. Needle valve for draining/recharging
R134a on the low pressure pipe
7. Needle valve for draining/recharging
R134a on the high pressure pipe
8. Drier filter
9. Evaporator
10. Minimum pressure switch

DESCRIPTION

The heating and ventilation system for the models with boxer engines is substantially the same as the one fitted on the model with turbodiesel engine. The main differences from this system are the following:

- the adoption of a compressor with fixed rather than variable displacement;
- the adoption of a minimum pressure switch;
- different positioning of the system components in the engine compartment.



BELOW ARE GIVEN THE VARIANTS (FOR EXAMPLE THE MONOGRAPHIC PARTS AND PROCEDURES) TO THIS SYSTEM IN RELATION TO THE TURBODIESEL VERSION

STRATEGY FOR CONNECTING AND DISCONNECTING THE COMPRESSOR

The compressor is controlled by the engine electronic injection management system which adapts the idle speed when the compressor is connected, or it cuts off the connection.

IAW injection system management

In addition to adapting the idle speed each time the compressor is connected, this injection system temporarily disables (appr. 10 sec) the compressor connection if high engine power is required.

MP3.1 injection system management

This injection system only adapts the engine idle speed each time the compressor is connected.

M2.10.3 injection system management

The injection system control unit carries out the following strategies:

- it adapts the engine idle speed each time the compressor is connected; if the engine speed falls below 700 rpm, the compressor is disconnected;
- in the need for high power (high speed - above 6000 rpm engine at full load - max throttle opening) it momentarily cuts off the supply to the compressor;
- it does not allow the compressor to be connected when starting the engine until normal operating conditions have been reached.

DESCRIPTION OF THE MAIN COMPONENTS OF THE AIR CONDITIONING SYSTEM**MINIMUM PRESSURE SWITCH**

The purpose of the minimum pressure switch is to de-energize the electromagnetic joint of the compressor pulley when the pressure (in the accumulator) reaches a mean rating of 1.72 bar re-energizing it again when the pressure reaches the mean rating of 3.17 bar, in order to maintain the cold required and to prevent the evaporator from freezing.

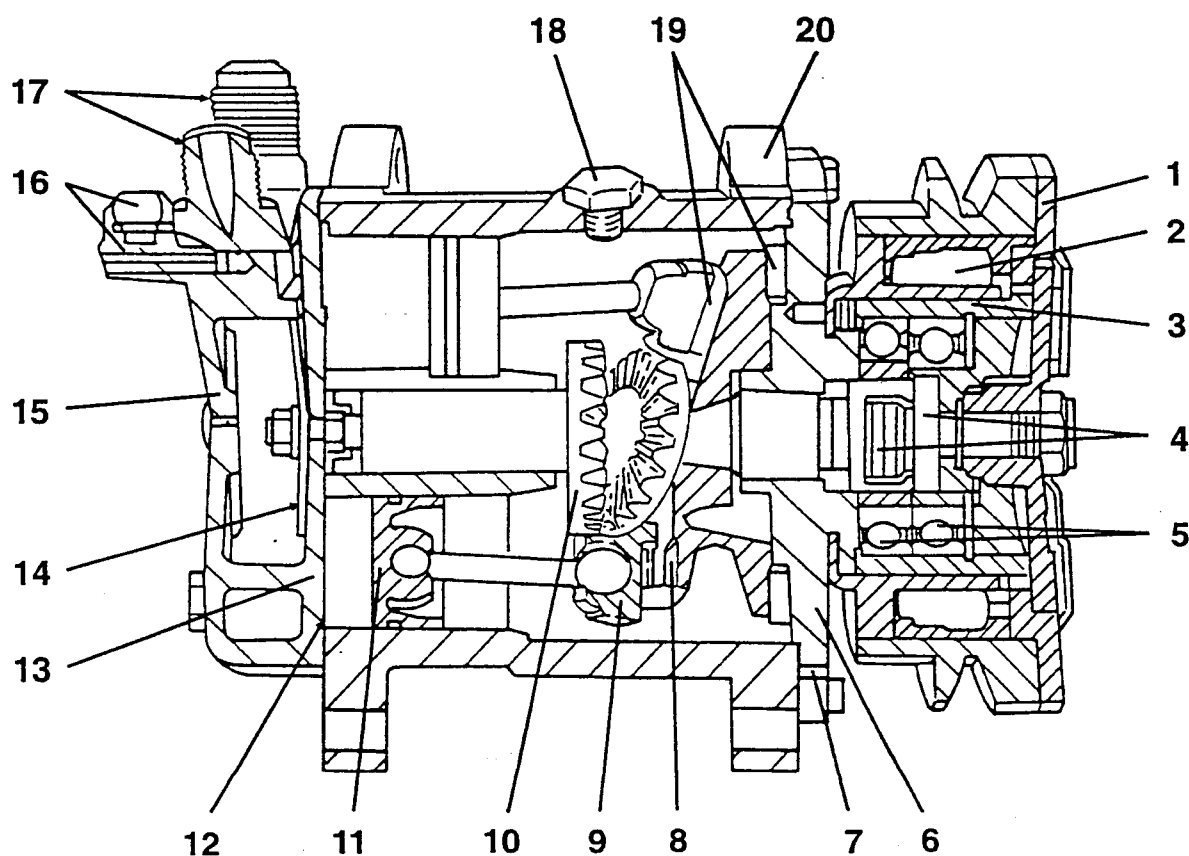
It also protects the compressor disconnecting the electromagnetic joint from its pulley when the pressure of the refrigerant falls below 1.58 bar due to a leak or when the environment temperature falls below 2.7°C.

COMPRESSOR

The SANDEN compressor shown in diagram form in the cutaway view below comprises the following:

- a block (20);
- seven pistons (11) complete with corresponding connecting rod;
- a plate (13) with one-way blade type delivery and intake valve that operates automatically;
- a cylinder (15) head on which the intake and exhaust ducts are machined (17).

The reciprocating motion needed for the pistons to run in their liners is developed by the rotary motion of a tilted plate (rotor 8) on which, with the interposition of roller (18) a plate (9) rests to which the connecting rods of the pistons (11) are connected by ball joints. The plate (9) is unable to rotate and it articulates on two toothed gears (10).



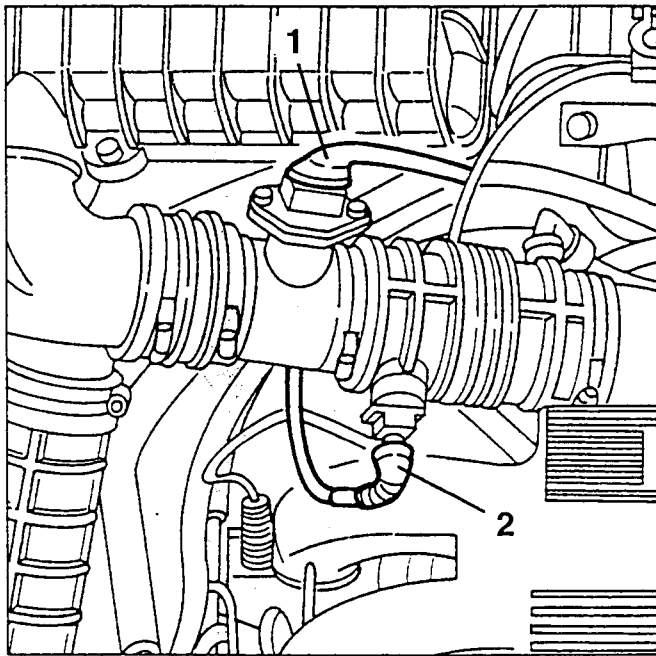
- | | |
|---------------------------------|-------------------------------|
| 1. Clutch plate | 11. Piston |
| 2. Electromagnet | 12. Seal for valve plate |
| 3. Rotor with pulley | 13. Valve plate |
| 4. Set of seals | 14. Cylinder head seal |
| 5. Ball bearings | 15. Cylinder head |
| 6. Front plate | 16. Service needle valve |
| 7. Seal ring | 17. Intake and delivery ducts |
| 8. Rotor | 18. Oil filler plug |
| 9. Connecting rod carrier plate | 19. Roller thrust bearings |
| 10. Antirotation gear | 20. Compressor block |

DUCTING SYSTEM AND HEATER - DISTRIBUTOR UNIT (TWO BOWDEN)

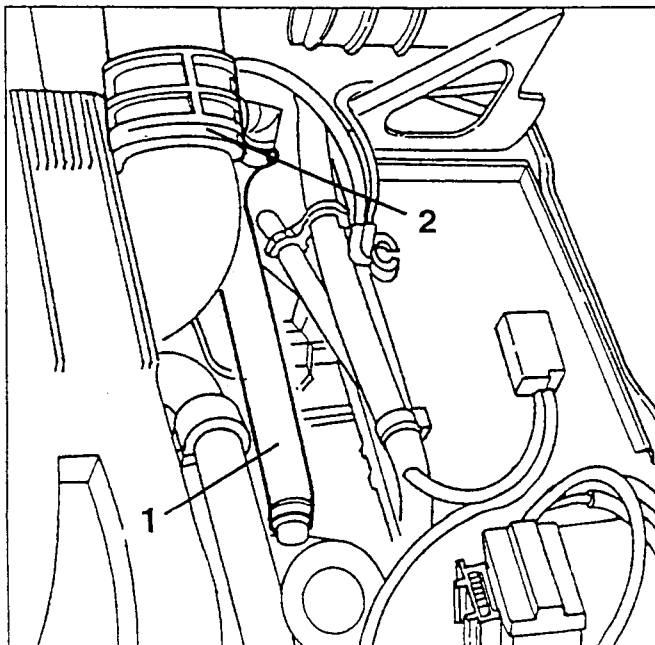
REMOVAL/REFITTING

- Drain the fluid from the conditioning system (see specific paragraph).
- Remove the battery with its acid drain tray (see GROUP 55).

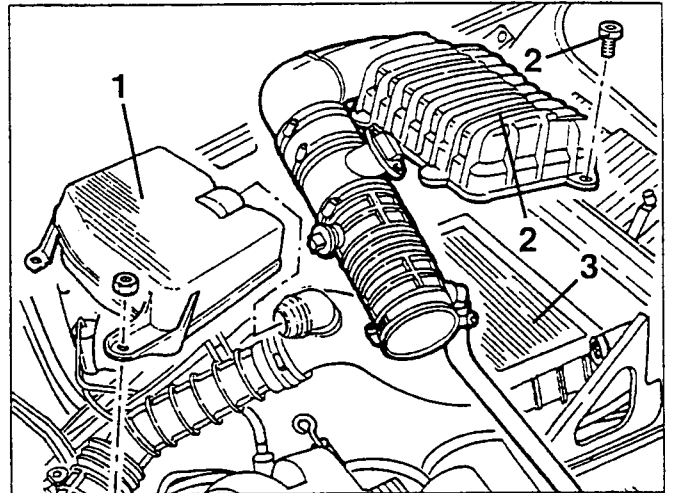
1. Disconnect the electrical connection from the air flow meter.
2. Disconnect the electrical connection from the intake air temperature sensor.



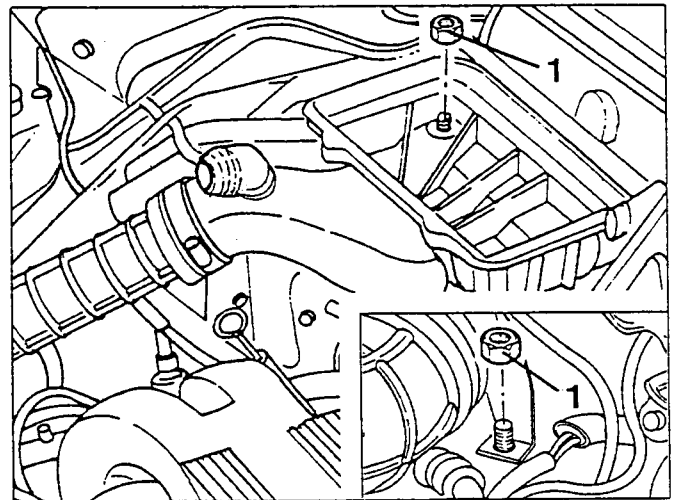
1. Disconnect the oil vapour recovery pipe from the engine oil filler.
2. Disconnect the corrugated sleeve from the intake box.



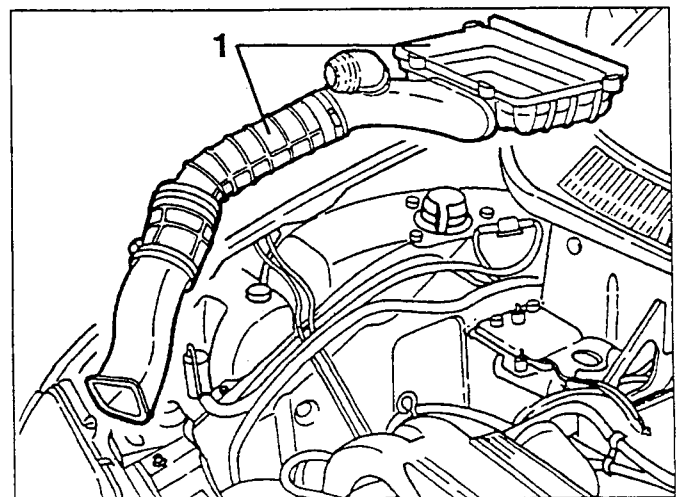
1. Remove the resonator
2. Slacken the four fastening screws and remove the air cleaner cover complete with sleeves.
3. Remove the filtering element.



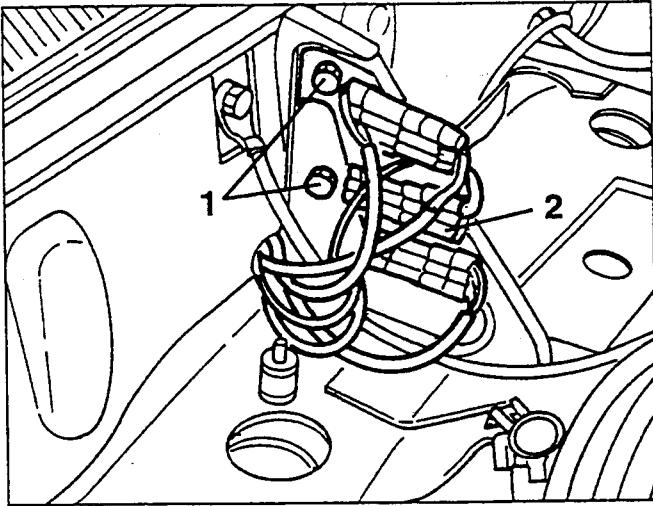
1. Slacken the three air cleaner fastening nuts and the front bolt fastening the air intake sleeve.



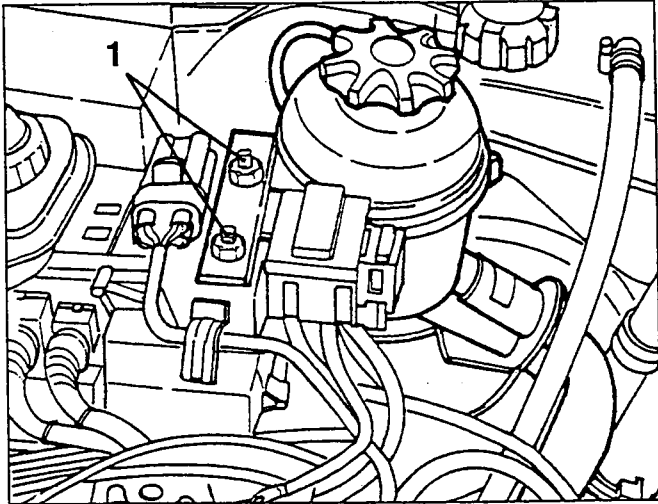
1. Remove the air cleaner box complete with air intake sleeve.



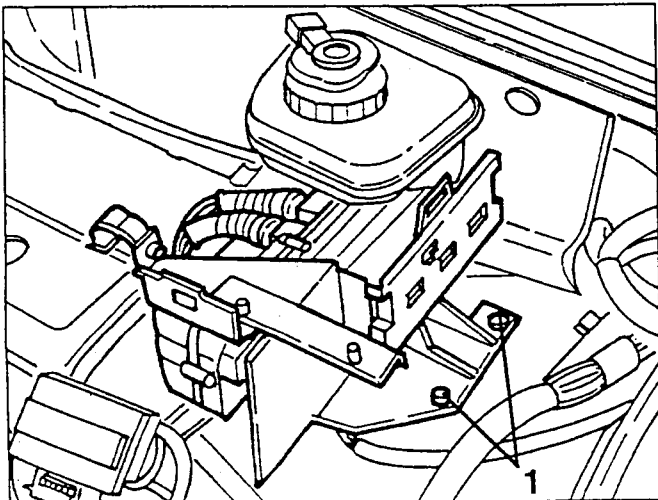
1. Slacken the two screws fastening the power steering crossrail support bracket.
2. Move the electrical connections away from the power steering crossrail support bracket.



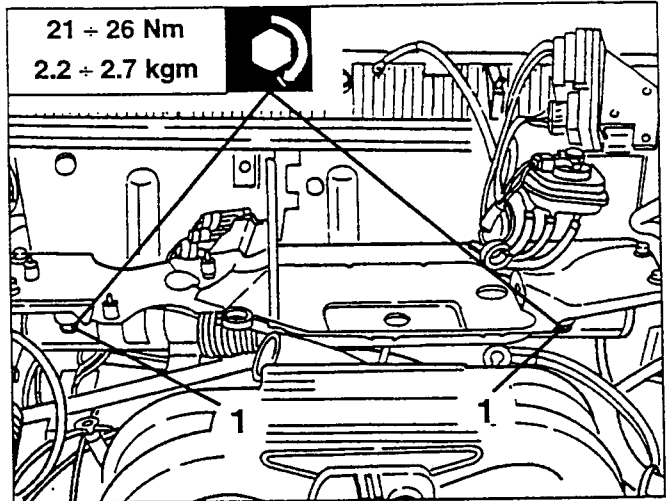
1. Slacken the two fastening screws and move the power steering reservoir sideways without disconnecting the pipes.



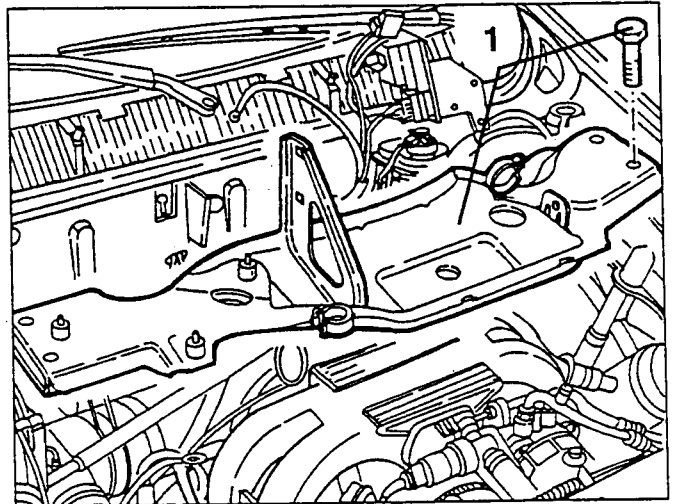
1. Free the support bracket of the relay switches from the electrical connections, then slacken the fastening screws and move it to one side.



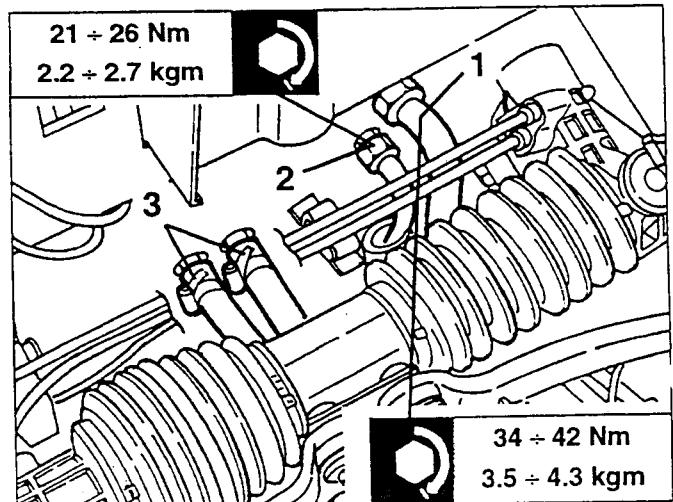
1. Slacken the four screws fastening the power steering box to the support crossrail.



1. Slacken the four fastening screws and remove the power steering unit support crossrail.

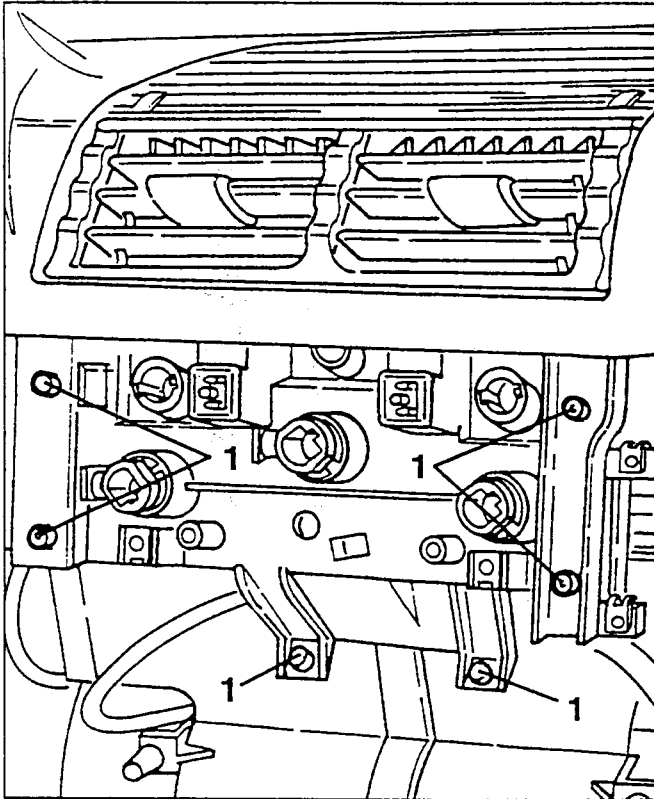


1. Using wrenches N° 1.822.112.000 and N° 1.822.115.000 disconnect the fluid outlet pipe union from the evaporator.
2. Using wrenches N° 1.822.111.000 and N° 1.822.113.000 the fluid inlet pipe union from the evaporator.
3. Disconnect the two coolant inlet and outlet pipes from the radiator and recover the coolant fluid.



- Remove the lower part of the dashboard and the centre console (see GROUP 70).

1. Slacken the four fastening screws and lower the heating and ventilation unit controls.



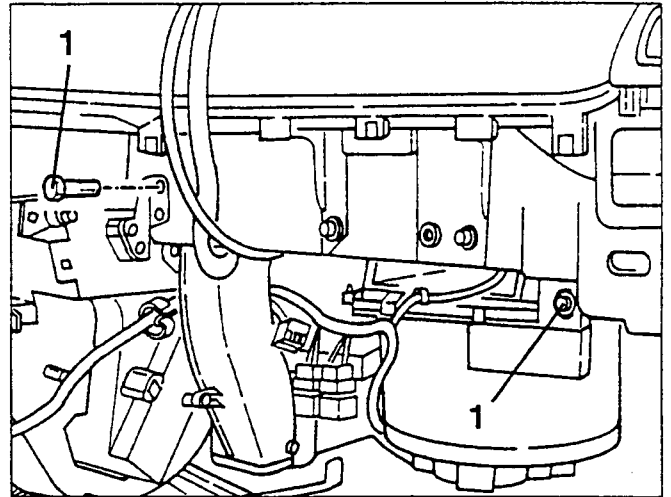
- Remove the two sections of air delivery pipe to the rear passenger face level (see GROUP 70).

- Disconnect the electrical connections of the heating and ventilation unit.

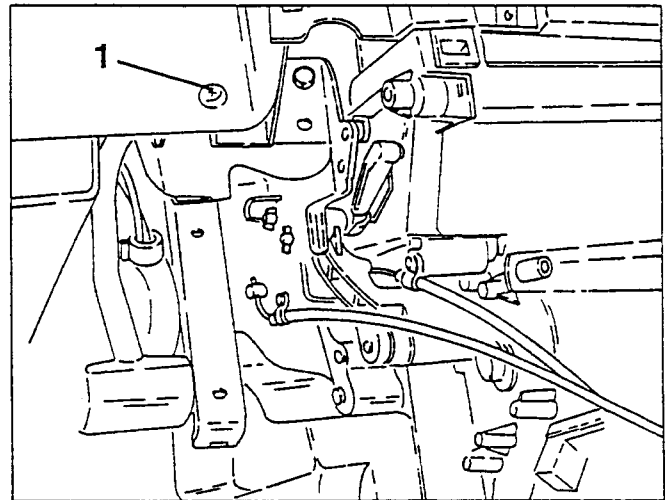
1. Move aside the floor mat, slacken the two fastening screws and remove the control unit cover.



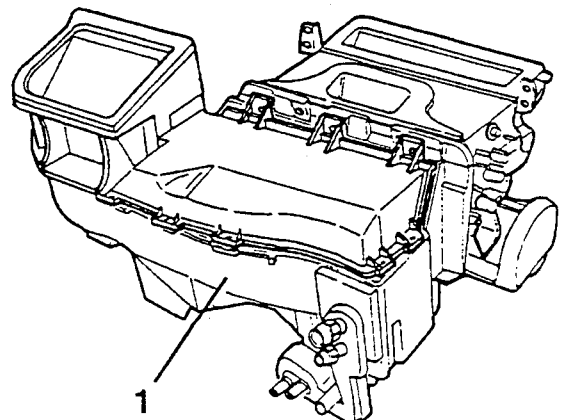
1. Slacken the three screws fastening the heating and ventilation unit on the righthand side.



1. Slacken the screw fastening the heating and ventilation unit on the lefthand side.



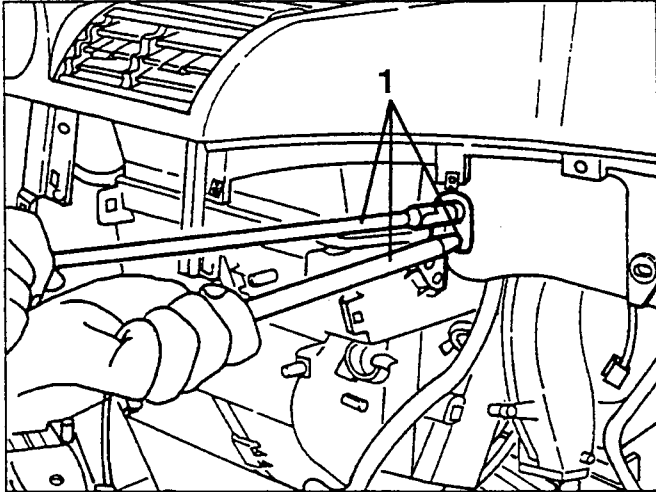
1. Remove the heating and ventilation unit.



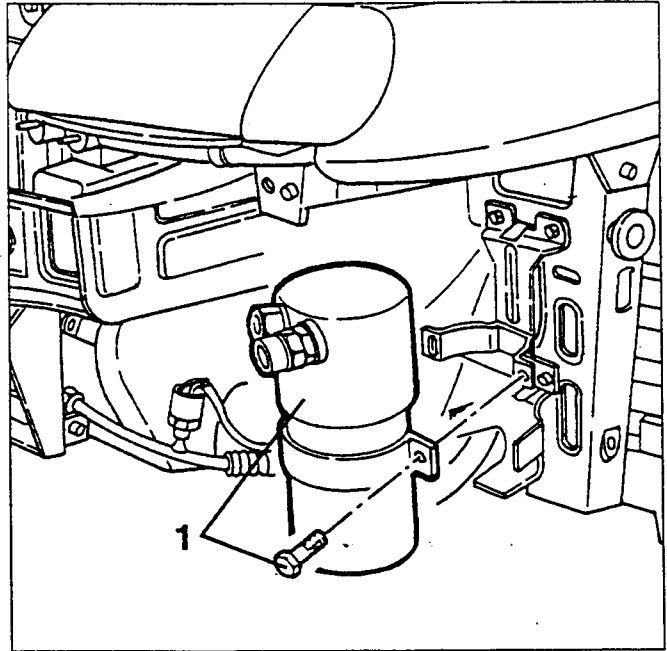


Refit the unit reversing the sequence followed for its removal, adhering to the following instructions:

- Coat the mouth of the heater, water drain and R134a pipes with vaseline.
 - Assemble the unit making sure that the above pipes are correctly inserted in the passage holes.
1. Use a centering pin positioned as shown, and centre the group before fixing it.



1. Slacken the clamp screw and remove the drier filter.



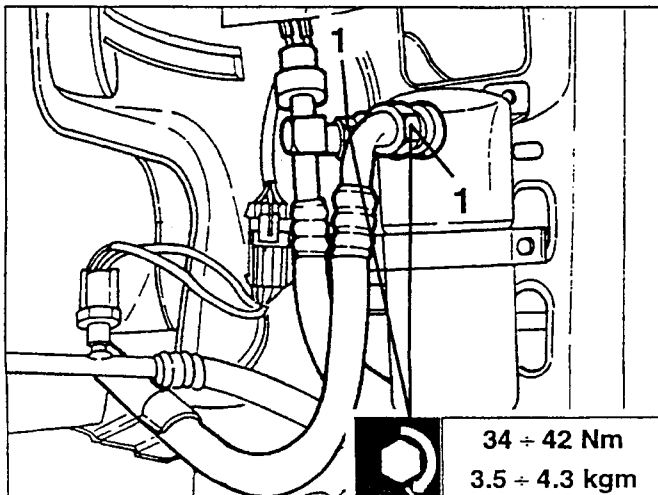
DIS-ASSEMBLY

- Proceed as described for the turbodiesel version.

DRIER FILTER

REMOVAL/REFITTING

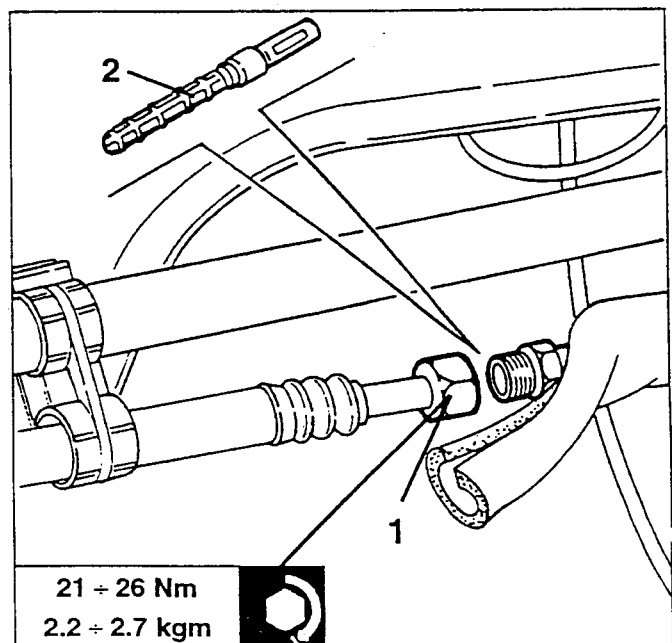
- Set the car on a lift.
 - Disconnect the battery (-) cable.
 - Drain the fluid from the conditioning system (see specific paragraph).
 - Remove the radiator grille and front bumper (see GROUP 70).
1. Disconnect the two refrigerant fluid inlet and outlet pipe unions from the drier filter.



EXPANSION VALVE

REMOVAL/REFITTING

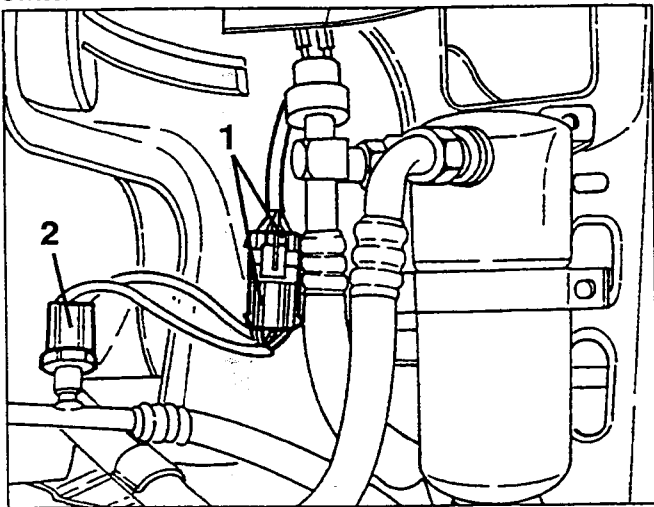
- Set the car on a lift.
 - Drain the fluid from the conditioning system (see specific paragraph).
 - Remove the left front wheel and wheel house.
1. Slacken the intermediate union of the freon delivery pipe from the condenser to the evaporator.
2. Pull out and remove the expansion valve.



THREE-LEVEL PRESSURE SWITCH (TRINARY)

REMOVAL/REFITTING

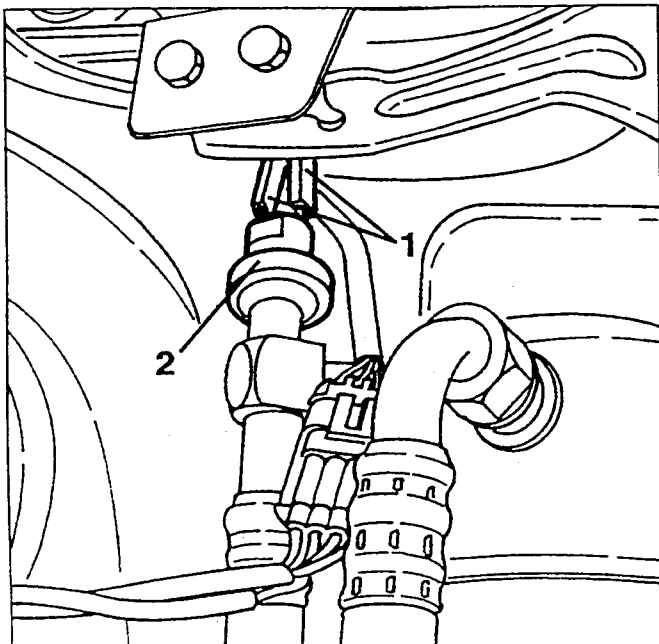
- Set the car on a lift.
- Remove the radiator grille and front bumper (see GROUP 70).
- 1. Disconnect the electrical connection of the three-level pressure switch.
- 2. Slacken and remove the three-level pressure switch.



MINIMUM PRESSURE SWITCH

REMOVAL/REFITTING

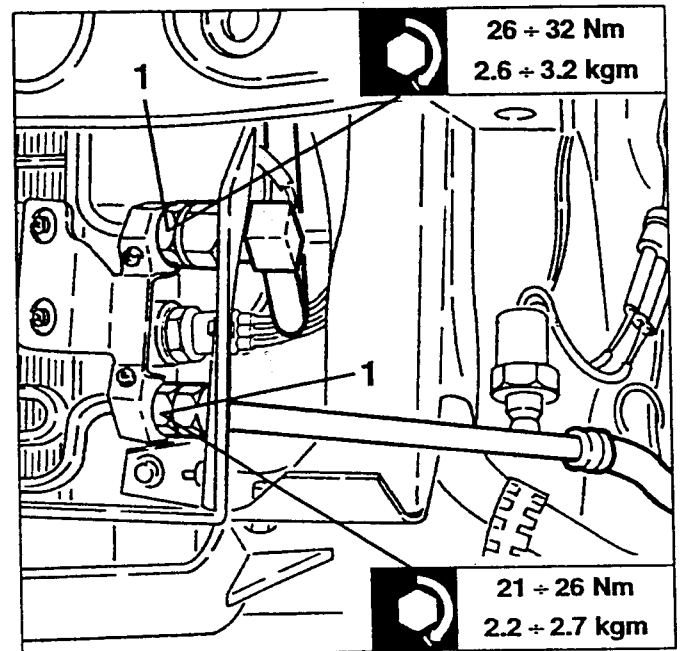
- Set the car on a lift.
- Remove the radiator grille and front bumper (see GROUP 70).
- 1. Disconnect the two electrical connections from the minimum pressure switch.
- 2. Slacken and remove the minimum pressure switch.



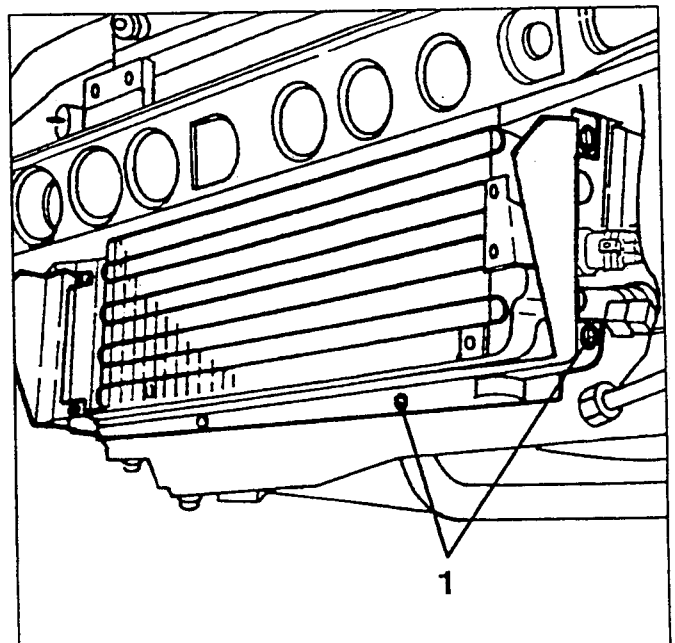
CONDENSER

REMOVAL/REFITTING

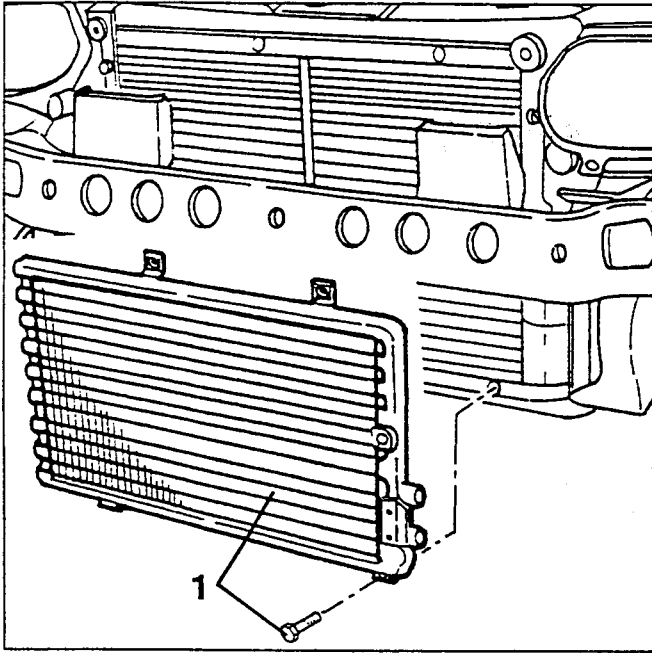
- Set the car on a lift.
- Drain the fluid from the conditioning system (see specific paragraph).
- Remove the radiator grille and front bumper (see GROUP 70).
- 1. Disconnect the refrigerant fluid inlet and outlet pipe unions from the condenser.



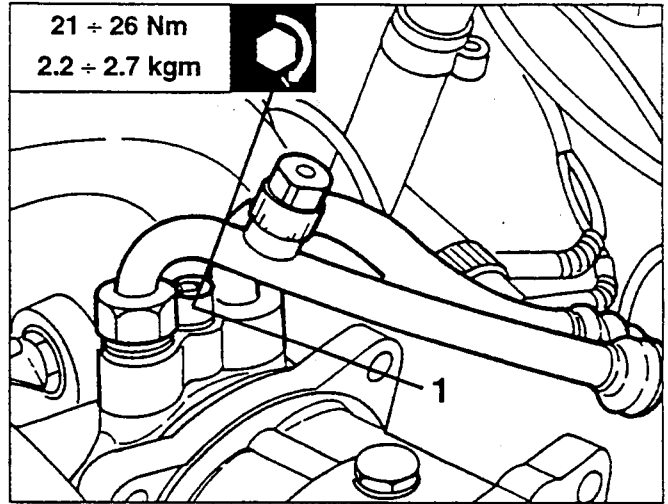
1. Slacken the fastening screws and remove the air ducting system.



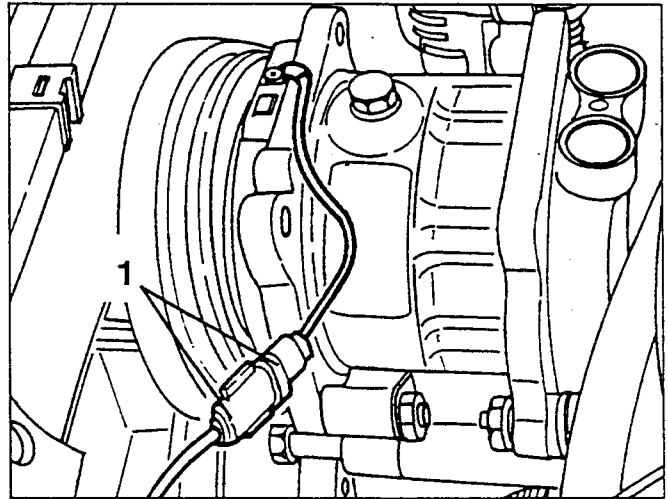
1. Slacken the four fastening screws and remove the condenser.



1. Disconnect the fluid inlet and outlet pipe unions from the compressor slackening the corresponding screw.



1. Disconnect the compressor electrical connection.



COMPRESSOR

REMOVAL/REFITTING

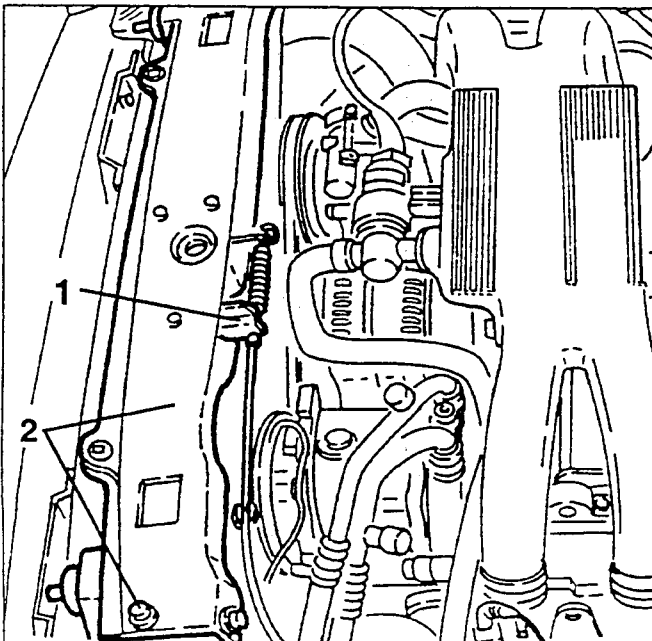
- Drain the fluid from the conditioning system (see specific paragraph).

- Disconnect the battery (-) terminal.

- Remove the radiator grille (see GROUP 70).

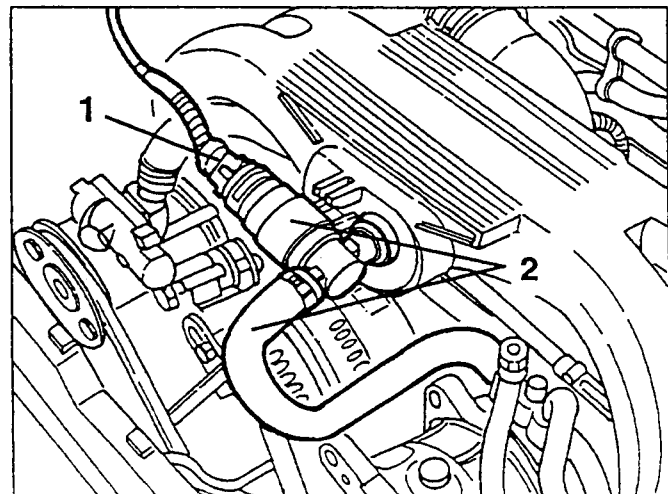
1. Disconnect the opening cable from the bonnet lock.

2. Slacken the fastening screws and remove the upper radiator crossrail.

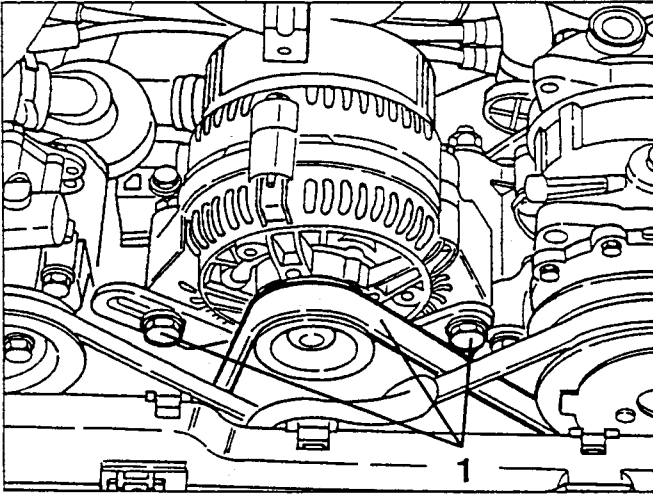


1. Disconnect the electrical connection from the idle speed actuator.

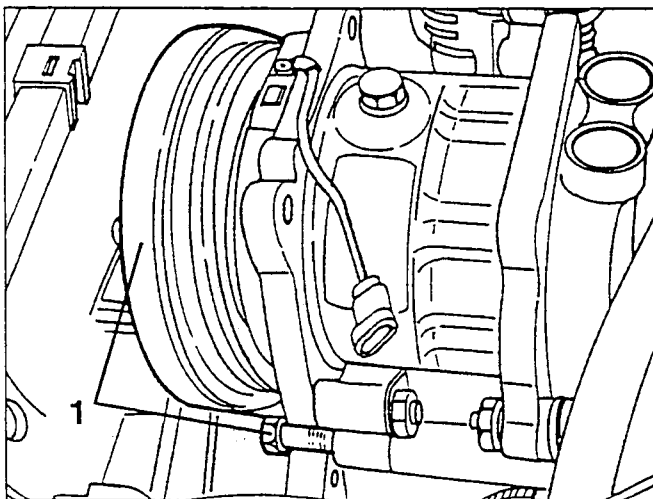
2. Slacken the clamp and disconnect the idle speed actuator from the intake box and move it to one side.



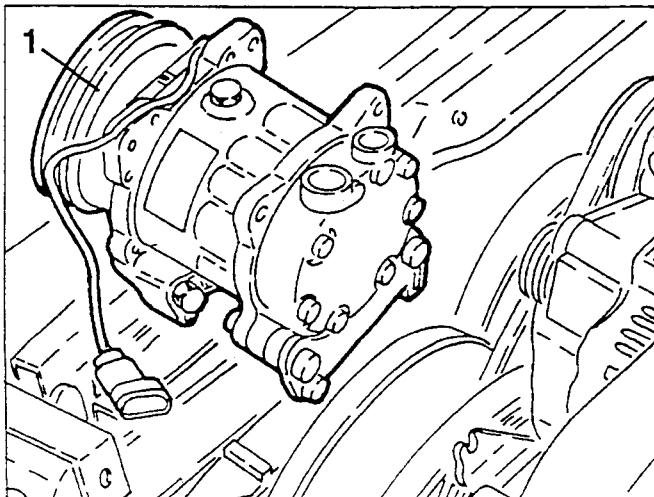
1. Slacken the two alternator fastening bolts and remove the drive belt.
 - Completely unscrew the two bolts slackened previously and move the alternator just enough to disconnect the electrical connections.



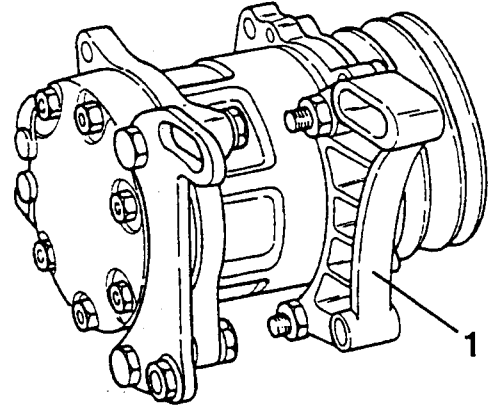
1. Slacken the right bolt and left screw fastening the compressor and remove the drive belt.



1. Completely unscrew the fastening bolt and screw and remove the compressor.



1. On the bench, slacken the fastening bolts and separate the brackets from the compressor.



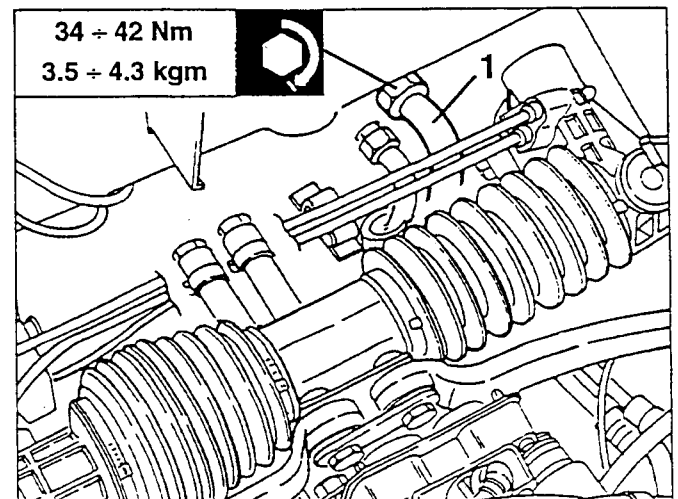
- When refitting, tension the compressor drive belt and the alternator - water pump drive belt (see GROUP 00).

PIPE FROM EVAPORATOR TO DRIER FILTER

REMOVAL/REFITTING

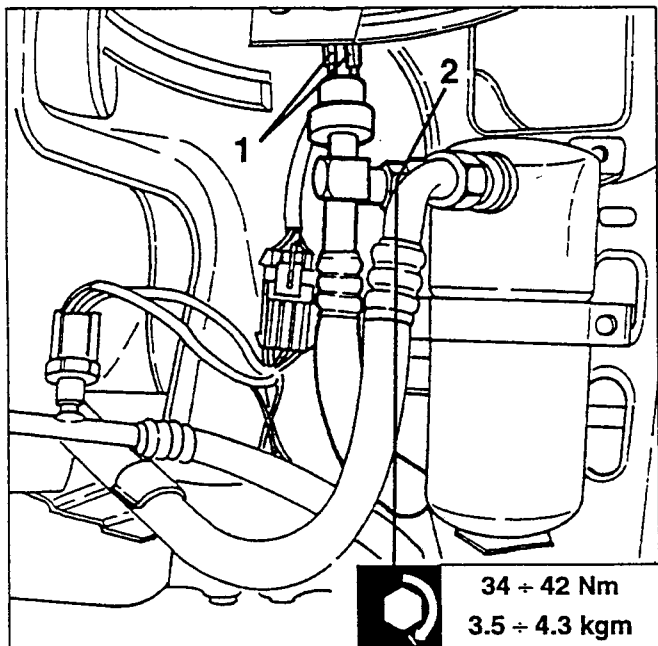
- Set the car on a lift.
- Drain the fluid from the conditioning system (see specific paragraph).
- Remove the radiator grille and front bumper (see GROUP 70).
- Remove the left front wheel.
- Remove the battery with its acid drain tray (see GROUP 55).
- Follow the first ten steps described in the "DUC-TING ASSEMBLY AND HEATER - DISTRIBUTOR UNIT" paragraph.

1. Using wrenches N° 1.822.112.000 and N° 1.822.115.000 disconnect the freon outlet pipe union from the evaporator.

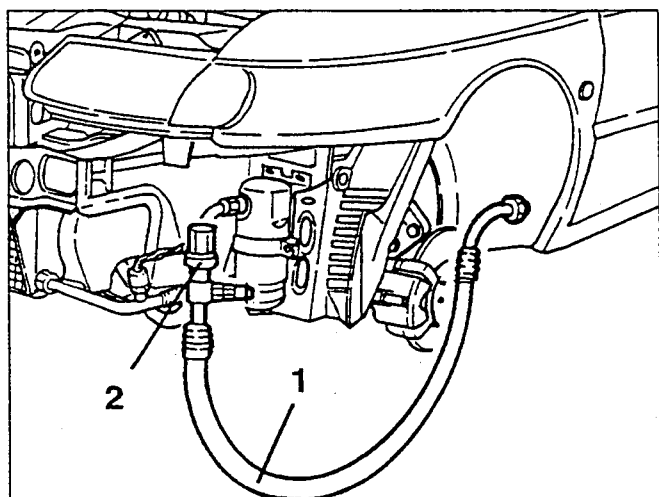


- Raise the car.

1. Disconnect the two electrical connections from the minimum pressure switch.
2. Disconnect the union of the pipe in question from the drier filter.



1. Remove the pipe in question disconnecting it from its clamps.
2. On the bench, slacken and remove the minimum pressure switch from the pipe.



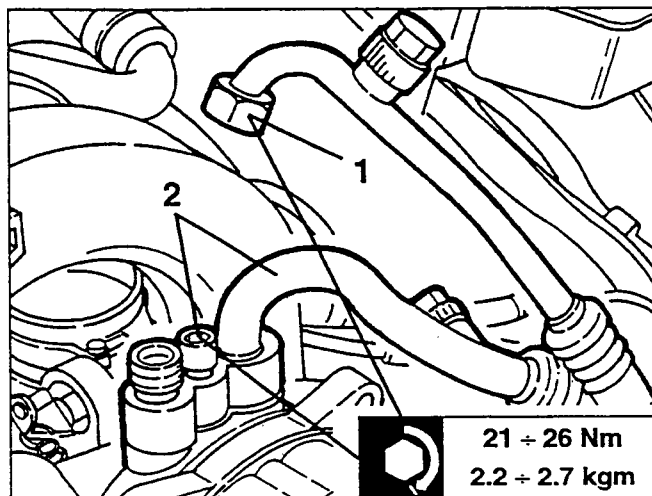
PIPE FROM THE DRIER FILTER TO THE COMPRESSOR

REMOVAL/REFITTING

- Set the car on a lift.
- Drain the fluid from the conditioner system (see specific paragraph).

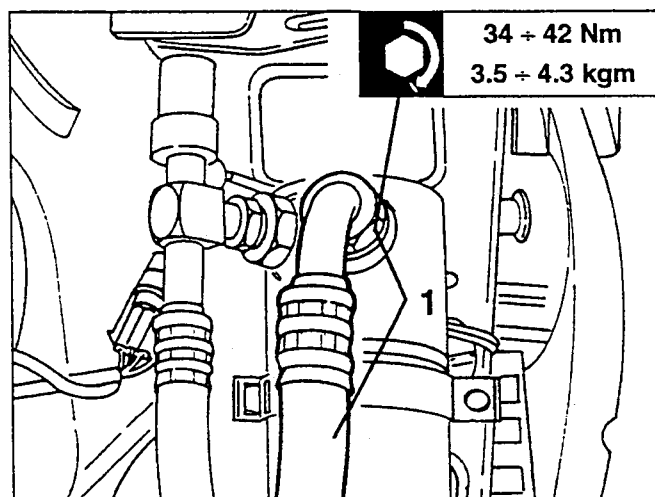
- Remove the radiator grille and front bumper (see GROUP 70).

1. Disconnect condenser connection pipe union from the compressor.
2. Slacken the fastening screw and disconnect the pipe in question from the compressor.



- Raise the car.

1. Disconnect the union of the pipe in question from the drier filter and release it from the hose clamps to remove it.



PIPE FROM THE CONDENSER TO THE EVAPORATOR

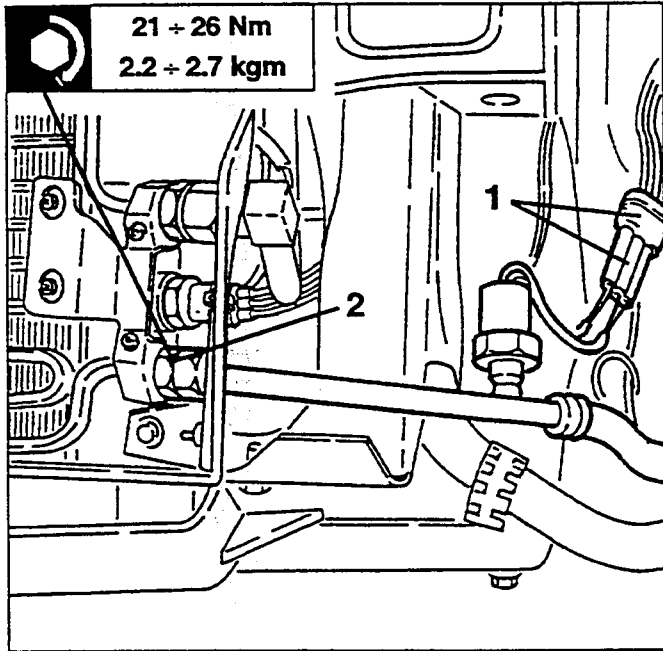
REMOVAL/REFITTING

- Set the car on a lift.
- Drain the fluid from the conditioning system (see specific paragraph).
- Remove the radiator grille and front bumper (see GROUP 70).
- Remove the left front wheel.
- Remove the battery with its acid drain tray (see GROUP 55).

- Follow the first ten steps of the procedure described in the paragraph "DUCTING ASSEMBLY AND HEATER - DISTRIBUTOR UNIT" without disconnecting the two inlet and outlet hoses carrying the engine coolant to and from the heater.

- Raise the car.

1. Disconnect the electrical connection of the three-level pressure switch.
2. Disconnect union of the pipe in question from the condenser.



PIPING FROM THE CONDENSER TO THE COMPRESSOR

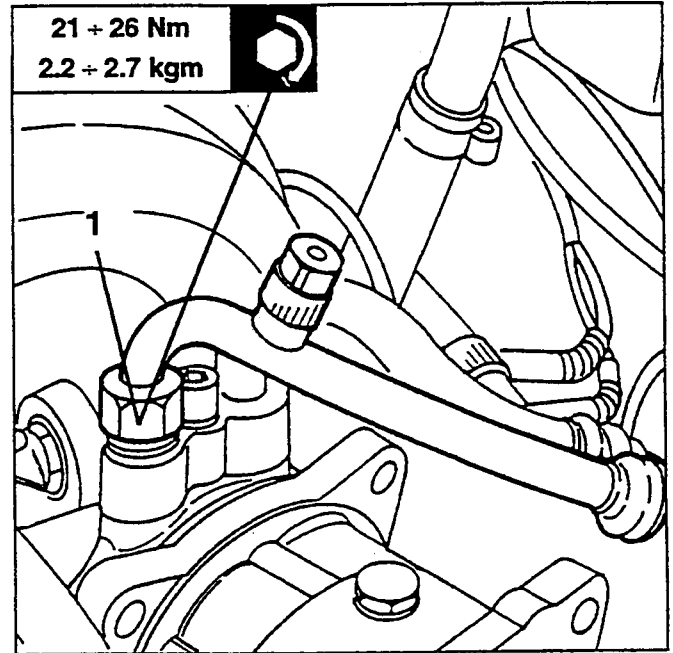
REMOVAL/REFITTING

- Set the car on a lift.

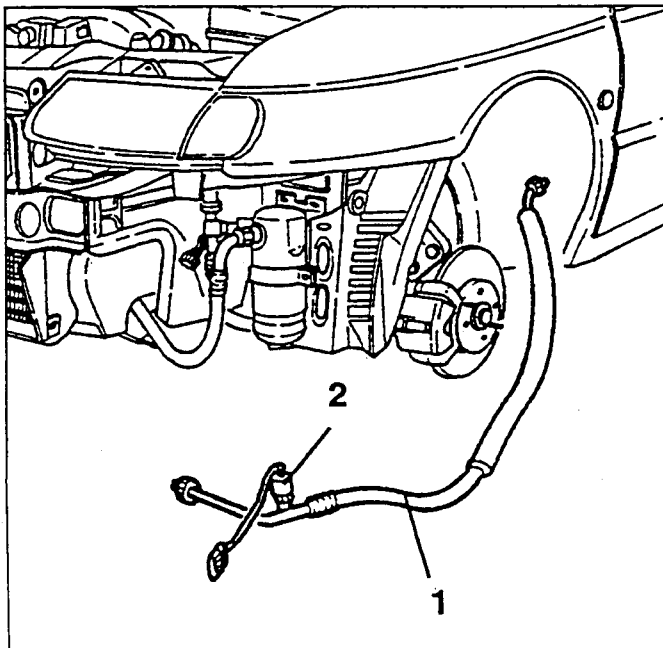
- Drain the fluid from the conditioning system (see specific paragraph).

- Remove the radiator grille and front bumper (see GROUP 70).

1. Disconnect the union of the pipe in question from the compressor.

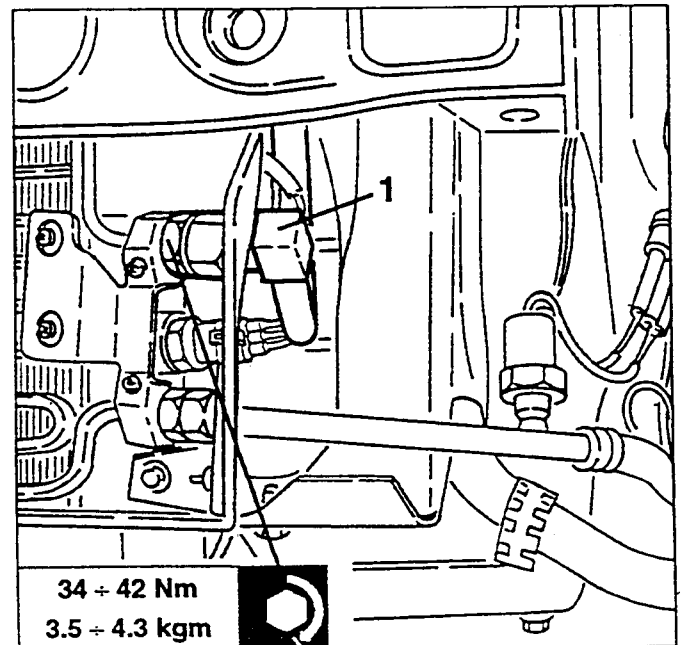


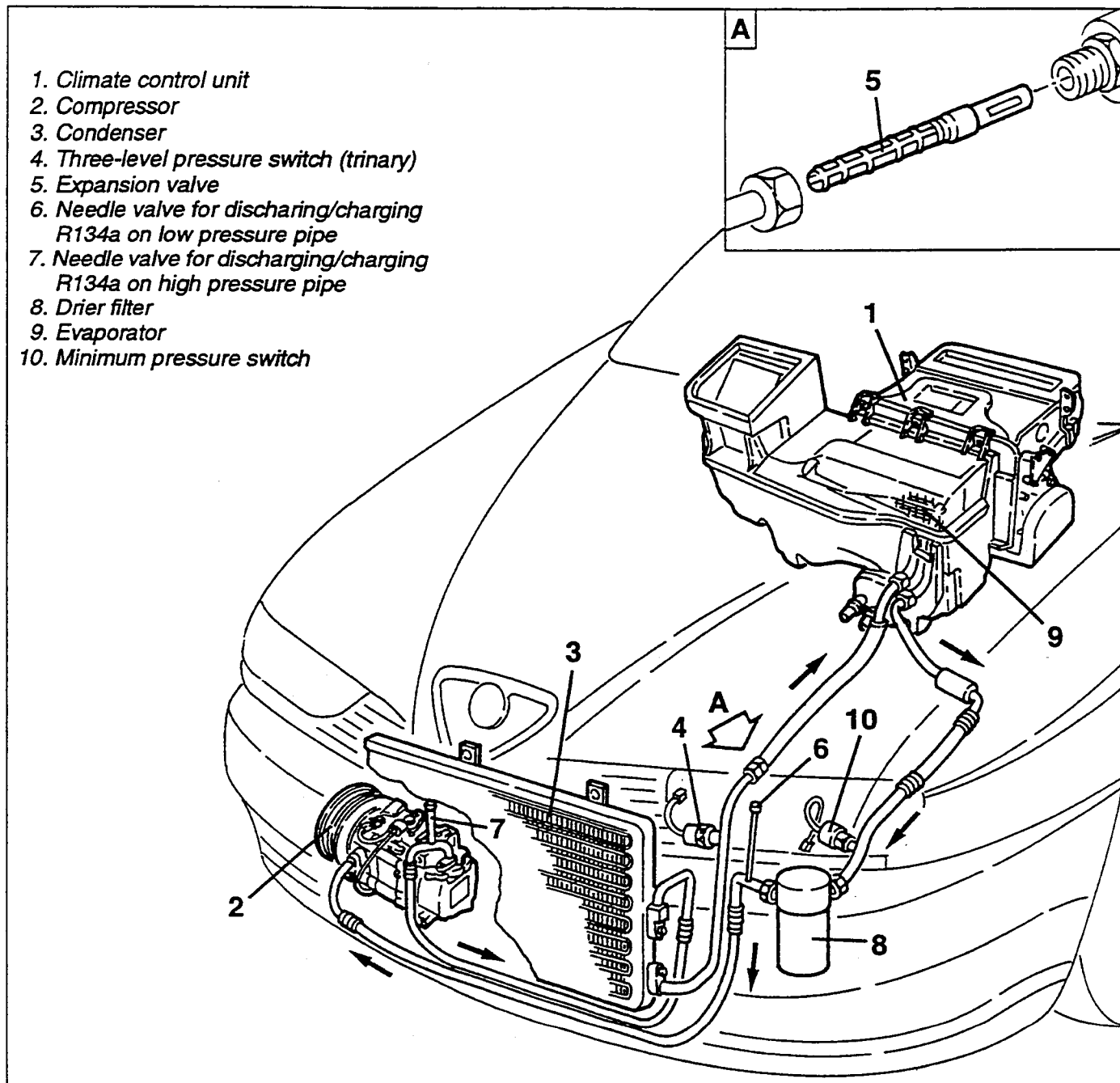
1. Remove the pipe in question freeing it of its clamps.
2. On the bench, slacken and remove the three-level pressure switch from the pipe.



- Raise the car.

1. Disconnect the union of the pipe in question from the condenser then remove it.



SYSTEM**DESCRIPTION**

The climate control system for models with T. Spark 16V engine is substantially the same as the one installed on the model with turbodiesel engine.

The main differences of this system are:

- the adoption of a minimum pressure switch.
- the adoption of a compressor with variable displacement which makes it possible to "follow" the load required by the system without engagement/disengagement of the compressor joint. In fact, the change in the flow rate of the coolant fluid in relation to the pressures involved makes it possible to compensate

the change in the number of revolutions of the compressor (connected with engine rpm) to adapt the amount of "cold" produced according to the requirements of the system.

- a different position of the system components in the engine compartment.

NOTE: BELOW WE ARE GIVING THE DIFFERENCES OF THIS SYSTEM CONCERNING THE DESCRIPTIONS AND PROCEDURES COMPARED WITH THE TURBODIESEL MODEL.

COMPRESSOR CUT-IN AND CUT-OUT STRATEGY

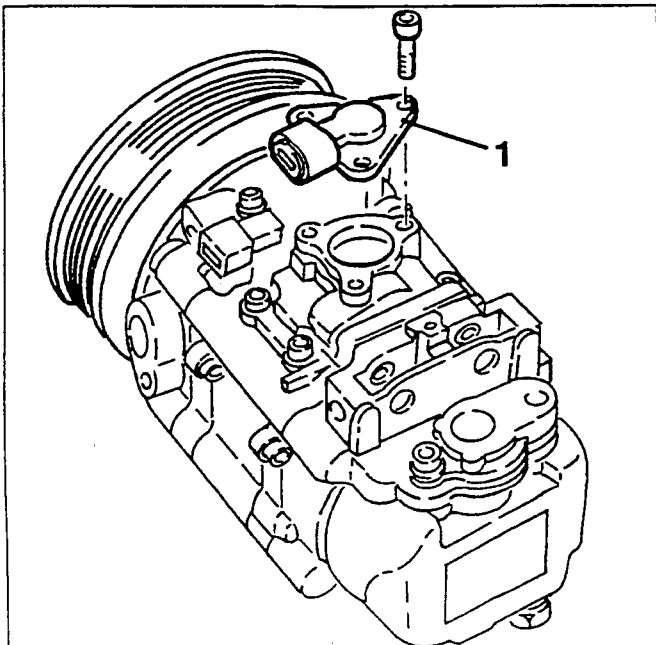
Compressor engagement is operated by the electromagnetic joint controlled by the electronic injection management system of the engine. Indeed the compressor absorbs a fair amount of power to the disadvantage of the overall output of the engine, and in certain instances, this must be avoided:

- at idle speed the engine must adapt its own speed taking account of this increase in absorbed power;
- when the engine is started or when high load is required, the compressor is cut off to leave all the available power for the engine.

With the M 2.10.3 injection system, the control unit carries out the following strategies:

- it adapts the engine idle speed each time the compressor is engaged; if the speed falls below 700 rpm the compressor is disengaged;
- in the event of the need for high power (high speed, over 6000 rpm, full load, maximum throttle opening), it cuts off the compressor momentarily;
- when the engine is started it prevents the compressor from being engaged until normal operating conditions are reached.

NOTE: You are reminded that the NIPPONDENSO TV14SC compressor with which this version is fitted, automatically cuts off the compressor through the safety thermal contact (1) if the temperature of the coolant fluid inside the compressor exceeds 160 °C.



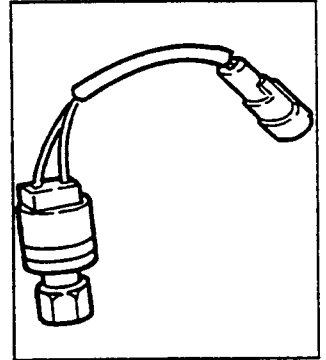
PA49300000004

DESCRIPTION OF THE MAIN COMPONENTS OF THE AIR CONDITIONING SYSTEM

MINIMUM PRESSURE SWITCH

The purpose of the minimum pressure switch is to de-energise the electromagnetic joint of the compressor when the pressure (in the drier filter) reaches appr. 1.8 bar, in order to keep the cold required, but prevent the evaporator from freezing.

The minimum pressure switch also protects the compressor by disengaging the electromagnetic joint, from its pulley, when the pressure of the coolant fluid falls to very low levels owing to a leak.



COMPRESSOR

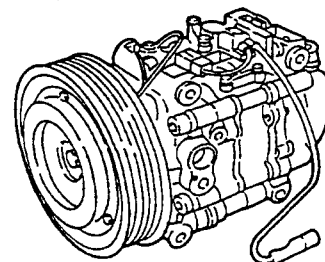
This is a NIPPONDENSO TV14SC with variable displacement: this parameter is automatically changed by the compressor itself according to the load (difference in pressure upstream and downstream of it): a special valve opens a by-pass which cuts off part of the fluid from the compression stage: the displacement can be reduced to 17% of the maximum level.

Adjustment takes place on the intake pressure:

- a **low intake pressure** makes the system **reduce the displacement**. This takes place for example when the refrigerating cycle is working in the best conditions: high engine rpm (thus also of the compressor), high heat exchange at the condenser, etc; (without a compressor with this variable configuration the compressor would be engaged and disengaged continuously);

- on the other hand, a **high intake pressure** **increase the displacement** to its maximum level.

This takes place for example with low engine speeds and for high requirement for "cold".



Composition and operation

It comprises a body (1) within which a chamber (2) has been made.

Four blades (3) turn in the chamber pulled by a hub (4) the axis of rotation of which does not coincide with the theoretical axis of the chamber.

Due to the particular geometry of the chamber, as the blades turn, they always stay in contact with the inner surface of the chamber: this way the volume in the compartments between one blade and the other changes during rotation.

Two covers are fastened to the body (1), a front one (5) and a rear one (6) containing respectively an intake or low pressure chamber (7) and a high pressure chamber (8). The gas, taken in by the union (9) on the cover (5), passes through the low pressure chamber (7) and the slit (10) machined on the body (1).

The gas is then compressed and sent out through the duct (11) in the high pressure chamber (8) and admitted to the system through the union (12).

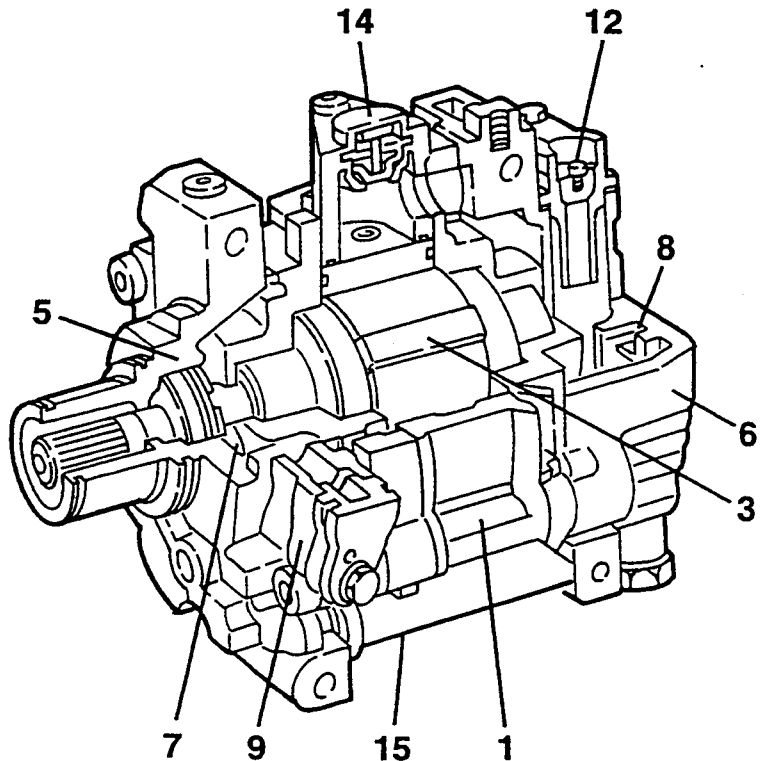
The reed valve (13) prevents the high pressure gas from returning into the compressor.

On the upper part of the body there is a thermal contact (14) connected in series to the electromagnetic joint. When the temperature reaches dangerous levels (over 160 °C), the thermal contact (14) disengages the compressor: it engages it again if the temperature falls below 140 °C.

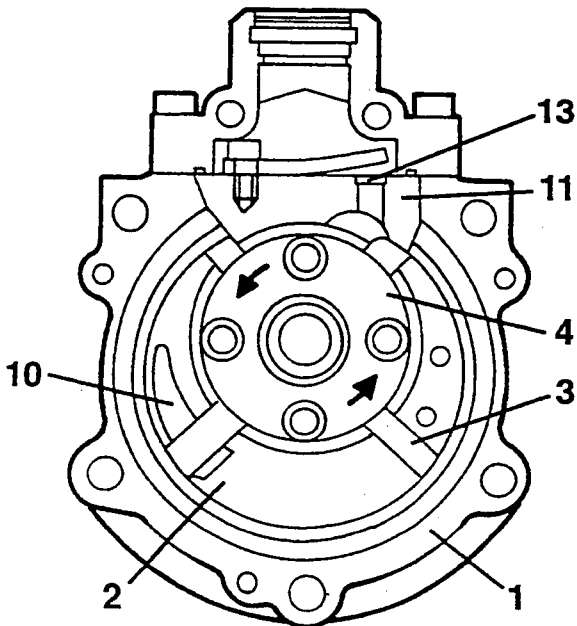
This prevents the compressor from operating in dangerous situations such as the lack of refrigerant fluid or oil.

The pressure regulator (15) in the lower section of the compressor adjusts the flow rate of the fluid in the compressor as described below.

- 1. Body
- 2. Chamber
- 3. Blades
- 4. Hub
- 5. Front cover
- 6. Rear cover
- 7. Intake or low pressure chamber
- 8. High pressure chamber
- 9. Union



- 10. Slit
- 11. Duct
- 12. Union
- 13. Reed valve
- 14. Thermal contact
- 15. Pressure regulator



Displacement control

Displacement control is obtained by a pneumatic device incorporated in the compressor, which by-passes part of the gas in the compression stage to the inlet, i.e. into the low pressure chamber.

When this system is activated it reduces the displacement in the compressor gradually and continuously to appr. 17% of the total.

The device comprises a piston (A) which can run in the cylinder (C) countered by the spring (B).

When the piston is positioned as in Fig A, it cuts off the holes (D) which put compartment (E), in which the gas starts being compressed, into communication with the low chamber (F).

Viceversa, when piston (A) is in the position of Fig. B, holes (D) put the two chambers into communication. The piston is operated by a small amount of pressurised gas, withdrawn by the duct (J) which communicates with the calibrated hole (G).

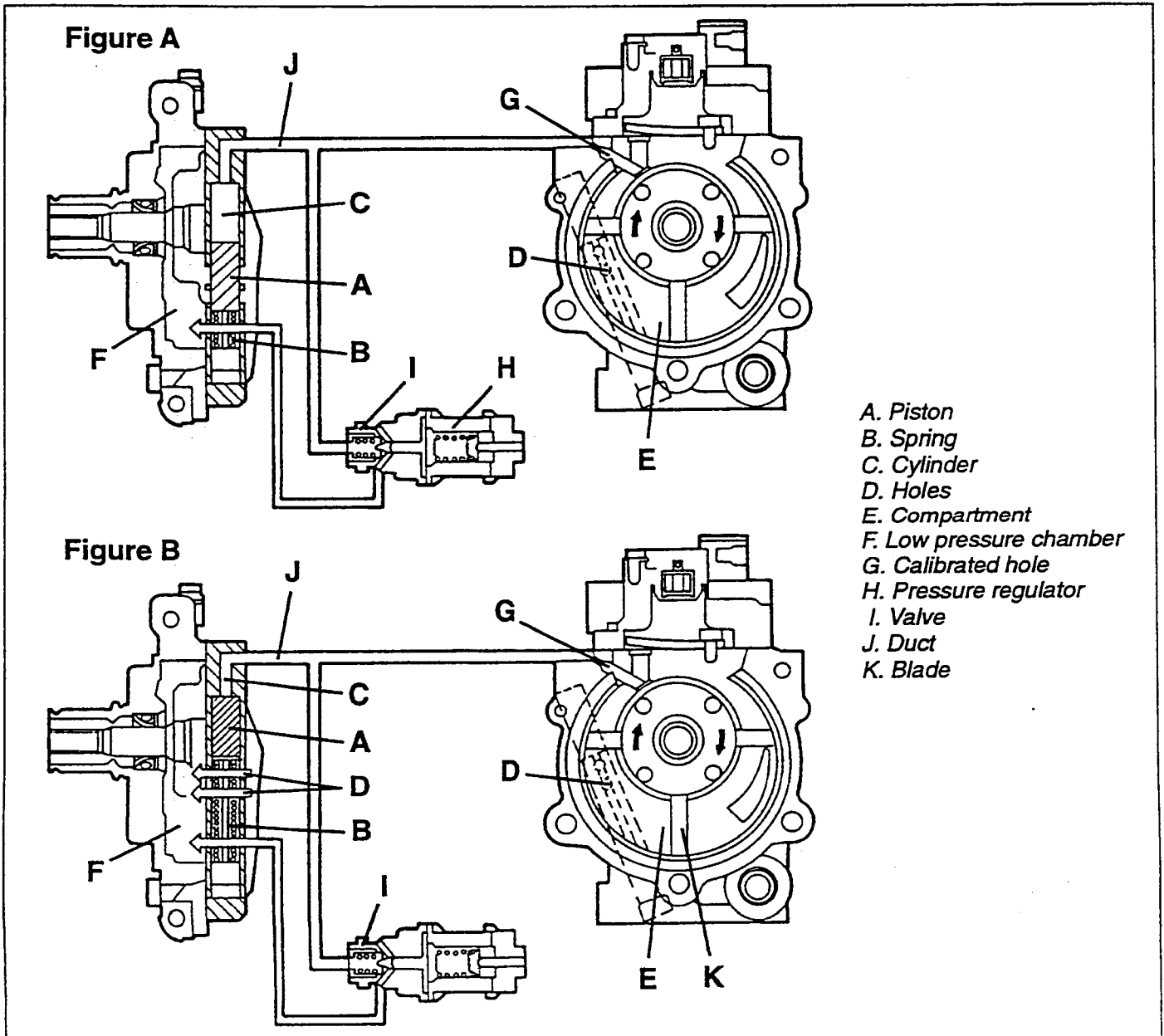
The pressure regulator (H) is adjusted by the difference in pressure between the intake - chamber (F) - and the delivery: with a high intake pressure, the valve (I) is closed, and the pressure of the gas acts on the piston (A) taking it to the position of Fig.A.

Holes (D) are cut off and by-passing does not take place, and in chamber (E) compression of the gas begins as described later.

When the intake pressure falls, the regulator (H) opens the valve (I) allowing the pressurised gas in the duct (J) and cylinder (C), to discharge into the low pressure chamber (F).

Piston (A) is pushed by the spring (B) allowing the by-pass holes (D) to open.

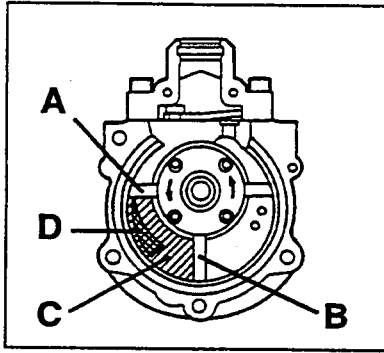
This way, part of the gas in the chamber (E) - start of compression - can flow into the low pressure chamber (F), until the blade (K), has passed the holes (D); this reduces the amount of gas in the chamber (E) thereby reducing the displacement of the compressor.



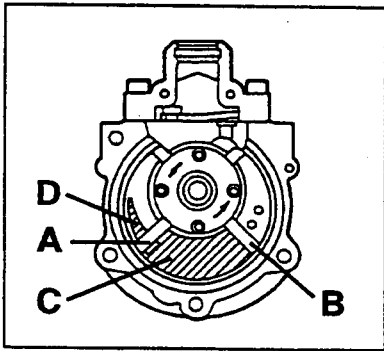
Normal operation (100% displacement - by-pass closed)

Intake

The gas is drawn in by the intake port (D) due to the gradual expansion of the compartment (C), delineated by blades (A) and (B). This is the start of the compression stage.

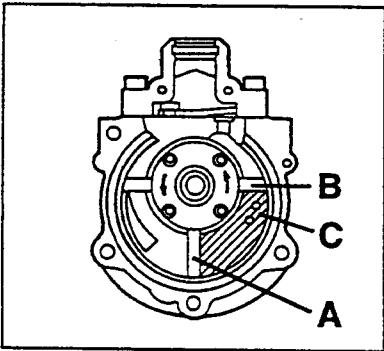


The new position of the blades (A) and (B) cause compartment (C) to be at its maximum volume. Blade (A) cuts off communication between compartment (C) and port (D) completing the intake stage.



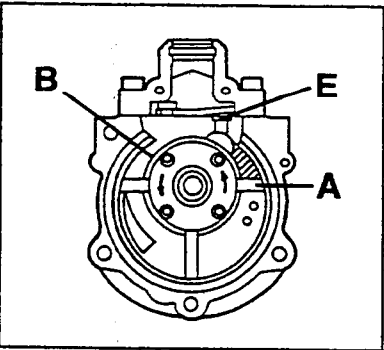
Compression

Compartment (C) reduces its volume thereby increasing the pressure of the gas: this is the start of the compression stage.

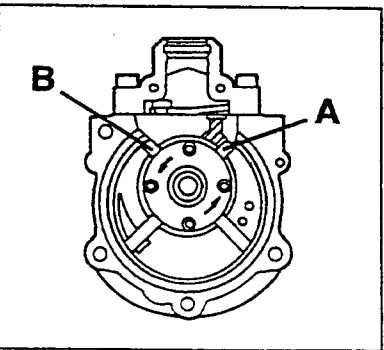


Exhaust

The pressure of the gas further increases until the reed (E) opens: in this precise moment the compression stage ends and exhaust begins.



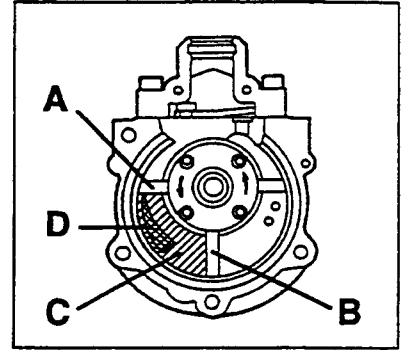
When blades (A) and (B) take the position shown in the diagram the exhaust stage ends.



Operation with reduction of the displacement (Down to 17% of the displacement - by-pass open)

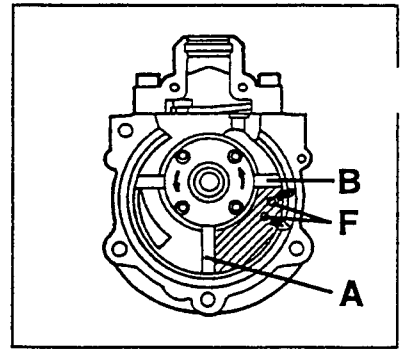
Intake

The gas is drawn in by the intake port (D) due to the gradual expansion of compartment (C), delineated by blades (A) and (B): this is the start of the compression stage.



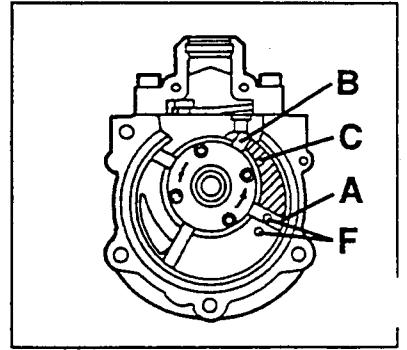
By - pass

If the holes (F) are open part of the gas flows out: the compression stage does not start yet.



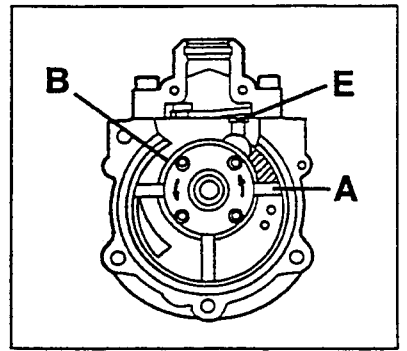
Compression

Once past the holes (F), compartment (C) reduces in volume thereby increasing the pressure of the remaining gas (down to a minimum of 17% of the total): the compression stage starts.



Exhaust

The pressure of the gas further increases until it opens the reed valve (E): in this precise moment the compression stage ends and exhaust begins.



Lubrication

The lubricating oil is contained in the high pressure chamber (A).

When the compressor is operating the high pressure in the chamber pushes the oil through the calibrated hole (B) into the inner moving components.

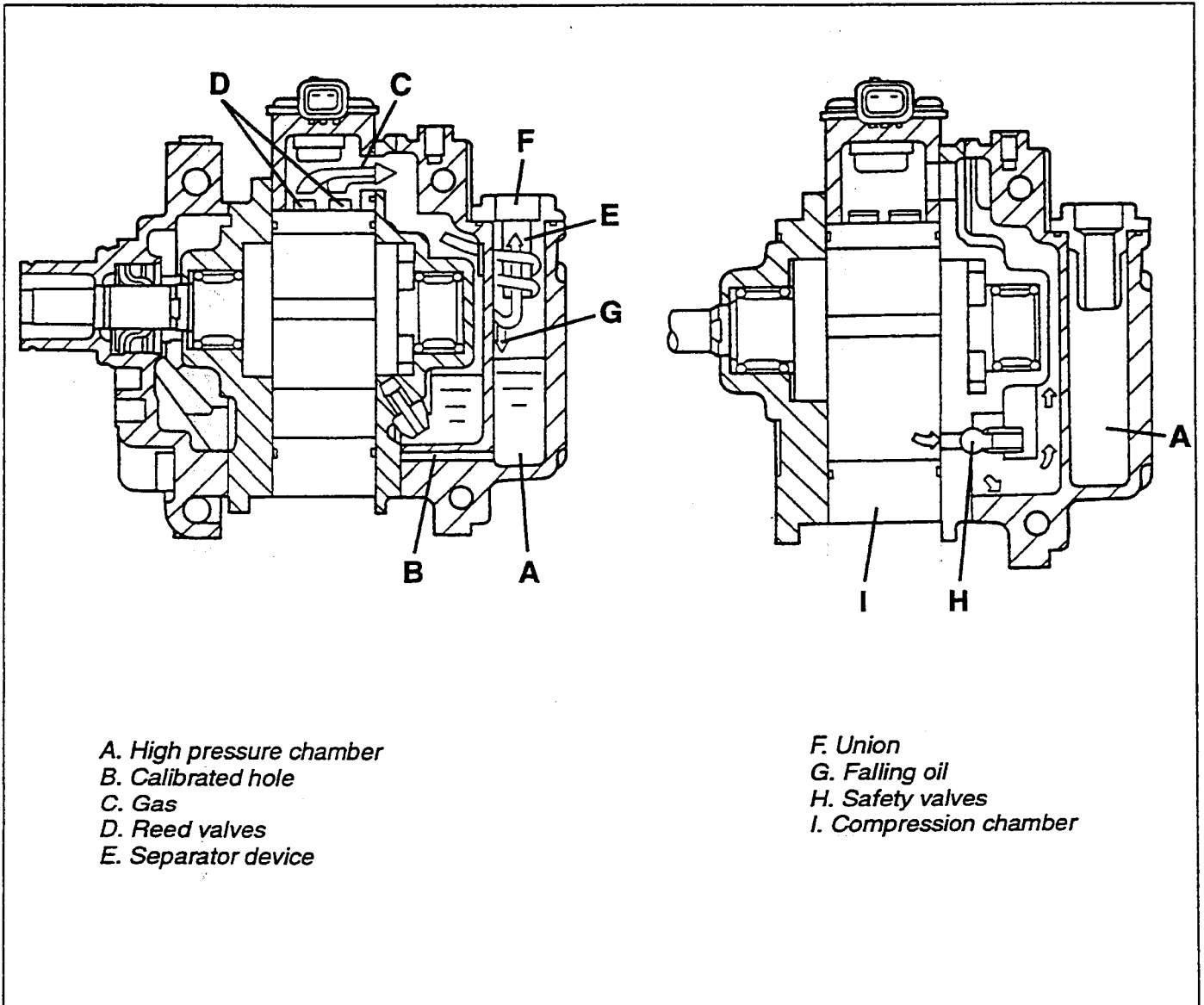
The oil mixed with gas (C) is sent out through the reed valves (D) in the high pressure chamber.

A separator device (E) installed in the gas outlet union

separates it from the oil (G) which falls by gravity into the bottom of the chamber (A) while the gas flows out of the union (F).

This device makes it possible to minimise the quantity of oil admitted into the system piping thereby increasing the thermal yield.

The compressor is also fitted with two safety valves (H) which relieve any overpressure in the compression chamber (I).



- A. High pressure chamber
- B. Calibrated hole
- C. Gas
- D. Reed valves
- E. Separator device

- F. Union
- G. Falling oil
- H. Safety valves
- I. Compression chamber

INSTRUCTIONS FOR REMOVING/REFITTING

During servicing operations, when the components of the air conditioner system are disconnected, plug the unions suitably to prevent damp and dirt from getting into the system.

When refitting the pipe unions always replace the O-Rings on them.

Lubricate the threads of the pipe unions with the specified antifreeze oil and tighten the unions to the specified torque.

In the event of any losses of oil from the system during servicing operations, restore the amount of oil in the system calculating the losses.

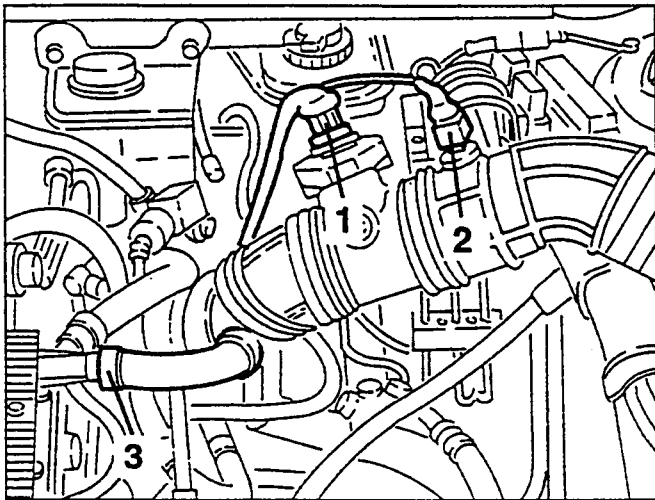
DUCTING UNIT AND HEATER - DISTRIBUTOR (TWO BOWDENS)

REMOVING/REFITTING

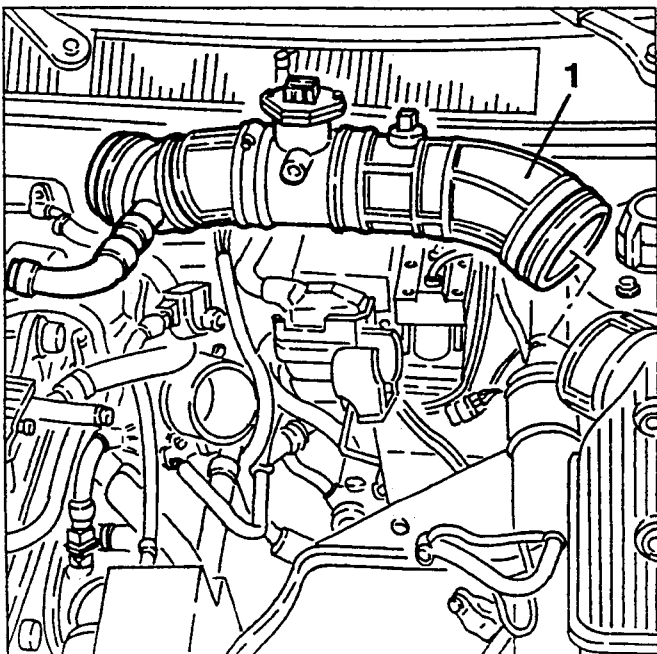
- Drain the fluid from the climate control system (see specific paragraph).

- Remove the battery (see specific paragraph).

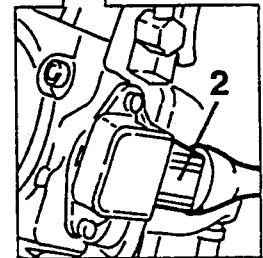
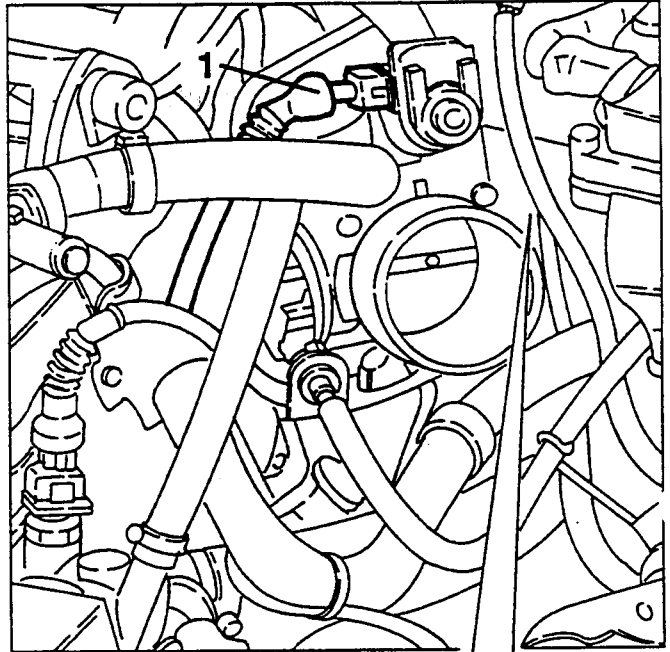
1. Disconnect the electrical connection from the air-flow meter.
2. Disconnect the electrical connection from the intake air temperature sensor.
3. Slacken the fastening clamp and disconnect the oil vapour recirculation pipe from the cylinder head cover.



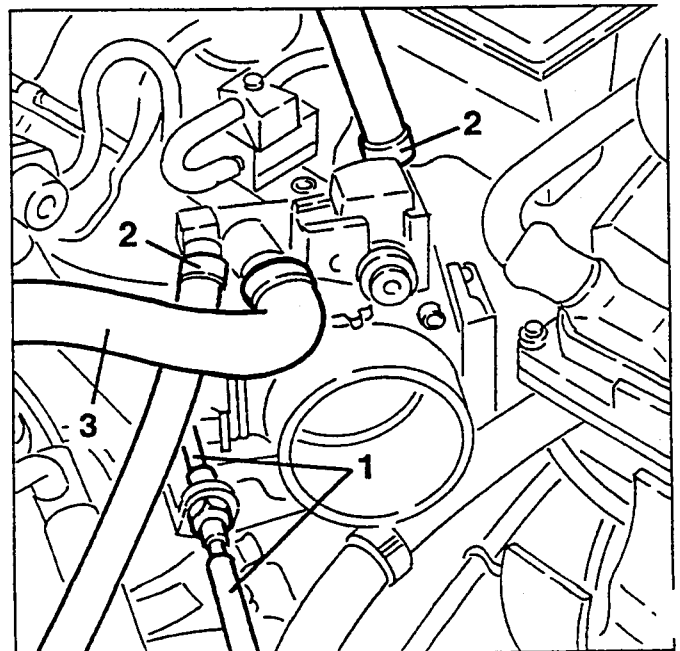
1. Slacken the fastening clamps and disconnect the corrugated sleeve complete.



1. Disconnect the electrical connection from the constant idle speed actuator.
2. Disconnect the electrical connection from the throttle potentiometer.

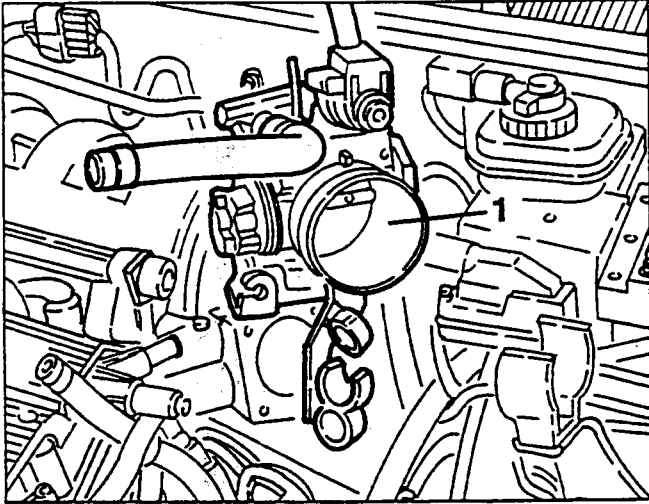


1. Disconnect the accelerator cable from the throttle body.
2. Disconnect the throttle body coolant inlet and outlet pipes.
3. Disconnect the idle speed oil vapour recirculation pipe.

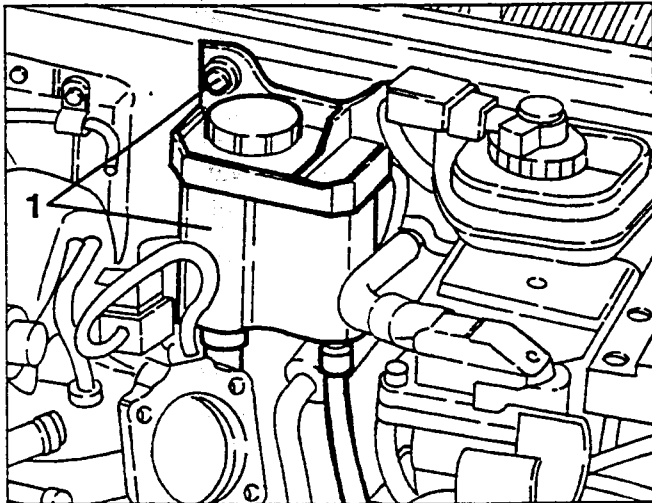


- Release the pipes from the fastenings on the bracket under the throttle body.

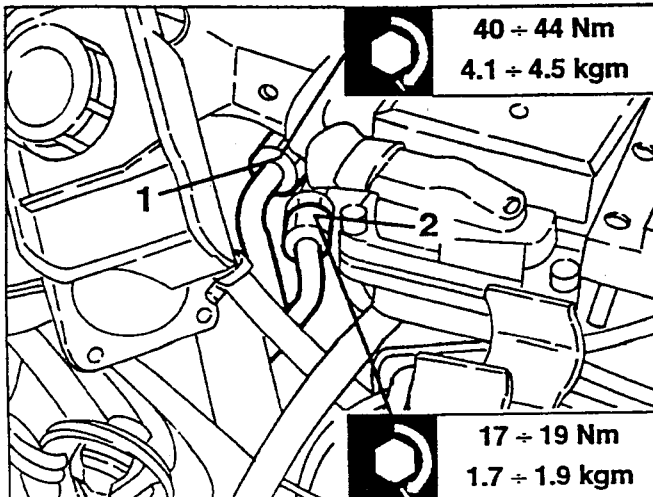
- Slacken the four fastening screws and remove the throttle body complete.
- Remove the seal.



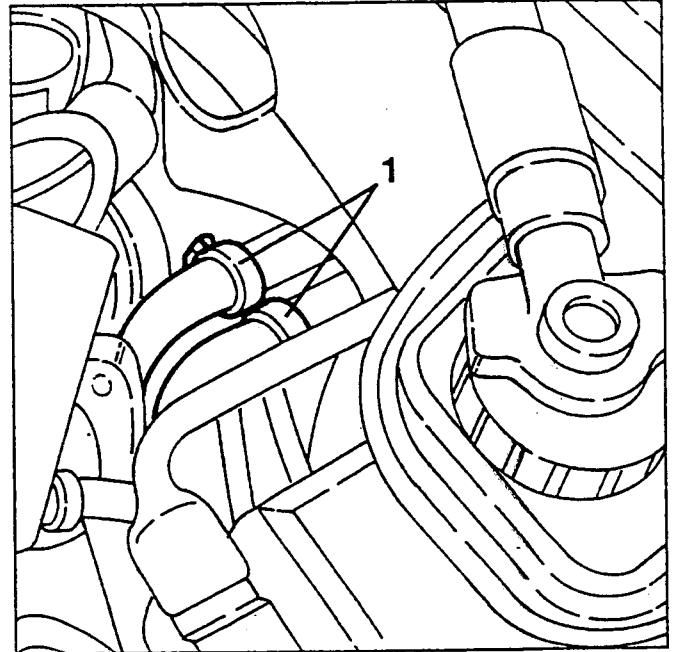
- Using a suitable syringe partially empty the power steering oil reservoir, then slacken the screws fastening the power steering oil reservoir and move it aside without disconnecting the pipes.



- Using wrenches no. 1.822.112.000 and no. 1.822.115.000, disconnect the evaporator fluid outlet pipe.
- Using wrenches no. 1.822.111.000 and no. 1.822.113.000, disconnect the fluid inlet pipe from the evaporator.

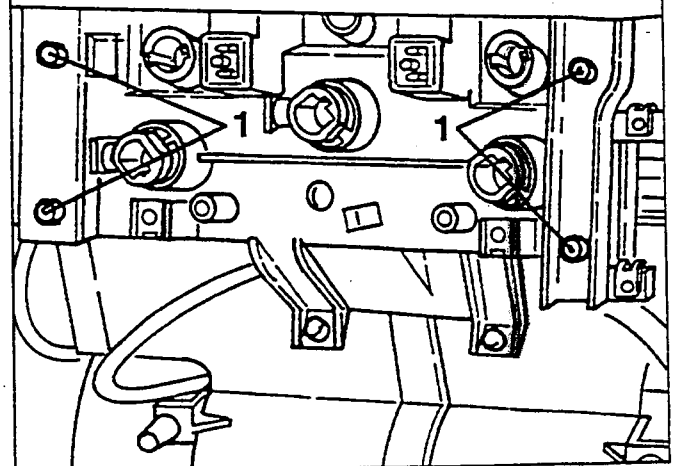
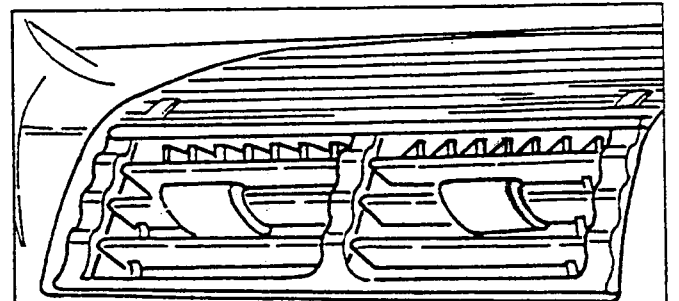


- Disconnect the coolant fluid inlet and outlet pipes from the climate control system recovering it in a suitable recipient.



- Remove the lower part of the dashboard and the centre console (see GROUP 70).

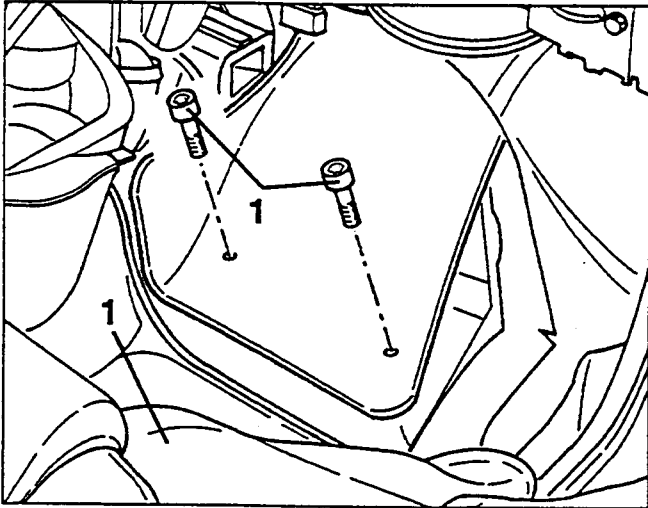
- Slacken the four fastening screws and lower the climate control unit controls.



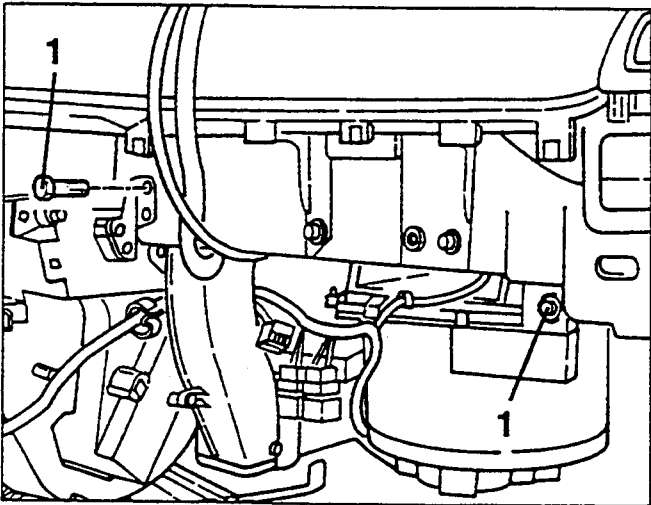
- Remove the two sections of air delivery duct to the rear seat (see GROUP 70).

- Disconnect the electrical connections of the climate control unit.

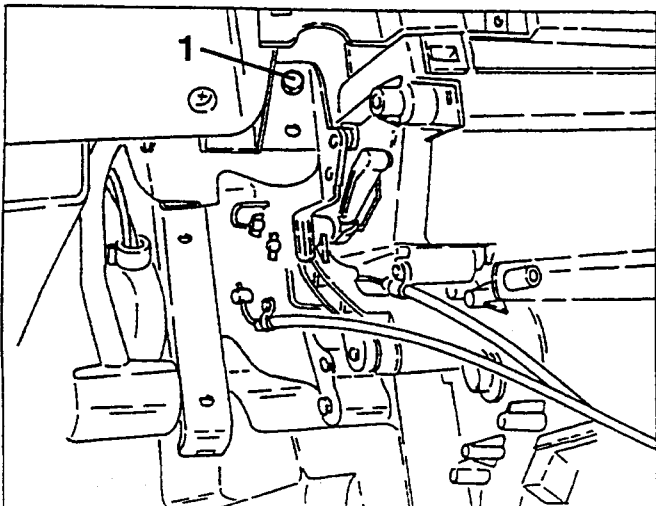
1. Move aside the floor mat, slacken the two fastening screws and remove the control unit cover.



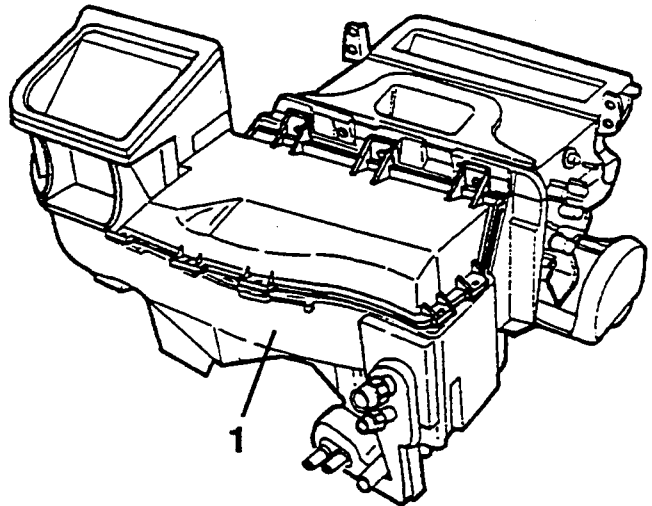
1. Slacken the three right-hand screws fastening the climate control unit.



1. Slacken the screw fastening the left-hand side of the climate control unit.



1. Remove the climate control unit.

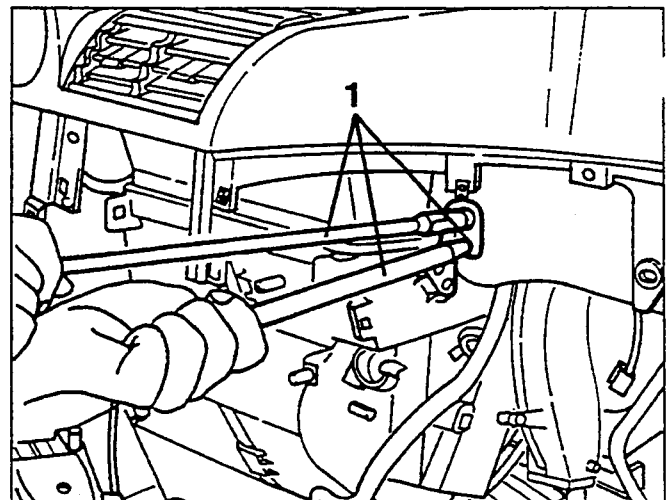


Re-assemble the climate control unit reversing the sequence followed for removal and observing the instructions below.

- Coat the mouth of the heater, water drain and coolant fluid pipes with vaseline.

- Assemble the climate control unit taking care to correctly insert the above-mentioned pipes in their holes.

1. Using a dowel positioned as illustrated, centre the position of the unit before fastening it.



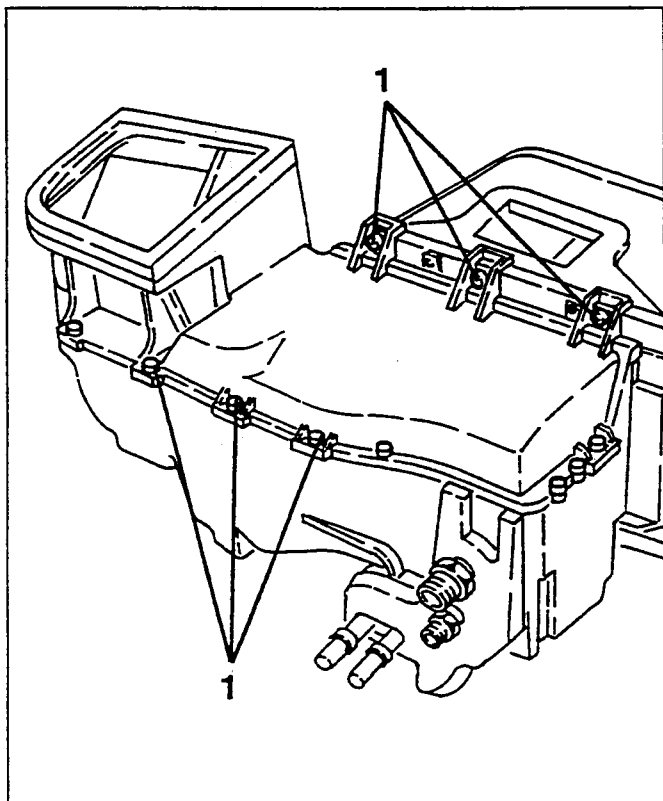
DIS-ASSEMBLY

- Proceed as described for the Turbodiesel version.

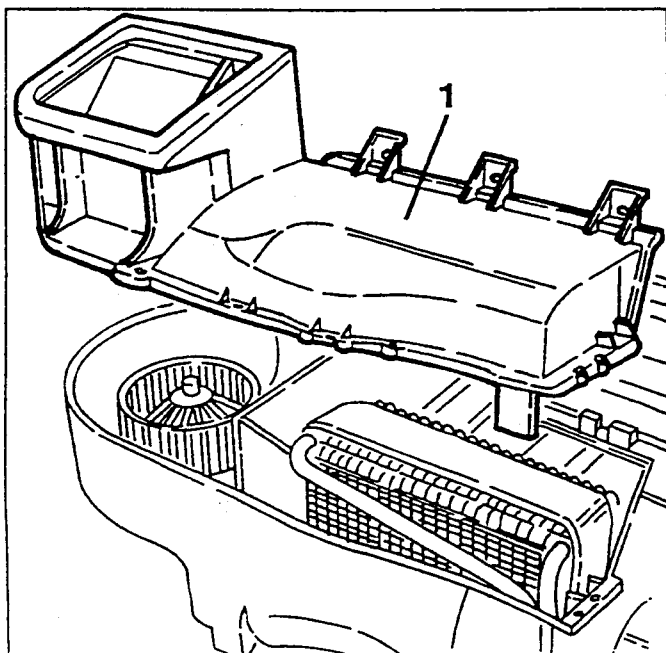
EVAPORATOR**REMOVING/REFITTING**

Remove the "Ducting unit and heater - distributor" as described in the corresponding procedure.

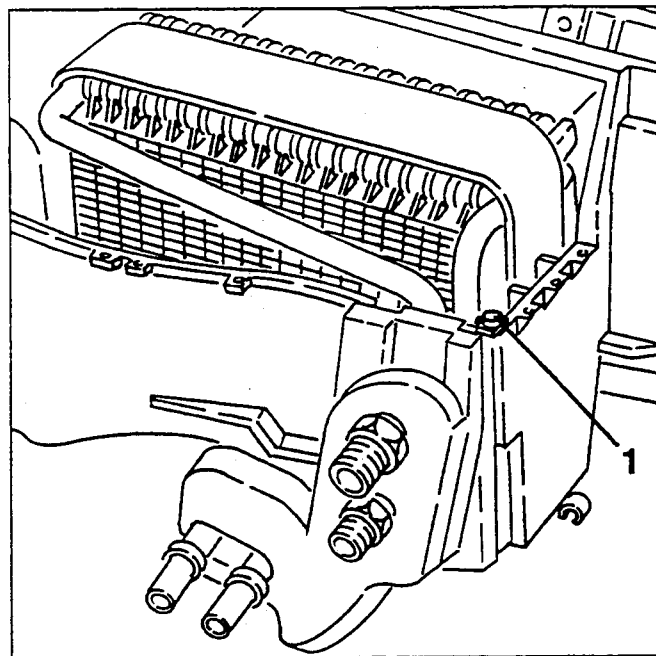
1. Slacken the screws fastening the upper half box to the ducting - distributor unit.



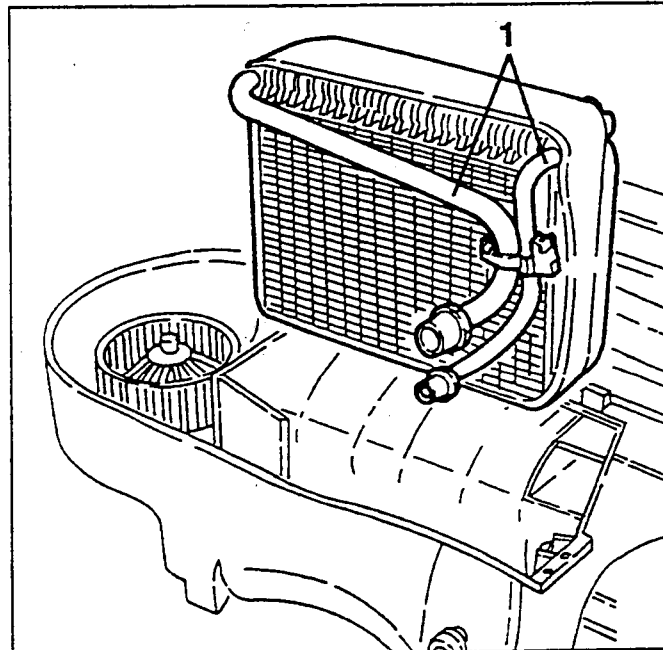
1. Remove the upper half box releasing it from the fastening clamps.



1. Slacken the screw fastening the evaporator to the ducting - distributor unit.



1. Remove the evaporator taking care to withdraw the pipes from the seals.



DRIER FILTER

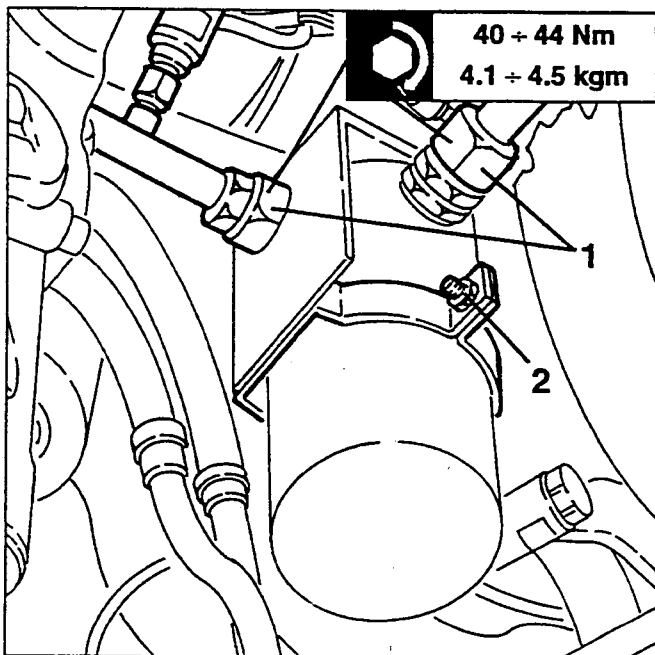
REMOVING/REFITTING

NOTE: In this system the spare drier filter is supplied with a certain amount of lubricating oil.

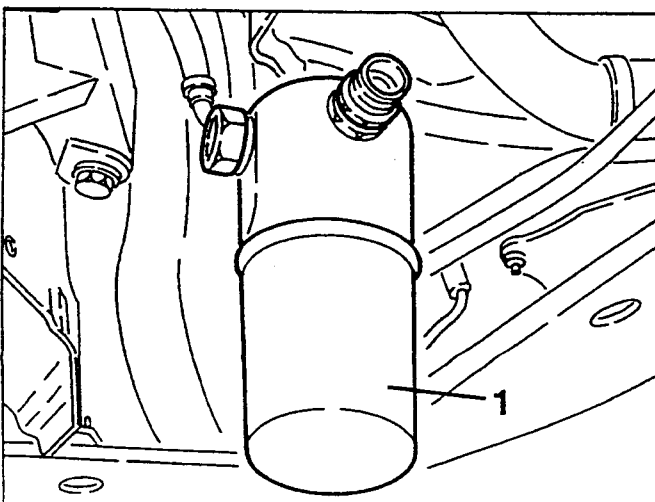
The filter should be changed only when the expansion valve is clogged or if the evaporator is faulty due to internal corrosion, or when the accumulator is leaking.

It is not necessary to replace the filter if it is distorted for some reason (eg. crash) unless it leaks.

- Set the car on a lift.
- Drain the fluid from the climate control unit (see specific paragraph).
- 1. Disconnect the coolant fluid pipe fittings from the filter.
- 2. Slacken the drier filter support clamp.



1. Remove the drier filter.

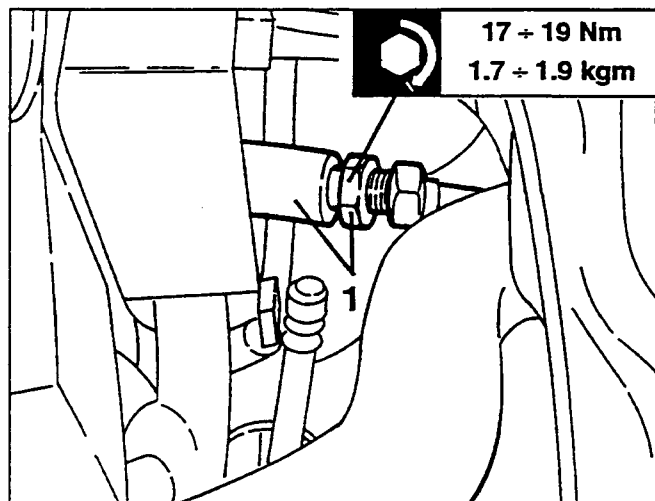


EXPANSION VALVE

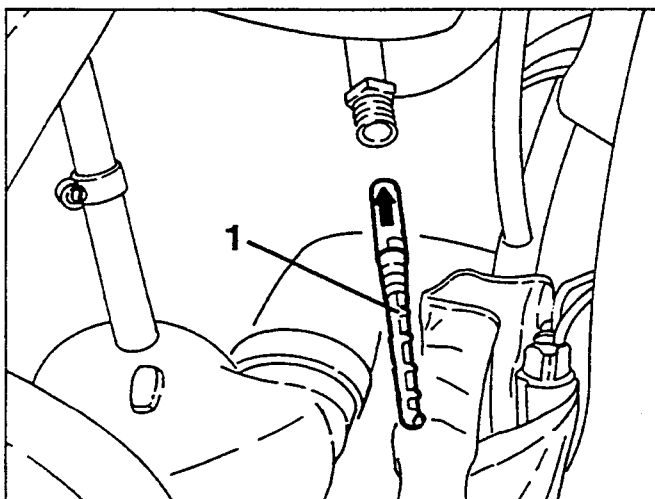
REMOVING/REFITTING

- Drain the fluid from the climate control unit (see specific paragraph).

1. Withdraw the insulating cover as far as necessary, then disconnect the intermediate union on the pipe connecting the condenser to the evaporator.



1. Withdraw the valve using pliers taking care not to damage it.



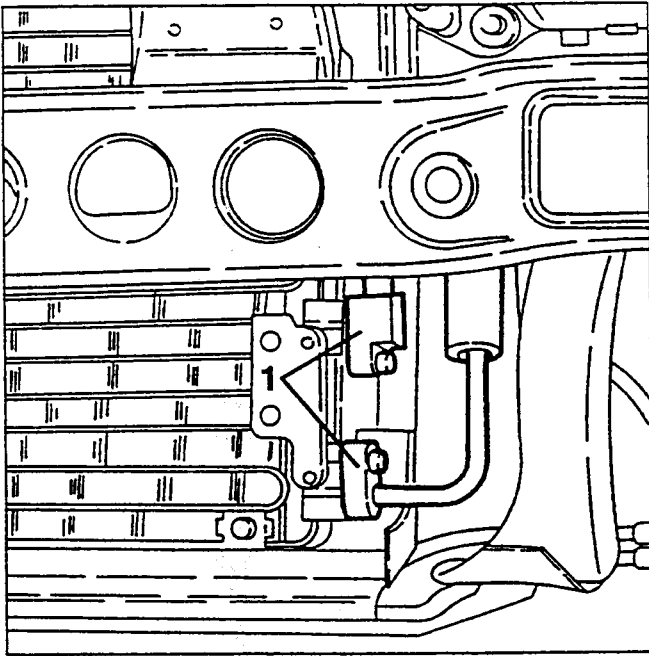
When refitting insert the expansion valve in the pipe with the arrow stamped on it pointing in the direction of the flow of the coolant.

CONDENSER

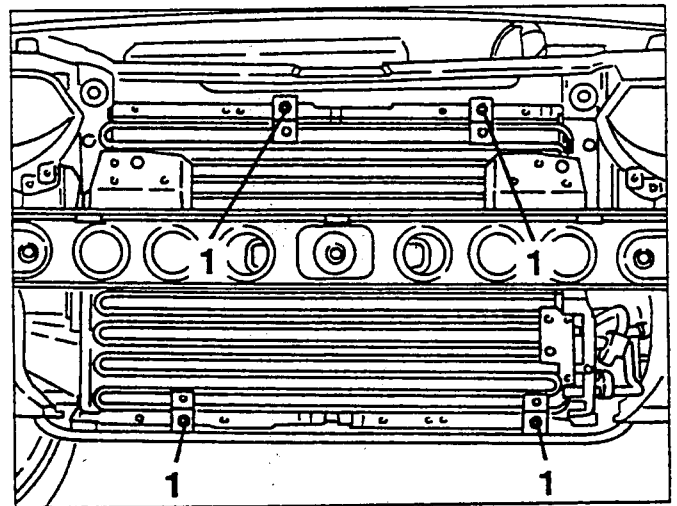
REMOVING/REFITTING

- Set the car on a lift.
- Drain the fluid from the climate control unit (see specific paragraph).
- Remove the front bumper (see specific paragraph).

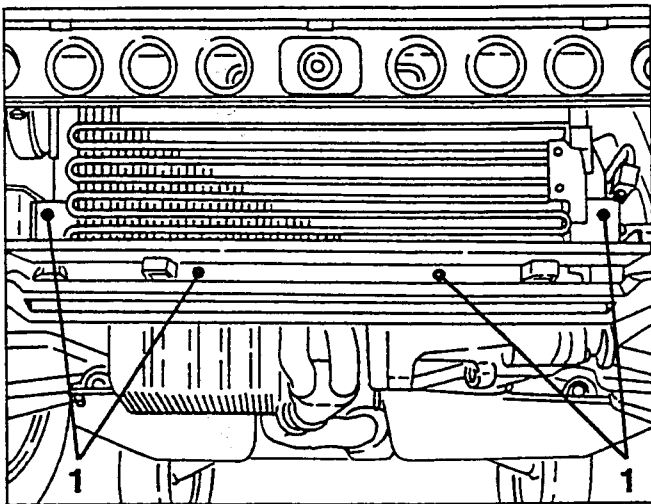
1. Slacken the two fastening screws and disconnect the two coolant inlet and outlet pipes from the condenser.



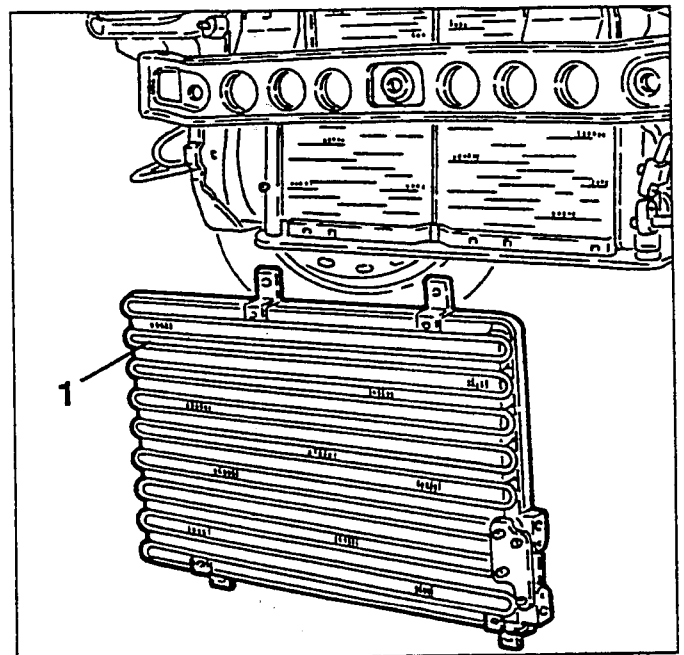
1. Slacken the four screws fastening the condenser of the climate control system to the radiator of the engine cooling system.



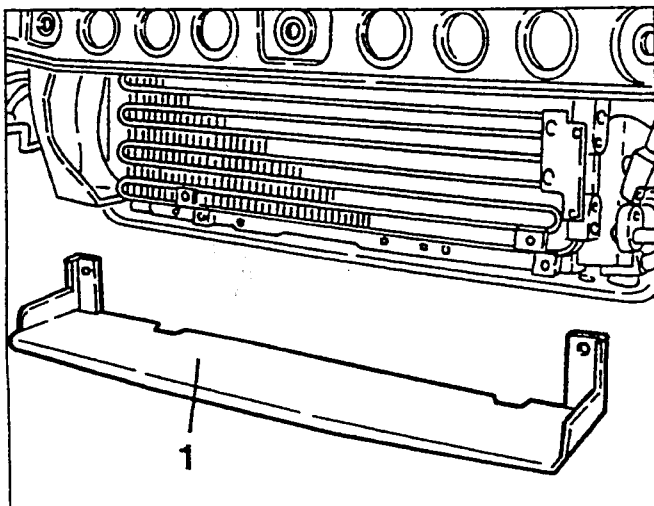
1. Slacken the four screws fastening the air duct to the engine coolant fluid radiator.



1. Remove the condenser withdrawing it from below.



1. Remove the air duct.



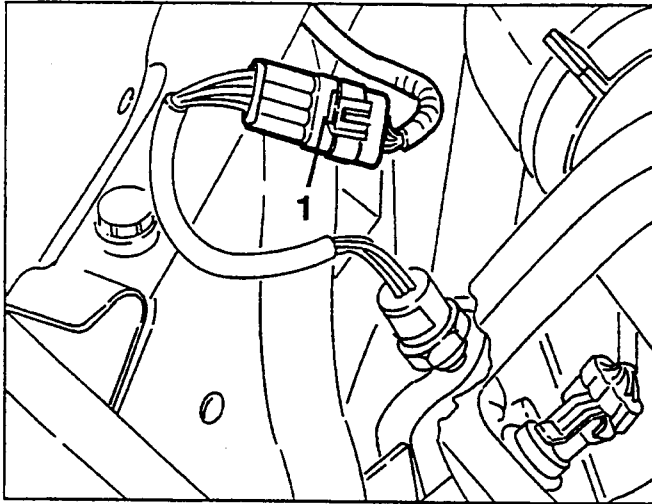
THREE - LEVEL PRESSUR SWITCH (TRINARY)

REMOVING/REFITTING

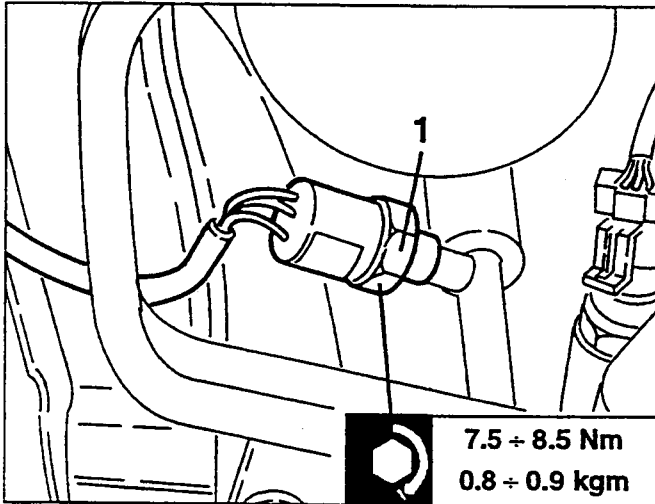
NOTE: Due to a non return valve on the pipe, the pressure switch can be removed without having to drain the coolant fluid.

- Set the car on a lift.
- Disconnect the battery (-) terminal.

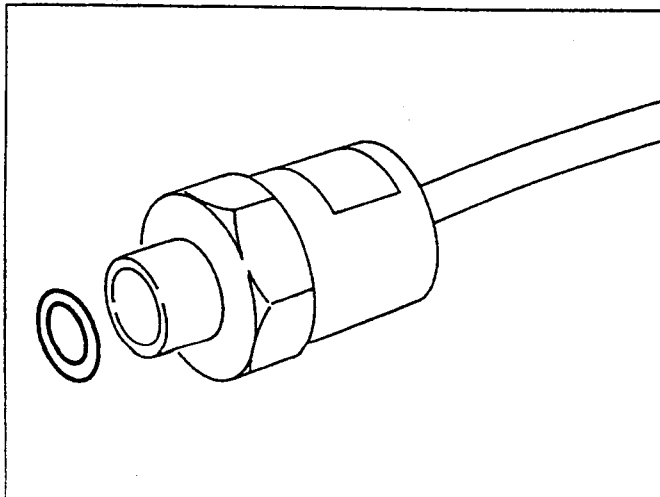
1. Disconnect the electrical connection of the three-level pressure switch.



1. Slacken and remove the three-level pressure switch.



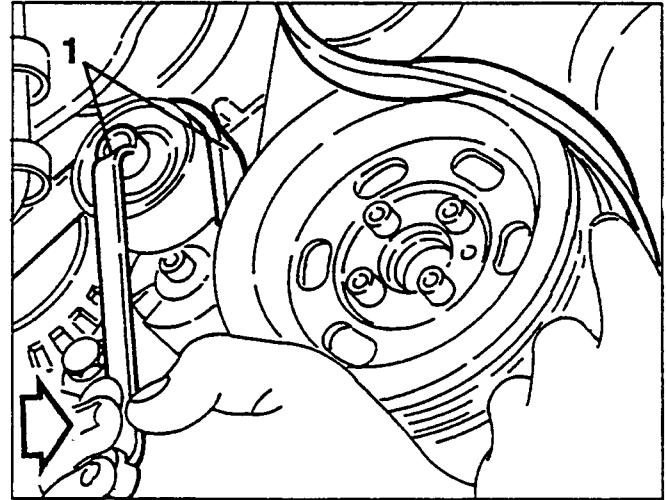
Before refitting the pressure switch make sure of the presence of the seal ring on the pressure switch itself and that it is intact.



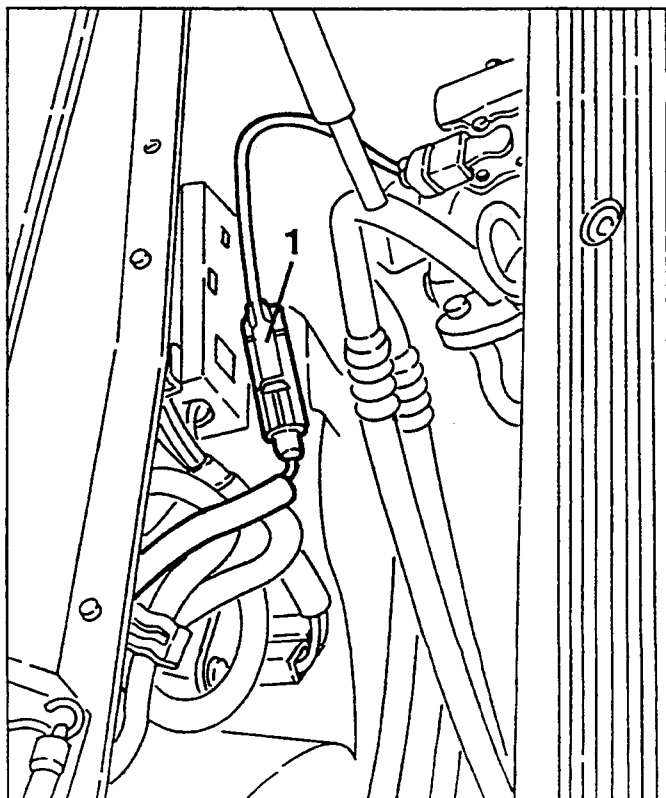
COMPRESSOR

REMOVING/REFITTING

- Set the car on a lift.
- Disconnect the battery (-) terminal.
- Drain the fluid from the conditioning system (see specific paragraph).
- Remove the right front wheel and mud flap.
- 1. Working as illustrated on the guide pulley, slacken the tension of the auxiliary components drive belt and remove it.

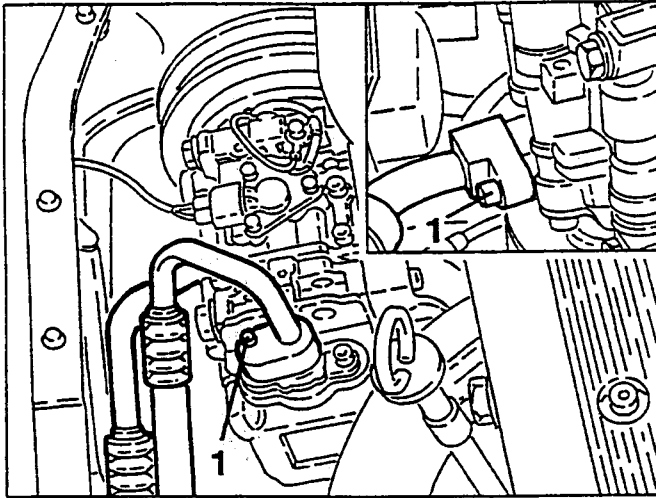


1. Disconnect the electrical connection of the compressor.

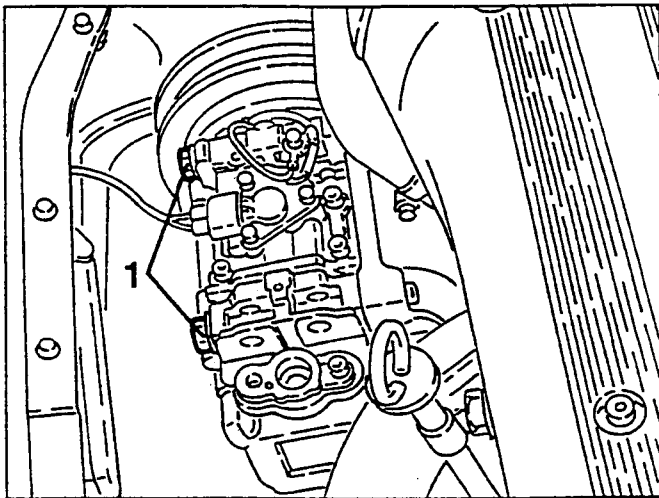


1. Slacken the fastening screws and remove the unions of the compressor coolant fluid inlet and outlet pipes.

NOTE: Suitably plug the compressor inlet and outlet holes to prevent dirt and humidity from getting in.



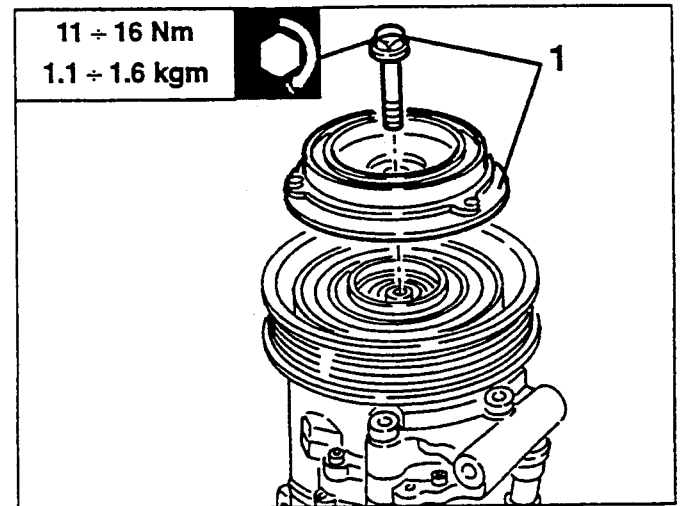
1. Slacken the four screws fastening the support bracket and remove the compressor.



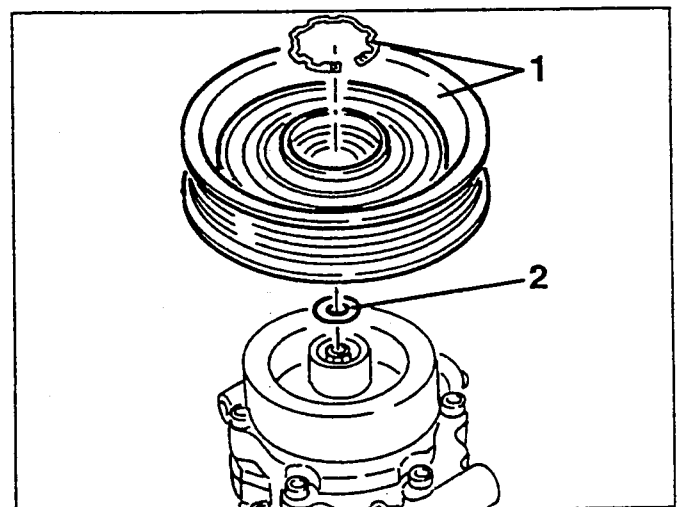
NOTE: The spare compressor is supplied pressurised with nitrogen to prevent the entrance of damp and dirt; during assembly it is therefore necessary to remove the plugs of the inlet and outlet unions slowly and with the compressor positioned absolutely as illustrated below (with the cover facing upwards).

REMOVING THE ELECTROMAGNETIC JOINT

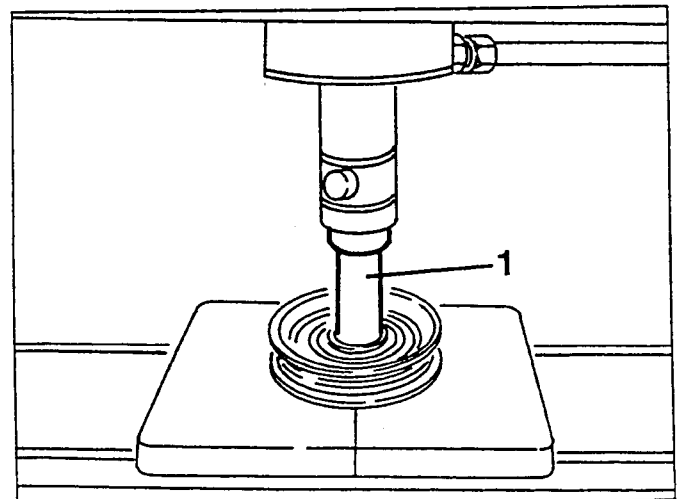
1. Slacken the fastening screw and remove the hub of the electromagnetic joint from the compressor.



1. Remove the circlip and withdraw the pulley of the electromagnetic joint.
2. Retrieve the thrust ring.

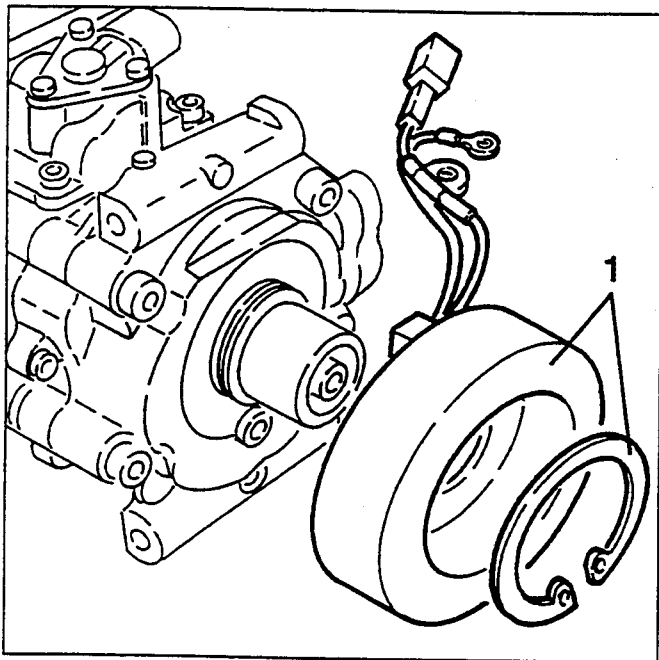


1. Working under a press and using a suitable punch, remove the bearing from the pulley.



- Disconnect the earth cable and the electrical connection to the safety thermal contact.

1. Remove the circlip and remove the electromagnet complete with electrical cables.



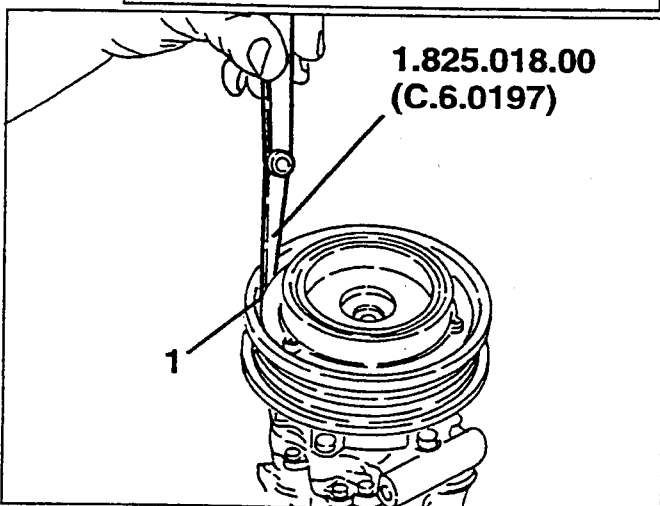
When refitting it is necessary to check that the clearance between the hub and the pulley of the electromagnetic joint is within the specified limit, proceeding as follows.

1. Before assembling the hub, between the pulley and the hub insert the curved thickness gauge no. 1.825.018.000 (C.6.0197) and check that the clearance is within the specified limits.



Clearance between hub and pulley of the electromagnetic joint

$0.5 \pm 0.15 \text{ mm}$



- If the measurement is not within the specified limits add or remove the special thrust rings between the hub and the compressor shaft.

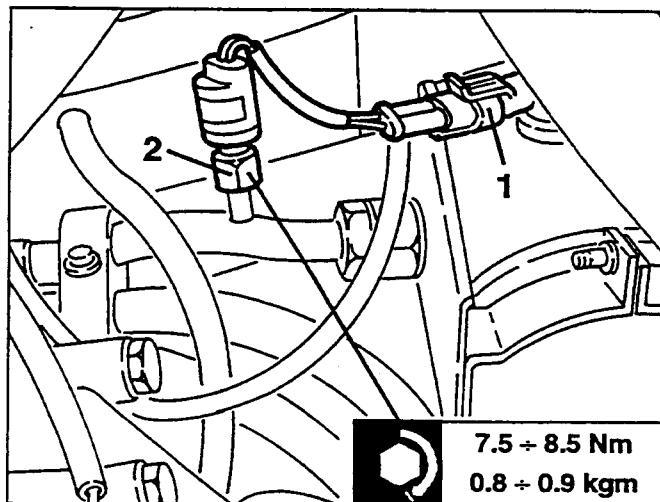
- After adjustment tighten the electromagnetic joint fastening screw to the specified torque.

MINIMUM PRESSURE SWITCH

REMOVING/REFITTING

NOTE: Due to the presence of a non return valve on the pipe the minimum pressure switch can be removed without having to drain the coolant fluid.

- Set the car on a lift.
 - Disconnect the battery (-) terminal.
1. Raise the car, then disconnect the electrical connection of the minimum pressure switch.
 2. Slacken and remove the minimum pressure switch.

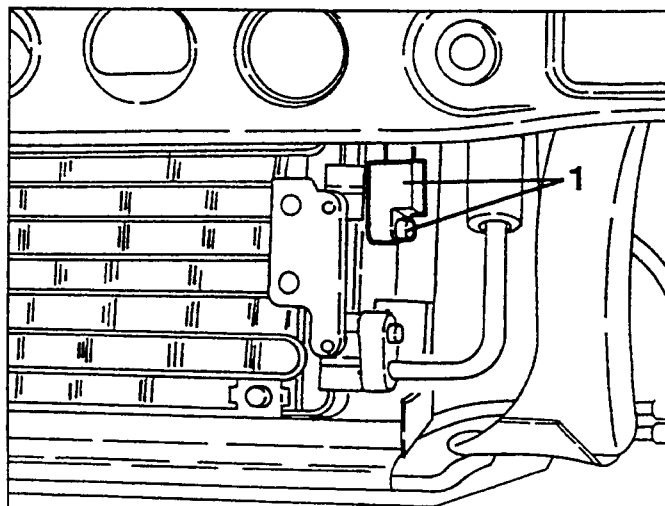


PIPE FROM COMPRESSOR TO CONDENSER

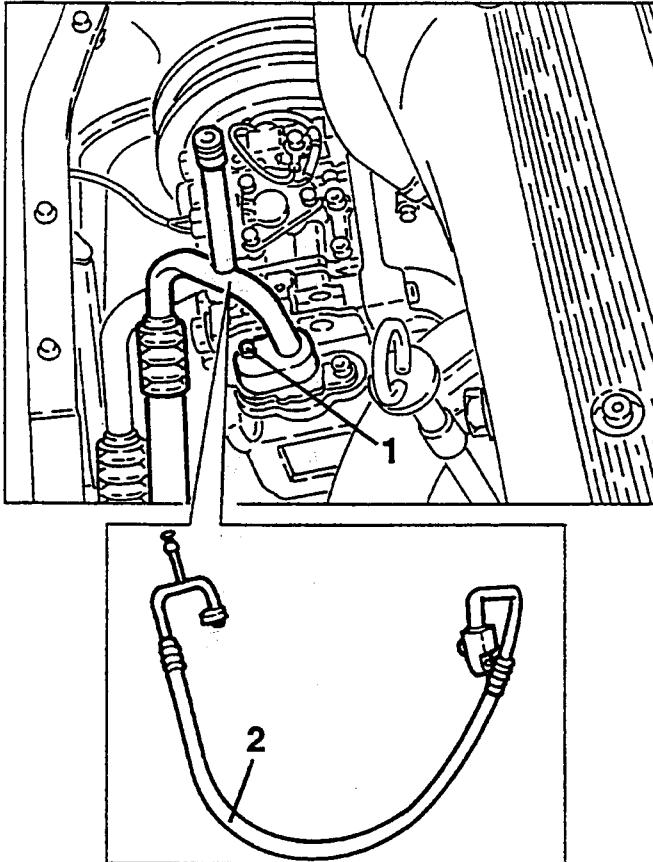
REMOVING/REFITTING

- Set the car on a lift.
- Drain the fluid from the conditioning system (see specific paragraph).
- Remove the il paraurti anteriore (see specific paragraph).

1. Slacken the fastening screw and disconnect from the condenser the fluid delivery pipe leading from the compressor.



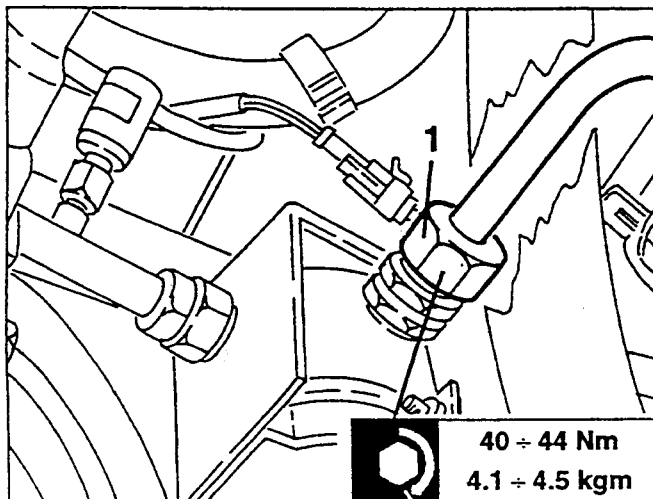
1. Slacken the fastening screw and disconnect the fluid delivery pipe to the condenser from the compressor.
2. Release the clamp fastening the pipe connecting the compressor to the condenser and remove it.



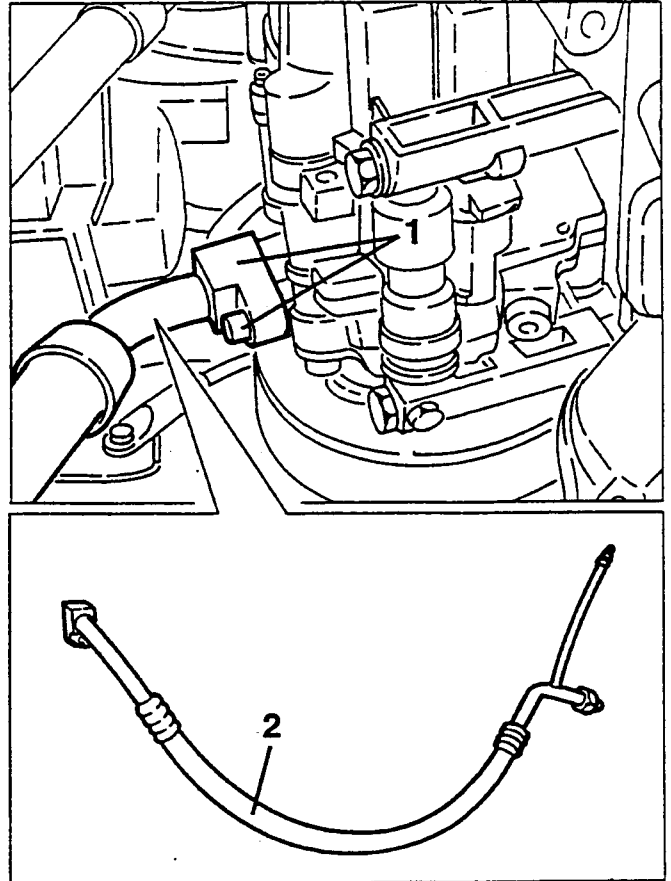
PIPE FROM DRIER FILTER TO COMPRESSOR

REMOVING/REFITTING

- Set the car on a lift.
 - Drain the fluid from the climate control unit (see specific paragraph).
1. Disconnect the union of the delivery pipe to the compressor from the drier filter.



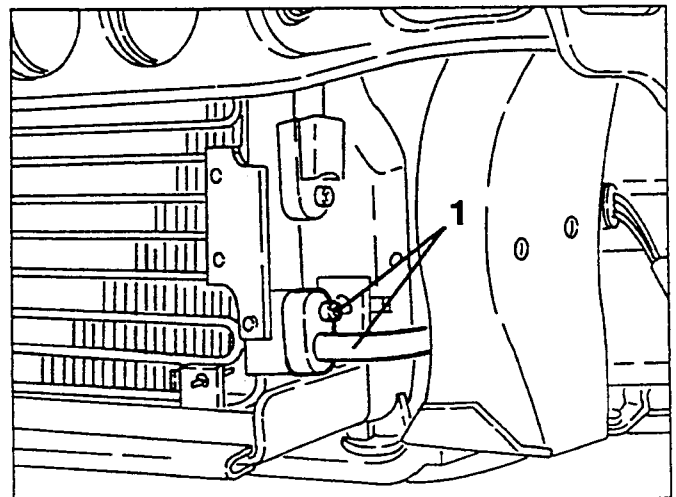
1. Slacken the fastening screw and disconnect the pipe leading from the compressor from the drier filter.
2. Release the clamp fastening the pipe connecting the drier filter to the compressor.



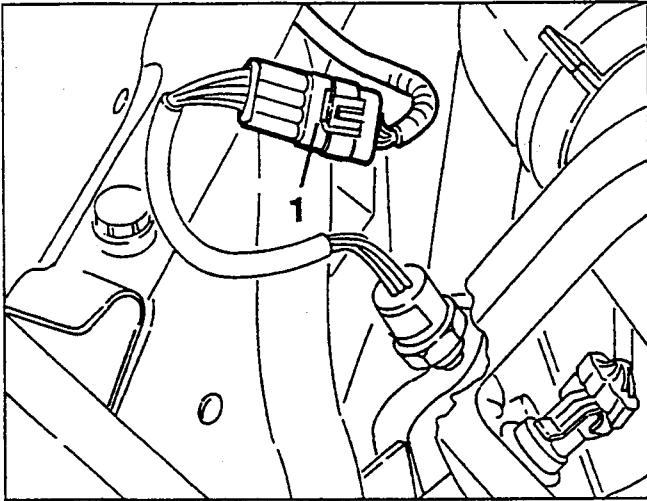
PIPE FROM CONDENSER TO EXPANSION VALVE

REMOVING/REFITTING

- Set the car on a lift.
 - Drain the fluid from the conditioning system (see specific paragraph).
 - Remove the il paraurti anteriore (see specific paragraph).
1. Slacken the fastening screw and disconnect the coolant fluid outlet pipe from the condenser.



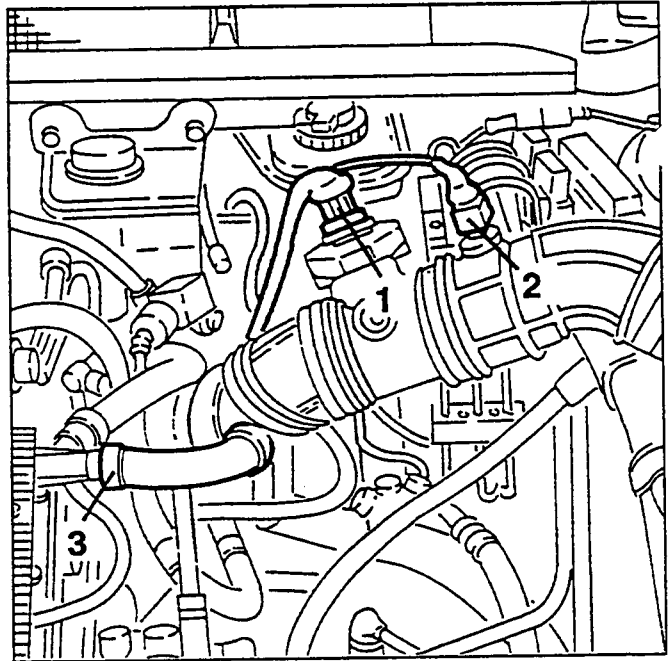
1. Disconnect the electrical connection of the three-level pressure switch.



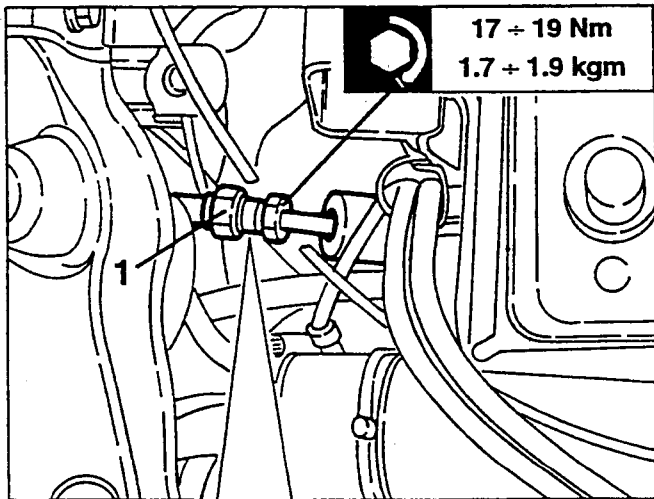
PIPE FROM EVAPORATOR TO DRIER FILTER

REMOVING/REFITTING

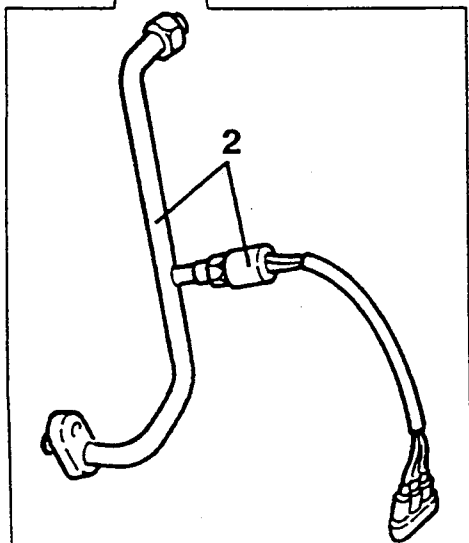
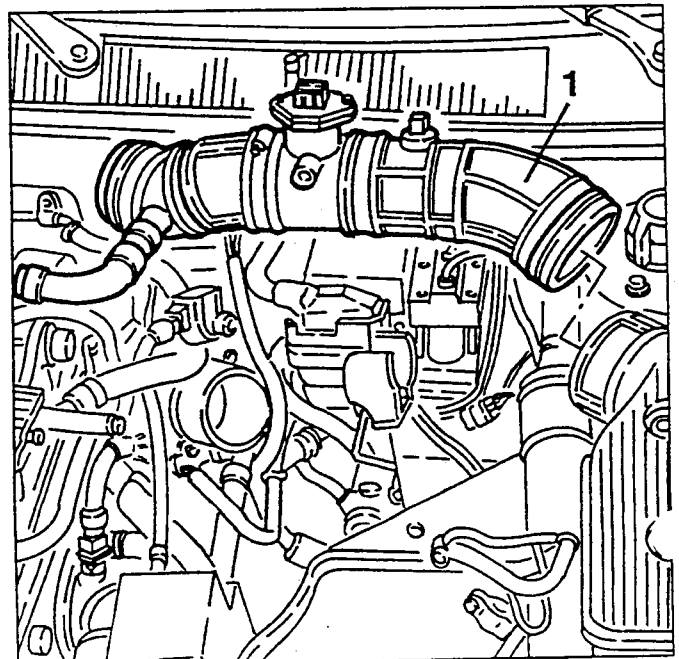
- Drain the fluid from the climate control unit (see specific paragraph).
- Remove the battery (see specific paragraph).
- 1. Disconnect the electrical connection from the air-flow meter.
- 2. Disconnect the electrical connection intake air temperature sensor.
- 3. Slacken the fastening clamp and disconnect the oil vapour recirculation pipe from the cylinder head cover.



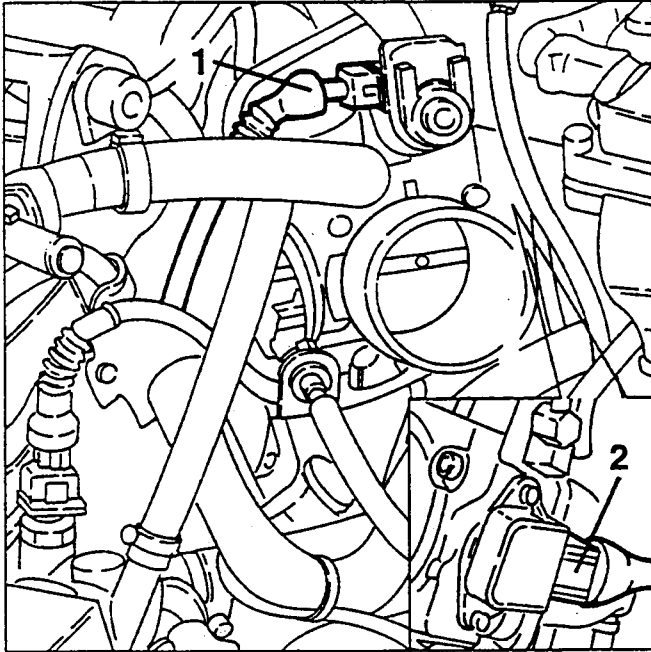
1. Withdraw the insulating cover, then disconnect the union on the expansion valve.
2. Remove the section of coolant fluid delivery pipe from the condenser to the expansion valve complete with three-level pressure switch and, if necessary, separate them on the bench.



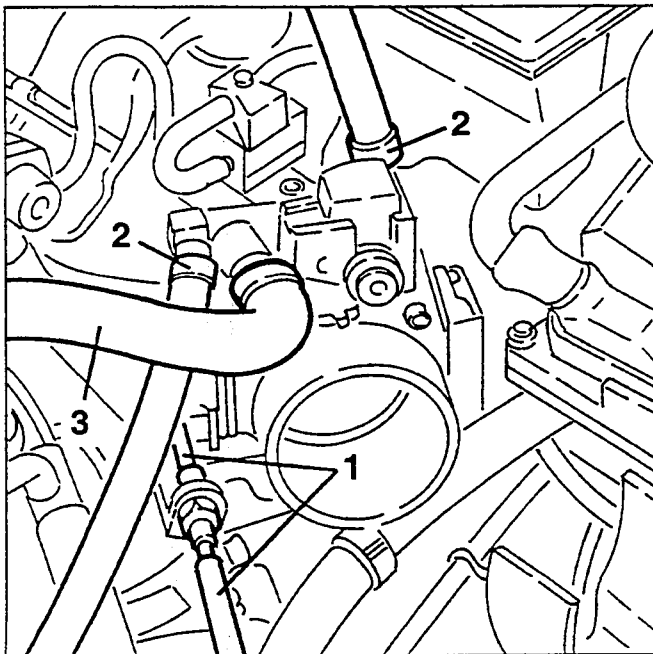
1. Slacken the fastening clamps and remove the th corrugated sleeve complete.



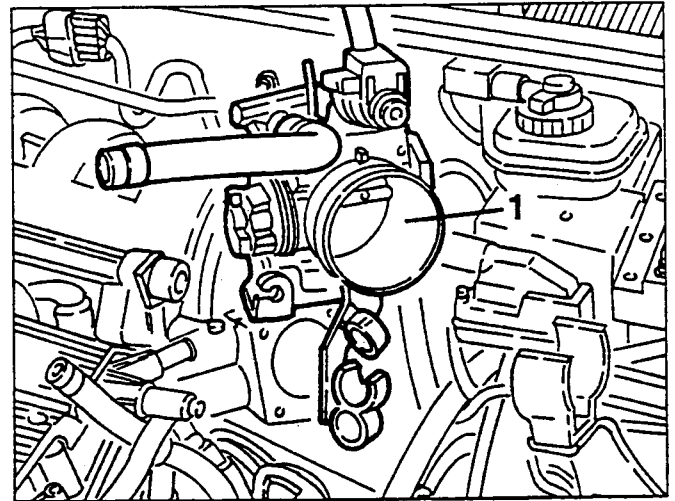
1. Disconnect the electrical connection from the constant idle speed actuator.
2. Disconnect the electrical connection from the throttle potentiometer.



1. Disconnect the accelerator cable from the throttle body.
2. Disconnect the coolant fluid inlet and outlet pipes from the throttle body.
3. Disconnect the idle speed oil vapour recirculation pipe.

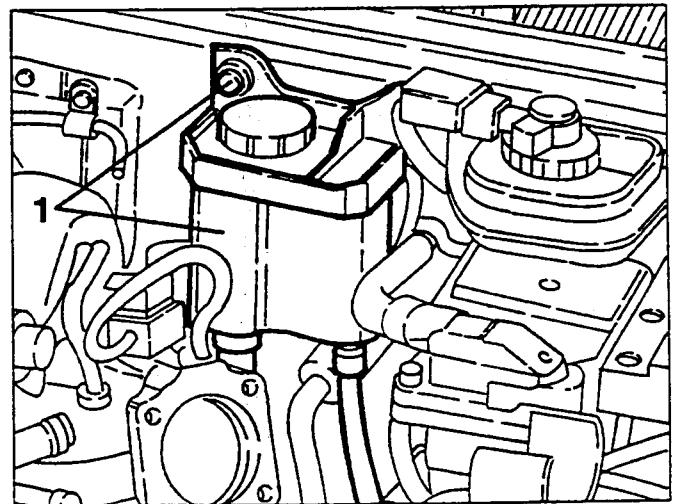


- Release the pipes from the fastenings on the bracket under the throttle body.
- 1. Slacken the four fastening screws and remove the throttle body complete.
- Remove the seal.

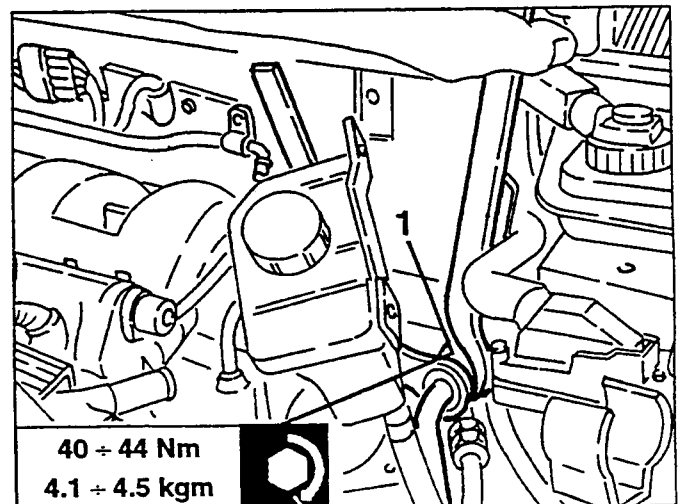


- Using a suitable syringe partially empty the power steering oil reservoir.

1. Slacken the screws fastening the power steering oil reservoir, then move it to one side without disconnecting the piping.

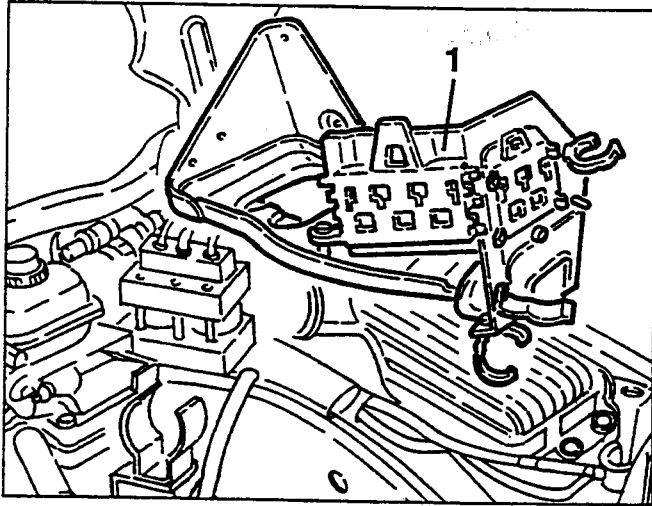


1. Using wrenches no. 1.822.112.000 and no. 1.822.115.000, disconnect the pipe in question from the evaporator.

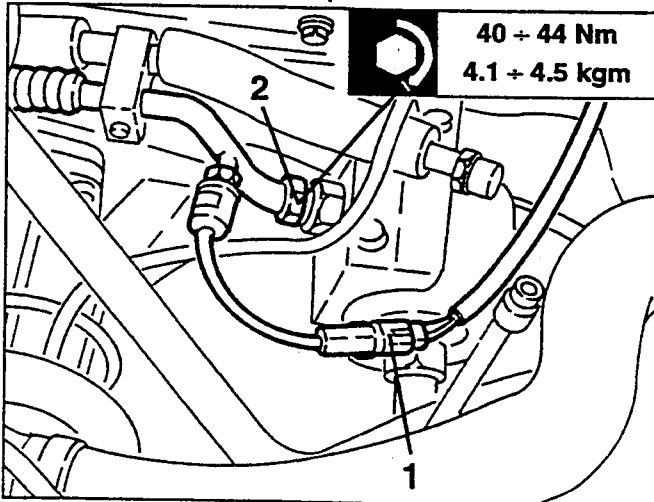


- Remove the relays from the battery support and set them to one side with their cablings so that they do not hinder the following operations.

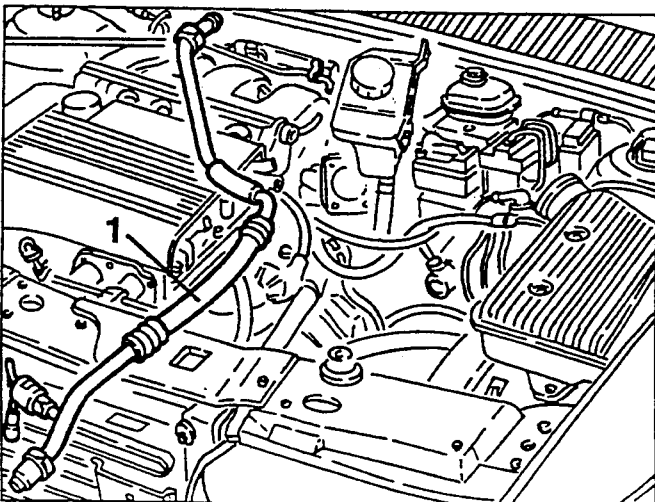
1. Slacken the fastening screws, then remove the battery support after removing the rear cable support bracket from it.



1. Disconnect the electrical connection of the minimum pressure switch.
2. From the drier filter disconnect the coolant fluid delivery pipe from the evaporator.



1. Remove the pipe from the evaporator to the drier filter complete with minimum pressure switch and, if necessary, separate them on the bench.

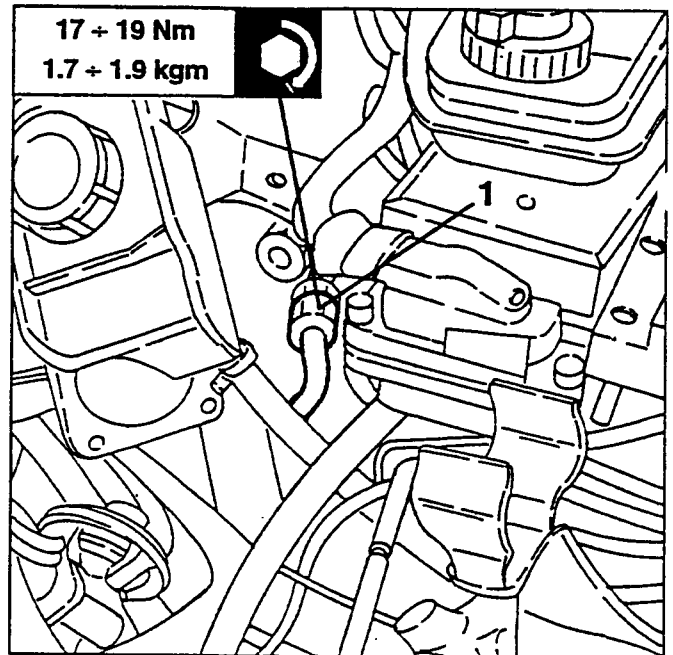


PIPE FROM EXPANSION VALVE TO EVAPORATOR

REMOVING/REFITTING

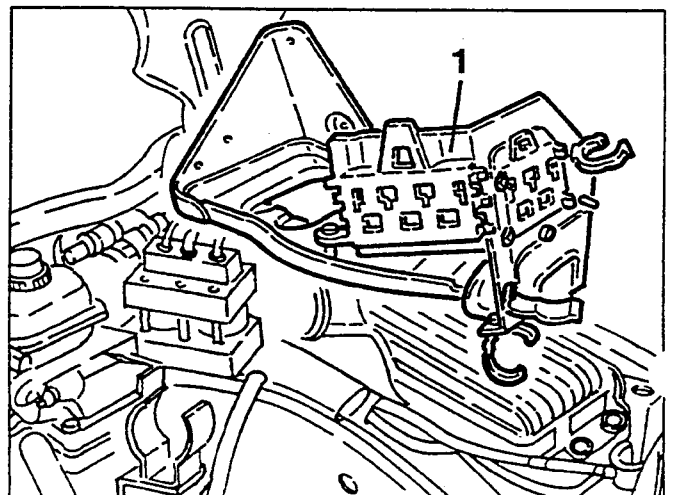
Proceed as described in the previous procedure up to disconnecting the coolant fluid outlet pipe from the evaporator.

1. Using wrenches no. 1.822.111.000 and no. 1.822.113.000, disconnect the pipe in question from the evaporator.

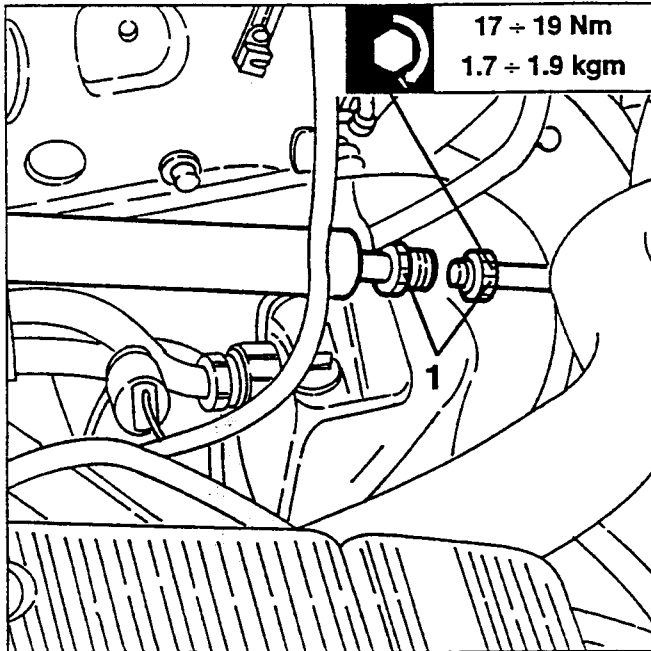


- Remove the relays from the battery support and set them to one side with their cablings so that they do not hinder the following operations.

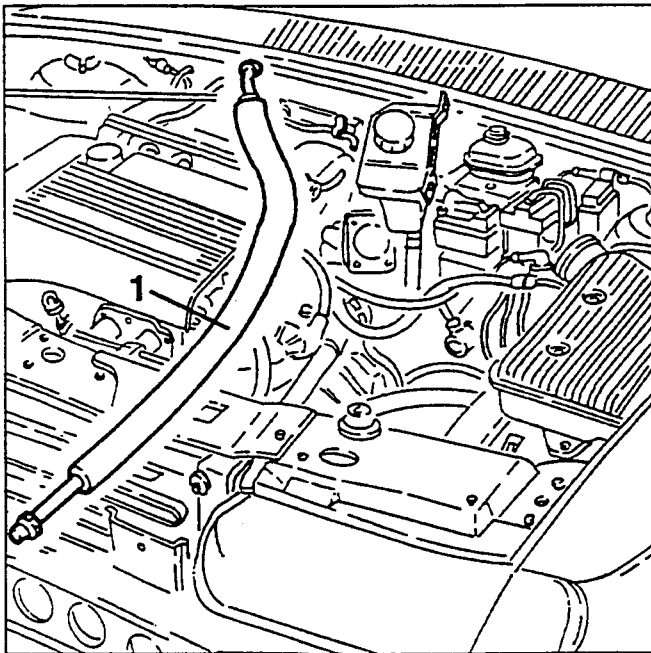
1. Slacken the fastening screws, then remove the battery support after removing the rear cable support bracket from it.



1. Pull back the insulating cover, then disconnect the union on the expansion valve.



1. Remove the section of pipe from the expansion valve to the evaporator.



TOPPING UP THE OIL LEVEL OF THE CLIMATE CONTROL UNIT COMPRESSOR



WARNING:

- The oil level in the compressor should only be carried out when presumably a considerable amount of lubricating oil has leaked due to damage or disconnection of components of the climate control system or if it has been emptied.
- The oil is highly hygroscopic: avoid leaving the cans open.
- Avoid leaving the compressor and any other part disconnected from the system longer than the time necessary.
- In the event of operations or servicing in the engine compartment with pipes of the system exposed to the air for more than six hours, it is not sufficient to top up the level, the compressor lubricating oil must be replaced completely, proceeding as described in point C.
- To top up the oil level only use new oil of the type specified in the "TECHNICAL DATA".

N.B. The procedures differ according to the cases.

Five are described below (A, B, C, D, E).

A) "SLOW" SYSTEM DRAINING -

In case of Routine Maintenance (emptying and recharging)

When draining the system using the special equipment, the compressor oil removed is collected in a special graduated container to be found on the equipment.

Before recharging the refrigerant fluid, top the system up with the quantity marked on the container, plus 15 cm³.

If the plug on the compressor and the pipe fittings are not accessible, use a syringe to send the oil through one of the recharging valves (this valve can be removed with a suitable tool comprising a hollow pipe with special groove).

B) "QUICK" SYSTEM DRAINING

(In under 5 minutes) - In the case of accidental breakages

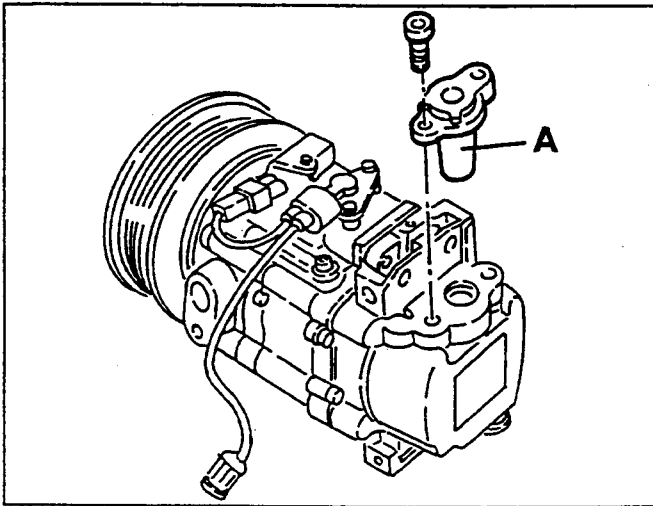
Under these circumstances it is not possible to determine the exact quantity of the oil lost.

Replace it as described above, in all cases with 50 cm³ of oil.

N.B.: if for some reason, the compressor is removed and refitted follow the description given in point C.

C) COMPLETE OVERHAULING OF THE SYSTEM
In the event of washing or "important" operations on the system

- Drain the coolant fluid from the climate control system and flush the system.
- Remove the compressor.
- Remove the oil separator device (A) fastened next to the outlet union of the compressor and drain all the oil contained in the compressor.



- Refill with new oil of the type and in the quantity specified in the "TECHNICAL DATA":
- Refit the compressor on the car and recharge the system.

D) CHANGING THE COMPRESSOR ONLY

- Drain the coolant fluid from the climate control system.
- Remove the compressor.
- Drain the oil from the compressor just removed, collecting it in a suitable recipient.
- Carry out the same operation for the new compressor.
- Fill the compressor with the same amount of oil removed from the old one.
- Refit the compressor on the car.
- Recharge the system, topping up with an additional 15 cm³.

E) CHANGING ONLY THE DRIER FILTER

the drier filter is supplied in production (and also as spare) with a certain amount of oil.

NOTE: this filter is easily distinguished by a label with the writing "CONTAINS 130 C.C. OF NIPPONDENSO N.D.9 OIL".

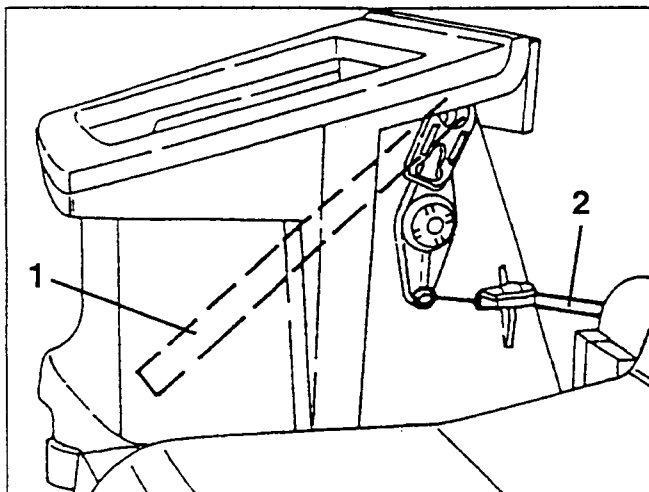
- Drain the coolant fluid from the climate control system.
- Remove the filter.
- Drain the oil from the filter, collecting it in a suitable recipient.
- Carry out the same operation for the new filter.
- Fill the new filter with the same amount of oil drained from the old one (remove or add accordingly).
- Refit the filter on the car.
- Recharge the system, topping up with an additional 15 cm³.

DESCRIPTION

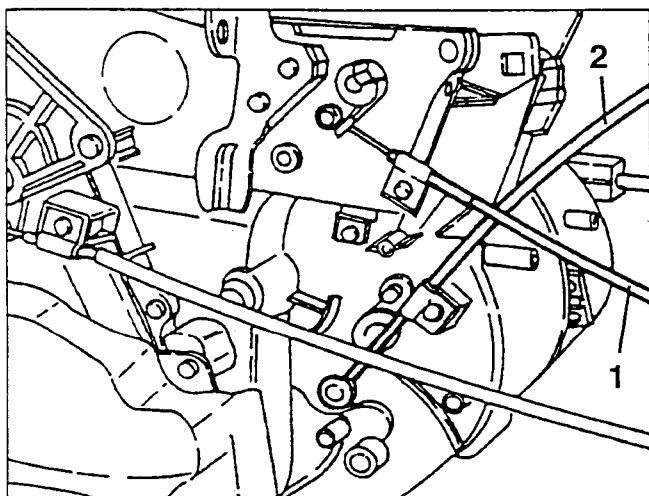
The heater unit is substantially the same as the climate control unit.

The main differences are the following:

- a) There is no evaporator;
- b) The outside air/recirculation flap (1) is not operated electrically by an actuator but by a control cable (2).

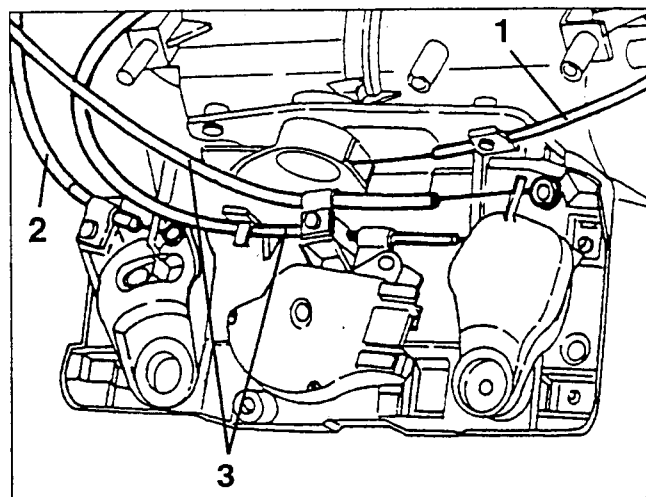


- c) The adoption of two control cables instead of one for moving the two air flow flaps, thus the transmission linkages have been eliminated.



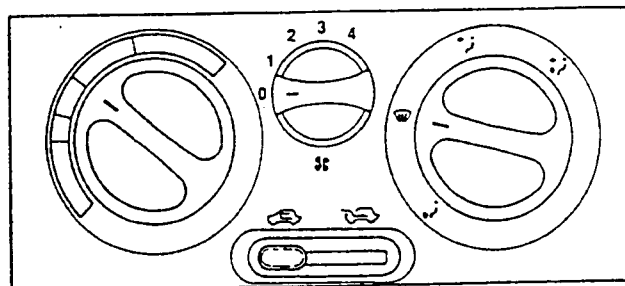
- 1. Upper air flow flap control cable
- 2. Lower air flow flap control cable

- d) Due to the above-mentioned differences, also the control unit differs as it will have four control cables rather than two and an electrical connection less.



- 1. Outside air/recirculation flap control cable
- 2. Air mixing flap control cable (unchanged)
- 3. Air flow flaps control cable

- Therefore, the control panel is without the pushbutton for turning on the compressor and with a lever for manually controlling the outside air/recirculation flap. In addition, the fan control knob no longer has the OFF position for shutting off the inlet of outside air.



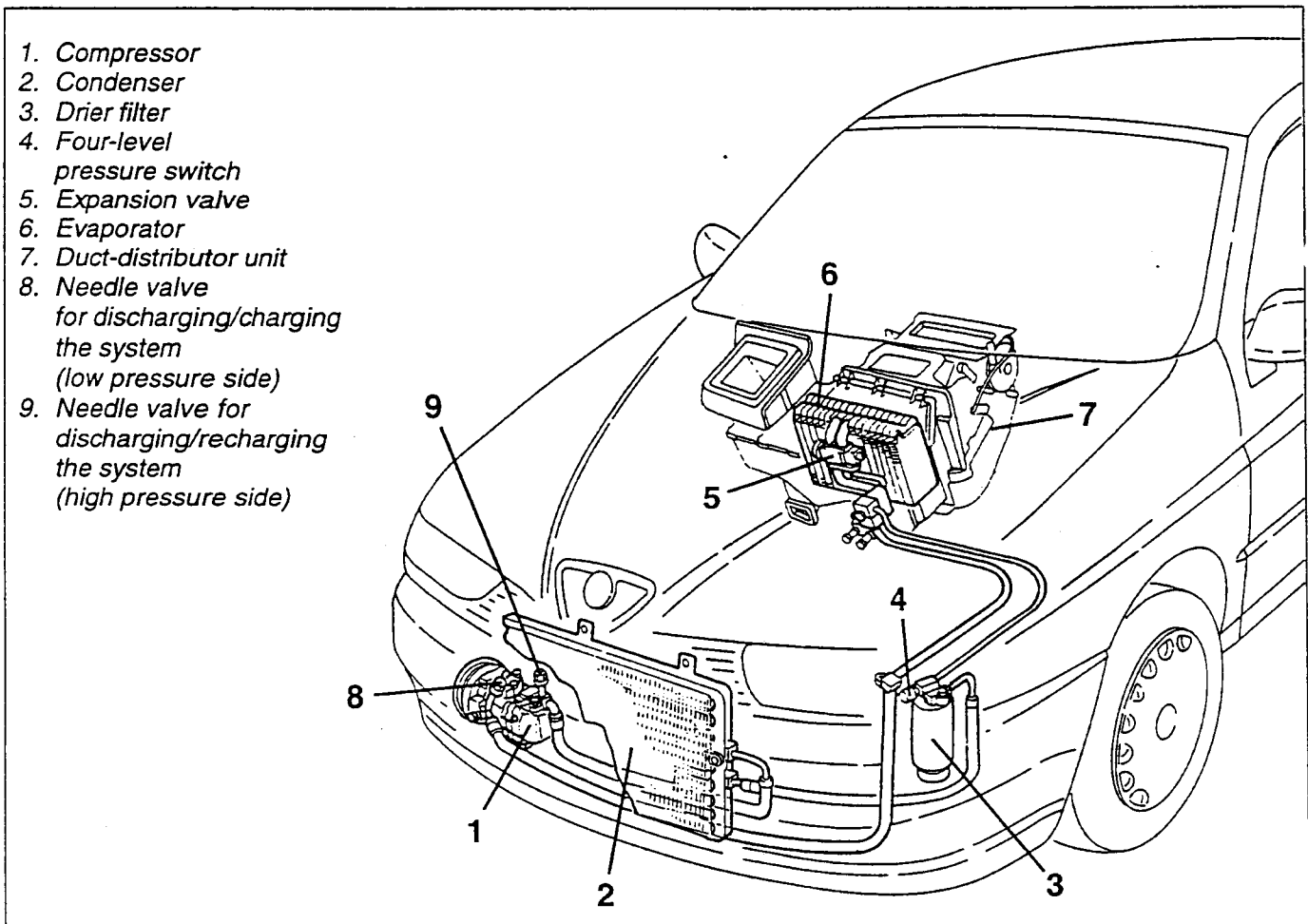
- e) There is no air flow vent to the rear passengers.

DESCRIPTION OF THE SYSTEM

The air conditioning system comprises the following components:

- a variable displacement compressor fastened to the engine by brackets;
- a condenser which is a heat exchanger fitted in front of the engine coolant fluid radiator;
- a drier filter located to the left side of the condenser;

- an evaporator which is the second heat exchanger of the system to be found in the duct-distributor unit;
- an expansion valve fitted on the evaporator inlet duct;
- various pipes and hoses which connect the different components of the system;
- four-level pressure switch installed on the drier filter. Two tubes are welded on the high and low pressure pipes on which a needle valve is fitted which serves for discharging and charging the system.



1. Compressor
2. Condenser
3. Drier filter
4. Four-level pressure switch
5. Expansion valve
6. Evaporator
7. Duct-distributor unit
8. Needle valve for discharging/charging the system (low pressure side)
9. Needle valve for discharging/recharging the system (high pressure side)

The system with thermostatic adjustment SEMI-AUTOMATICALLY CONTROLS the climate control system of the car.

In fact, according to the temperature required in the passenger compartment, it manages the following automatically:

- air temperature at the vents;
- fan speed (with constant changing).

Upon manual operation it handles the following:

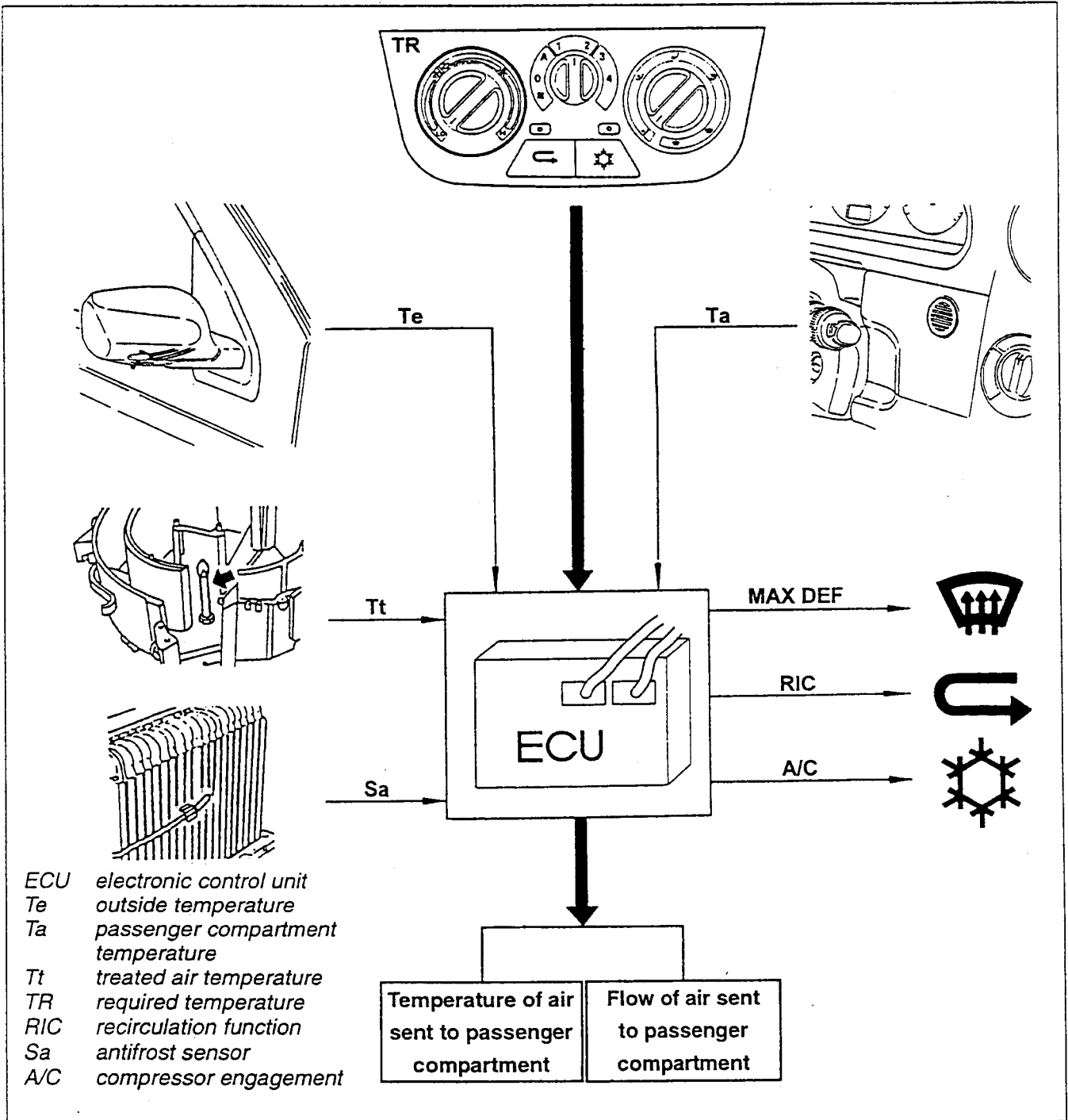
- fixed fan speed (4 speeds);
- compressor engagement (air cooling circuit);
- engagement of air recirculation;
- "MAX DEF" function.

Lastly the distribution of the flows of air to the different vents are adjusted completely manually (through bowden cable).

OPERATING LOGIC

A special control unit manages automatic operation of the system controlling the thermodynamic parameters in order to provide the climatic comfort (temperature and humidity) required by the occupants of the vehicle.

According to the requests received and the temperature conditions detected, the control unit sets certain functions to adapt the temperature of the passenger compartment to the one required.

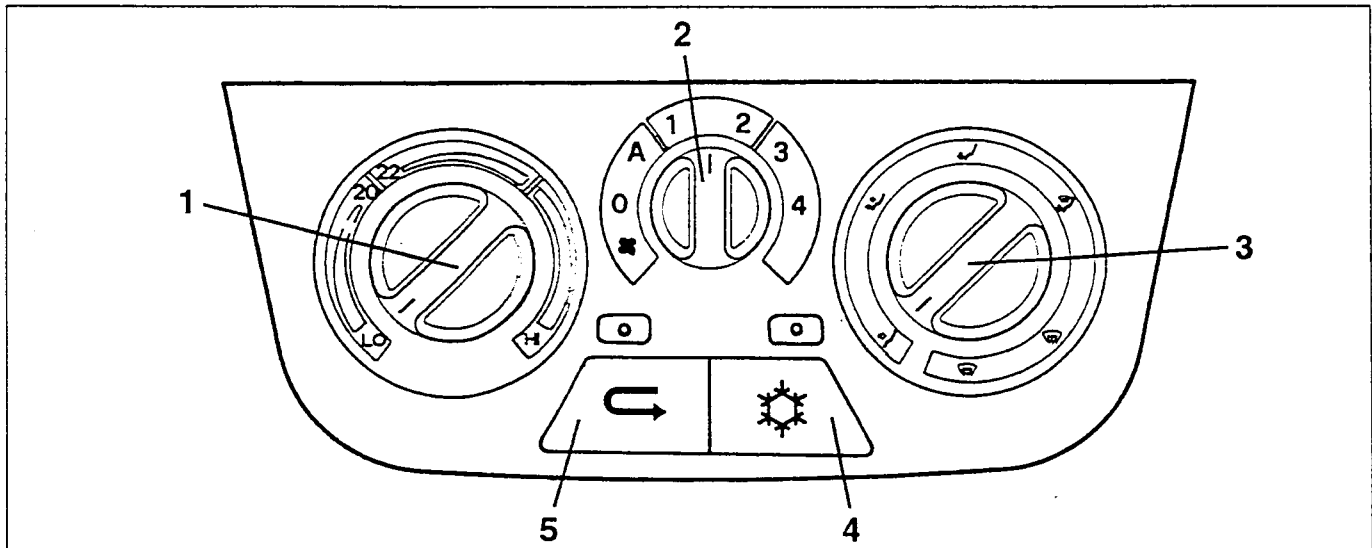


Through suitable control logics of the sensors and adjustment with "self-teaching" of the actuators, the electronic control unit is capable of recording and memorising a series of faults and failures that may occur in the system.

If these faults occur, the control unit still continues to manage system operation replacing any abnormal

values with suitable "recovery" values which ensure minimal operation though not perfect of the system. For further information, see "ELECTRIC - ELECTRONIC DIAGNOSIS".

CONTROLS



The left knob (1) is used to select the TEMPERATURE REQUIRED (between 18 and 30°C): it is connected to a potentiometer which detects the different angular positions and transmits a signal to the electronic control unit for a total of 15 different positions (one per degree centigrade) of which the two extreme positions are "LO" and "HI" which correspond respectively to the request for the highest amount of cool air and the highest amount of warm air. The centre knob (2) adjusts AIR VENTILATION: this too, is connected to a potentiometer which detects the different angular positions and transmits a signal to the electronic control unit. There are four possible flow rates that can be set manually in a permanent manner (1, 2, 3 and 4), while in the 'AUTO' position it is the system itself that automatically selects the most suitable temperature for reaching or keeping the required temperature.

NOTE: Position "0" indicates minimum ventilation: the fan is off and only a light flow of air will go through the vents.

NOTE: There are two different maps inside the control unit which correlate the air flow rate and the fan speed: the presence of the pollen filter on the outside air inlet lowers the flow rate - at the same fan speed - in the "dynamic air" condition compared with "recirculation".

The right knob (3) selects FLOW DISTRIBUTION of air to the passenger compartment which can take place in five different ways:

selection takes place manually through a cable which controls the movement of the distribution ports.

When the button (4) is pressed, it enables operation of the COMPRESSOR (air cooling circuit); when the button is released operation is cut off.

Engagement takes place completely manually: only in the "MAX DEF" mode is the compressor still engaged with the button released.

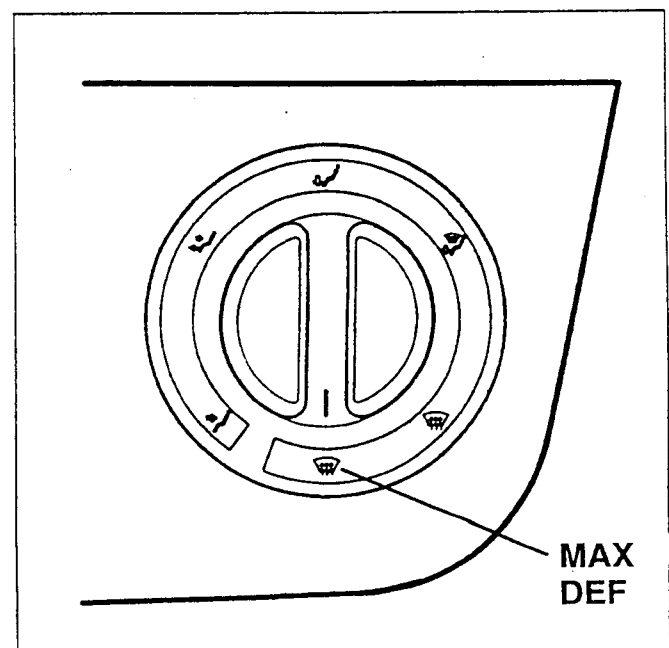
When button (5) is pressed, it engages the AIR RECIRCULATION function from inside the passenger compartment; when the button is released it allows the inlet of "dynamic" air from outside.

Engagement takes place entirely manually: only in the "MAX DEF" mode is recirculation cut off also with the button pressed.

"MAX DEF" function

When the distribution knob is turned completely clockwise - it activates - through a special microswitch - the "MAX DEF" function for quick defrosting which involves:

- maximum air flow rate;
- mixing with the highest amount of heat available
- recirculation off, regardless of the position of button (5);
- compressor enabled, regardless of the position of button (4).

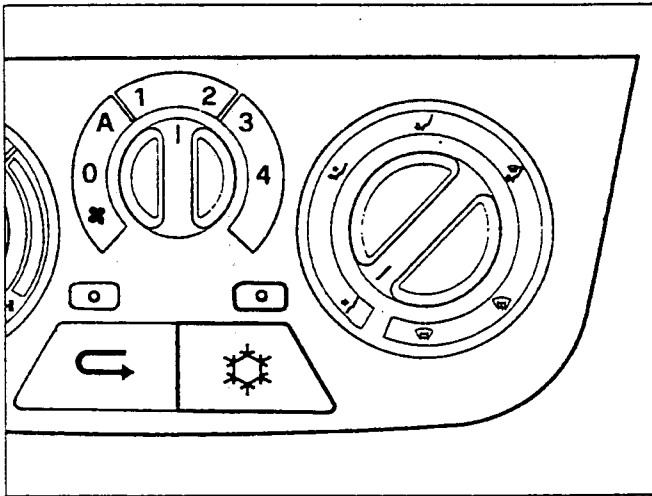


Compressor engagement

When pressed, the button illustrated enables COMPRESSOR OPERATION (air cooling circuit); when the button is released operation is disengaged.

However actual engagement of the compressor depends on the following conditions:

- outside temperature below 5°C: (disengagement below 4°C and re-engagement above 6°C);
- temperature detected by the antifrost sensor: (disengagement below 3.5°C and re-engagement above 5°C).



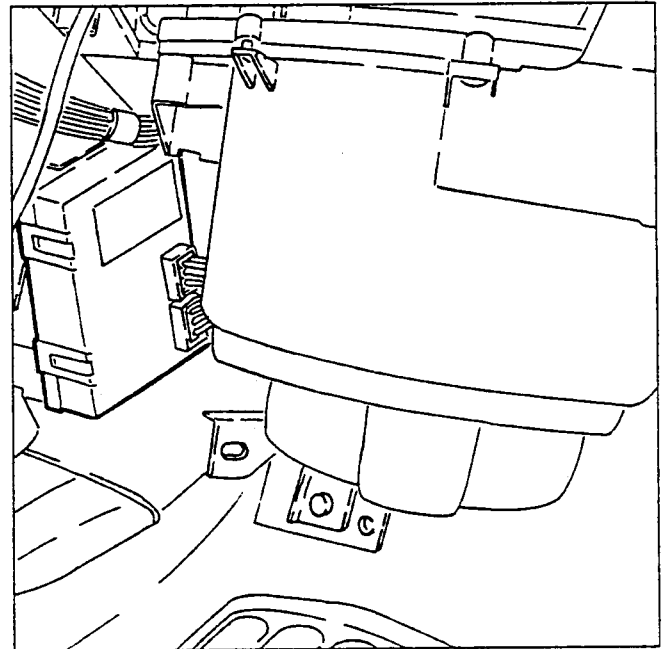
You are reminded that the compressor may also be disengaged by the four-level pressure switch or by the engine control unit. This logic depends on the different engine management control units (see ELECTRIC - ELECTRONIC DIAGNOSIS).

SYSTEM COMPONENTS

ELECTRONIC CONTROL UNIT

The electronic control unit manages automatic operation of the system controlling the thermodynamic parameters in order to provide the climatic comfort (temperature and humidity) required by the occupants of the car.

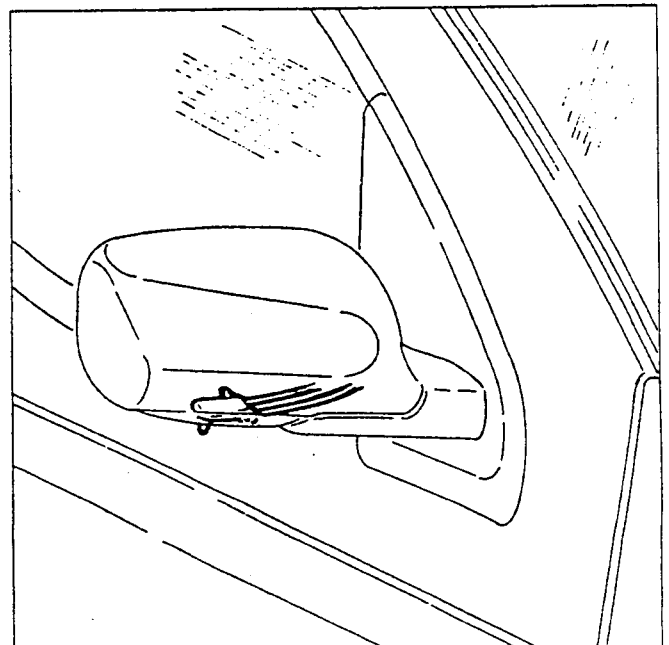
It is on the right side of the duct-distributor unit and access to it is easily gained from the passenger compartment.



OUTSIDE AIR TEMPERATURE SENSOR

This is on the right wing mirror.

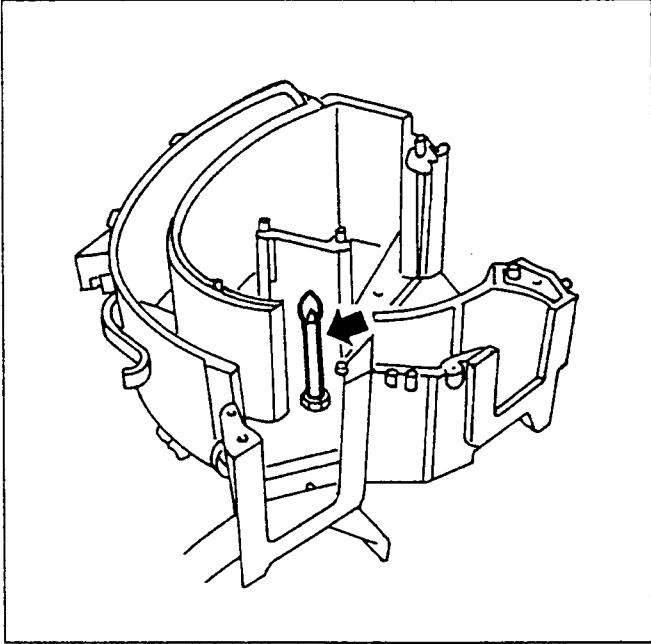
It is an NTC sensor - resistance that lowers with the temperature (R at 25°C = 10 kOhm), with operating range from -30°C to +50°C.



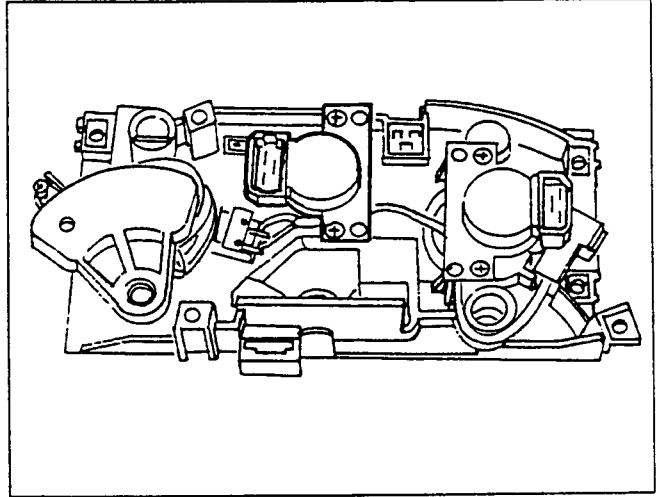
**TREATED AIR TEMPERATURE
SENSOR**

This is inside the distributor unit immediately upstream of the air flow distribution ports to the different vents.

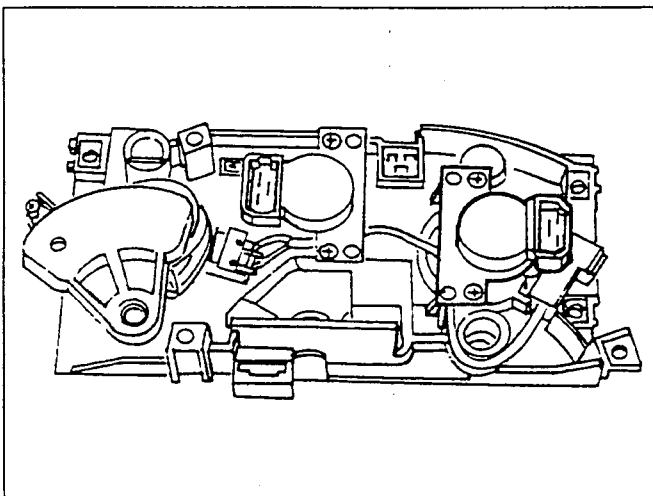
It is an NTC sensor (R at $25^{\circ}\text{C} = 10 \text{ k}\Omega$), with operating range from 0°C to $+80^{\circ}\text{C}$.

**REQUIRED AIR FLOW
POTENTIOMETER**

The potentiometer is connected to the air ventilation knob and detects the different angular positions, thereby transmitting a signal to the electronic control unit: there are four possible air flow rates set manually permanently (1, 2, 3 e 4), plus the "AUTO" and "0" position.

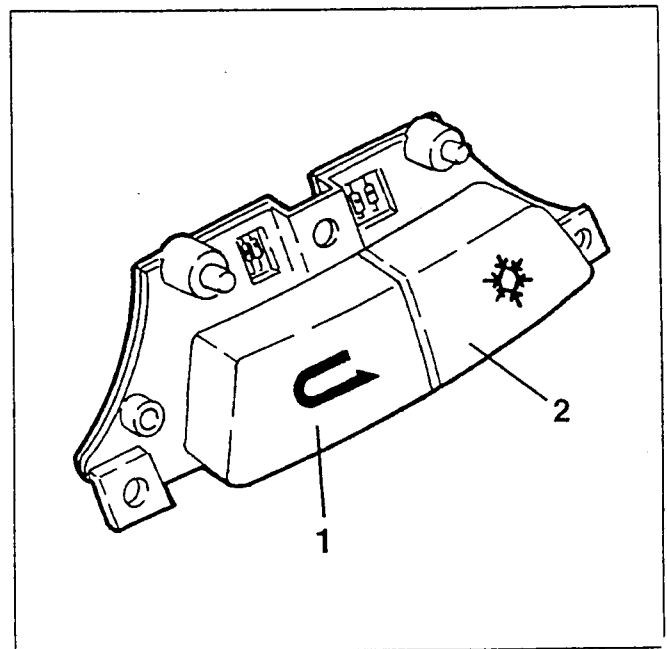
**REQUIRED TEMPERATURE
POTENTIOMETER**

The potentiometer is connected to the temperature knob and detects the different angular positions, thereby transmitting a signal to the electronic control unit for a total of 15 different positions (one per degree centigrade) the two extreme positions of which are "LO" and "HI".

**SET OF SWITCHES
AND RECIRCULATION/COMPRESSOR
ENGAGEMENT FUNCTION**

When button (1) is pressed it engages the recirculation function managed entirely manually.

When button (2) is pressed, it enables operation of the compressor of the air conditioning system.

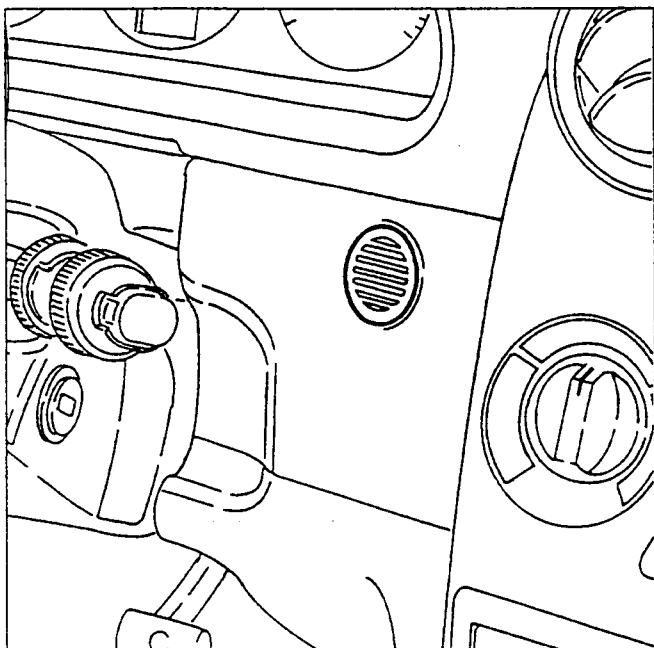


**PASSENGER COMPARTMENT
TEMPERATURE SENSOR**

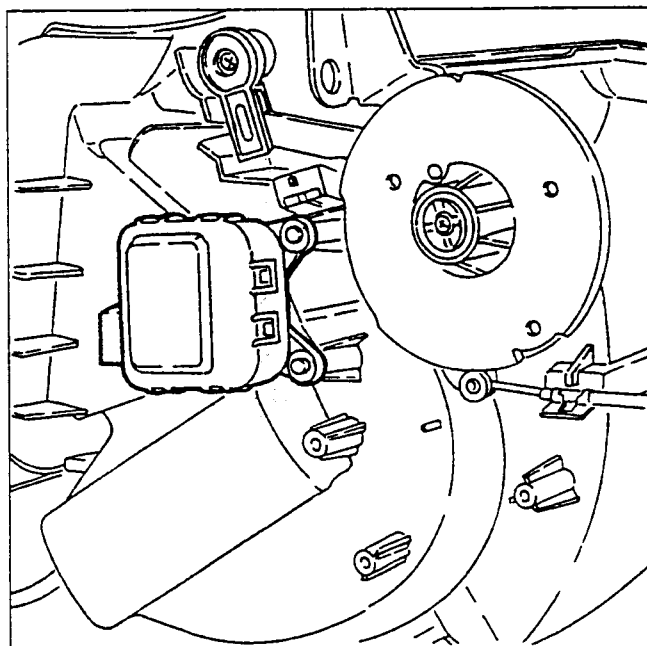
This is on the right hand trim on the driver's side of the dashboard.

It is an NTC sensor (R at $25^{\circ}\text{C} = 2.2 \text{ k}\Omega$), with operating range from $+5^{\circ}\text{C}$ to $+45^{\circ}\text{C}$.

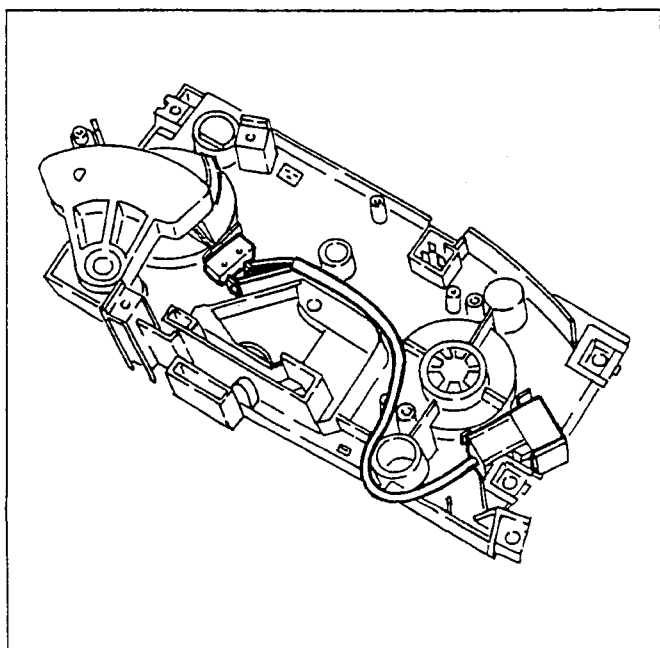
The sensor is "ventilated", i.e. inside it incorporates a small fan that is always supplied so that the temperature reading is not affected by the air stagnating inside the dashboard which would give an unrealistic result.

**ELECTRIC MIXING ACTUATOR**

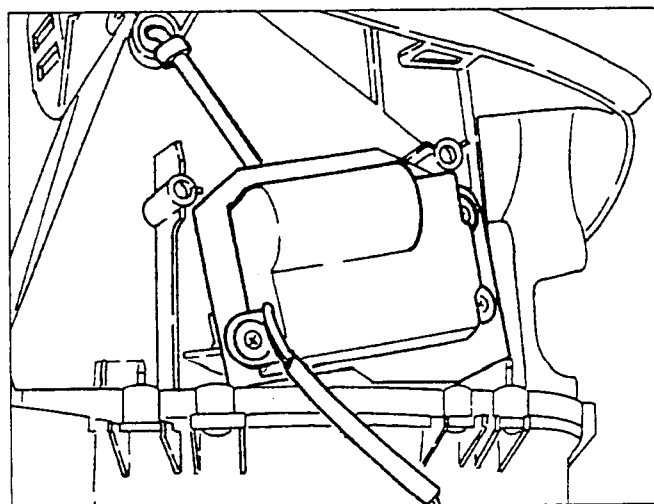
The temperature of the treated air is adjusted by suitably controlling the mixing actuator between hot and cold air which acts on the port which sends or shuts off the flow of incoming air on the heater radiator, crossed by hot water leading from the engine. A motor supplied at 12V controls the rotary movement of a draw pin which acts directly on the mixing port. A potentiometer detects the actual position and acts as "feedback" to the control unit.

**MAX DEF FUNCTION SWITCH**

A special switch activates the MAX DEF function: this is located on the distribution knob; it is an N.O. contact which is closed with the knob turned completely clockwise.

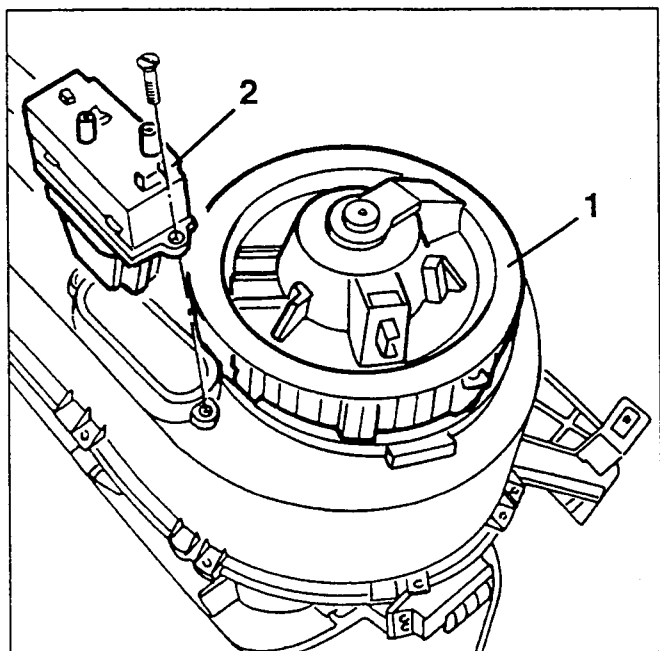
**RECIRCULATION ELECTRIC
ACTUATOR**

Rotation of the outside air inlet port is obtained by suitably controlling the recirculation actuator which acts on the port itself passing from the "dynamic air" position to the "recirculation" position. There are NO intermediate positions. A motor supplied at 12V controls the rotary movement of a draw pin which acts directly on the port. Reversing the polarity, movement in the opposite direction is obtained.



FAN WITH ELECTRONIC SPEED REGULATOR

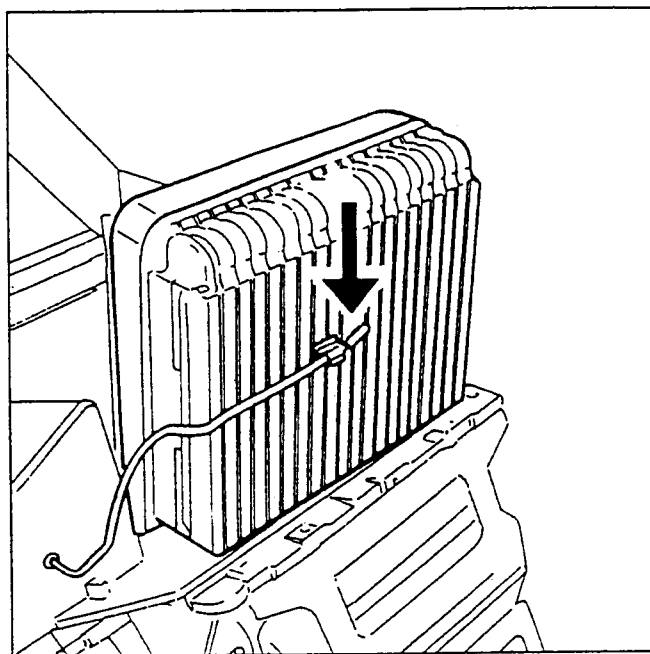
The fan (1) that sends outside or recirculation air towards the duct-distributor unit is supplied at 12V and controlled continuously at different speeds by an electronic regulator (2) located next to it.



ANTIFROST SENSOR

The antifrost sensor is inside the duct-distributor unit, installed directly on the evaporator. It detects the temperature of the evaporator and informs the control unit which - if necessary - turns off the compressor to prevent freezing.

It is an NTC sensor (R at $25^{\circ}\text{C} = 10 \text{ k}\Omega$), with operating range from -5°C to $+25^{\circ}\text{C}$.



DUCT DISTRIBUTOR UNIT

This assembly, shown in cross section below, is the main component of the system and it comprises a duct (1) and a heater distributor unit (2).

The duct (1) is formed of two parts, a lower one and an upper one; the right part of the latter is suitably shaped so that it mates perfectly with the upper right part of the dashboard surface (area under the windscreen of the partition between the engine and passenger compartments) with which it is in contact.

On the upper part of the right hand side of the duct there are two rectangular openings; the first is in an almost horizontal position and coincides with the one on the dashboard thus it communicates with the outside environment, while the other faces the passenger in an almost vertical position and allows the inlet of the air to the passenger compartment.

In the upper inner part of the duct there is a flap (3) which, duly directed by the special actuator, can take a position between the limits for closing of one of the above-mentioned openings.

Inside the duct on the lower part in correspondence with the above-mentioned openings, there is a fan (4) which, duly supplied at different voltages can turn at different speeds.

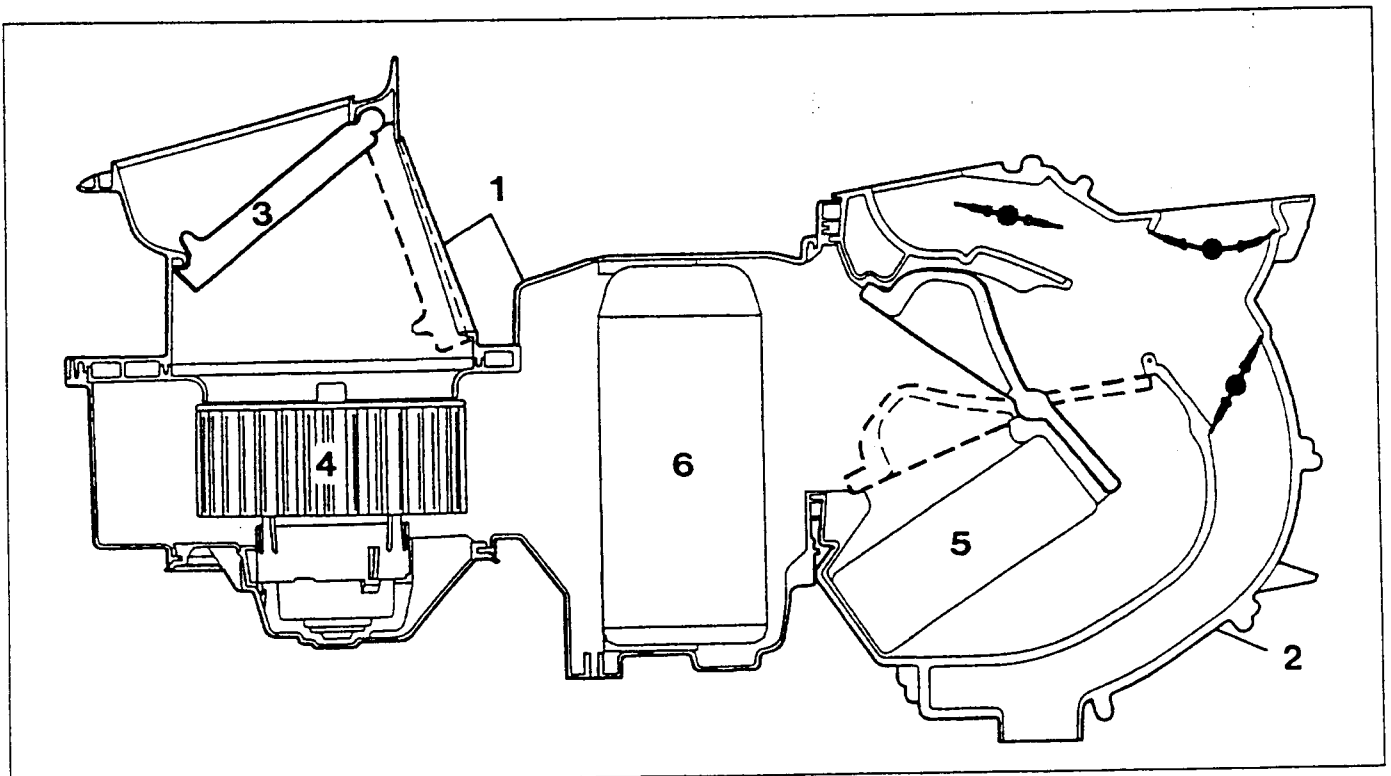
Between the duct (1) and the distributor (2) there is the evaporator (6).

The heater - distributor unit is mainly composed of a box housing the following:

- in the central position, a mixing port which duly directed by a knob through a bowden cable allows or prevents the entire flow of air taken in by the fan (4) or part of it to flow on the finned surface of the heater radiator (5);

- at the bottom centre, the heater radiator (5) the inlet and outlet fittings of which jut from the right side surface of the above-mentioned unit;

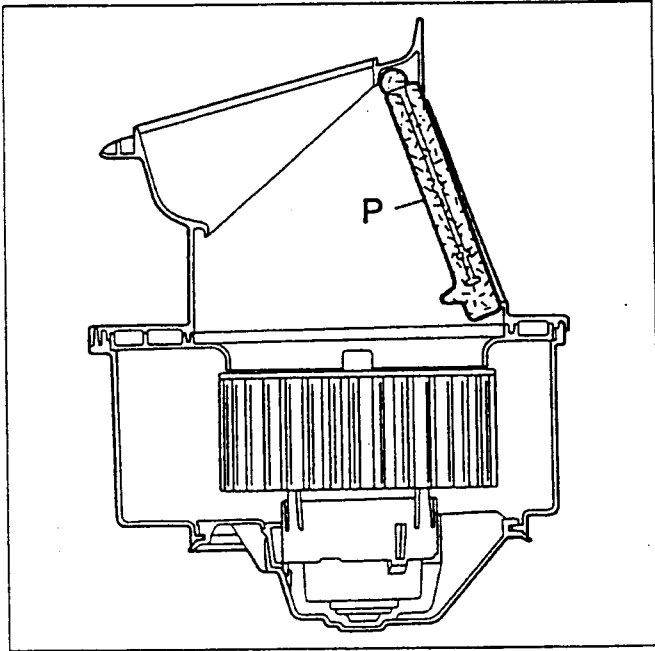
- above and at the front, four flaps which duly directed by a knob through a bowden cable, a toothed sector, a disk with grooves acting as distributor, shutter or fully close the section of the inside ducts which send air respectively to the feet, front vents and to the windscreen demisting vents.



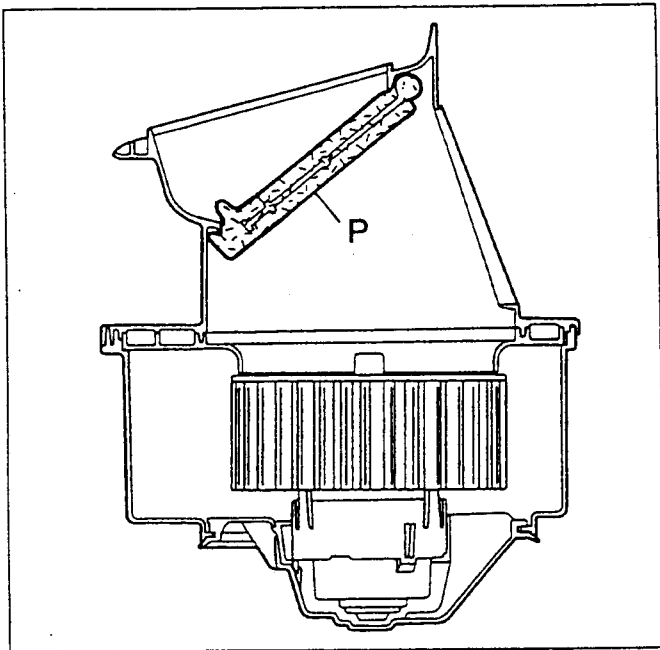
Dynamic/recirculation air

The special actuator turns the air inlet port (P) between two extreme positions.

- The position illustrated shuts inside air inlet, thus the fan withdraws only outside air.



- If the port is turned as illustrated, the outside air is inhibited and recirculation air is withdrawn.

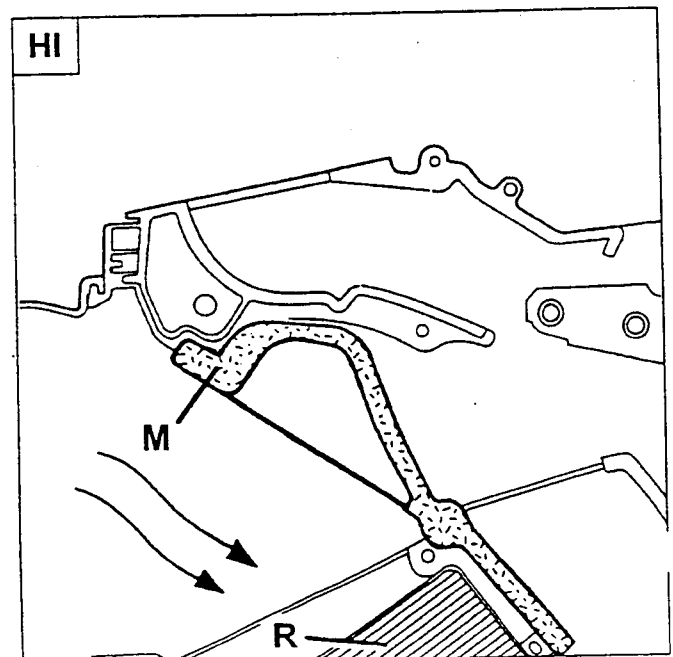
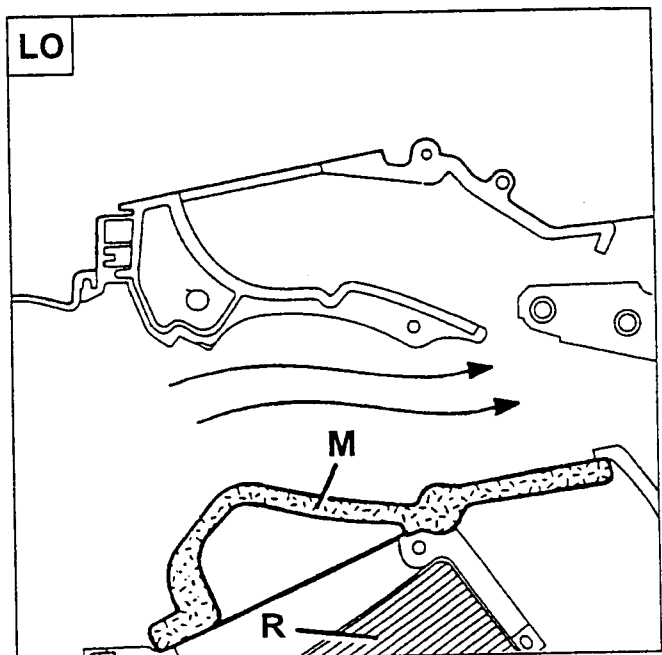


Hot/cold air mixing

The special actuator turns the port (M) between the extreme (LO) and (HI) positions.

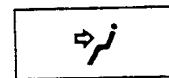
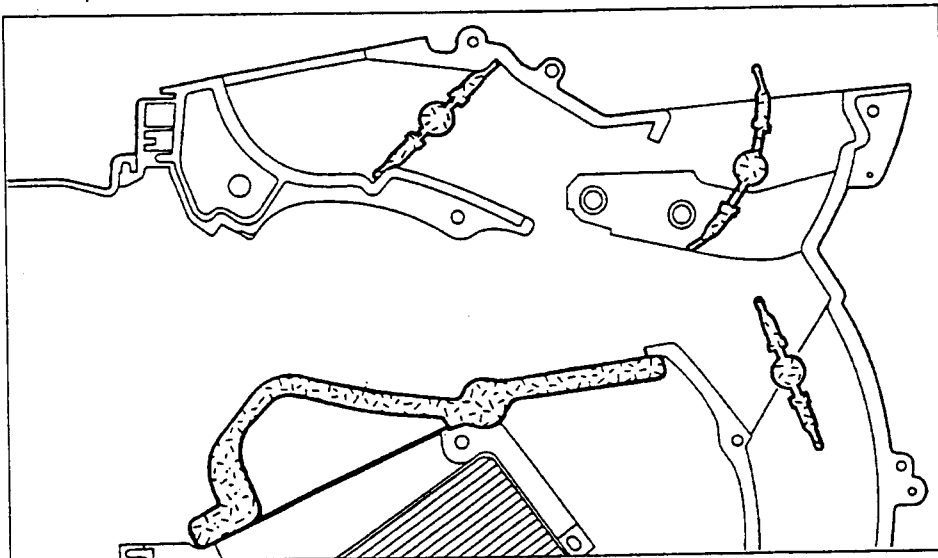
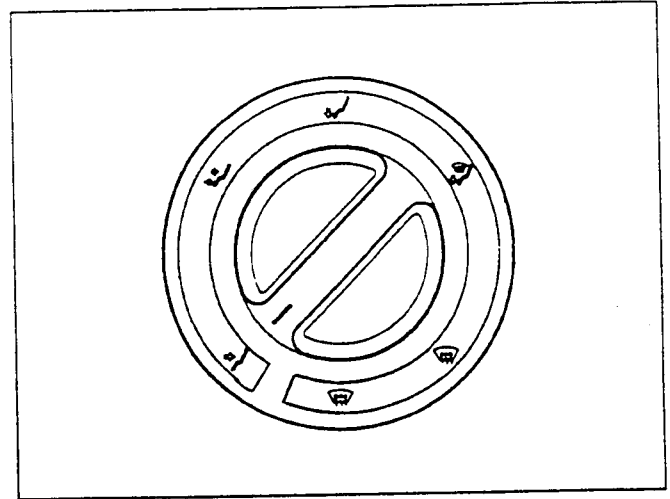
In the (LO) position the flow of air withdrawn by the fan is distributed to the different vents without undergoing any change in temperature as it is unable to flow against the finned surface of the heater radiator (R). When the mixing port is at the limit position (HI) the entire flow of air withdrawn by the fan is compelled to flow against the fins of the heater radiator, therefore warm air at the highest temperature possible will be distributed to the different vents.

When the mixing port is at an intermediate position between the above-mentioned two, only part of the flow of air withdrawn by the fan touches the radiator fins.

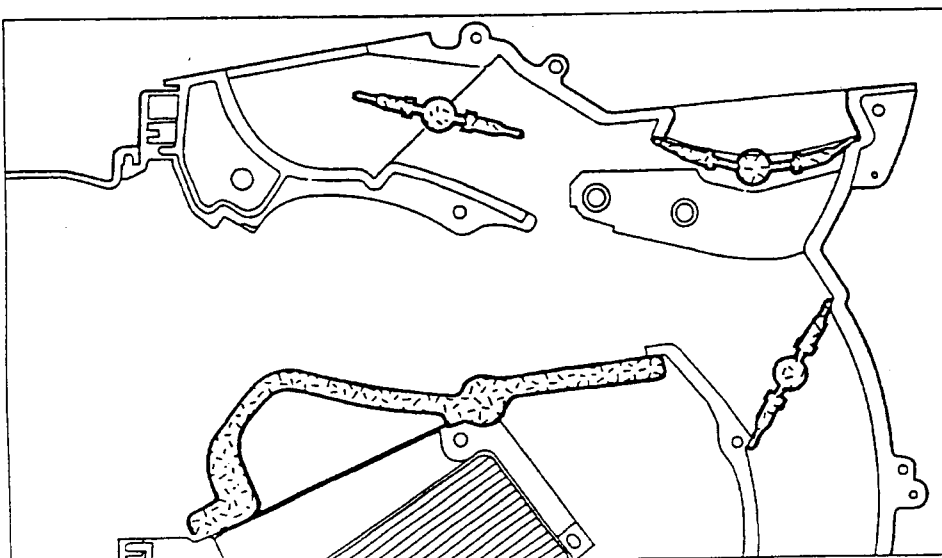


Air distribution

Turning the right knob clockwise suitably turns the four flaps to distribute the air as shown in the different pictograms, i.e. starting from only to the front vents up to only to the windscreen vents as illustrated below.



Detail of position of the different distribution flaps when the knob is turned completely counter-clockwise



Detail of position of the different distribution flaps when the knob is turned completely clockwise

INSTRUCTIONS FOR REMOVING/REFITTING

During maintenance operations, when the components of the air conditioning system are disconnected, suitably plug the disconnected fittings to prevent damp and impurities from being admitted to the system.

When re-installing the pipe fittings always change the O-rings on the actual fittings.

Lubricate the threads of pipe fittings with the specified antifreeze oil and tighten them to the specified torque.

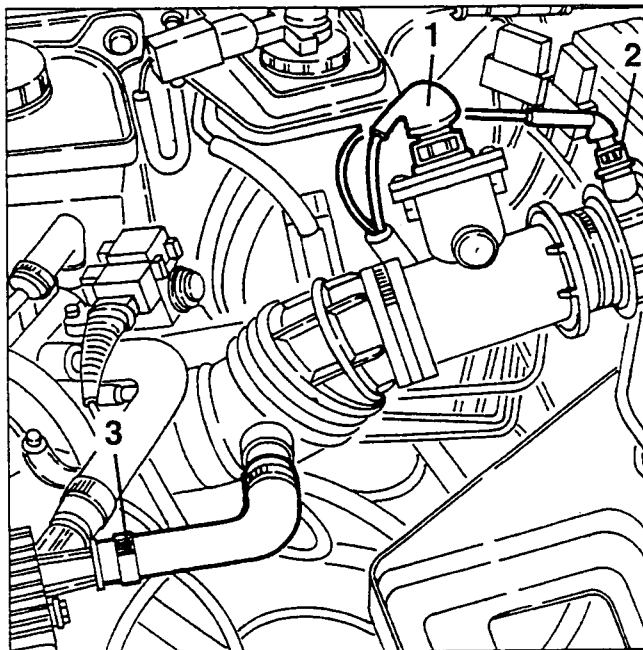
If oil is lost from the system during maintenance operations, restore the quantity of oil in the system calculating such losses.

Removing/refitting the following components:

- heater radiator
- expansion valve
- evaporator
- antifrost sensor

is only possible removing the "Duct assembly and heater-distributor unit" from the car and disassembling it up to where necessary.

1. Disconnect the electrical connection from the air flow meter.
2. Disconnect the electrical connection from the intake air temperature sensor.
3. Slacken the fastening clamp and disconnect the oil vapour recirculation pipe from the cylinder head.

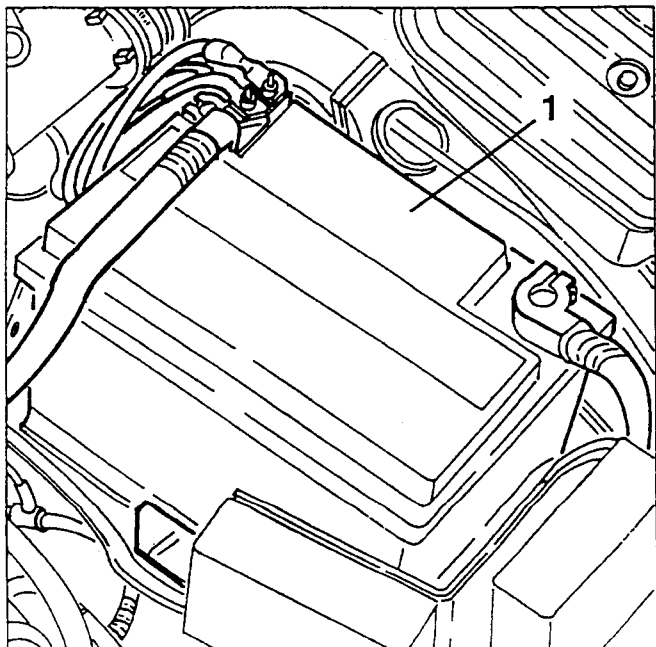


DUCT ASSEMBLY AND HEATER-DISTRIBUTOR UNIT

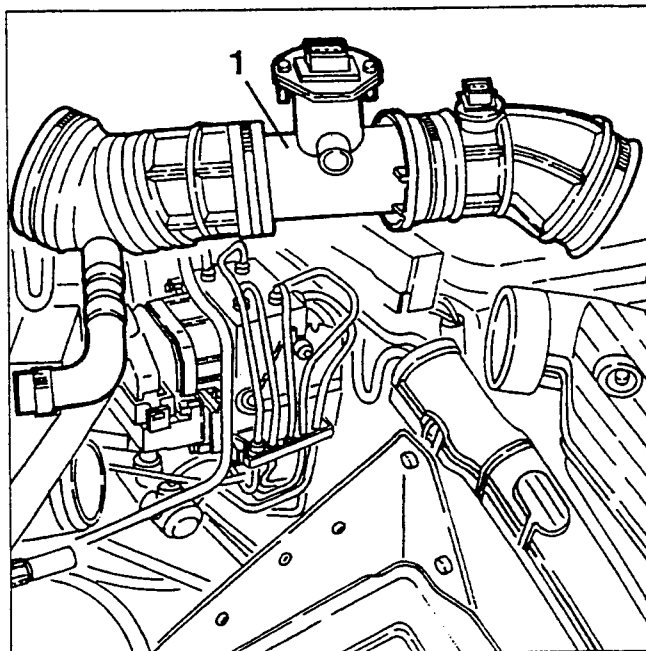
REMOVING/REFITTING

- Discharge the fluid of the climate control system (see specific paragraph).

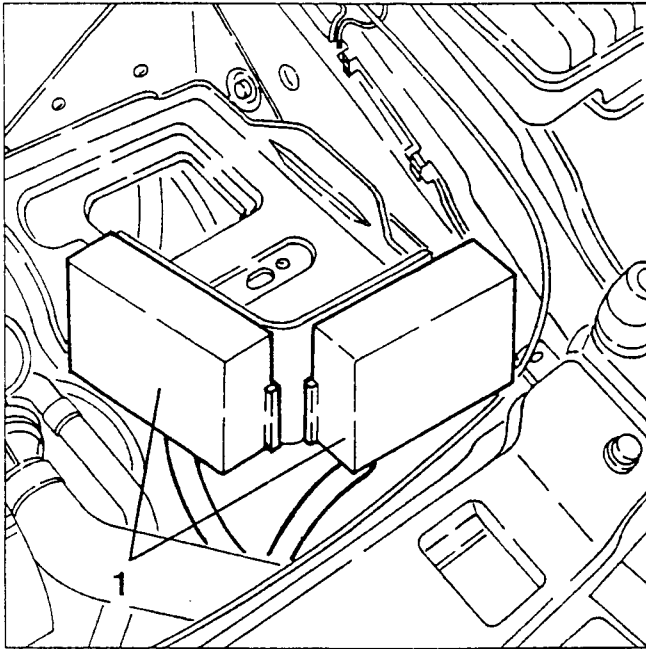
1. Disconnect the terminals, then remove the battery.



1. Slacken the two fastening clamps, then remove the corrugates sleeve complete.

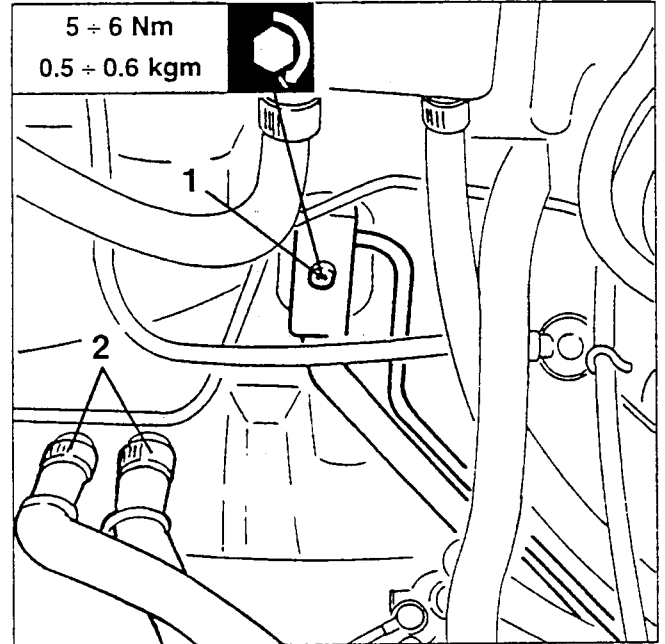


1. From the battery support release the two relay holder supports and set them to one side.

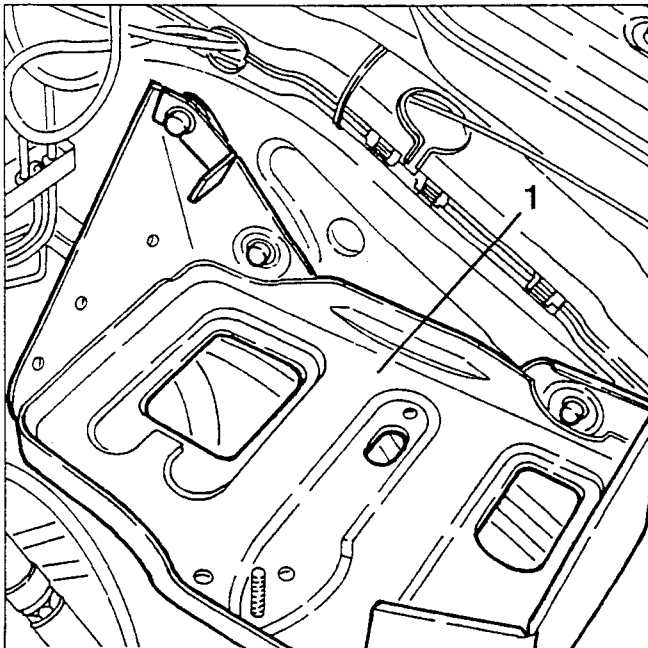


1. Slacken the fastening screw and disconnect the flange of the coolant fluid inlet and outlet pipes from the evaporator.

2. Disconnect the coolant fluid inlet and outlet pipes from the heater of the climate control system collecting the fluid in a suitable container.

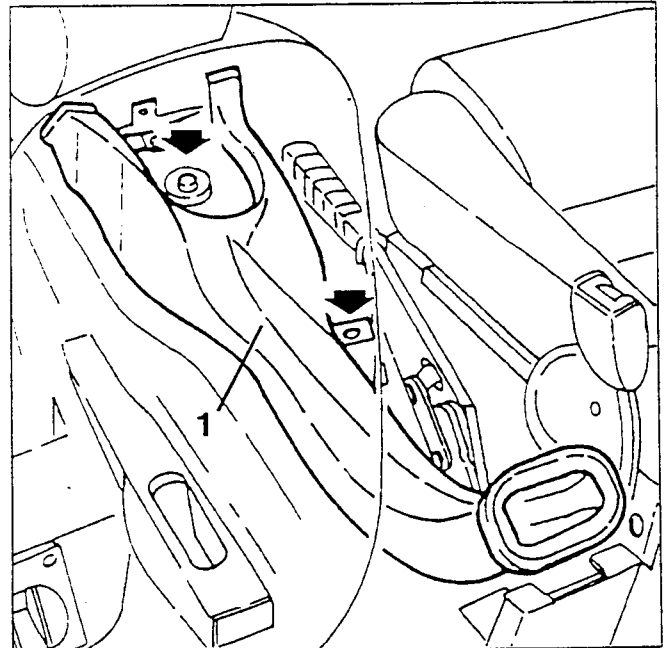


1. Slacken the fastening screws and remove the battery support complete with drain tube after freeing this from the wheel house.

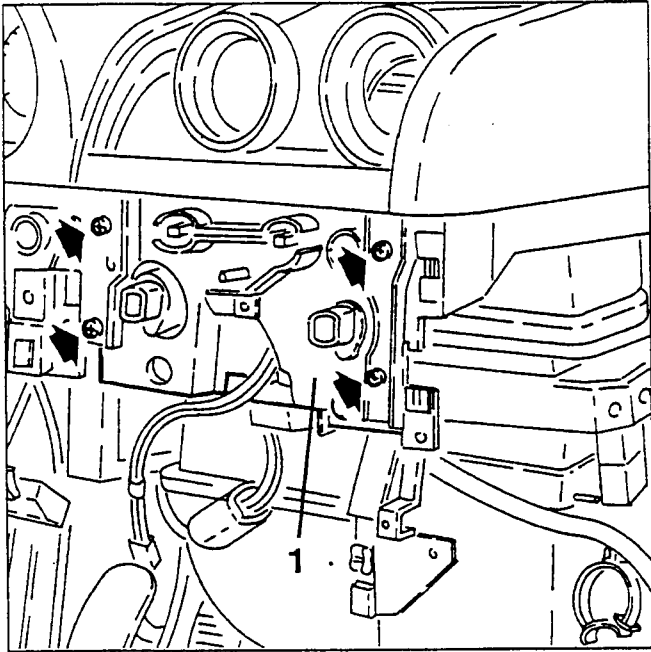


- Remove the lower part of the dashboard and the centre console (see GROUP 70).

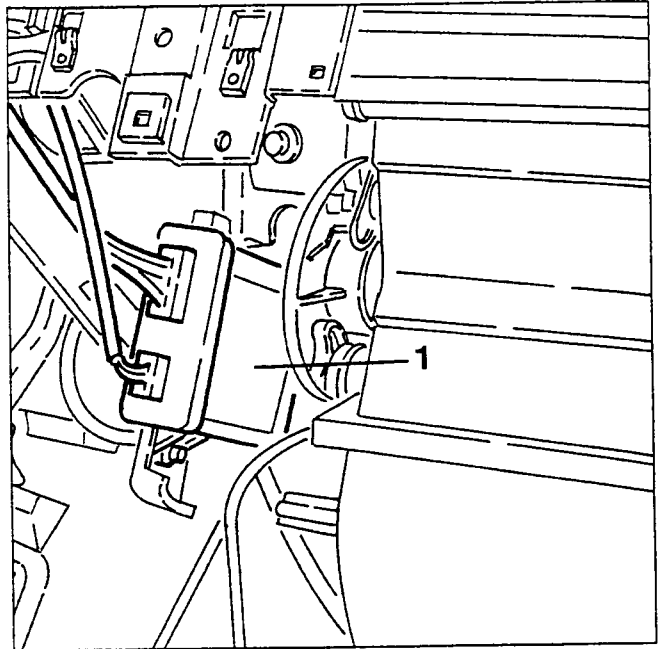
1. Slacken the two fastening screws and remove the rear section of the air delivery duct to the rear passengers' face.



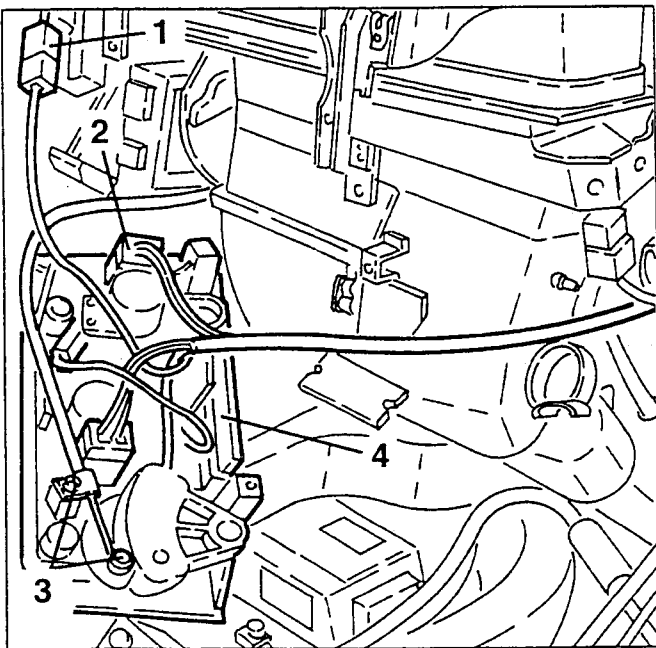
1. Slacken the four fastening screws and lower the controls of the climate control system.



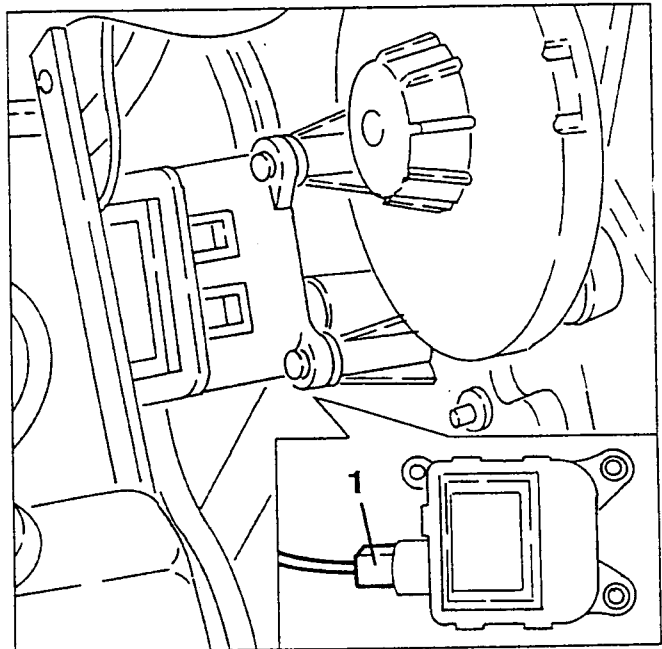
1. Slacken the fasteners, then set aside without disconnecting the electrical connections, the Alfa Romeo CODE control unit.



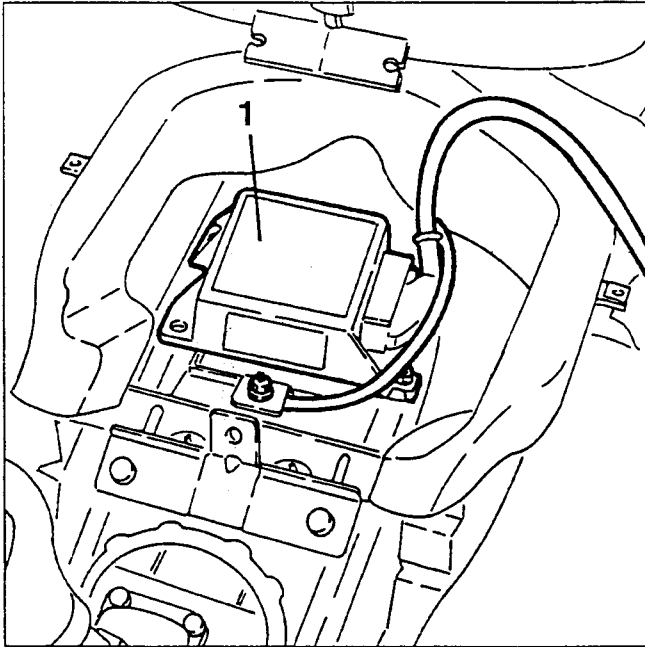
1. Disconnect the electrical connection of the inside air temperature sensor.
2. Disconnect the electrical connections from the climate control system controls.
3. Disconnect from the controls the bowden cable for moving the air distribution ports.
4. Remove the climate control system controls releasing them from the electrical wiring.



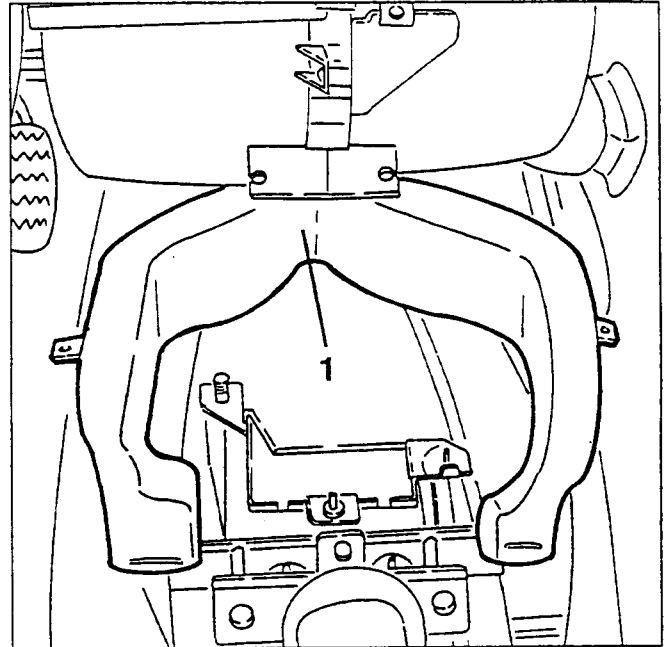
1. Disconnect the electrical connection from the air mixing port control motor.



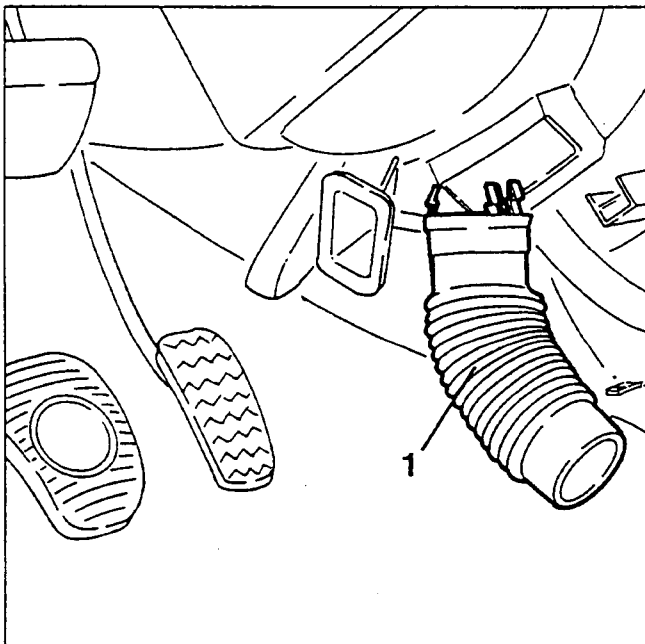
1. Slacken the fasteners, then set aside without disconnecting the electrical connections, the Air Bag control unit.



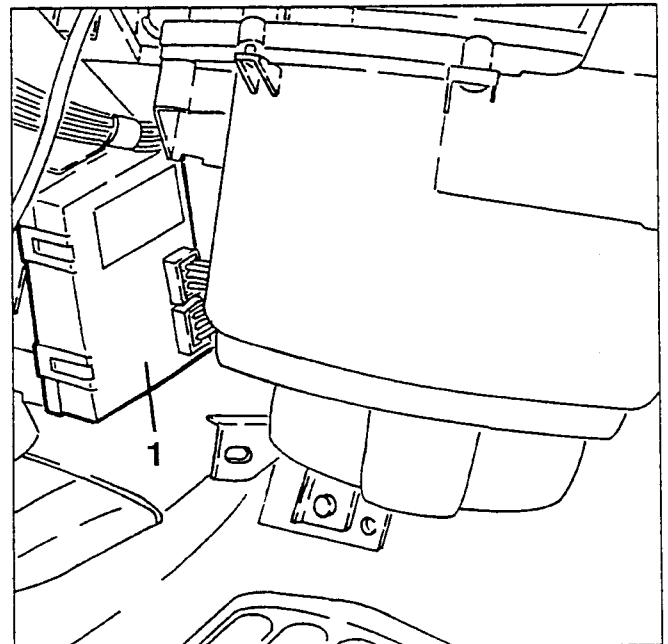
1. Slacken the fastenings and remove the front section of the air delivery duct to the rear passengers.



1. Remove the two elbows with bellows connecting the climate control system to the air delivery duct to the rear passengers' feet.

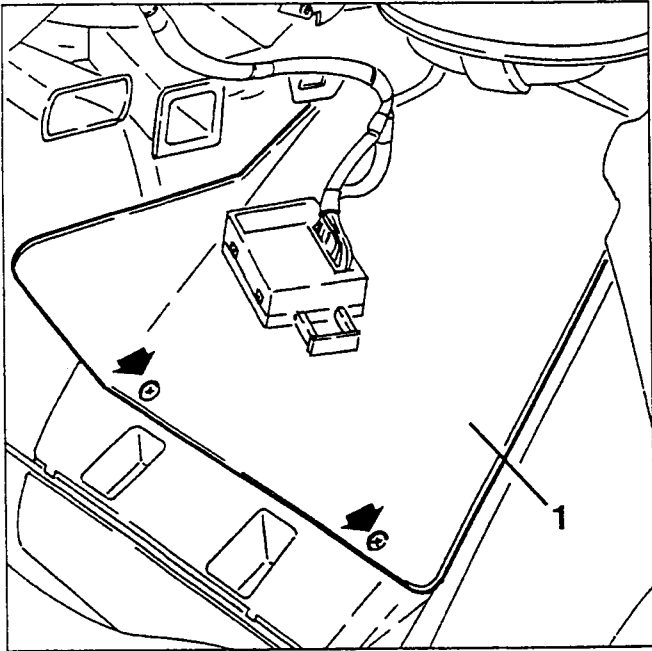


1. Release the climate control unit from the fastening clip, then set it to one side without disconnecting the corresponding electrical connections.



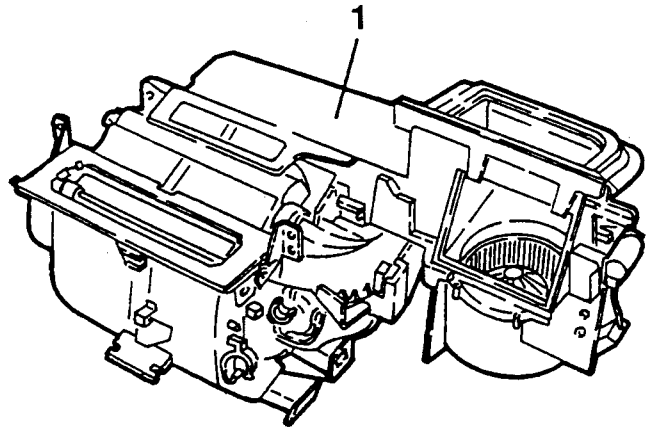
- Disconnect the following electrical connections:
 - from the fan
 - from the electronic fan speed regulator
 - of the recirculation/outside air control motor
 - of the treated air temperature sensor.

1. Move the floor mat, slacken the fastening screws and remove the injection control unit cover.



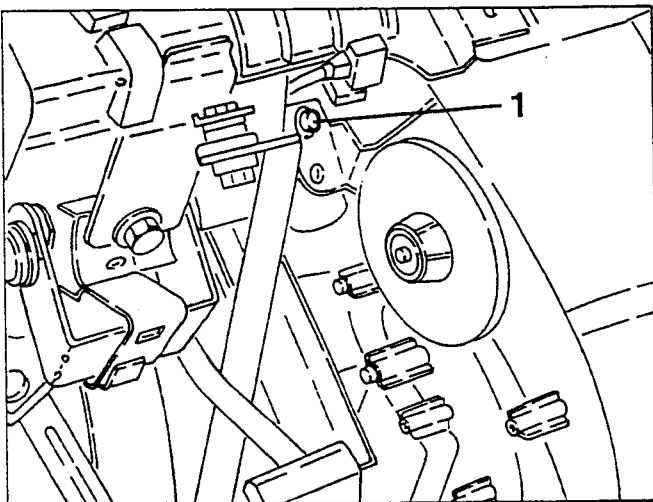
- Slacken the front screws fastening the air grooves to the feet and lower them just enough to remove the climate control group.

1. Withdraw and remove the climate control group.



Refit the unit reversing the sequence followed for removal and adhering to the instructions given below.

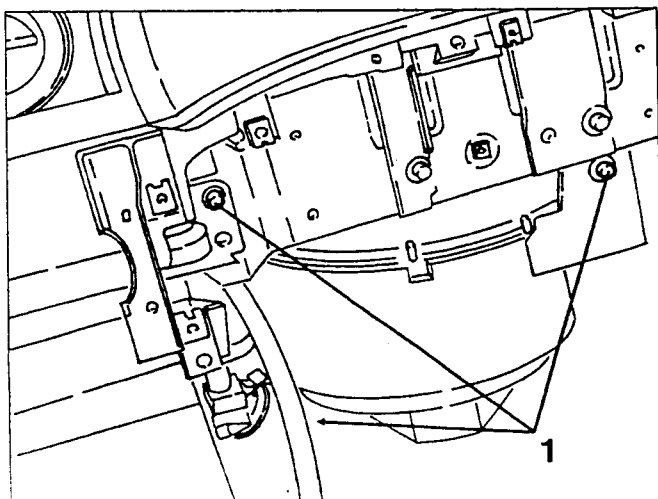
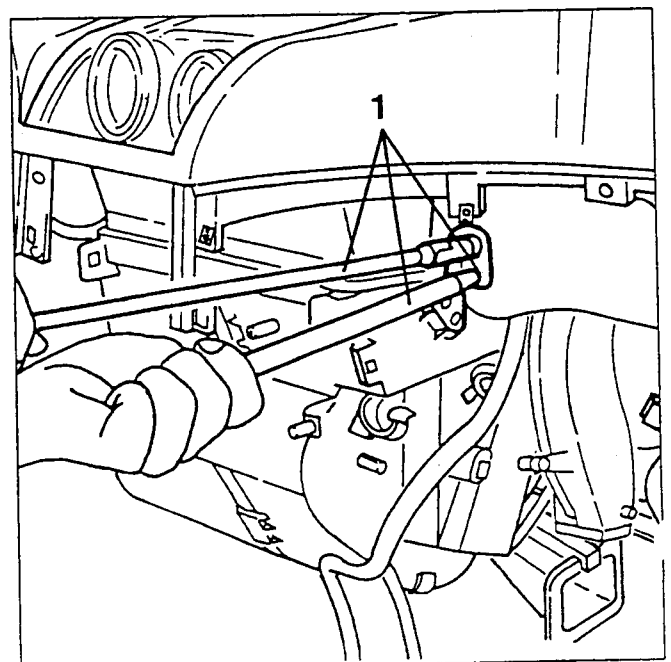
1. Slacken the screws fastening the climate control group to the body.



- Coat the mouth of the heater and water drain pipes with vaseline, and when installing the climate control group make sure that these pipes are inserted correctly in the passage holes.

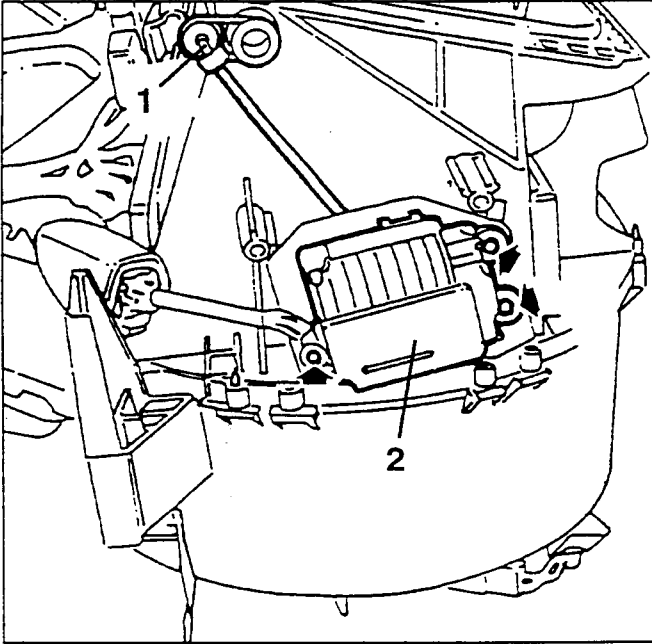
- Before reassembling the climate control group, remove the sponge under the upper part of the dashboard on the passenger's side and refit it after fastening the group itself.

1. Using a dowel, positioned as illustrated, centre the position of the group before fastening it.

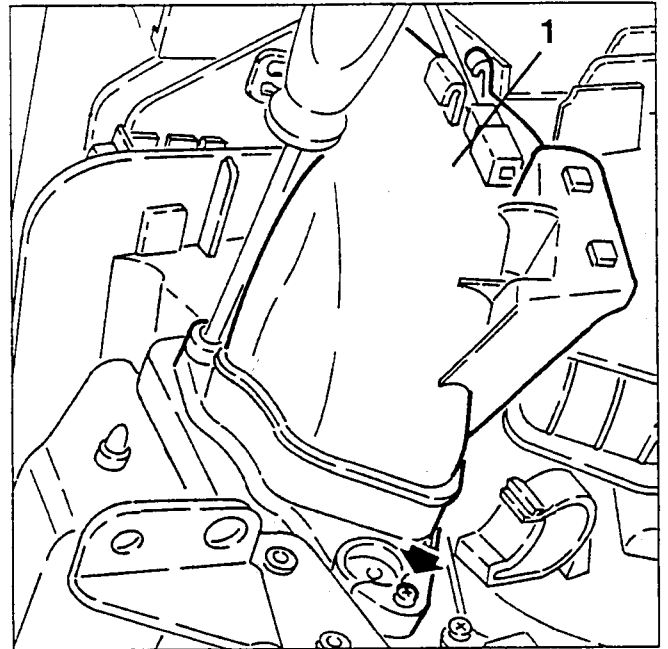


DISASSEMBLY

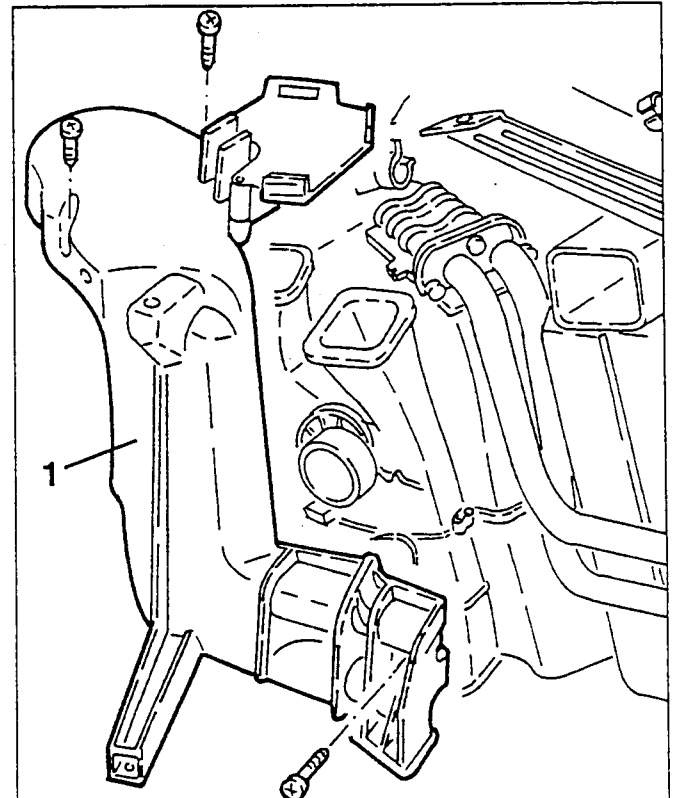
1. Disconnect the control rod from the coupling on the recirculation/outside air port.
 2. Slacken the three fastening screws and remove the recirculation/outside air control motor complete with control rod.
- Retrieve the upper plate and grommets on the fastening holes.



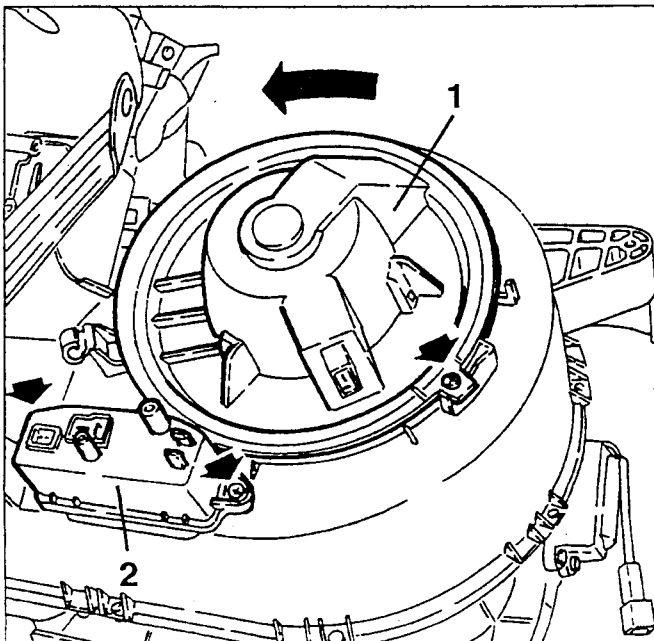
1. Slacken the fastening screws and remove the cover.



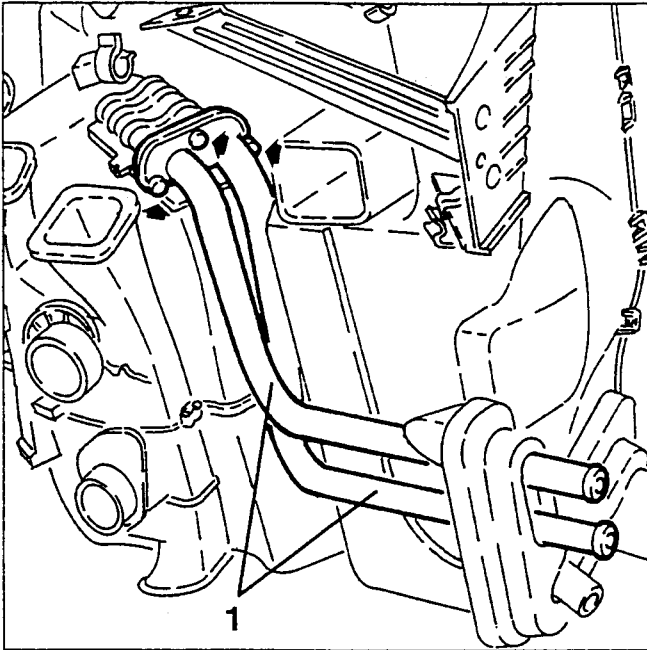
1. Slacken the three fastening screws and remove the heater cover and the corresponding pipes.



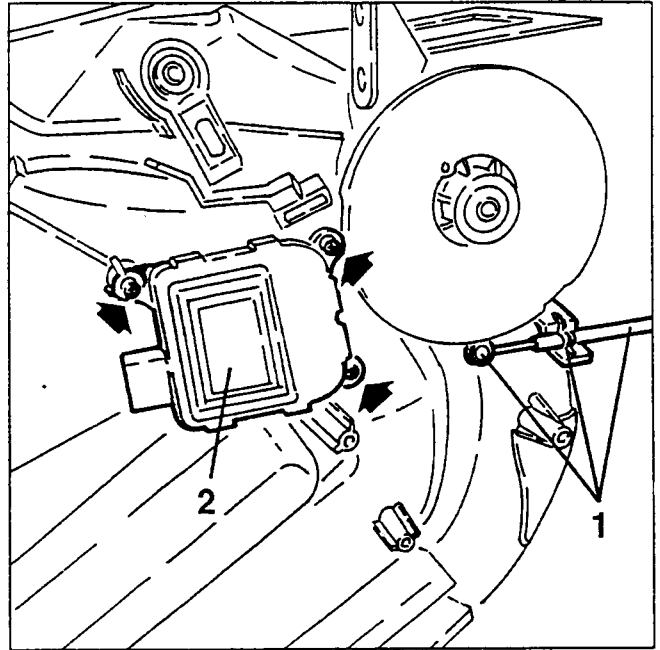
1. Slacken the fastening screw, raise the tab and turn the fan clockwise as far as its stop, then remove it from the climate control group.
2. Slacken the two fastening screws and remove the electronic fan speed regulator.



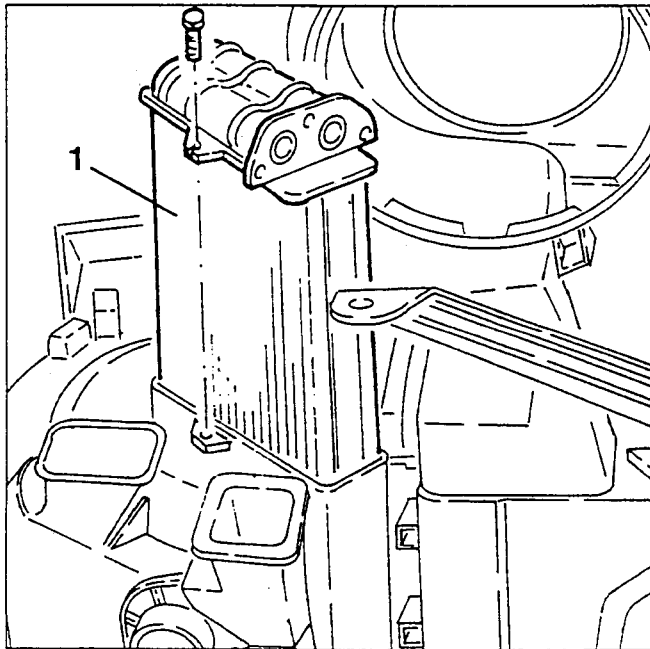
1. Slacken the three fastening bolts of the plate retaining the heater coolant fluid inlet and outlet pipes, then remove them.
- Remove the O-Rings and taper metal seal rings.



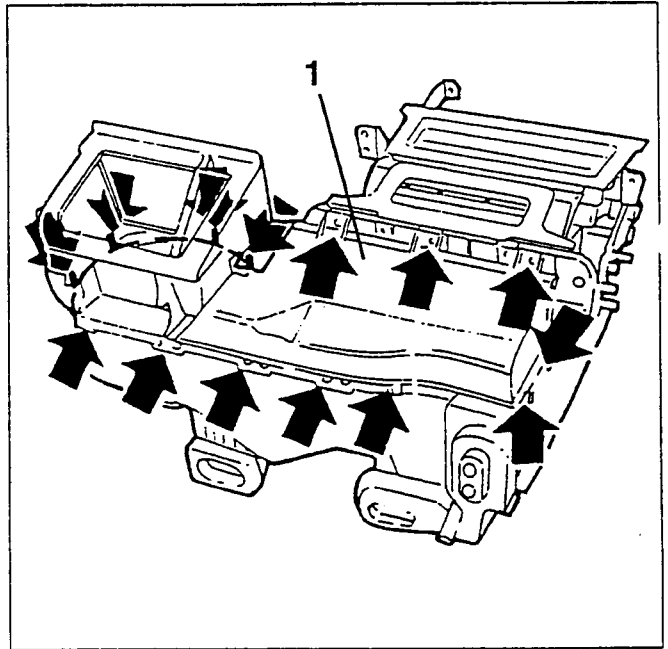
1. Free the air distribution port bowden control cable from its fasteners, then remove it.
2. Slacken the three fastening screws and remove the air mixing port control motor.



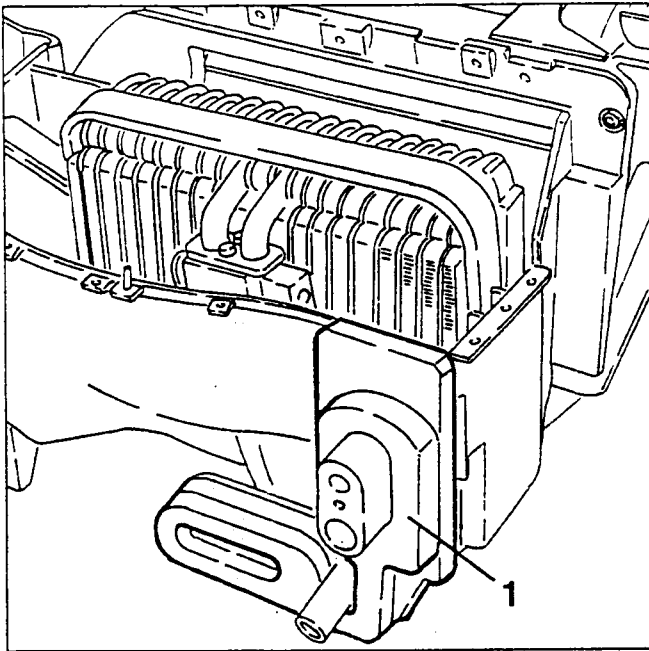
1. Slacken the two fastening screws and withdraw the heater.



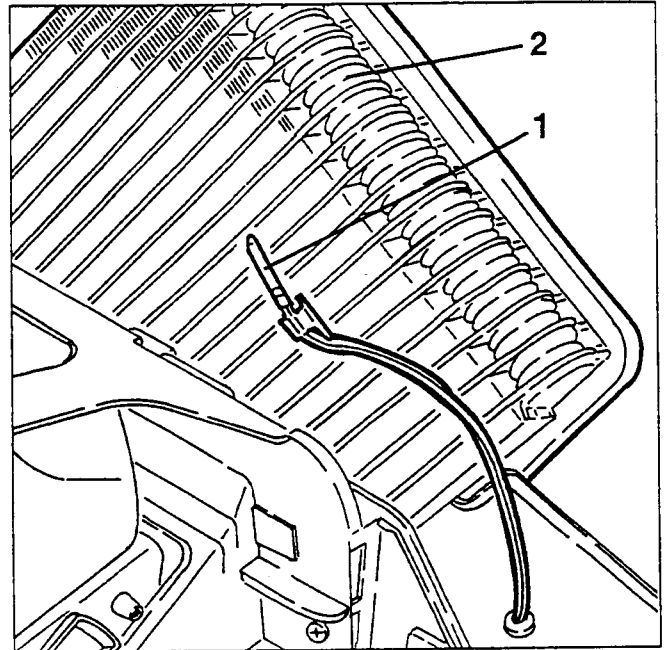
1. Slacken the fastening screws and separate the upper half box from the climate control group.



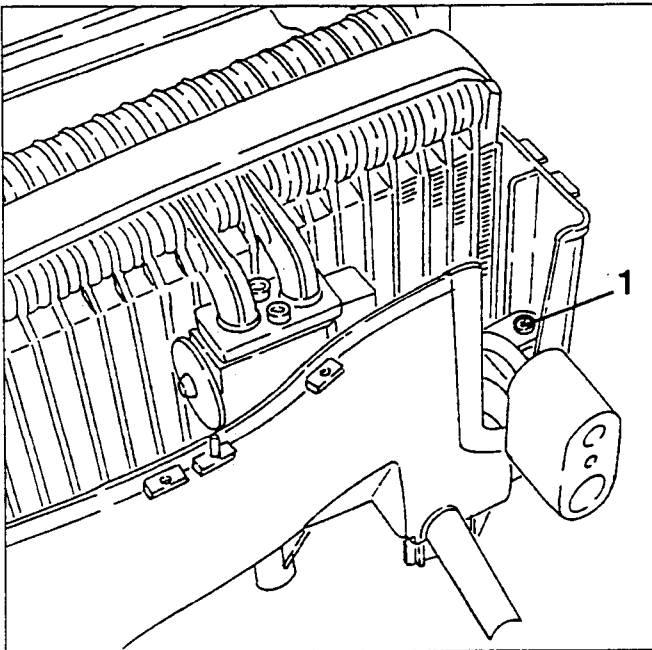
1. Remove the protective sponge.



1. Withdraw the evaporator from its housing just enough to disconnect the antifrost sensor from the clamp on it.
2. Withdraw and remove the evaporator complete with expansion valve.

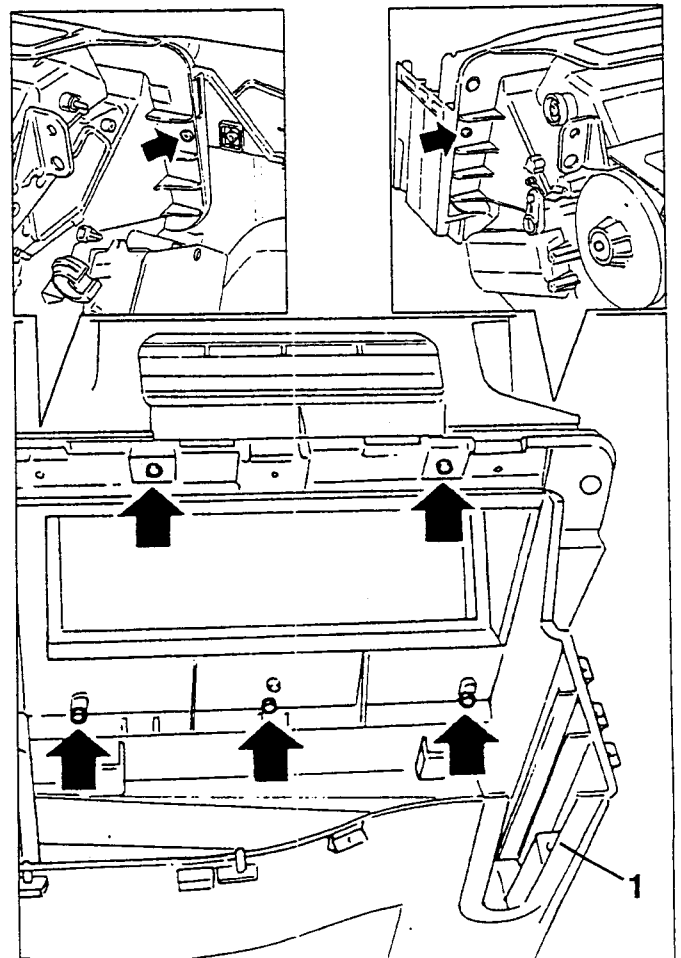


1. Slacken the screw fastening the evaporator.

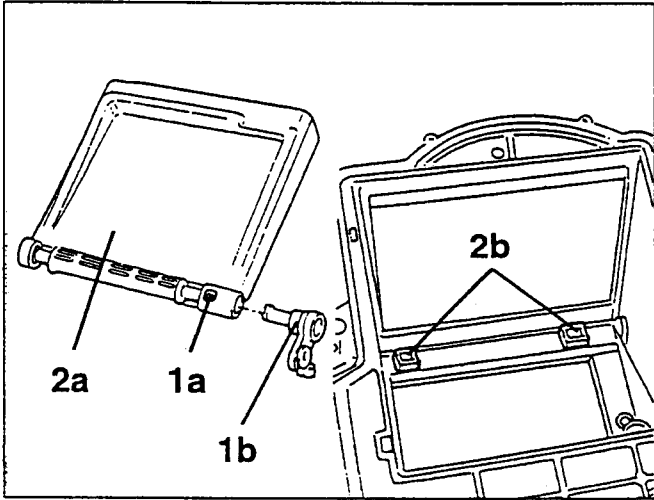


- If necessary, remove the expansion valve from its fittings slackening the fastening screws.

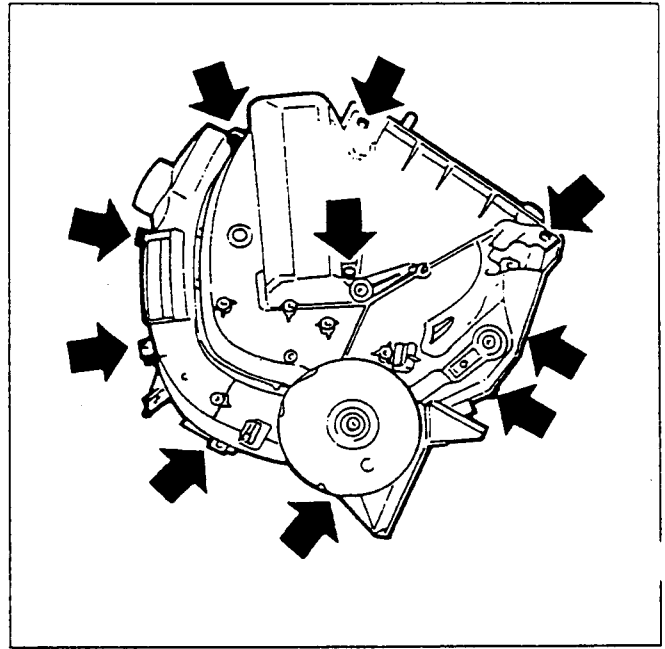
1. Slacken the fastening screws and remove the lower half box from the heater distributor unit.



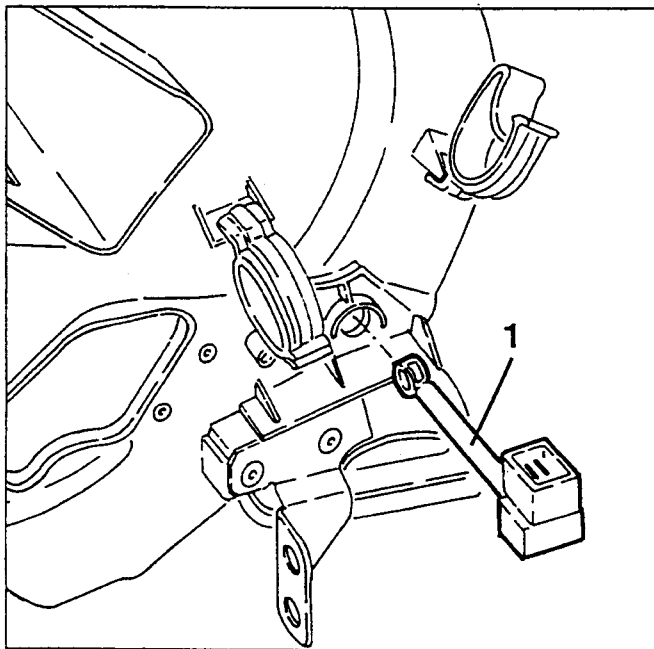
1. Work through the small slot (1a) machined on the air intake port spindle to release from it the tang of lever (1b) which may thus be withdrawn from the upper half box.
2. Release the air intake port (2a) from the upper half box bearing in mind that its spindle is dap fitted and articulates on the tabs (2b).



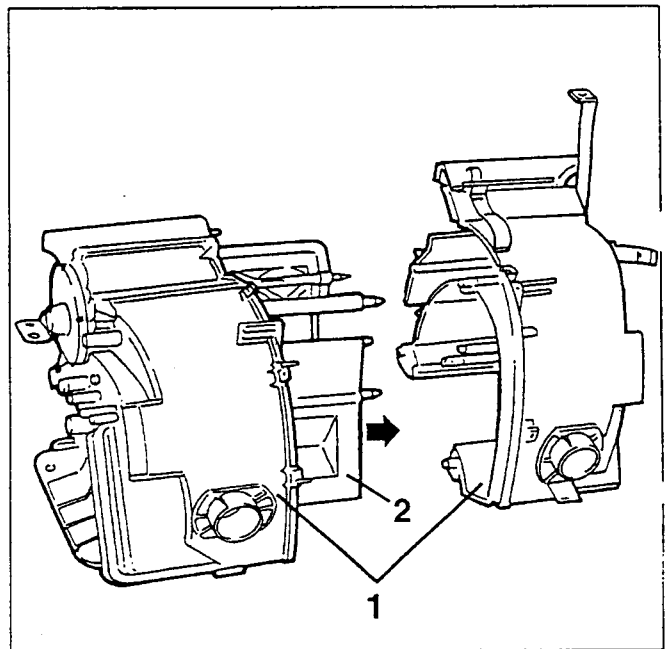
- Slacken the screws illustrated which join the two half boxes of the heater distributor unit.



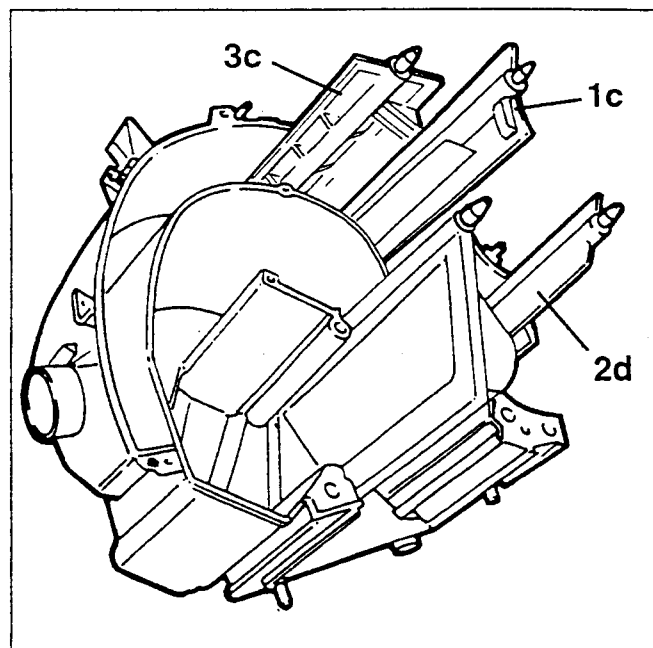
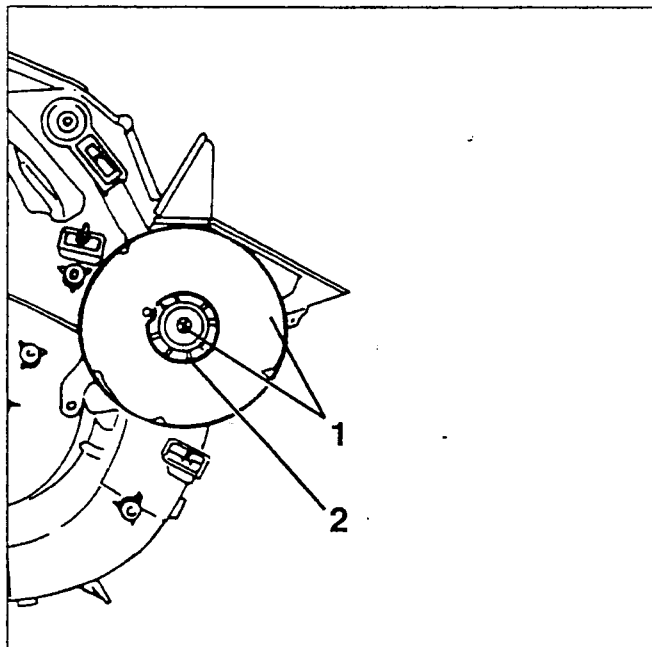
1. Remove the treated air temperature sensor.



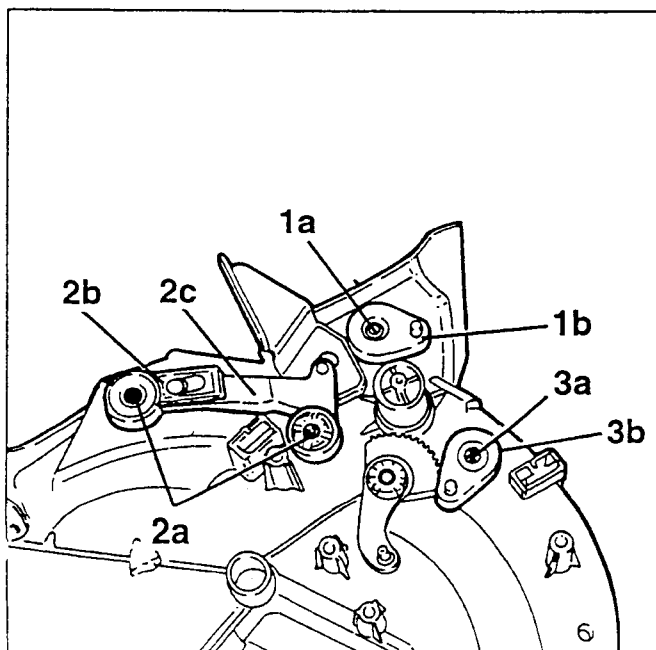
1. Release the right half box from the left one taking care not to damage the ports.
2. Withdraw the mixing port from the left half box.



1. Slacken the fastening screw and remove the distributor disk from the left half box.
2. Retrieve the shaped plastic washer.



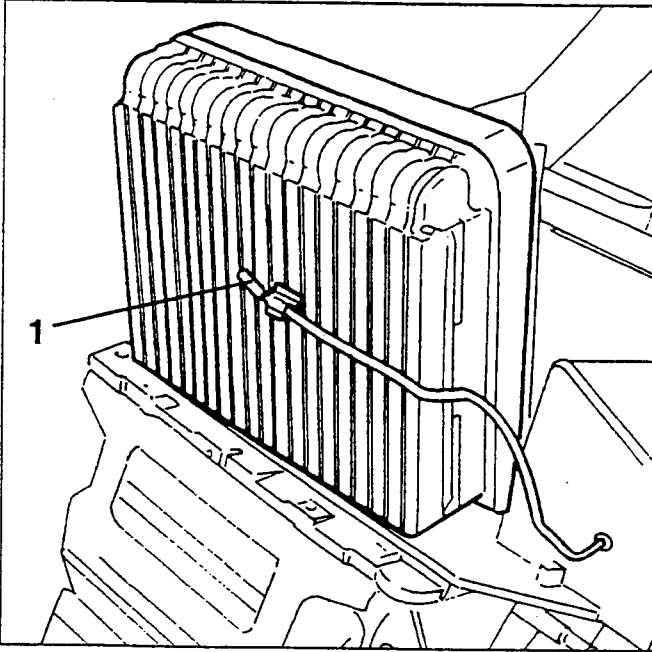
1. Slacken the fastening screw (1a) and release the lever (1b) inserted in a compulsory position on the spindle of rear upper distribution port (1c), then remove the latter from the left half box.
2. Slacken the fastening screws (2a) and release the lever (2b) with the control lever (2c) inserted in a compulsory position on the front upper distribution port sprindile (2d), then remove the latter from the left half box.
3. Slacken the fastening screw (3a) and release the lever (3b) from the lower distribution port spindle (3c).



REASSEMBLY

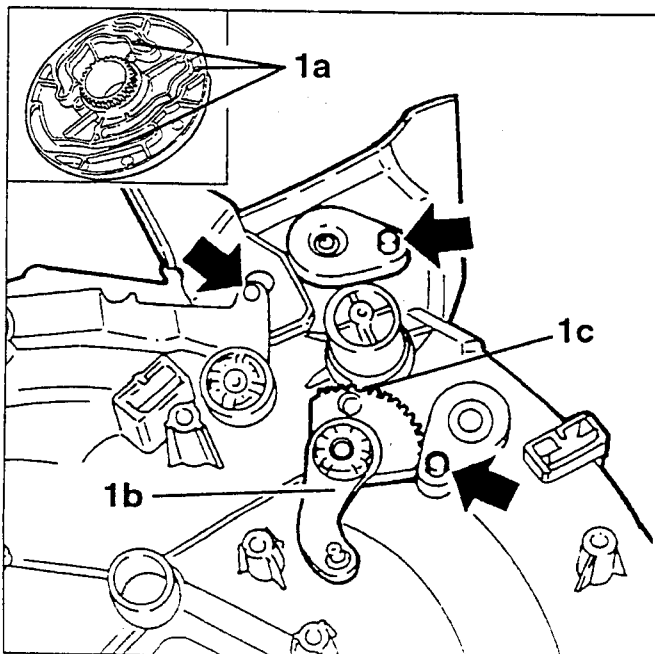
Reverse the sequence followed for disassembly adhering to the following instructions.

1. The sensitive element of the antifrost sensor must be set at the centre of the finned surface of the evaporator, therefore the catch must be inserted in a suitable position to obtain this position.



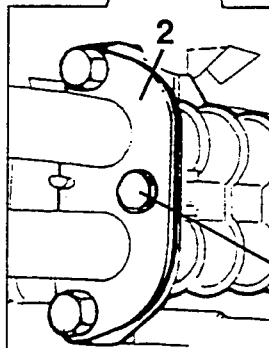
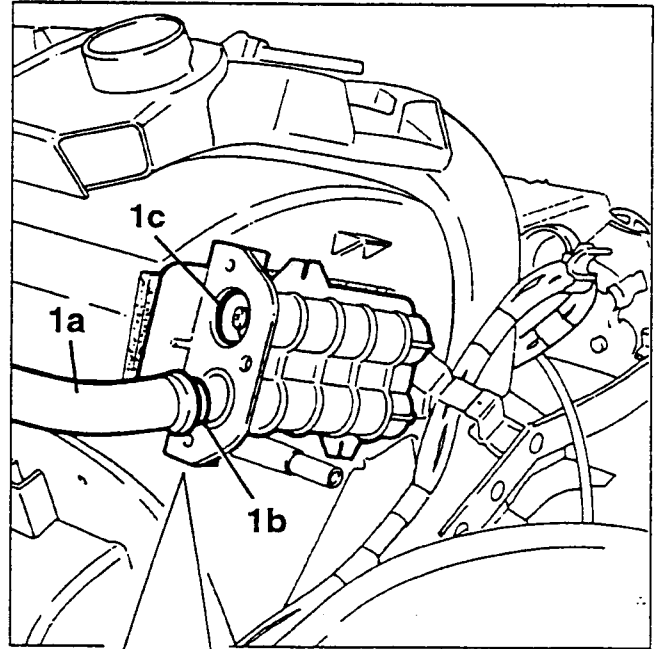
- Before reassembling the distributor disk, carefully lubricate the different grooves, for operating the levers, with TUTELA ZETA 2 grease.


1. Suitably direct the various levers so that their operating pins (indicated by the arrows) are aligned with the holes (1a) on the distributor disk when this is fitted correctly on the toothed sector (1b), i.e. when the relief (1c) of the toothed sector inserted in the special groove of the disk.



1. Before inserting the two metal pipes (1a) in the heater double fitting, check that the taper metal rings are inserted on their ends (1b) and that the O-Rings are inserted on the coupling holes (1c).

2. After inserting the above-mentioned pipes in the double fitting of the heater, fasten them using the plate directed as illustrated and the corresponding screws, taking care not to spoil the seal rings.



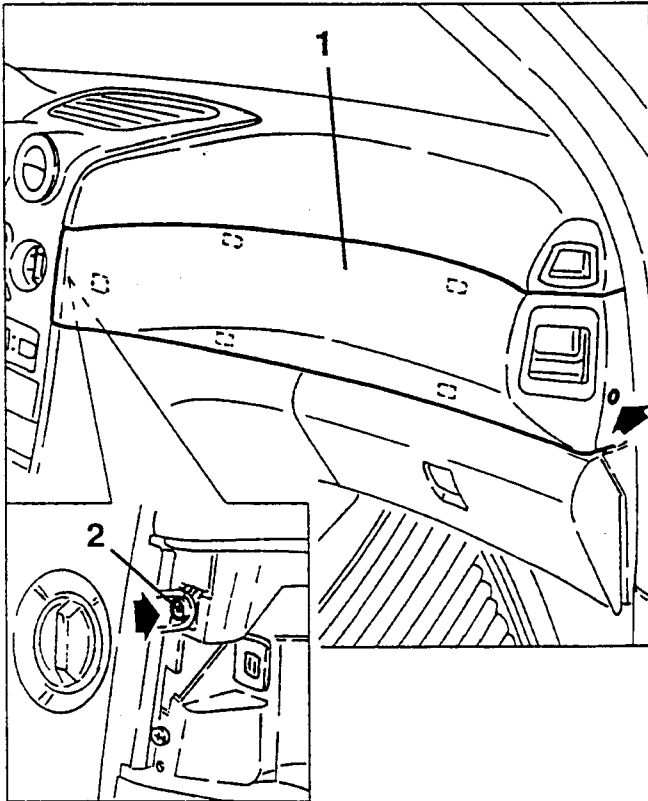
 $5 \div 6 \text{ Nm}$
 $0.5 \div 0.6 \text{ kgm}$

CLIMATE CONTROL SYSTEM CONTROLS

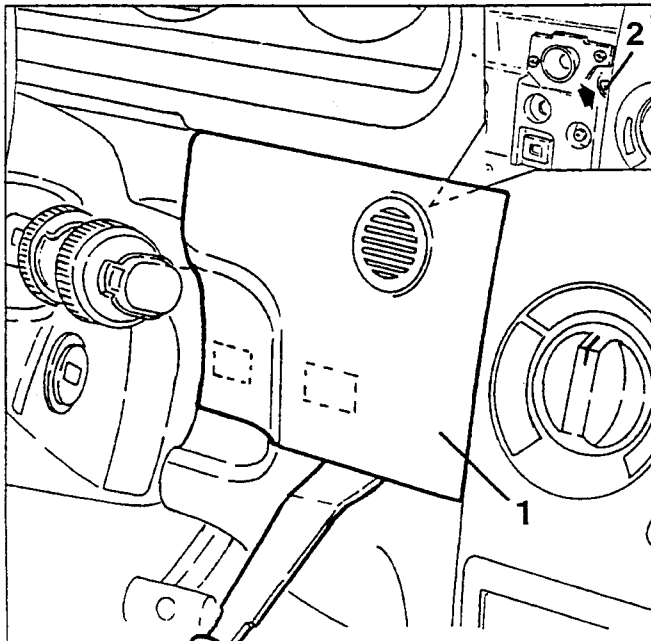
REMOVING/REFITTING

- Disconnect the battery (-) terminal.

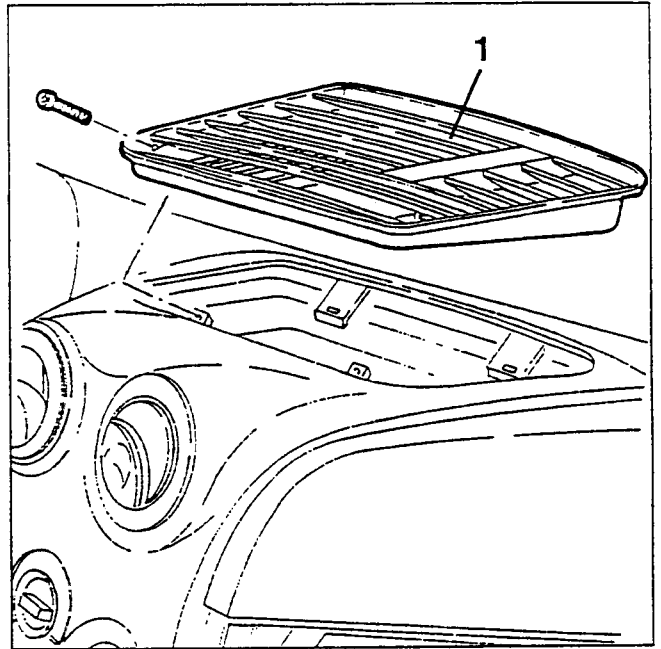
1. Slacken the fastening screw, then prise and remove the passenger side dashboard trim.
2. Slacken the fastening screw illustrated of the climate control system controls module.



1. Remove the right hand driver's side dashboard trim prising it off the fastening clips.
2. Slacken the fastening screw illustrated of the climate control system controls module.

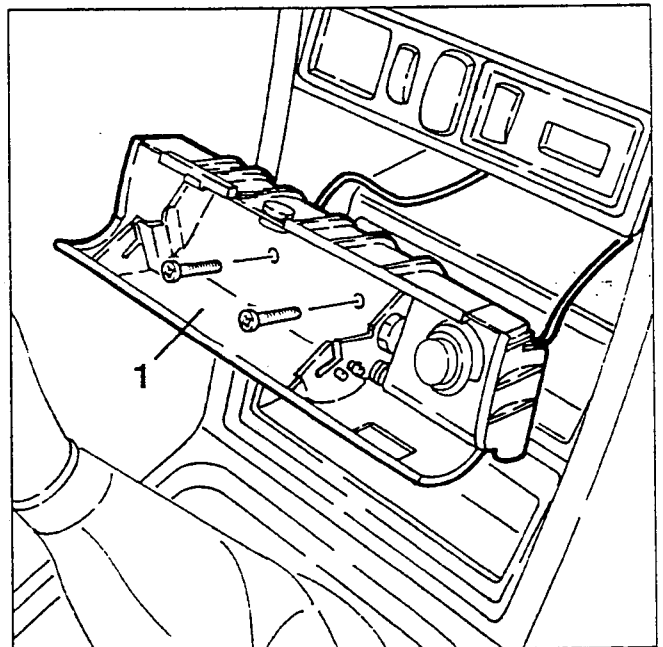


1. Slacken the two fastening screws and remove the upper dashboard air vent.

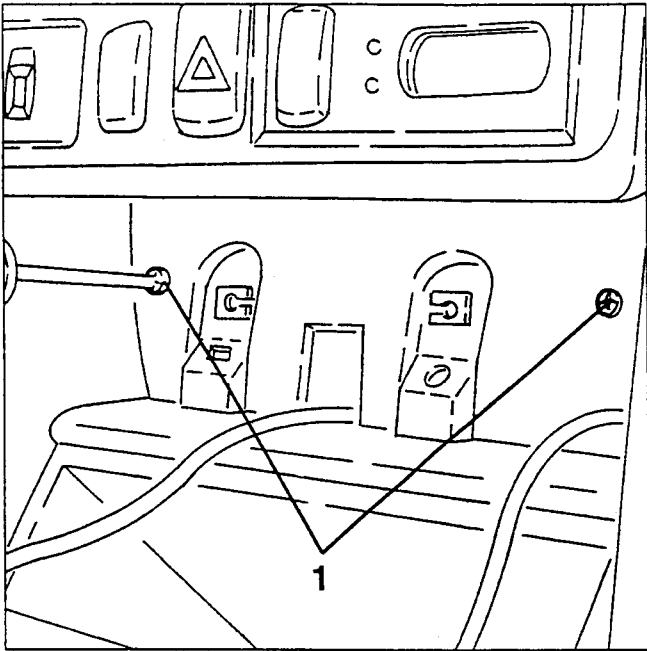


- Remove the ashtray.

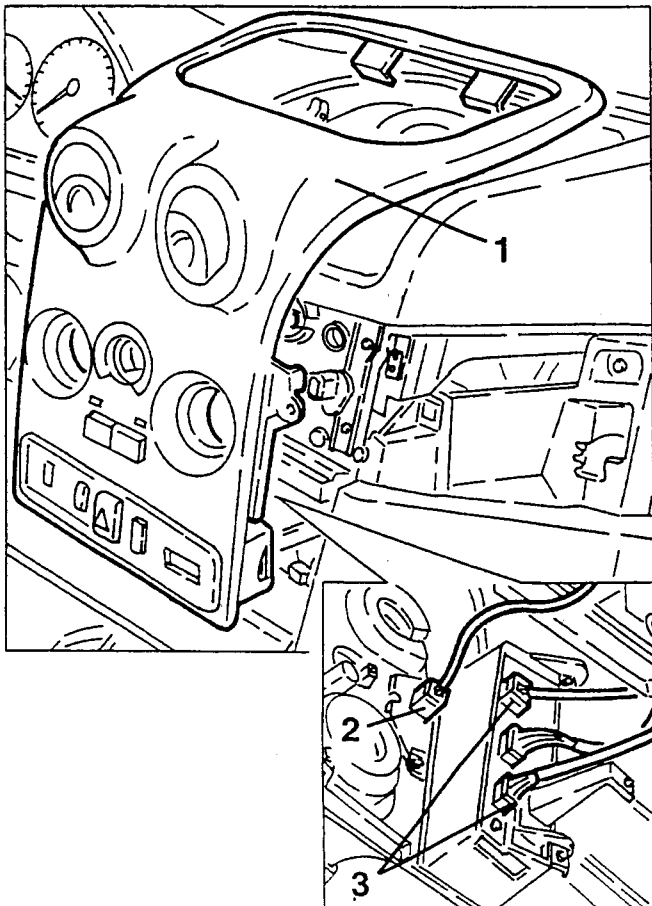
1. Slacken the fasteners, then withdraw the ashtray support and set it aside without disconnecting the corresponding electrical connections.



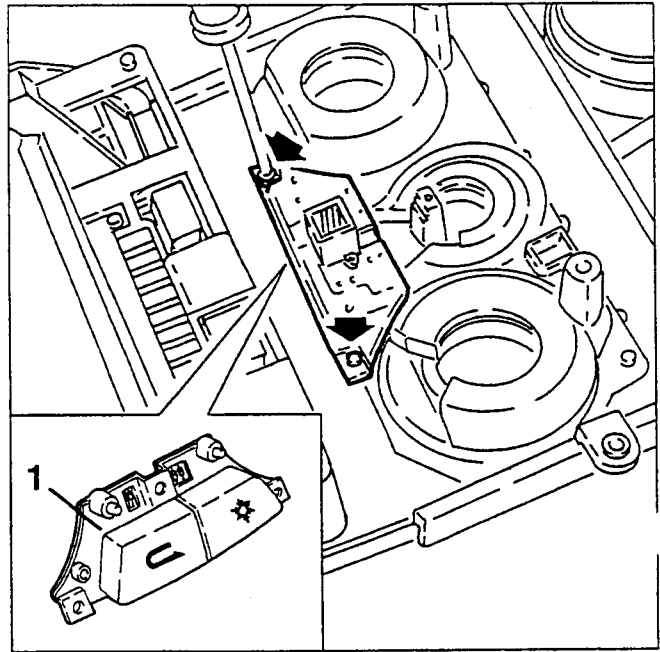
1. Slacken the two screws illustrated fastening the climate control system controls module.



1. Withdraw the three control knobs and back away the module as necessary.
2. Disconnect the electrical connection from the set of air recirculation and compressor engagement switches.
3. Disconnect the electrical connections from the services controls, then remove the climate control system controls module.



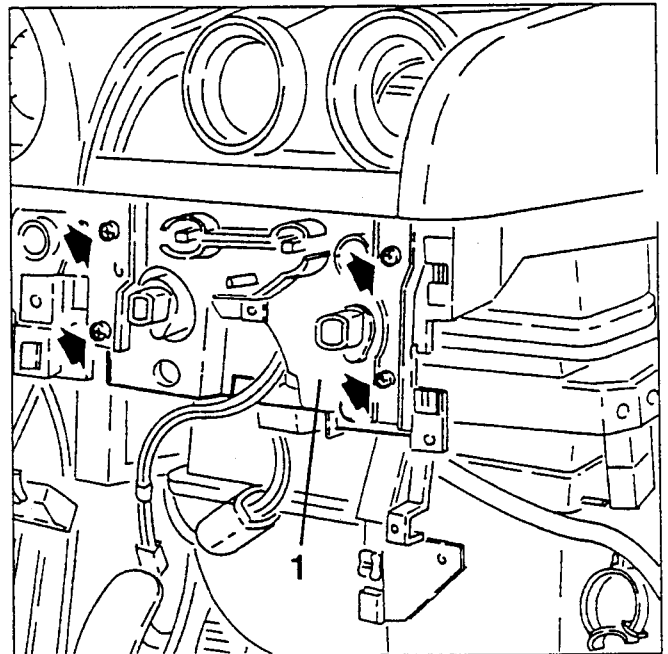
1. On the bench, if necessary, slacken the two fastening screws and remove the set of air recirculation and compressor engagement control switches.



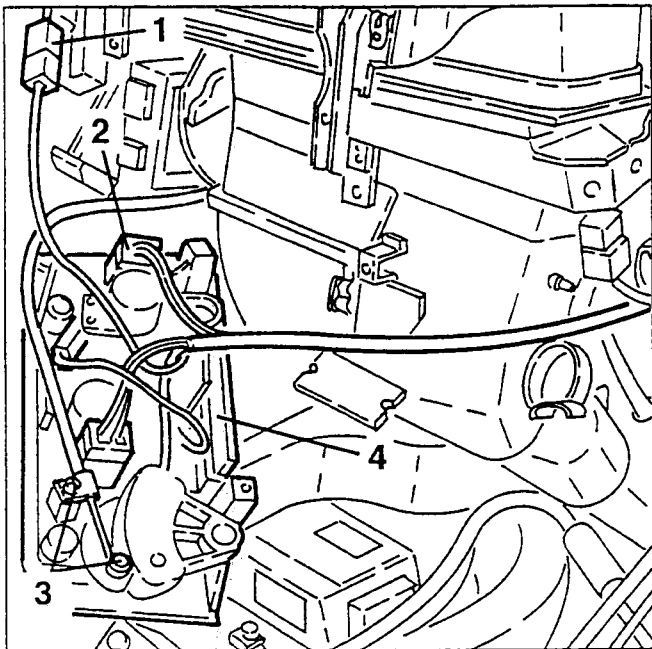
If necessary, also remove the controls group support, as described below.

- Remove the lower part of the dashboard (see GROUP 70).

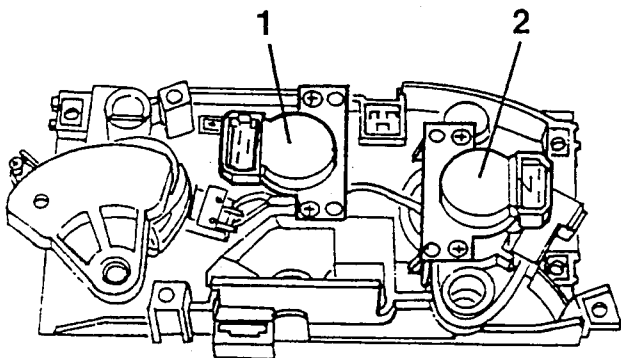
1. Slacken the four fastening screws and lower the climate control system controls group.



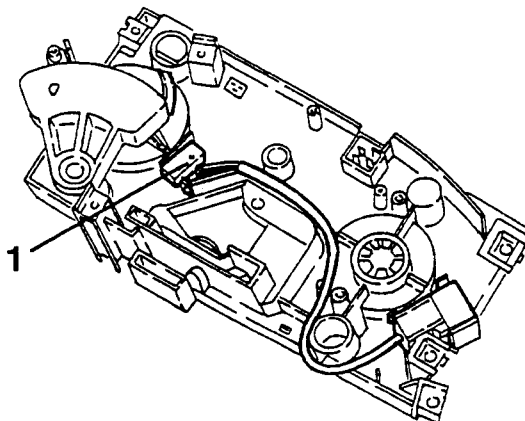
1. Disconnect the electrical connection of the inside air temperature sensor.
2. Disconnect the electrical connections from the climate control system controls support.
3. Disconnect the air distribution port bowden cable from the support.
4. Remove the support releasing it from the electrical wiring.



1. On the bench, if necessary, slacken the two fastening screws and remove the potentiometer for the air flow control knob.
2. Slacken the two fastening screws and remove the potentiometer for the required air temperature selection knob.



1. Remove the "MAX DEF" function control micro-switch.

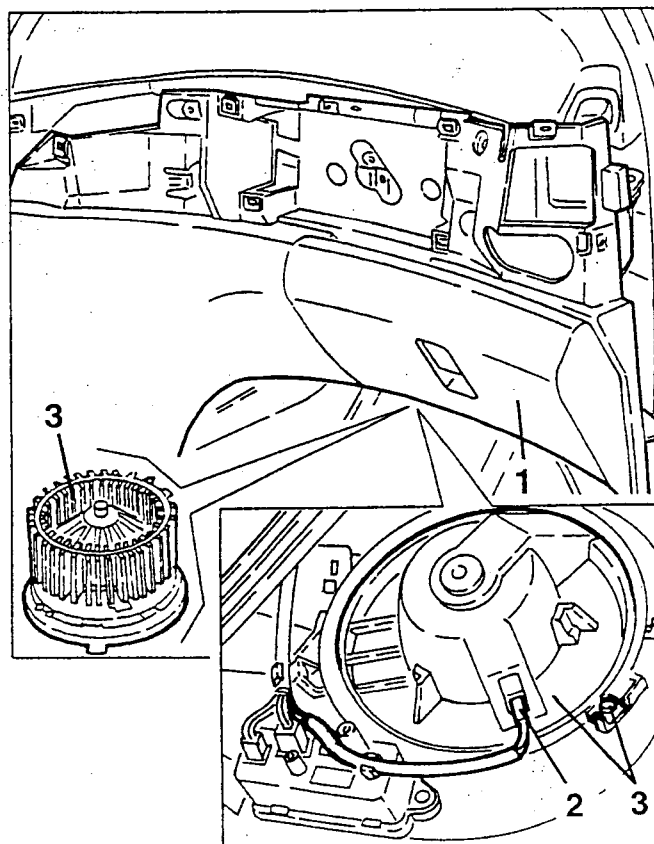


FAN

REMOVING/REFITTING

- Disconnect the battery (-) terminal.

 1. Move away the lower part of the dashboard as illustrated (see GROUP 70).
 2. Disconnect the electrical connection from the fan.
 3. Slacken the fastening screw, raise the tab and turn the fan counter-clockwise as far as its stop, then withdraw it from the climate control group.

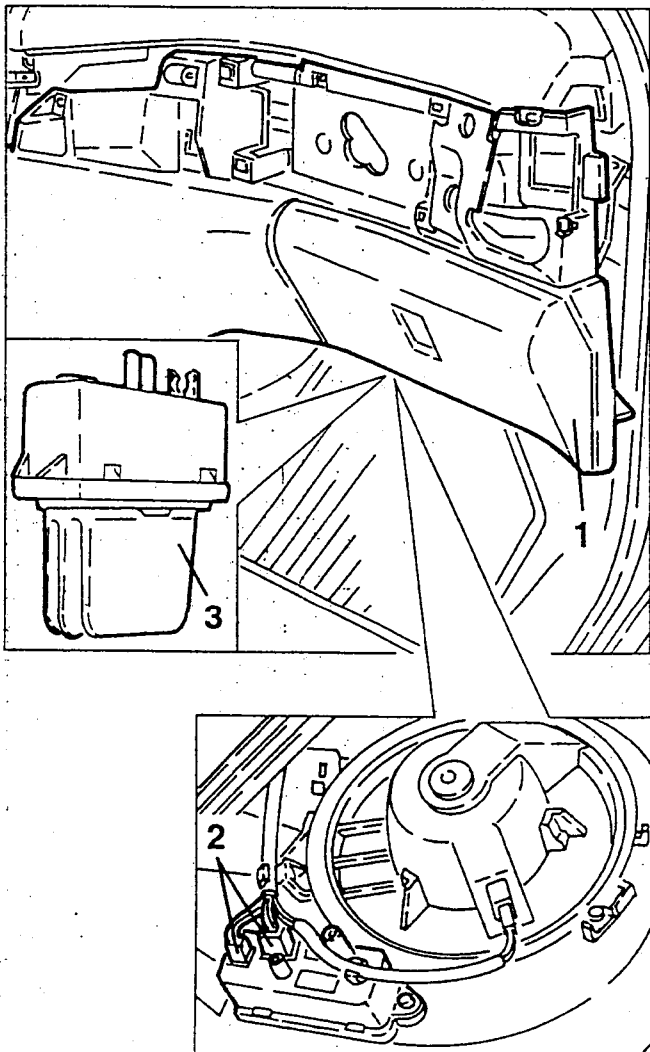


**ELECTRONIC FAN SPEED
REGULATOR****REMOVING/REFITTING**

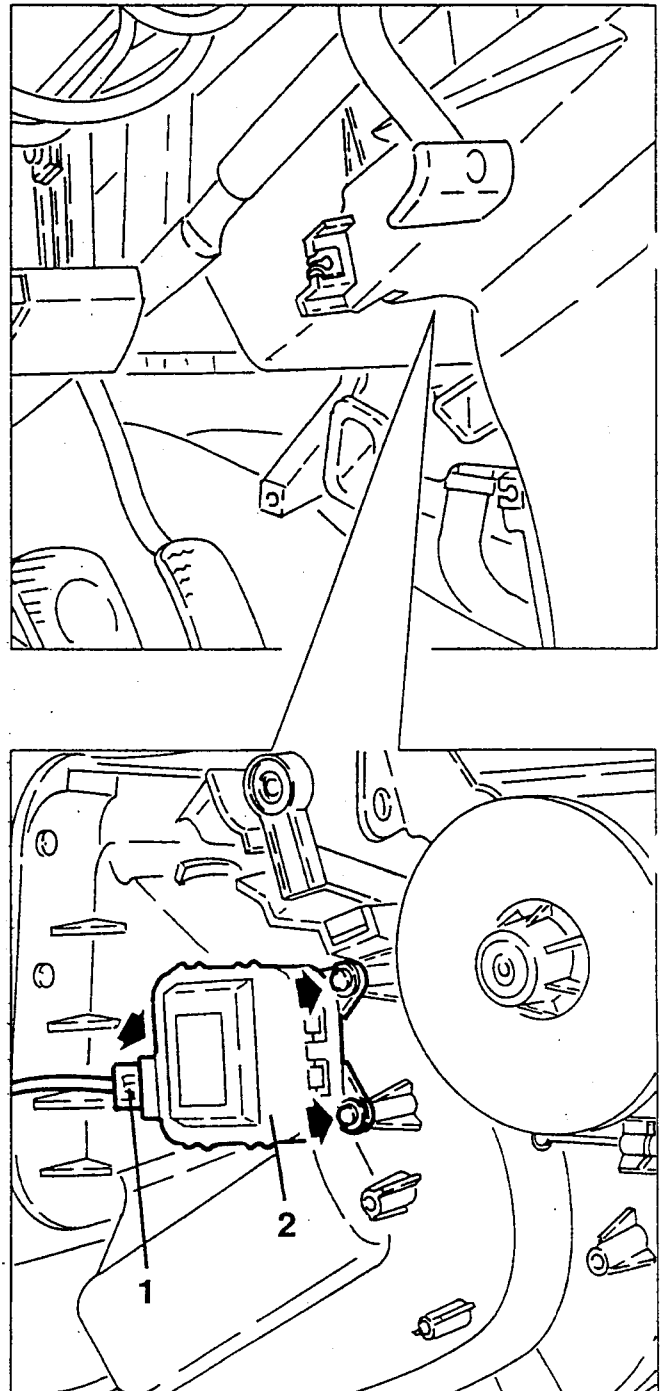
- Disconnect the battery (-) terminal.
- 1. Move aside the lower part of the dashboard as illustrated (see GROUP 70).

NOTE: To facilitate access to the electronic fan speed regulator, it is advisable to move the floor mat and remove the injection control unit cover.

- 2. Disconnect the electrical connections from the electronic fan speed regulator.
- 3. Slacken the two fastening screws and remove the electronic fan speed regulator.

**AIR MIXING PORT
CONTROL MOTOR****REMOVING/REFITTING**

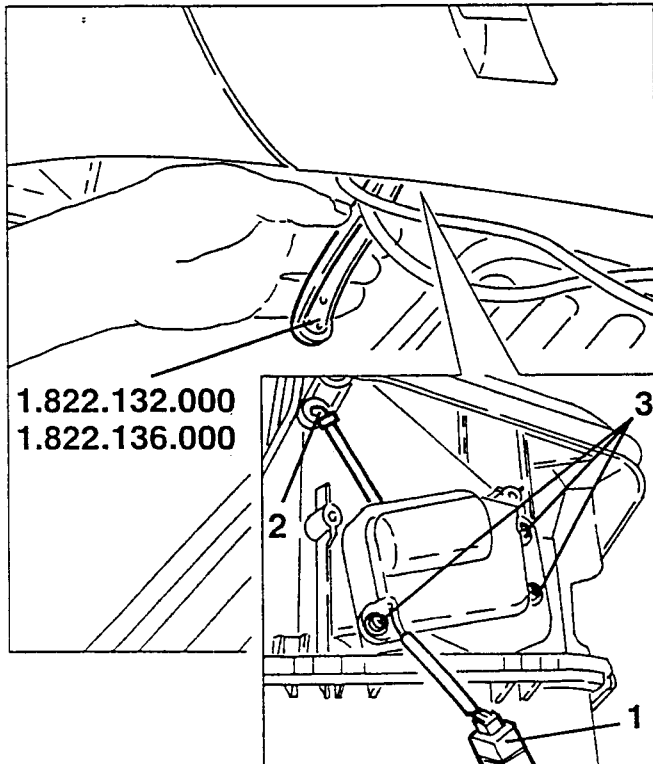
- Disconnect the battery (-) terminal.
- Remove the valve box trim (see GROUP 70).
- 1. Disconnect the electrical connection from the air mixing port control motor.
- 2. Slacken the three fastening screws and remove the air mixing port control motor.



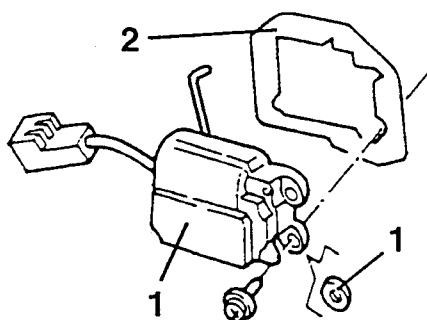
OUTSIDE/RECIRCULATION AIR PORT CONTROL MOTOR

REMOVING/REFITTING

- Disconnect the battery (-) terminal.
- 1. Disconnect the electrical connection of the outside/recirculation air port control motor.
- 2. Disconnect the control rod from the coupling on the outside/recirculation air port.
- 3. Slacken the three cross-slot screws fastening the motor using tool no. 1.822.132.000 with insert no. 1.822.136.000.



1. Remove the outside/recirculation air port control motor complete with control rod and grommets on the fastening holes.
2. Retrieve the rear plate.

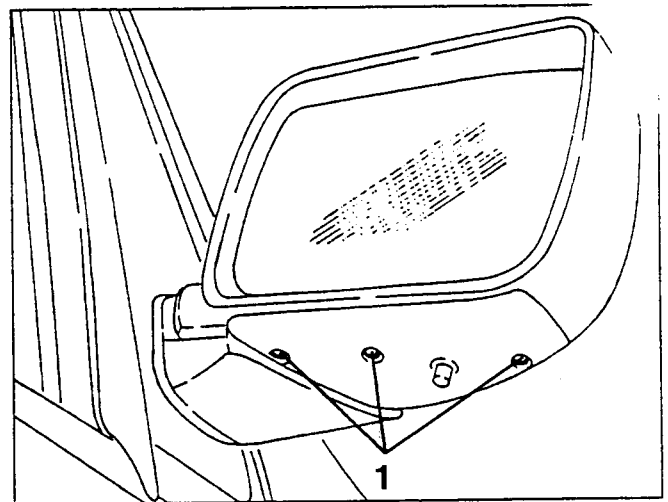


When refitting replace the cross-slot motor fastening screws with socket screws to be tightened with wrench no. 1.822.132.000 and insert of set no. 1.822.136.000. Also check the correct position of the grommets in the motor fastening holes.

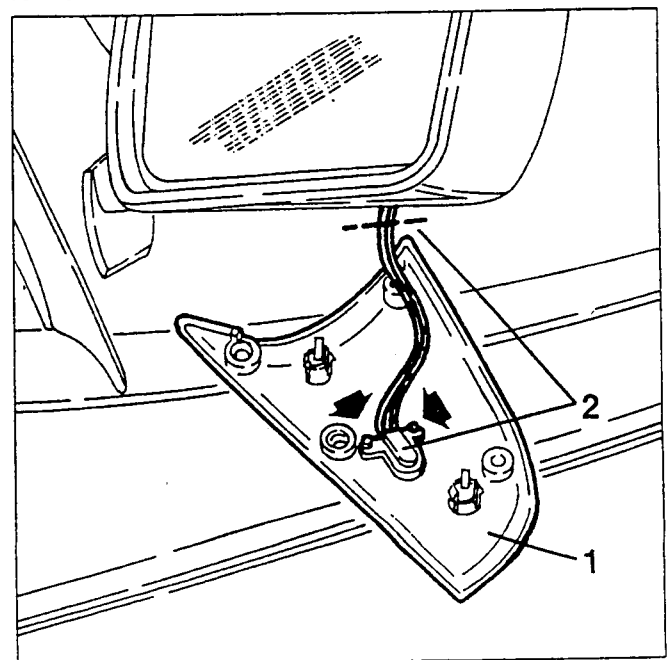
OUTSIDE AIR TEMPERATURE SENSOR

REMOVING/REFITTING

- Disconnect the battery (-) terminal.
- 1. Slacken the fastening screws of the right rear view mirror lower trim.

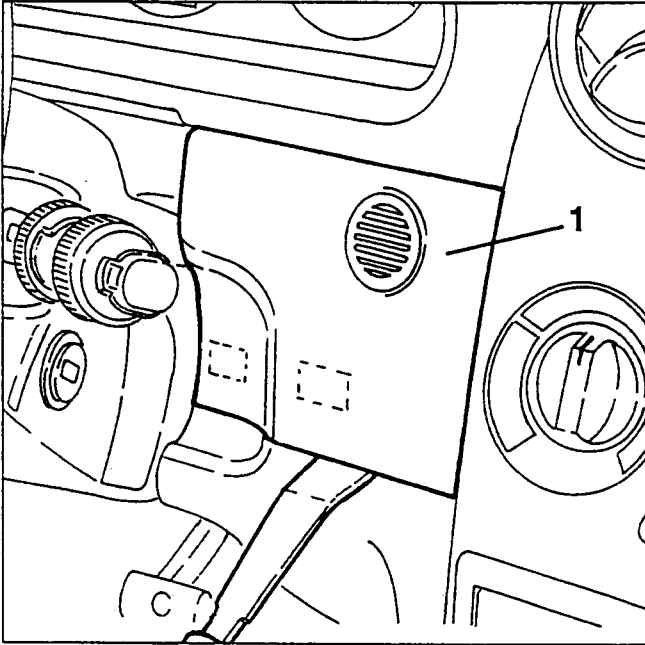


1. Lower the mirror trim as necessary, then remove it after slackening the two screws that fasten it to the outside temperature sensor.
 2. Cut the two electrical cables connecting the outside air temperature sensor where illustrated, then remove it.
- Install a special connector on the electric cables cut previously and on the new outside air temperature sensor to be used.
 - Install the new outside air temperature sensor connecting it with the cable cut previously through the connector fitted.
 - Complete refitting reversing the sequence followed for removal.

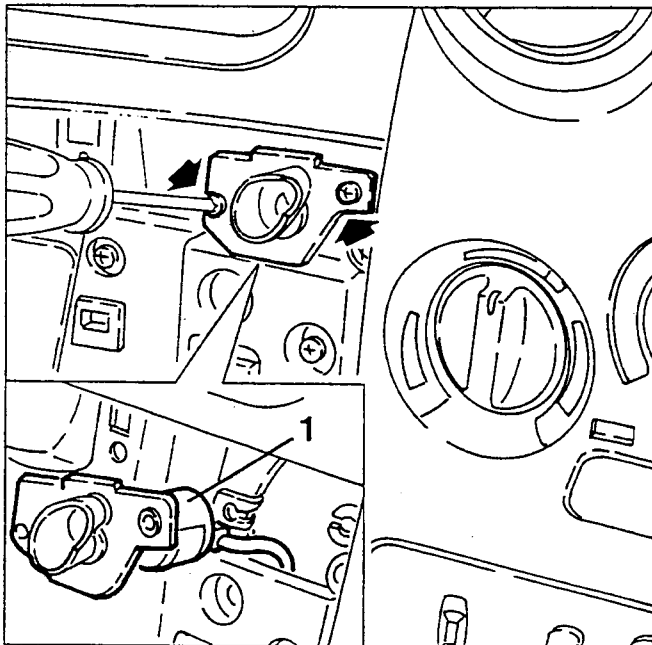


**PASSENGER COMPARTMENT
AIR TEMPERATURE SENSOR****REMOVING/REFITTING**

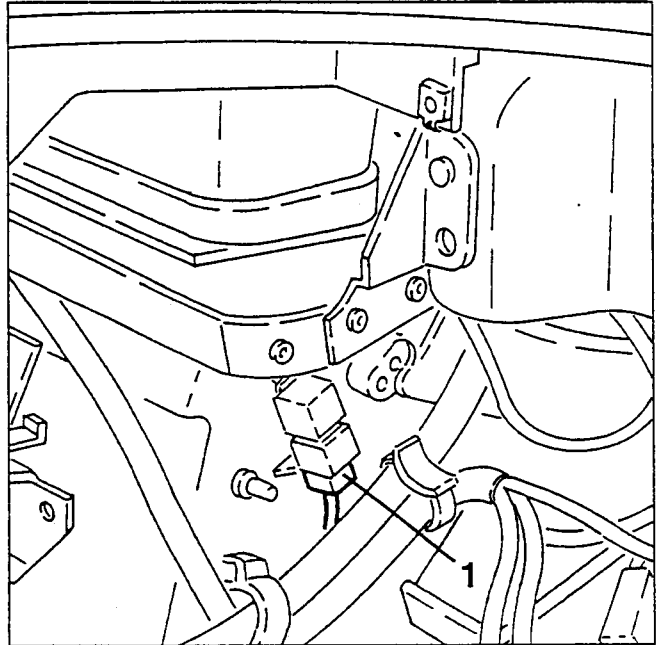
- Disconnect the battery (-) terminal.
- 1. Remove the right driver's side dashboard trim prising it off the fastening clips.



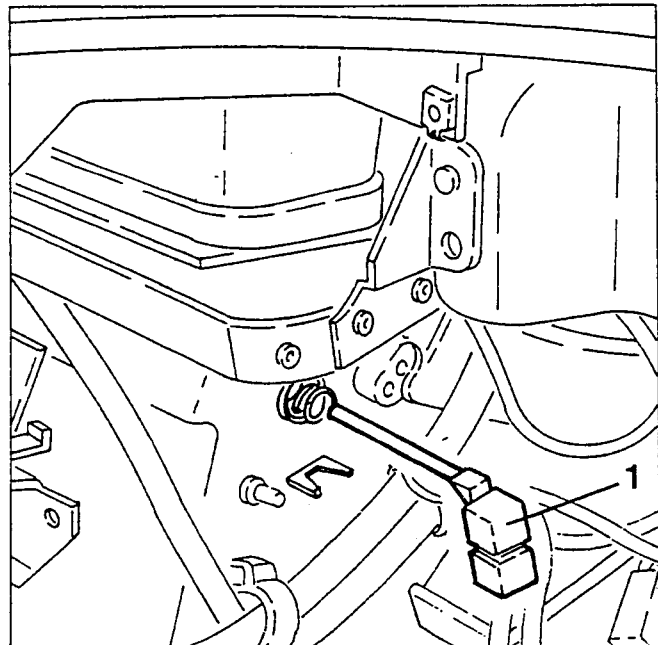
- 1. Slacken the two fastening screws, then withdraw the sensor just enough to disconnect the electrical connection and remove it.

**TREATED AIR
TEMPERATURE SENSOR****REMOVING/REFITTING**

- Disconnect the battery (-) terminal.
- Remove the lower part of the dashboard (see GROUP 70).
- 1. Disconnect the electrical connection from the treated air temperature sensor.



- 1. Withdraw and remove the treated air temperature sensor from its housing.

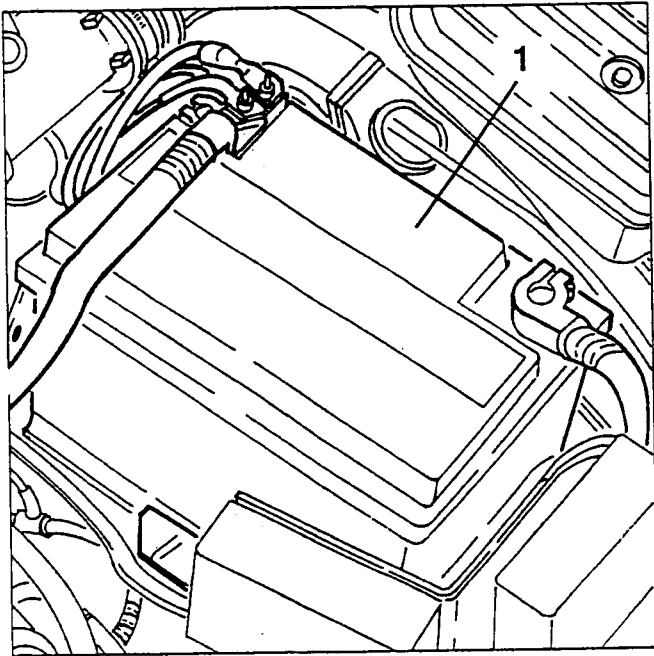


DRIER FILTER

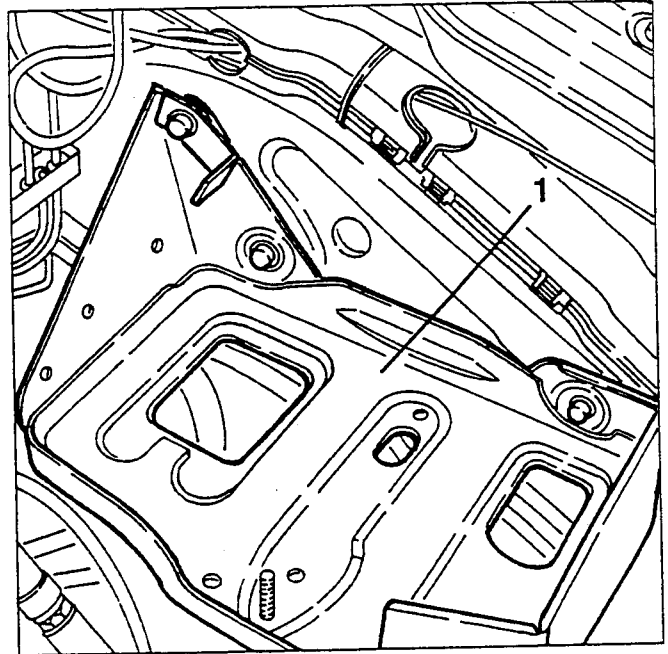
REMOVING/REFITTING

- Drain the fluid from the climate control system into a suitable container (see specific paragraph).

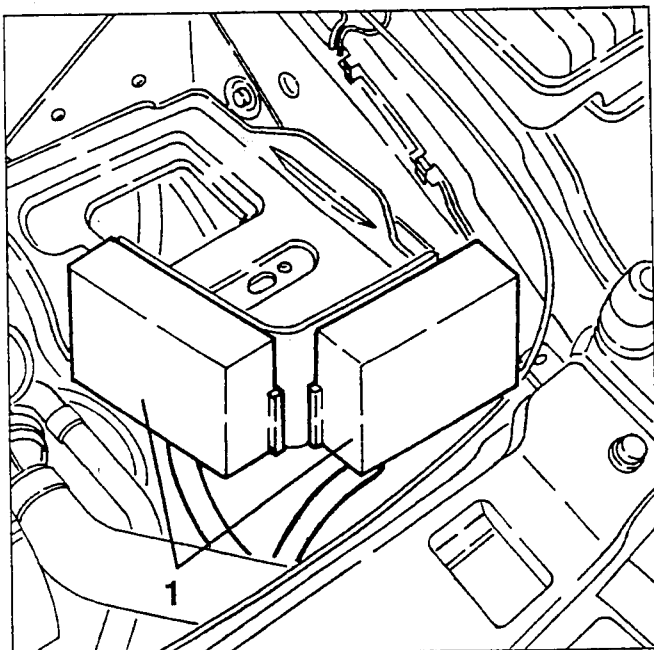
1. Disconnect the terminals and remove the battery.



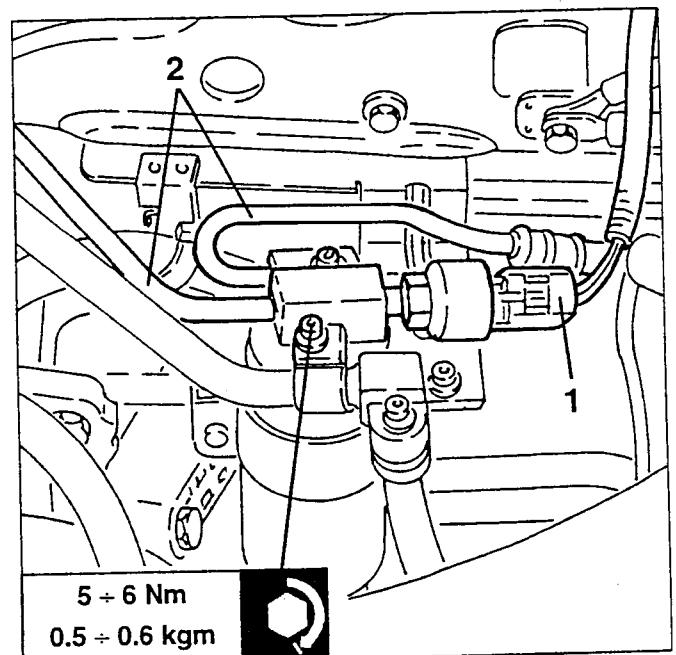
1. Slacken the fastening screws and remove the battery support complete with drain pipe after releasing this from the wheel house.



1. Release the two relay boxes from the battery support and set the aside.



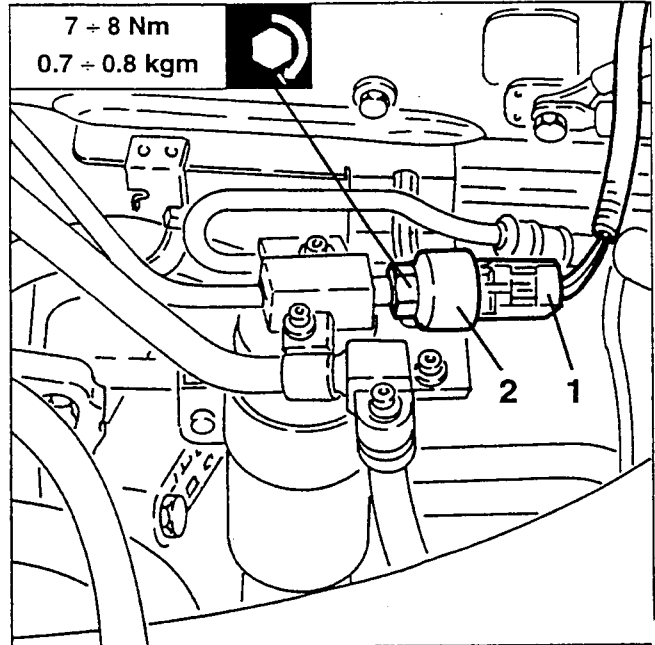
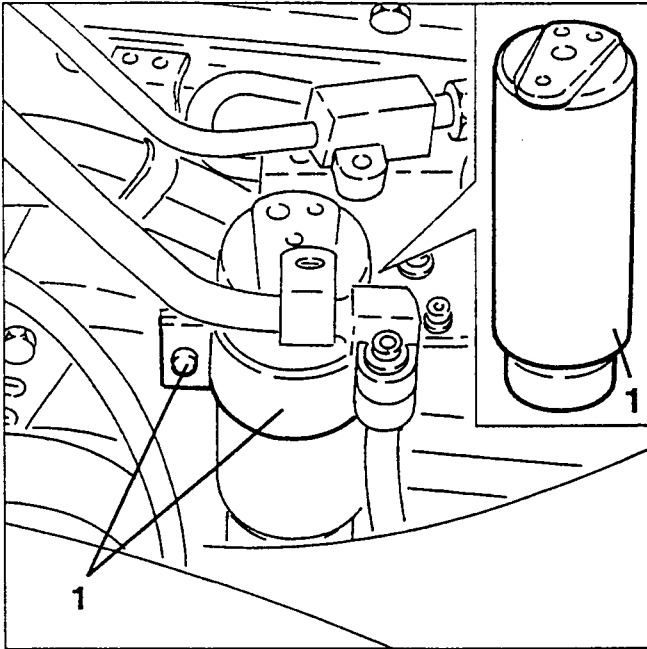
1. Disconnect the electrical connection from the four level pressure switch.
2. Slacken the two fastening screws and disconnect the coolant fluid stiff pipes from the drier filter.



5 ÷ 6 Nm
0.5 ÷ 0.6 kgm



1. Slacken the fastening clamp and remove the drier filter withdrawing it upwards.



PIPES FROM EVAPORATOR TO DRIER FILTER

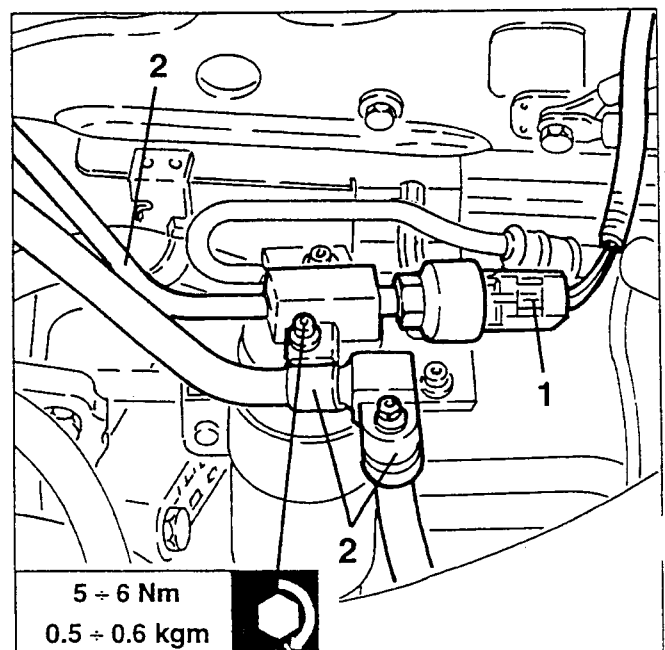
REMOVING/REFITTING

- Drain the fluid from the climate control system (see specific paragraph).
 - Remove the battery, its support and the corrugated sleeve proceeding as described in the procedure "Duct assembly and heater-distributor unit - Removing/Refitting".
 - Using a suitable syringe, empty the brake-clutch fluid reservoir.
1. Disconnect the electrical connection from the four-level pressure switch.
 2. Slacken the fastening screw and nut, then disconnect the stiff pipe from the drier filter and the intermediate connector.

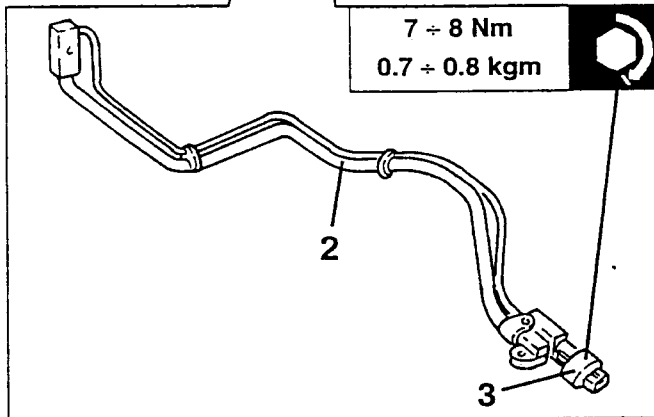
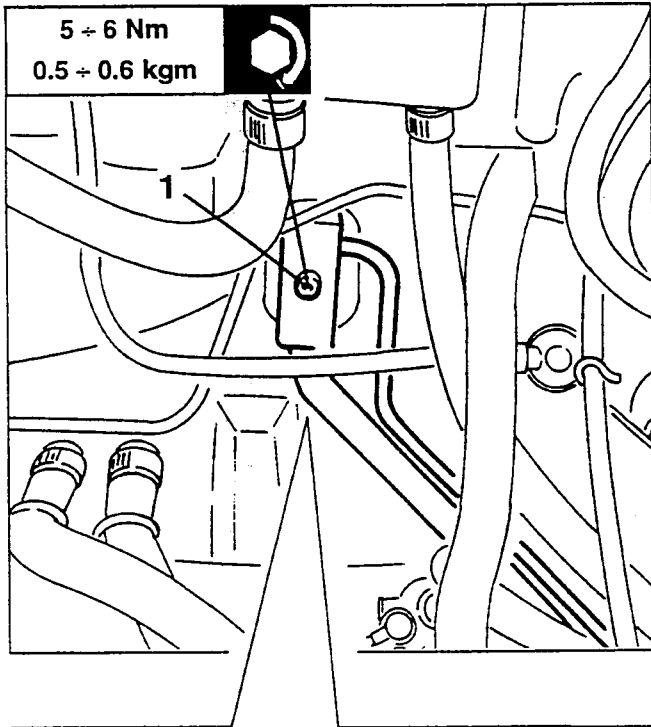
FOUR-LEVEL PRESSURE SWITCH

REMOVING/REFITTING

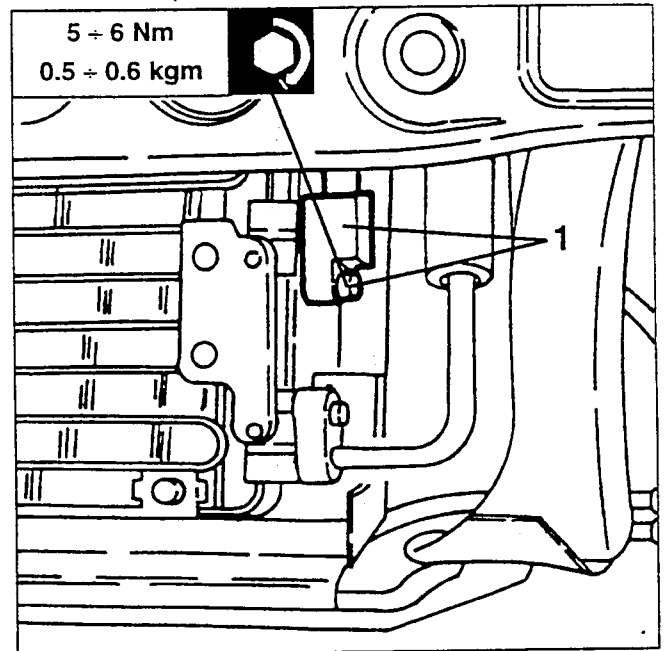
- Disconnect the battery (-) terminal.
 - To gain access to the pressure switch, remove the battery and its support proceeding as described in the procedure "Drier Filter - Removing/Refitting".
1. Disconnect the electrical connection from the four-level pressure switch.
 2. Slacken and remove the four-level pressure switch.



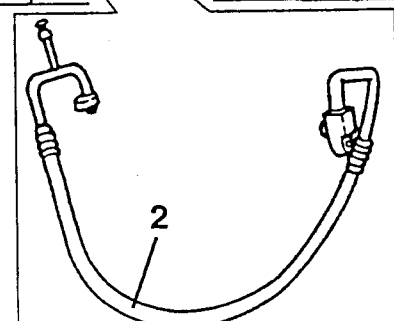
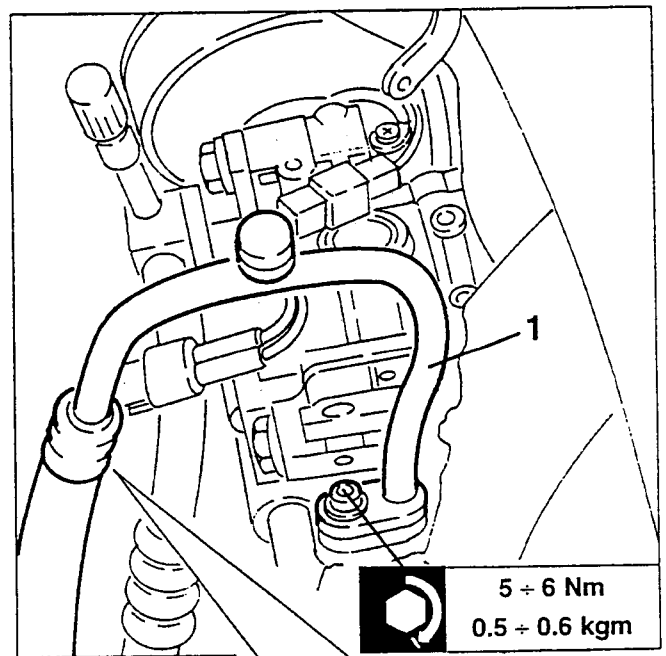
- Remove the power steering piping retainer bracket.
 - Remove the damping mass from the gearshift bowden cable support bracket.
 - Remove the clutch pump outlet pipe.
1. Slacken the screw fastening coolant fluid inlet and outlet pipes from the evaporator.
 2. Remove the pipes connecting the evaporator to the drier filter and to the intermediate connector of the compressor intake pipe.
 3. If necessary, on the bench, remove the four-level pressure switch from the pipe.



1. Slacken the fastening screw and disconnect from the condenser the coolant fluid delivery pipe leading from the compressor.



1. Slacken the fastening screw and disconnect from the compressor the coolant fluid delivery pipe to the condenser.
2. Free from the fastening clamps and remove the coolant delivery pipe from the compressor to the condenser.



PIPE FROM COMPRESSOR TO CONDENSER

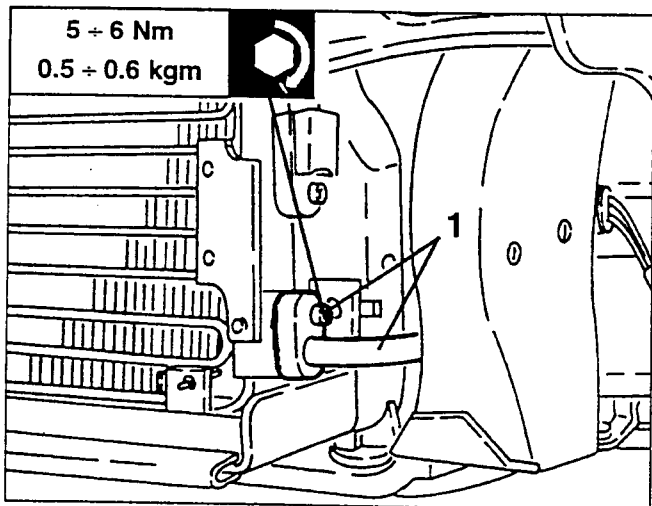
REMOVING/REFITTING

- Set the car on a lift.
- Drain the fluid from the climate control system (see specific paragraph).
- Remove the front bumper (see GROUP 70).

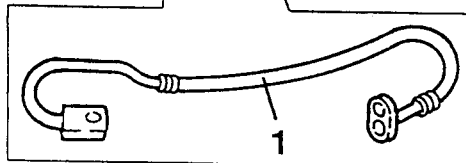
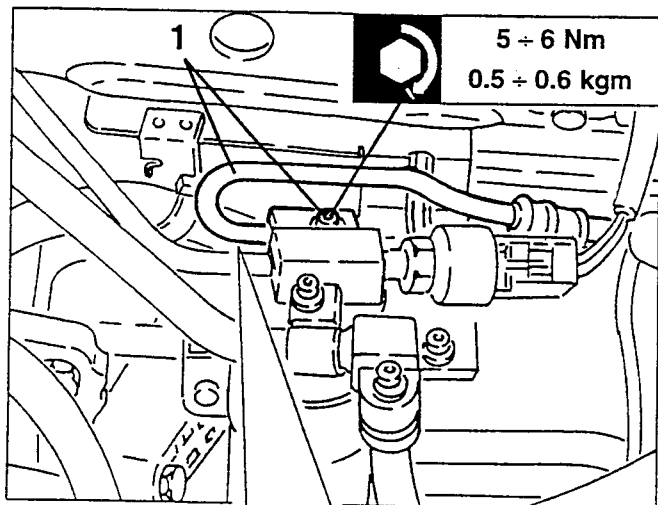
PIPE FROM DRIER FILTER TO CONDENSER

REMOVING/REFITTING

- Set the car on a lift.
 - Drain the fluid from the climate control system (see specific paragraph).
 - Remove the front bumper (see GROUP 70).
1. Slacken the fastening screw and disconnect the coolant outlet pipe from the condenser.



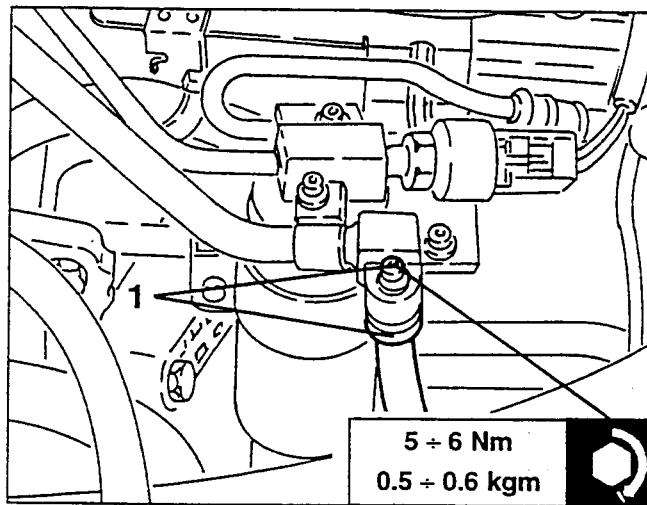
1. Working under the car slacken the fastening screw and disconnect the pipe leading from the condenser from the drier filter, then remove it.



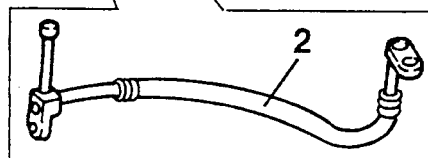
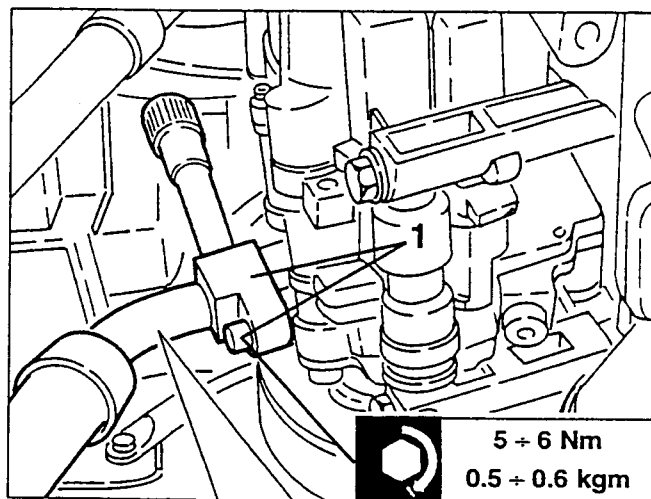
PIPE FROM THE COMPRESSOR TO THE INTERMEDIATE CONNECTOR

REMOVING/REFITTING

- Set the car on a lift.
 - Drain the fluid from the climate control system (see specific paragraph).
1. Working under the car, slacken the fastening nut and disconnect the intermediate connector of the coolant delivery pipe from the compressor to the evaporator.



1. Slacken the fastening screw and disconnect from the from the compressor the coolant delivery pipe to the evaporator.
2. Release from the fastening clamps and remove the coolant delivery pipe from the compressor to the intermediate connector.



DESCRIPTION

The assembly represented below in cross-section is the main component of the system and it comprises a duct (1) and a heater distributor unit (2).

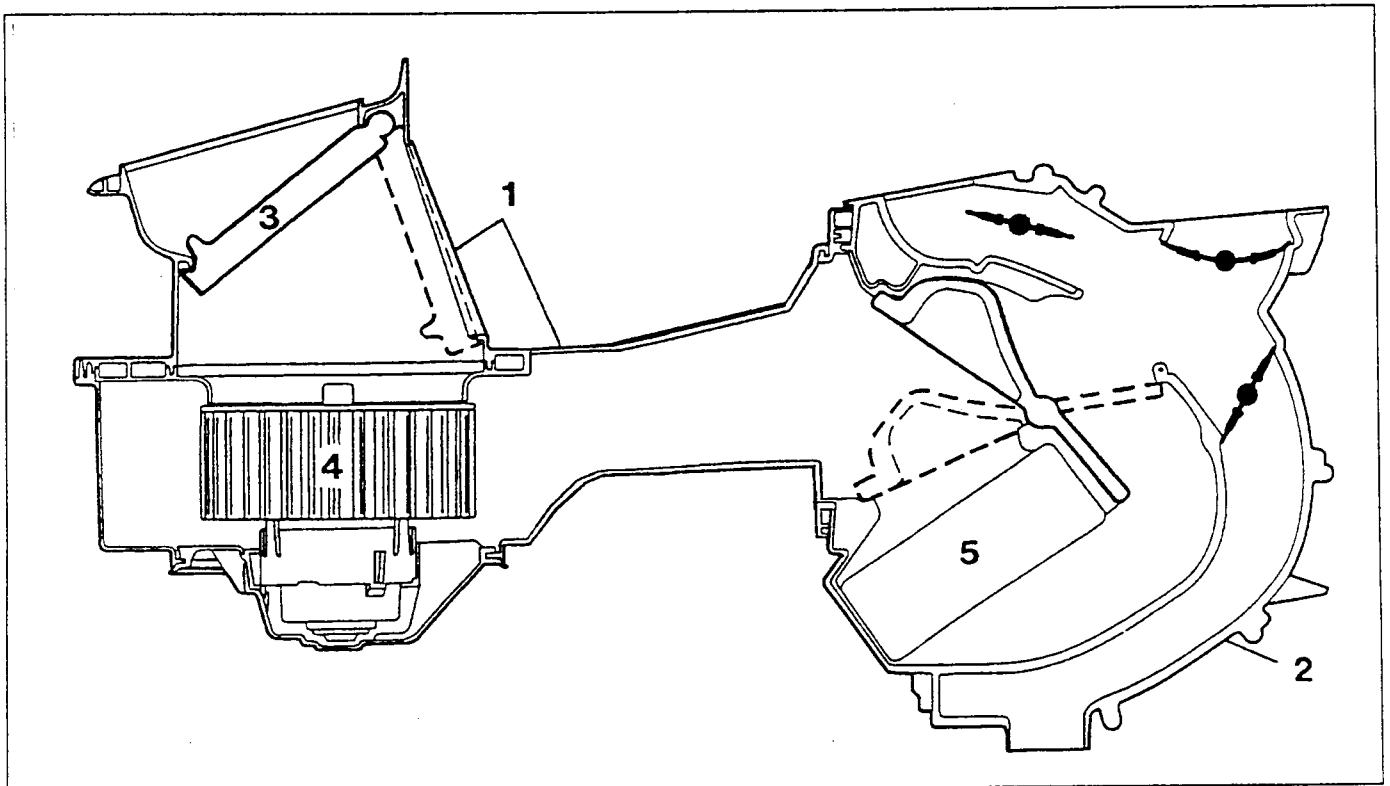
The duct (1) is formed of two sections, a lower one and an upper one; the right hand part of the latter is suitably shaped so that it mates perfectly with the right upper part of the dashboard surface (area under the windscreen of the partition between the engine and passenger compartment) with which it is in contact.

On the upper part of the right hand side of the duct there are two rectangular apertures; the first is in an almost horizontal position and mates with the one on the dashboard, thus communicating with the outside environment, while the other, facing the passenger in an almost vertical position, allows the inlet of the air present in the passenger compartment (recirculation). In the upper inner part of the duct there is a flap (3) which, duly directed through a slider and hose and shaft, can take any intermediate position between the closing limits of the above-mentioned two apertures.

Inside the duct, dap fitted on the lower part in correspondence with the above-mentioned apertures there is a fan (4) which, duly supplied at different voltage ratings, can turn at four different speeds.

The heater - distributor unit mainly comprises a box housing the following:

- centrally a mixing flap which, duly directed by a knob through a bowden cable, allows or prevents the entire flow of air withdrawn by the fan (4), or part of it, to flow against the finned surface of the heater radiator (5);
- at bottom centre the heater radiator (5) the inlet and outlet fittings of which protrude from the right side surface of the above-mentioned unit;
- above and at the front four ports which, duly directed by a knob through a hose and shaft, a toothed sector, a disk with grooves acting as distributor, shutter or fully close the section of the inner ducts which send the air respectively to the feet, front vents and windscreen demisting vents.



FURTHER INFORMATION ON THE DESCRIPTION OF THE COMPONENTS FORMING THE SYSTEM REMOVING/REFITTING THE LATTER IS NOT AVAILABLE AT THE TIME OF GOING TO PRESS.

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INTERIOR FITTINGS

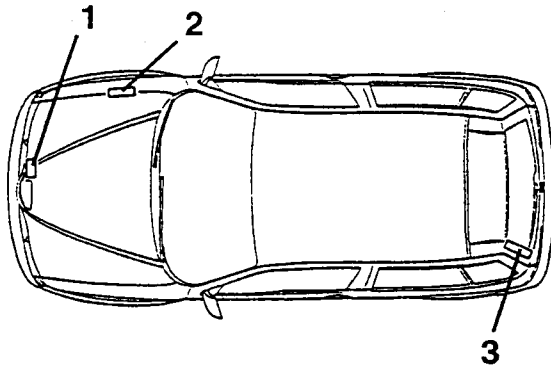
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IDENTIFICATION LABEL



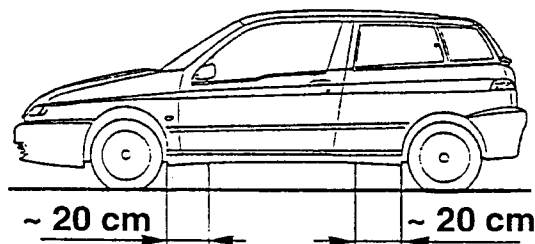
1. Identification label
2. Body label
3. Bodywork paint label

- For the identification codes see: GROUP 00.

CAR LIFTING POINTS

With arm lift or workshop jack.

- The car should be raised setting the ends of the arms or the jack in the areas illustrated.



CAR TOW POINTS

The car has two rings, one at the front and one at the rear, on the right-hand side of the bumpers.

The rear ring is covered by a lid that is opened by pushing on the edge.

Always strictly adhere to local regulations on the subject of towing.

Before towing, the ignition switch of the towed car should be turned to MAR and then to STOP without removing it; this will prevent the steering from locking.

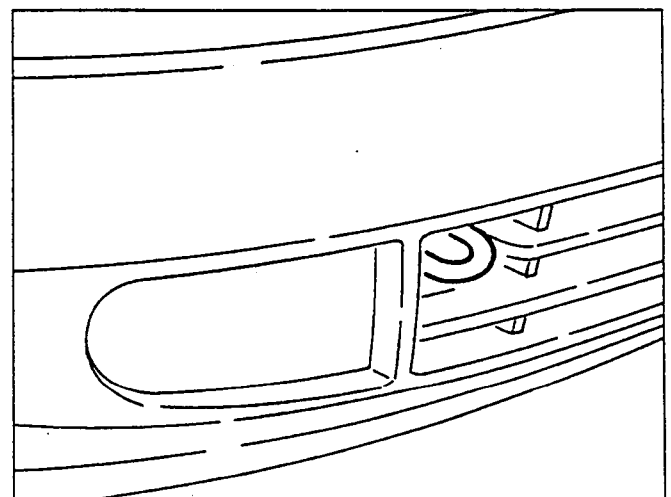
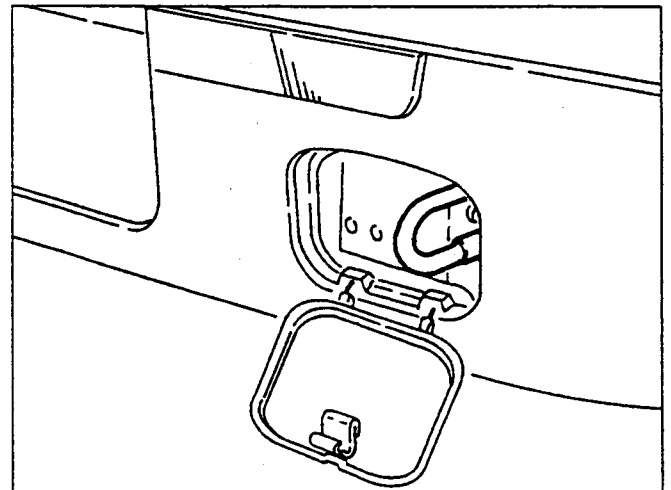
Remember that when the car is towed, the vacuum is not created in the servobrake system, therefore, considerably greater pressure on the brake pedal is required.

Additionally, when the engine is off, the power steering circuit is not operational, thus more effort is required on the steering wheel.



WARNING:

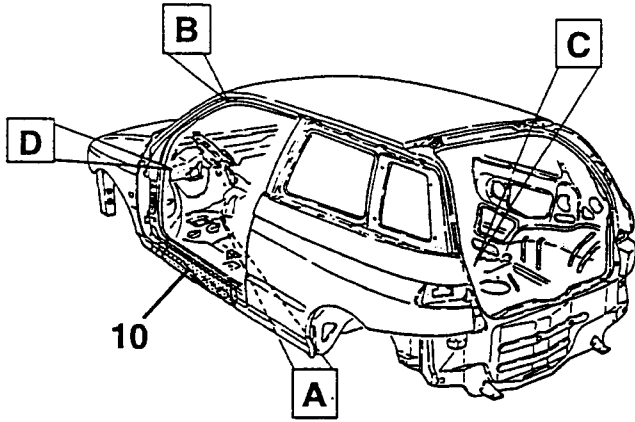
Absolutely never remove the ignition key from the lock; this will lock the steering.



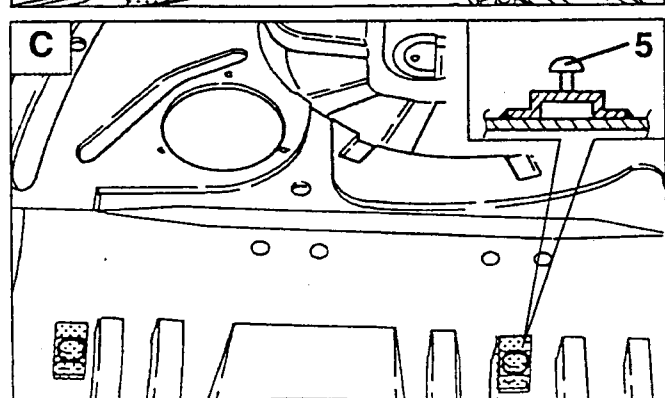
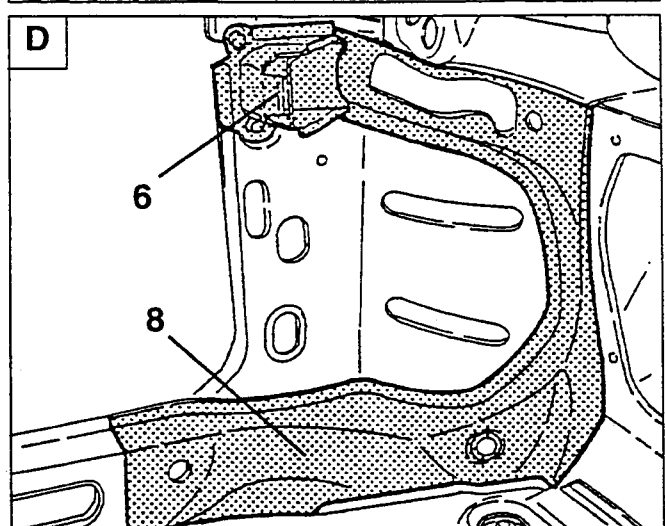
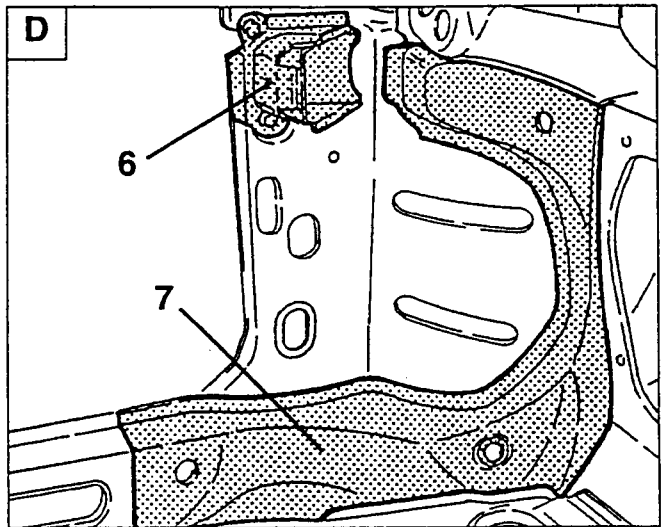
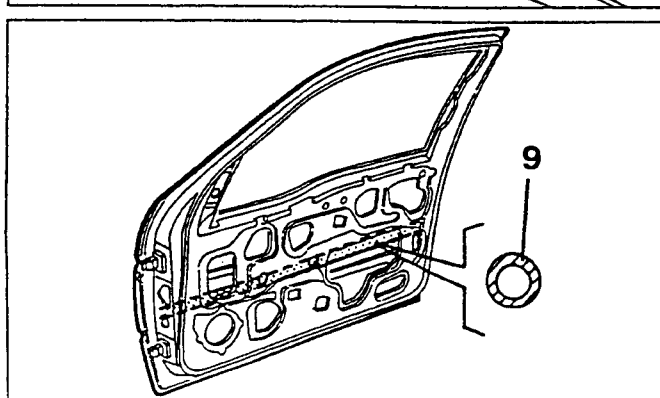
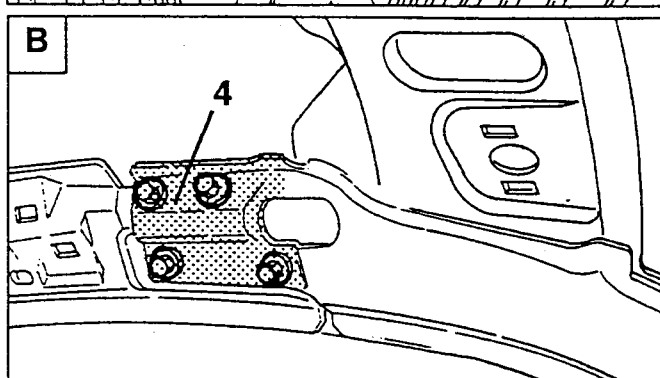
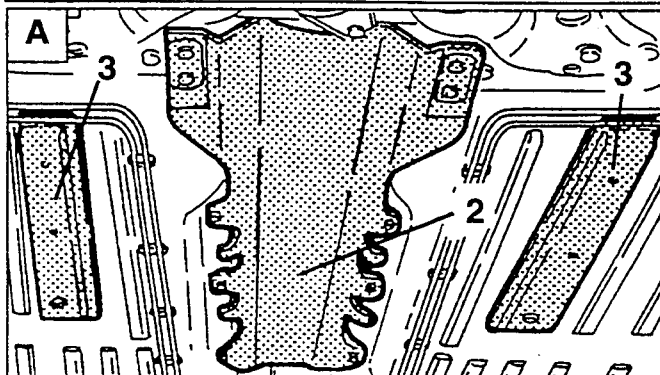
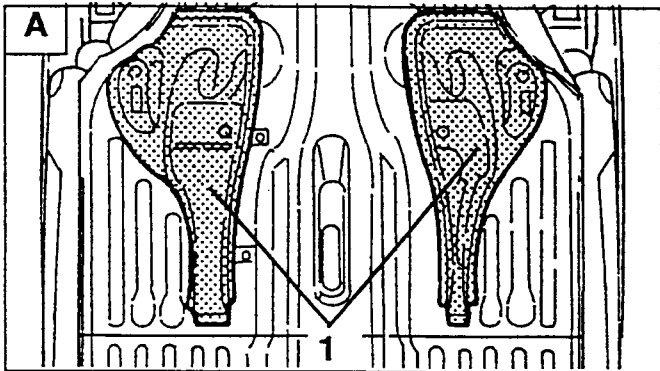
DESCRIPTION OF BODY

The body has been specifically studied to crumple in a controlled fashion during a collision whether from the front or from the side, absorbing the energy produced by the impact without compromising the spaces within the passenger compartment which are vital to the survival of its occupants.

To protect the passengers the floor, door sill rails, doors and front and central uprights have been reinforced in order to conform to future safety regulations.



1. Boxed parts under floor panel (Boxer engines)
2. Gear lever support (Turbodiesel engines)
3. Boxed parts under floor panel (Turbodiesel engines)
4. Front pillar reinforcing
5. Rear seat cushion retaining hook
6. Dashboard crossmember support
7. Strut (Boxer engines)
8. Strut (Turbodiesel engines)
9. Door reinforcing bar
10. Reinforcing under door



In this way the model not only conforms to the EEC regulations in force at present but also with the severer ECE norms which are already in force in some states and which have been recently introduced in Italy but not as yet implemented.

To give an example, regulation ECE12 specifies that during a collision with a barrier at a speed of 48.3 kph, the steering wheel must not move towards the driver more than 12.7 cm. This vehicle offers a higher level of performance than that specified by the law with a horizontal, vertical and lateral movement of the steering wheel limited to less than 10 cm.

During a 55 kph frontal crash tests against a barrier with a 15° slope, special biomechanical crash-test dummies simulating the human body were used. These dummies are able to detect the shocks to which the organs of the human body are subject during collision in order to accurately establish the consequences of an impact.

The tests carried out on this model have made it possible to establish that under these impact conditions the survival of the driver and any passengers is guaranteed.

Also during lateral impact at 50 kph the crumple values and those relative to the deceleration of the

dummy are within the limits proposed by the EEVC regulation (collision with a 950 kg barrier which hits the vehicle at a speed of 50 kph exactly where the driver is sitting).

The table below gives the torsional and flecional rigidity values.

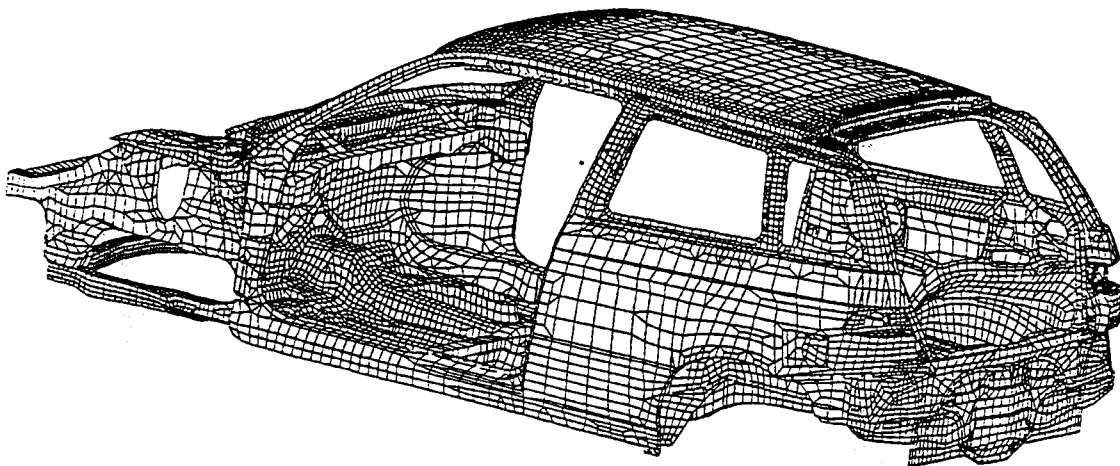
| Torsional rigidity (kgm/mm) | Flecional rigidity (kgm/mm) |
|-----------------------------|-----------------------------|
| 1200 (1) 1400 (2) | 580 |

(1) Turbodiesel engines

(2) Boxer engines

These higher rigidity values can be translated into advantages, for example:

- lesser vibration;
- lower noise levels;
- improved handling;
- greater resistance to breakage caused by uneven road surfaces;
- sensation of compactness of the vehicle;
- longer life of the vehicle in terms of overall quality.



TYPES OF SHEET METAL

The zinc treatment of the body panels guarantees a much higher degree of protection against attack by atmospheric agents in comparison to panels which are not treated.

The protective action of the zinc stems from the high reactivity of this metal with the chemical agents which form the atmosphere, combined with an equally high inertia levels of the compound which derives from it (zinc oxide).

The film of zinc oxide which forms on the parts of the sheet metal which come into contact with the atmosphere thus forms an efficient protective barrier against oxidation.

The film of protective zinc may be deposited:

- on two sides of the sheet metal when both surfaces are exposed to the atmosphere
- on only one side of the sheet metal. In this case the treated side faces outwards.

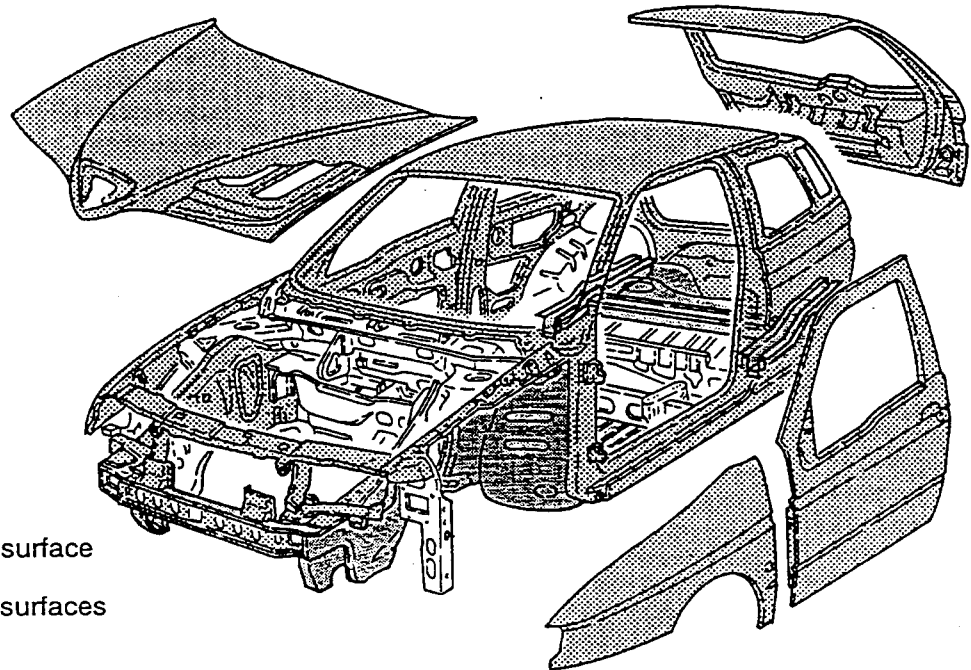


CHART SHOWING APPLICATION OF DAMPING PANELS

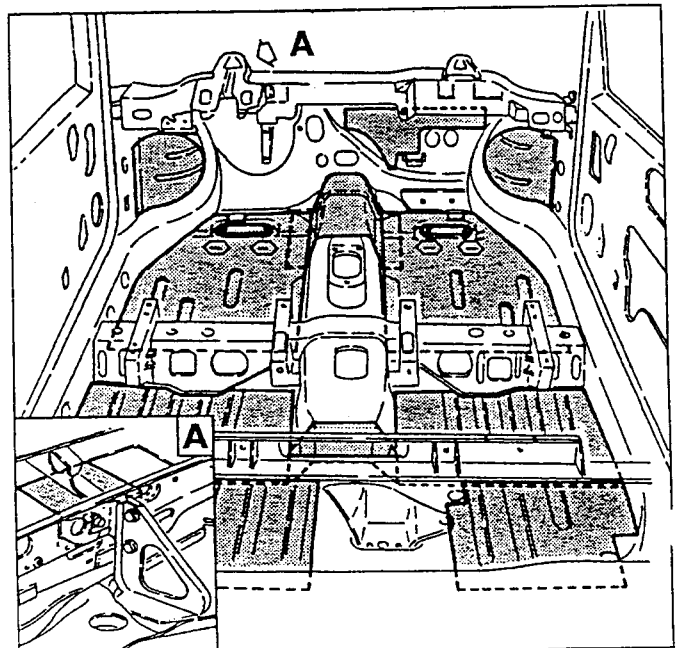
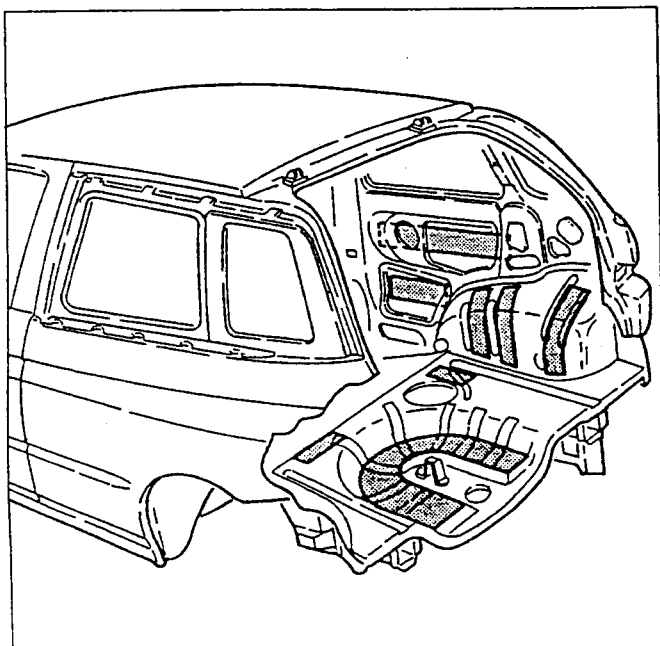


CHART SHOWING UNDERBODY PROTECTIVE COATING (PVC)

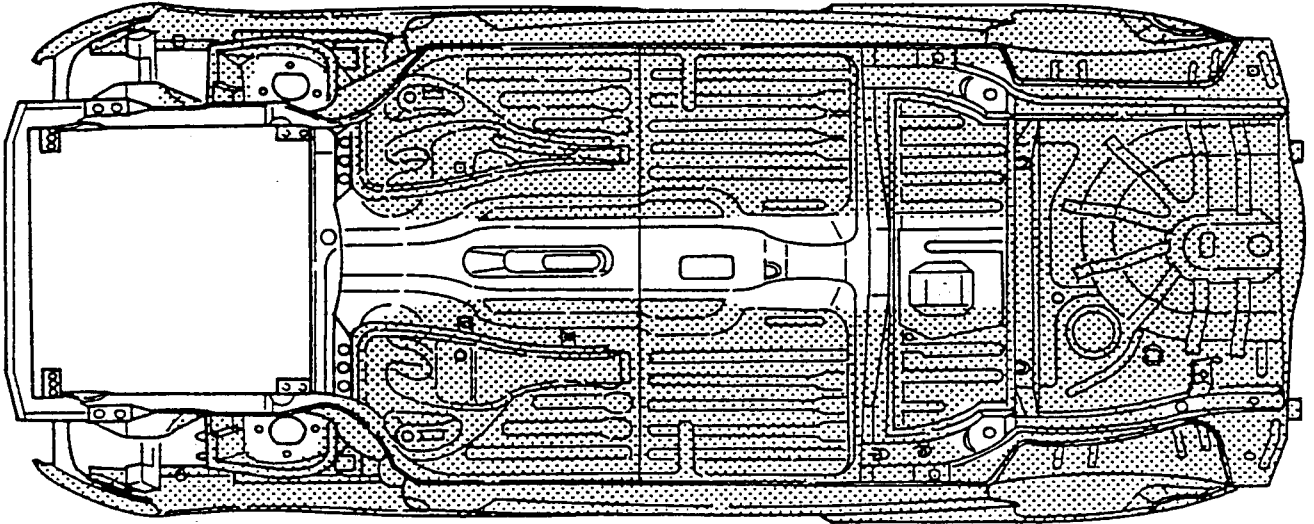
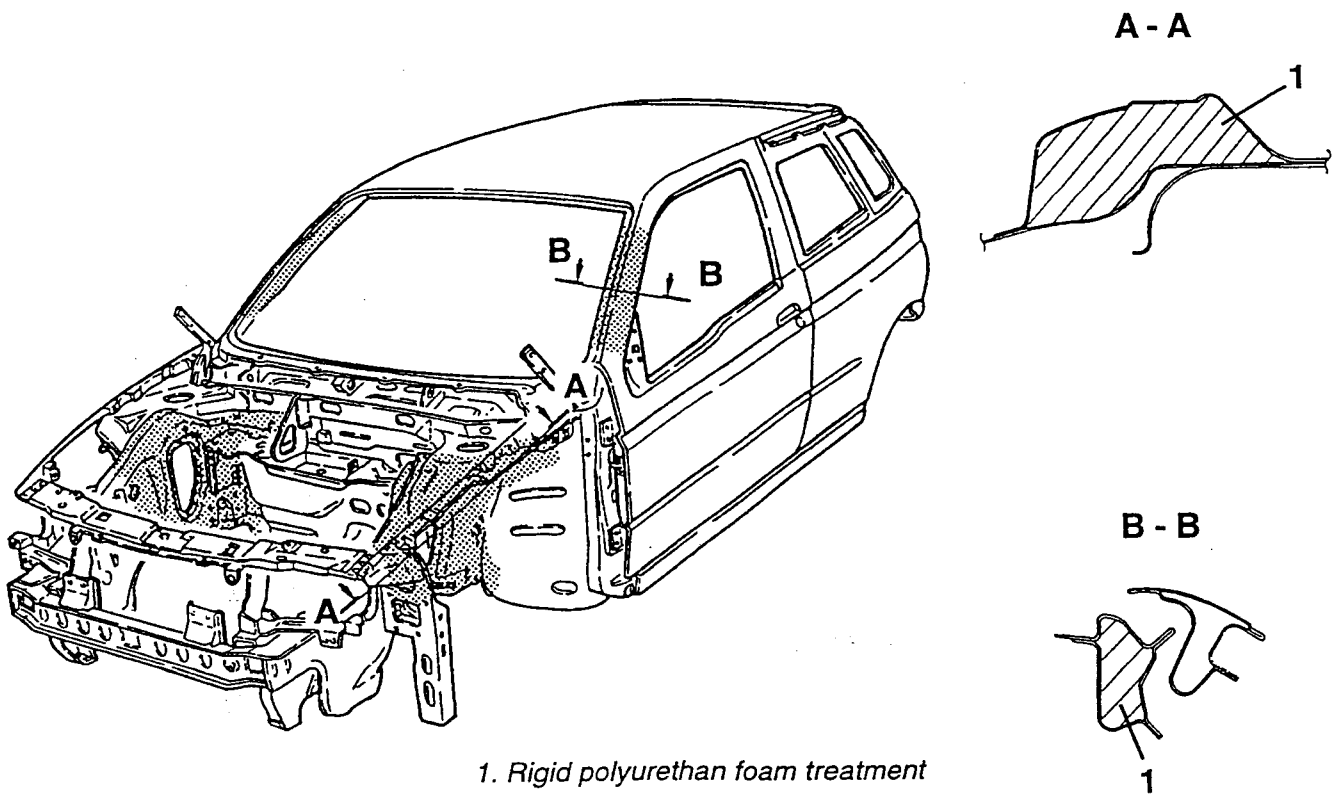


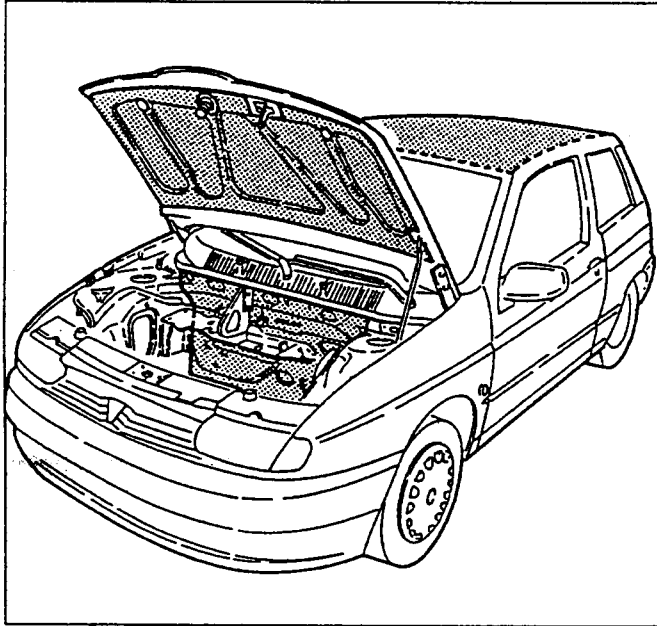
CHART SHOWING APPLICATION OF FOAM TREATMENT



1. Rigid polyurethane foam treatment

CHART SHOWING APPLICATION OF SOUND-PROOFING PANELS

Sound-absorbing



Sound-proofing

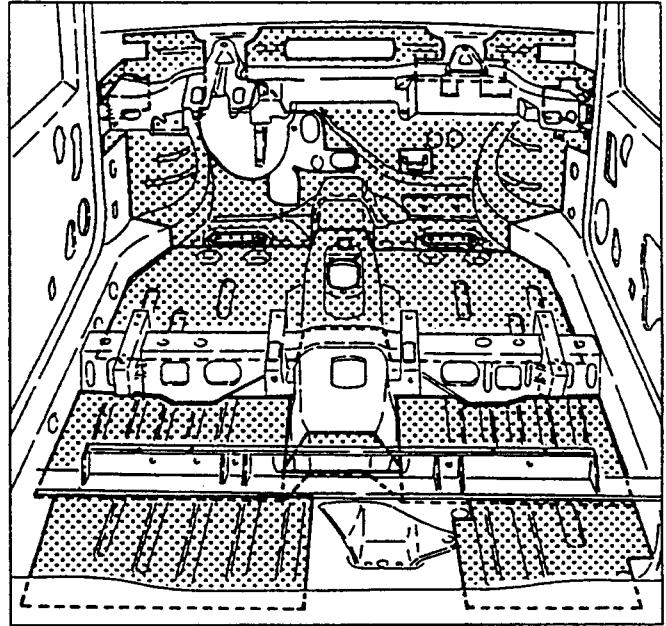
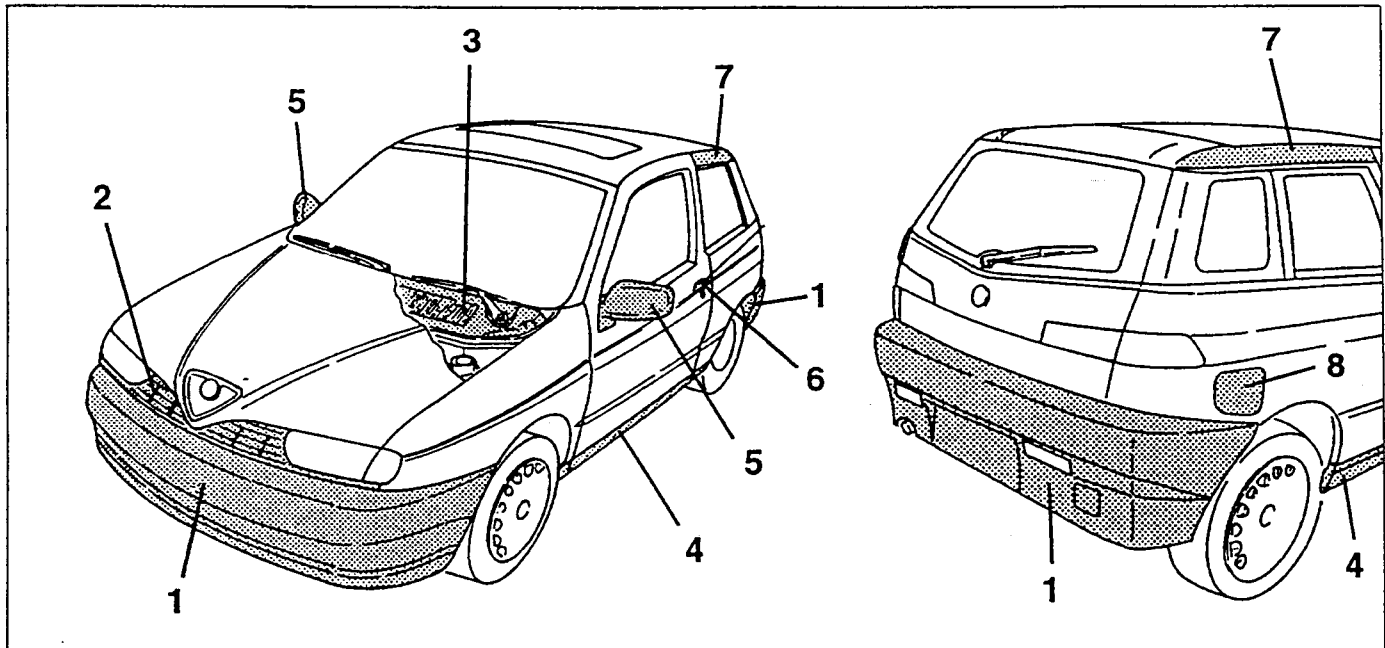


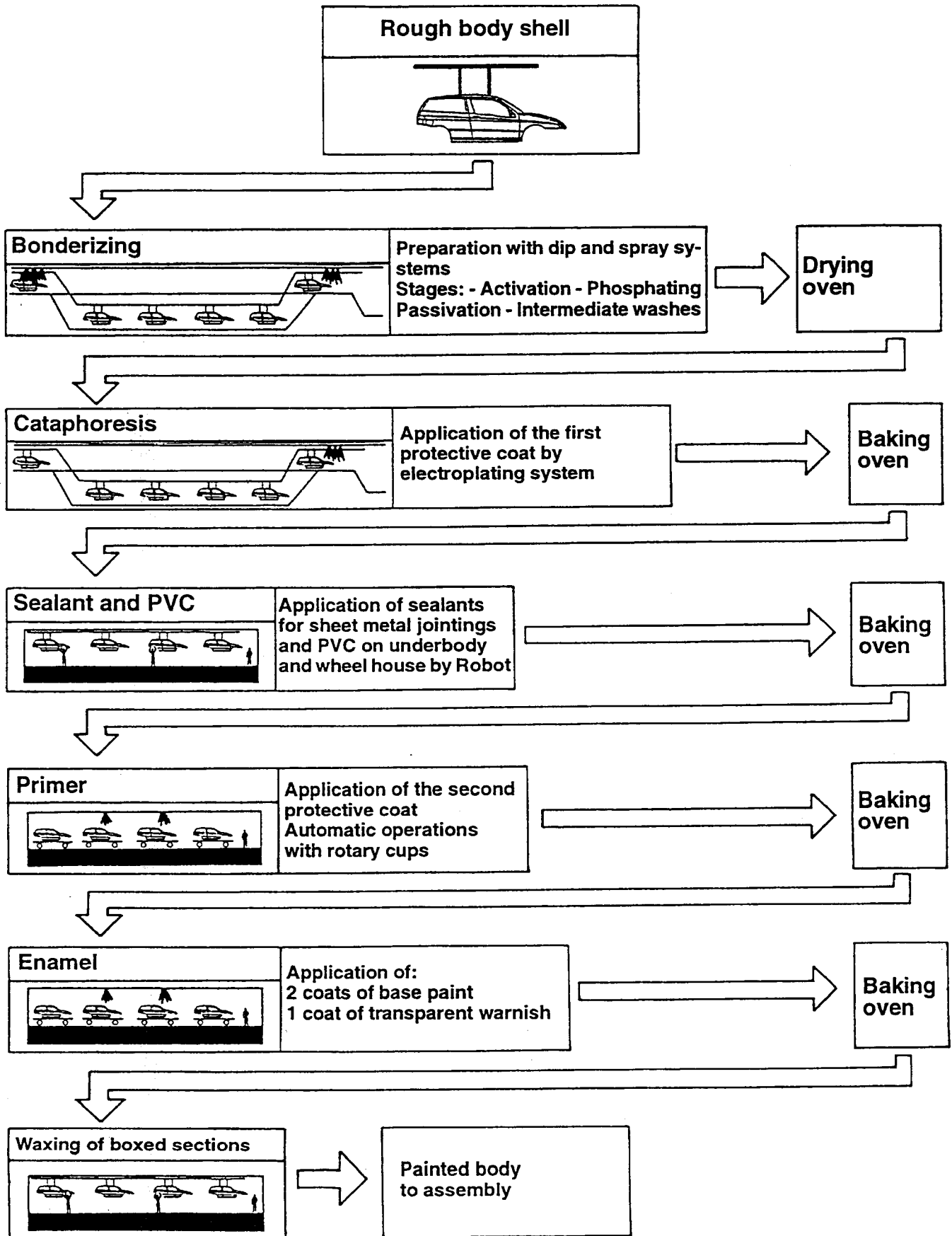
CHART SHOWING NATURE OF PLASTIC PARTS



1. Front and rear bumpers - polypropylene
2. Radiator grille - thermohardened polyester
3. Grille under windscreen (Noryl)
4. Shaft cover - polypropylene
5. Door mirror - polycarbonate - ABS

6. Door handles - polyethylene - thermoplastic polyester
7. Roof rail cover - thermohardened polyester
8. Fuel flap - thermohardened polyester

BODY SHELL PAINTING CYCLE DURING PRODUCTION



BODYWORK RESTORATION AND PAINTING CYCLES SPECIFIED BY THE ASSISTANCE NETWORK AND INCLUDED IN THE FLAT-RATE MANUAL

The word "painting" means the operation of restoration carried out on a painted surface.

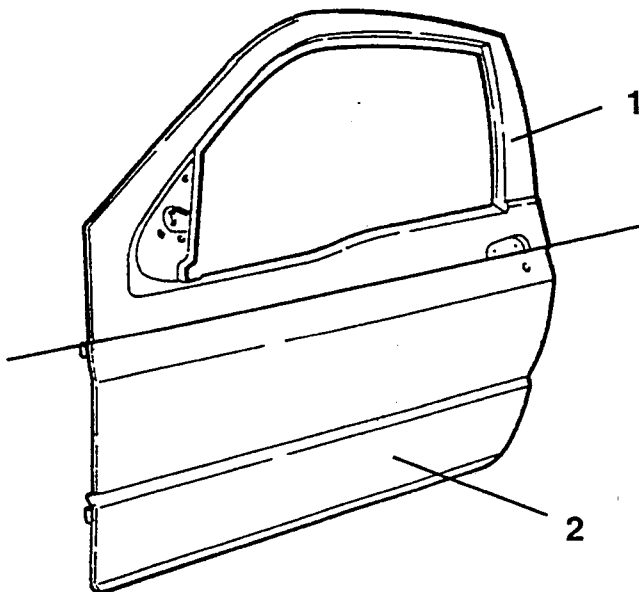
When a surface is only partially affected the operation is called "repainting cycle". Depending on the type of repair work to be carried out the following repainting cycles have been defined:

- Painting of replaced fixed metal sheet;
- Painting of replaced mobile metal sheet;
- Repainting of flawed metal sheet;
- Repainting of metal sheet with surface defect;
- Restoration of metal sheet without painting: dent removal.

For painting purposes it is important to define the term "panel".

To clarify this concept the door depicted in the diagram has been taken as an example.

The entire door is a panel but for reasons of convenience it can be divided into two areas: the upper area and the lower area. Area then, means a surface included between two borders.



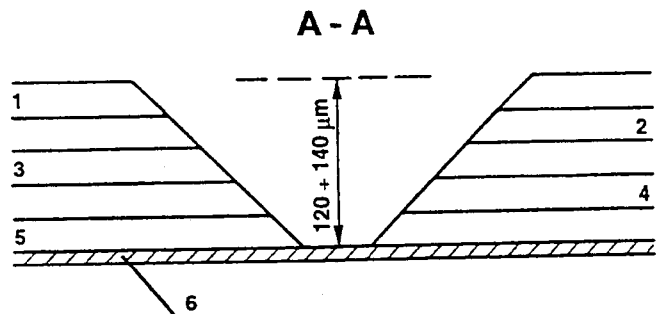
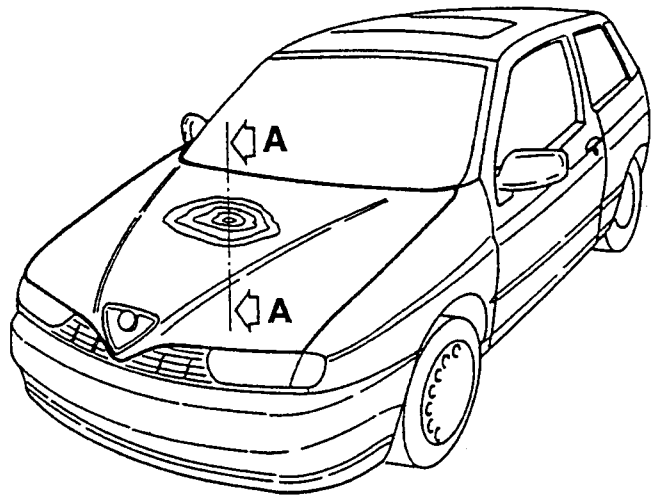
1. Upper area

2. Lower Area

NOTE:
Metal sheeting supplied as a spare part is treated by cathoporesis.

Preparation

Wash the affected part and asses the degree of damage. Sand the affected part with the grade of sandpaper most suited to the operation in hand.



1. Varnish
2. Paint
3. Undercoat

4. Cataphoresis (Primer)
5. Galvanization
6. Sheet metal

Thoroughly clean the affected areas with silicone-proof products.

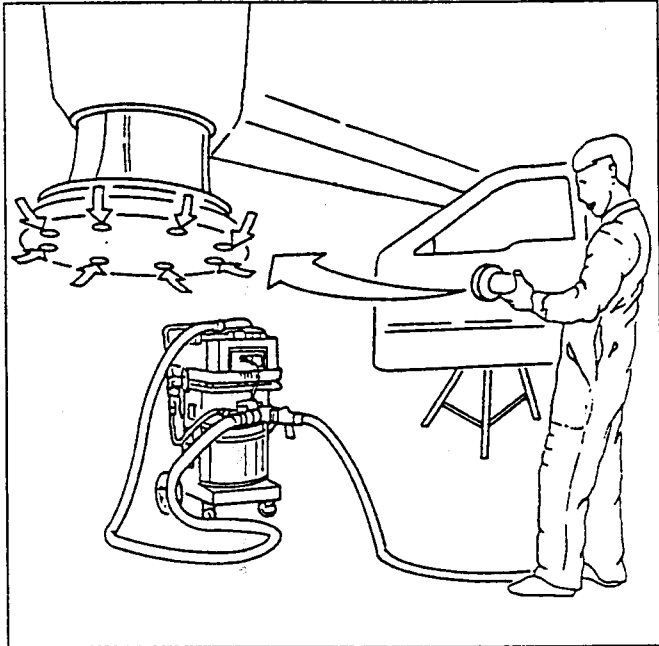
Correction or Surfacing

Repair operations carried out on sheet metal usually involve a correction and/or surfacing phase.

It is vitally important that the products are mixed before application. A coating which is sufficiently thick to cover the irregularities should be applied without exceeding the specified thickness.

Sanding

Dry sanding may be carried out by hand or using an electric or pneumatic sander fitted with the specified abrasive paper.



Masking

The areas surrounding the parts to be repaired should be masked with sheets of paper fixed to the surface with adhesive tape.

The importance of this operation should not be underestimated and should be carried out, as with all other operations, by taking all the necessary precautions to prevent repainting parts which are not affected.

Masking should be applied:

- before applying the primer;
- before applying the undercoat;
- before applying the layers of paint.

Application of Primer

The primer is applied to the bare metal surfaces as a protection against corrosion.

Sealing

Sealing is required in order to avoid penetration of water or humidity and is carried out by the application of different products.

Sealants are products that fill, insulate and protect and are applied to the joints between the metal panels.

Sealant should be applied with a brush or suitable spray gun.

Application of Undercoat

The undercoat due to its thickness ensures that the underlying layers are isolated. This intervention eliminates any imperfections of the layer beneath.

The undercoat must be prepared and applied following the indications given in the appropriate painting cycle.

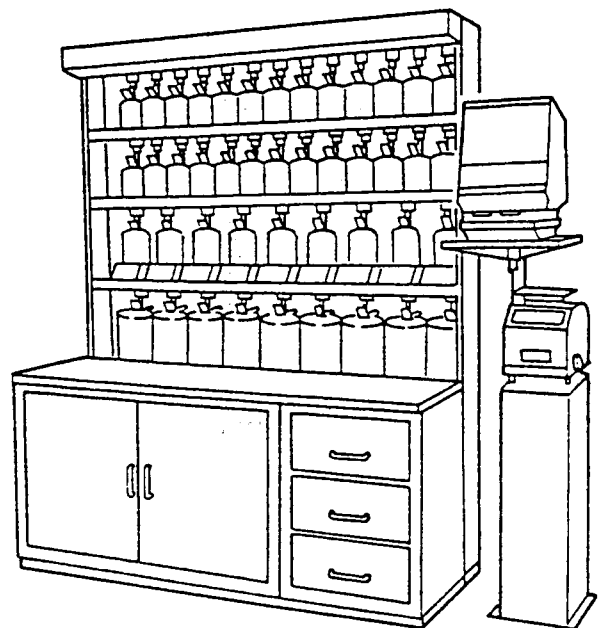
Sanding of Undercoat

Sanding is necessary, given the thickness of the undercoat, in order to eliminate any imperfections or irregularities in the sheet metal.

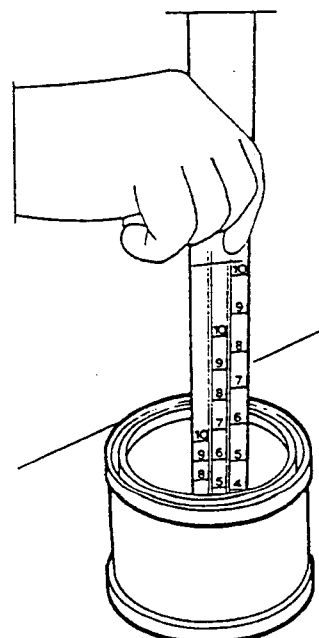
A spy coat should be applied in order to facilitate identification of any imperfections.

Preparation of the Paints

Consult the manufacturer's technical specifications before mixing the catalyst and thinner in the proportions relative to the preparation of the paint products.



Application of Paints



The required colour may be prepared by mixing the basic colours in the ratio indicated by the applicable colour formula. The enamels obtained in this way do not have the same viscosity values suitable for application and should therefore be mixed with a catalyst and thinned to the proportions indicated by the manufacturer using a rod-scale.

It is extremely important that the enamel is thinned correctly in order to avoid defects (running, pin-holing etc).

Before application check that the colour or the prepared paint corresponds exactly to the colour of the vehicle.

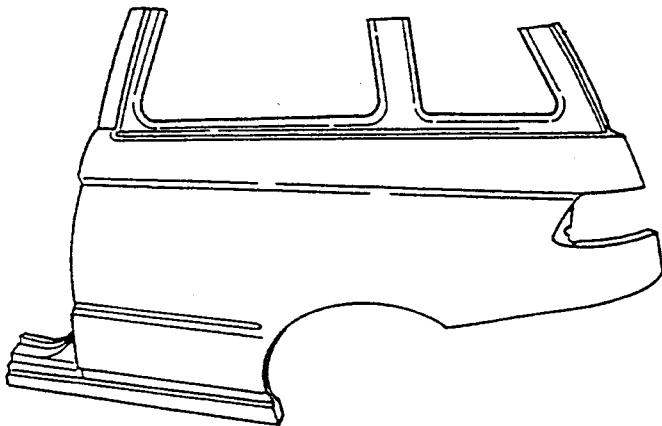
Waxing

Waxing is a supplementary protection for the boxed parts and serves to extend the protection against corrosion. It is applied through appropriate holes in the body.

Foam Treatment

Treatment with foam prevents the passage of air turbulence and sound- proofs the components treated in this way.

PAINTING OF REPLACED FIXED METAL SHEET (complete cycle)



The successive phases relative to the painting of replaced fixed metal sheet are as follows:

1. Preparation (washing, sanding and cleaning)
2. Surfacing
3. Sanding
4. Masking
5. Application of Primer (on bare metal)
6. Sealing
7. Application of undercoat
8. Sanding
9. Masking
10. Application of paints (paint and varnish)

- Wash the affected area, dry sand the cataphoresis, blow-off with compressed air, clean with a cloth soaked in a silicone-proof product and dry carefully.

- Surface any imperfections and leave to dry out.
- Sand, level the filler and carefully clean the treated areas.
- Mask the affected area, apply primer to the bare metal and allow to dry naturally.
- Apply the specified sealant to the mating surfaces and dry.
- Apply the undercoat and spy-coat (paint).
- Dry sand, remove the masking and blow-off with compressed air and clean with a silicone-proof product.
- Mask the area surrounding the sanded surfaces and adequately cover the remaining parts of the vehicle.
- Blow-off with compressed air and clean the surfaces with a tack-rag.
- Prepare and apply the paints (paint and varnish). For the flash-period between coats consult the manufacturers chart.

PAINTING OF REPLACED MOBILE METAL SHEET (complete cycle)

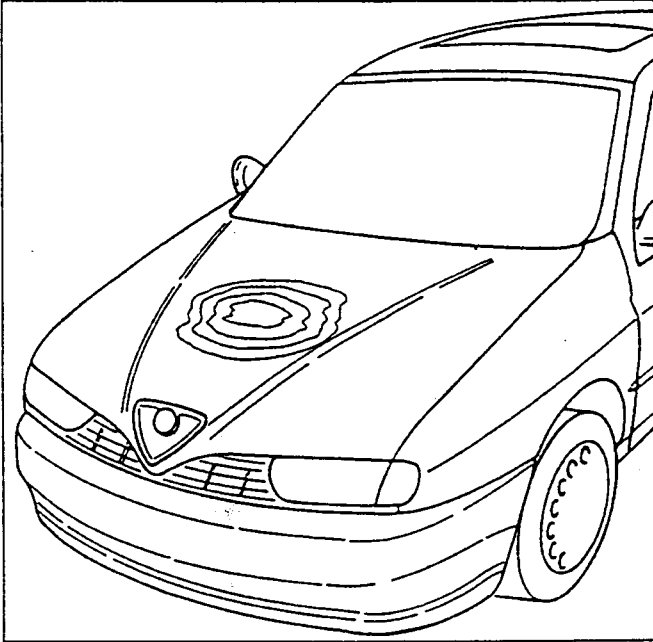
The successive phases relative to the painting of replaced mobile metal sheets are as follows:

1. Preparation (washing, sanding and cleaning)
2. Correction and/or surfacing if necessary
3. Sanding
4. Application of Primer (on bare metal)
5. Sealing
6. Application of undercoat
7. Sanding
8. Application of paints (paint and varnish)

- On a bench wash and dry sand the cataphoresis, blow-off with compressed air and clean with a cloth soaked in silicone-proof product, and allow to dry.
- Surface any imperfections and allow to dry completely.
- Sand, level the filler and carefully clean the treated surfaces.
- Apply the primer to the bare metal and allow to air-dry.
- Apply the specified sealant to the mating surfaces and dry.
- Apply the undercoat and spy-coat (paint)
- Dry sand, blow-off with compressed air and then clean with a silicone-proof product.
- Prepare and apply the paints (paint and varnish). (For the flash-period between coats consult the manufacturer's technical charts).

REPAINTING DAMAGED METAL SHEET

In the event of repairs being carried out on fixed or mobile parts, repair the defect in the metal and then proceed as described in PAINTING OF REPLACED FIXED METAL SHEET (complete cycle).



REPAINTING METAL SHEET WITH A SURFACE DEFECT

This cycle should be used in cases where the following anomalies occur:

- Water blistering
- Sagging
- Dulling
- Orange peel
- Dirt
- Transparency
- Roping
- Colour change
- Obvious touching-up
- Stripping
- Cissing
- Staining
- Roughness
- Chalking

The successive intervention phases relative to the surface painting operation of sheet metal are given below:

1. Preparation
2. Sanding (elimination of anomalies)
3. Dulling with scotch brite across the entire surface
4. Masking
5. Application of paints (paint and varnish)

- Wash the affected areas, dry sand, clean with a cloth soaked in a silicone-proof product and dry carefully.
- Sand to eliminate the anomalies in the sheet metal.
- Dull the entire panel with brite.
- Mask the areas surrounding the sanded surfaces and suitably cover the remaining part of the vehicle.
- Blow-off with compressed air and clean the surfaces with a tack-rag.
- Prepare and apply the paints (paint and varnish). For the appropriate flash-period between coats consult the manufacturer's technical charts.

RESTORATION OF METAL SHEET WITHOUT REPAINTING (DENT REMOVAL)

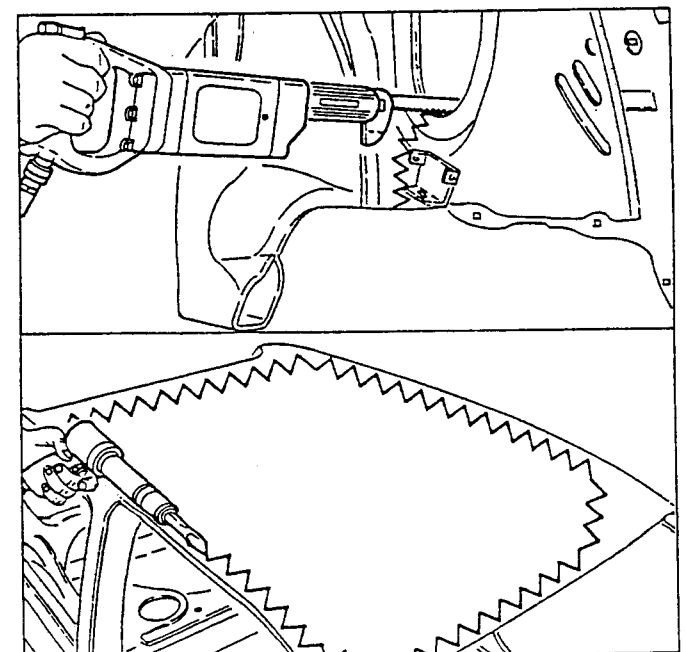
This procedure enables small dents to be removed from the bodywork using suitable tools and avoids surfacing and painting therefore maintaining the initial characteristics of the metal sheet.

GENERAL INFORMATION REGARDING REMOVAL AND INSTALLATION

SYMBOLS

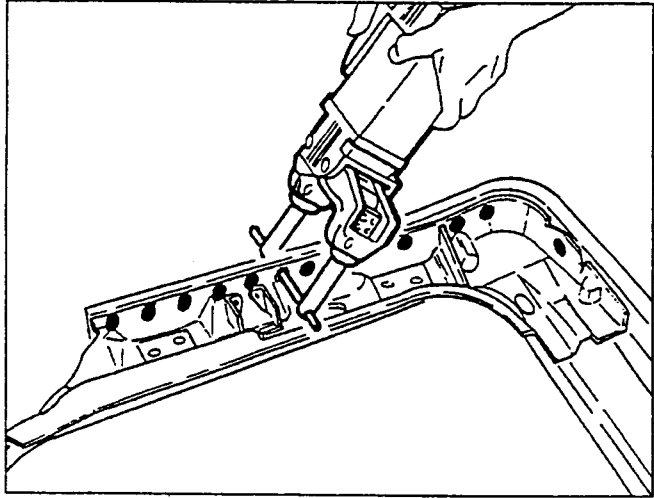
The symbols regarding operations of cutting, welding/brazing, chamfering, the use of protective products, sealants, corrosion inhibitors etc. used in this manual are shown in the following diagrams:

| | |
|---------|---------------------------------------|
| VVVVVVV | Cut made with saw or pneumatic chisel |
|---------|---------------------------------------|

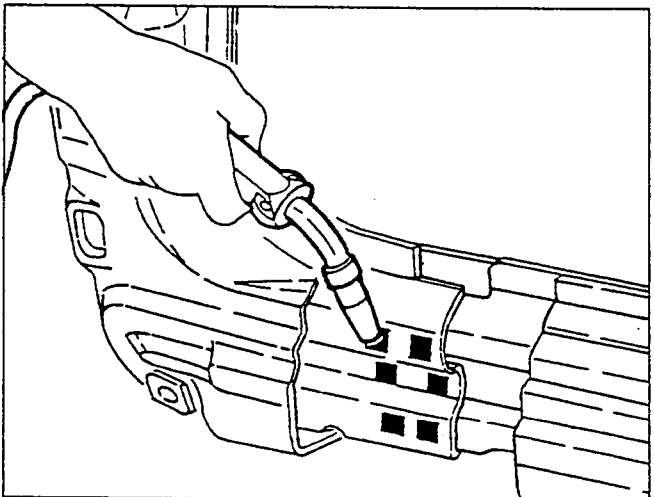


● ● ● ● Spot welding

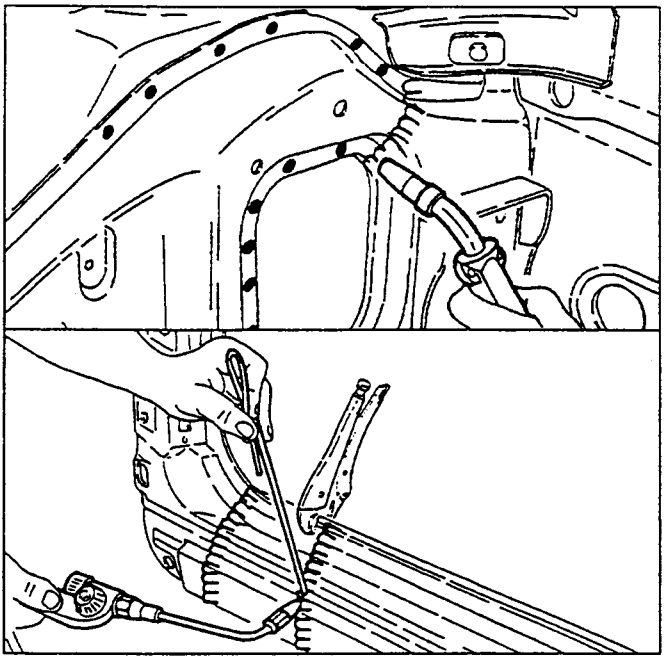
NOTE:
To make the diagrams clearer no symbols are used to make a distinction between welding of two sheets and that applied to three sheets.



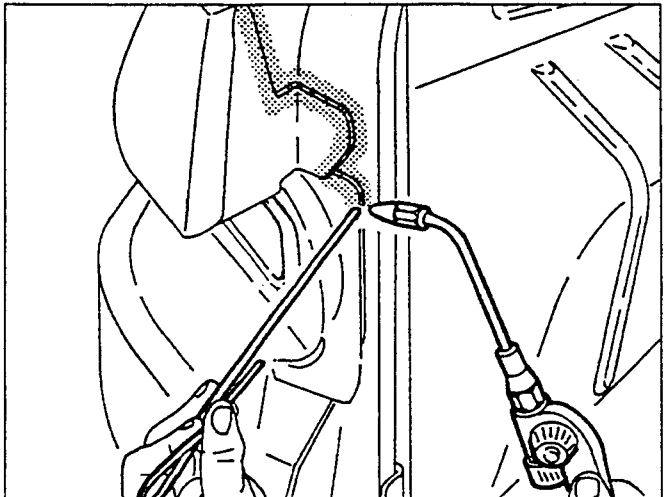
■ ■ ■ ■ ■ MIG welding for filling



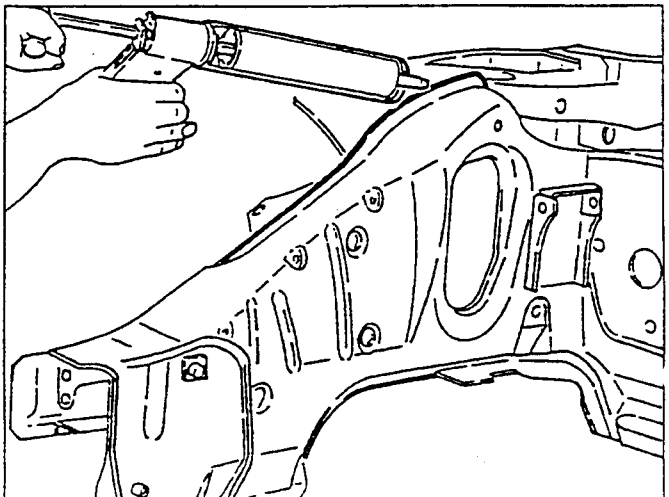
~~~~~ Continuous MIG welding/for seams



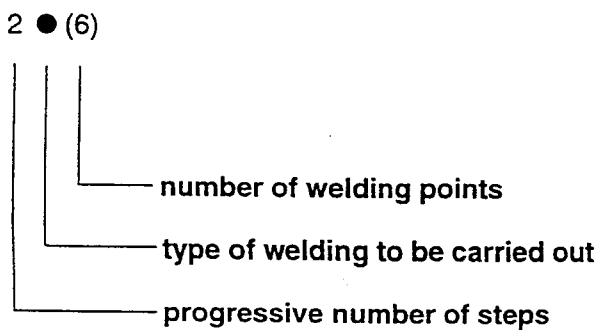
■ Braze-welding

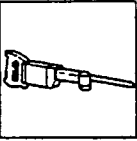
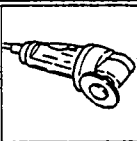
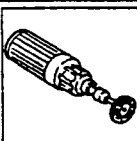
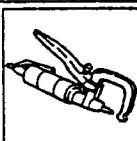
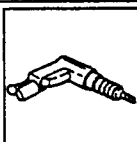
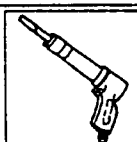

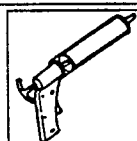
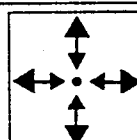
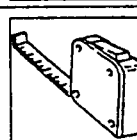
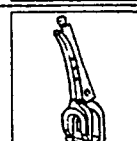



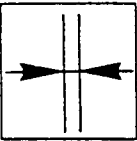
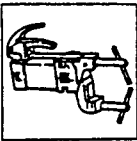
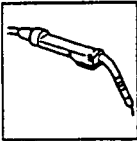
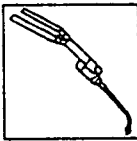
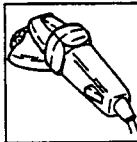

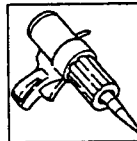




— Sealing



In order to condense the information relative to the operations described in the procedure for replacing components the following technique is used:



|                                                                             |                                                                                     |
|-----------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| CUT WITH JIG SAW                                                            |    |
| CUT WITH CIRCULAR SAW                                                       |    |
| CLEAN WITH ROTATING BRUSH                                                   |    |
| REMOVAL OF WELDING POINTS WITH CHAMFERING MACHINE                           |    |
| REMOVAL OF WELDING POINTS WITH DRILL                                        |    |
| DRILLING FOR MIG WELDING                                                    |   |
| RELEASE OF SHEET METAL WITH CHISEL<br>REMOVAL OF WELDING POINTS WITH CHISEL |  |
| APPLICATION OF ELECTROWELDABLE PROTECTION                                   |  |
| APPLICATION OF HIGH-THICKNESS ELECTROWELDABLE PROTECTION                    |  |
| CENTERING OF COMPONENTS                                                     |  |
| MEASUREMENT                                                                 |  |
| ATTACHMENT OF COMPONENTS                                                    |  |

|                                     |                                                                                       |
|-------------------------------------|---------------------------------------------------------------------------------------|
| CHECKING OF GAPS                    |    |
| SPOT WELDING                        |    |
| MIG WELDING                         |    |
| WELDING WITH OXYACELYLENE • TORCH   |    |
| GRIND                               |    |
| APPLICATION OF RUST INHIBITORS      |   |
| APPLICATION OF SEALANTS             |  |
| APPLICATION OF UNDERBODY PROTECTION |  |
| APPLICATION OF PAINTS               |  |
| APPLICATION OF WAX PROTECTION       |  |
| APPLICATION OF FOAM PROTECTION      |  |

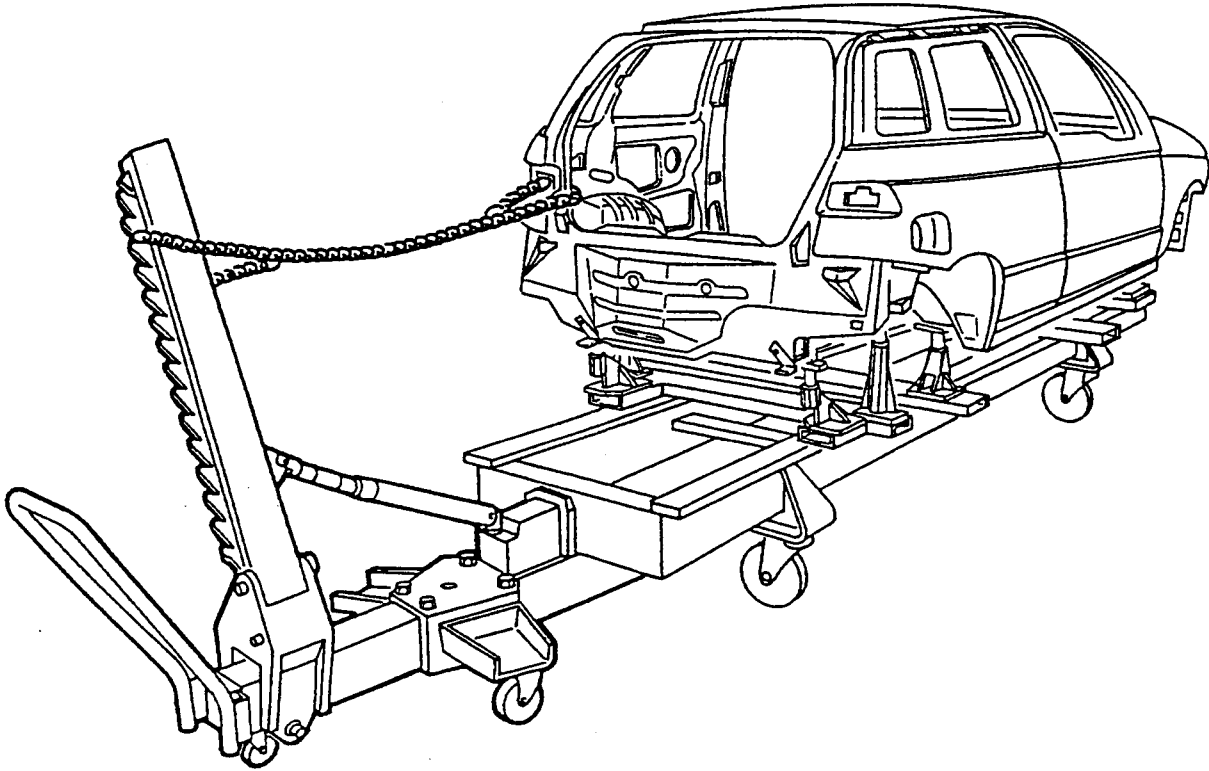


## REMOVAL OF COMPONENTS

- a. Ensure that all the damaged parts have been identified by measuring the main squaring values. See "Body Squaring".
- b. Pull the body using a tool which is suitable to the extent of the damage and apply traction in the direction opposite to the impact. Removed parts can be re-used providing they meet the requirements listed in "Body Squaring".

## WARNING:

Pay special attention when securing tension chains to the body in order to avoid accidental release during the operations.



- c. Cut away the damaged parts

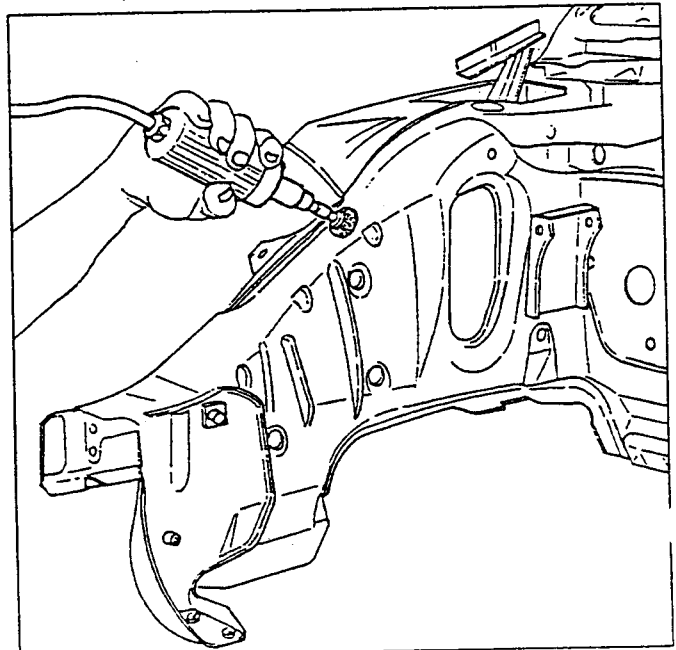
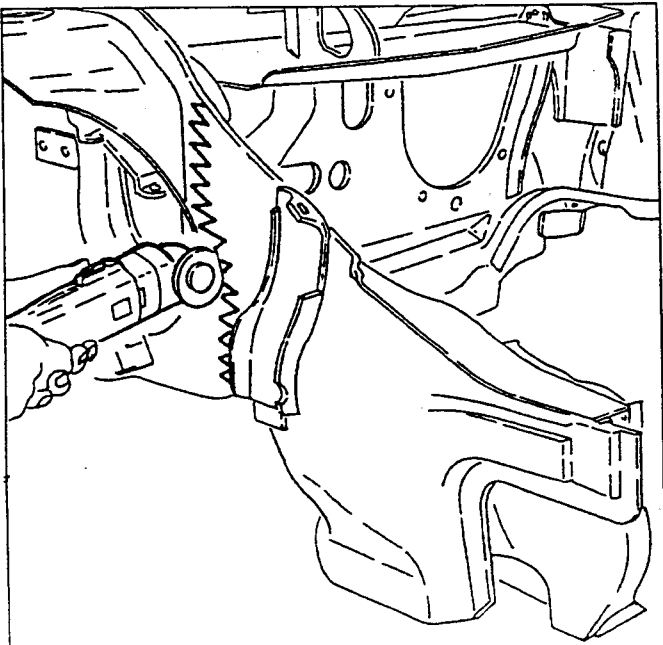
Tools required:

- Pneumatic saw
- Pneumatic chisel

- d. If the spot welds are not visible remove the paint with a wire brush.

Tools required:

- Rotating brush.



e. Punch each welding point where necessary to make a centering point for the drill bit.

Tools required:

- Hammer
- Graver.

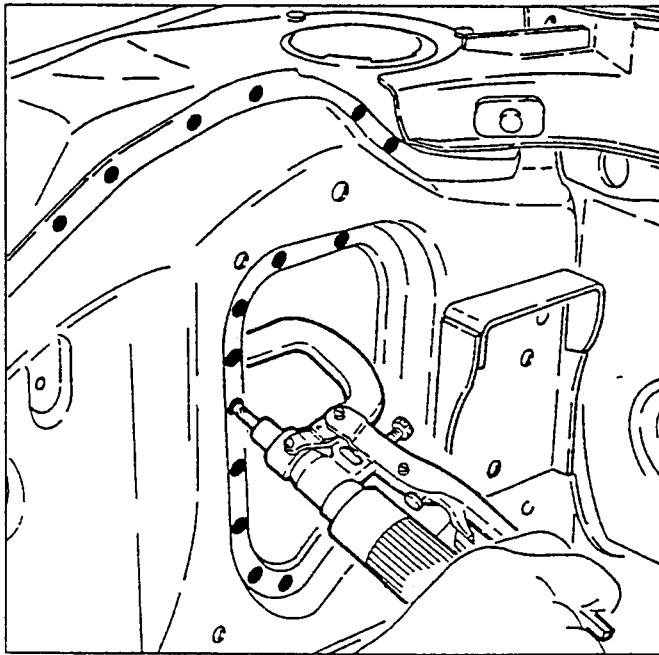
**WARNING:**

Centre punching of each welding point should be deep and exactly centered. An off-centre punch will not permit the welding point to be completely removed while a weak punch will not allow the drill bit to be securely guided.

f. Remove the spot welds using a chamfering machine or pneumatic drill.

Tools required:

- Spot-cutter
- Drill



**NOTE:**

Where it is not possible to use a spot-cutter or drill, use a chisel.

The chisel is particularly useful for spot-cutting thin sheet metal from thick sheet metal.



**WARNING:**  
Use gloves and protective glasses.

**WARNING:**

- Position the chamfering machine over the centre of the spot to be removed.
- To facilitate the operation a cutting speed of approximately 1000 r.p.m. should be used.
- Adjust the milling depth by acting on the screw.

- Care should be taken to avoid drilling mating components. Plug any holes by welding.
- Holes can reduce component rigidity and give rise to water seepage.

g. Remove the traces of welding using a chisel.

Tools required:

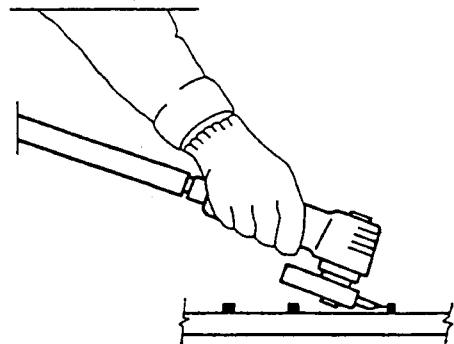
- Chisel
- Hammer.

**PREPARATION**

a. Grind the metal sheet at the welding points using a sander.

Tools required:

- Grinding machine with brush
- Disk-sander.



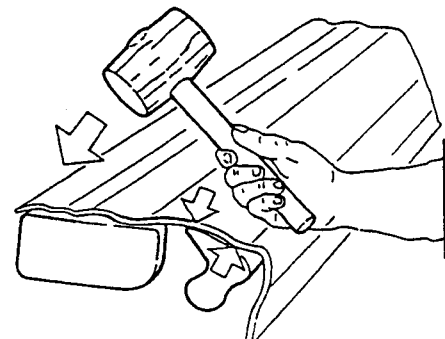
**WARNING**

- When using the sander care should be taken to avoid excessively reducing the thickness of the metal sheet as this may adversely affect welding strength.
- Thoroughly clean the metal dust from the ground surfaces and surrounding areas.
- Metal dust reduces welding strength and can lead to corrosion.

b. Straighten the buckled areas with a hammer and dolly block.

Tools required:

- Hammer
- Dolly block.



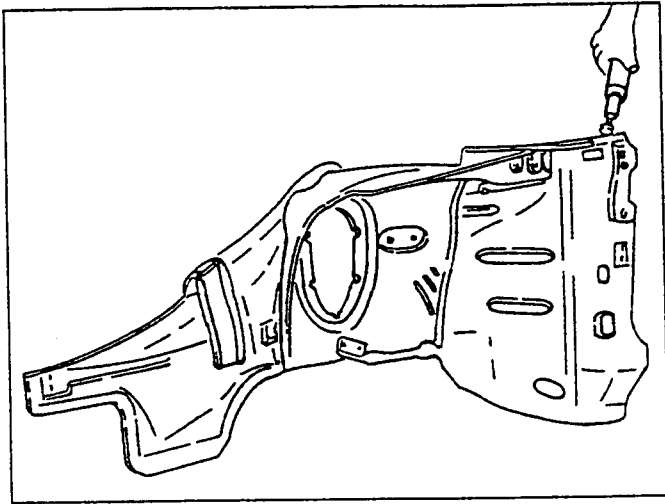
**WARNING:**

- Ensure that even the slightest buckling is removed, particularly on the inner panels or in hidden positions.
- If all buckling is not removed problems may arise during installation in addition to a reduction in strength due to the concentration of stresses.
- Carefully inspect the joint areas of each pillar.

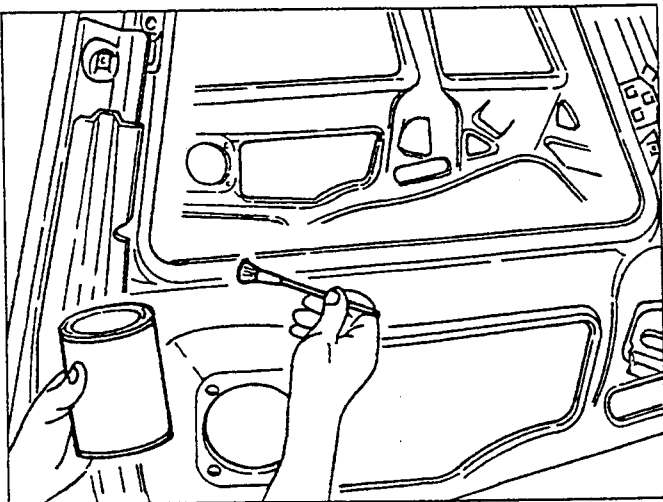
c. Remove all traces of paint from the welding surfaces.

Tools required:

- Belt sander
- Disk sander
- Rotating brush.



d. Apply electroweldable protection products to the edges of all the sheets that are to be spot welded.

**NOTE:**

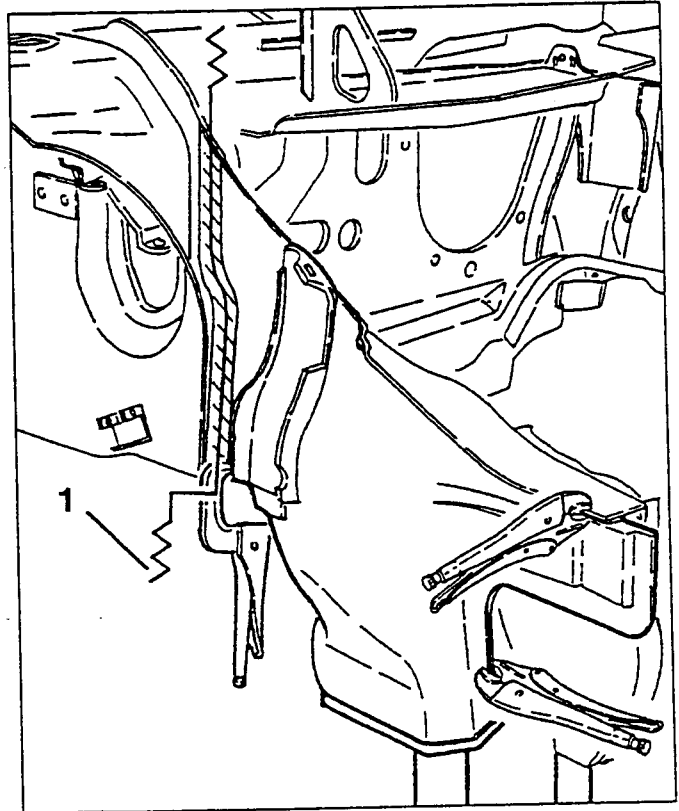
In some areas it may be necessary to apply very thick electroweldable protection to seal between the joints as well as acting as a protective coating.

e. When partially replacing a damaged sheet an overlap of approx. 50 mm should be maintained when

cutting away the unusable metal sheet in order to leave a wide enough area to permit bonding.

Tools required:

- Pneumatic saw
- Hand saw
- Scribe
- Shears.



1. Overlap

**POSITIONING AND INSPECTION**

a. Temporary installation of new components.

Tools required:

- Adjustable clamps
- Squaring tool (sighted)
- Chassis dimensional control system (Dime).

**WARNING:**

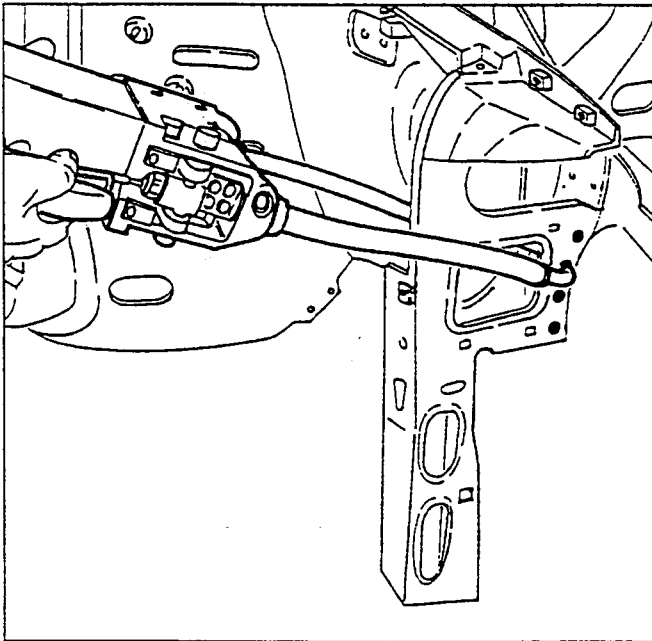
- Position the components as indicated in the diagrams in the "BODY SQUARING" paragraph.
- Draw together the edges of the sheets to be welded until they are in the correct position.
- Position mobile parts (doors, bonnet and boot lids) and check for proper installation by verifying gaps, parallelism and squaring.
- Secure the parts to be welded with clamps or a few spot welds.

## WELDING AND FINISHING OF THE SHEET METAL

a. All welding should be carried out in strict accordance with the indications in "WELDING PRECAUTIONS".

Tools required:

- Spot welder
- MIG welder
- Oxyacetylene torch.

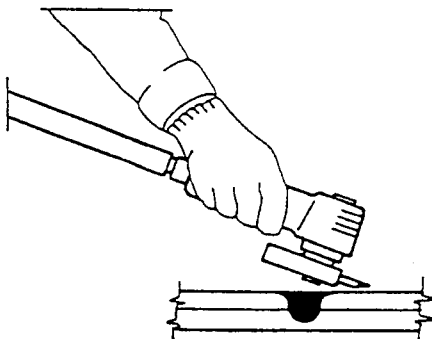


b. After welding remove the clamps used to hold the edges in place and remove the dents which may have been caused.

c. Sand the welds with a sander.

Tools required:

- Pneumatic sander
- Disk sander
- Grinding machine with milling cutter.

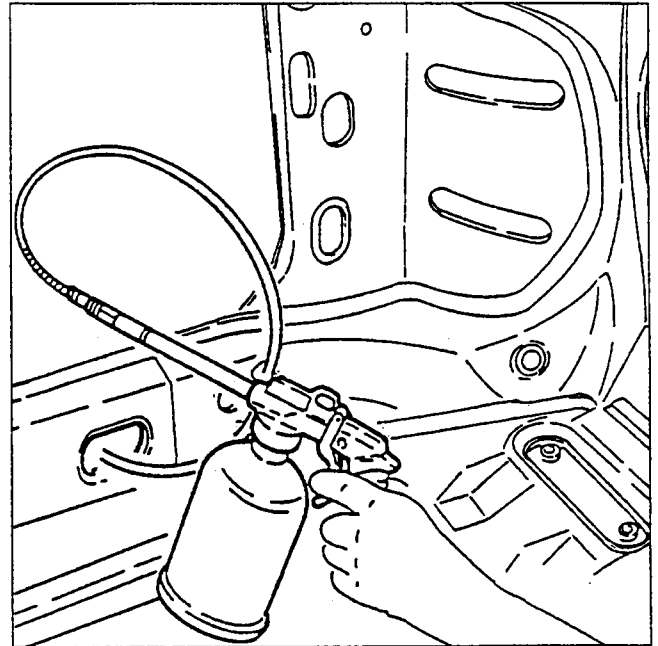


### WARNING:

- When using the sander care should be taken to avoid excessively reducing the thickness of the metal sheet as this may adversely affect welding strength.
- Remove metal dust from the surfaces that have been smoothed and from the surrounding areas.
- Metal dust may cause corrosion.

## PROTECTION

a. Apply a rust inhibitor to the components subject to MIG welding and oxyacetylene torch.



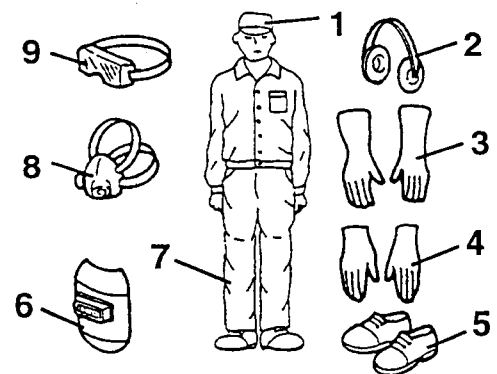
b. Apply the specified sealant to the joints in the metal.  
c. Carry out the paint, wax and foam treat procedures (see specific paragraph).

## INDICATIONS FOR OPERATORS

### PREVENTION OF WORK ACCIDENTS

a. Protective clothing.

- Depending on the nature of the work to be carried out ensure that adequate protective glasses, ear protectors and dust masks are worn. As a general rule work clothes, safety shoes and cap should always be worn while working.



1. Cap
2. Ear protectors
3. Welding gloves
4. Gloves
5. Safety shoes

6. Protective shield
7. Work clothes
8. Dust-mask
9. Protective glasses

## b. Safety supports.

- After the vehicle has been raised ensure that safety supports are adequately positioned. Refer to "LIFTING POINTS" for the location of bearing points.

## c. Inflammable materials.



- Ensure that the negative lead is disconnected from the battery before undertaking repairs.

- In the event of needing to do any welding near the fuel tank, fuel vapour separator or fuel vapour filter, they must be removed from their housing.

- Plug the open ends of the fuel, brake fluid and fuel vapours hoses when they are disconnected.

- Remove the electronic control units before carrying out electric welding on the vehicle.

## d. Work environment.

- To guarantee the safety of the operators the work environment should be well ventilated and lighted.

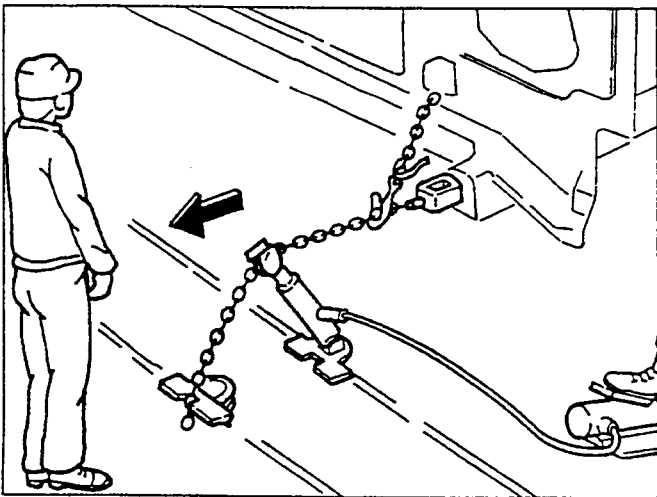
- As paints and sealants produce toxic gasses when heated it is advisable to use pneumatic chisels or saws instead of oxyhydrogen flame to cut and remove the damaged metal sheets.

- To remove the paint from the metal sheet a belt sander or rotating brush should be used.

- To contain the dust produced use a suction hood.

## e. Vehicle bodywork straightener

- Ensure that the straightener is used in strict accordance with the procedures given in the Manufacturer's Instruction Manual.

**WARNING:**

During straightening of the damaged part never stand in front of the straightener in the direction of the tension load.

**PROTECTION OF EXTERNAL COMPONENTS AND FURNISHINGS**

## a. Protection of furnishings

- Remove or cover the interior furnishings in the vehicle (upholstery, instruments, carpets).

- Cover glass, instruments, upholstery and carpets with heat resistant materials before attempting welding operations.

## b. Protection of external components.

- When external components (bonnet, boot, mouldings, trimmings) are removed they must be adequately protected from scratching by using rags, protective tape or other materials.

**WARNING**

Painted surfaces which are even minimally scratched must be repaired as any scratching may lead to successive corrosion.

**INDICATIONS FOR REPLACEMENT**

The use of Alfa Romeo spare parts is recommended as these ensure the best results with regard to repairs and maintenance of vehicle serviceability.

**INDICATIONS FRO WELDING**

Before electric welding remove the electronic control units from the vehicle to avoid damaging them.

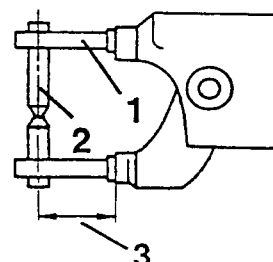
**SPOT WELDING**

The strength of spot-welds depends on the execution of the following inspections before welding operations begin:

## a. Adjustment of the welding arm.

- Keep the arm as short as possible in order to maintain maximum loading between electrodes.

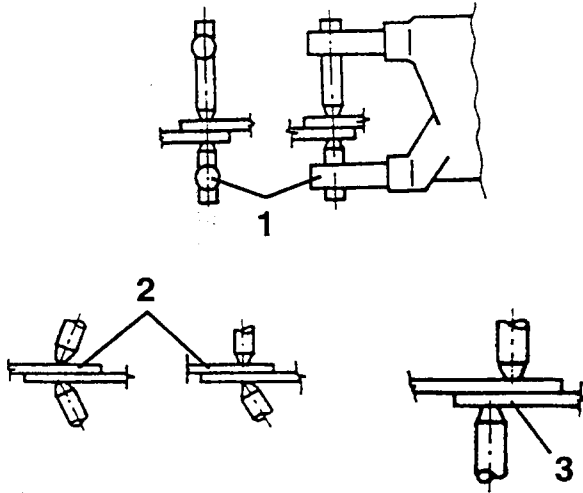
- Fully tighten the arm and electrodes so that they do not work loose during welding.



1. Welding arm
2. Tip of electrode
3. Minimum arm length

### b. Alignment of electrodes.

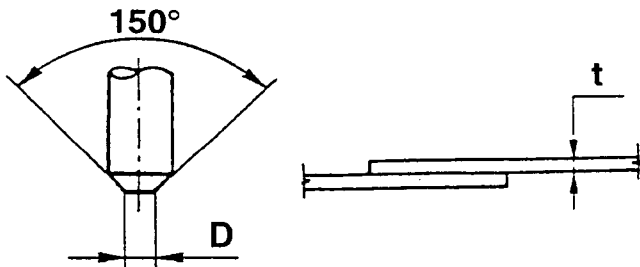
- Align the tips of the upper and lower electrodes. Any misalignment of the electrodes causes low pressure on the welding points resulting in a reduction in strength.



1. Correct alignment of arms
2. Incorrect position of arms
3. Incorrect length of arms

### c. Diameter of electrode tip

- It is necessary to check the diameter of the electrode in order to obtain the necessary welding strength. Before beginning work ensure that the diameter of the tip (D) is adequate for the thickness of the metal sheet following the formula given. Remove all traces of burns or foreign bodies from the tips of the electrodes.



$$D = t + 3 \text{ (mm)}$$

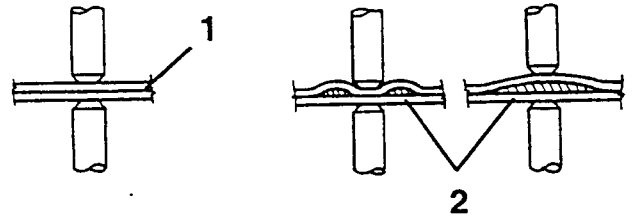
D = Diameter of the electrode tip  
t = Thickness of sheet metal

### Condition and preparation of the panels to be welded.

The presence of discontinuity, paint, rust or dust on panel edges prevents the flow of electricity and thus reduces welding strength. Before beginning welding check the condition of the mating surfaces and make any adjustments necessary.

### a. Gaps between mating surfaces

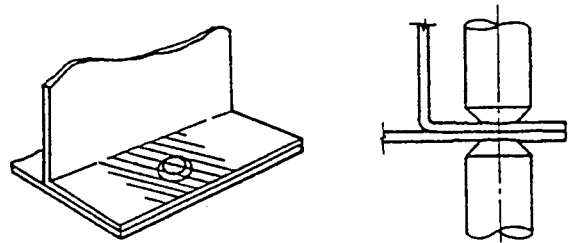
- Even a slight gap between the surfaces to be welded reduces the intensity of the flow of electricity resulting in welds which will be too small or weak. Before welding join the surfaces and when necessary, secure them with a clamp.



1. Correct mating of the surfaces to be welded
2. Incorrect mating - gap between the surfaces to be welded

### b. Welding of metal surfaces.

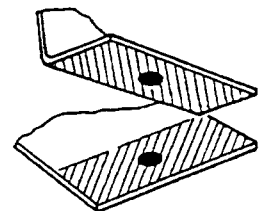
- To obtain the best results prepare the surfaces to be welded by removing all traces of impurities and foreign bodies (paint, dust, rust).



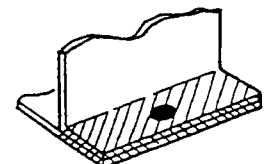
### c. Corrosion prevention on metal surfaces.

- Coat the area to be welded with a high conductive corrosion inhibitor. The edges should also be coated with this product.

### PRELIMINARY OPERATIONS

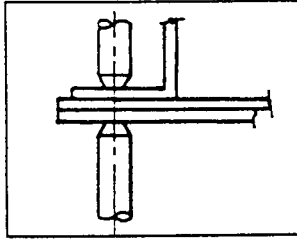


APPLY THE CORROSION INHIBITOR TO ALL THE SURFACES AND AROUND THE EDGES



## Indications to be followed when spot welding.

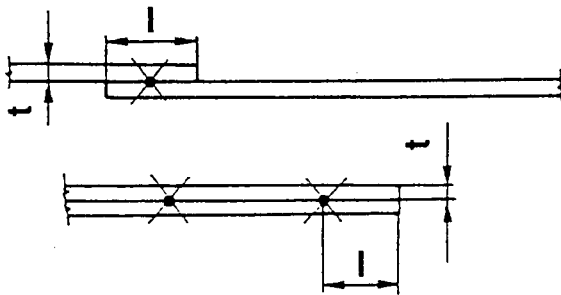
- a. Welding of three or more overlapping metal sheets.
- When three or more overlapping sheets are to be welded, welding should be repeated a second time.



- b. Number of spot-welds.
- Weld in accordance with the number of spots indicated in this manual.

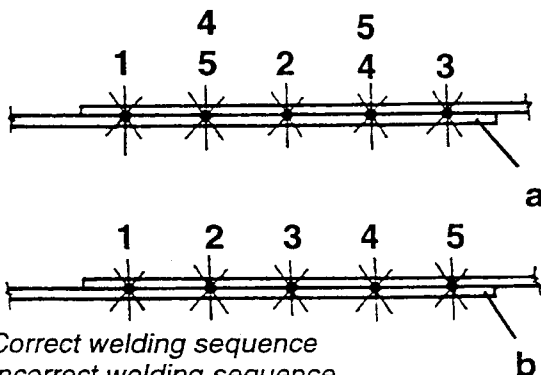
- c. Minimum distance between spot welds and the edge of the sheet metal.
- When welding near the edges of the metal sheet the values given in the following table should be used.

| Thickness of sheet metal (t)<br>mm | Minimum distance from the edge of the metal sheet (l)<br>mm |
|------------------------------------|-------------------------------------------------------------|
| 0.6                                | 11                                                          |
| 0.8                                | 11                                                          |
| 1.0                                | 12                                                          |
| 1.2                                | 14                                                          |
| 1.6                                | 16                                                          |
| 1.8                                | 17                                                          |



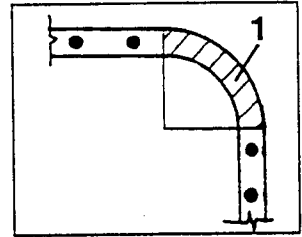
Welding carried out too close to the edge will not be strong enough and sheets may warp.

- d. Welding sequence.
- Do not weld in one direction only as this results in weak welds due to electricity shunting. If the electrodes overheat and change colour interrupt the operation, leave them to cool and reshape the tips.



a. Correct welding sequence  
b. Incorrect welding sequence

- e. Welding on angled surfaces.
- Do not weld on angled surfaces as a concentration of voltage is created which can cause breakage.



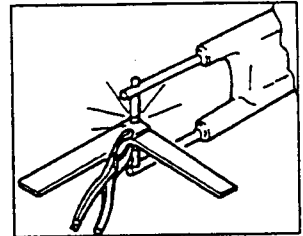
1. Angular surfaces exempt from welding.

- Examples:
- Front pillar upper corner.
  - Front part of rear wing.
  - Front and rear window corners.

## Inspecting the welding areas.

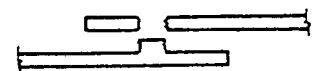
The spot-welding areas can be inspected either visually or by using a destructive method. This last method should be applied before and after welding. Spot-welds should be equally spaced and positioned at the centre of the flange.

- a. Sample test to be carried out before welding.
- Prepare the samples using metal sheet of the same thickness as the parts to be welded and secure them so that they do not move during welding.

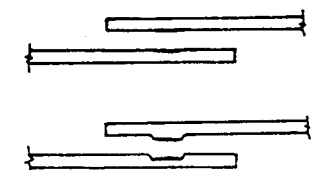


- Carry out welding.
- Rotate the samples around the spot-weld until they detach and then inspect the break.
  - The entire spot-weld should remain on one of the two samples and a circular hole should be on the other.
- If this condition is not met welding conditions are incorrect. Adjust the pressure, electricity and electricity flow time and other welding parameters and repeat the test until better results are obtained.

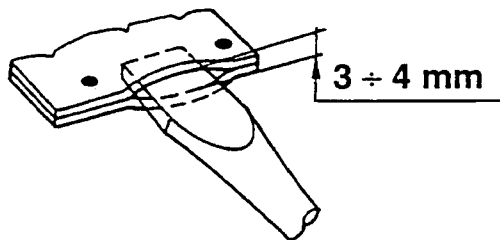
CORRECT WELDING PARAMETERS



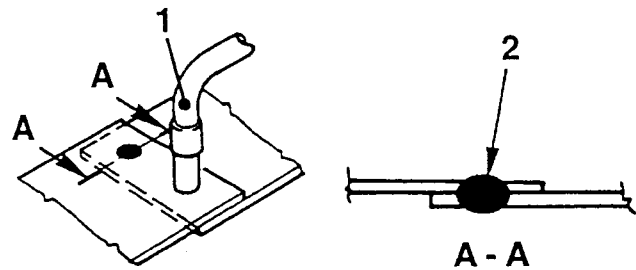
INCORRECT WELDING PARAMETERS



b. Test to be carried out after welding using a hammer and chisel.  
 - Insert the point of a chisel between the welded sheets and lightly tap the chisel until a gap of 3-4 mm is obtained. If no warping is found then the welding is acceptable.



- If the gauge of the sheets is not equal the gap should be restricted to 1.5 - 2 mm.
- It should be remembered that the above values are for reference only.
- The gap can vary depending on the position of the spot-welds, length of the flange, thickness of the sheet, welding angle and other factors. To avoid breaking the spot-welds do not exceed these limits.
- Ensure that the damaged parts are repaired after testing.



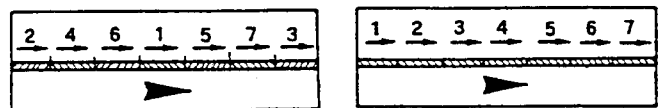
1. Blowtorch  
 2. Welding point

b. Head-welding.  
 - Tack the two surfaces by welding intermittently in order to align correctly and prevent buckling. Fill the empty spaces with small welding seams.

**NOTE:**  
 The correct gap is approx. 1 mm.

**NOTE:**  
 If welding is intermittent deformation is less. If welding is continuous deformation is greater.

- Do not weld a continuous seam as buckling may occur. In order to reduce buckling proceed as shown in the diagram.



CORRECT

INCORRECT

- After welding sand the weld following the shape of the part. If any holes are left in the weld fill them and then sand.

## MIG WELDING

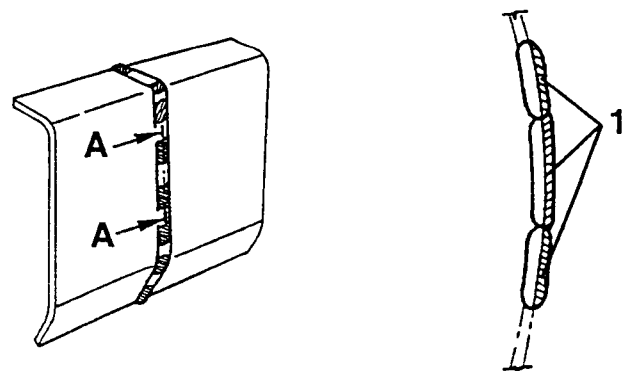
- Use MIG welding for parts where spot-welding cannot be used.

### Conditions of the panel to be welded.

Remove all traces of foreign materials by sanding or brushing. Paint, rust or oil on the surface of the sheet may reduce the welding strength and cause blistering.

### Welding indications.

- a. Filler welding (of prepared holes).
- Drill a hole 5 to 6 mm in diameter on one of the sheets to be welded and secure the sheets together.
  - Position the blowpipe at right-angles to the sheet and fill the hole. At each interruption in the welding process an oxide coating is formed on the surface which causes blistering. If this occurs remove the oxide with a brush.
  - Ensure that the welding of the upper and lower sheets is perfect.



1. Part of the seam-weld to be flushed.

### Inspecting filler-welds

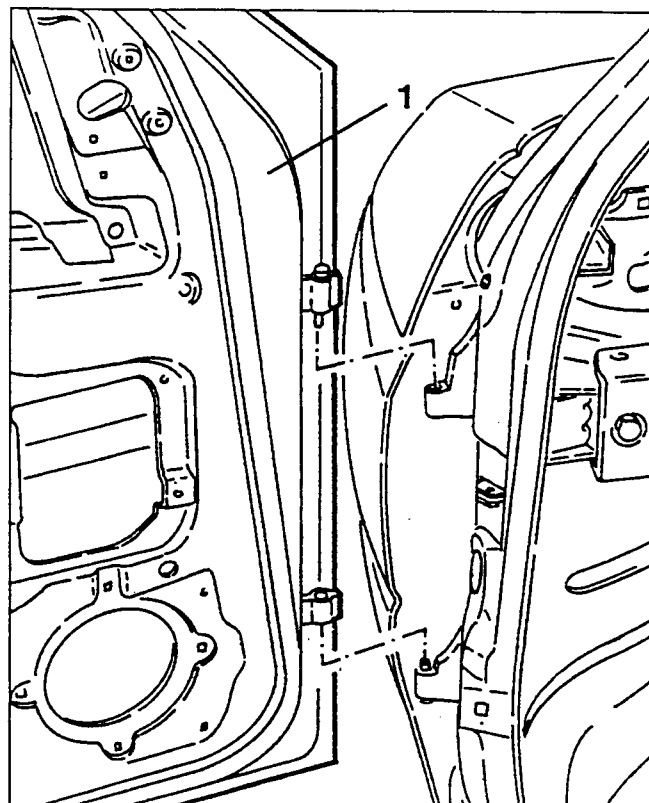
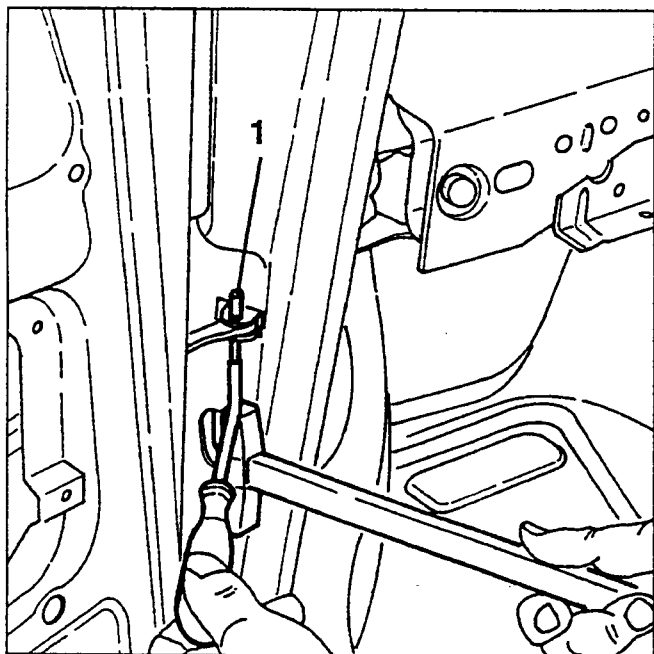
This procedure is similar to that previously described for spot-welding.



## DOORS

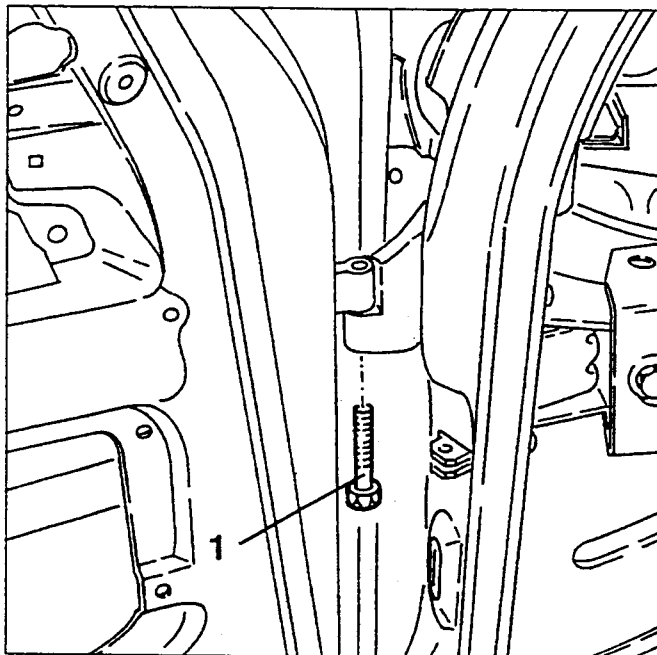
### REMOVAL AND REFITTING

1. Remove the pin from the door check strap, half-close the door to back off the pin and then re-open the door.



Refit the door by reversing the procedure followed for removal and note the following.

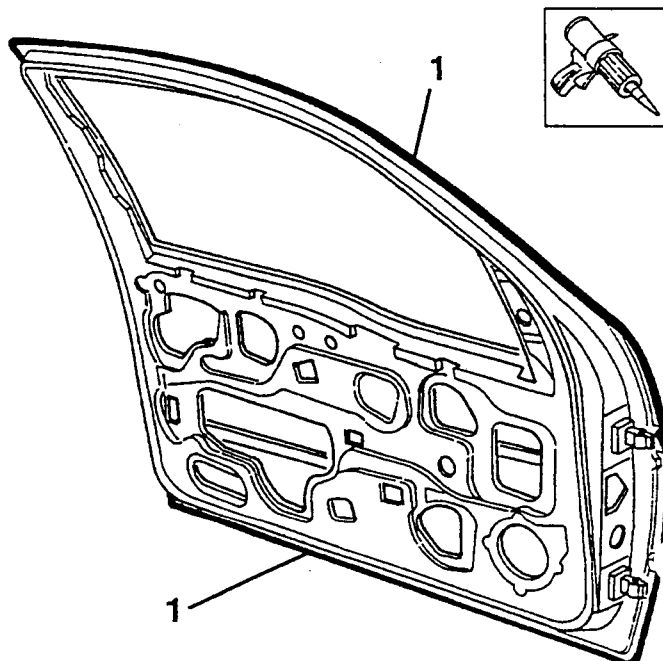
1. Loosen the two screws securing the door to the hinge.



1. If a new door is being used apply the specified sealant along the inside edge of the door.

**NOTE:**  
Check that the sound-proof panels are present inside the door panels.

1. Lift the door unit the tapered pins of the hinges can be lifted from their seatings. Remove the door.

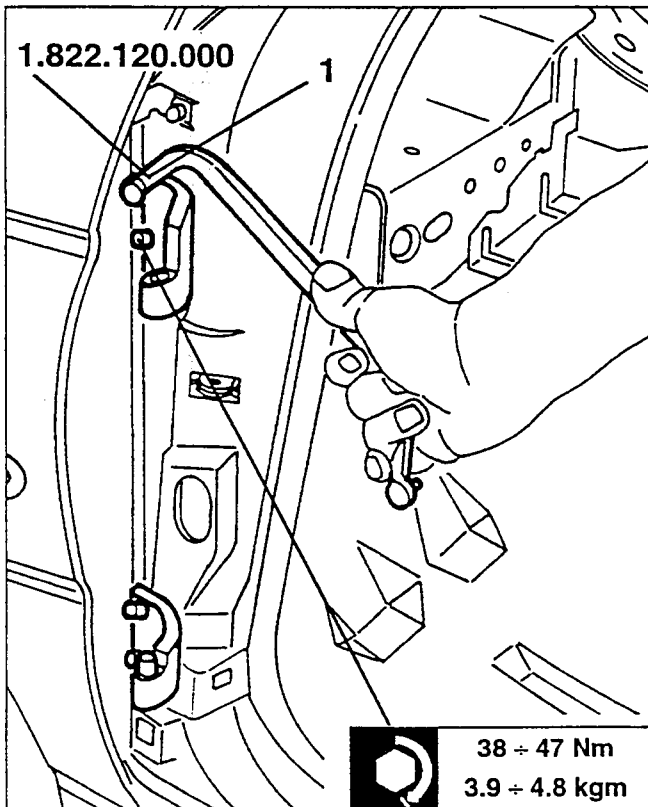


- If necessary adjust the door following the indications given in the relative paragraph.

## HINGES

### REMOVAL/REFITTING

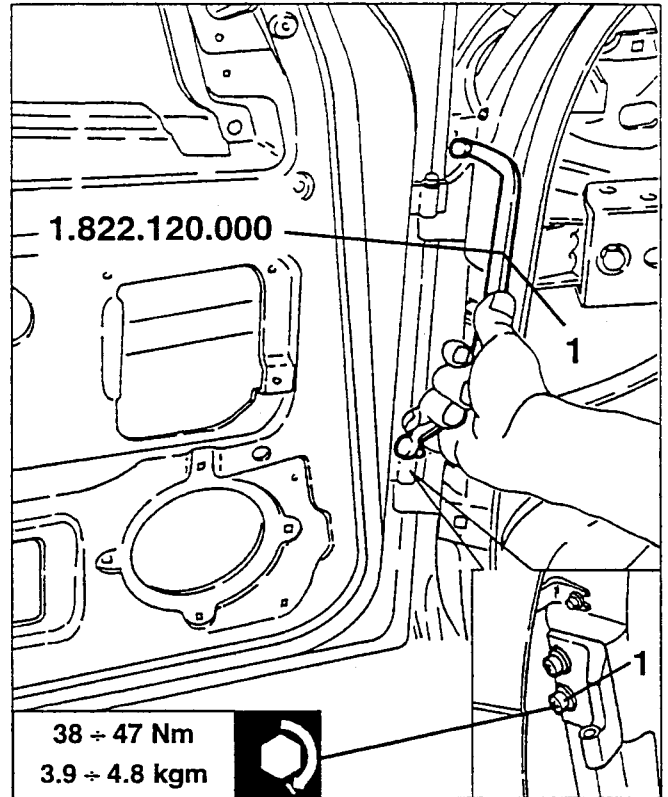
- Remove the door (see specific paragraph)  
 1. Using tool N° 1.822.120.000, loosen the two screws and remove the hinge.



Refit the hinges by reversing the procedure followed for removal and adjust the door as described in the relative paragraph.

### ADJUSTING DOORS AND HINGES

1. Using tool no. 1.822.120.000, slacken the screws fastening the hinges to the pillar.

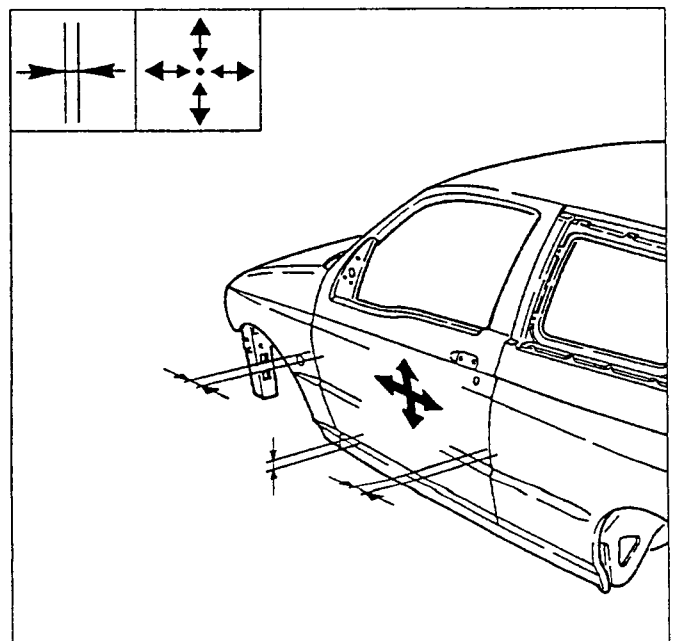


- Adjust the door longitudinally and in height checking that it mates correctly and the lights.

**NOTE:** Adjust the door maintaining the screws fastening the hinges to the door tightened in package.

- If necessary position shims under the hinges and under the door catch.

**NOTE:** To adjust the door the relative gaskets, lock and catch must be fitted.

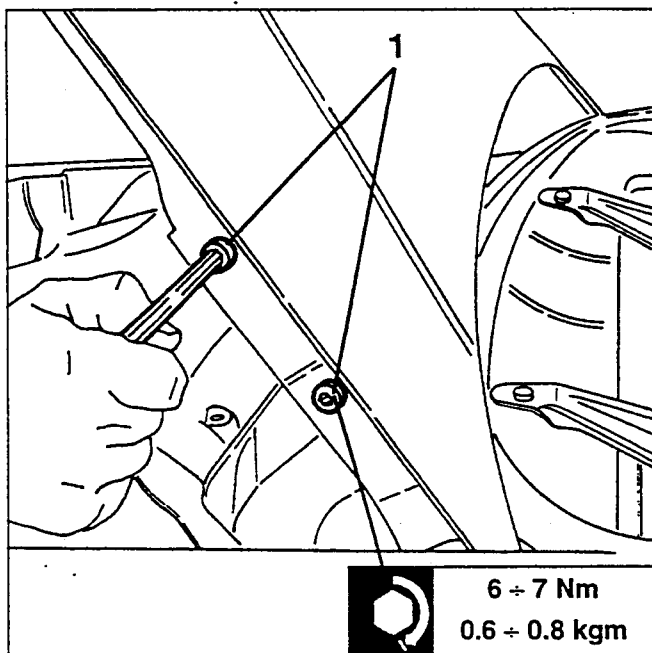


### BONNET

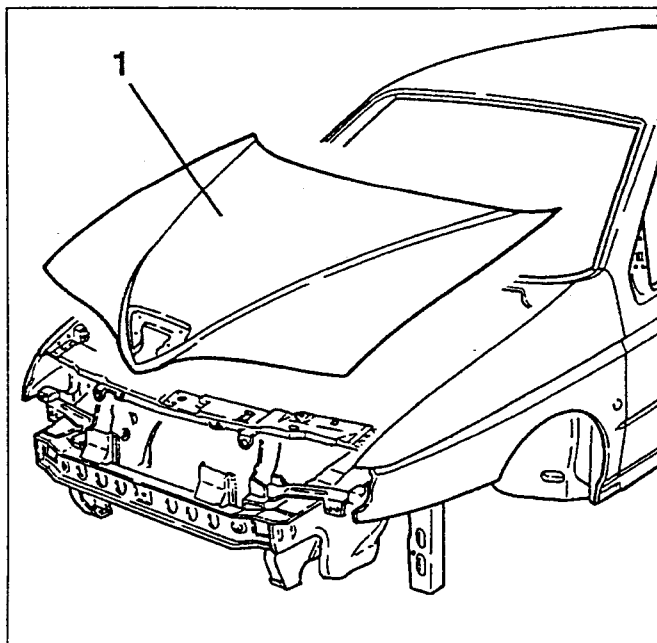
#### REMOVAL/REFITTING

- Open and suitably support the bonnet.

1. Loosen the two screws, on each side, securing the bonnet to the hinges.

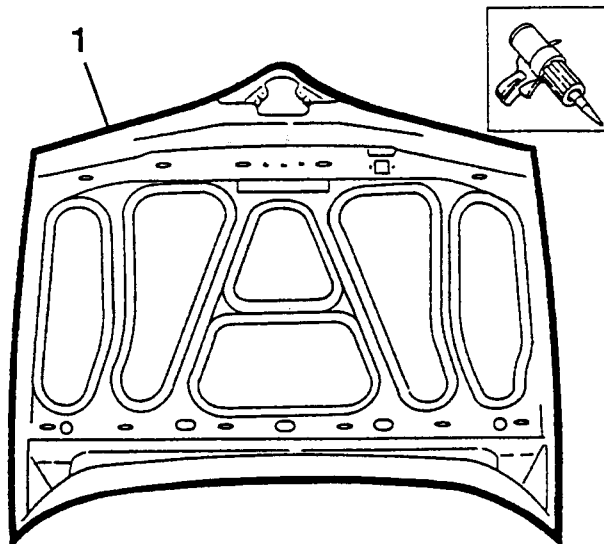


1. Remove the bonnet.



Refit the bonnet by reversing the procedure followed for removal and note the following.

1. If a new bonnet is being used apply the specified sealant around the inner edges of the bonnet.



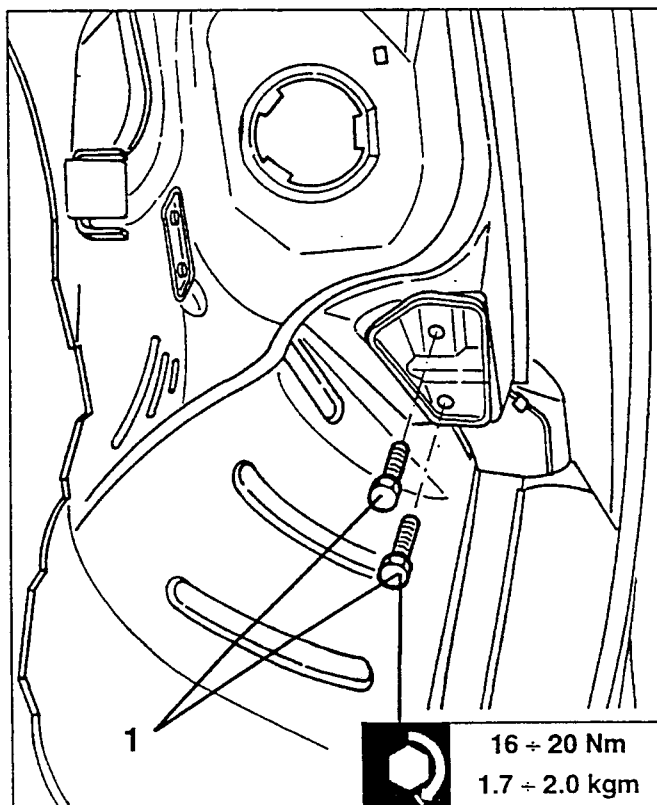
- If necessary adjust the bonnet as described in the relative paragraph.

### BONNET HINGES

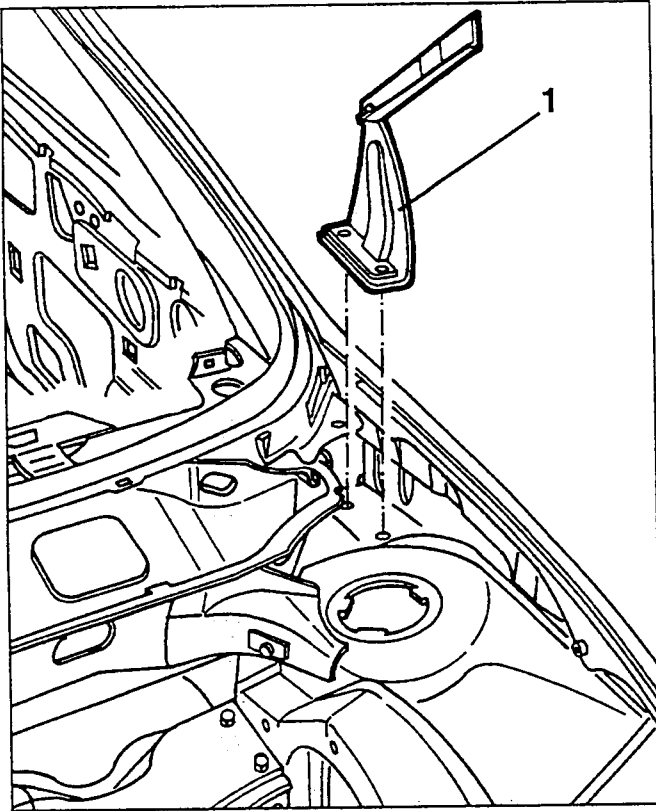
#### REMOVAL/REFITTING

- Remove the bonnet (see specific paragraph).

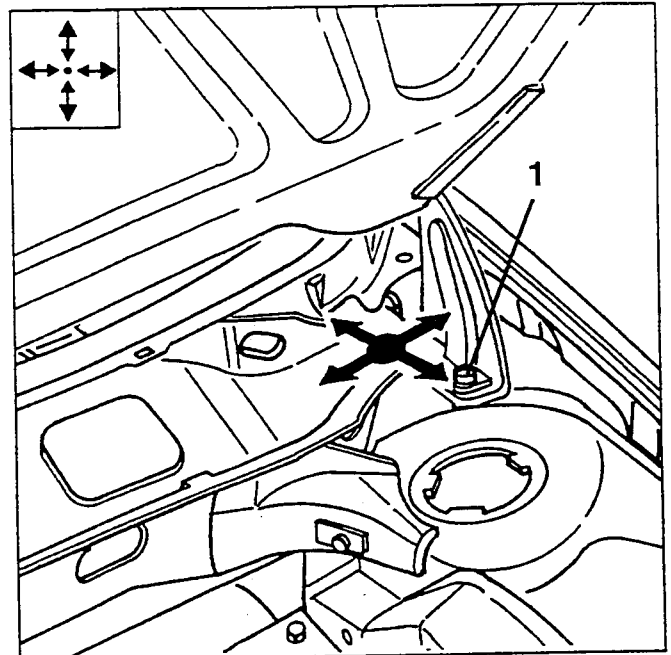
1. Working from the wheel housing, loosen the screws securing the hinge to the body.



1. Remove the hinge.



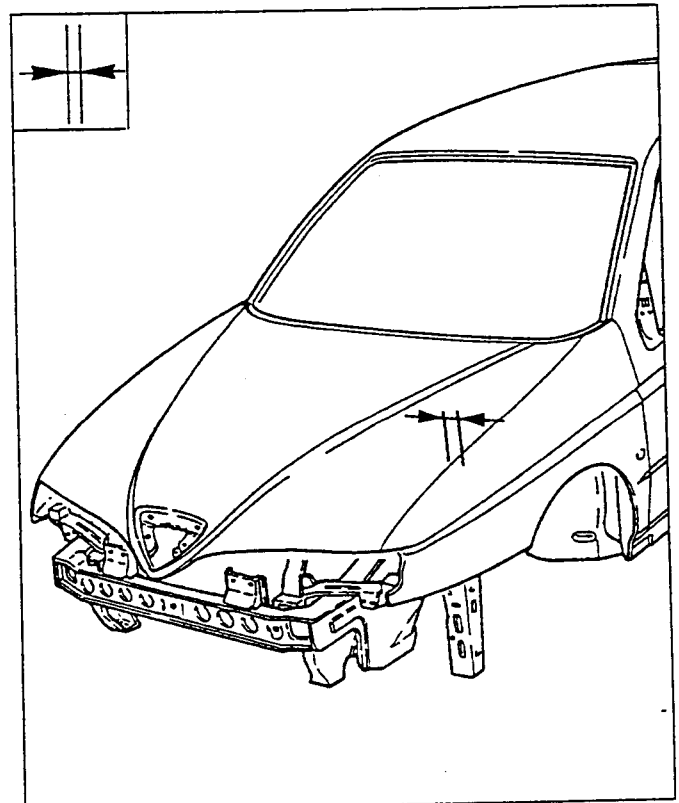
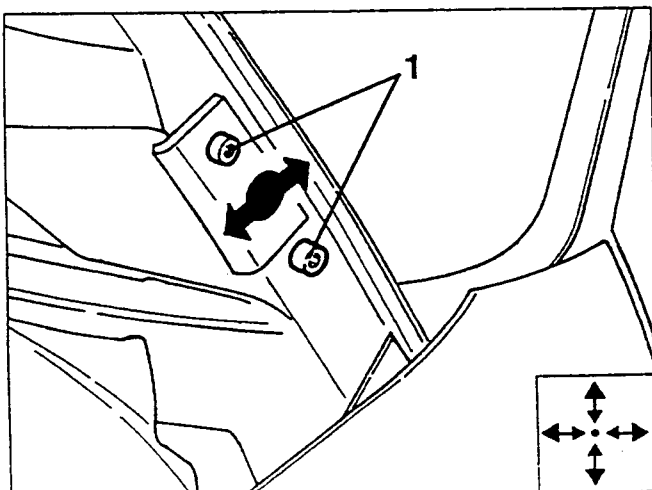
1. Adjust the bonnet longitudinally and laterally by adjusting the screws securing the hinges to the body checking the alignment of the gaps.



Refit the hinge by reversing the procedure followed for removal and adjust the bonnet as described in the relative paragraph.

## ADJUSTING BONNET AND HINGES

1. Adjust the bonnet for height by acting on the screws securing it to the hinge.



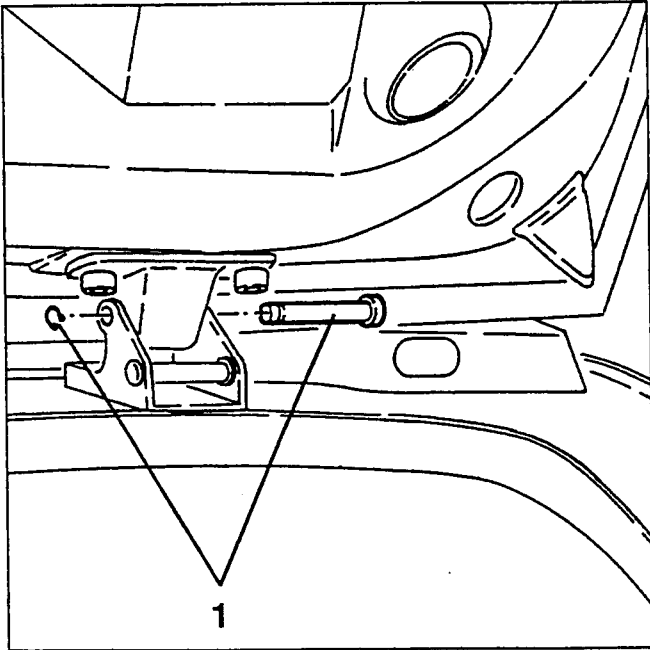
**NOTE:**  
To adjust the bonnet the closure adjustment pin and the anti-vibration buffers must be installed.

## BOOT AND HINGES

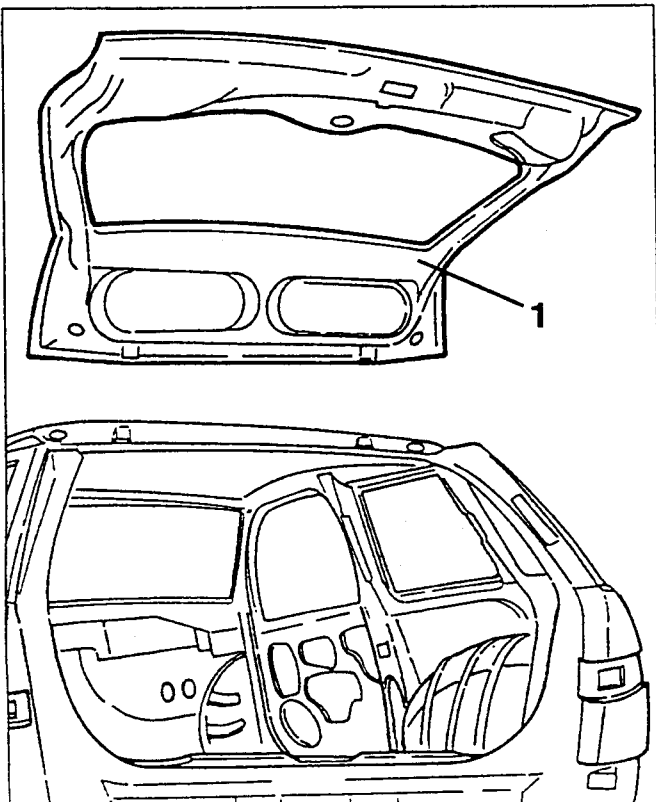
### REMOVAL/REFITTING

- Open and suitably support the boot.

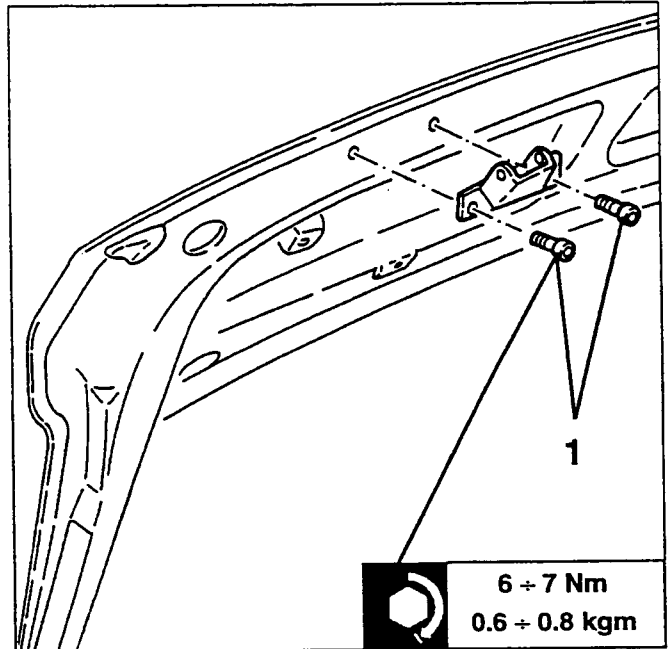
1. Remove the locking pin and withdraw the pins securing the hinge.



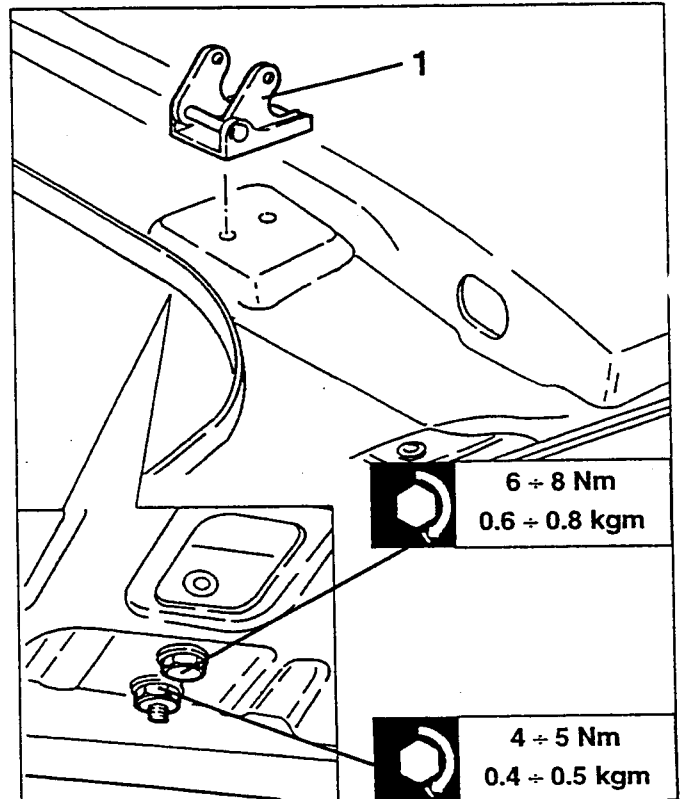
1. Remove the boot.



1. If necessary loosen the screws and remove the half-hinge from the boot.

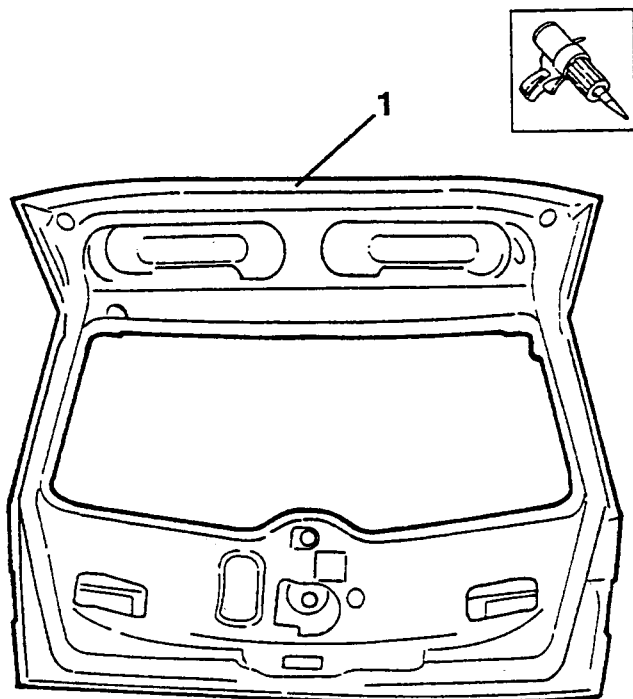


1. If necessary loosen the screws and nuts and remove the half-hinge from the body.



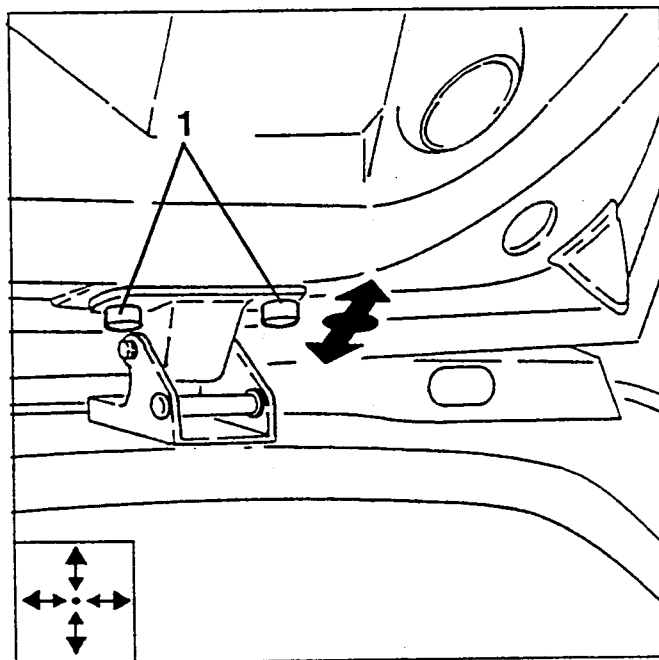
Refit the boot by reversing the procedure followed for removal and carry out the following:

1. If a new boot is being used apply the specified sealant along the internal edge of the boot before painting it.

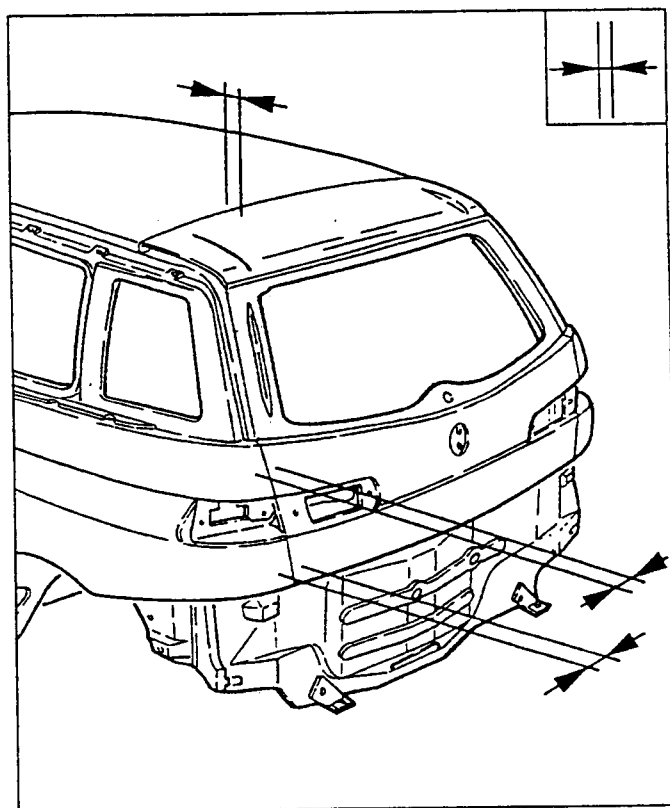
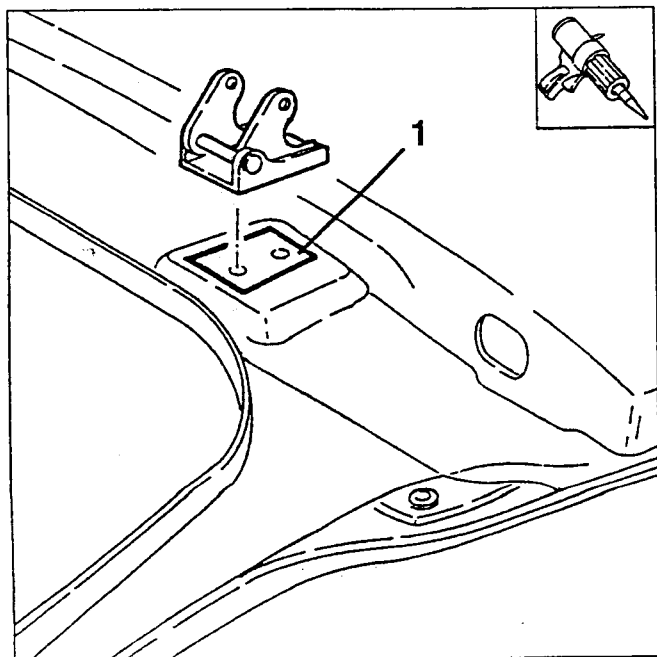


## ADJUSTING THE BOOT

1. Adjust the boot longitudinally by acting on the screws securing it to the hinge and check the alignment of the gaps.



1. Apply the specified sealant when installing between the boot hinge and the body.

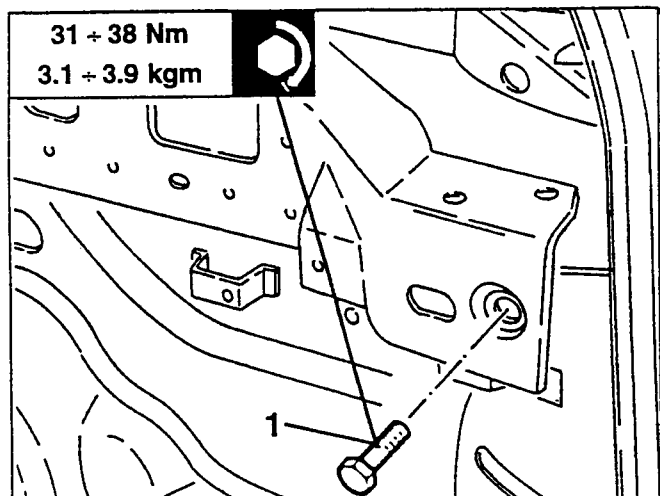


**NOTE:**  
To adjust the boot correctly the gaskets, locks and telescopic support must be fitted.

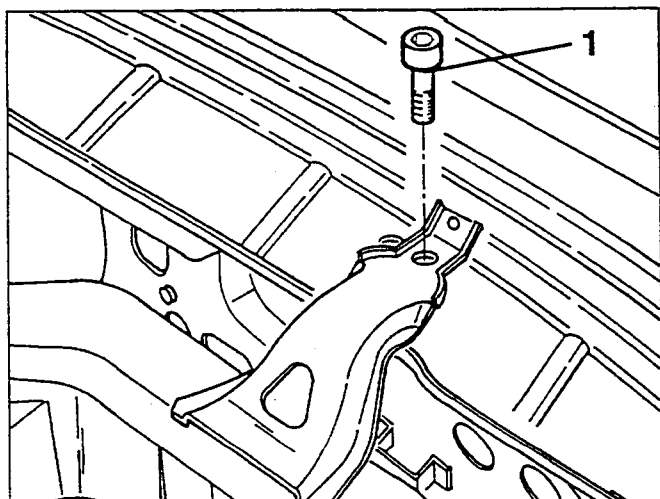
## DASHBOARD SUPPORT CROSSMEMBER

### REMOVAL/REFITTING

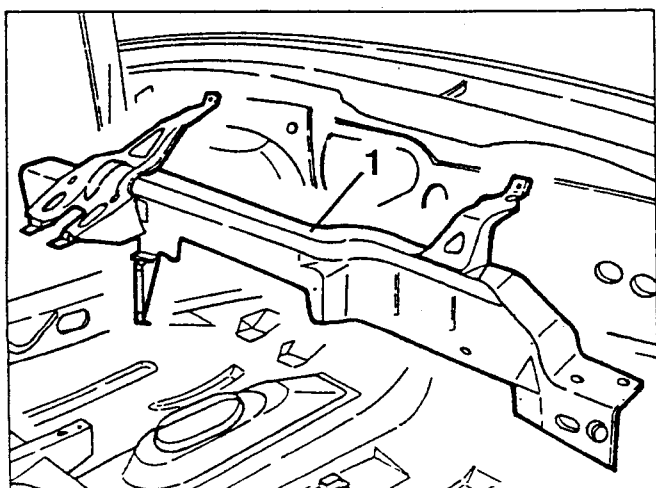
1. Loosen the two side screws securing the dashboard support crossmember.



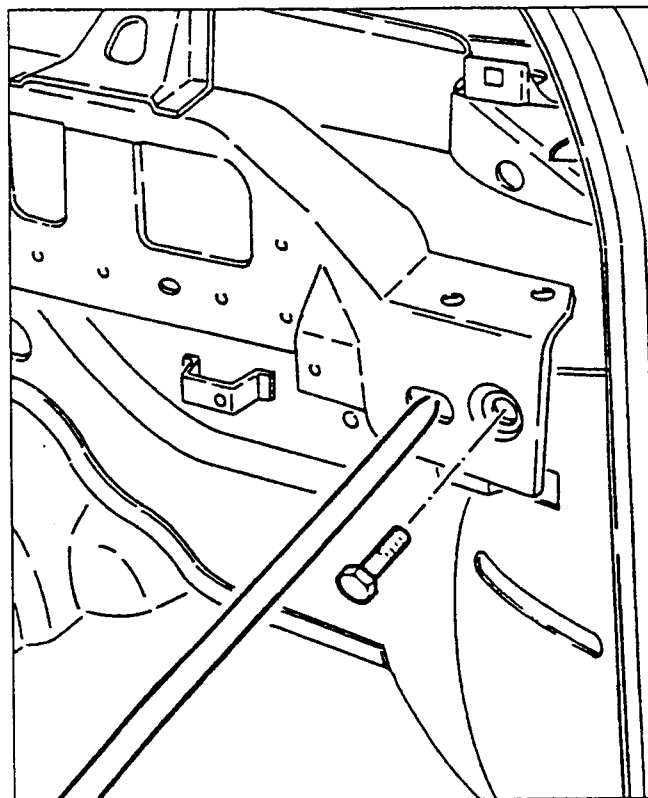
1. Loosen the two upper screws securing the dashboard support crossmember.



1. Remove the dashboard support crossmember.



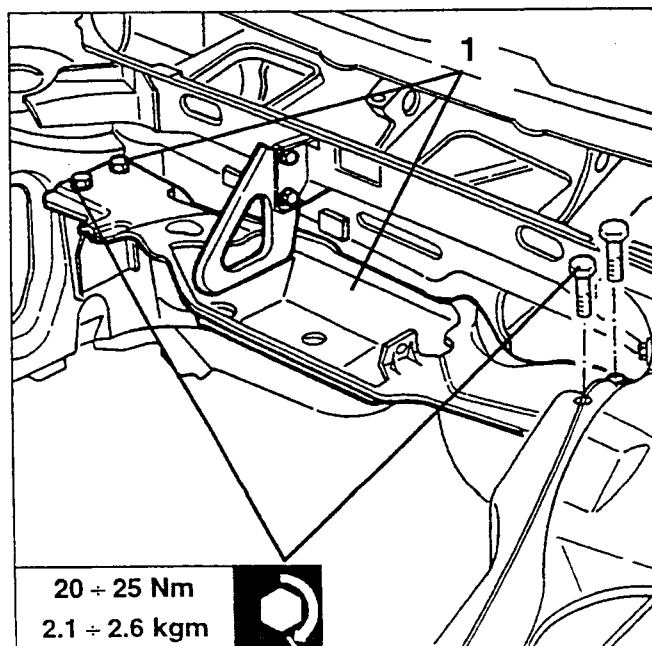
When refitting, before tightening the screws securing the crossmember, position the centering pin in its slot.



## BATTERY SUPPORT CROSSMEMBER (Only for Boxer versions)

### REMOVAL/REFITTING

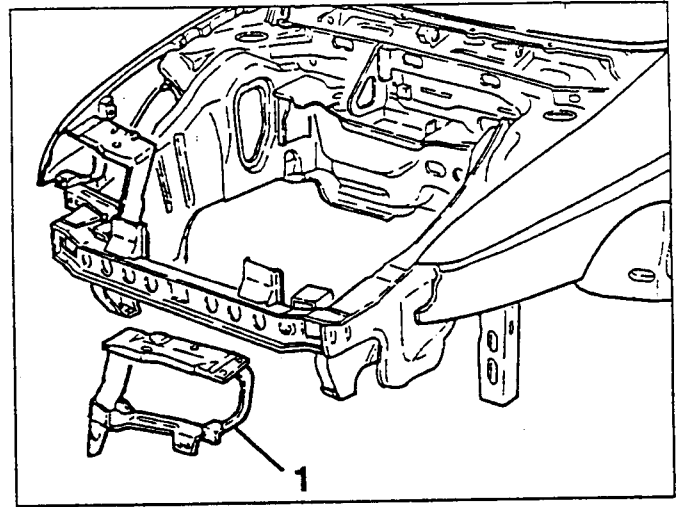
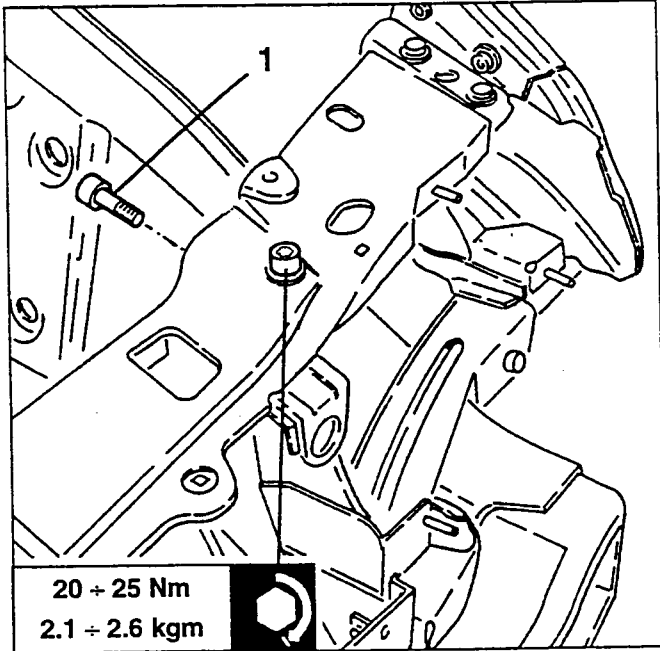
1. Loosen the six screws and remove the battery support crossmember.



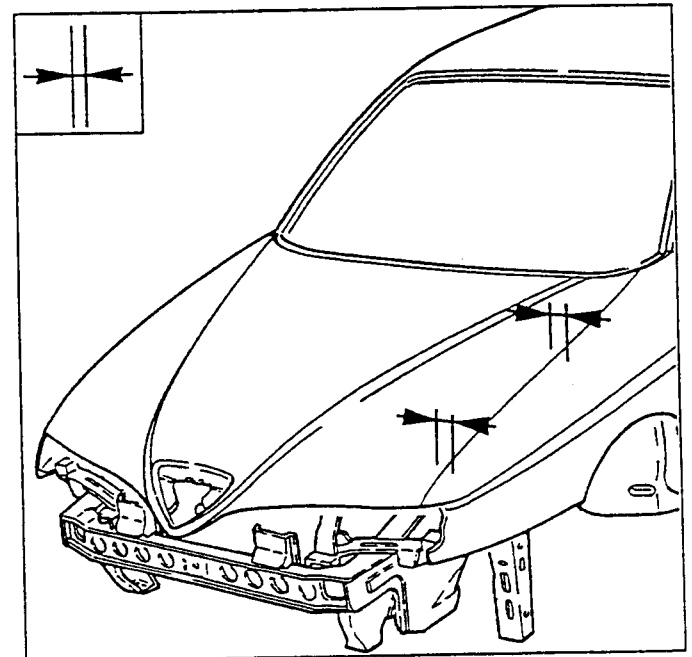
## HEADLIGHT CROSSRAIL AND FRAME

### REMOVAL/REFITTING

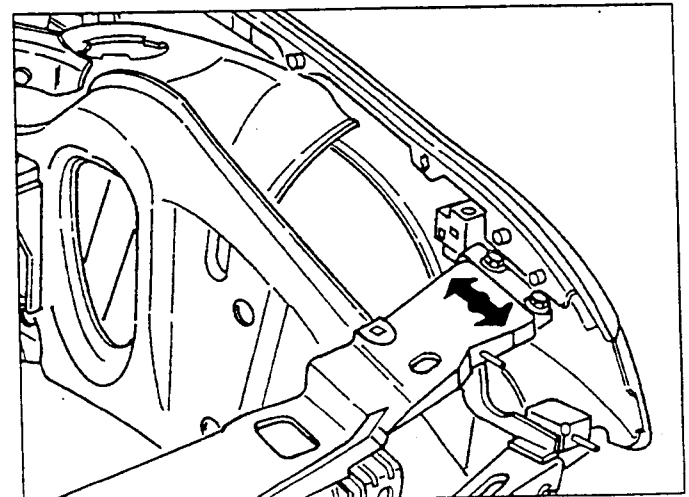
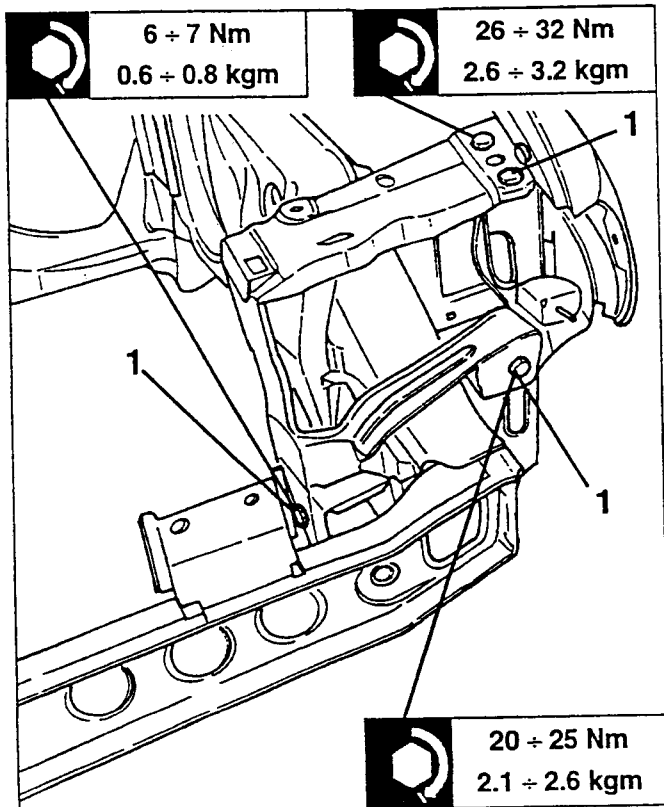
1. Loosen the side screws securing the crossrail.



When refitting position the headlight frame and check the alignment and gaps between the bonnet and wing and adjusting the screws indicated in the diagram if necessary.



1. Loosen the screws securing the headlight frame.

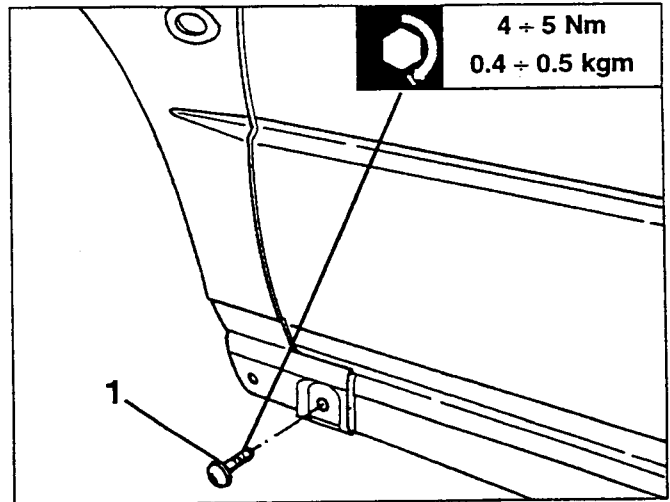
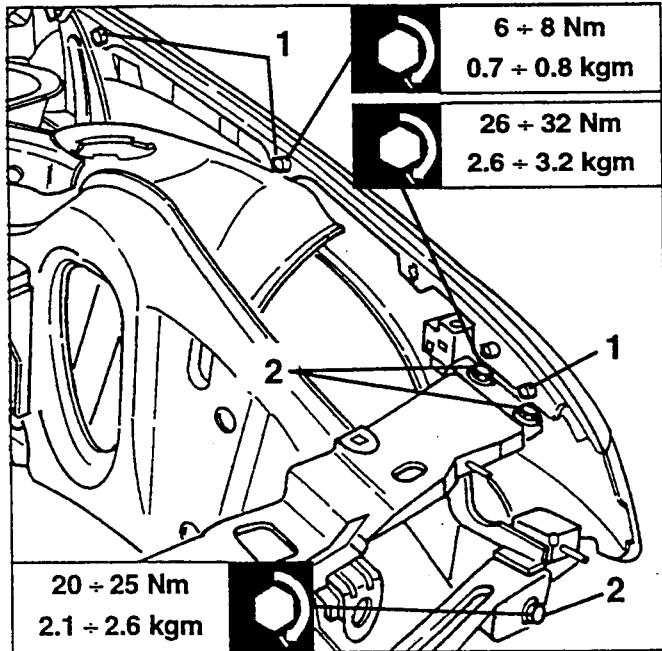


1. Remove the headlight frame.

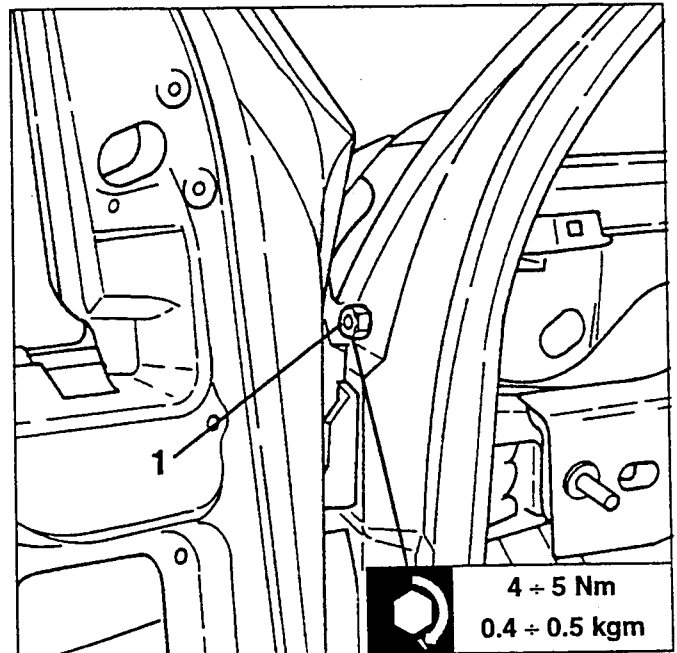


## FRONT WING

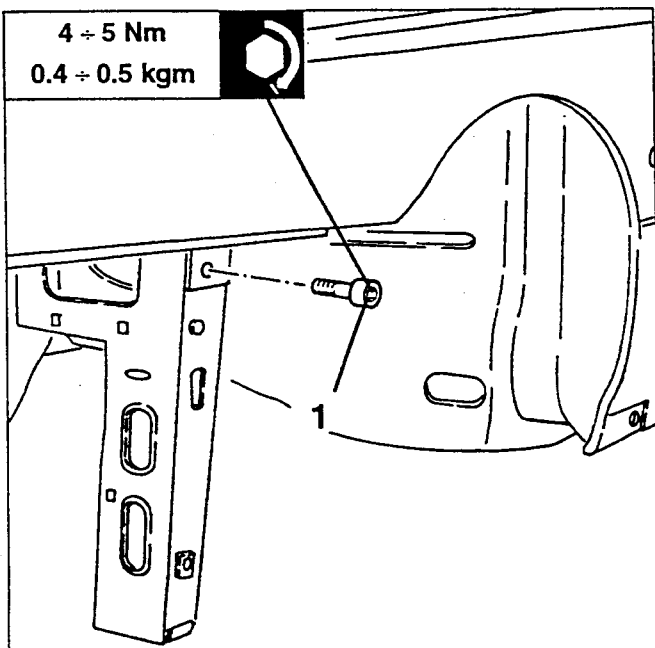
1. Loosen the four screws securing the wing to the upper panel.
2. Loosen the three screws securing the wing to the headlight frame.



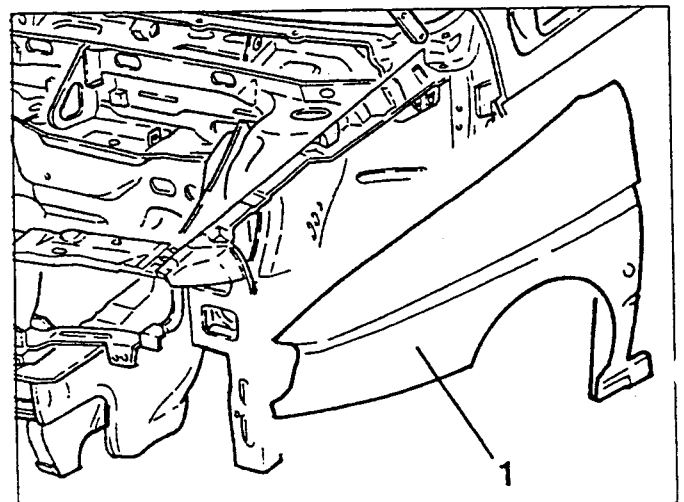
1. Loosen the nut securing the wing to the side panel.



1. Loosen the screw securing the wing to the lateral shelf.



1. Cut the sealant and remove the front wing.

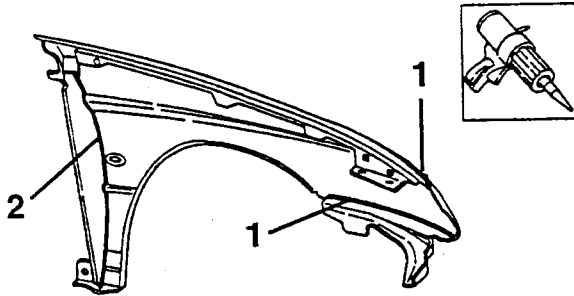


1. Loosen the screw securing the wing to the door sill.

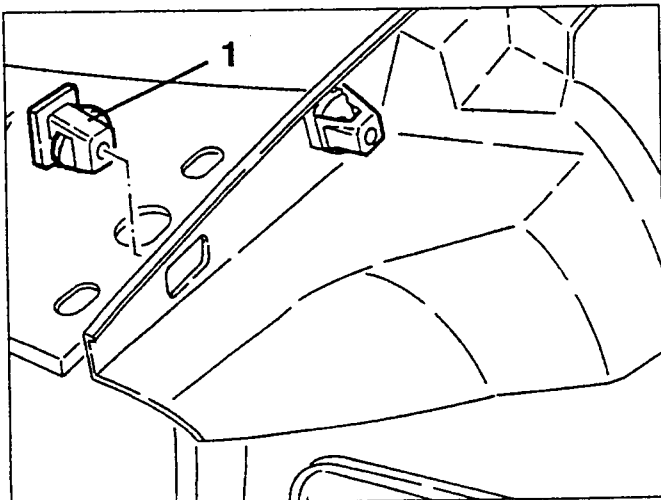
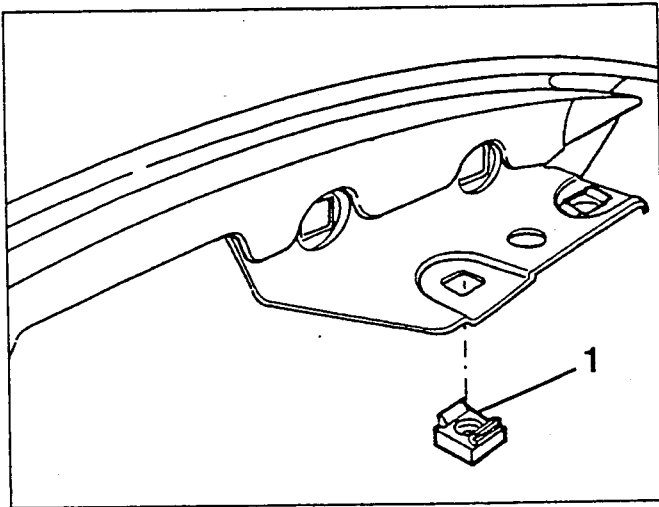


Refit the front wing by reversing the procedure followed for removal and note the following.

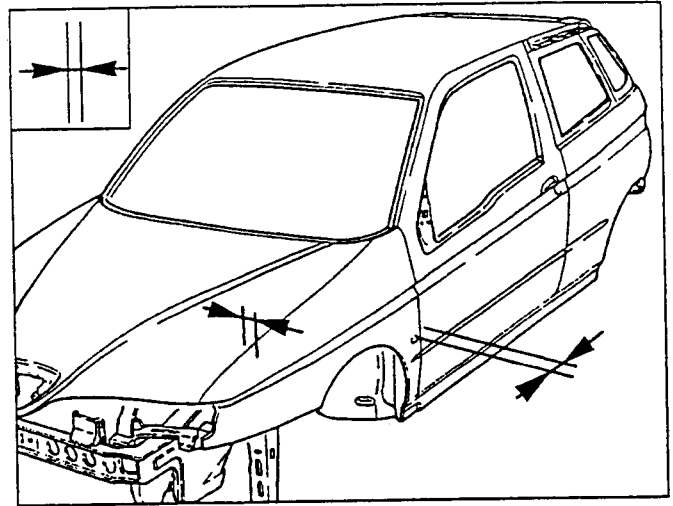
1. If a new front wing is being used, apply the specified sealant along the lines shown in the diagram before fitting.
2. Once the wing has been fitted apply the specified sealant along the lines indicated in the diagram.



1. Inspect the blocks and nuts for damage and replace if necessary.



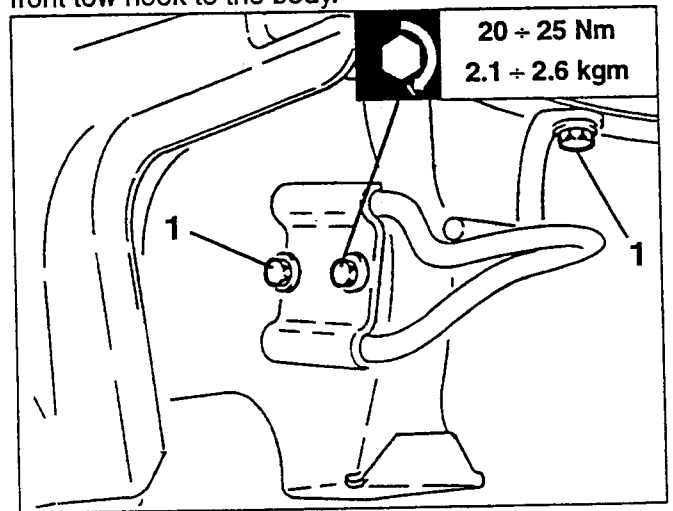
- Check the alignment and gaps between the front wing and the bonnet and door.



## FRONT TOW HOOK

### REMOVAL/REFITTING

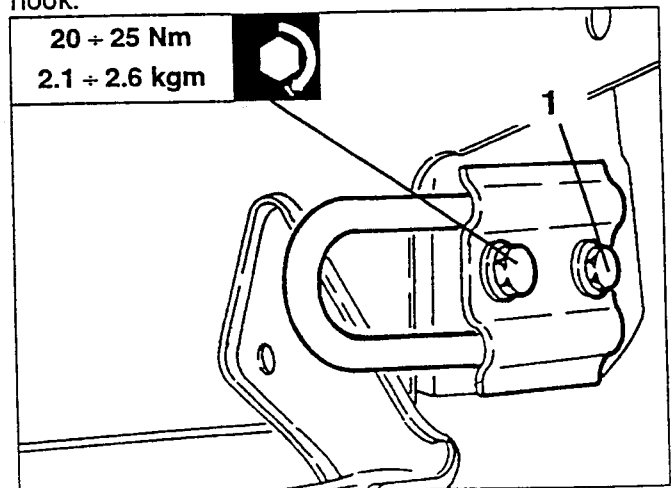
1. Loosen the three screws securing and remove the front tow hook to the body.



## REAR TOW HOOK

### REMOVAL/REFITTING

1. Loosen the two screws and remove the rear tow hook.



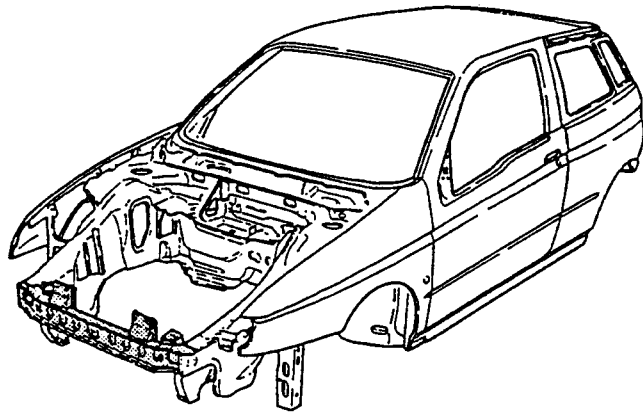
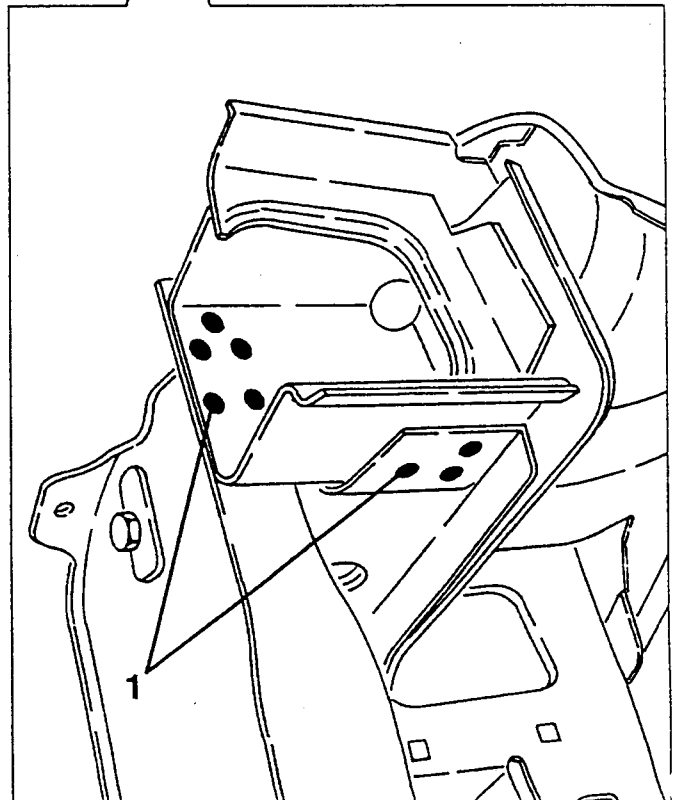
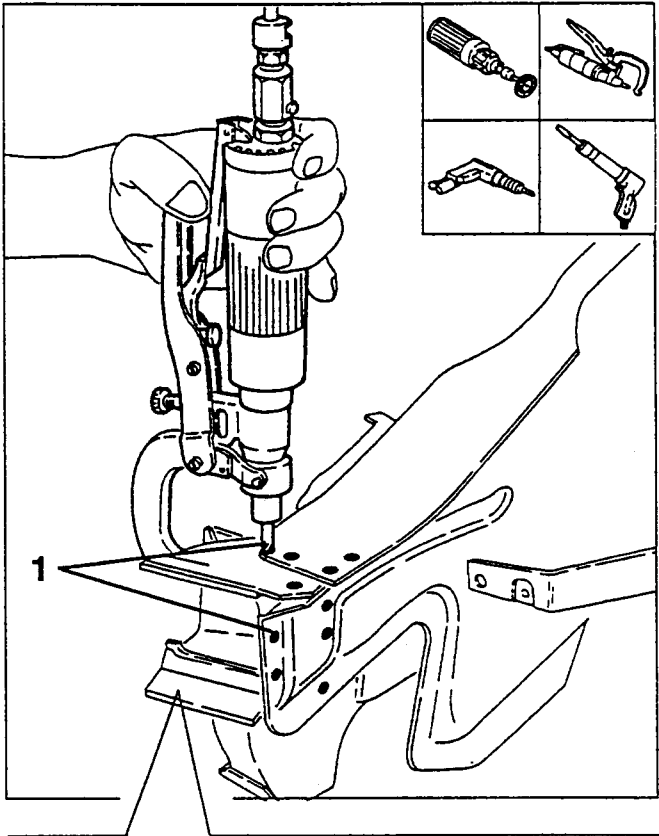
### FRONT CROSSMEMBER

#### PRELIMINARY OPERATIONS

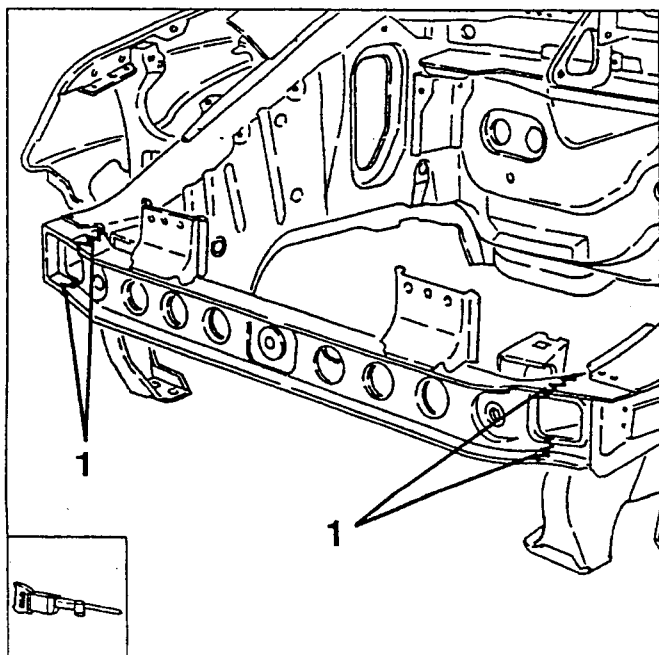
- Disconnect the negative (-) cable from the battery and remove the control units.
- Remove the trim components, electrical and mechanical systems which could hinder the repair operations or get damaged during work (see specific paragraphs).
- Remove the following sheet metal parts:
  - radiator upper crossmember (see specific paragraph).
  - headlight housing frame (see specific paragraph).

#### REMOVAL

- Using a rotating brush, clean the areas to be spot-cut to show up the welding points.
- 1. Using a chamfering machine, remove the accessible welding points, remove the remaining welding points using a drill or a chisel.



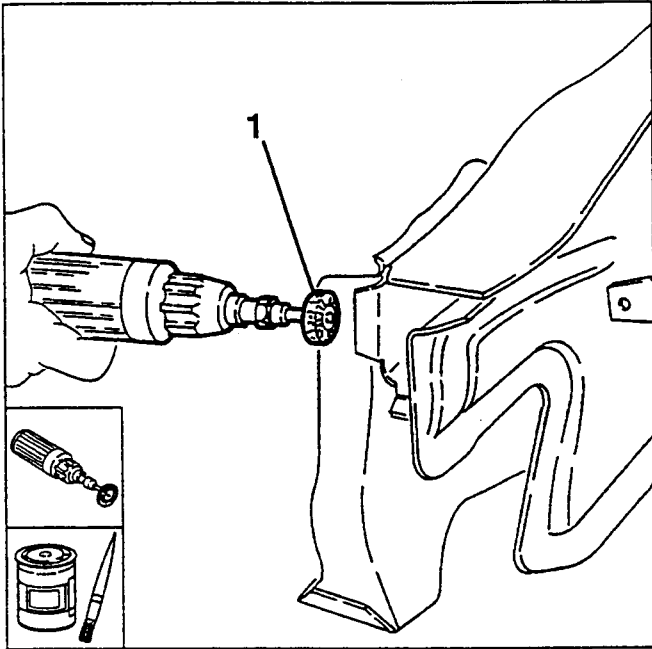
- 1. Using a jig saw, cut following the lines shown in the diagram and remove the front crossmember.



- Remove the side pieces from the front crossmember.

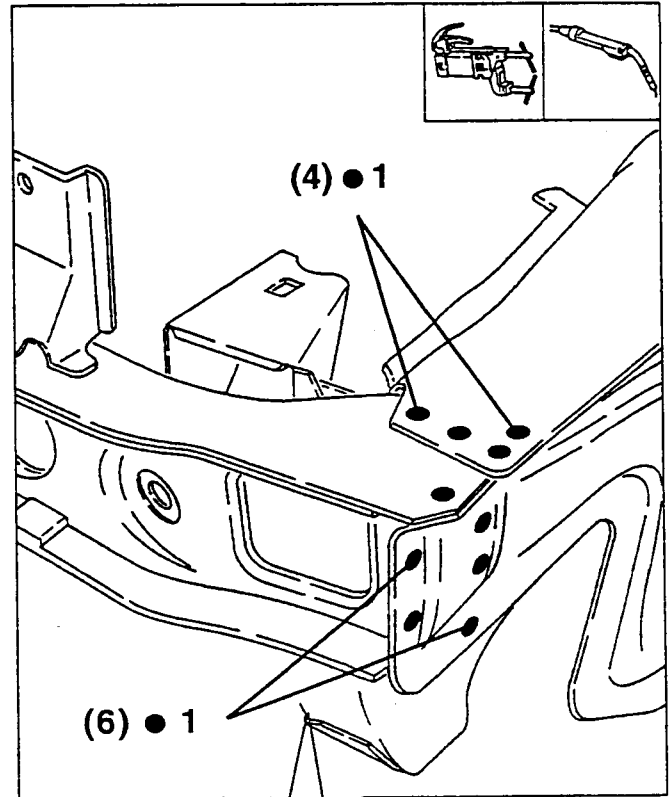
## PREPARATION

- Using a rotating brush, clean the areas which are to be spot welded.
- Apply the specified electroweldable protection product to the areas to be welded.



## WELDING AND FINISHING OF THE SHEET METAL

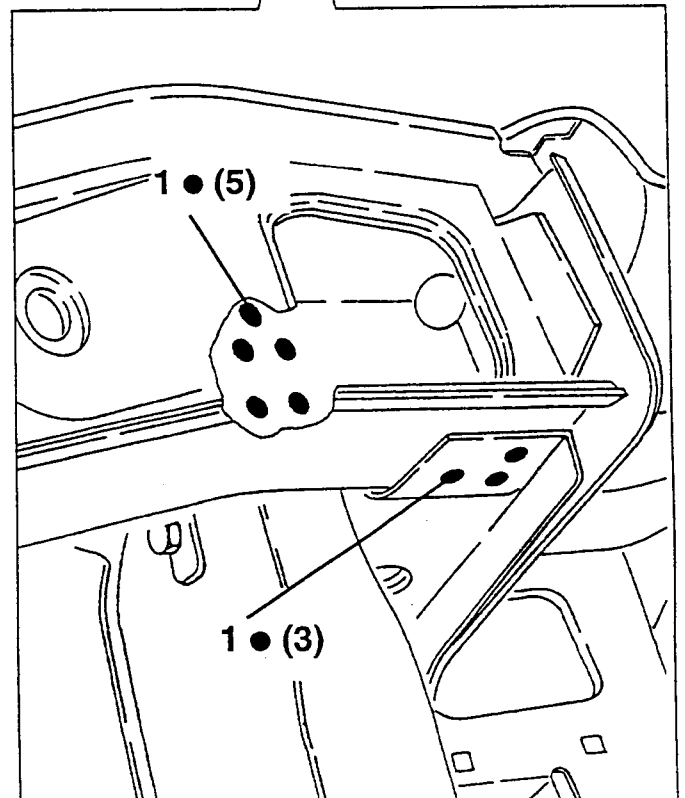
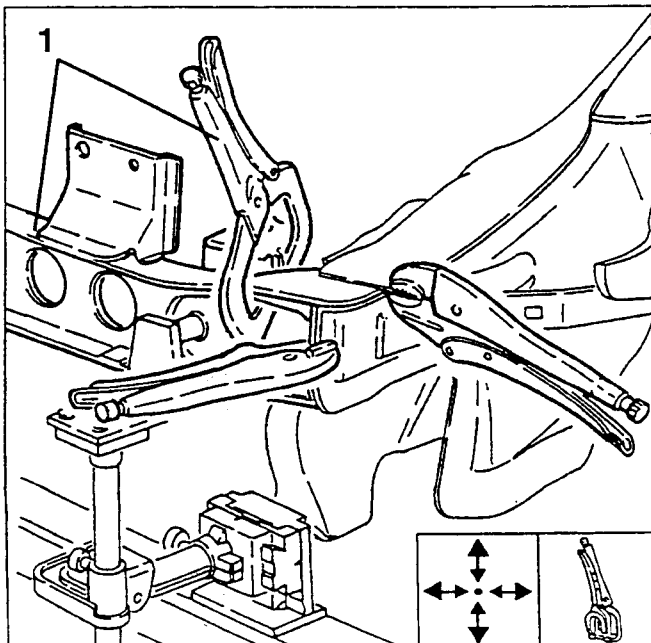
- Using a spot-welder or, where necessary, a MIG welder, proceed as shown in the diagram.



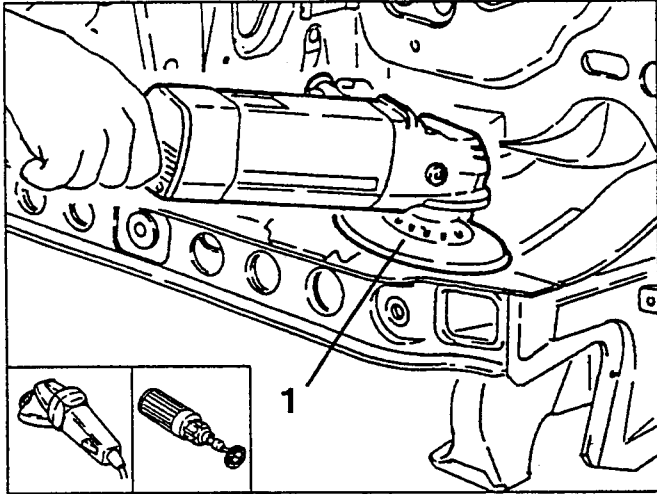
## POSITIONING

- Position the new crossmember by mating the edges to be welded and securing them with clamps.

**NOTE:**  
Use a jig if necessary.



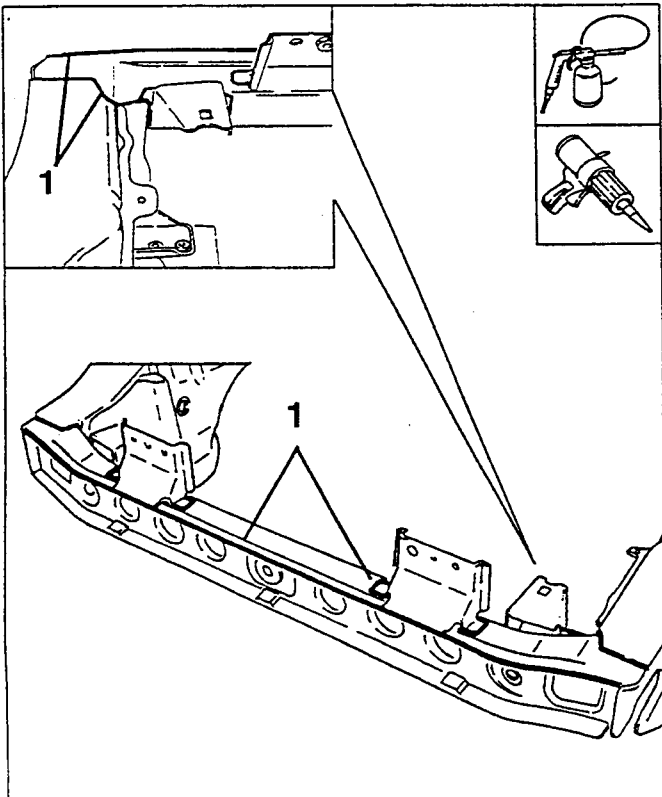
- Using an abrasive grinding machine, remove and flush the residues left after welding.
- Using a rotating brush, clean the welded areas.



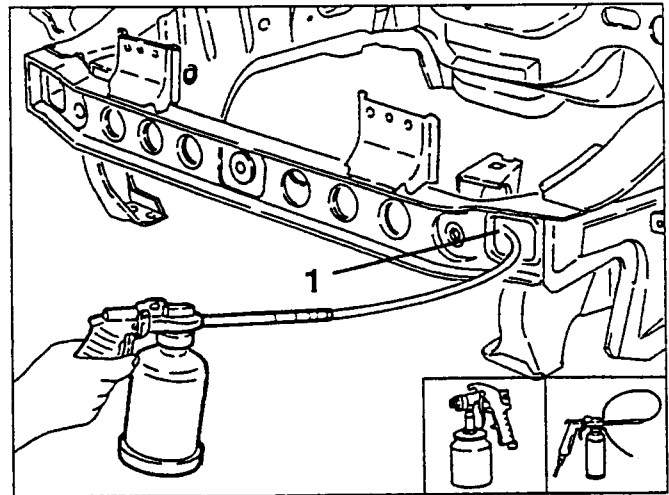
- Check that the components are correctly positioned after welding.

### PROTECTION

- Apply the specified corrosion inhibitor to the areas which have been MIG welded.
- Apply the specified sealant along the lines highlighted in the diagram.



- Proceed to the painting phase.
- Wax-treat the boxed parts.



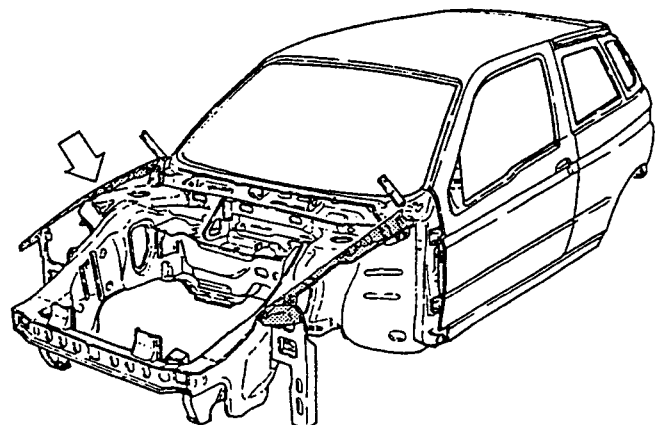
- Refit the components removed by reversing the procedure followed for removal.

## UPPER PANEL

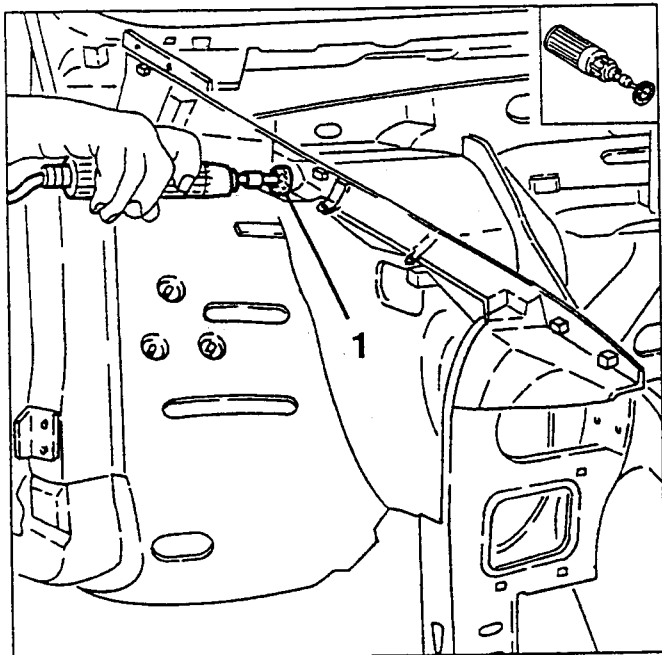
### PRELIMINARY OPERATIONS

- Disconnect the negative (-) cable from the battery and remove the control units.
- Remove the trim components, electrical and mechanical systems which could hinder the repair operations or get damaged during work (see specific paragraphs).
- Remove the following sheet metal parts:
  - upper radiator crossmember (see specific paragraph).
  - headlight housing frame on affected side (see specific paragraph).
  - front wing on affected side (see specific paragraph).

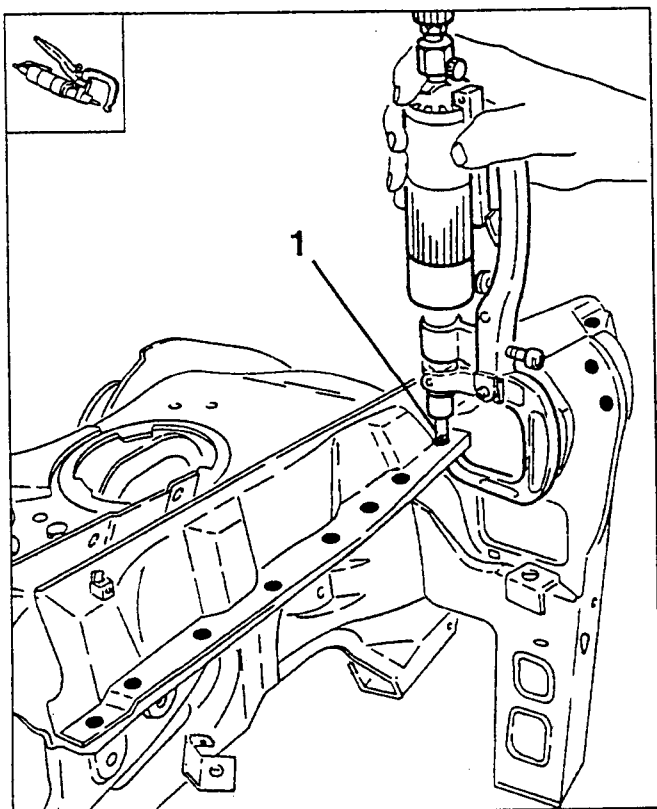
### REMOVAL



1. Using a rotating brush, clean the areas to be spot-cut to show up the welding points.



1. Using a chamfering machine, remove the welding points.

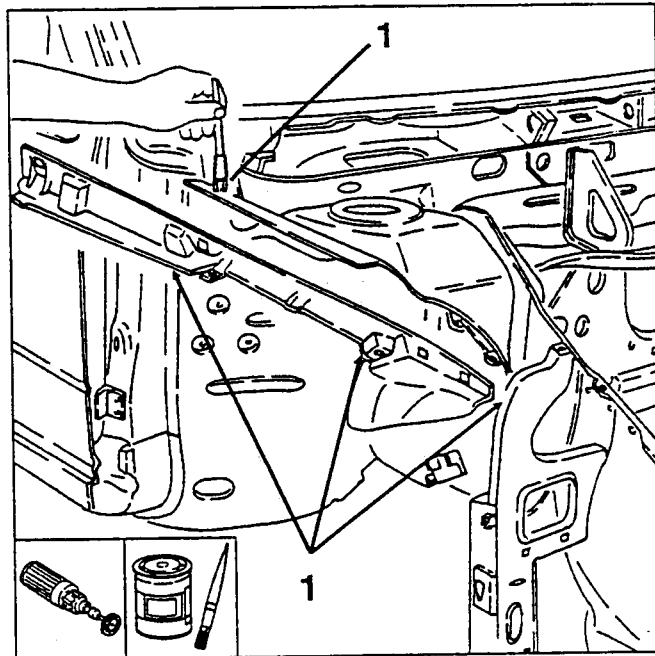


- Remove the upper panel and if necessary cut away the sealant.

## PREPARATION

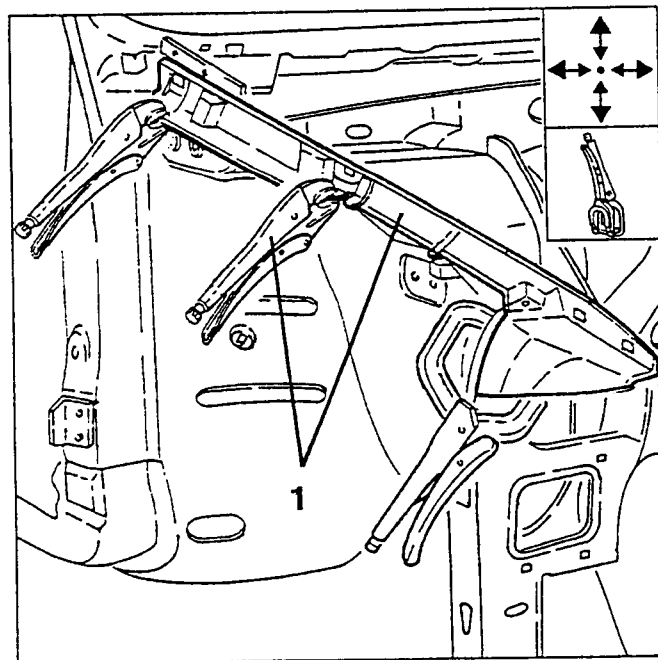
- Using a rotating brush, clean the areas which are to be welded.

1. Apply the specified electroweldable protection product to the areas to be spot-welded.



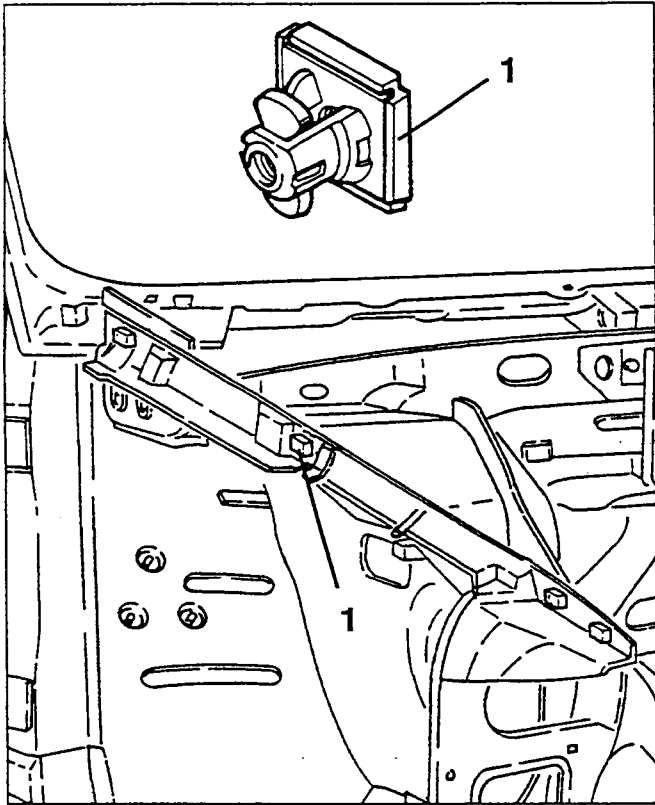
## POSITIONING AND INSPECTION

1. Position the new upper panel joining together the edges to be welded and securing them with clamps.

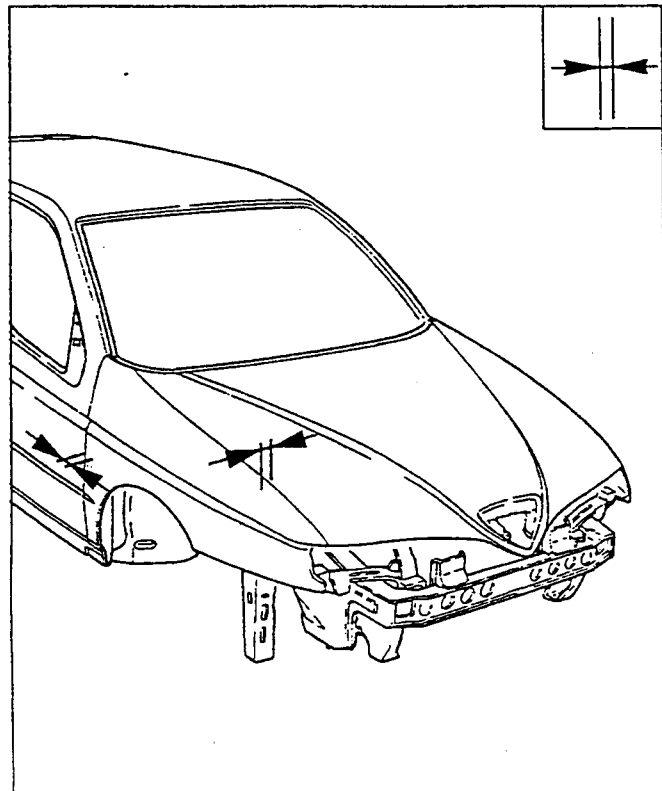


- Using screws temporarily fix the upper panel to the body.

1. Install the four blocks securing the front wing.



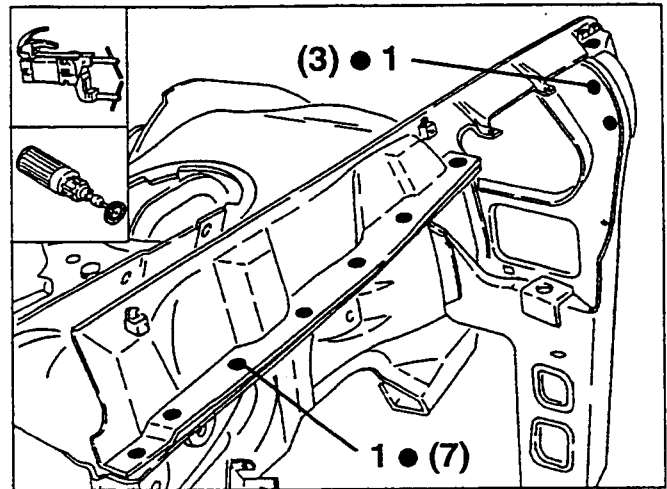
- Check parallelism, gaps and angles and refit the previously removed mobile components with their gaskets together with any parts which, once installed, make it possible to check the successful outcome of the operations.



## WELDING AND FINISHING OF THE SHEET METAL

1. Using a spot-welder, proceed as shown in the diagram.

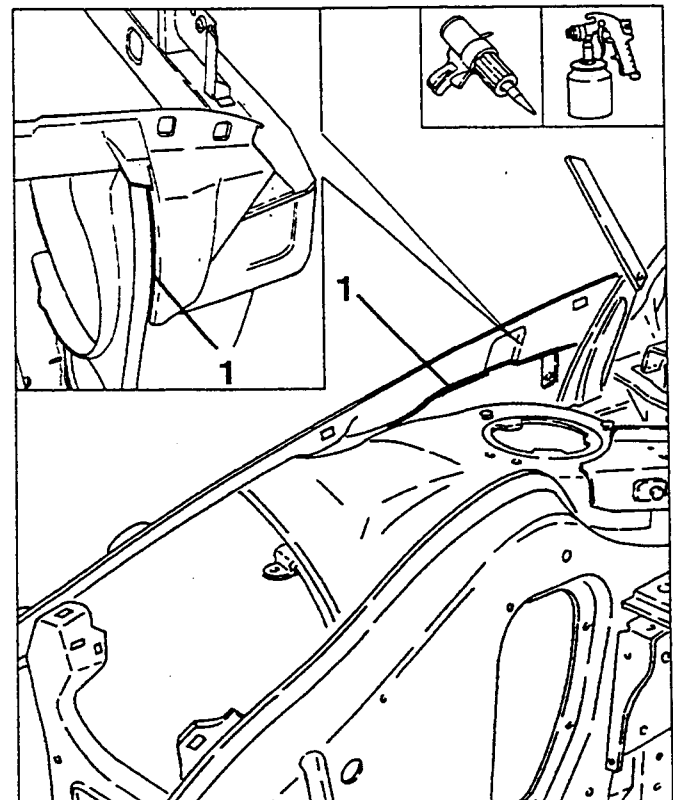
- Using a rotating brush, clean the welded areas.



## PROTECTION

1. Apply the specified sealant along the lines highlighted in the diagram.

- Proceed to the painting phase.



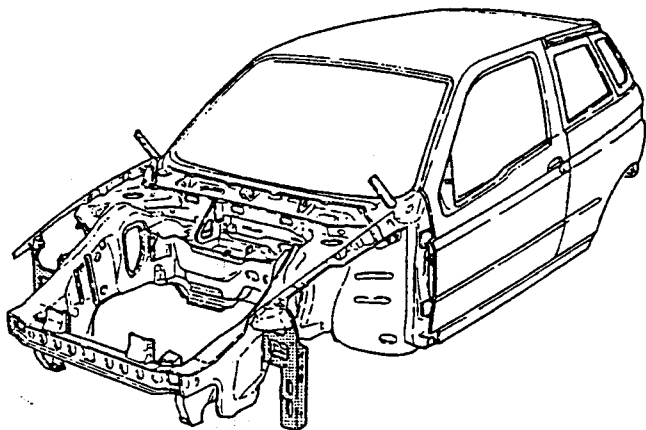
- Complete the refitting operation by reversing the procedure followed for removal and ensure that the gaps between the wing and the bonnet and the wing and the door are correctly adjusted.

### SIDE PANEL

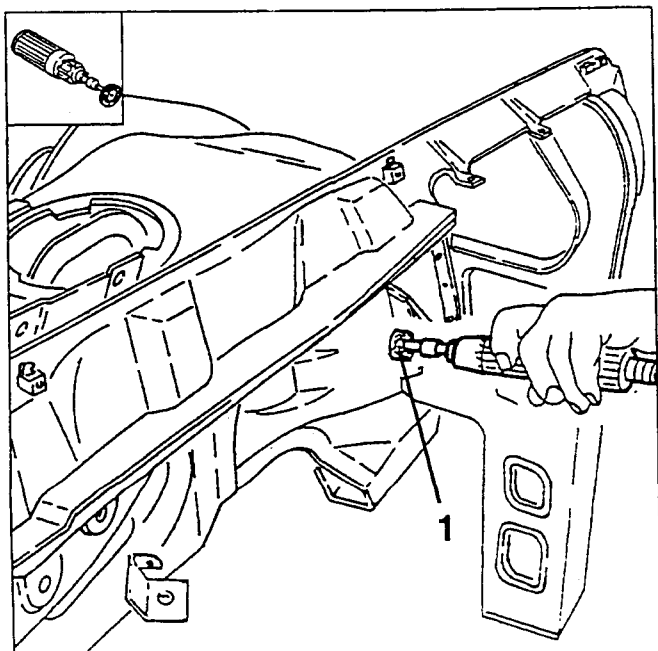
#### PRELIMINARY OPERATIONS

- Disconnect the negative (-) cable from the battery and remove the control units.
- Remove the trim components, electrical and mechanical systems which could hinder the repair operations or get damaged during work (see specific paragraphs).
- Remove the following sheet metal parts:
  - upper radiator crossmember (see specific paragraph).
  - headlight housing frame on affected side (see specific paragraph).
  - front wing on affected side (see specific paragraph).

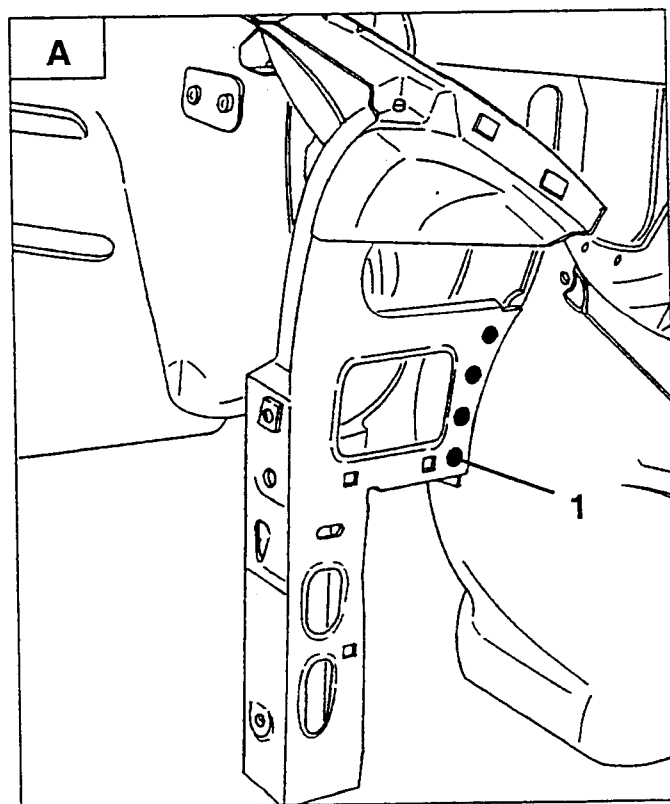
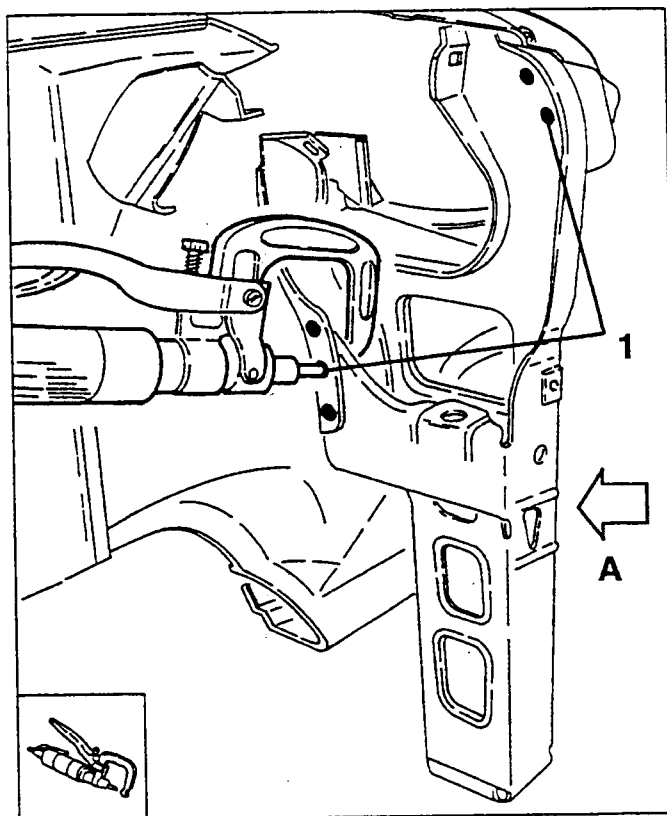
#### REMOVAL



1. Using a rotating brush, clean the areas to be spot-cut to show up the welding points.



1. Using a chamfering machine, remove the welding points.

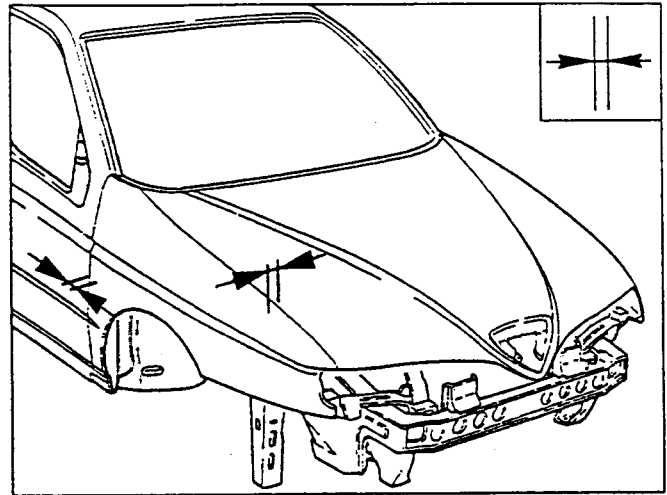
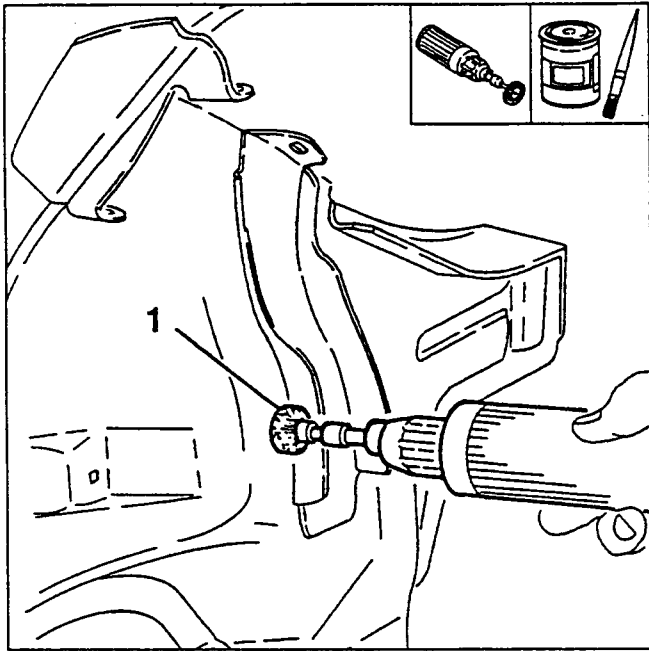


- Remove the side panel and where necessary cut away the sealant.



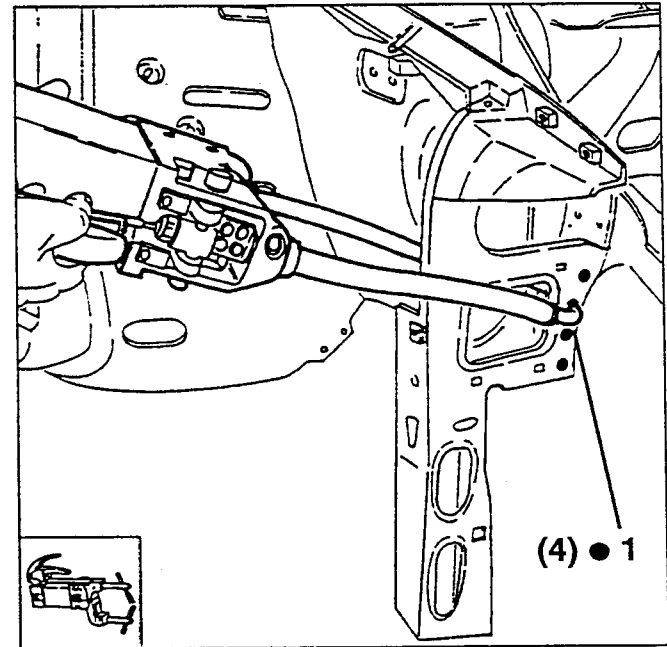
## PREPARATION

- Using a rotating brush, clean the areas which are to be welded .
- Apply the specified electroweldable protection product to the areas to be spot-welded.



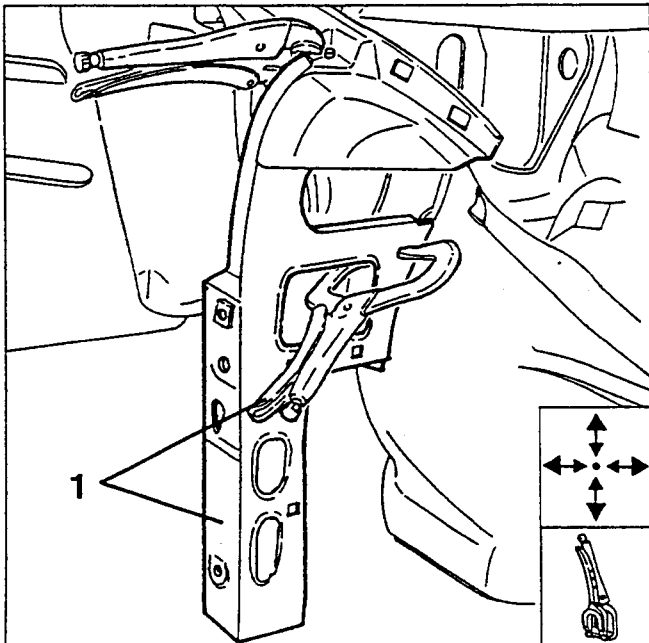
## WELDING AND FINISHING OF THE SHEET METAL

- Using a spot-welder, proceed as shown in the diagram.

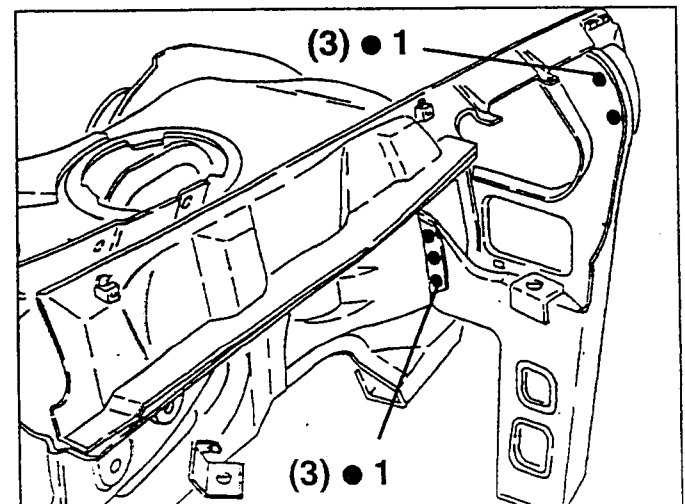


## POSITIONING AND INSPECTION

- Position the new side panel joining together the edges to be welded and secure it with clamps.

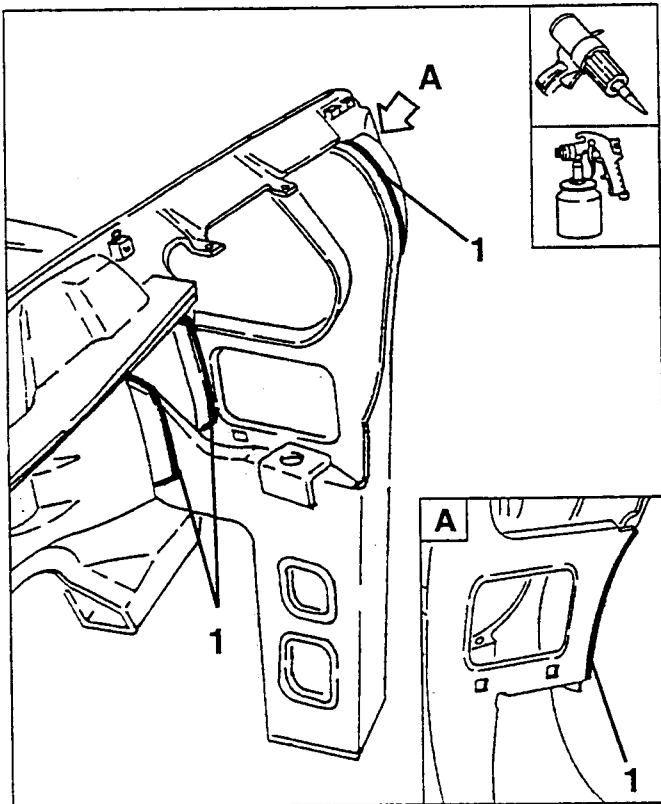


- Check parallelism, gaps and angles and refit the previously removed mobile components with their gaskets together with any parts which, once installed, make it possible to check the successful outcome of the operations.



**PROTECTION**

1. Apply the specified sealant along the lines highlighted in the diagram.
- Proceed to the painting phase.

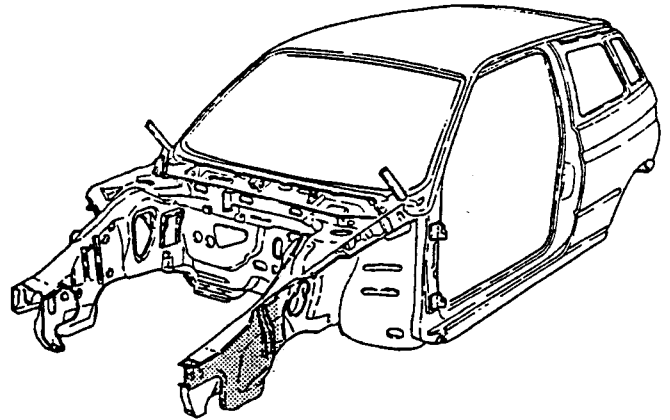


- Refit the components removed by reversing the procedure followed for removal.

## FRONT SIDE PANEL - EXTERNAL PART (Boxer versions)

**PRELIMINARY OPERATIONS**

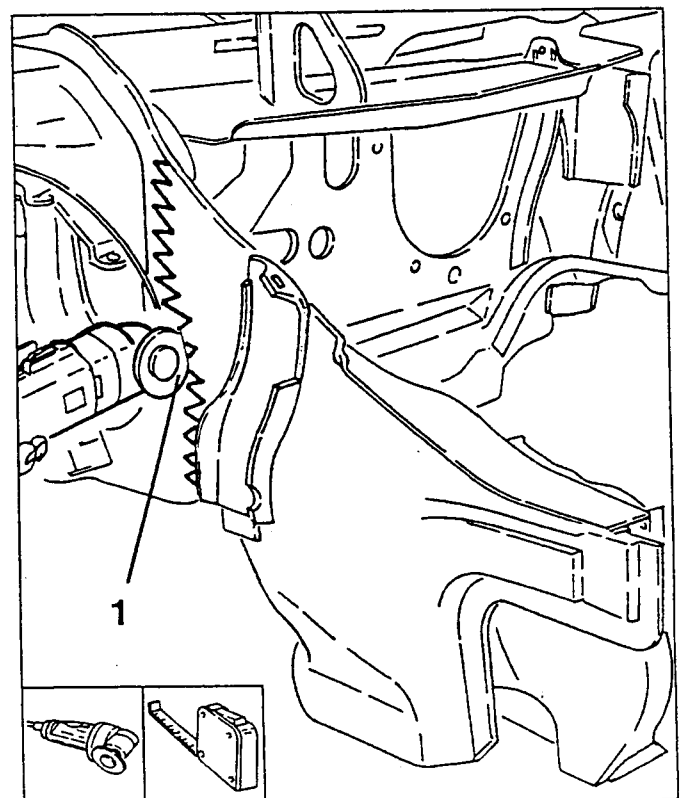
- Disconnect the negative (-) cable from the battery and remove the control units.
- Remove the trim components, electrical and mechanical systems which could hinder the repair operations or get damaged during work (see specific paragraphs).
- Remove the following sheet metal parts:
  - upper radiator crossmember (see specific paragraph).
  - headlight housing frame (see specific paragraph).
  - front wing on affected side (see specific paragraph).
  - front crossmember, if necessary (see specific paragraph).
  - upper panel on affected side (see specific paragraph).
  - side panel on affected side (see specific paragraph).

**REMOVAL**

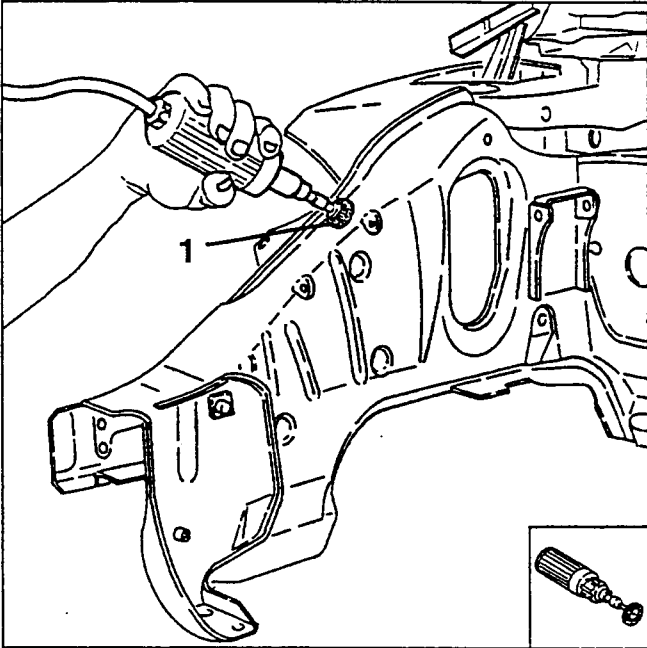
1. Using a circular saw, cut the external front side panel along the lines indicated in the diagram without damaging the underlying parts.

**NOTE:**

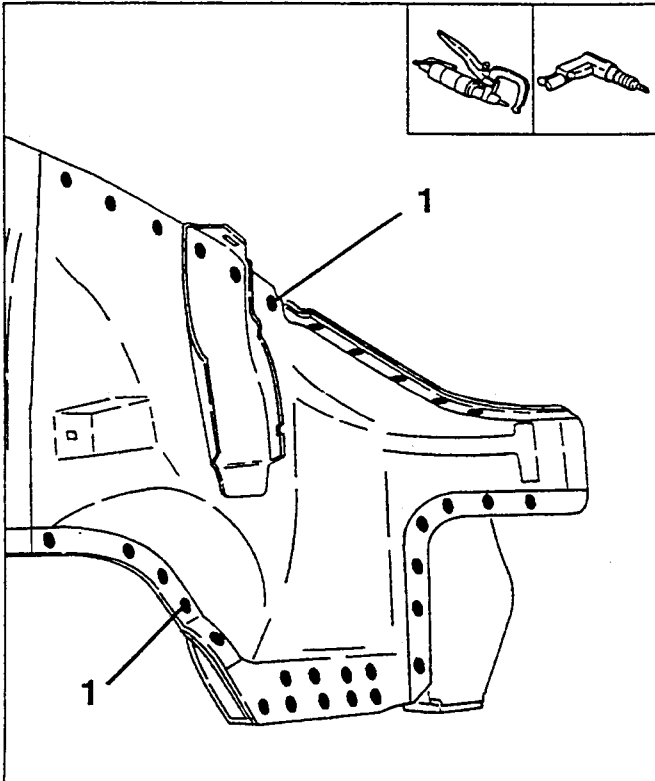
The cut on the side panel must be about 50 mm from the front suspension attachment pillar.



1. Using a rotating brush, clean the areas to be spot-cut to show up the welding points.



1. Using a chamfering machine, remove the accessible welding points; remove the remaining welding points using a drill.

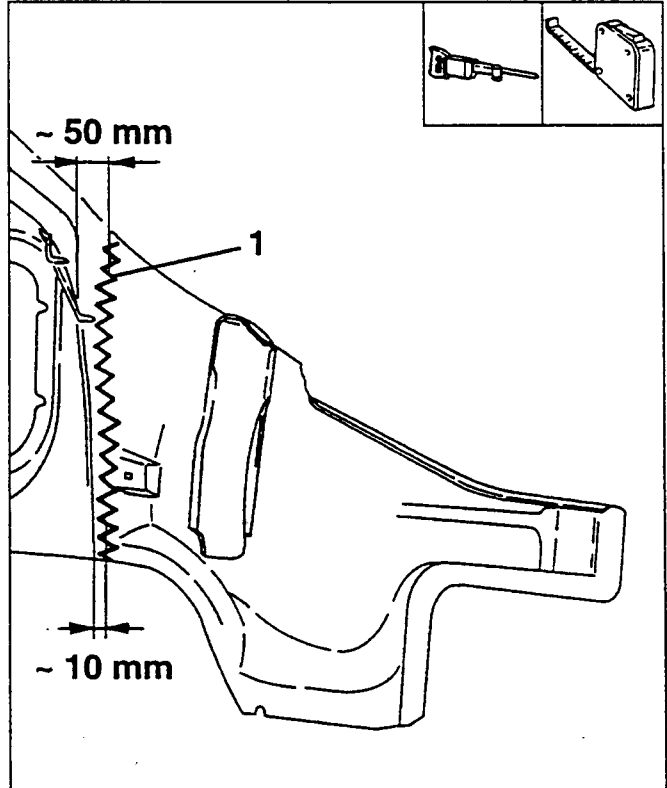


- Remove the partial front outer side panel, if necessary cutting away the sealant.

### PREPARATION

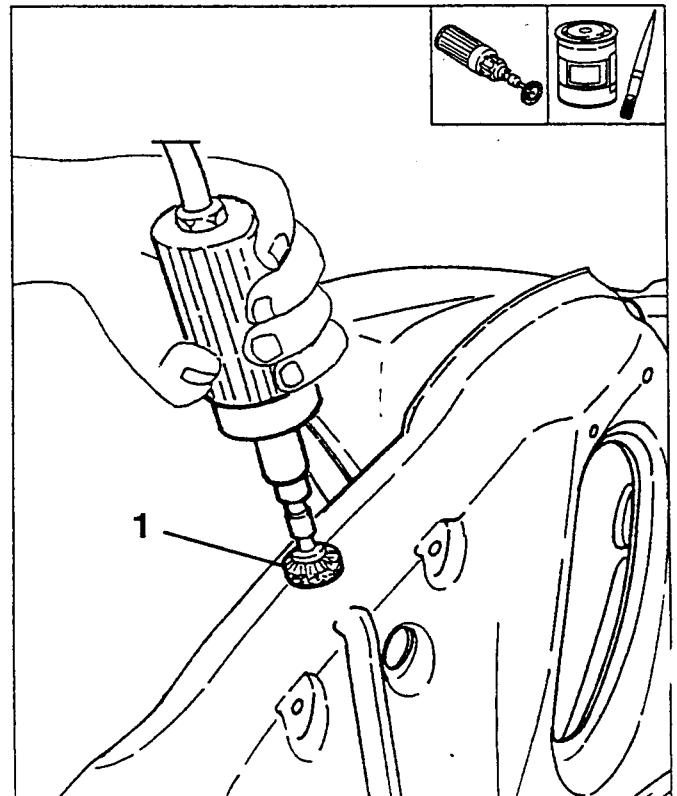
1. Working on a bench and using a jig saw cut the new

outer side panel to the dimensions indicated in the diagram in order to maintain the correct overlapping tolerances.



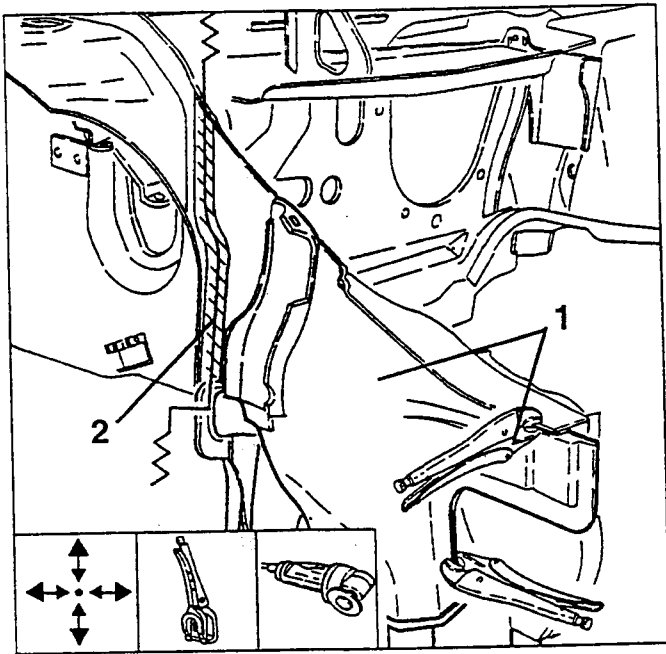
1. Using a rotating brush, clean the outer edge of the inner and outer side panels on both sides of the sheet metal.

- Apply the specified electroweldable protection product to the areas to be spot-welded.

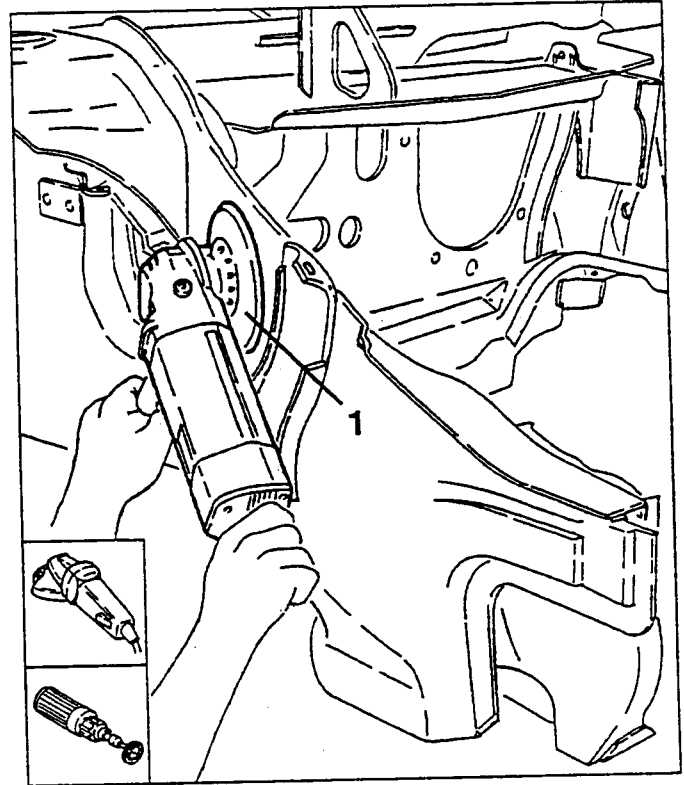


### POSITIONING

1. Using a jig, position the outer side panel and overlap as shown. Fix the panel with clamps and join together the edges to be welded.
2. Using a circular saw, trim the sheet metal and remove the excess.

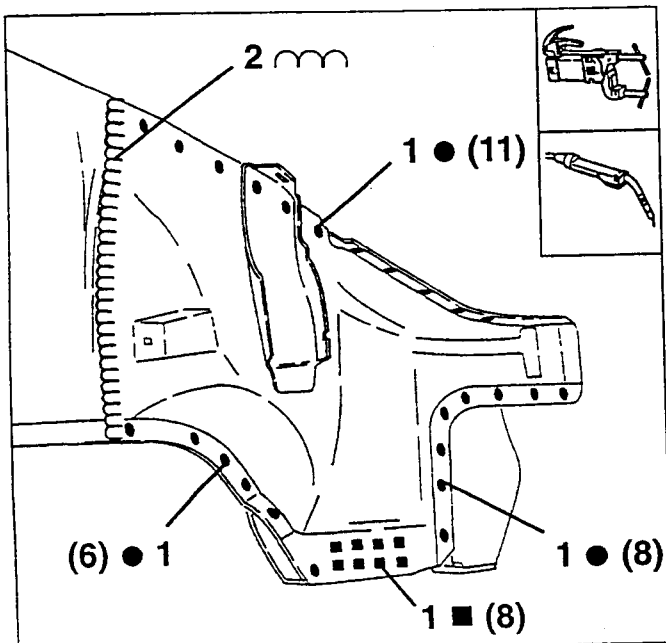


1. Using an abrasive grinding machine, remove and flush the residues left after welding.
- Using a rotating brush, clean the welded areas.



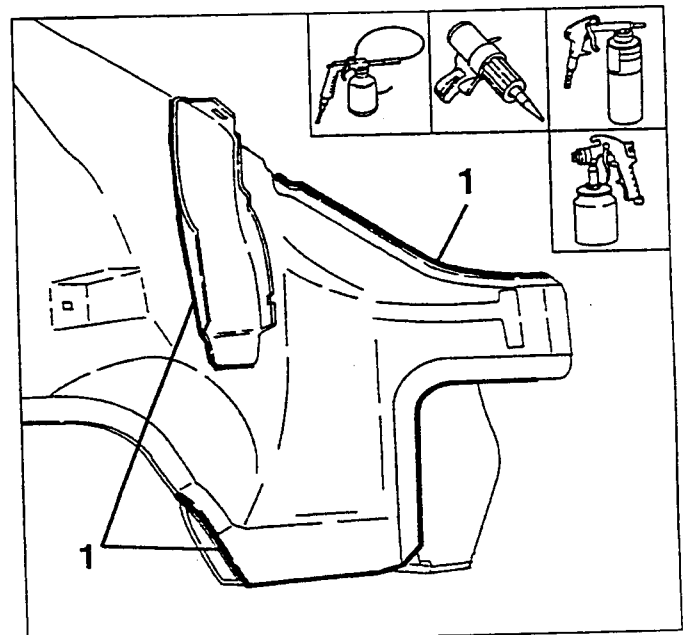
### WELDING AND FINISHING OF THE SHEET METAL

1. Using a spot-welder or, where necessary, a MIG welder, proceed as shown in the diagram.
2. Using a MIG welder, carry out seam welding.

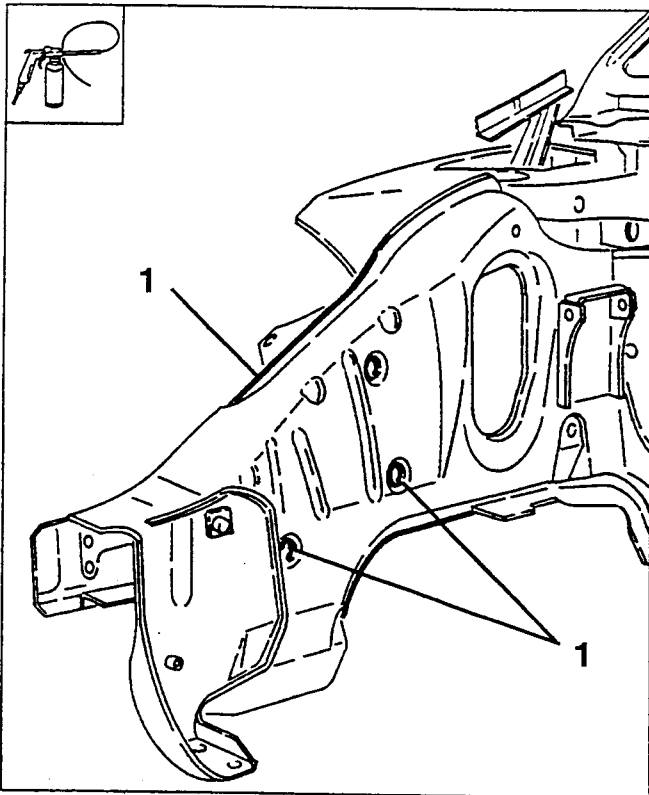


### PROTECTION

- Apply the specified corrosion inhibitor to the areas which have been MIG welded.
1. Apply the specified sealant around the edges of the joints of the side panel.
- Apply the specified underbody protection to the replaced areas.
  - Proceed to the painting phase.



1. Wax-treat the boxed parts through the holes shown in the diagram.



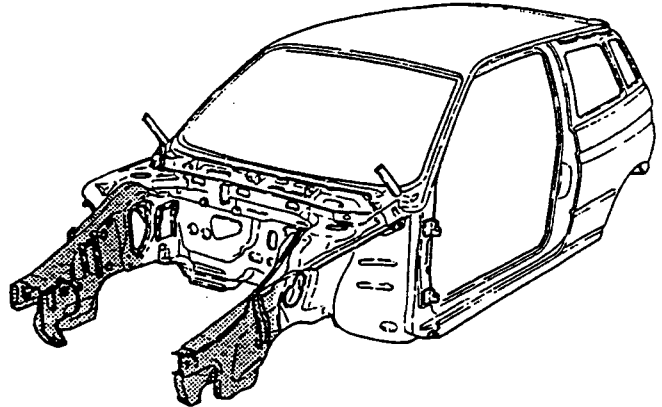
- Refit the components removed by reversing the procedure followed for removal.

## FRONT SIDE PANEL - INTERNAL AND EXTERNAL PARTS (Boxer versions)

### PRELIMINARY OPERATIONS

- Disconnect the negative (-) cable from the battery and remove the control units.
- Remove the trim components, electrical and mechanical systems which could hinder the repair operations or get damaged during work (see specific paragraphs).
- Remove the following sheet metal parts:
  - upper radiator crossmember (see specific paragraph).
  - headlight housing frame (see specific paragraph).
  - front wing on affected side (see specific paragraph)
  - front crossmember, if necessary (see specific paragraph).
  - upper panel on affected side (see specific paragraph).
  - side panel on affected side (see specific paragraph).
  - battery support crossmember (see specific paragraph).

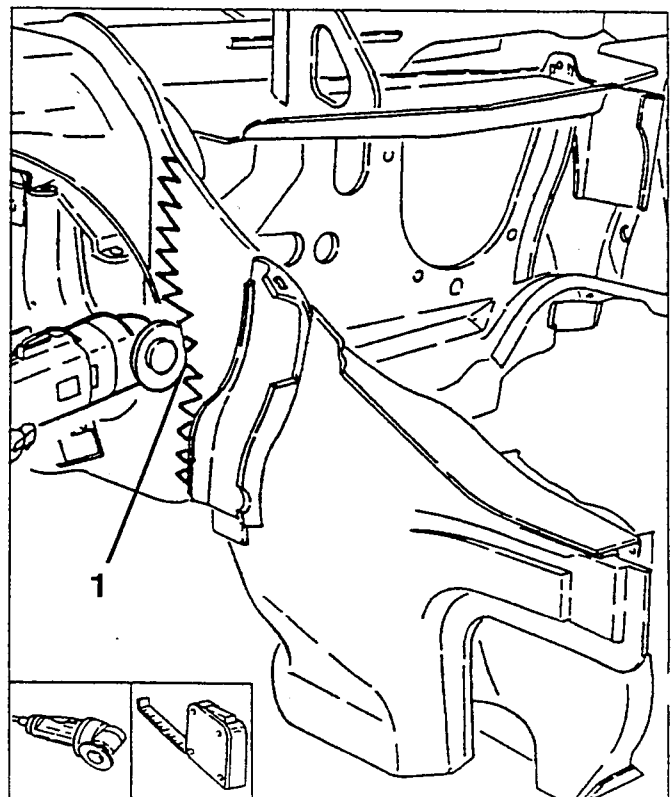
### REMOVAL



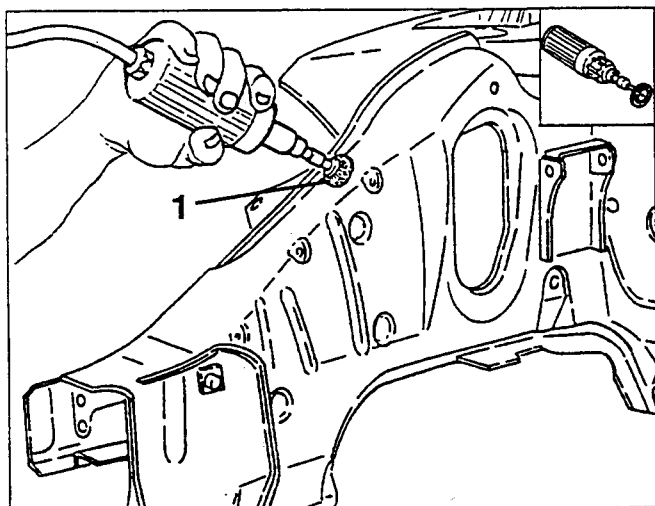
1. Using a circular saw, cut the outer front side panel along the lines shown in the diagram.

#### NOTE:

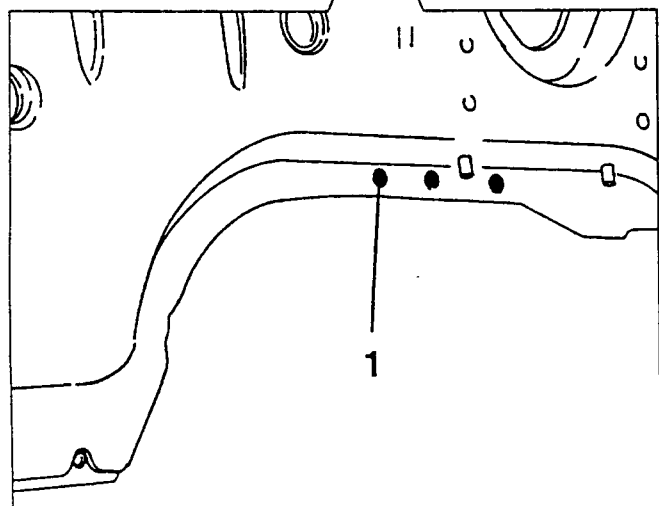
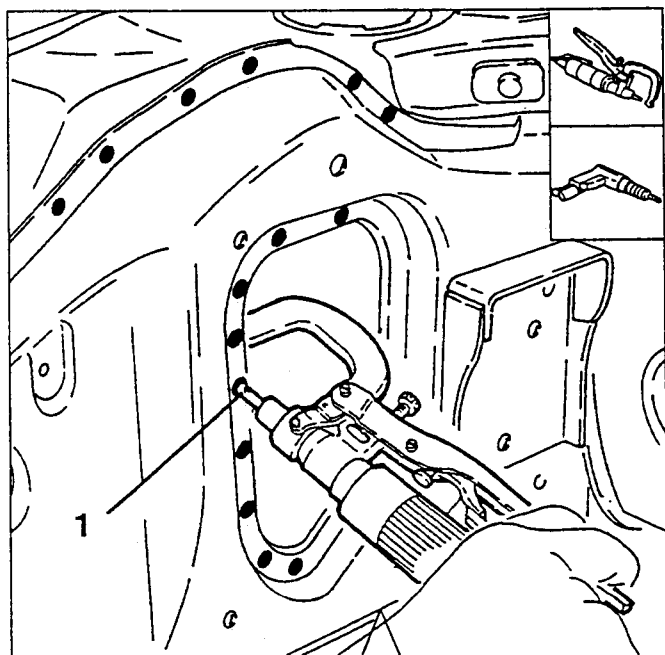
The cut on the side panel must be approx. 50mm from the front suspension attachment pillar.



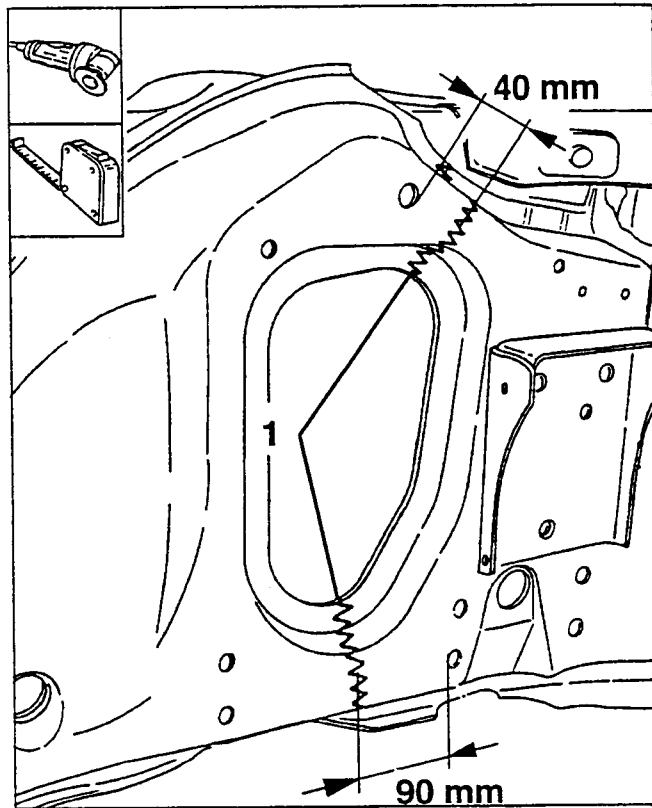
1. Using a rotating brush, clean the areas to be spot-cut to show up the welding points.



1. Using a chamfering machine, remove the accessible welding points; remove the remaining points using a drill.



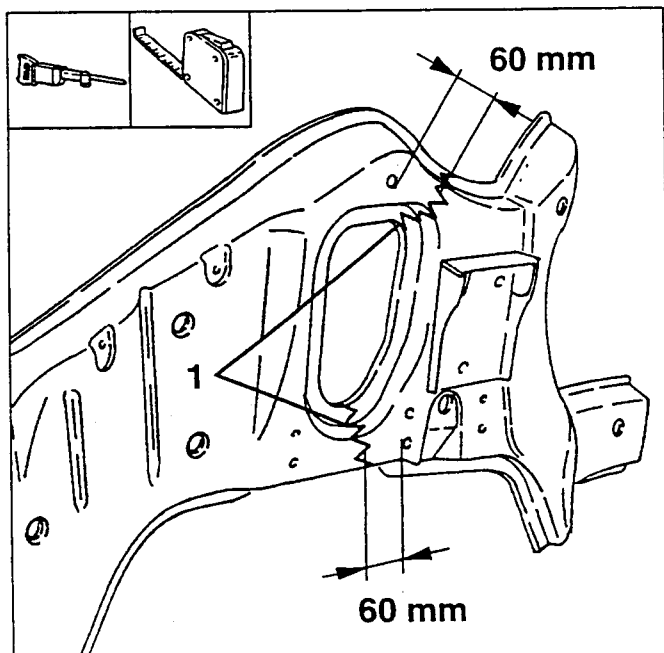
1. Using a circular saw, cut the inner part of the side panel to the dimensions indicated following the lines shown in the diagram taking care not to damage the external part of the side panel.



- If necessary cut away the sealant to remove the front partial side panel (internal and external).

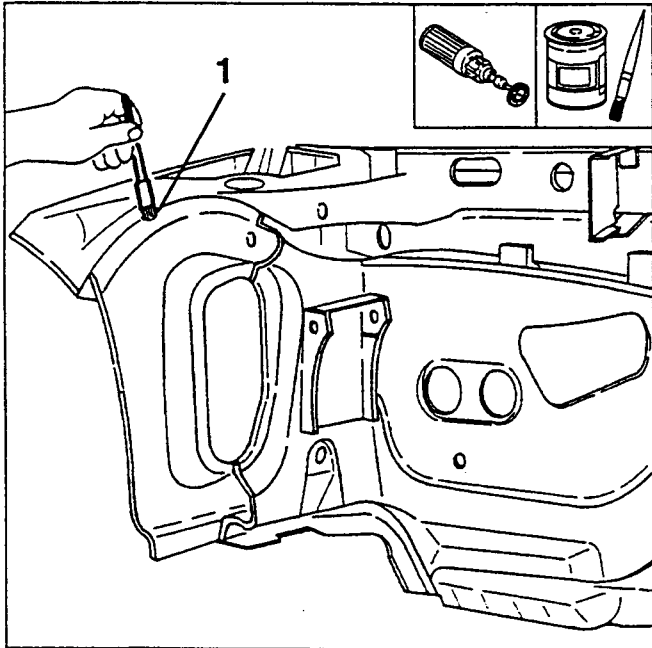
## PREPARATION

1. Working on a bench using a jig saw, cut the new inner side panel to the dimensions given in the diagram to maintain the correct overlapping tolerances.



- Using a rotating brush, clean the areas which are to be welded and remove the foam treatment product from the area to be cut along approximately 30 mm to prevent burning during welding.

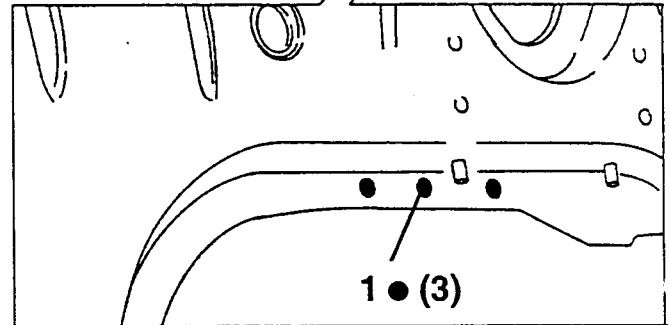
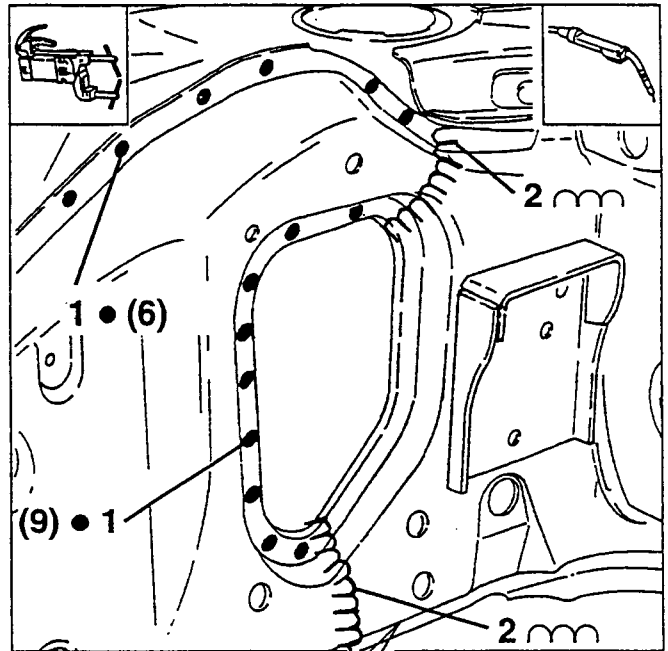
1. Apply the specified electroweldable protection product to the areas to be spot-welded.



### WELDING AND FINISHING THE SHEET METAL

1. Using a spot-welder or, where necessary, a MIG welder, proceed as shown in the diagram.

2. Using a MIG welder, weld to seams.

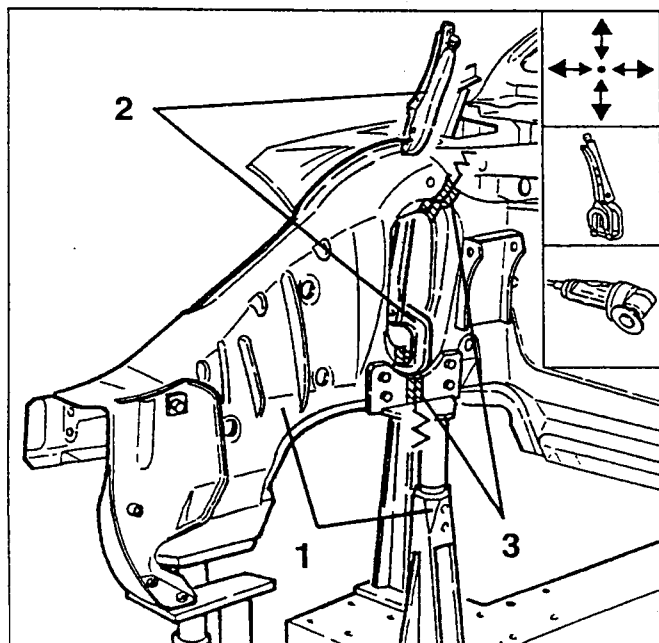


### POSITIONING

1. Using a jig, correctly position the front inner partial side panel.

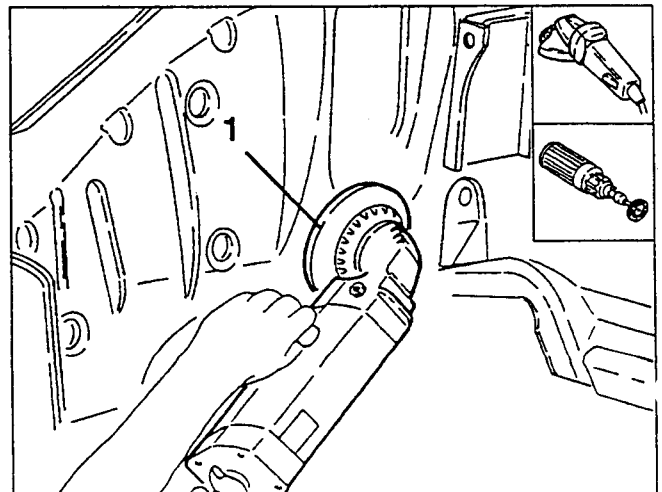
2. Overlap and secure the components to be welded in position using clamps, join together the edges and check alignment.

3. Using a circular saw, trim the sheet metal to eliminate the excess parts.



1. Using an abrasive grinding machine, remove and flush the residues left after welding.

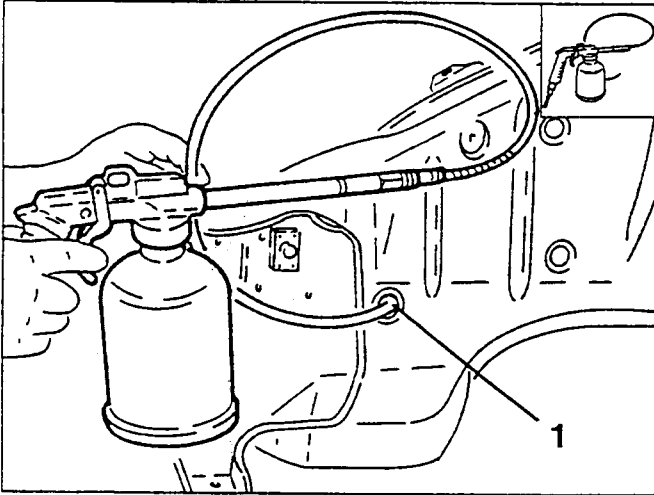
- Using a rotating brush, clean the welded areas.



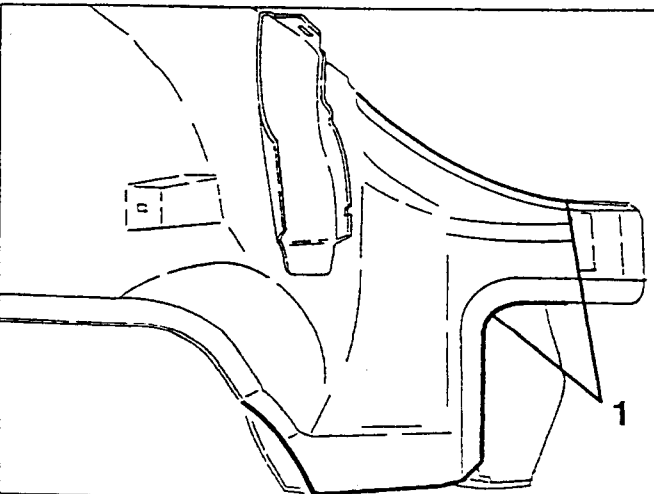
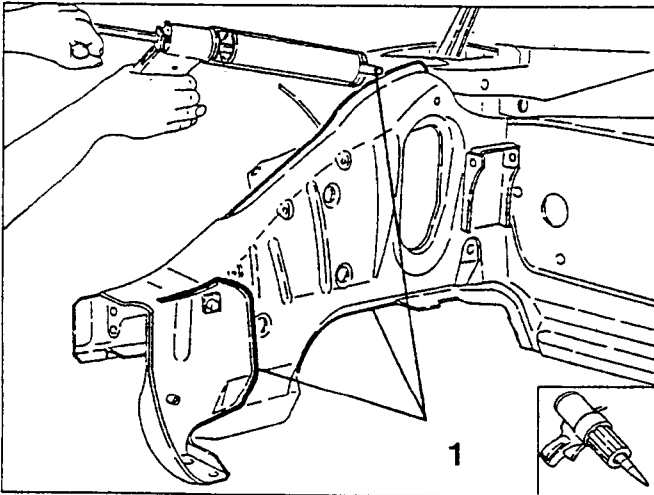
- Refit the partial outer side panel (see specific paragraph).

### PROTECTION

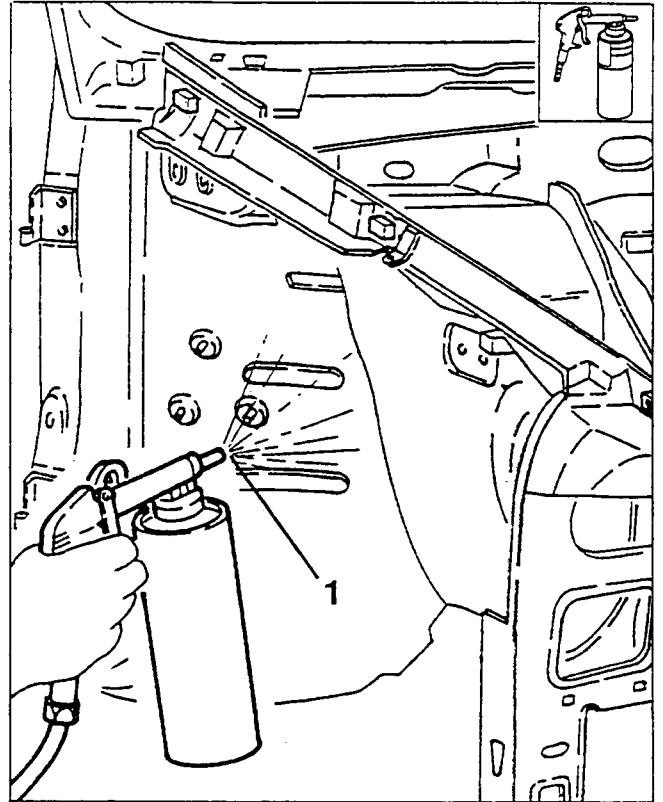
1. Apply the specified corrosion inhibitor to the areas which have been MIG welded.



1. Apply the specified sealant around the edges of the panel.



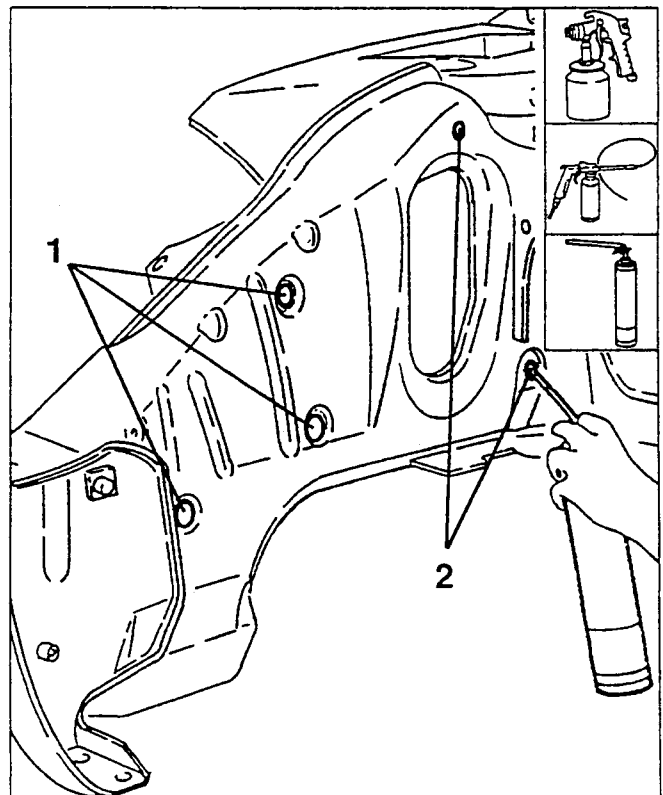
1. Apply the specified underbody protection to the replaced areas.



- Proceed to the painting phase.

1. Wax-treat the boxed parts through the holes shown in the diagram.

2. Foam-treat the boxed parts through the holes shown in the diagram.



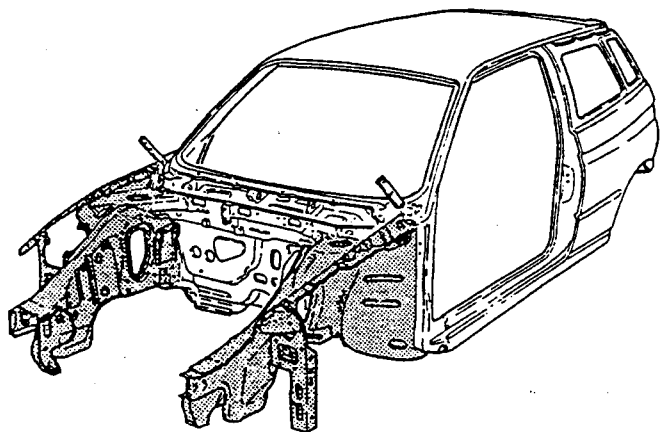


### COMPLETE FRONT SIDE PANEL WITH FRONT PILLAR REMOVED (Boxer versions)

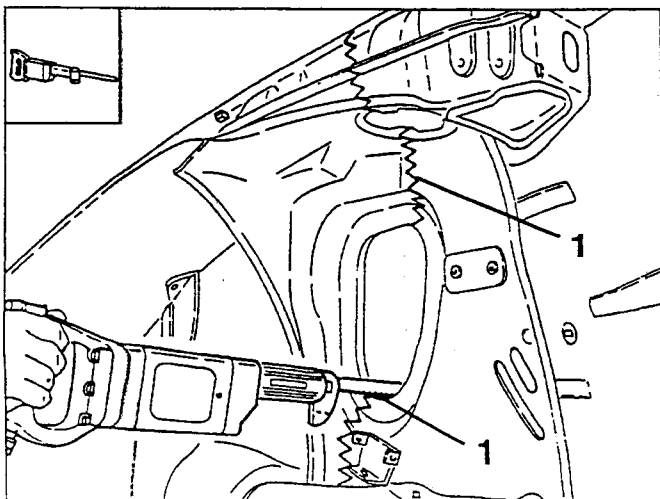
#### PRELIMINARY OPERATIONS

- Disconnect the negative (-) cable from the battery and remove the control units.
- Remove the trim components, electrical and mechanical systems which could hinder the repair operations or get damaged during work (see specific paragraphs).
- Remove the following sheet metal parts:
  - upper radiator crossmember (see specific paragraph).
  - headlight housing frame (see specific paragraph).
  - front crossmember (see specific paragraph).
  - battery support crossmember (see specific paragraph).
  - front bonnet hinge on affected side (see specific paragraph).
  - dashboard support crossmember (see specific paragraph).

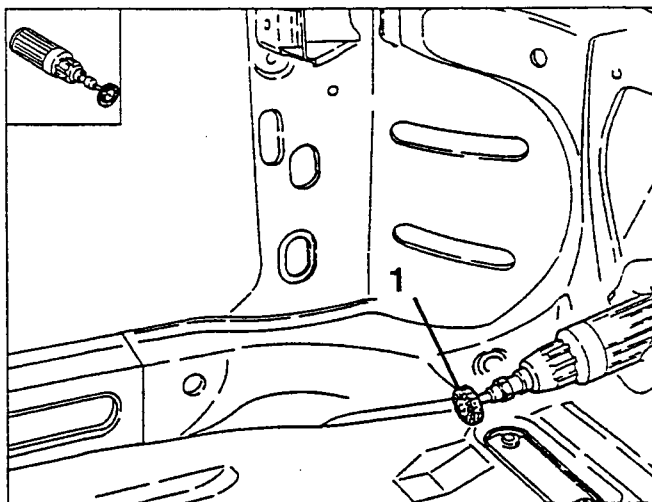
#### REMOVAL



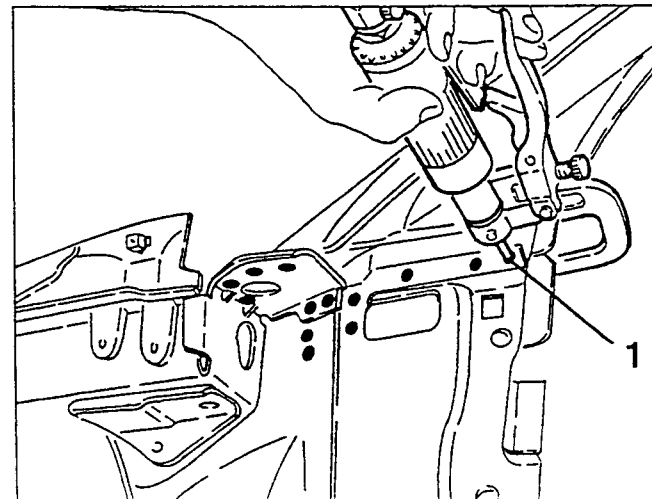
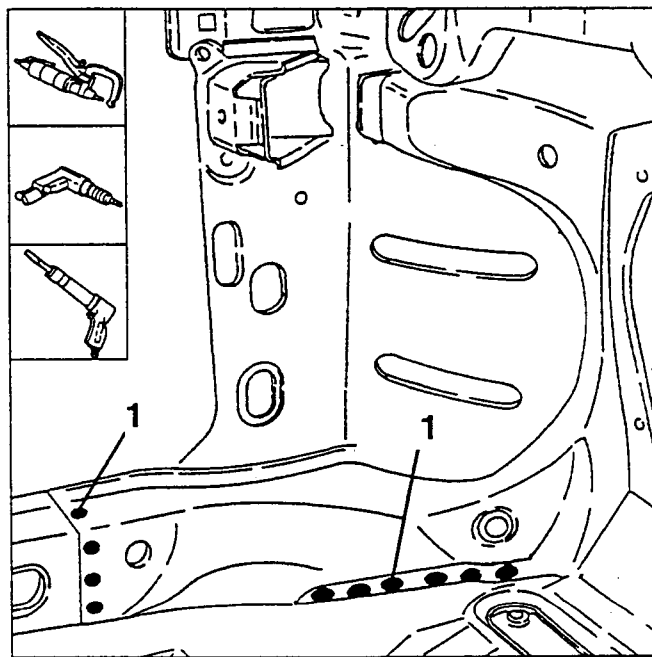
1. Using a jig saw, cut away the side panel as shown in the diagram.



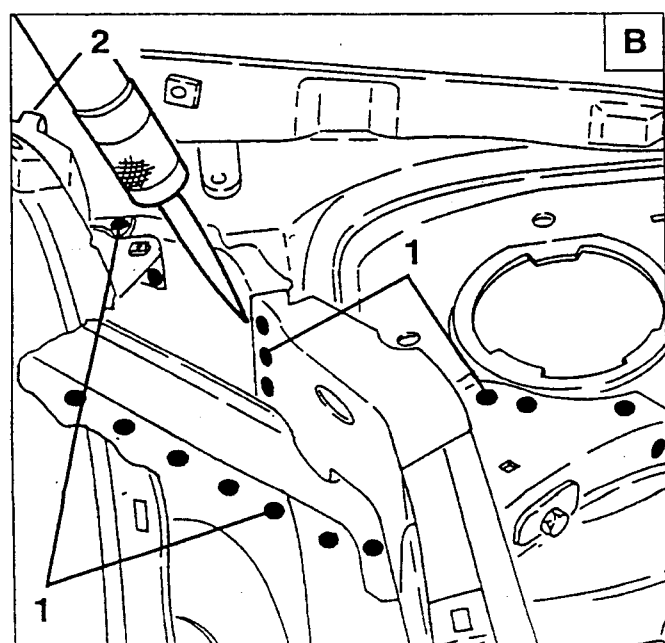
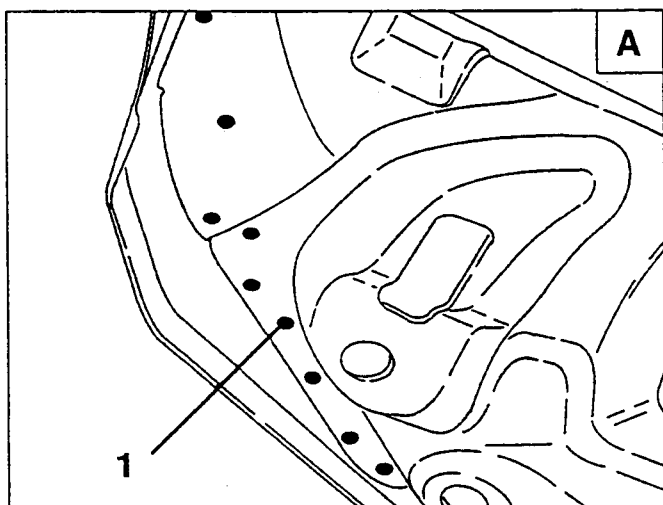
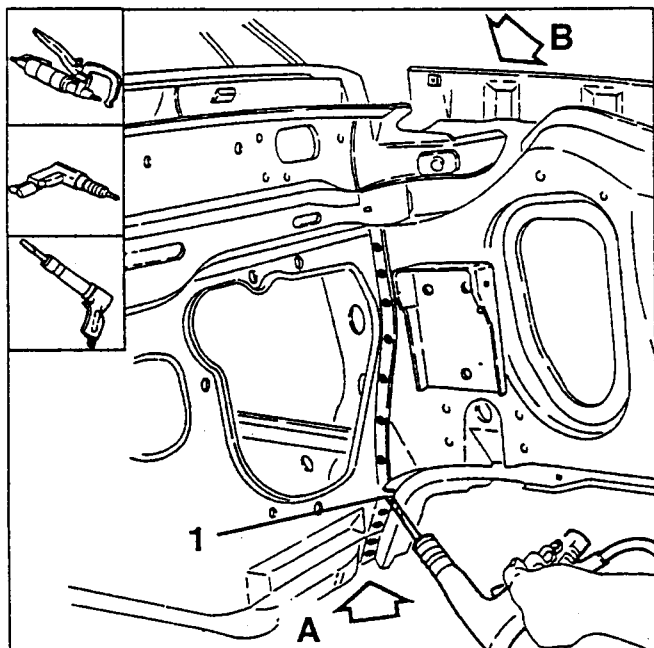
1. Using a rotating brush, clean the areas to be spot-cut to show up the welding points.



1. Using a chamfering machine, remove the accessible welding points; remove the remaining welding points using a drill or a chisel.



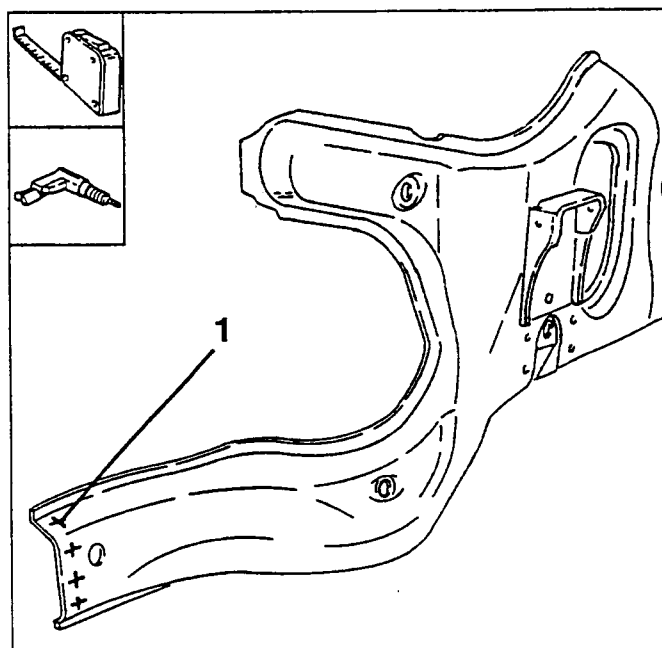
1. Using a chamfering machine remove the accessible welding points; remove the remaining welding points using a drill or a chisel.
2. Open the clinch tabs.



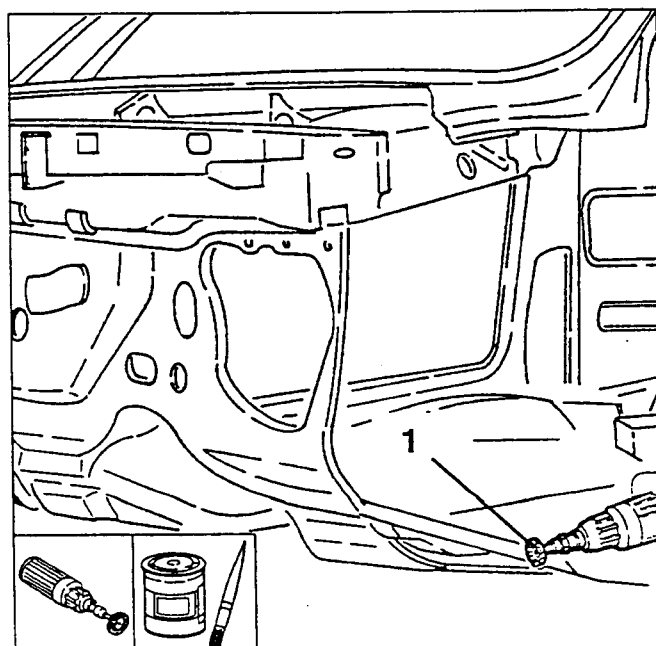
- Remove the complete front side panel cutting away the sealant if necessary.

### PREPARATION OF THE INNER FRONT SIDE PANEL

1. Working on a bench, mark out and perforate the inner side panel with a 5 mm bit as shown in the diagram.

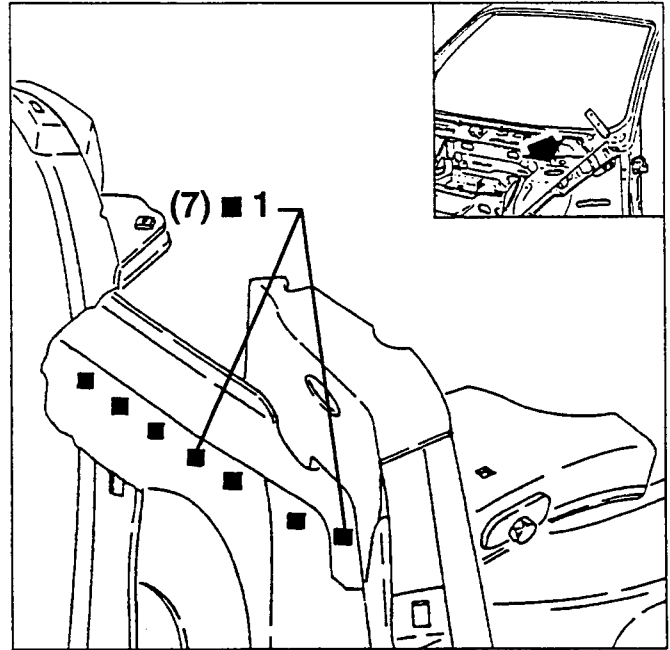
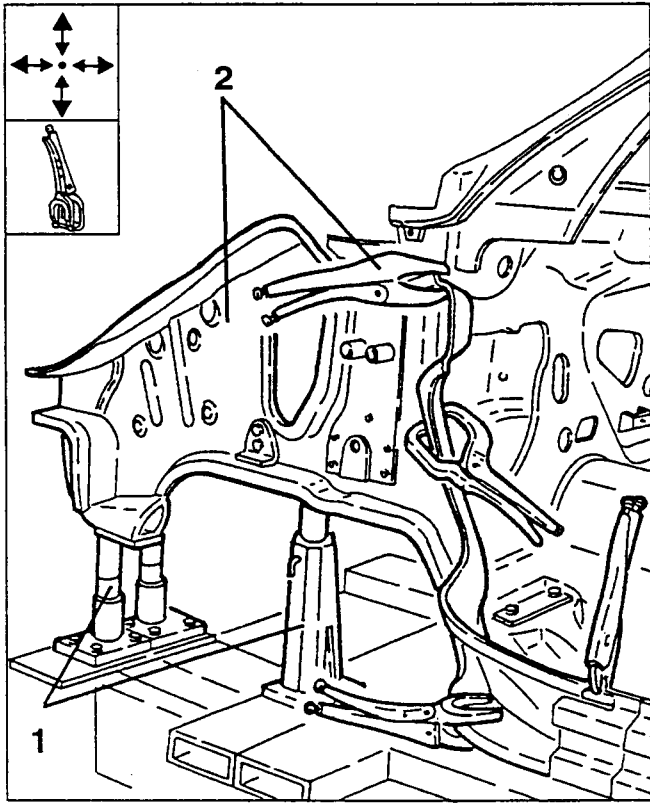


1. Using a rotating brush, clean the edge of the inner side panel and the areas to be welded.
- Apply the specified electroweldable protection product to the areas to be spot-welded.



## POSITIONING OF THE INNER FRONT SIDE PANEL

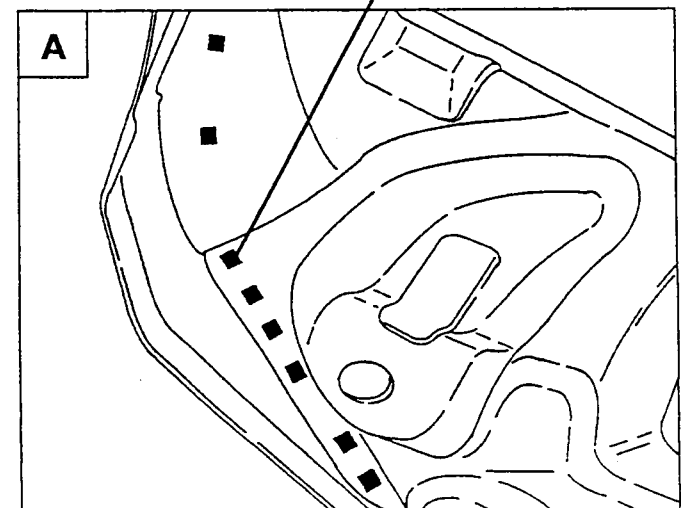
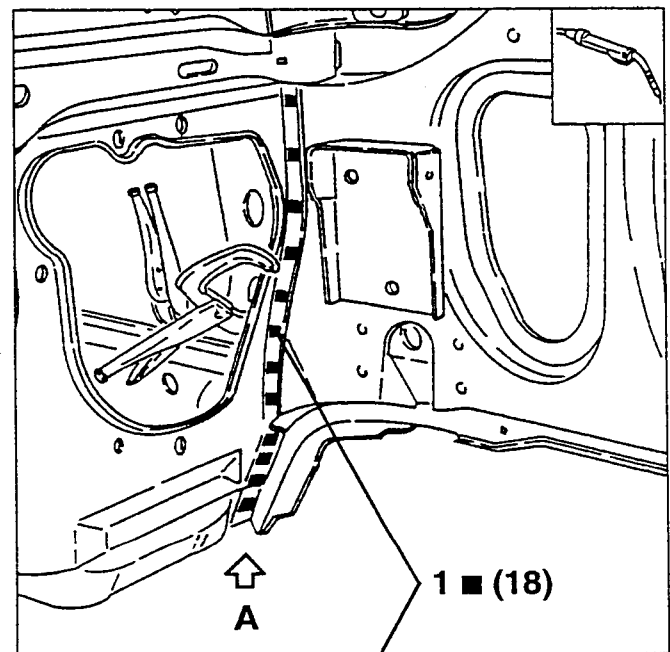
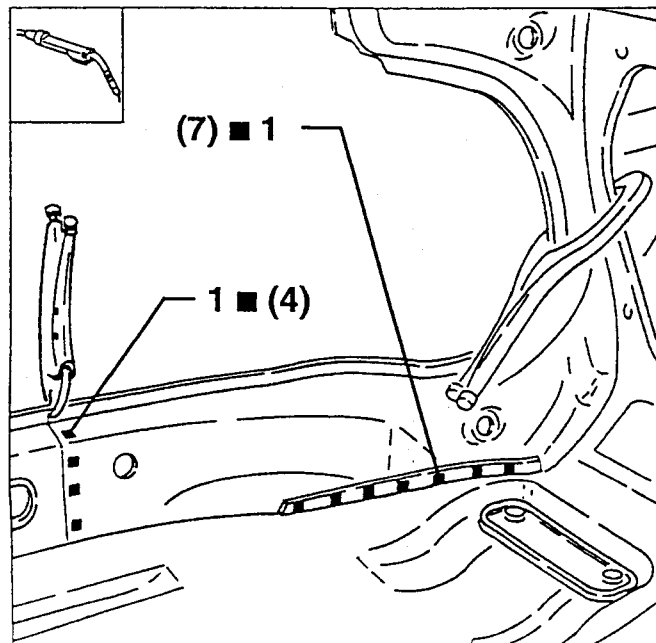
1. Using a jig, correctly position the inner side panel.
2. Lock the components to be welded into position using clamps, join together the edges and check alignment.



1. Using a MIG welder, proceed as shown in the diagram.

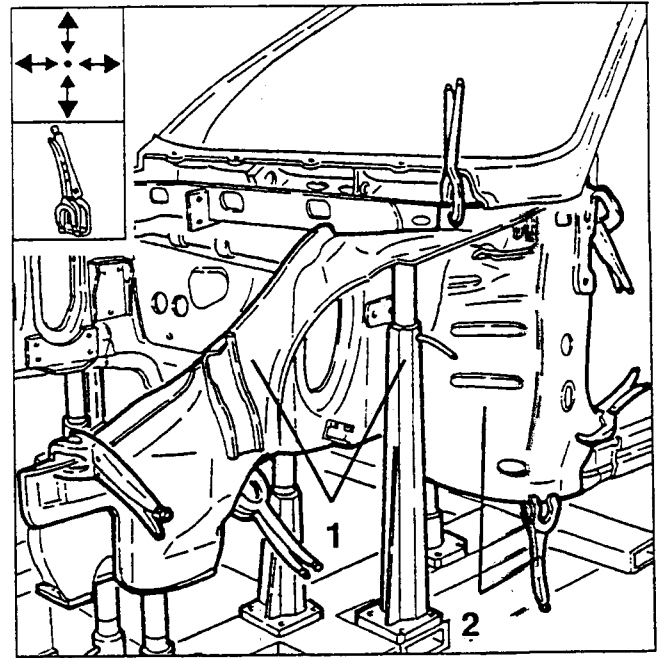
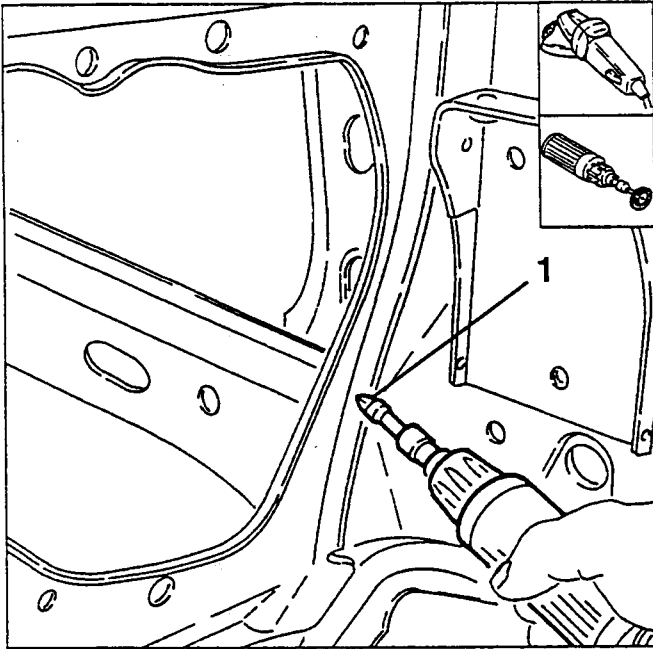
## WELDING AND FINISHING OF THE INNER FRONT SIDE PANEL

1. Using a MIG welder, proceed as shown in the diagram.



1. Using an abrasive grinding machine or a grinding machine with milling cutter on the which cannot be reached with the grind wheel, remove and flush the residues left after welding.

- Using a rotating brush, clean the welded areas.



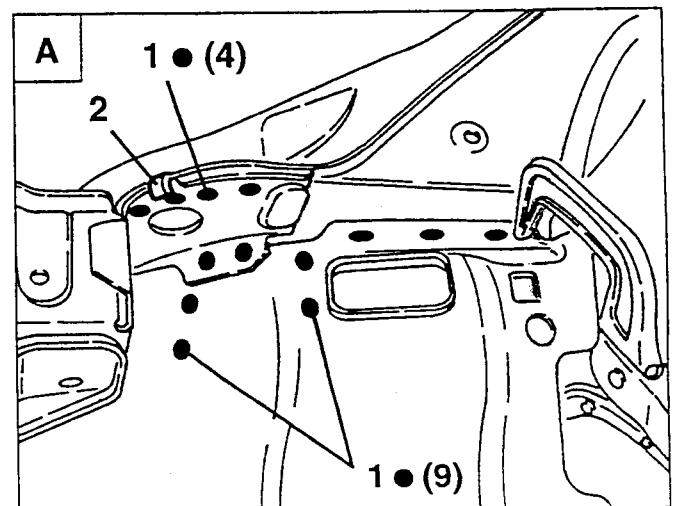
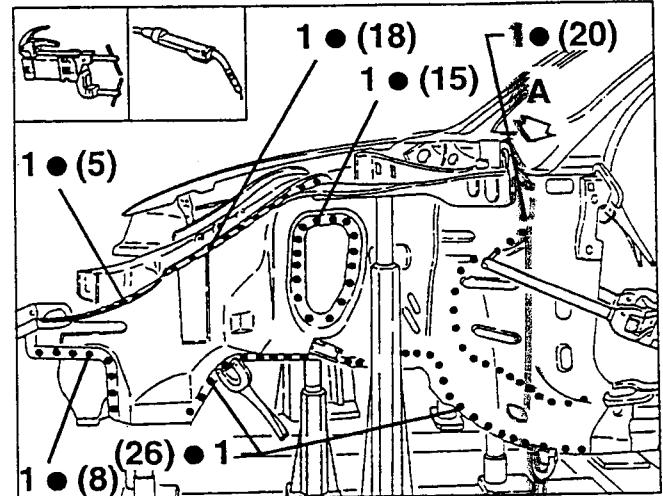
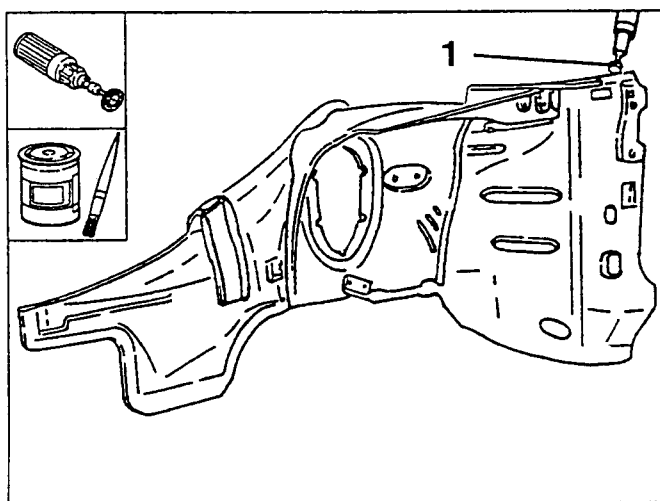
### WELDING AND FINISHING OF THE OUTER FRONT SIDE PANEL

1. Using a spot-welder or, where necessary, a MIG welder, proceed as shown in the diagram.
2. Bend the tabs over.

### PREPARATION OF THE OUTER FRONT SIDE PANEL

1. Using a rotating brush, clean the edges of the outer side panel and the areas to be welded.

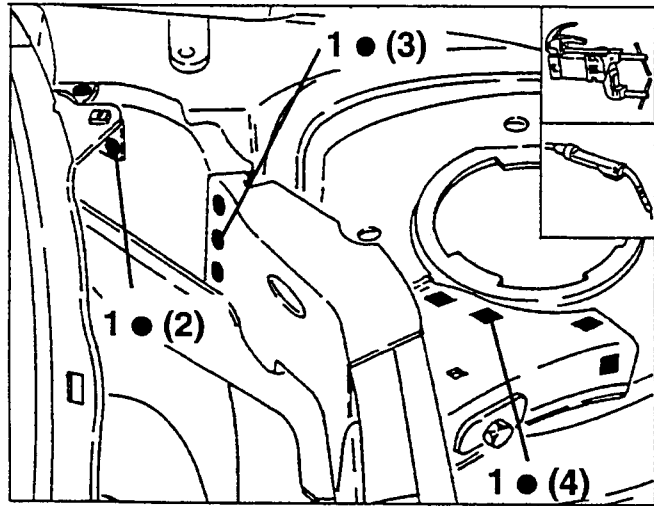
- Apply the specified electroweldable protection product to the areas to be spot-welded.



### POSITIONING OF THE OUTER FRONT SIDE PANEL

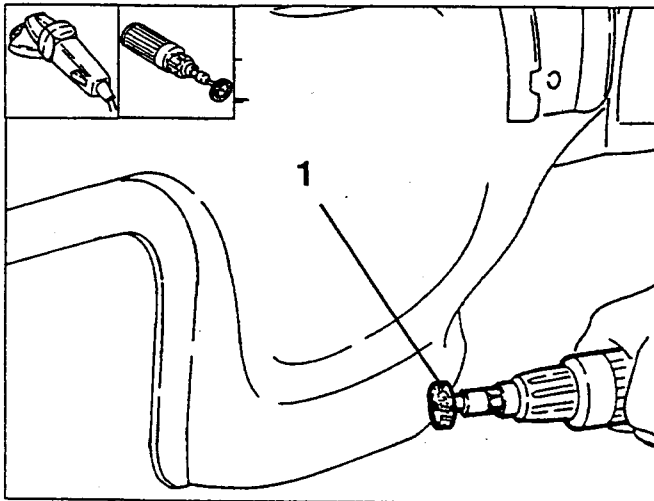
1. Using a jig correctly position the outer side panel.
2. Clamp the components to be welded into position, joint the edges together and check alignment.

1. Using a spot-welder or, where necessary, a MIG welder, proceed as shown in the diagram.



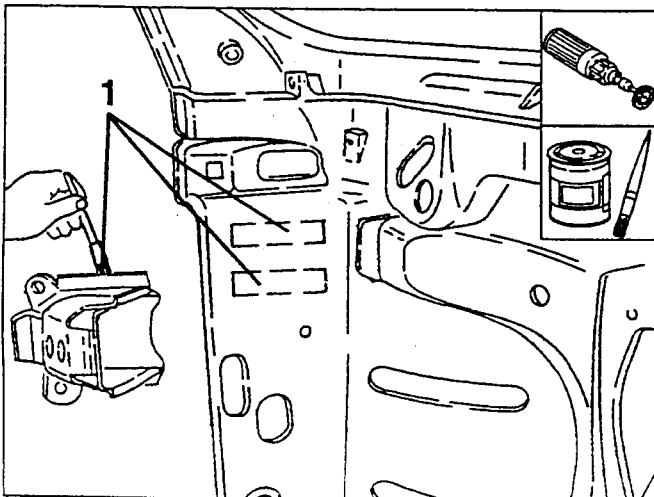
- Using an abrasive grinding machine remove and flush the residues left after welding.

1. Using a rotating brush, clean the welded areas.



- Using a rotating brush, clean the areas which are to be welded on the dashboard support crossmember bracket.

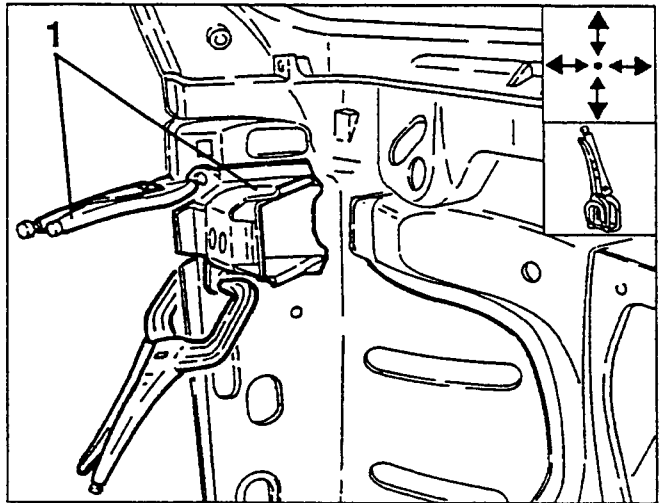
1. Apply the specified electroweldable protection product to the areas to be spot-welded.



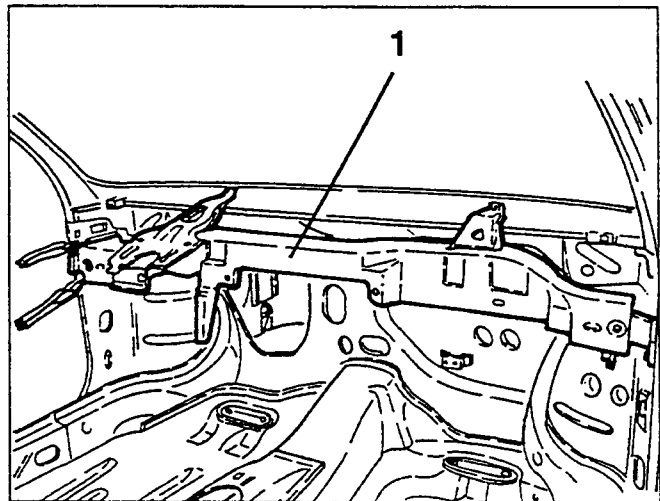
1. Position the dashboard crossmember support bracket and clamp it into position.

**NOTE:**

For the correct position of the bracket use the two special pins as shown in the diagram.

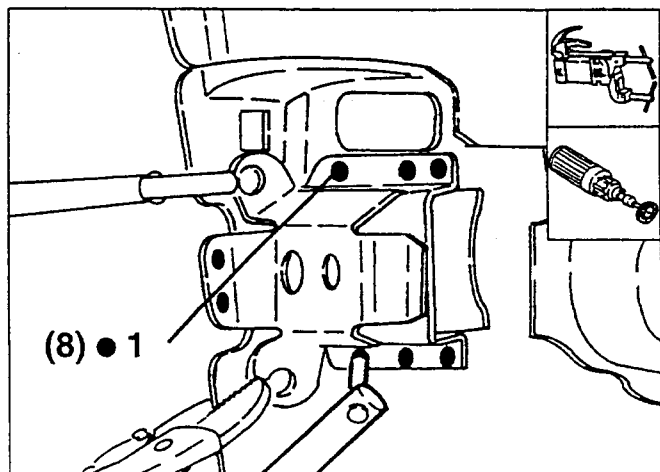


1. Temporarily install the dashboard crossmember to check the correct positioning of the support bracket and then remove it again.



1. Using a spot-welder, proceed as shown in the diagram.

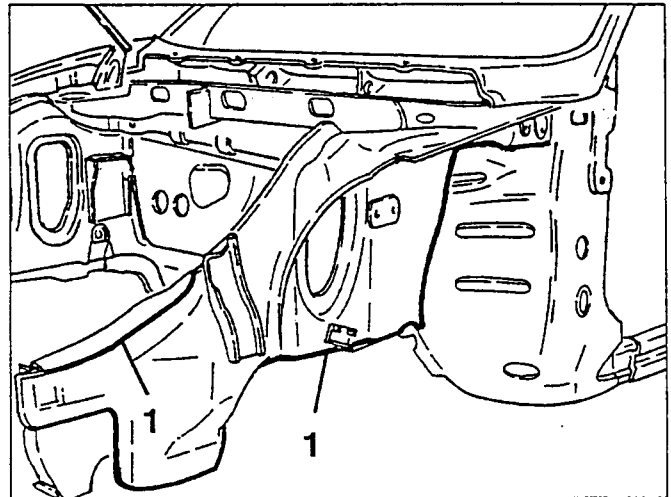
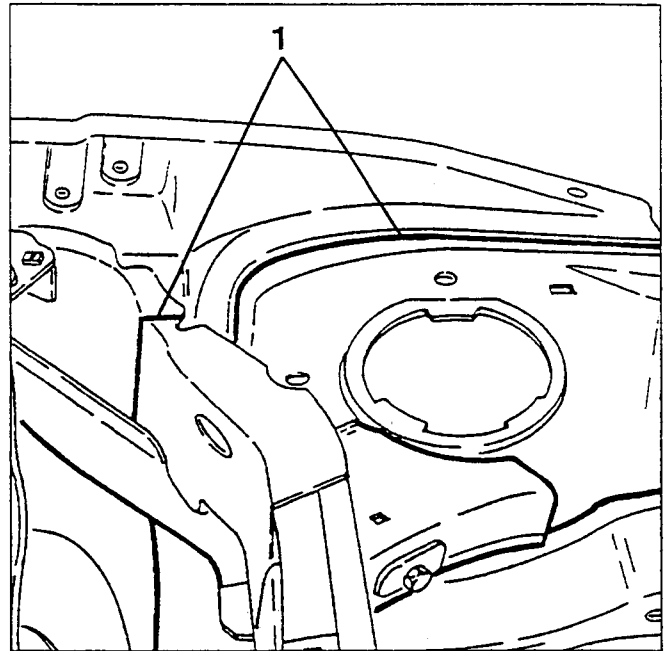
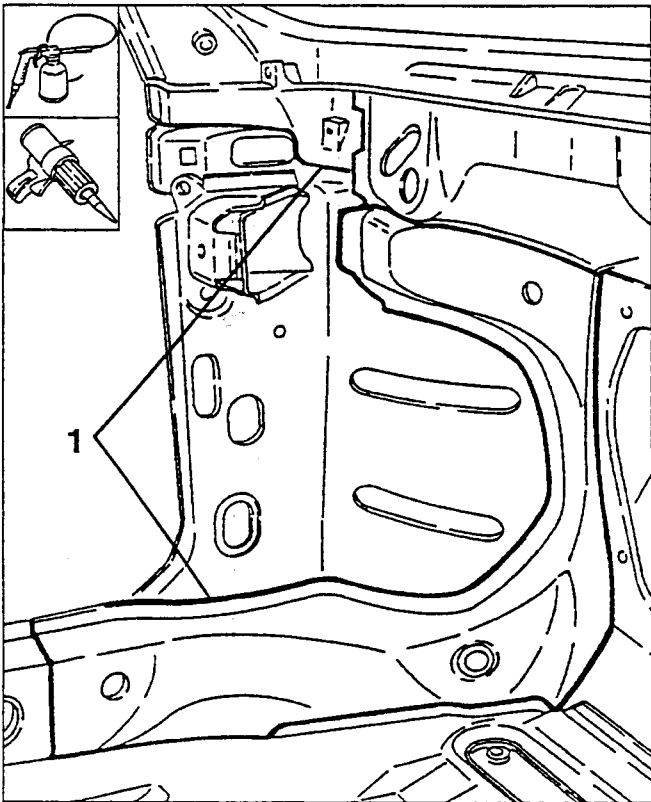
- Using a rotating brush, clean the welded areas.



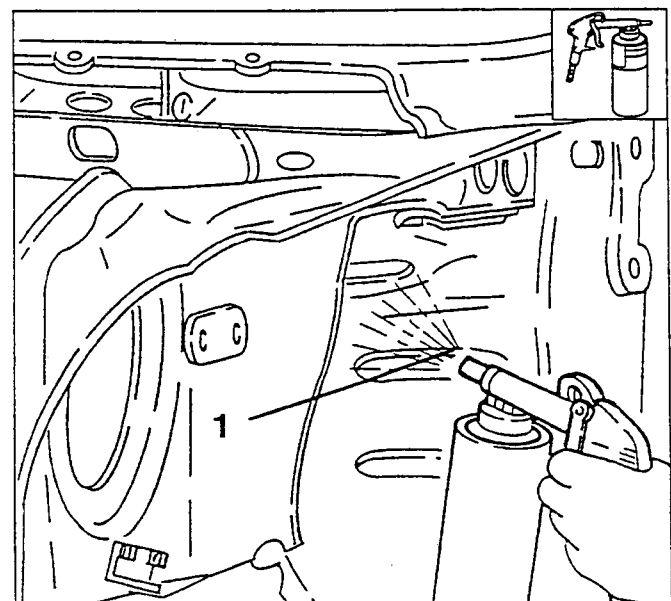
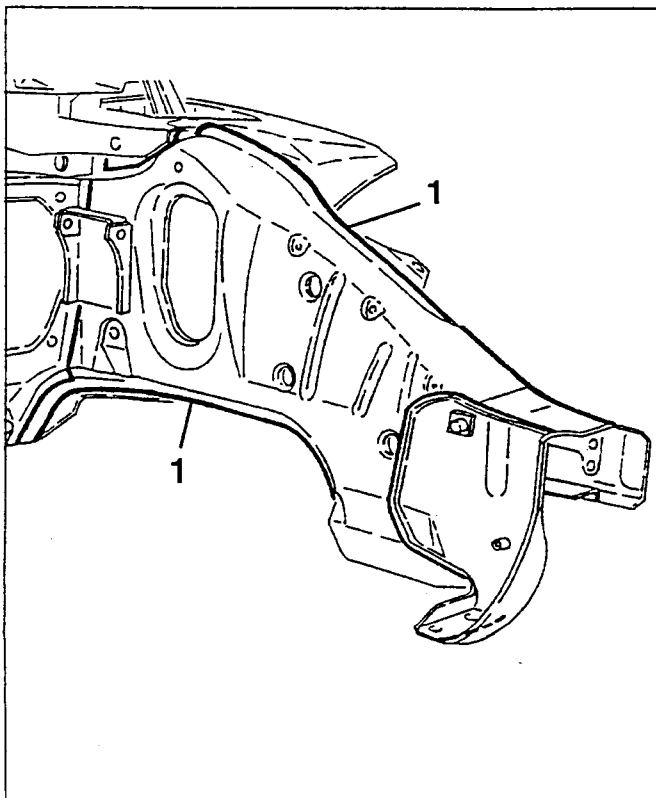
## PROTECTION

- Apply the specified corrosion inhibitor to the areas to be welded MIG.

1. Apply the specified sealant to all the joints of the side panel.

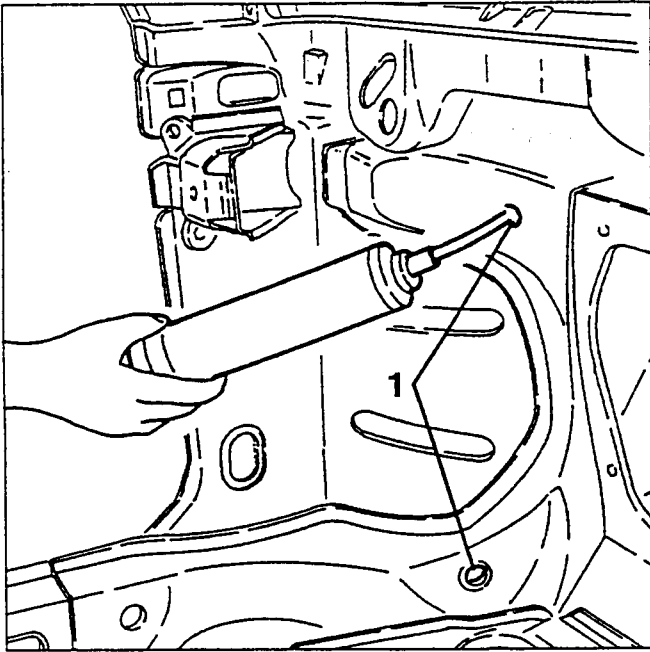


1. Apply the specified underbody protection to the replaced areas in the wheel housing.



- Proceed to the painting phase.  
- Wax-treat the boxed parts.

1. Foam treat the boxed parts through the hole shown in the diagram.

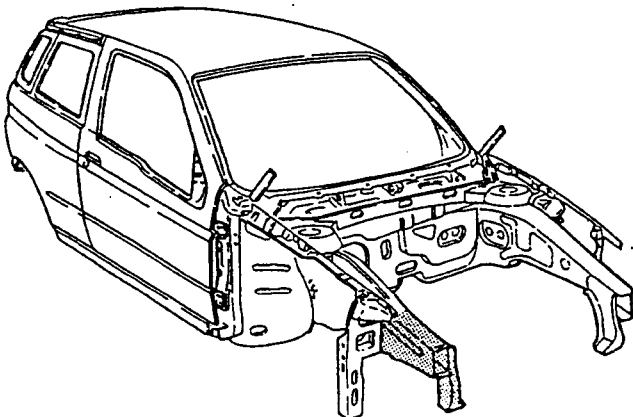


### FRONT SIDE PANEL - PARTIAL (Turbdiesel version)

#### PRELIMINARY OPERATIONS

- Disconnect the negative (-) cable from the battery and remove the control units.
- Remove the trim components, electrical and mechanical systems which could hinder the repair operations or get damaged during work (see specific paragraphs).
- Remove the following sheet metal parts:
  - headlight housing frame (see specific paragraph).
  - front crossmember, (see specific paragraph).

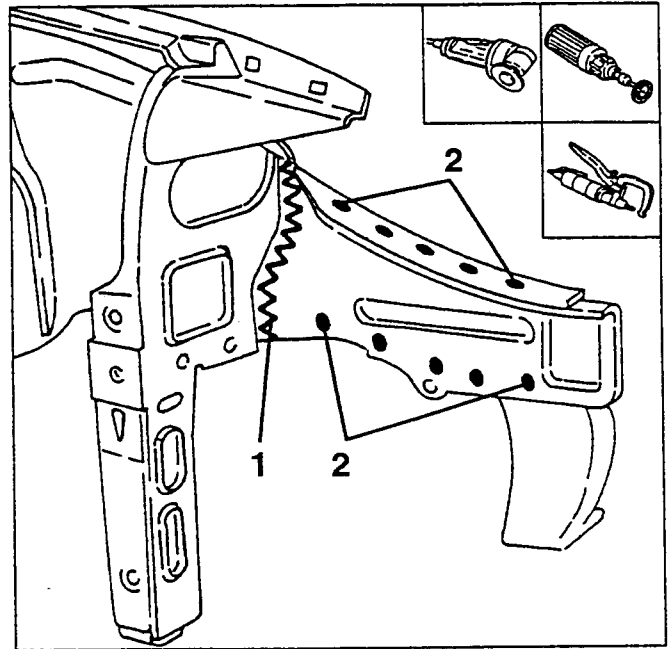
#### REMOVAL



1. Using a circular saw, cut the external panel along the lines indicated in the diagram without damaging the underlying parts.

- Using a rotating brush, clean the areas to be spot-cut to show up the welding points.

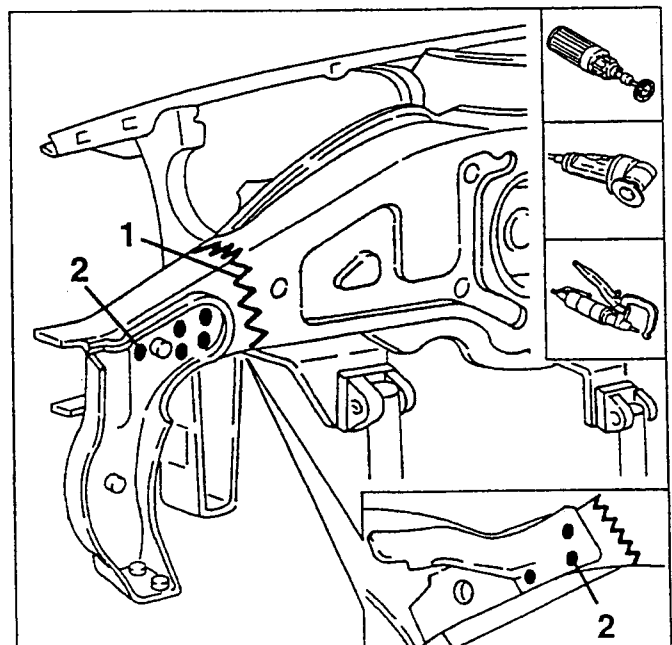
2. Using a chamfering machine, remove the welding points.



1. Using a circular saw, cut the internal panel along the lines indicated in the diagram without damaging the underlying parts.

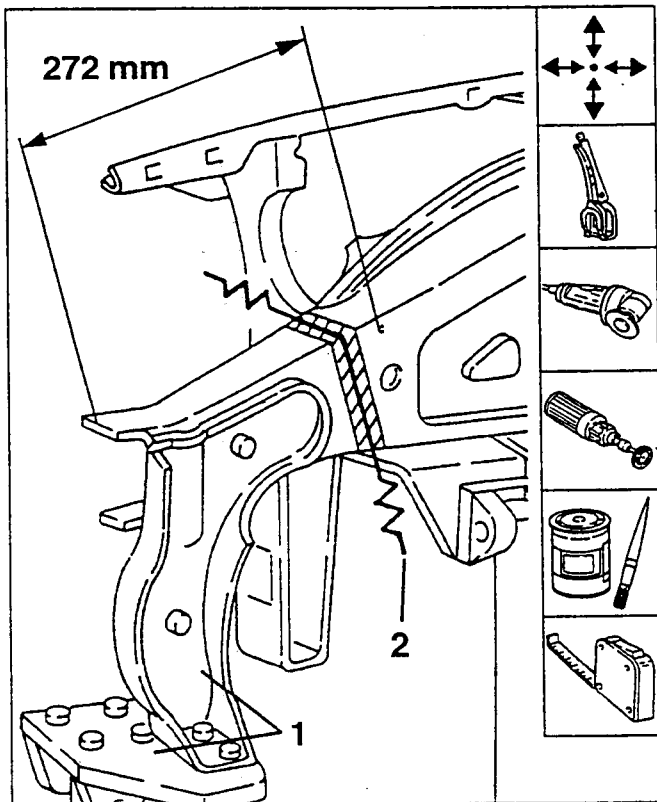
- Using a rotating brush, clean the areas to be spot-cut to show up the welding points.

2. Using a chamfering machine, remove the welding points.



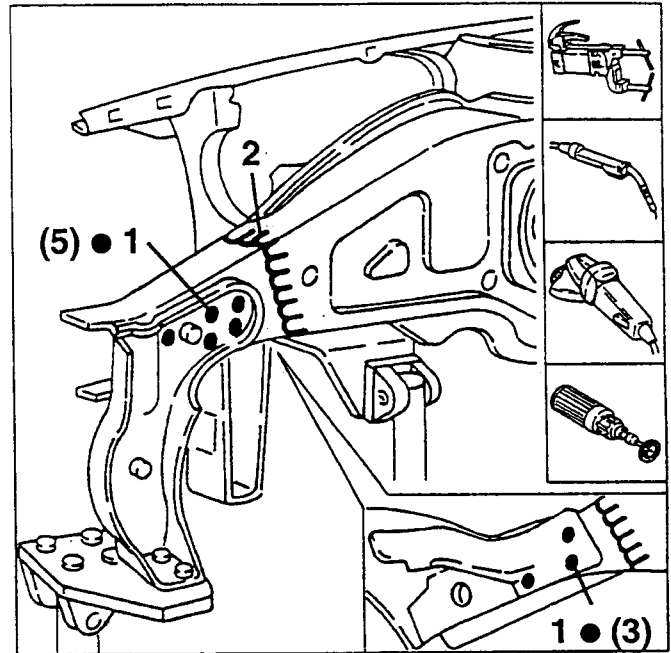
## PREPARING AND POSITIONING THE INNER SIDE PANEL

- Using a jig to secure the radiator attachment bracket correctly position the partial inner side panel and check the value given in the figure below.
  - Fix the side panel to the strut and check alignment and overlapping of the components.
- Using a circular saw, trim the sheet metal to eliminate the excess parts.
  - Remove the inner side panel.
  - Using a rotating brush, clean the areas which are to be welded.
  - Apply the specified electroweldable protection product to the areas to be spot-welded.
  - Position the inner side panel and check alignment.



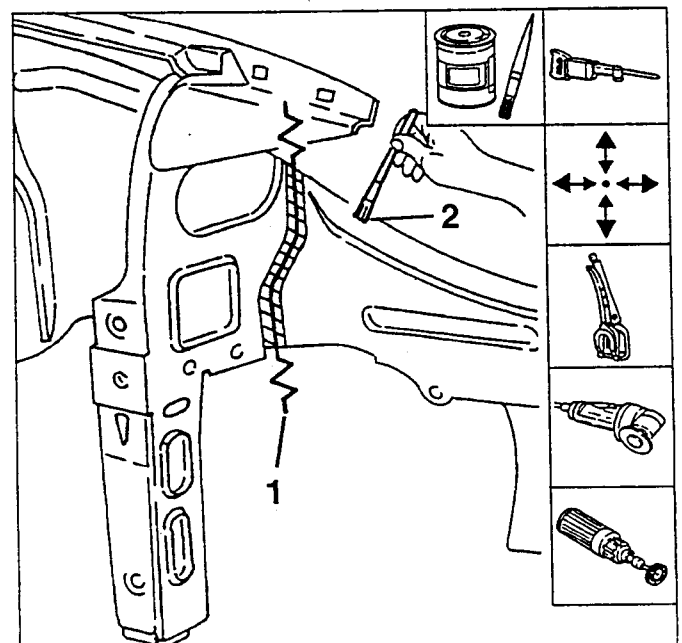
## WELDING AND FINISHING OF THE INNER SIDE PANEL

- Using a spot-welder or, where necessary, a MIG welder, proceed as shown in the diagram.
- Using a MIG welder, carry out seam welding.
  - Using an abrasive grinding machine, remove and flush the residues left after welding.
  - Using a rotating brush, clean the welded areas.



## PREPARING AND POSITIONING THE OUTER SIDE PANEL

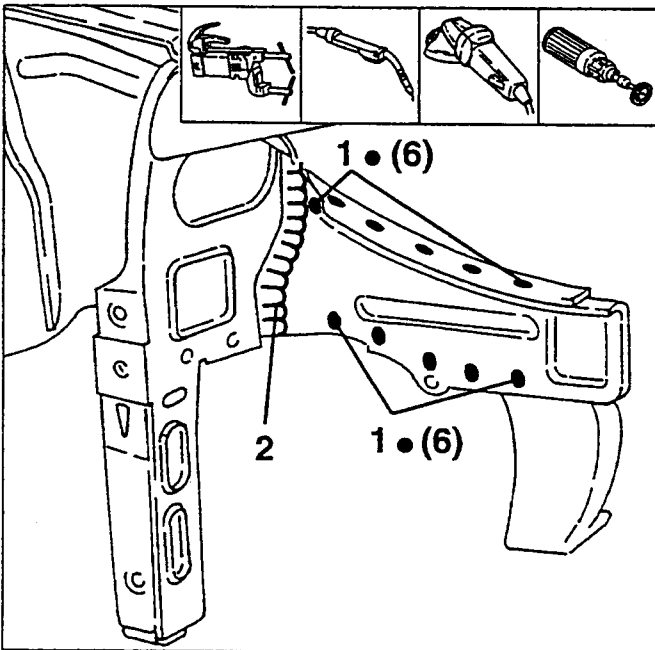
- Working on a bench use a jig saw to cut the new outer side panel leaving enough material to allow for overlapping.
- Secure the outer side panel to the strut and to the inner side panel.
  - Using a circular saw, trim the sheet metal to eliminate the excess parts.
    - Remove the outer side panel.
    - Using a rotating brush, clean the areas which are to be welded.
  - Apply the specified electroweldable protection product to the areas to be spot-welded.
    - Position the outer side panel and check alignment.



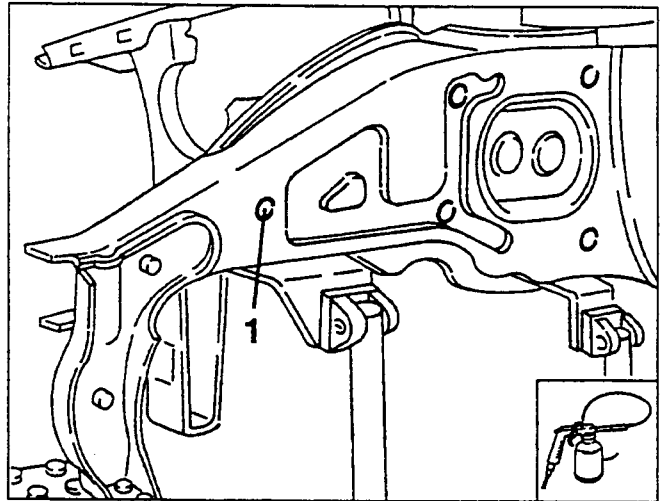


## WELDING AND FINISHING OF THE OUTER SIDE PANEL

1. Using a spot-welder or, where necessary, a MIG welder, proceed as shown in the diagram.
  2. Using a MIG welder, carry out seam welding.
- Using an abrasive grinding machine, remove and flush the residues left after welding.
  - Using a rotating brush, clean the welded areas.



- Centre the boxed parts through the hole shown in the diagram.



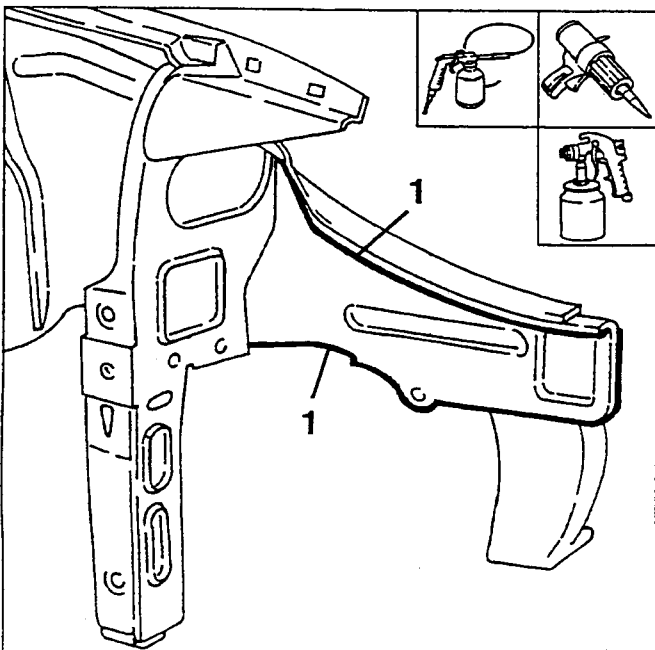
## FRONT SIDE PANEL - EXTERNAL PARTIAL (Turbo diesel version)

### PRELIMINARY OPERATIONS

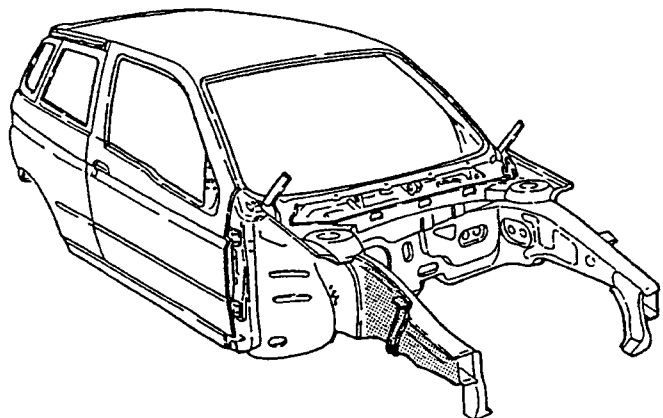
- Disconnect the negative (-) cable from the battery and remove the control units.
- Remove the trim components, electrical and mechanical systems which could hinder the repair operations or get damaged during work (see specific paragraphs).
- Remove the following sheet metal parts:
  - front wing of relative side (see specific paragraph).
  - front cross-member if necessary (see specific paragraph).
  - upper panel on relative side (see specific paragraph).
  - side shelf on relative side (see specific paragraph).

### PROTECTION

- Apply the specified corrosion inhibitor to the areas to be welded MIG.
- 1. Apply the specified sealant along the lines highlighted in the diagram.
- Proceed to the painting phase.



### REMOVAL

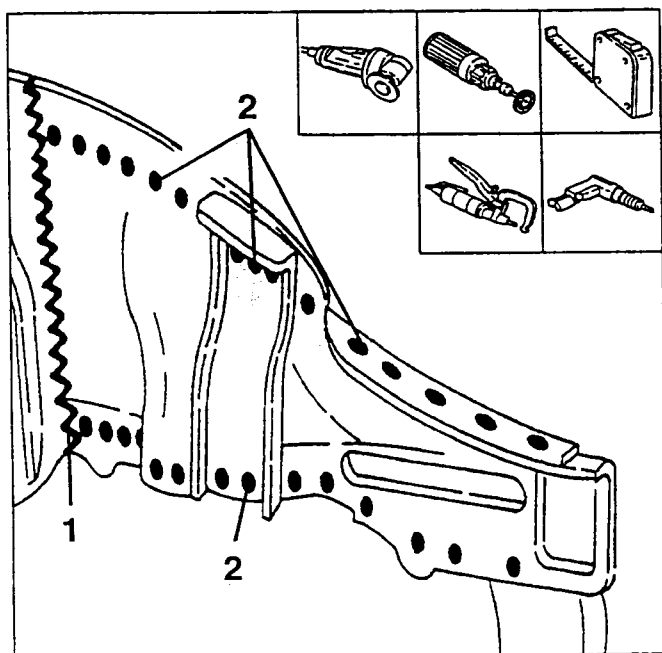
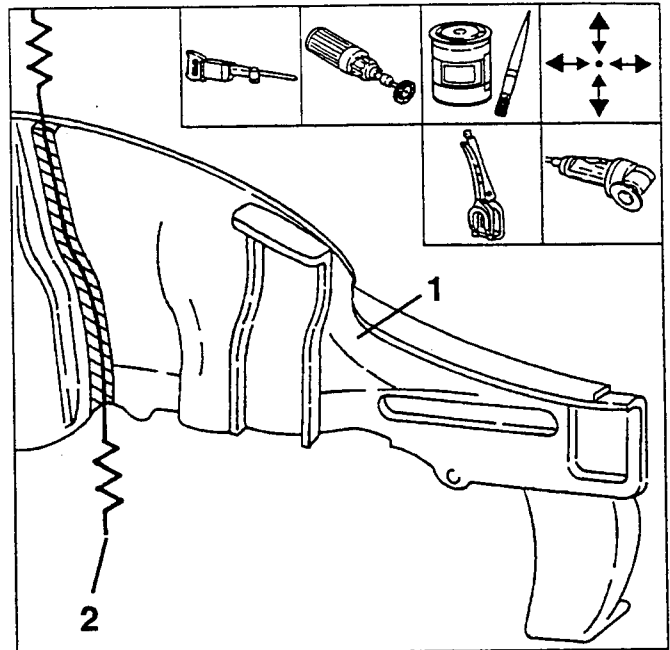


1. Using a circular saw, cut the outer front side panel along the line shown in the diagram without damaging the underlying parts.

**NOTE:**

The cut on the side panel must be approx. 50mm from the front suspension attachment pillar.

- Using a rotating brush, clean the areas to be spot-cut to show up the welding points.
- 2. Using a spot cutter remove the accessible welds. Remove the remaining welds using a drill.



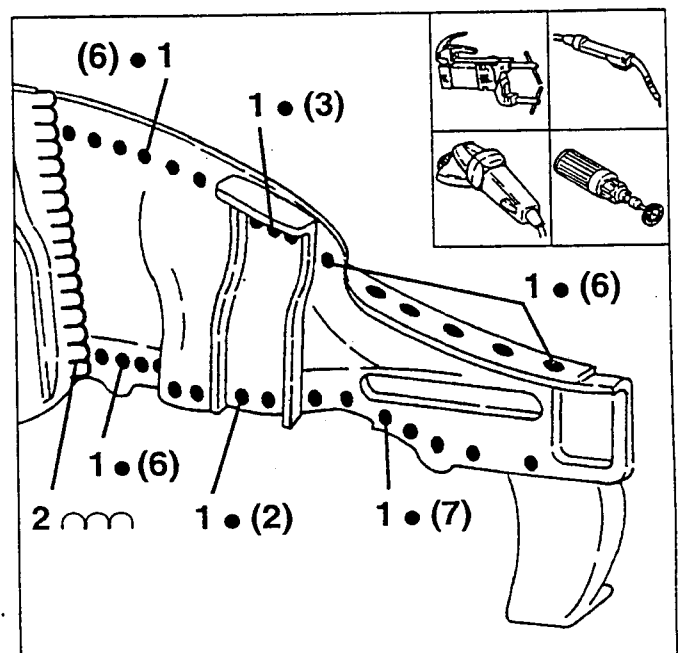
### WELDING AND FINISHING OF THE SHEET METAL

1. Using a spot-welder or, where necessary, a MIG welder, proceed as shown in the diagram.
2. Using a MIG welder, carry out seam welding.
  - Using an abrasive grinding machine, remove and flush the residues left after welding.
  - Using a rotating brush, clean the welded areas.

- Remove the outer partial front side panel and if necessary cut the sealant.

### PREPARING AND POSITIONING

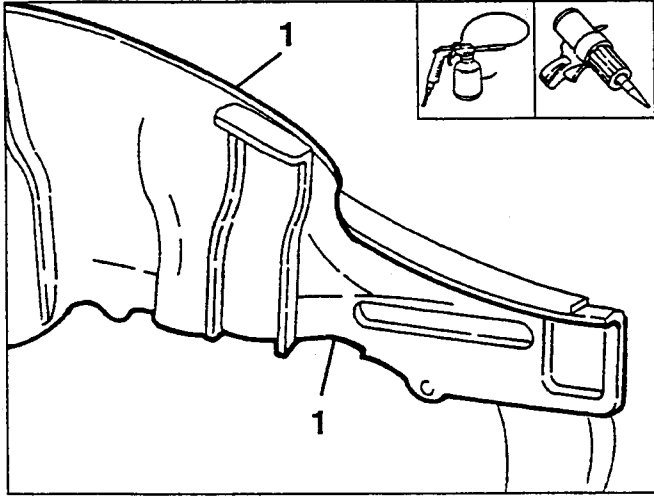
- Working on a bench use a jig saw to cut the new outer side panel allowing enough material for overlapping.
  - Using a rotating brush clean around the edges of the inner and outer side panels on both sides of the sheet metal.
  - Apply the specified electroweldable protection product to the areas to be spot-welded.
1. Position the outer side panel and overlap as shown in the diagram. Secure it using clamps and mate the edges to be welded.
  2. Using a circular saw, trim the sheet metal to eliminate the excess parts.



### PROTECTION

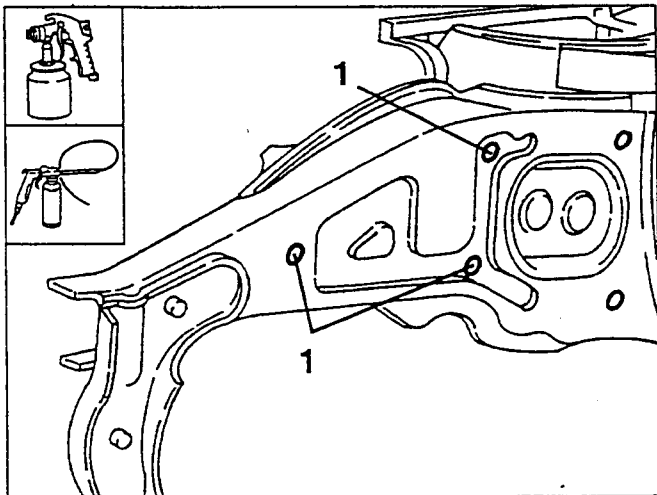
- Apply the specified corrosion inhibitor to the areas to be welded MIG.

1. Apply the specified sealant along the lines highlighted in the diagram.



- Proceed to the painting phase.

1. Centre the boxed parts through the holes shown in the diagram.



### FRONT SIDE PANEL - INTERNAL AND EXTERNAL PARTIAL (Turbodiesel version)

#### PRELIMINARY OPERATIONS

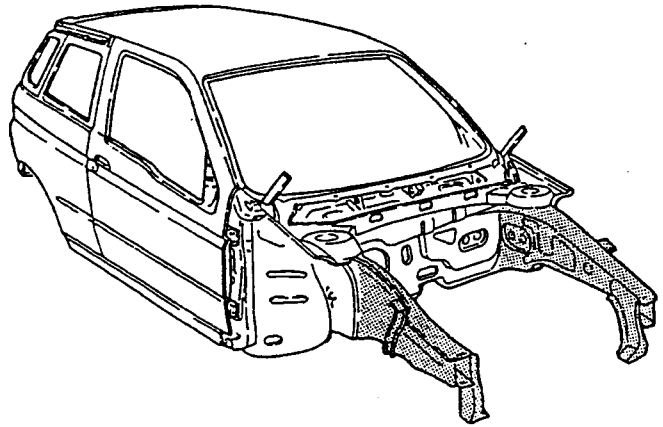
- Disconnect the negative (-) cable from the battery and remove the control units.

- Remove the trim components, electrical and mechanical systems which could hinder the repair operations or get damaged during work (see specific paragraphs).

- Remove the following sheet metal parts:

- front wing of relative side (see specific paragraph).
- front cross-member if necessary (see specific paragraph).
- upper panel on relative side (see specific paragraph).
- side shelf on relative side (see specific paragraph).

### REMOVAL

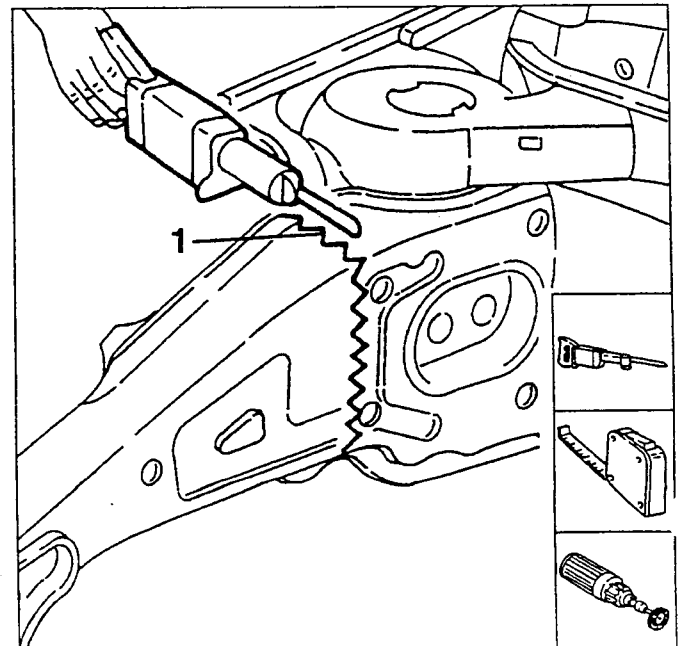


1. Using a jig saw cut the inner and outer front side panels along the line shown in the diagram.

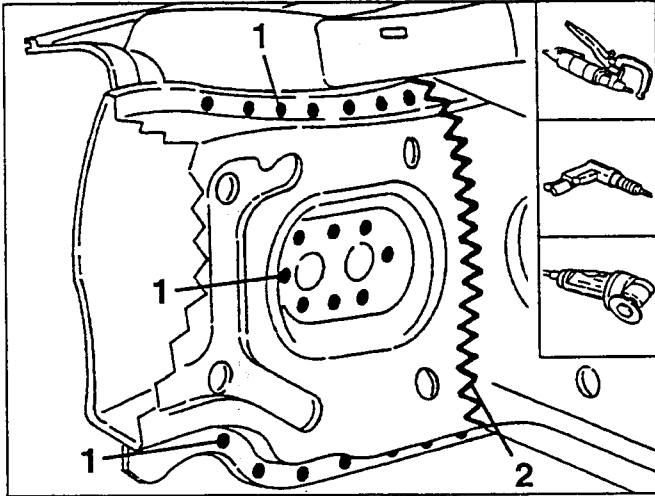
#### NOTE:

The cut on the side panel must be approx. 50mm from the front suspension attachment pillar.

- Using a rotating brush, clean the areas to be spot-cut to show up the welding points.

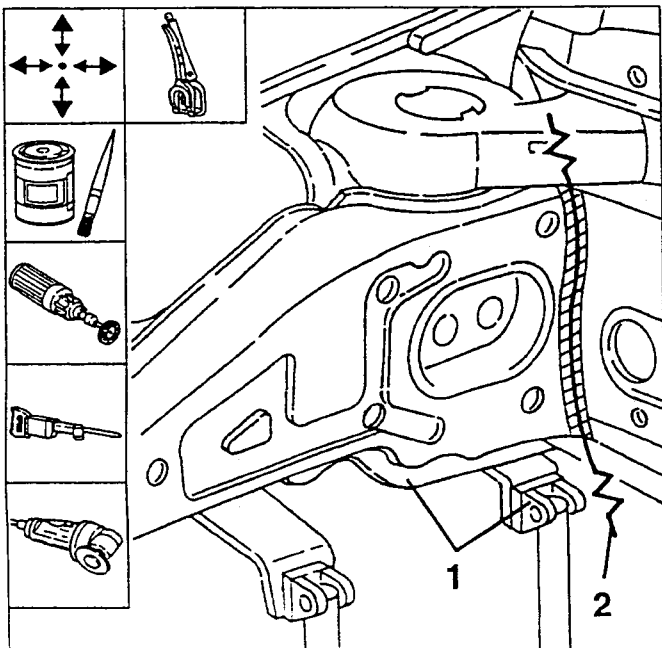


1. Using a spot cutter remove the accessible welds. Remove the remaining welds using a drill.
2. Using a circular saw, cut the inner side panel along the line shown in the diagram without damaging the underlying parts.



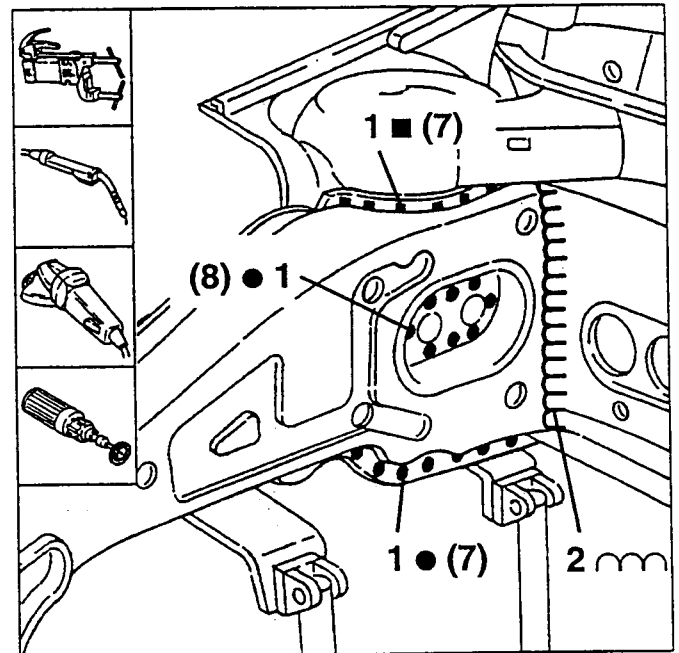
### PREPARING AND POSITIONING

- Working on a bench use a jig saw to cut the new inner side panel allowing enough material for overlapping.
  - Using a rotating brush clean around the edges of the inner and outer side panels on both sides of the sheet metal.
  - Apply the specified electroweldable protection product to the areas to be spot-welded.
1. Using a jig correctly position the partial inner side panel and overlap as shown in the diagram; secure it with clamps and mate the edges to be welded.
  2. Using a circular saw, trim the sheet metal to eliminate the excess parts.



### WELDING AND FINISHING OF THE SHEET METAL

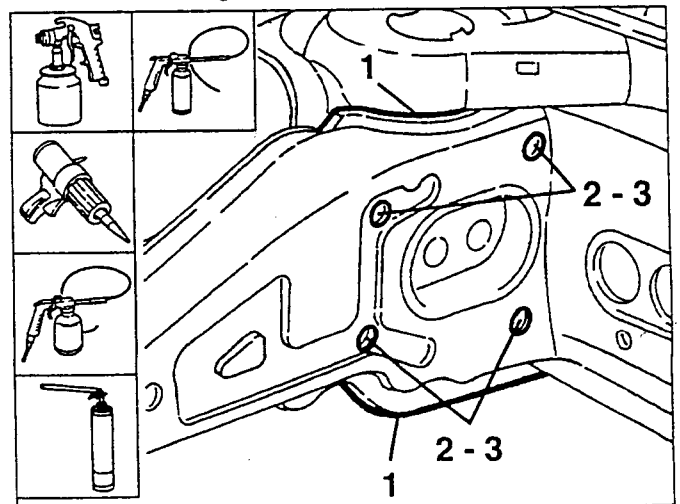
1. Using a spot-welder or, where necessary, a MIG welder, proceed as shown in the diagram.
2. Using a MIG welder, carry out seam welding.
  - Using an abrasive grinding machine, remove and flush the residues left after welding.
  - Using a rotating brush, clean the welded areas.



- Mount the partial outer side panel (see specific paragraph)

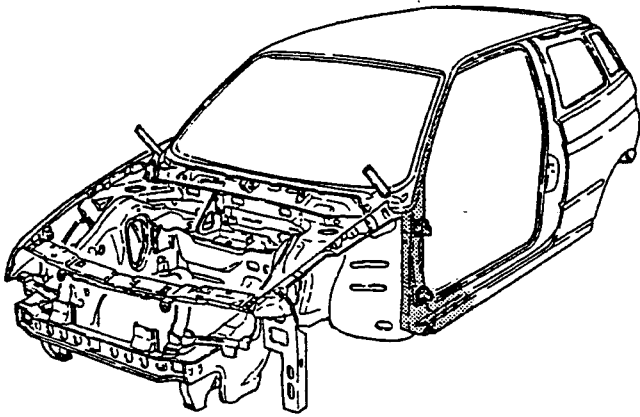
### PROTECTION

- Apply the specified corrosion inhibitor to the areas to be welded MIG.
1. Apply the specified sealant along the join with the side panel.
- Proceed to the painting phase.
2. Centre the boxed parts through the holes shown in the diagram.
  3. Foam treat the boxed parts through the holes shown in the diagram.

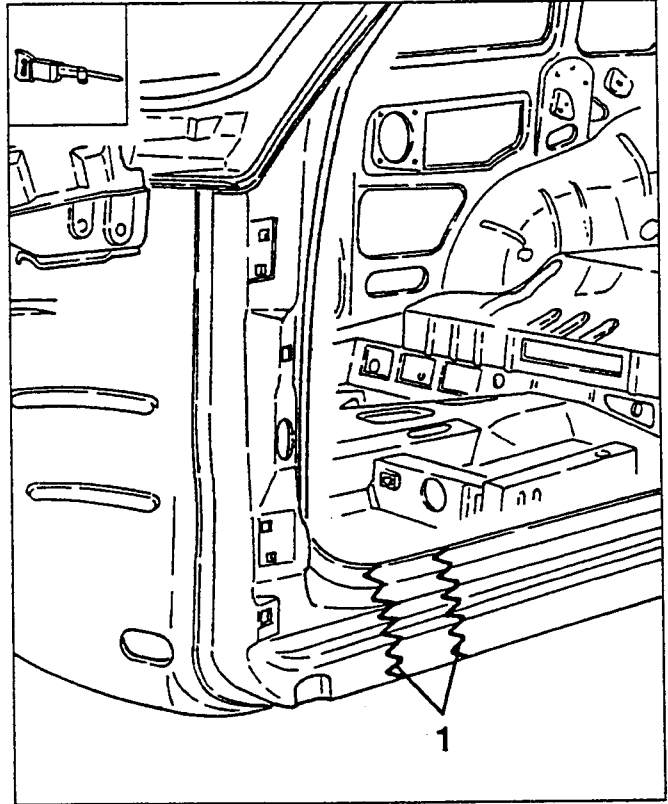


**FRONT PILLAR****PRELIMINARY OPERATIONS**

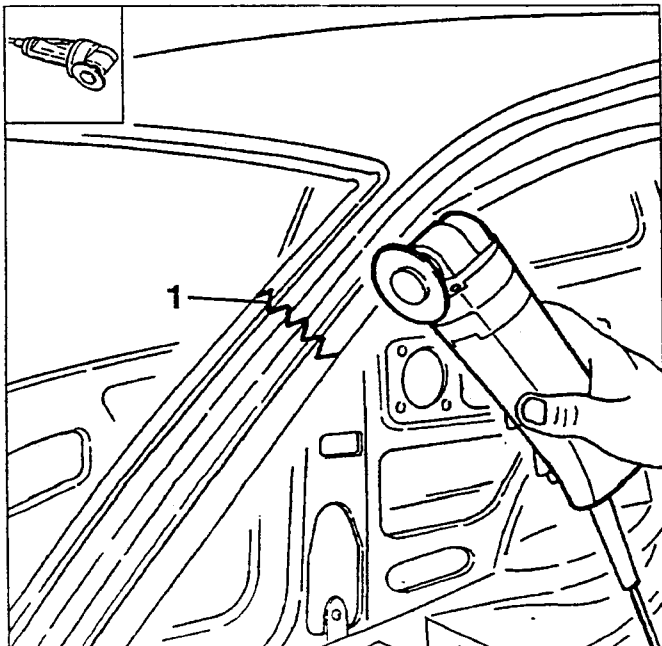
- Disconnect the negative (-) cable from the battery and remove the control units.
- Remove the trim components, electrical and mechanical systems which could hinder the repair operations or get damaged during work (see specific paragraphs).
- Remove the following sheet metal parts:
  - bonnet (see specific paragraph).
  - door on affected side (see specific paragraph).
  - front wing on affected side (see specific paragraph).

**REMOVAL**

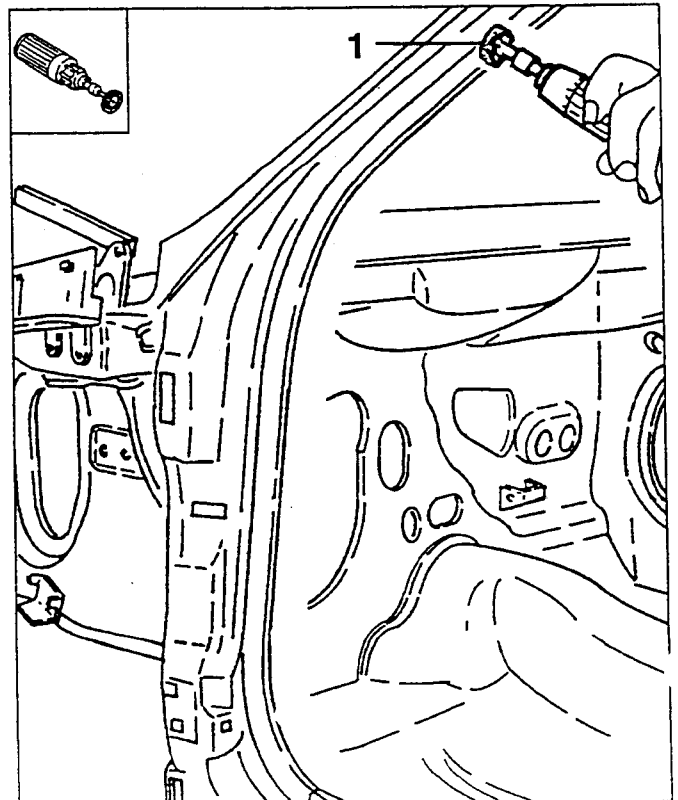
1. Using a jig saw, cut following the lines shown in the diagram, without damaging the underlying parts.



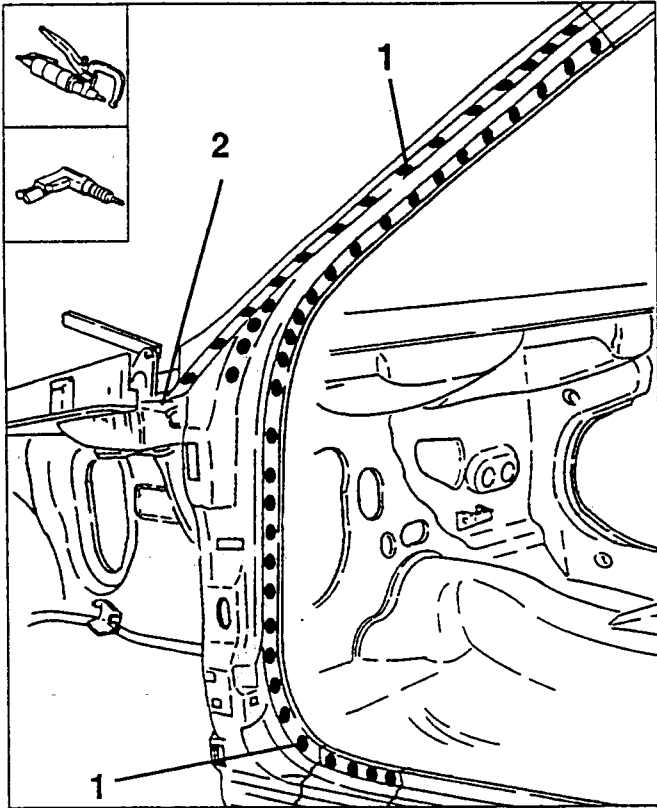
1. Using a circular saw, cut following the lines shown in the diagram, without damaging the underlying parts.



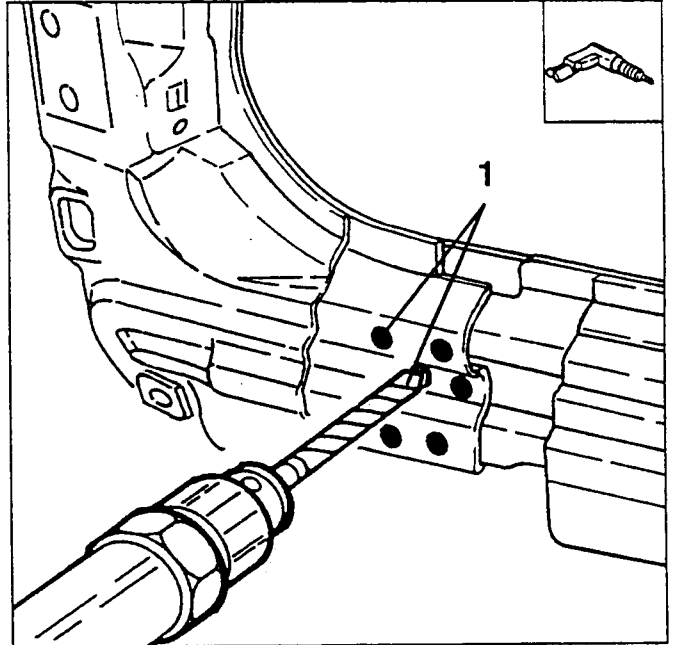
1. Using a rotating brush, clean the areas to be spot-cut to show up the welding points.



1. Using a chamfering machine, remove the accessible welding points, remove the remaining welding points using a drill.
2. Open the clinch tabs.

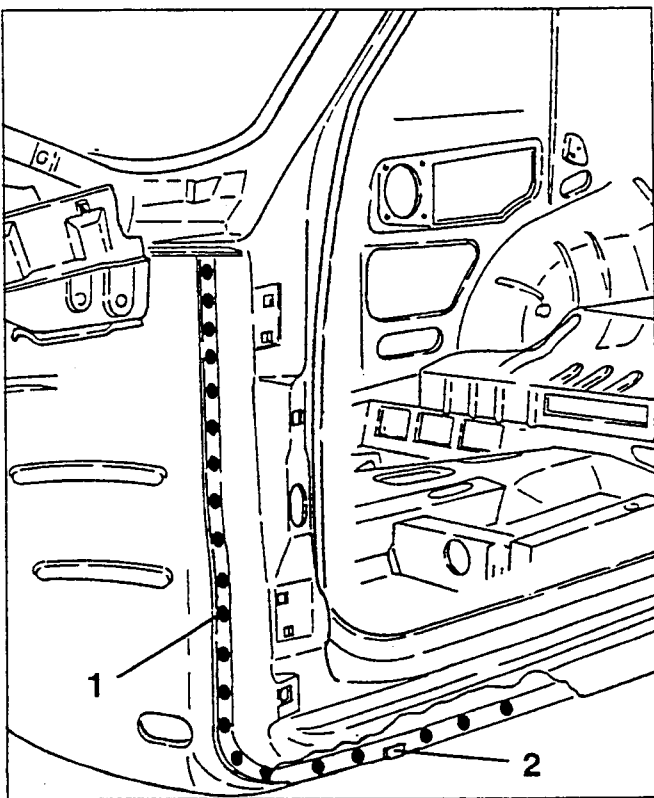
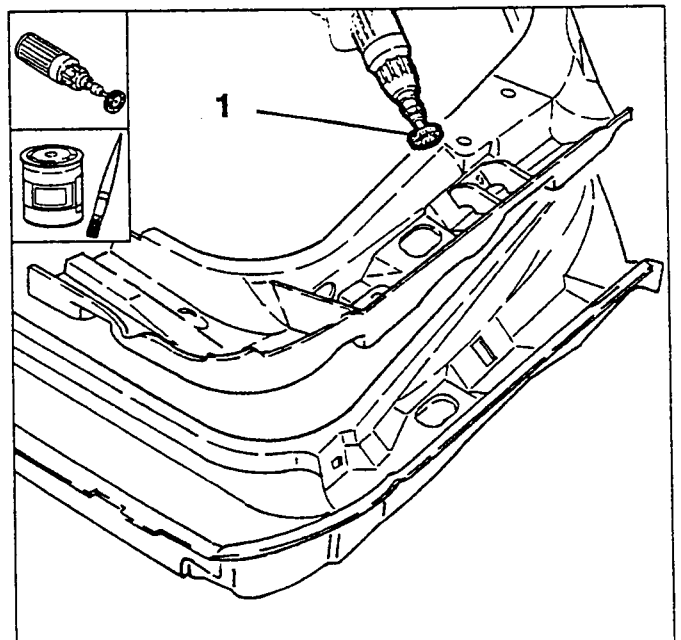


1. Using a drill, remove the welding points.
- Remove the front pillar complete with frame cutting the sealant if necessary.



### PREPARATION

- Working on a bench prepare for the installation of the front pillar and frame as follows:
  1. Using a rotating brush, clean the areas which are to be welded.
  - Apply the specified electroweldable protection product to the areas to be spot-welded.

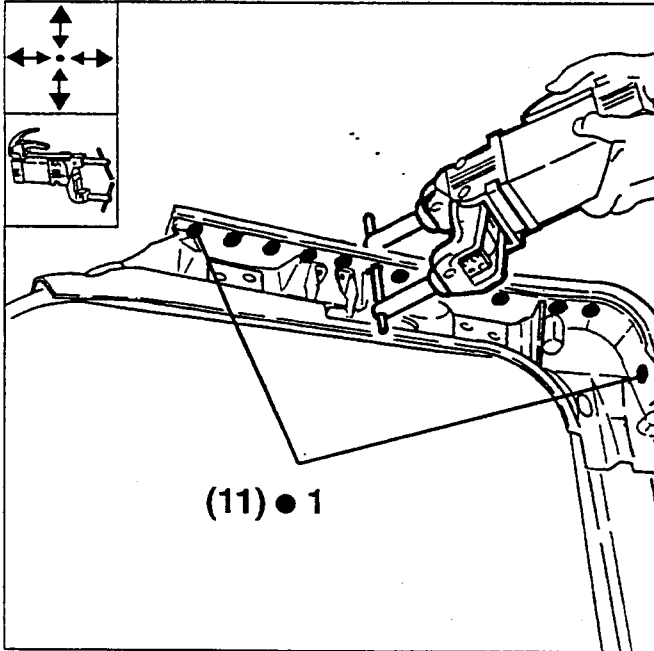


- Remove the plug from the door sill to gain access to the welding points on the front pillar frame.

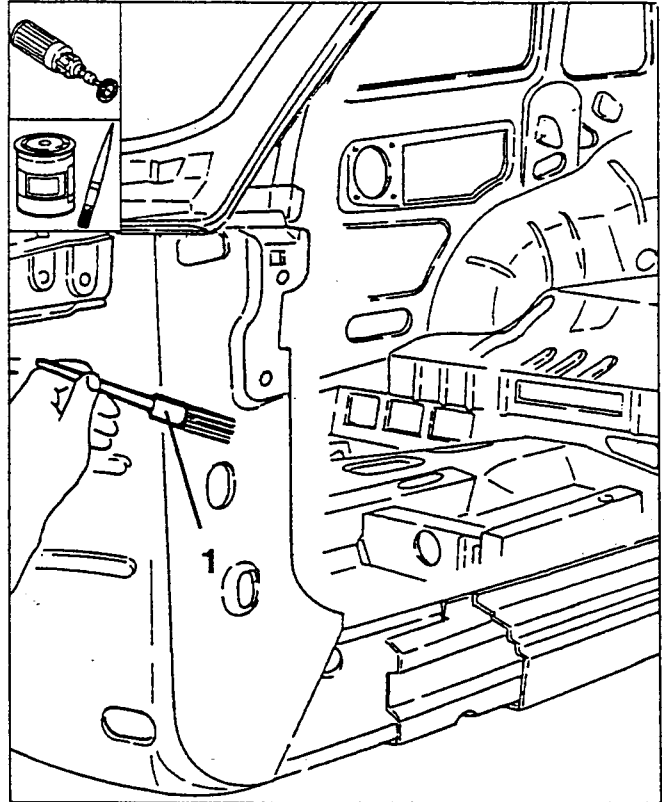
- Position the frame in on the pillar and lock the components in place.

**NOTE:**  
Check centering of the hinge attachment hole to check the position.

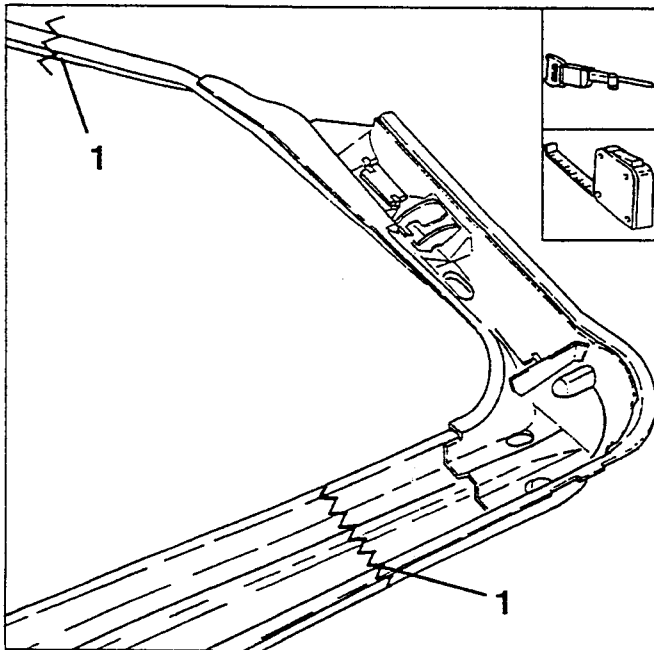
1. Using a spot-welder, proceed as shown in the diagram.



1. Apply the specified electroweldable protection product to the areas to be spot-welded.

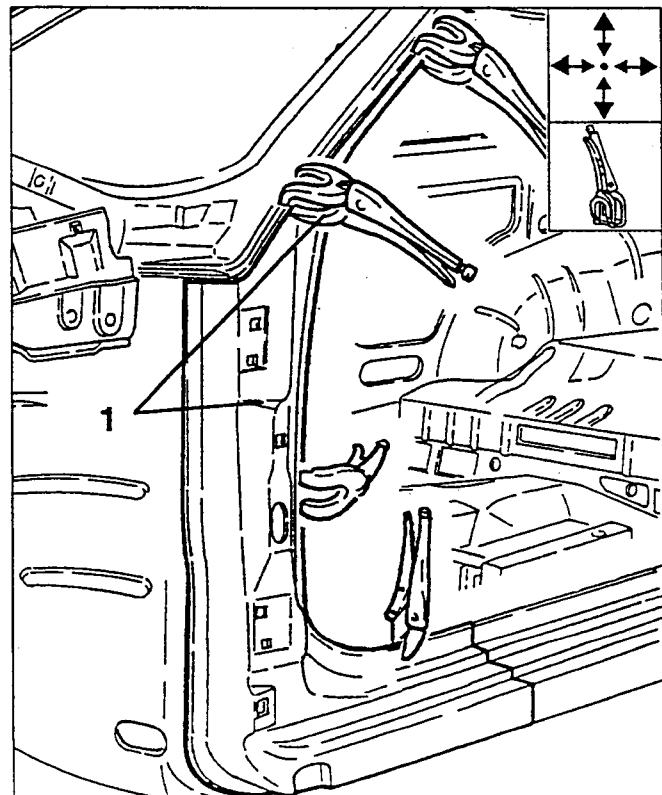


1. Working on a bench cut the new front pillar with a jig saw ensuring that enough margin is left for overlapping.



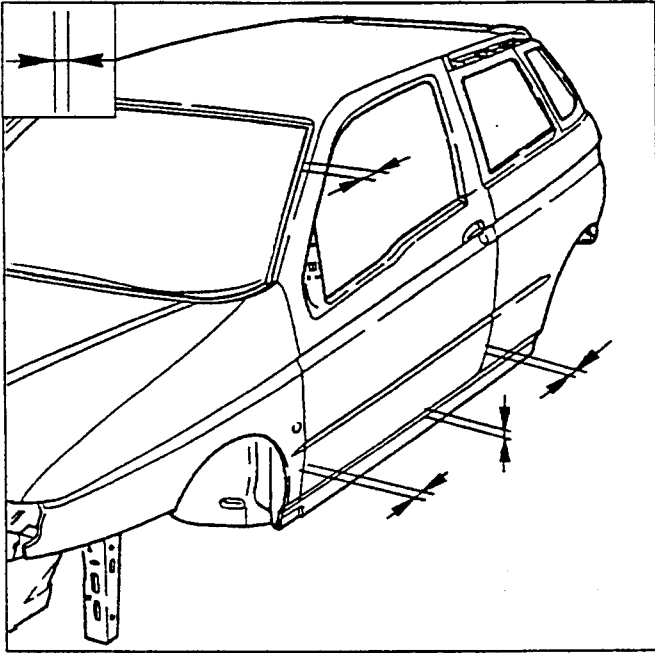
### POSITIONING AND INSPECTION

1. Position the front pillar complete with frame joining together the edges to be welded and securing them with clamps.

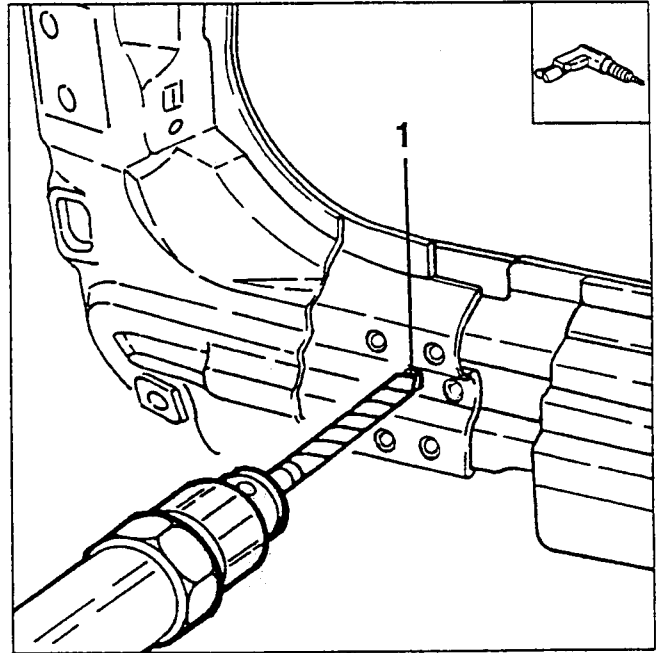


- Using a rotating brush, clean the areas which are to be welded on the vehicle and on the pillar.

- Temporarily fix the front pillar with screws and remove the previously installed clamps.
- Check parallelism, gaps and angles and refit the previously removed mobile components with their gaskets together with any parts which, once installed, make it possible to check the successful outcome of the operations.



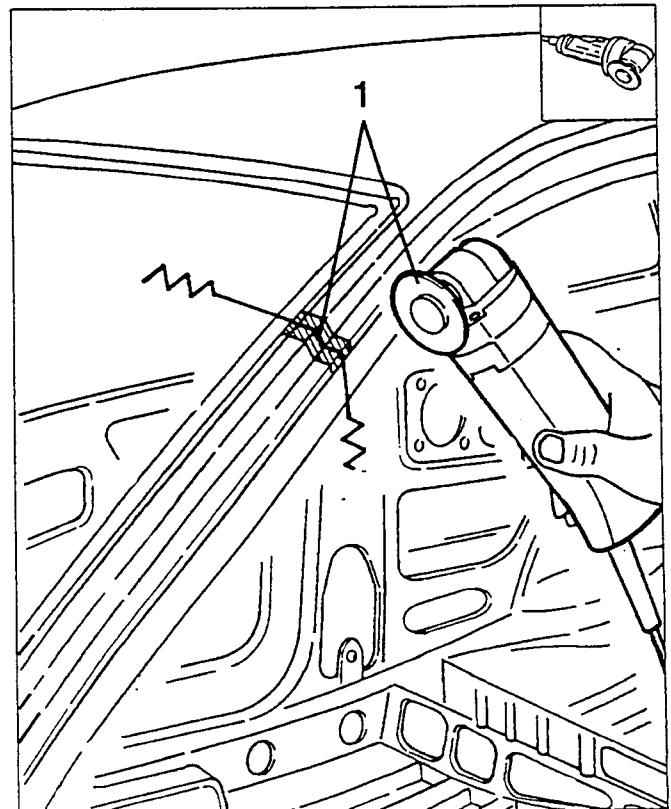
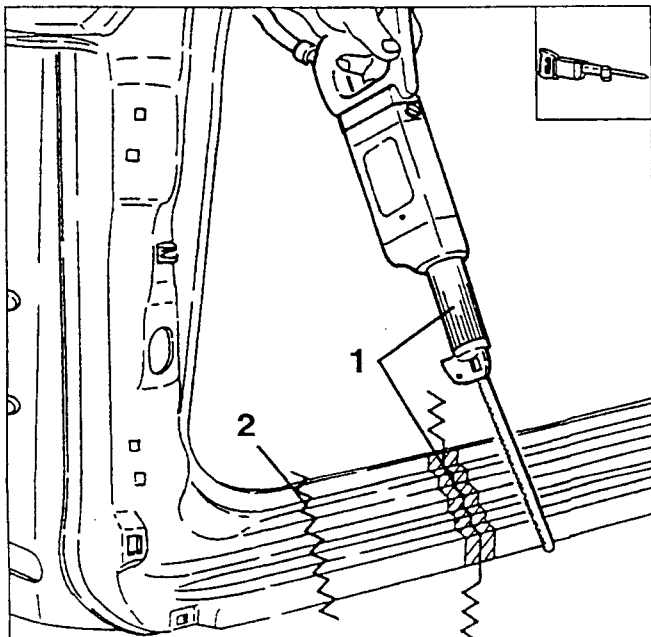
1. Using a drill, perforate with a 5 mm bit on the front pillar frame in order to permit welding.



- Remove the components installed previously to check the correct position of the pillar.

1. Using a jig saw, trim the lower sheet metal panels removing the excess parts without damaging the underlying sheeting.
2. Using a jig saw, make another cut as shown in the diagram to create a plug to allow access to the welding on the pillar.

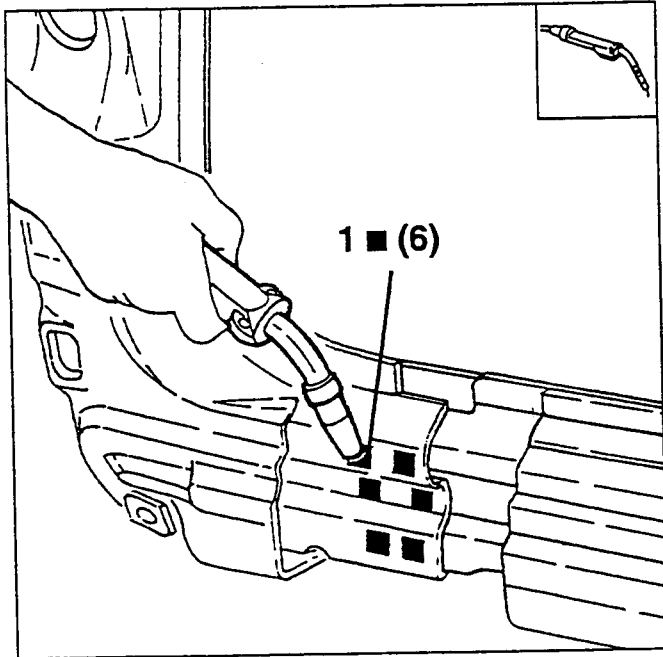
1. Using a circular saw, trim the upper sheet metal panels removing the excess parts without damaging the underlying sheeting.



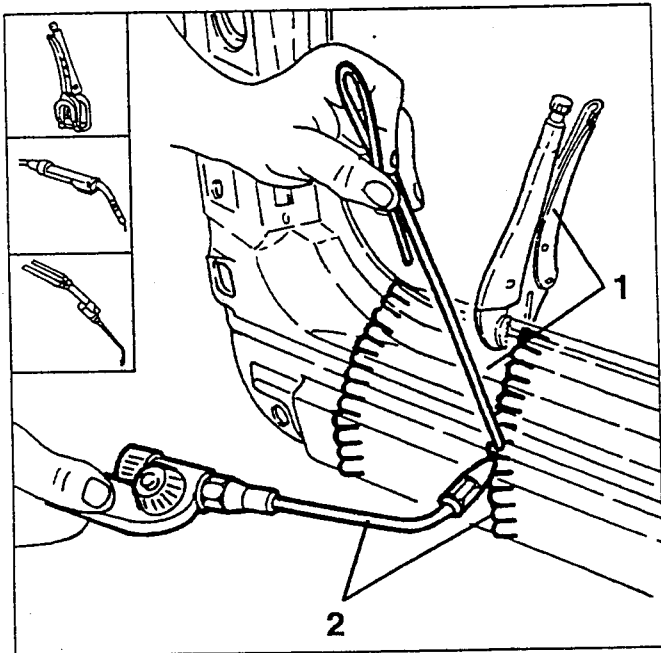


## WELDING AND FINISHING OF THE SHEET METAL

1. Using a MIG welder, proceed as shown in the diagram.

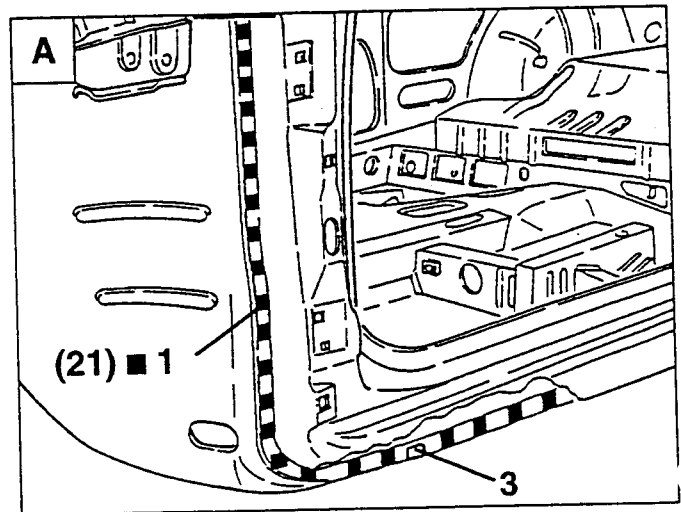
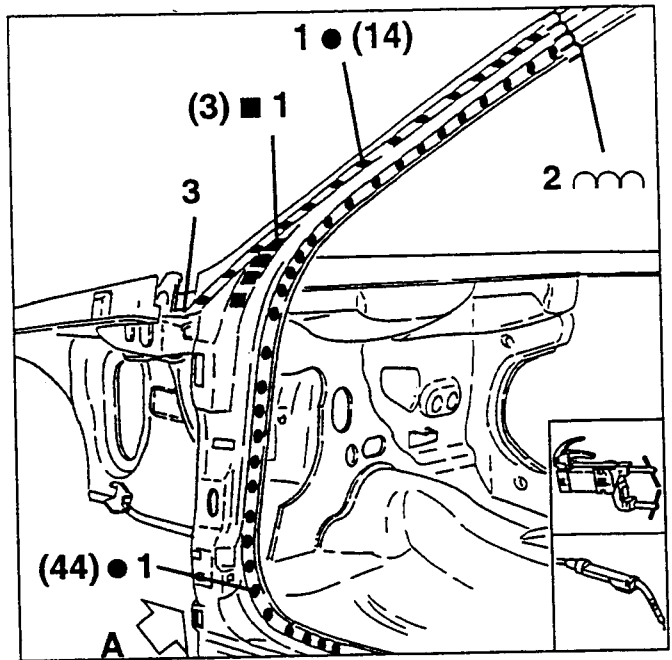


1. Install the previously created plug and fix it in position with clamps.
2. Using a MIG welder or an oxyacetylene torch weld as shown in the diagram.



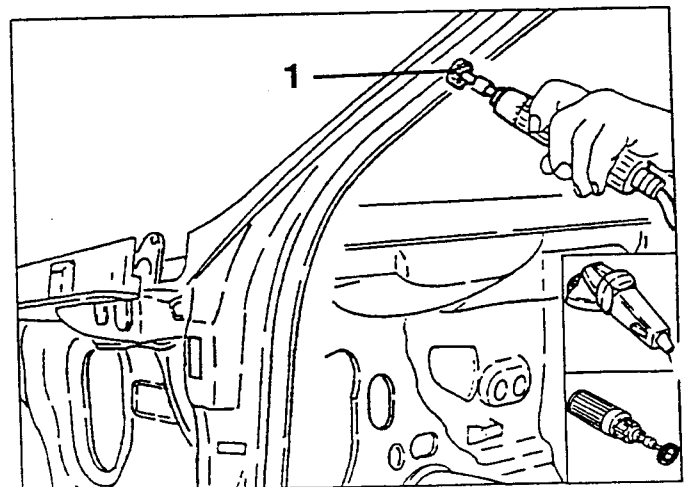
1. Using a spot-welder or, where necessary, a MIG welder, proceed as shown in the diagram.
2. Using a MIG welder, weld a seam.

3. Bend the clinch tabs.



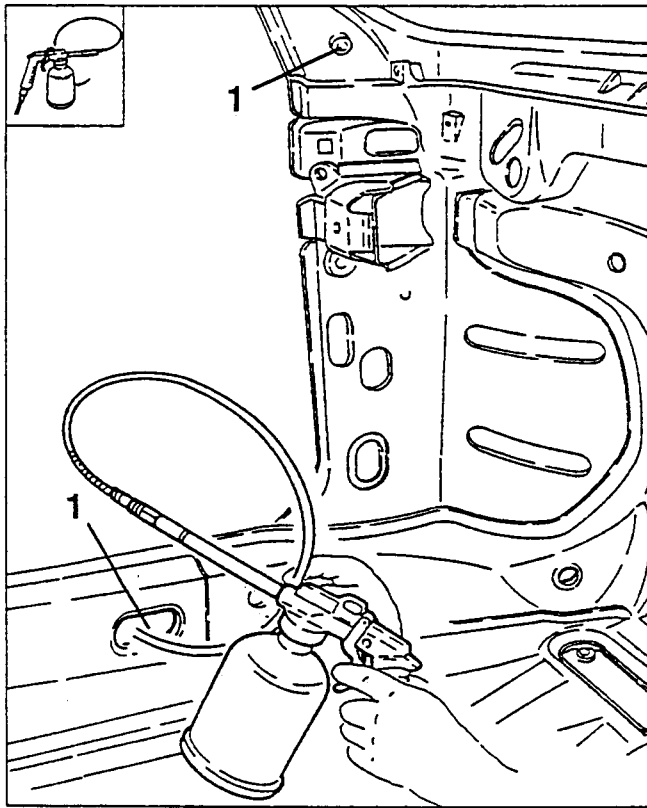
- Using an abrasive grinding machine, remove and flush the residues left after welding.

1. Using a rotating brush, clean the welded areas.

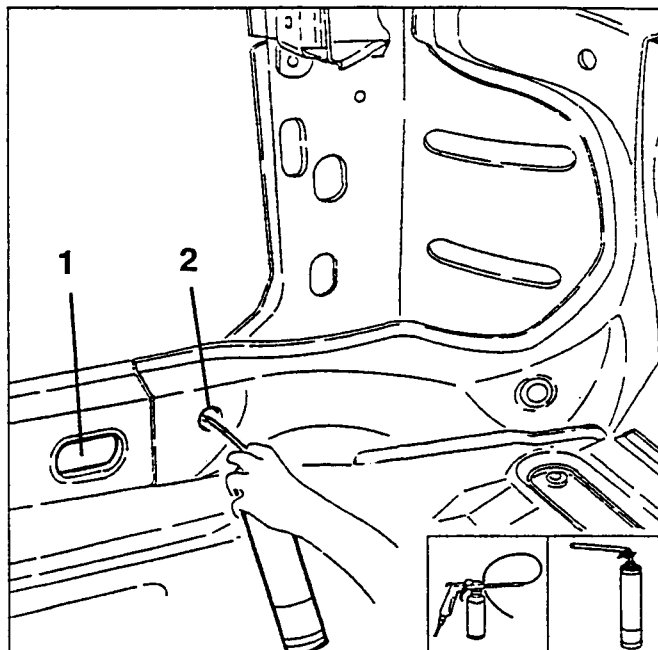


### PROTECTION

1. Apply the specified corrosion inhibitor to the areas to be welded MIG, through the holes shown in the diagram.

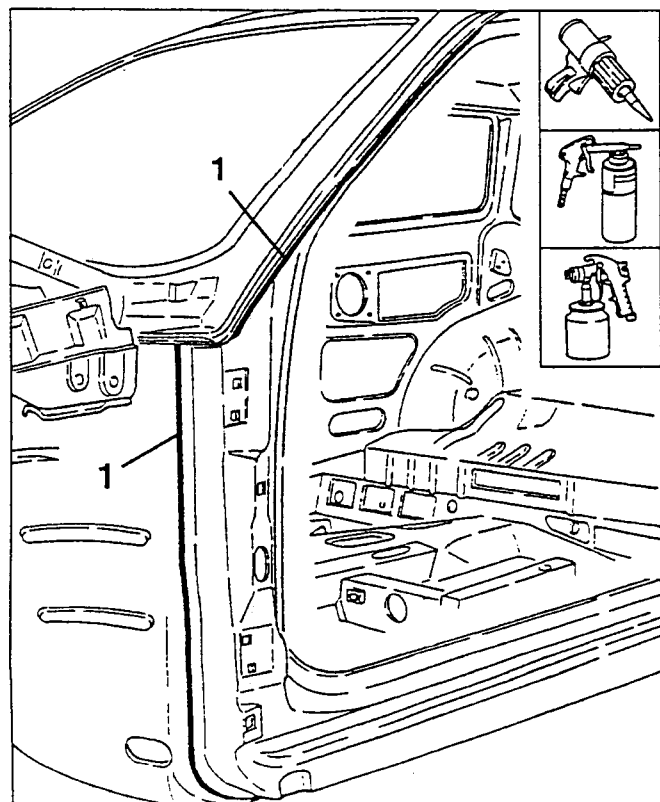


1. Wax treat the boxed parts through the hole shown in the diagram.  
2. Foam treat the boxed parts through the hole shown in the diagram.



1. Apply the specified sealant along the lines highlighted in the diagram.

- Apply the specified underbody protection to the replaced areas.
- Proceed to the painting phase.

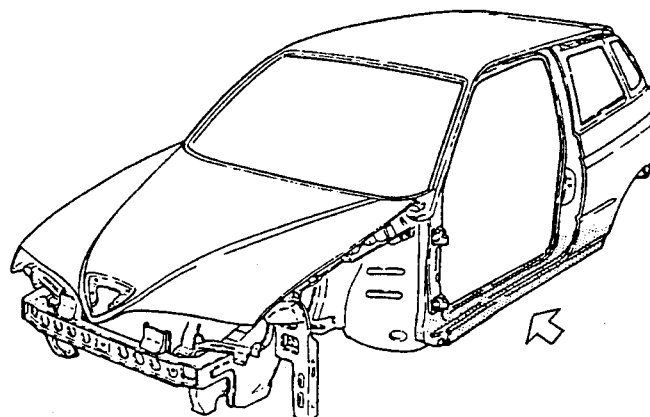


### DOOR SILL RAIL

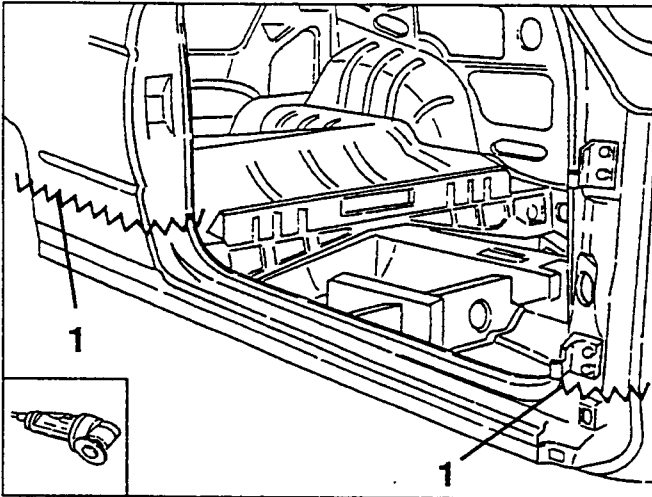
#### PRELIMINARY OPERATIONS

- Disconnect the negative (-) cable from the battery and remove the control units.
- Remove the trim components, electrical and mechanical systems which could hinder the repair operations or get damaged during work (see specific paragraph).
- Remove the following sheet metal parts:
  - door on affected side (see specific paragraph).
  - front wing on affected side (see specific paragraph).

#### REMOVAL

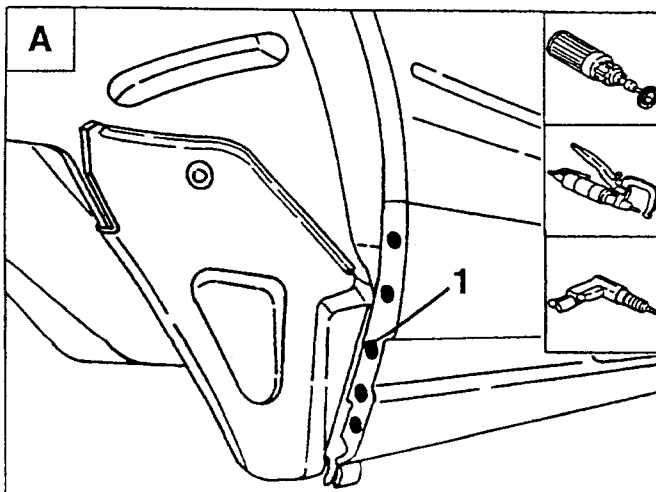
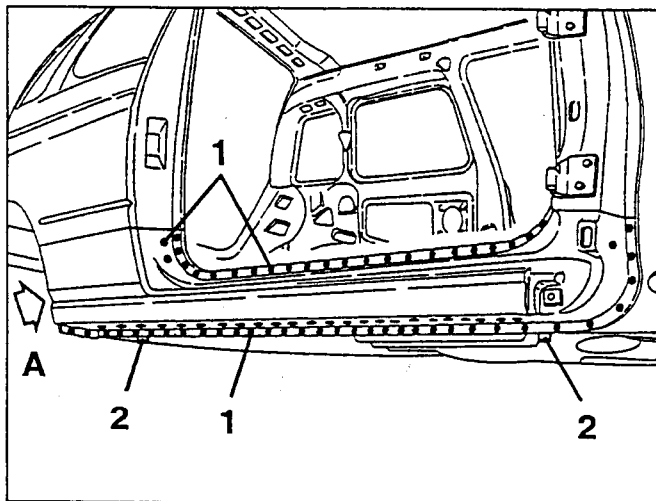


1. Using a circular saw, cut following the lines shown in the diagram, without damaging the underlying areas.



- Using a rotating brush, clean the areas to be spot-cut to show up the welding points.

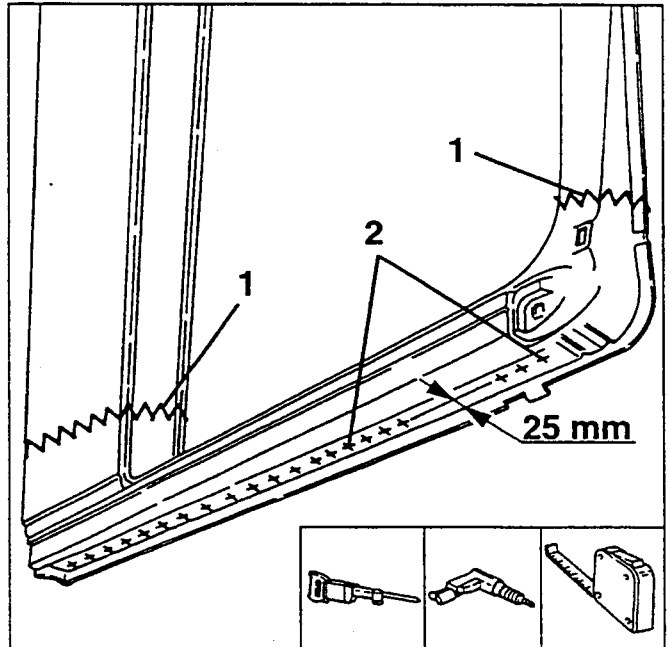
1. Using a chamfering machine, remove the accessible welding points; remove the remaining welding points using a drill.  
2. Open the clinch tabs.



- Remove the door sill rail cutting away the sealant if necessary.

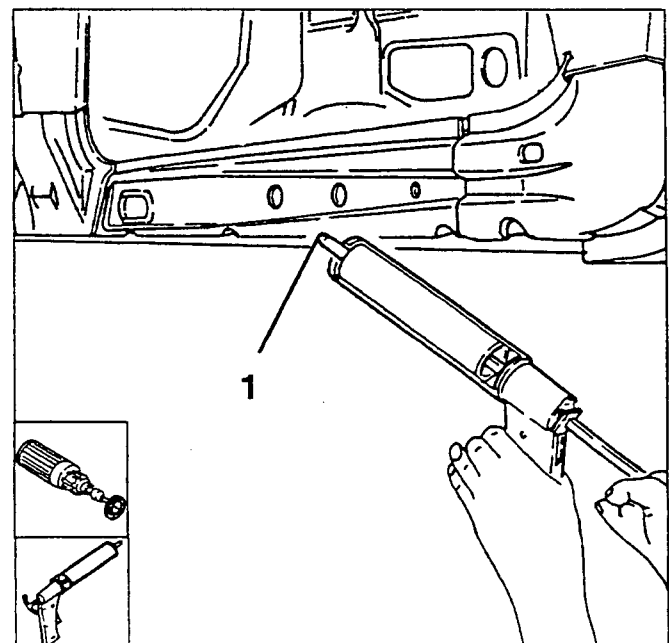
### PREPARATION

1. Working on a bench with a jig saw cut the new door sill rail allowing enough or overlapping.  
2. Trace out the rail and drill with a 5 mm bit as shown in the diagram.

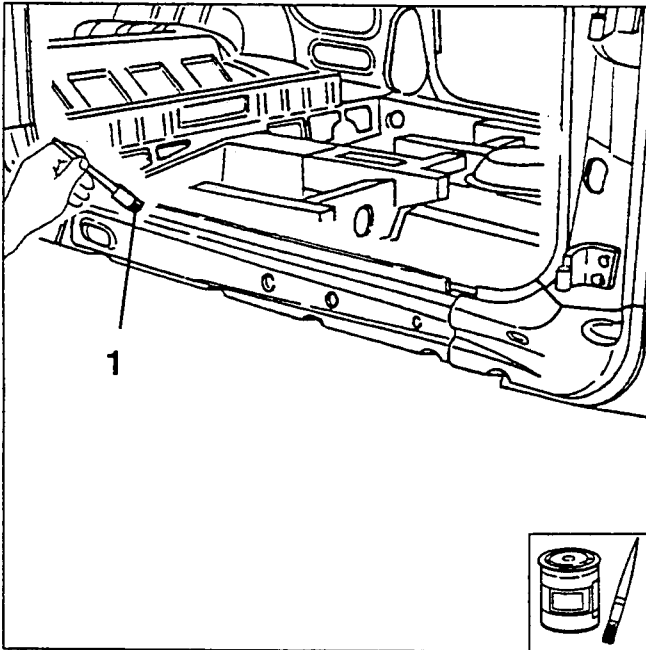


- Using a rotating brush, clean the areas which are to be welded.

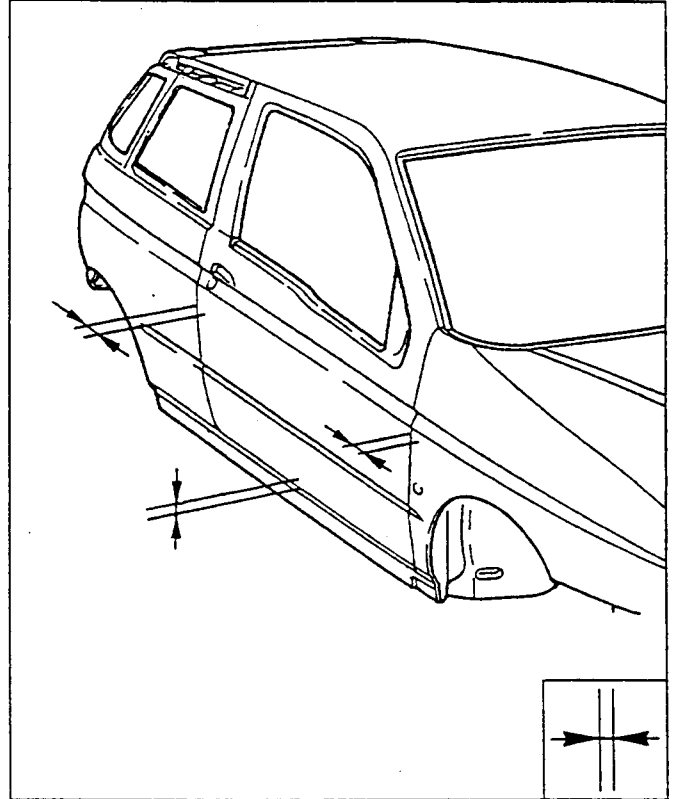
1. Apply a thick layer of electroweldable protection to the lower part of the door sill rail and in the rear wheel housing.



1. Apply electroweldable protection with a brush to the remaining areas to be spot welded.

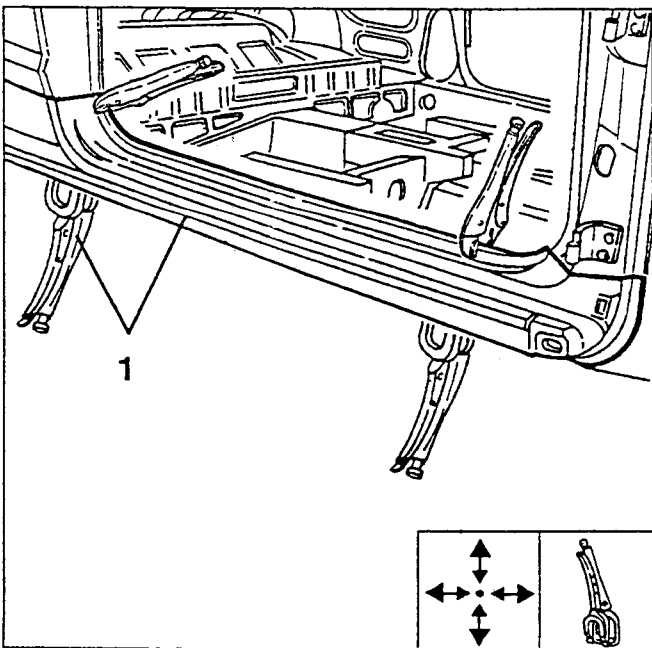


- Check parallelism, gaps and angles and refit the previously removed mobile components with their gaskets together with any parts which, once installed, make it possible to check the successful outcome of the operations.



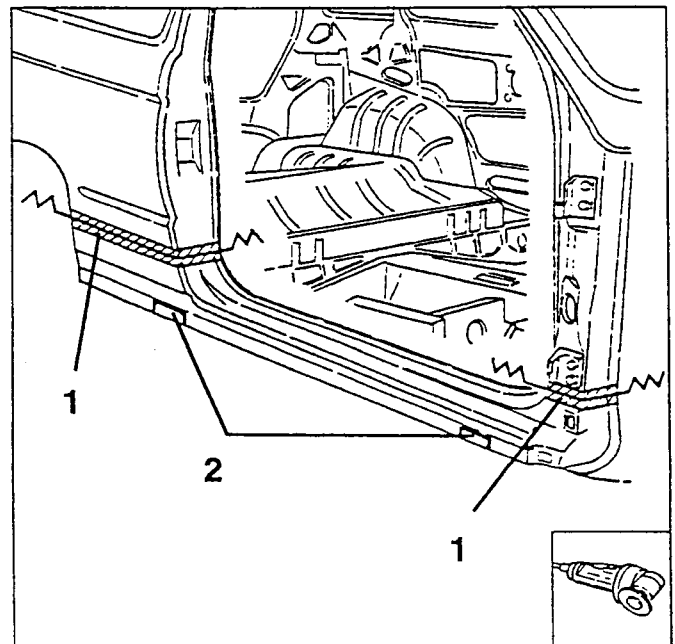
### POSITIONING AND INSPECTION

1. Position the door sill rail joining together the edges to be welded and securing them with clamps.



- Remove the components installed to check the correct position of the door sill rail.

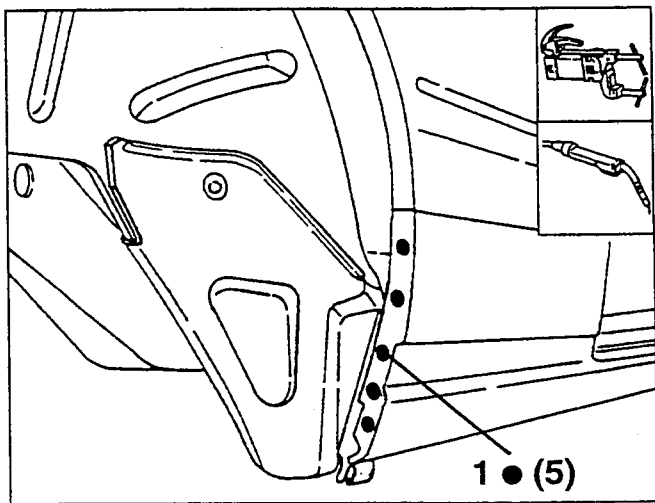
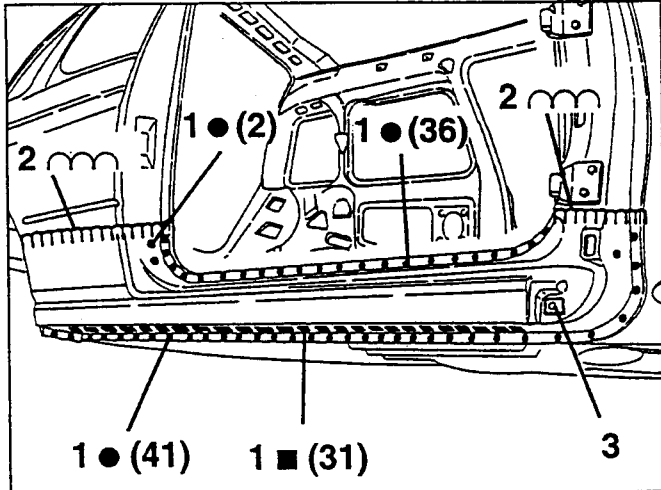
1. Using a circular saw, trim the sheet metal and remove the excess parts without damaging the underlying parts.
2. Bend the clinch tabs.



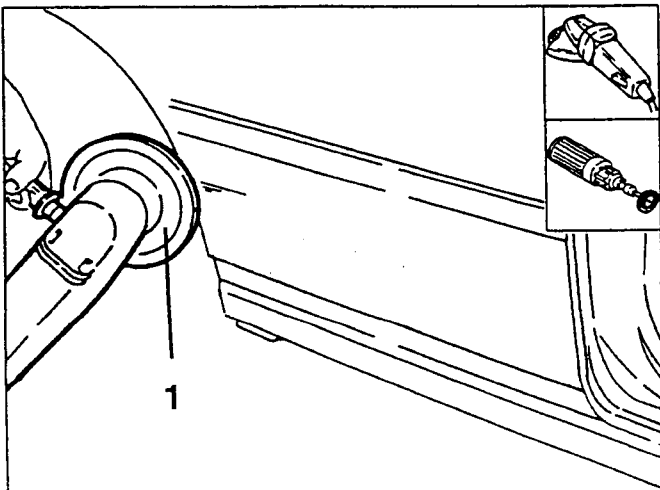
- Temporarily fix the door sill rail with screws and then remove the previously fitted clamps.

## WELDING AND FINISHING OF THE SHEET METAL

1. Using a spot-welder or, where necessary, a MIG welder, proceed as shown in the diagram.
2. Using a MIG welder, seam weld as shown in the diagram
3. Install the block securing the wing.

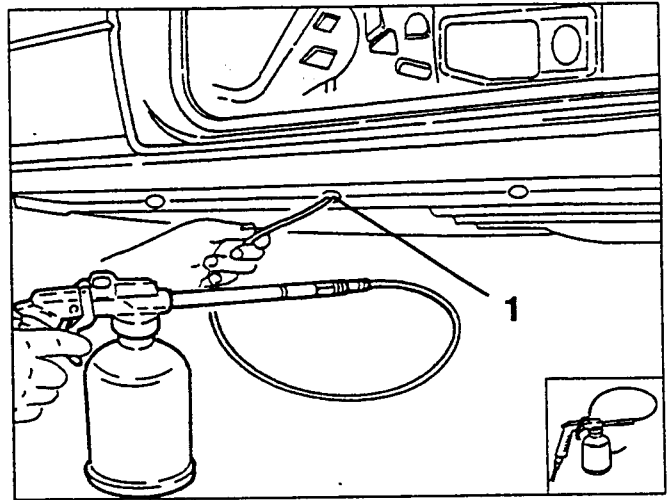


1. Using an abrasive grinding machine, remove and flush the residues left after welding.
- Using a rotating brush, clean the welded areas.

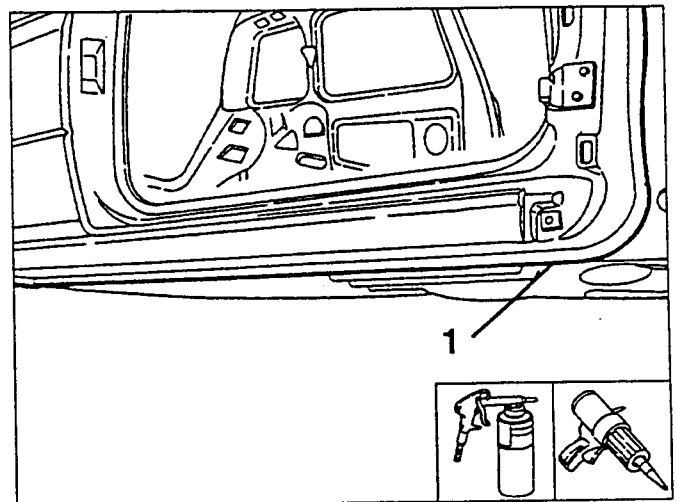


## PROTECTION

1. Apply the specified corrosion inhibitor to the areas to be welded MIG.

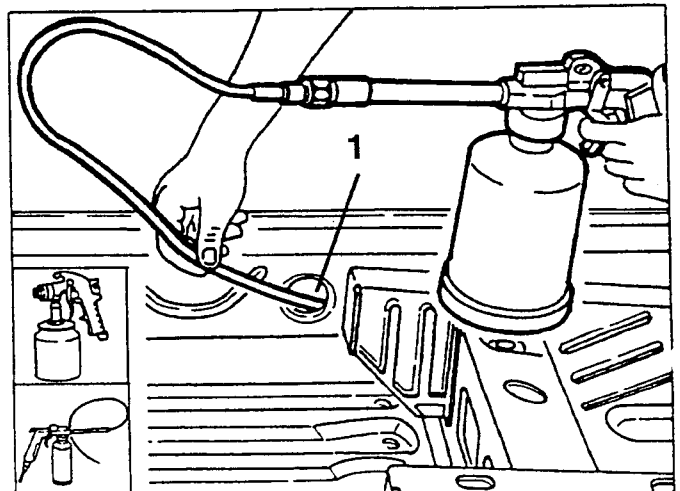


1. Apply the specified sealant along the lines highlighted in the diagram.
- Apply the specified underbody protection to the replaced areas.



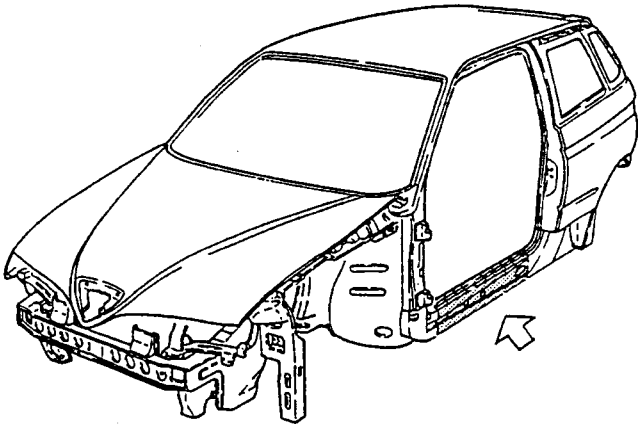
- Proceed to the painting phase.

1. Wax treat the boxed parts through the hole shown in the diagram.

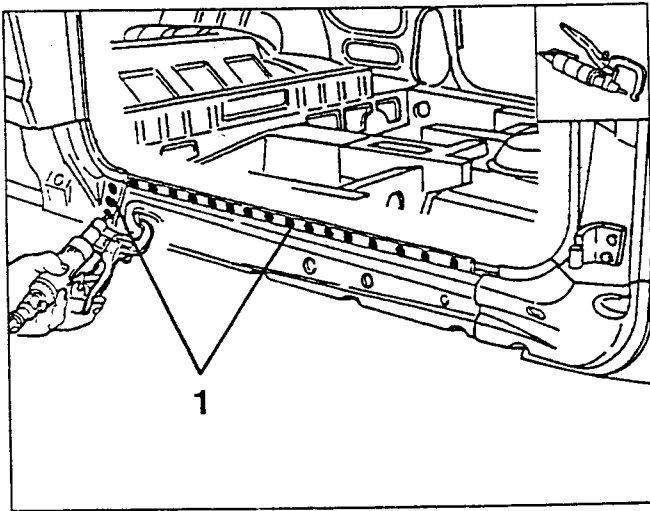


### DOOR SILL FRAME (WITH DOOR SILL REINFORCING REMOVED)

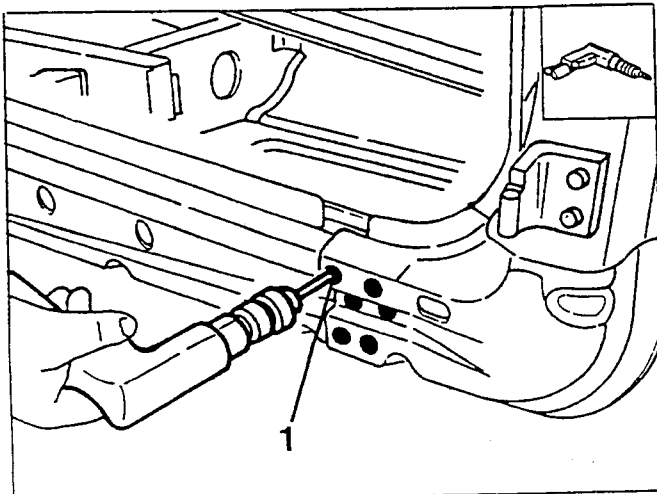
#### REMOVAL



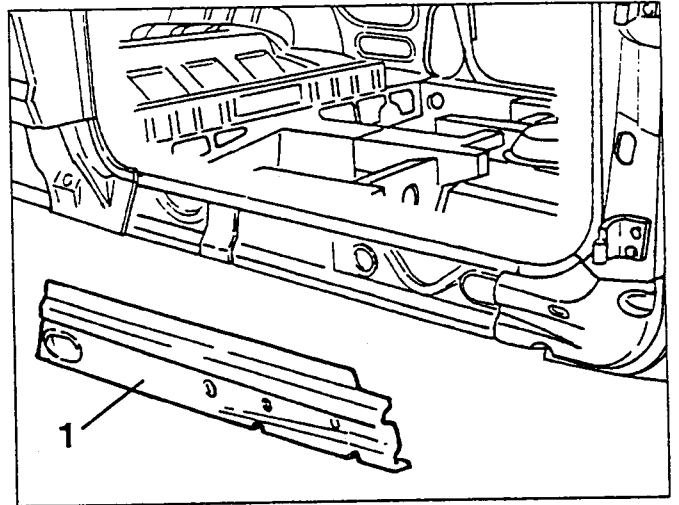
1. Using a spot cutter, remove the welding points shown in the diagram.



1. Using a drill, remove the welding points shown in the diagram.

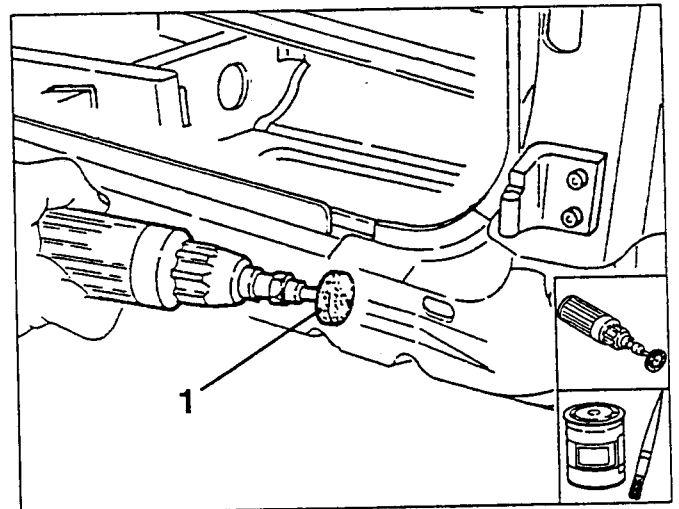


1. Remove the door sill frame.



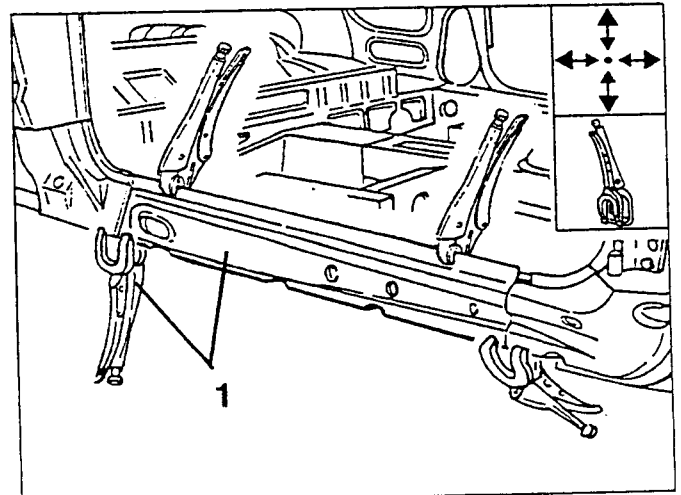
#### PREPARATION

1. Using a rotating brush, clean the area to be welded.  
- Apply the specified electroweldable protection to the areas to be spot welded.



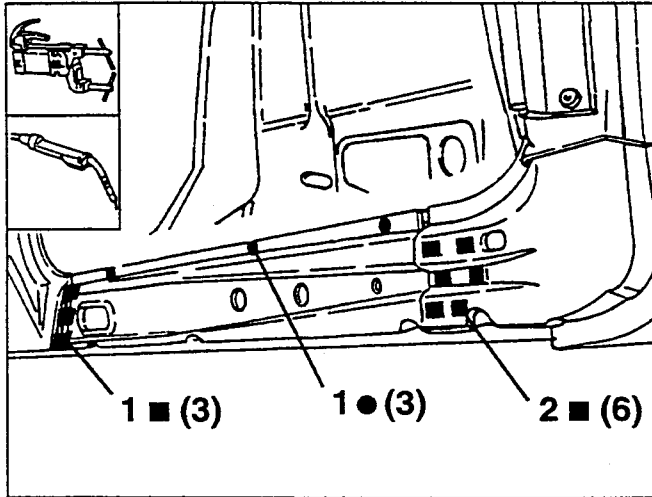
#### POSITIONING

1. Position the door sill frame and join the edges together and secure with clamps.



### WELDING AND FINISHING THE SHEET METAL

1. Using a spot welder, tack the door sill frame as shown in the diagram.
2. Using a MIG welder, proceed as shown in the diagram.



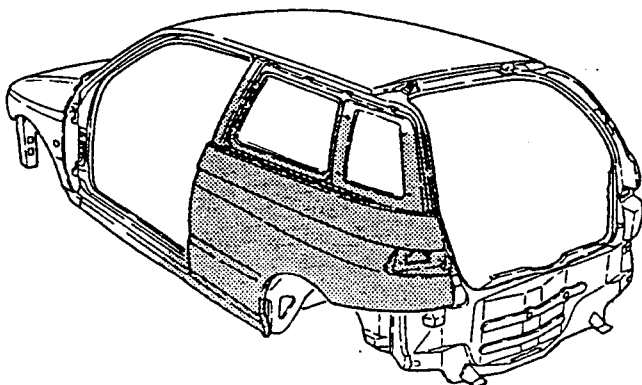
- Refit the reinforcing of the door sill proceeding as described in the relative paragraph.

### REAR WING

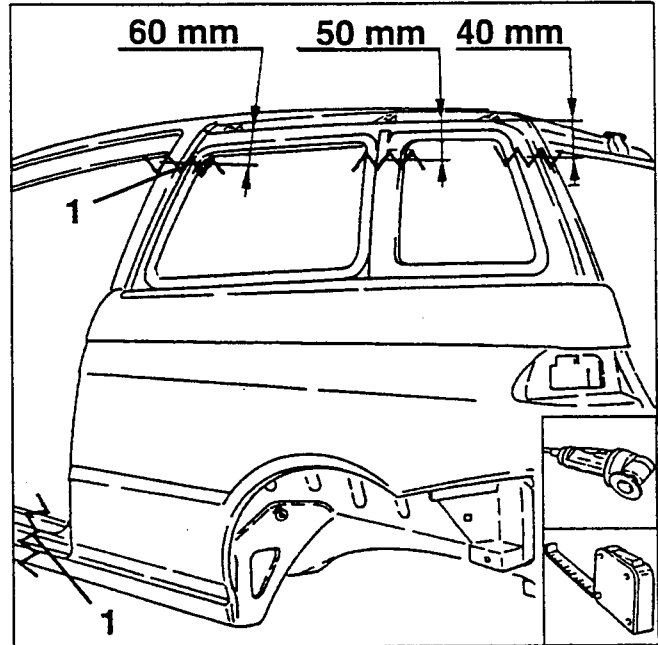
#### PRELIMINARY OPERATIONS

- Disconnect the negative (-) cable from the battery and remove the electronic control units.
- Remove the trim components, electrical and mechanical system which could hinder the repair operations or get damaged during work (see specific paragraphs)
- Remove the following sheet metal parts:
  - door on affected side (see specific paragraph).
  - front wing on affected side (see specific paragraph).

#### REMOVAL



1. Using a circular saw, cut following the lines indicated in the diagram, without damaging the underlying components.

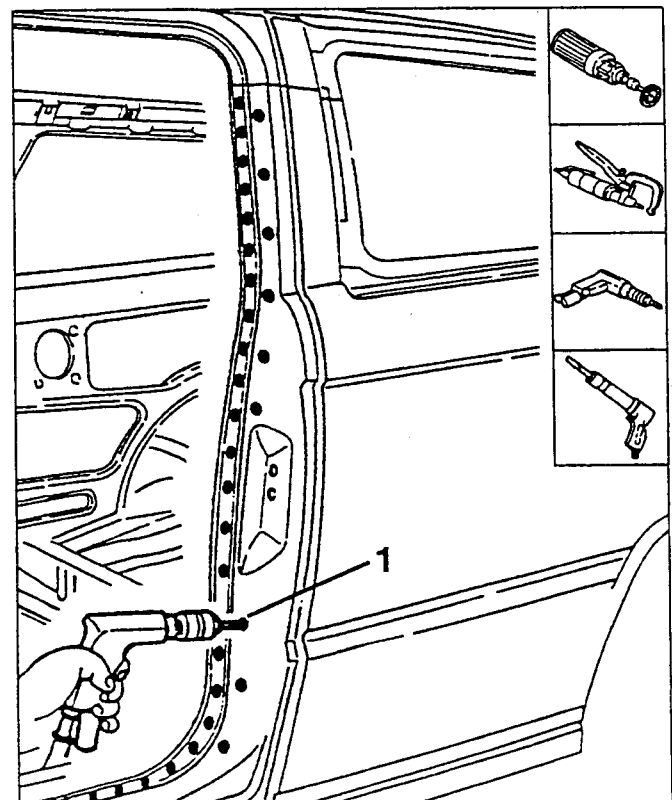


- Using a rotating brush, clean the areas to be spot-cut to highlight the welding points.

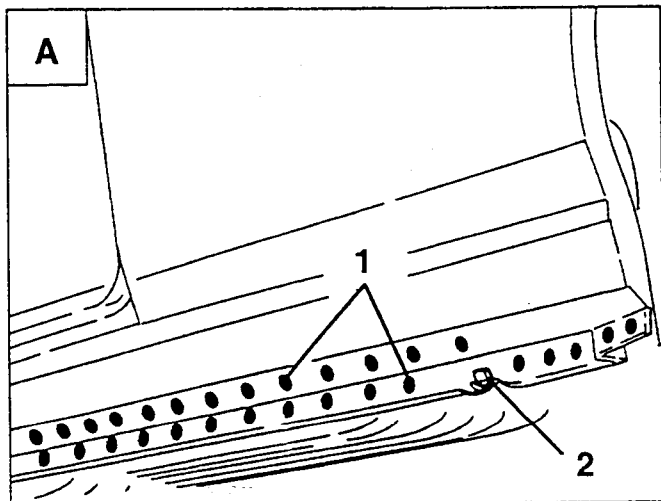
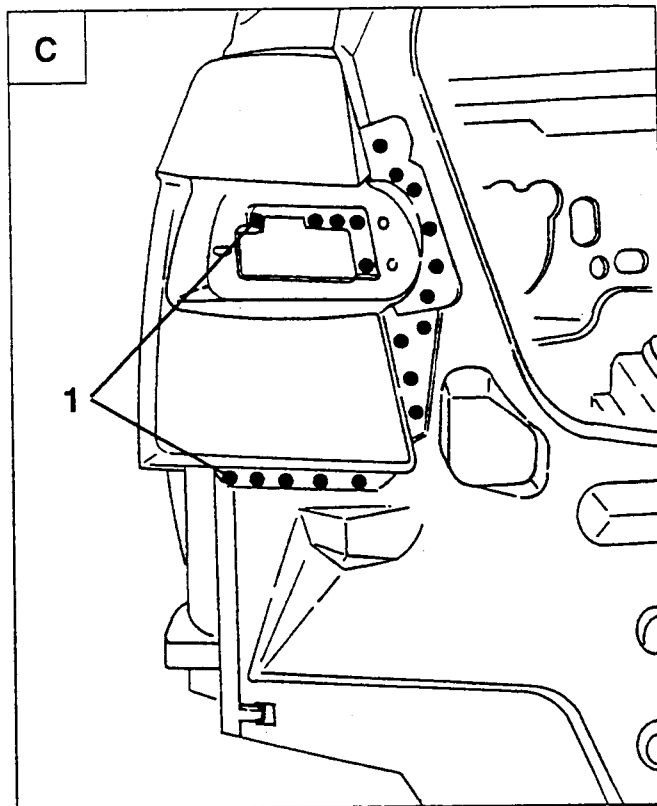
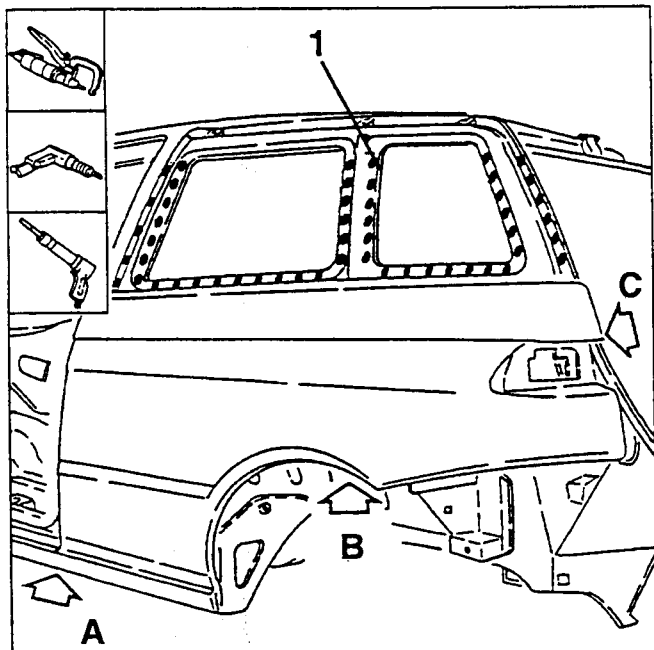
1. Using a spot cutter, remove the accessible welding points; remove the remaining welding points using a drill or a chisel.

#### NOTE:

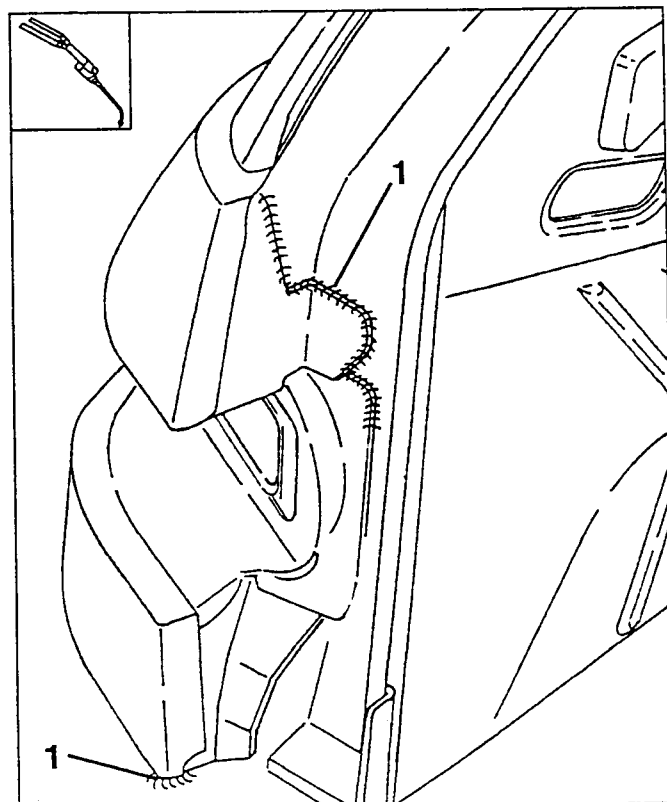
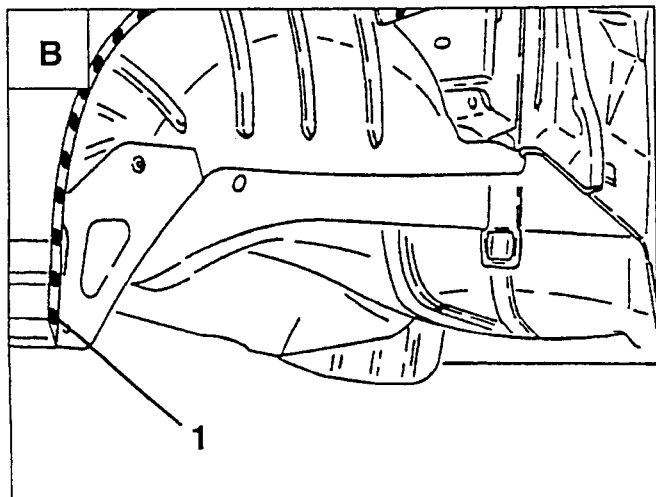
If necessary free the sheet metal to facilitate the spot cutting operations



1. Using a spot cutter, remove the accessible welding points; remove the remaining points using a drill or a chisel.
2. Open the clinch tabs.



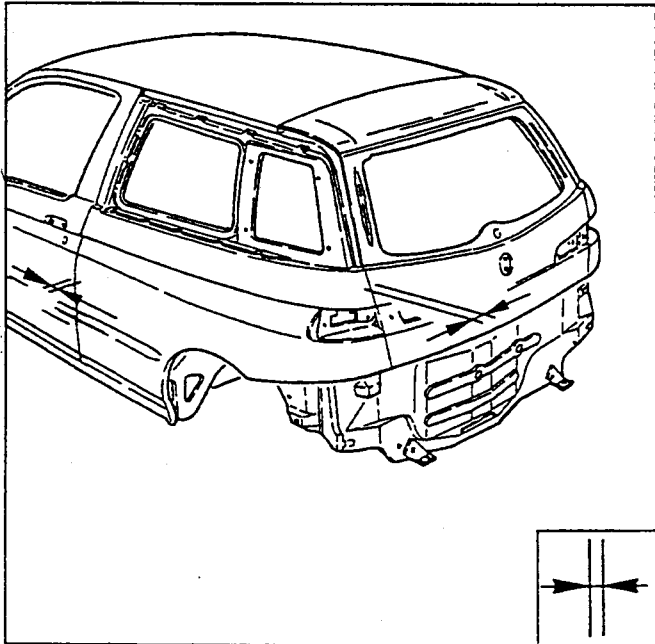
1. Using an oxyacetylene torch, unweld and remove the rear areas of the wing.



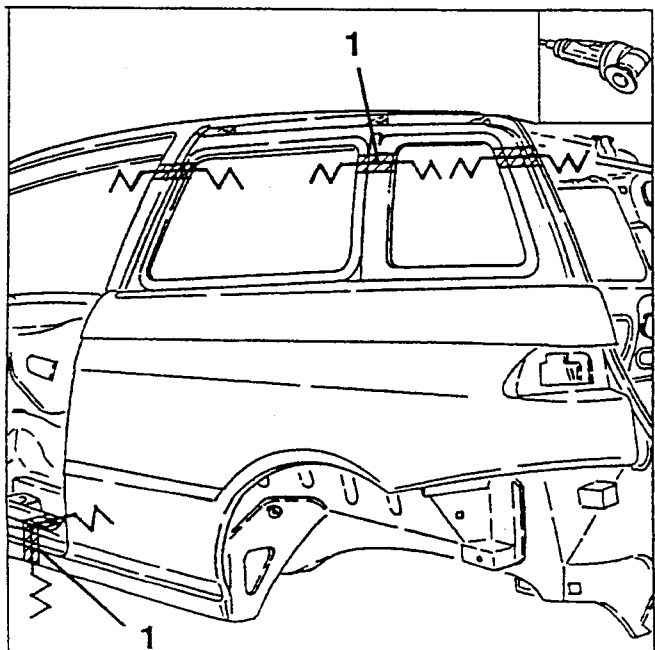


### PREPARATION AND INSPECTION

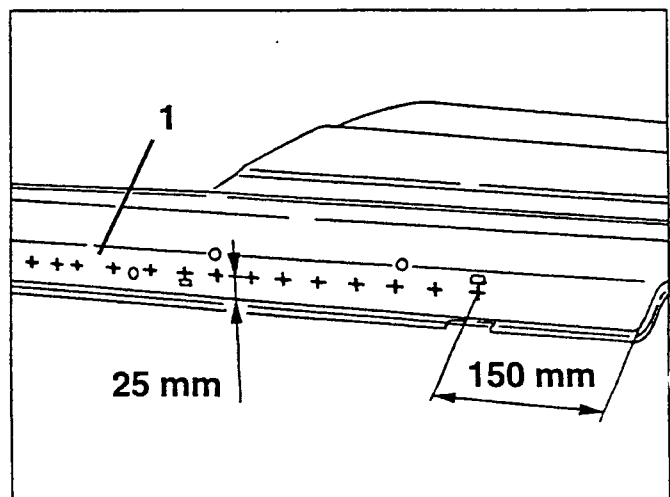
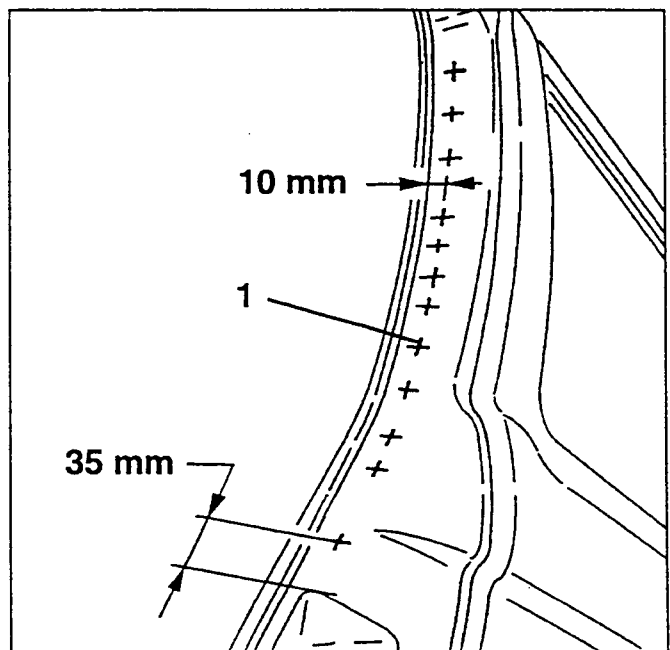
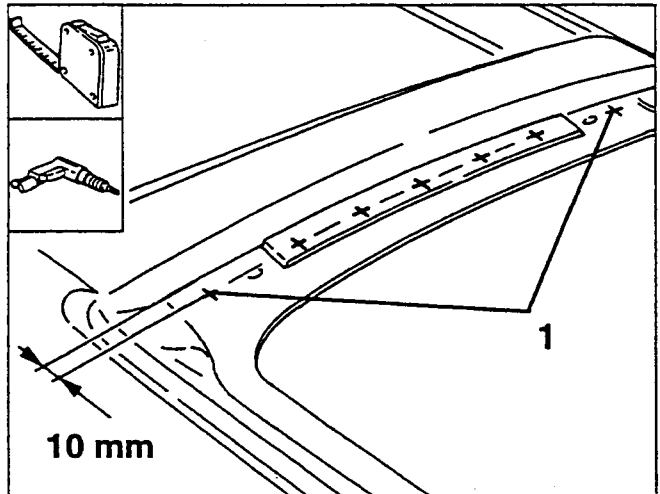
- Working on a bench with a jig saw cut the new rear wing, remembering to leave enough margin for overlapping.
- Temporarily install the rear wing.
- Check parallelism, gaps and angles and refit the mobile components removed previously with their gaskets and the parts which, when fitted, permit verification of the success of the operations.



- Remove the components installed to check the correct positioning of the rear wing.
1. Using a circular saw, trim the excess sheet metal parts without damaging the underlying components.

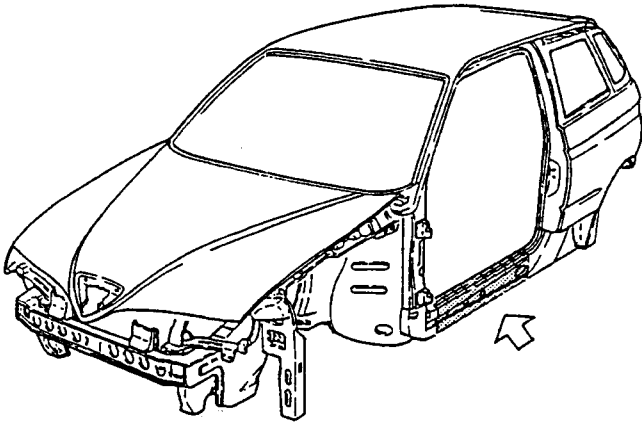


1. Remove the wing and, working on a bench trace out and perforate using a drill and  $\varnothing$  5 mm bit, as shown in the diagram.

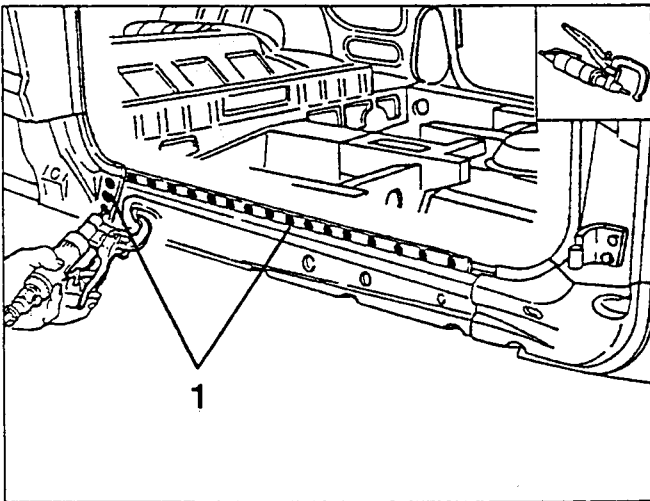


## DOOR SILL FRAME (WITH DOOR SILL REINFORCING REMOVED)

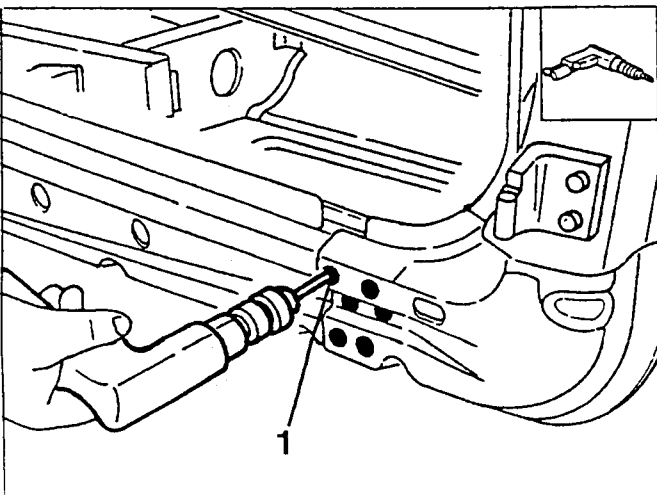
### REMOVAL



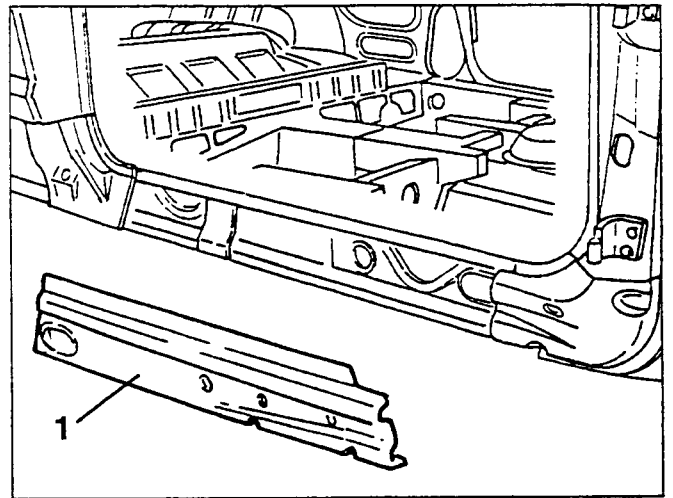
1. Using a spot cutter, remove the welding points shown in the diagram.



1. Using a drill, remove the welding points shown in the diagram.

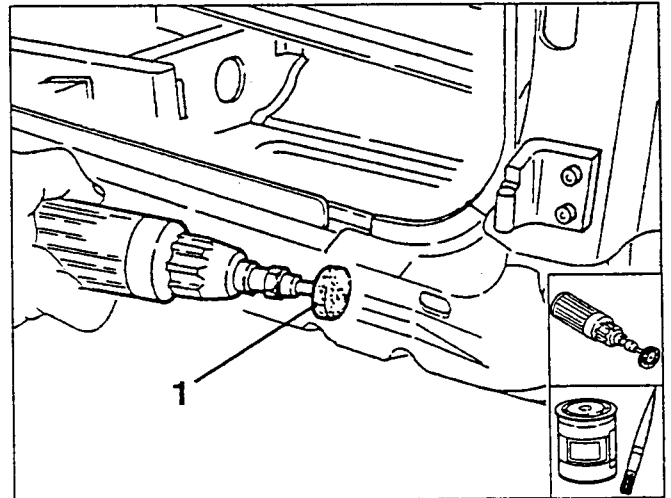


1. Remove the door sill frame.



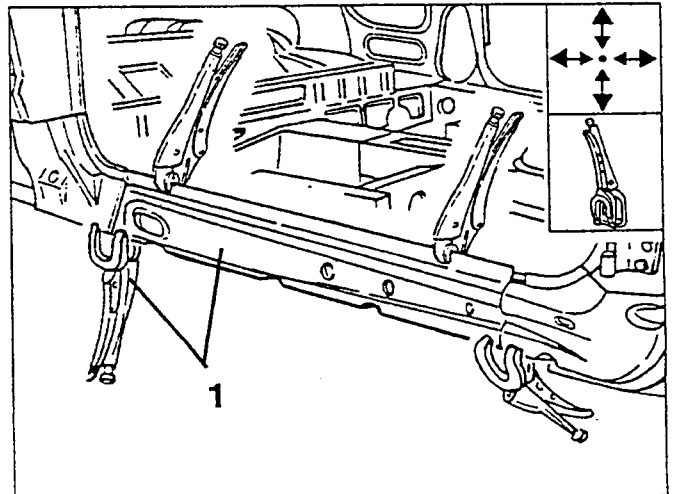
### PREPARATION

1. Using a rotating brush, clean the area to be welded.  
- Apply the specified electroweldable protection to the areas to be spot welded.

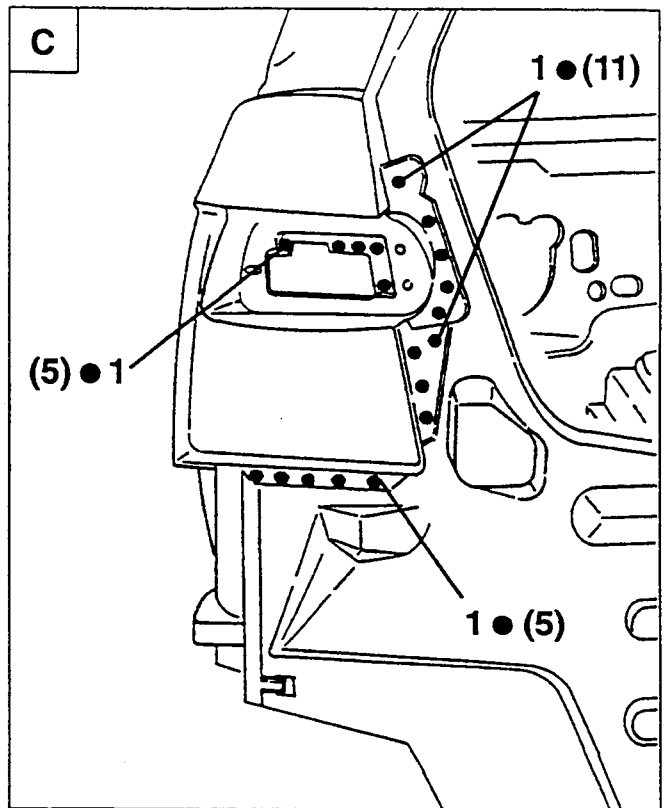
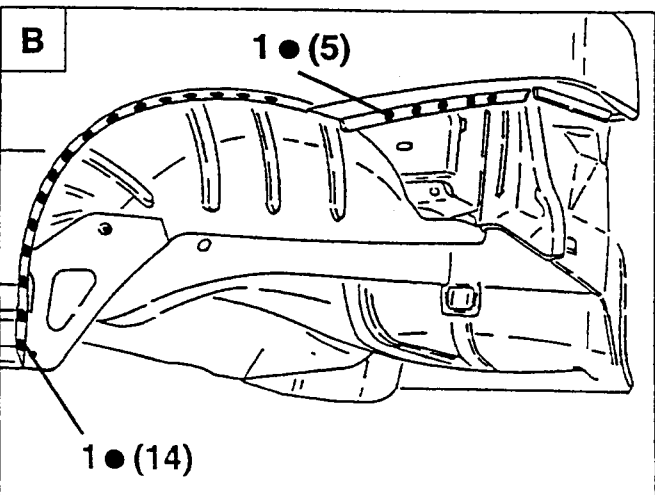
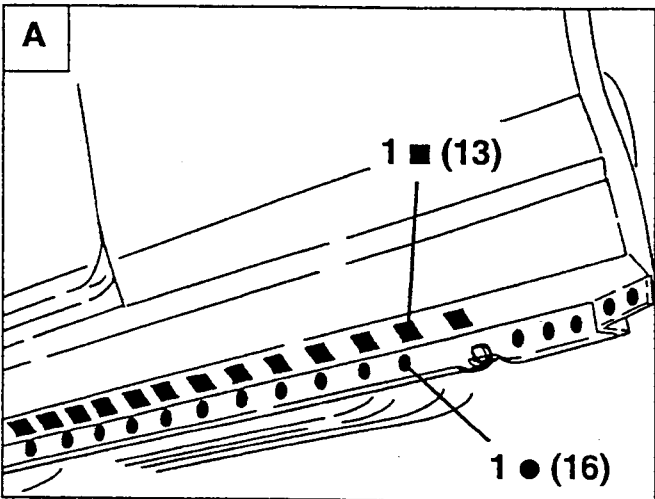
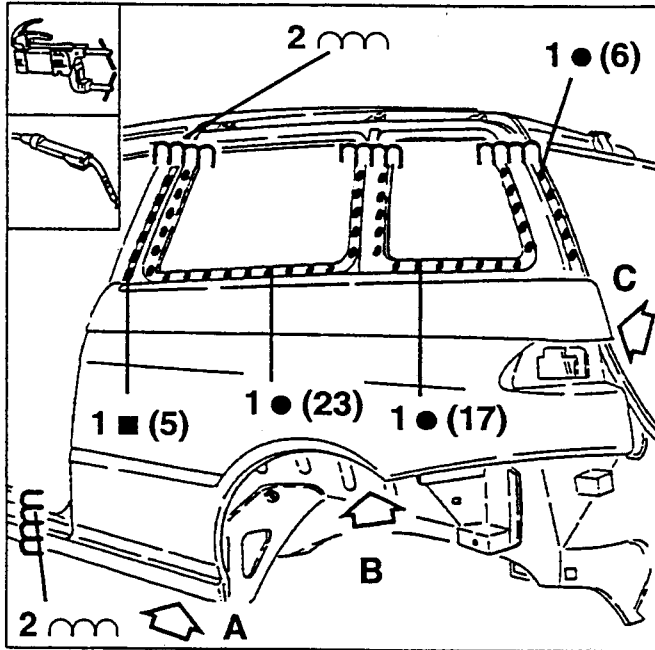


### POSITIONING

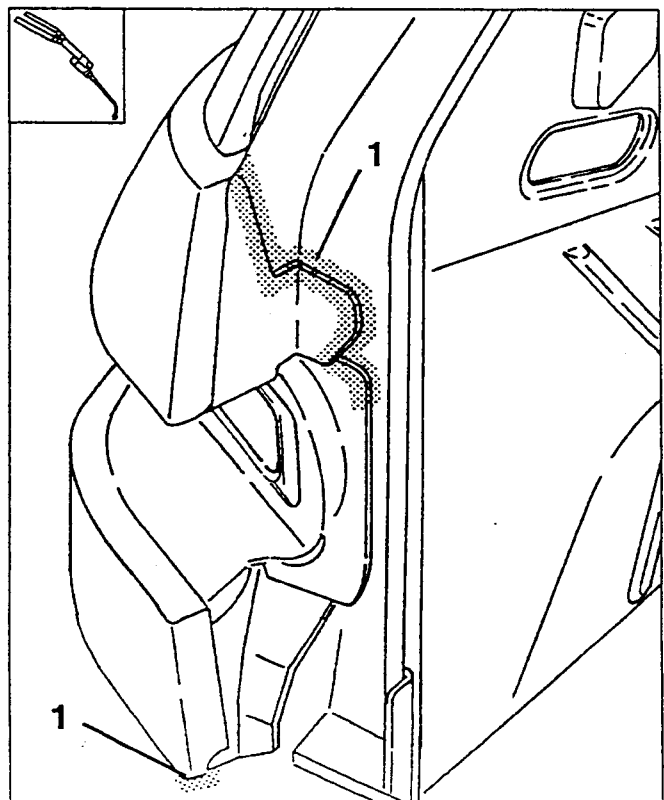
1. Position the door sill frame and join the edges together and secure with clamps.



1. Using a spot welder or, where necessary, a MIG welder, proceed as shown in the diagram.
2. Using a MIG welder, weld a seam as shown in the diagram.

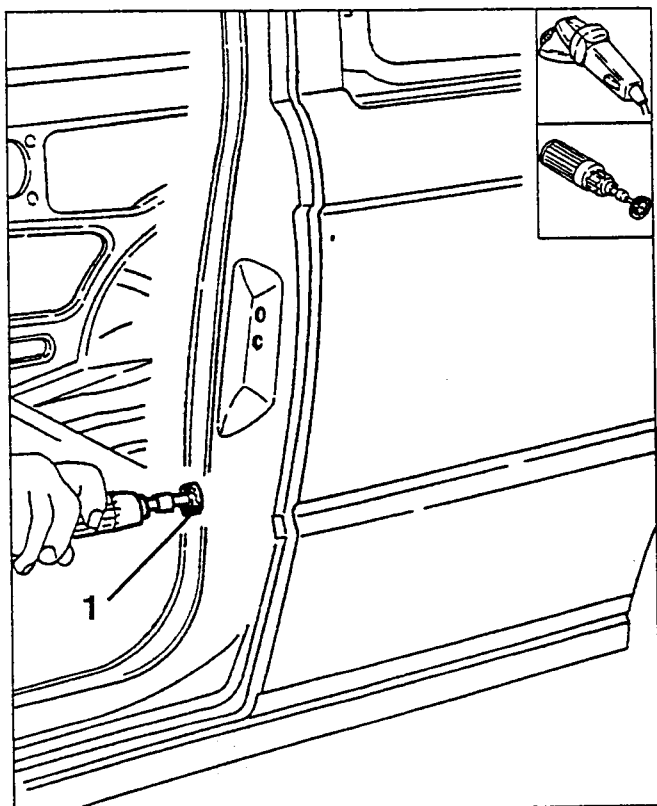


1. Using an oxyacetylene torch, brass braze-weld as shown in the diagram.

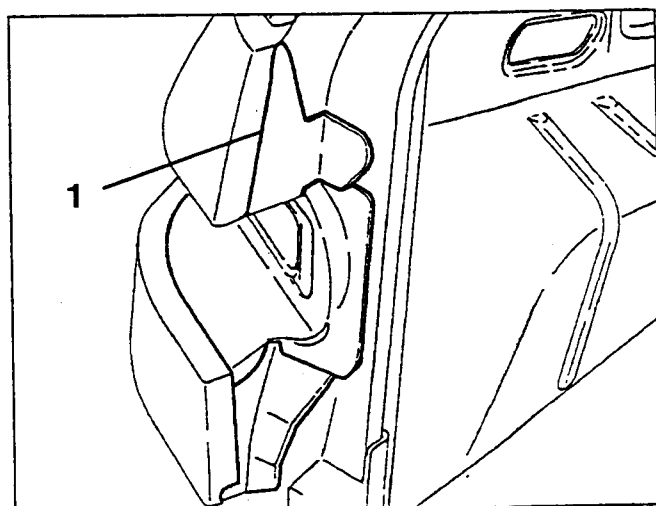
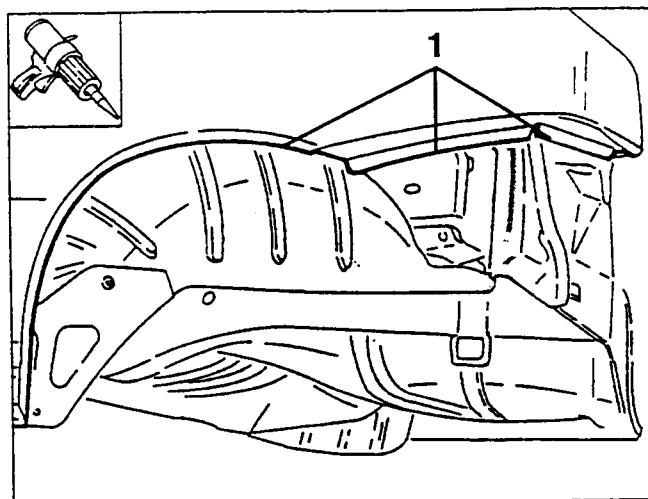


- Using an abrasive grinding wheel, remove and flush the residues left by welding.

1. Using a rotating brush, clean the welded areas.



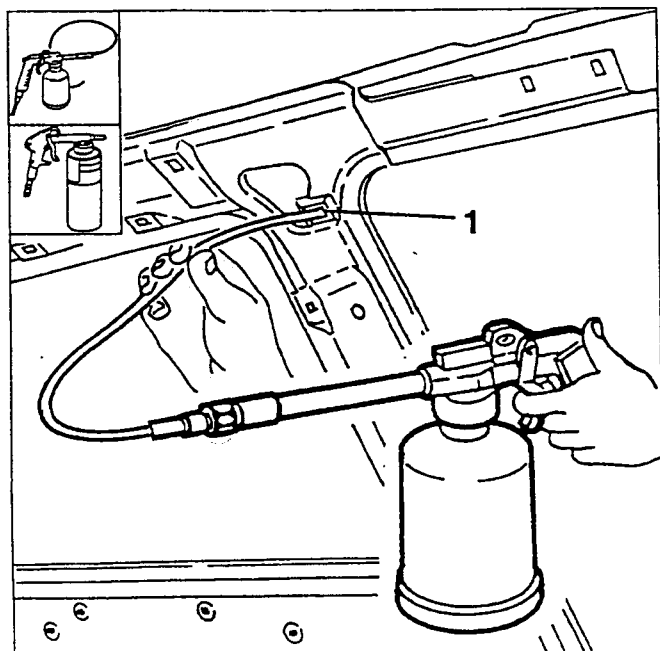
1. Apply the specified sealant to the joints in the metal sheet of the rear wing.



### PROTECTION

1. Apply the specified corrosion inhibitor to the areas to be MIG welded and braze-welded.

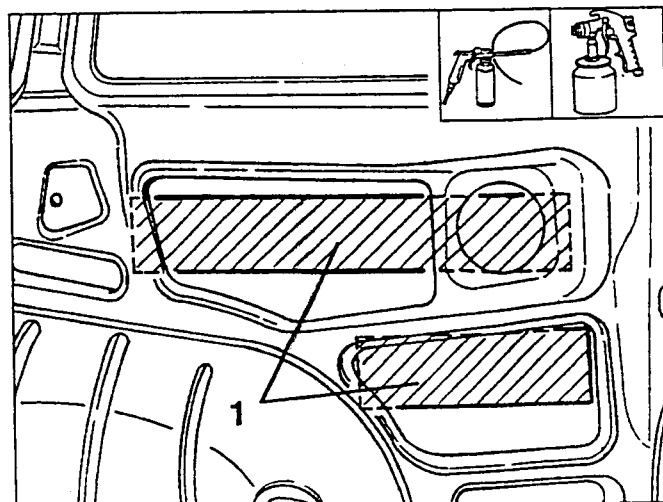
- Apply the underbody protection in the new areas of the wheel housing.



1. Apply the sound-proof panels to the rear wing as shown in the diagram.

- Proceed to the painting phase.

- Proceed to the wax-treatment phase.



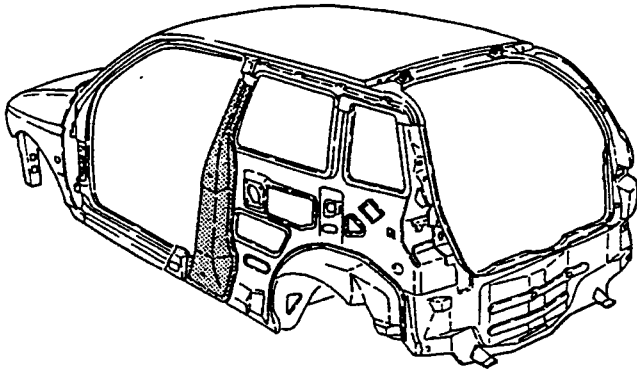
## CENTRAL PILLAR (WITH REAR WING REMOVED)

- Remove central pillar.

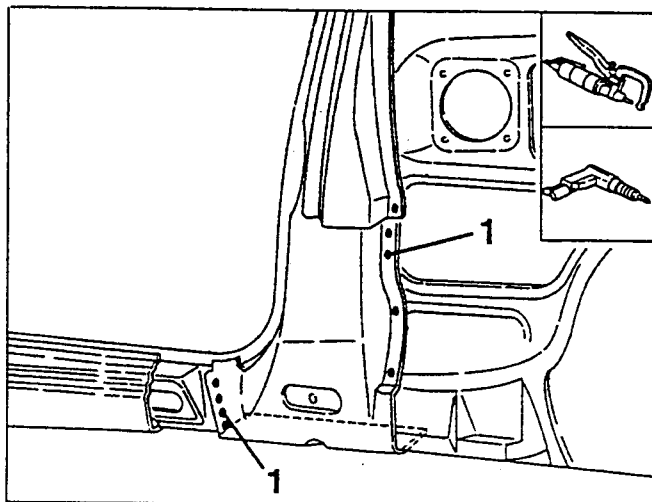
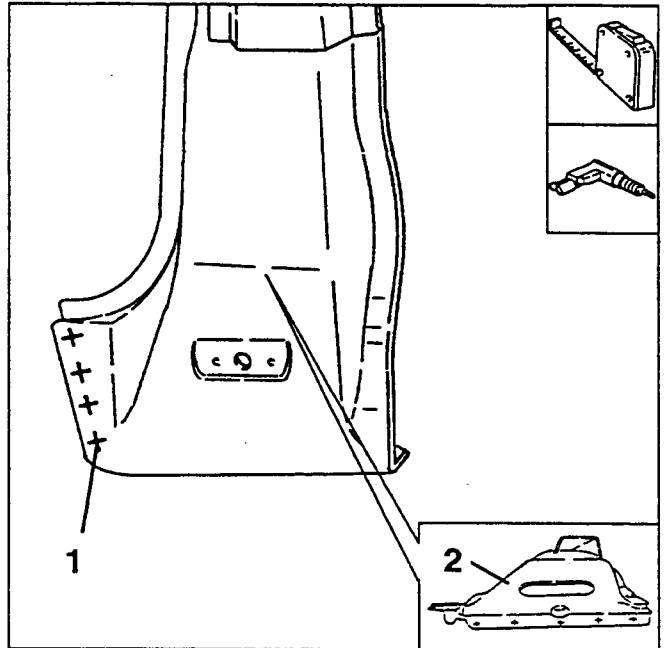
### REMOVAL

### PREPARATION

1. Working on a bench trace out and perforate the new pillar with a drill and  $\varnothing$  5 mm bit, as shown in the diagram.
2. Trace as shown in the figure for subsequent assembly with the wheel arch.

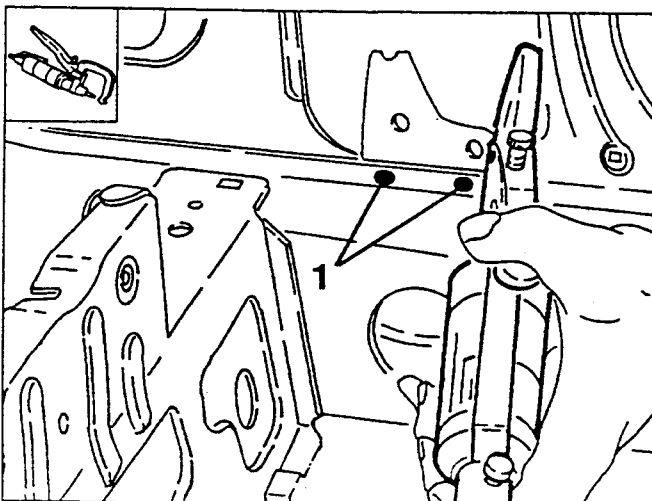
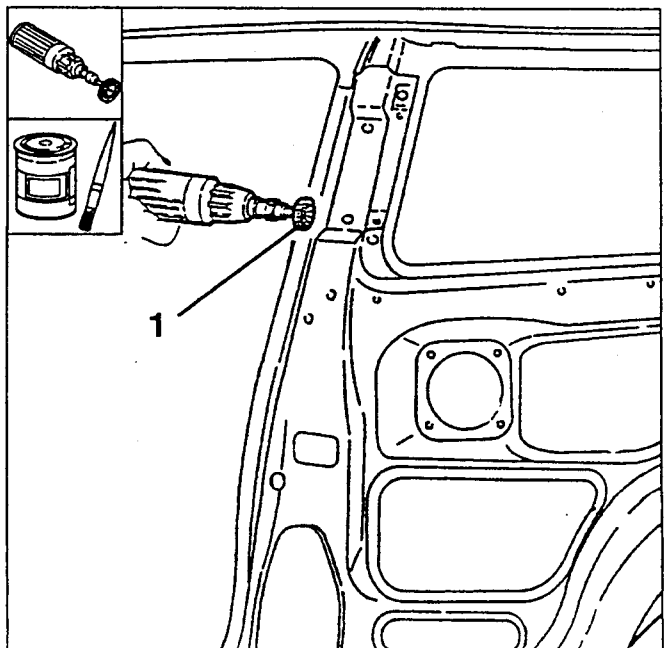


1. Using a spot cutter, remove the accessible welding points; remove the remaining welding points using a drill.



1. Using a rotating brush, clean the area to be welded.  
- Apply the specified electroweldable protection to the areas to be spot welded.

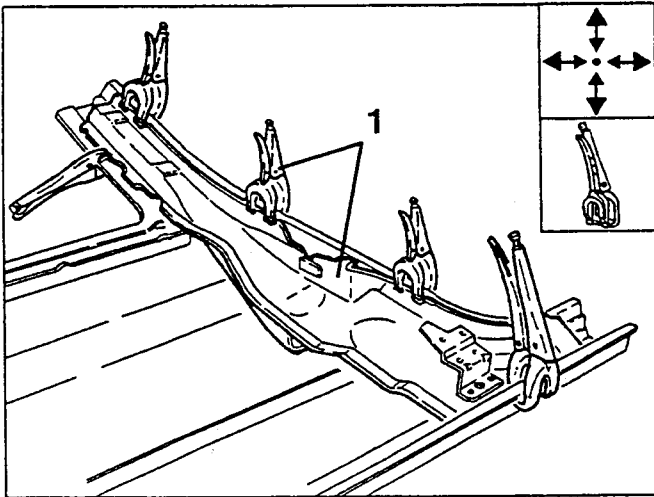
1. Using a spot cutter, remove the welding points shown in the diagram.



1. Position the new pillar on the rear wing and fix it with clamps.
- Fix the pillar to the wing using screws and then remove the clamps.

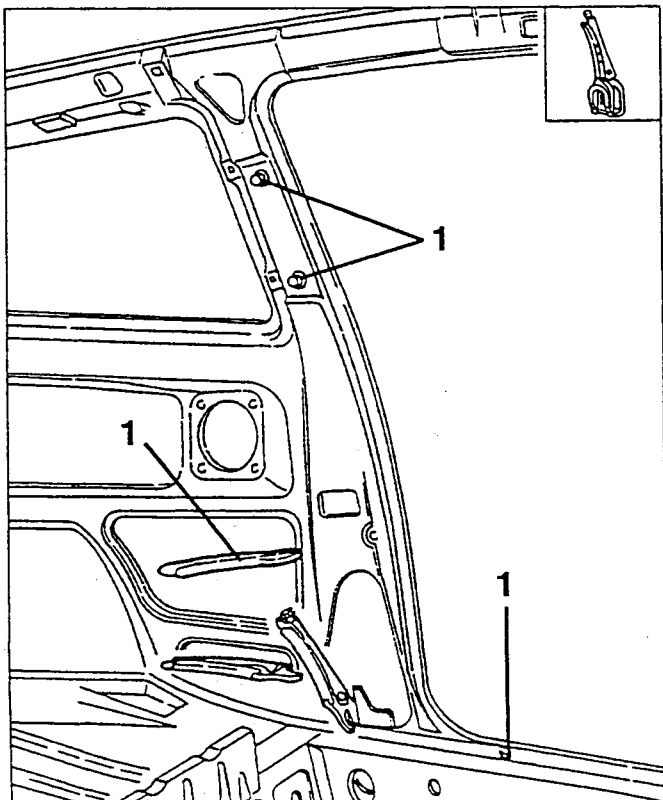
**NOTE:**

Take the centering of the plate for attaching the door catch as a reference point for the installation of the pillar on the rear wing.



**POSITIONING**

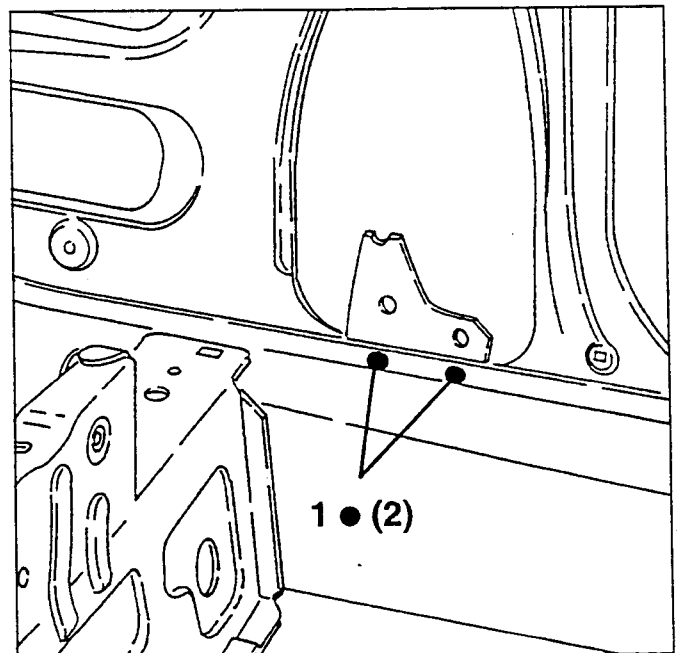
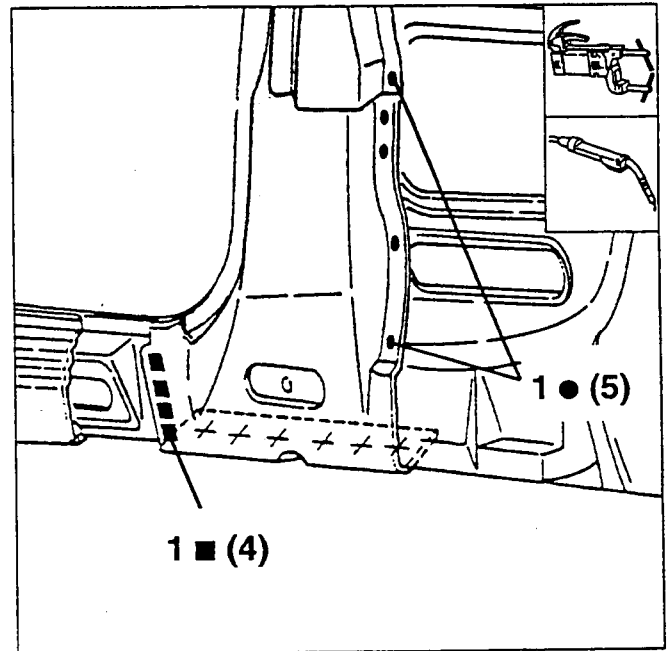
1. Install the assembled rear wing and pillar and secure it with clamps from the inside and with the two screws attaching the upper seatbelt attachment and a self-tapping screw.



- Check alignment of the door with its seals and parts which when installed make it possible to check the outcome of the operations.
- Remove the rear wing leaving the pillar in its correct position.

**WELDING AND FINISHING THE SHEET METAL**

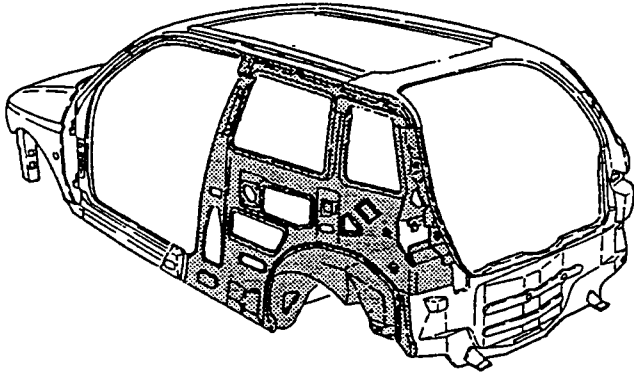
1. Using a spot welder or, where necessary, a MIG welder, proceed as shown in the diagram.



- Using an abrasive grinding wheel, remove and flush the residues left by welding.
- Using a rotating brush, clean the welded areas.

## INNER SIDE PANEL FRAME (WITH REAR WING, CENTRAL PILLAR AND ROOF PANEL REMOVED)

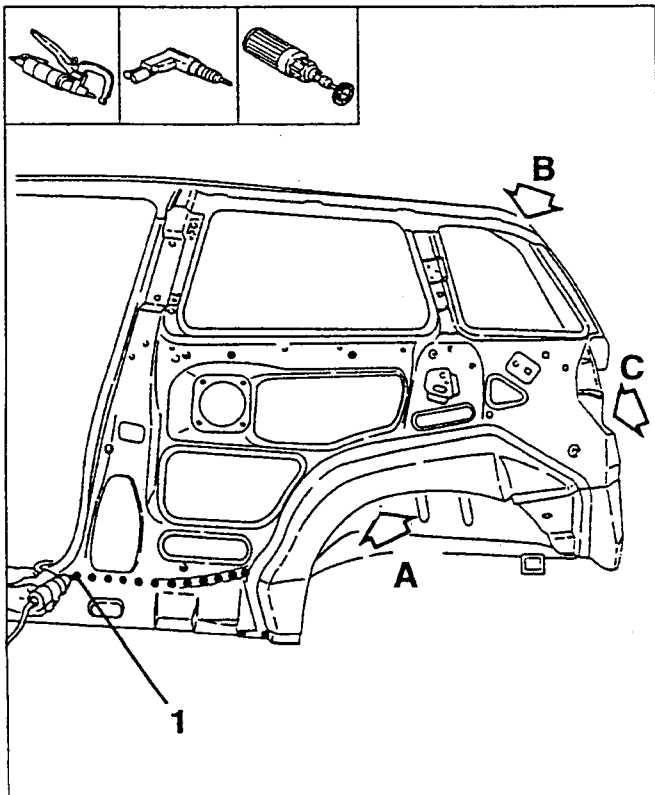
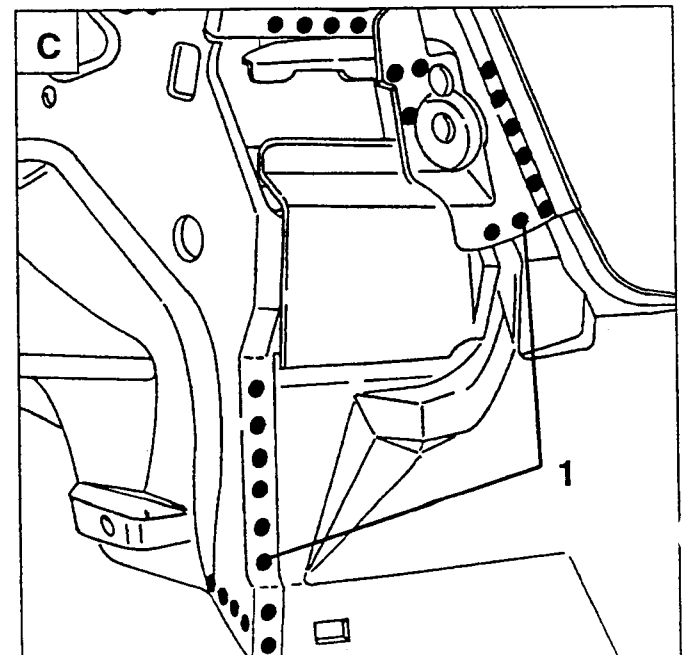
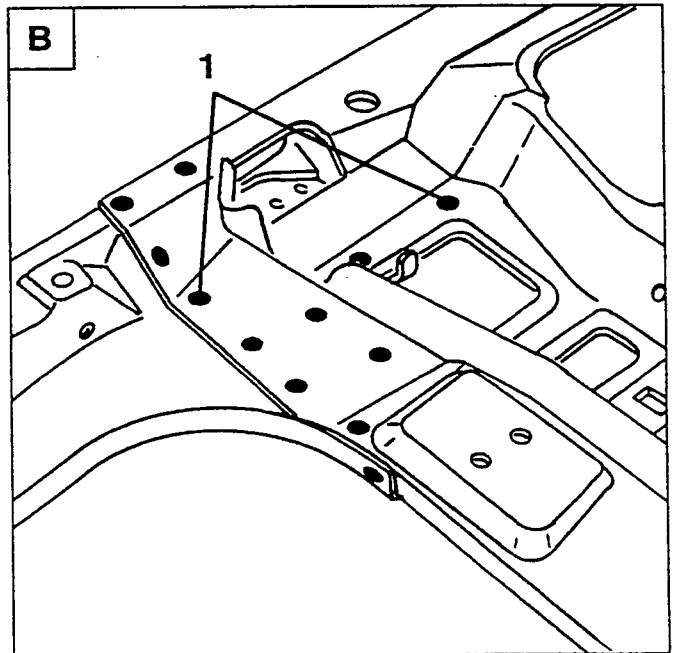
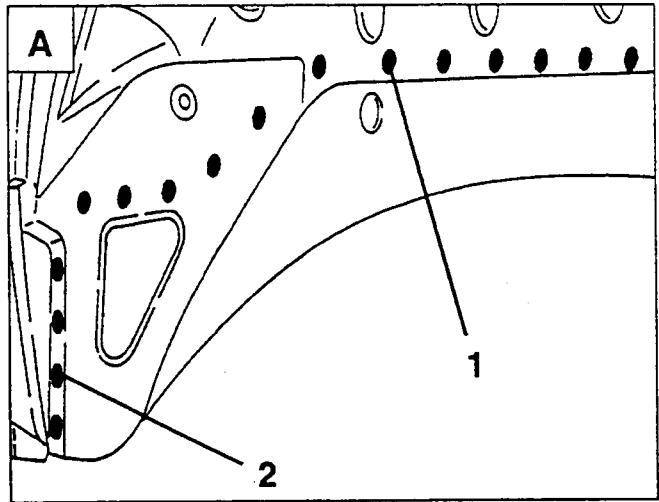
### REMOVAL



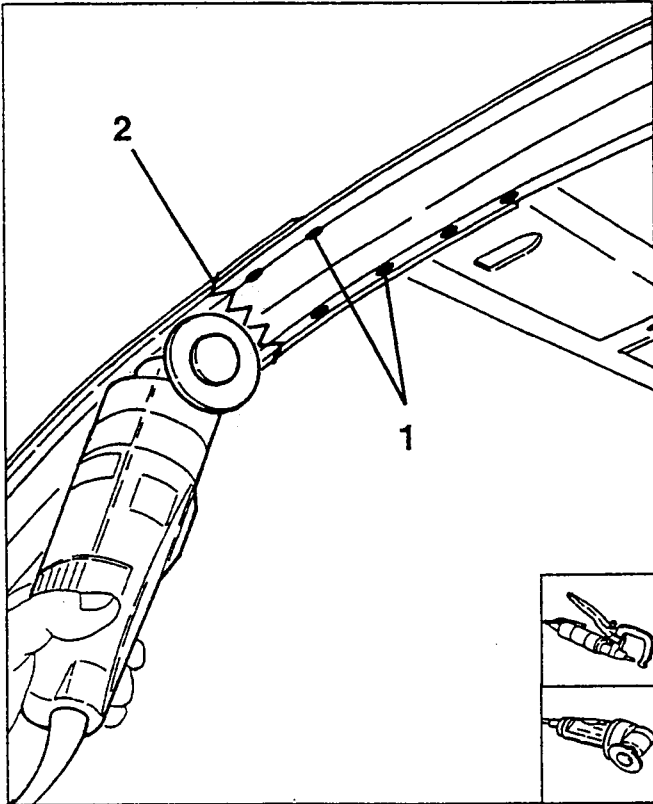
- Using a rotating brush, clean the areas to be spot-cut to highlight the welding points.

1. Using a spot cutter, remove the accessible welding points; remove the remaining welding points using a drill.

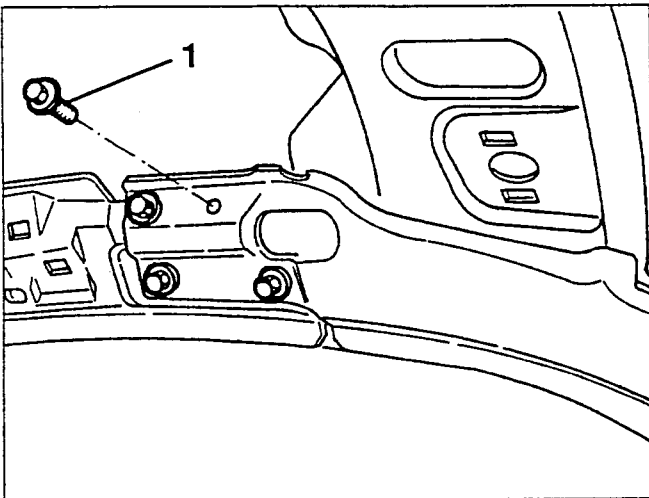
2. Using a drill, remove the welding points indicated after freeing the sheet metal to permit access.



1. Using a spot cutter, remove the welding points shown in the diagram.
2. Using a circular saw, cut following the lines indicated in the diagram without damaging the underlying components.



1. Loosen the four screws securing the inner frame of the side panel and the front windscreen frame.

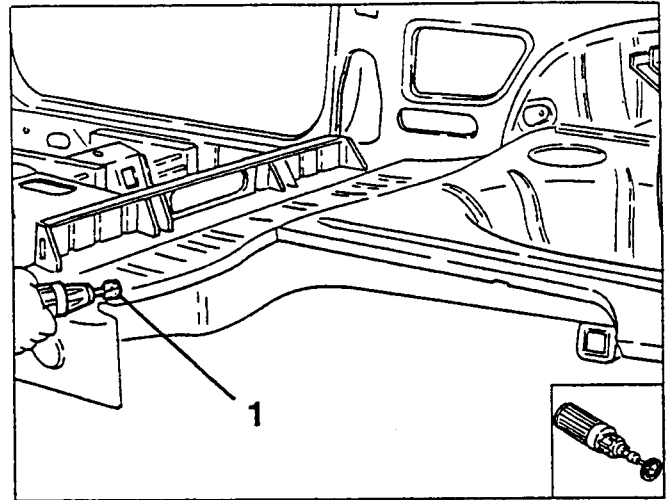


- Remove the complete inner side panel frame after opening the clinch tabs.

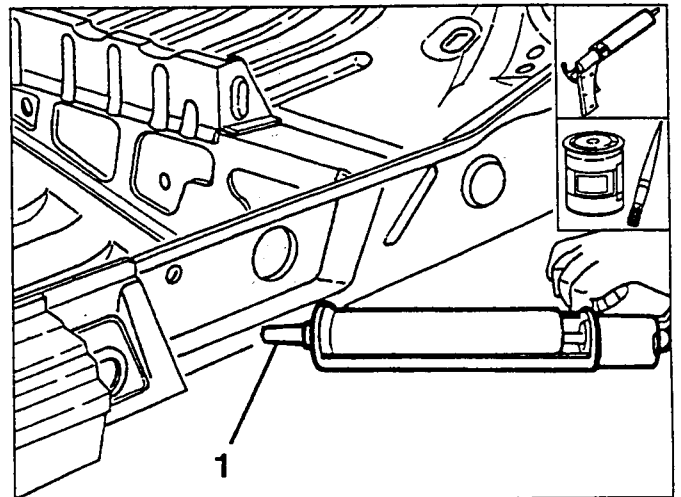
### PREPARATION

1. Using a rotating brush, clean the area to be welded.

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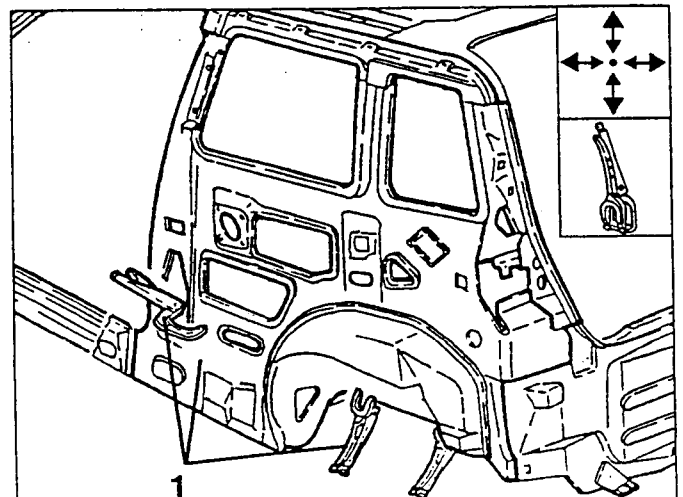


1. Apply a thick layer of electroweldable protection to the entire lover part of the side panel inner frame mating surfaces and with a brush to the remaining areas to the spot welded.



### POSITIONING AND INSPECTION

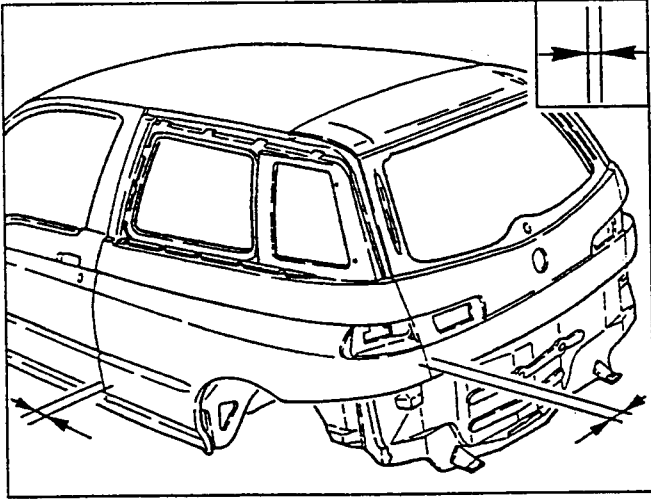
1. Position the side panel inner frame and join the edges together and secure with clamps and the four front screws connecting the front windscreen frame and the clinch tabs.





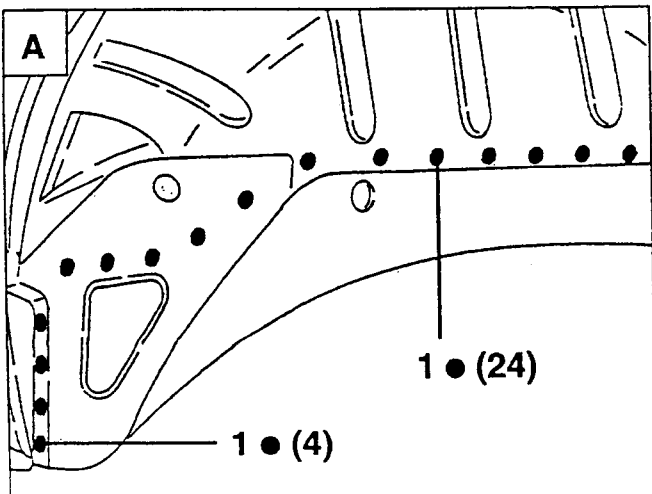
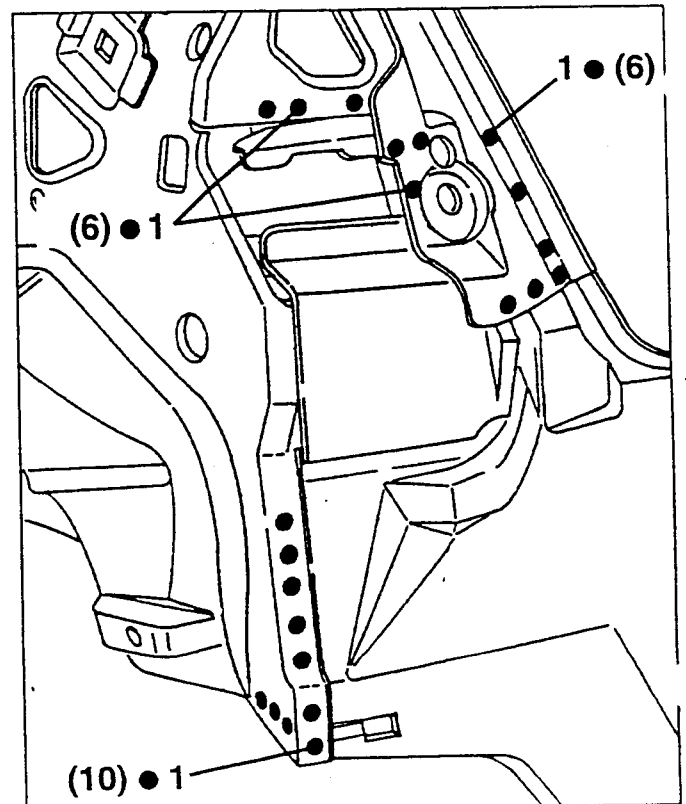
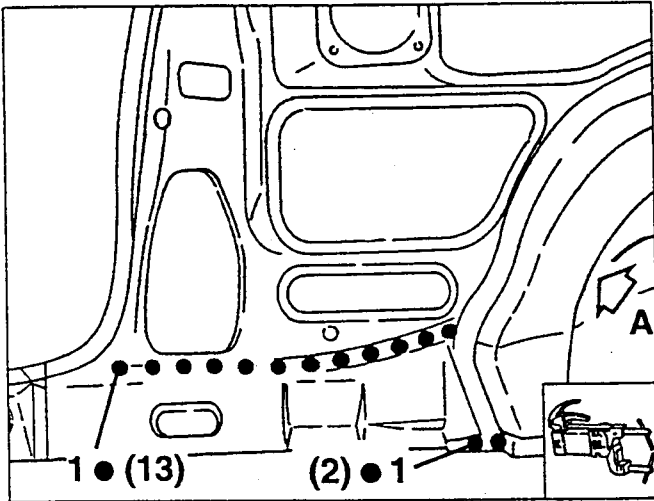
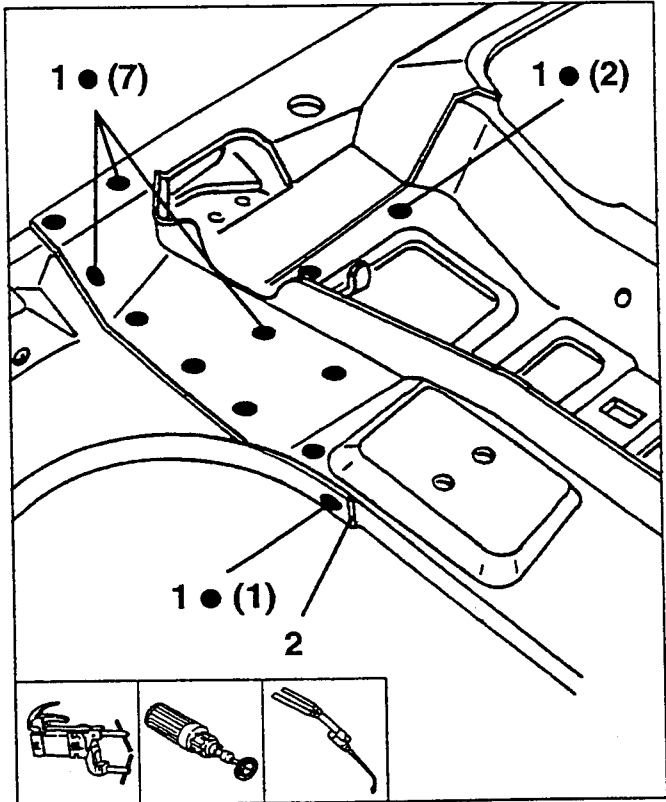
- Check parallelism, gaps and angles and refit the mobile components removed previously with their gaskets and the parts which, when fitted, permit verification of the success of the operations.

1. Using a spot welder, proceed as shown in the diagram.
- Using a rotating brush, clean the welded areas.
2. Using an oxyacetylene torch, brass braze-weld as shown in the diagram.

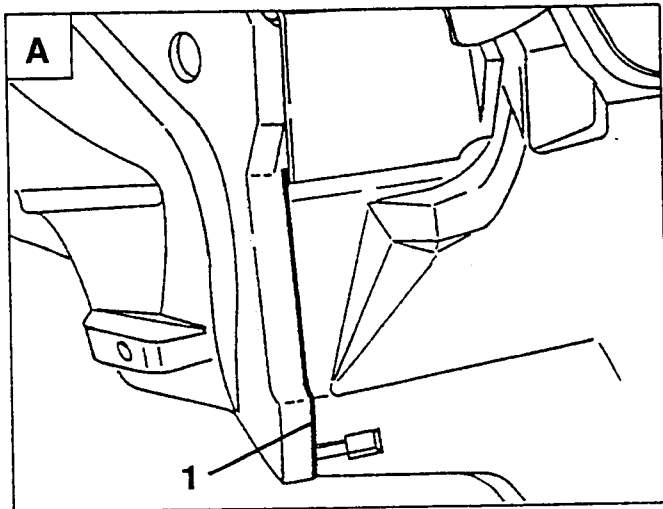
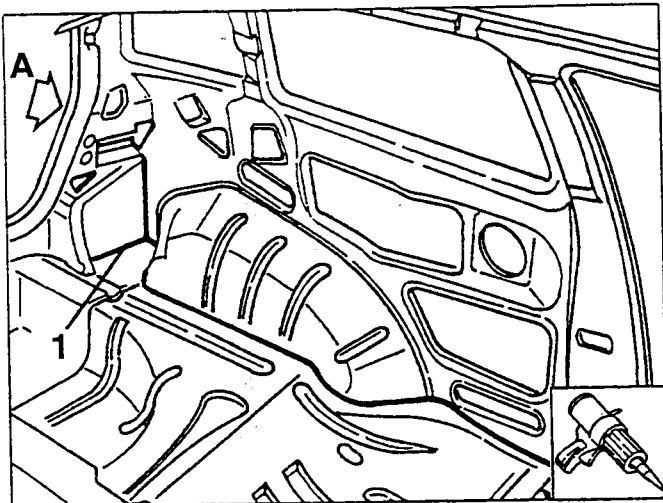


### WELDING AND FINISHING THE SHEET METAL

1. Using a spot welder, proceed as shown in the diagram.

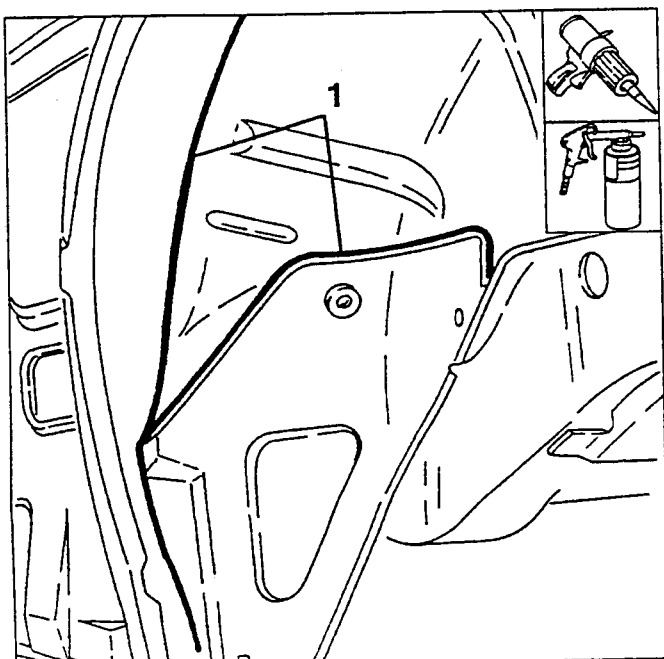


1. Apply the specified sealant along the lines shown in the diagram.



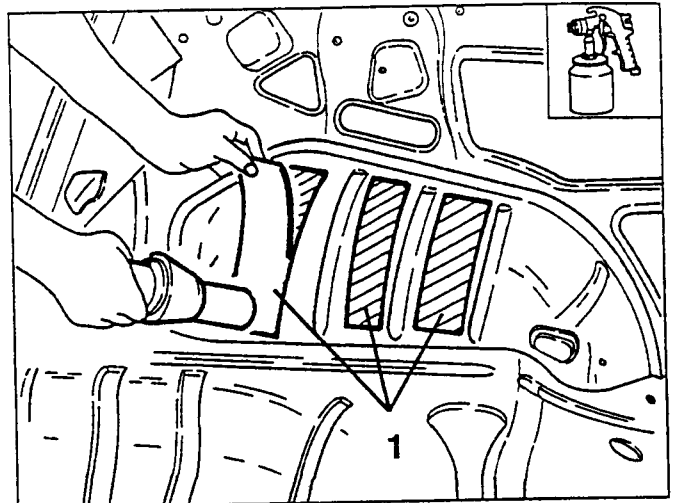
1. Apply the specified sealant along the lines shown in the diagram.

- Apply the specified underbody protection in the new areas of the wheel housing.



1. Apply the sound-proof panels as shown in the diagram.

- Proceed to the painting phase.

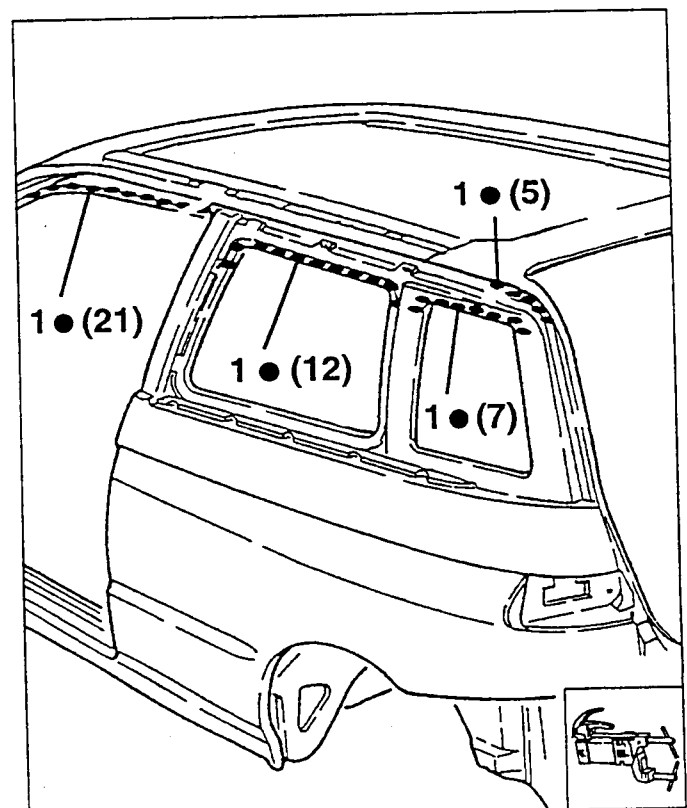


- Complete the refitting operations as described in the procedures for "central pillar" and Rear wing" ensuring that the following steps are added as this is a complete replacement of the rear wing and not a partial replacement.

1. Using a spot welder, proceed as shown in the diagram.

**NOTE:**

Due to the above it is not necessary to seam weld the lower to the upper parts of the wing.

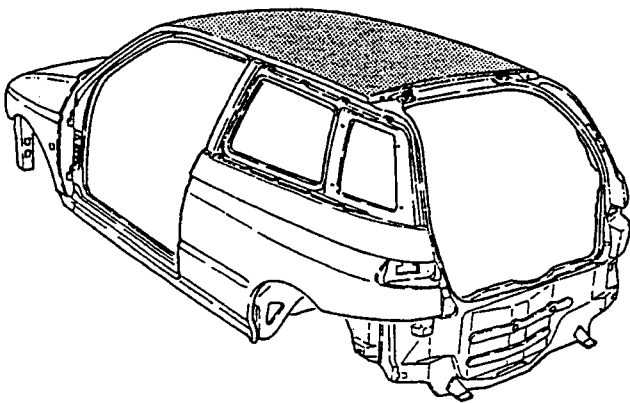


## ROOF PANEL

### PRELIMINARY OPERATIONS

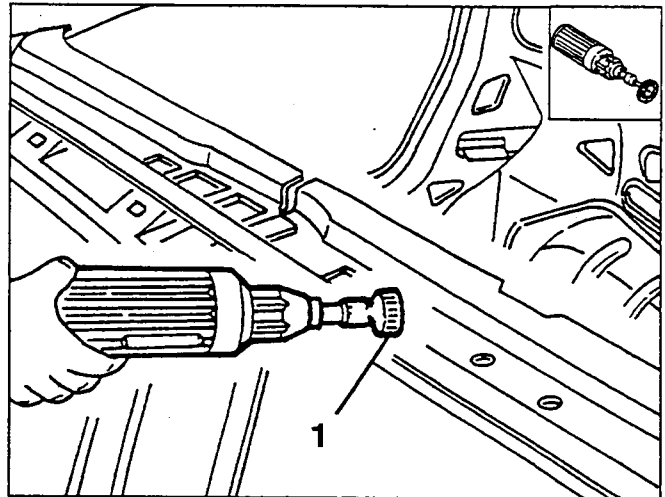
- Disconnect the negative (-) cable from the battery and remove the electronic control units.
- Remove the trim components, electrical and mechanical system which could hinder the repair operations or get damaged during work (see specific paragraphs).
- Remove the following sheet metal parts:
  - windscreen (see specific paragraph).
  - boot (see specific paragraph).
  - doors (see specific paragraph).

### REMOVAL

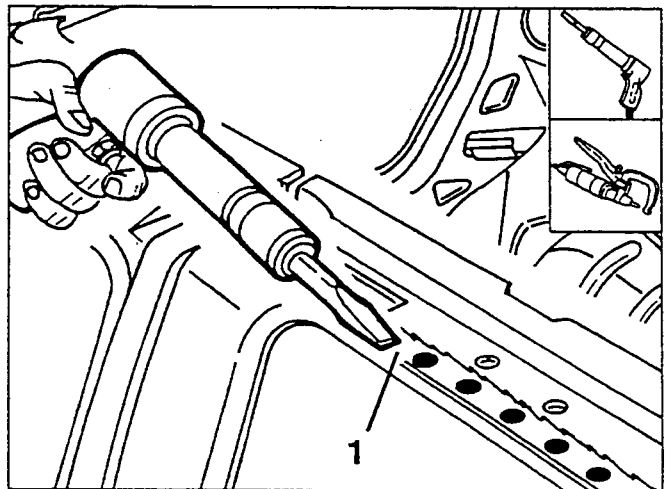


1. Using a chisel free the roof panel as shown in the diagram.

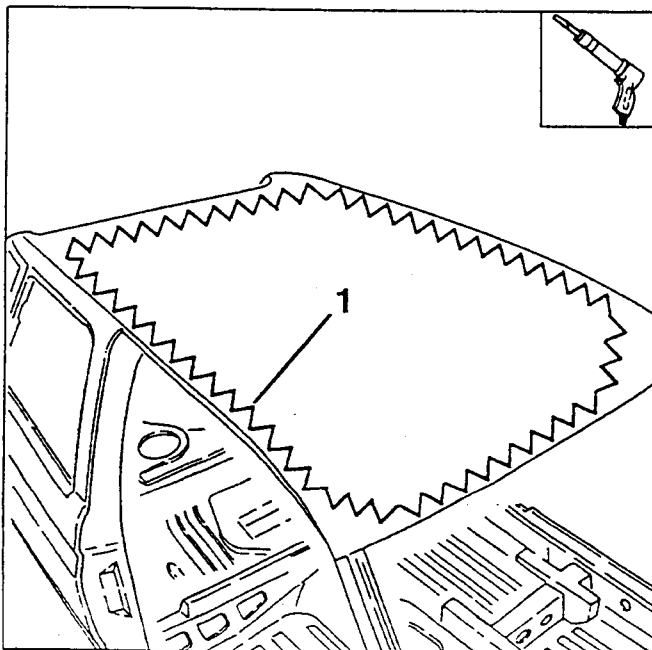
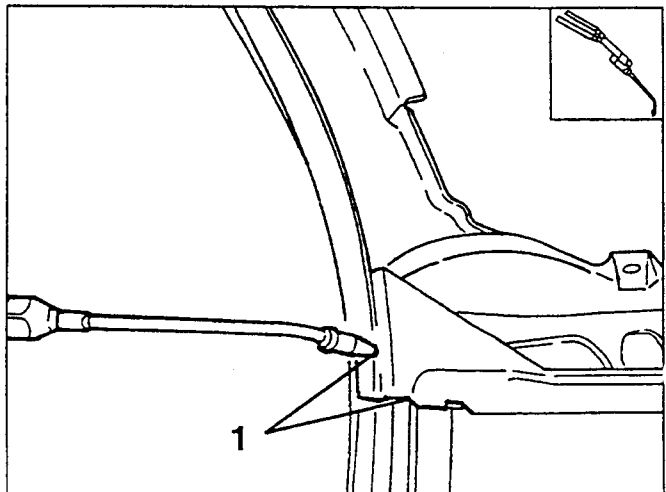
1. Using a rotating brush, clean the edge of the roof panel to highlight the welding points.



1. Using a chisel or spot cutter, remove the welding points from the edges of the roof panel remaining on the body.



1. Using an oxyacetylene torch, unweld the roof panel from the pillars and remove the edges of the panel.

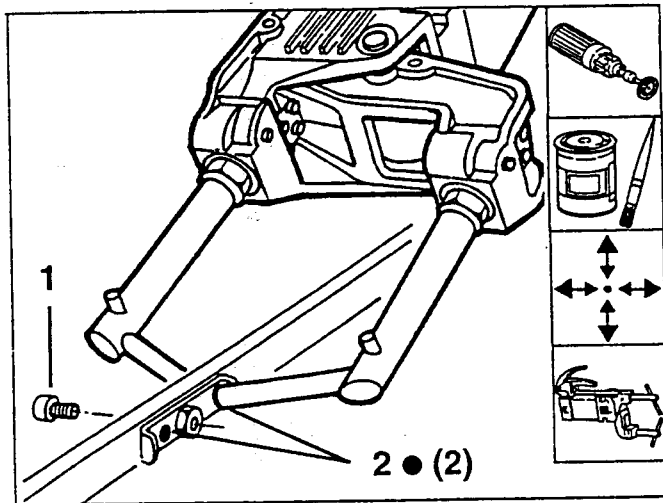


### PREPARATION

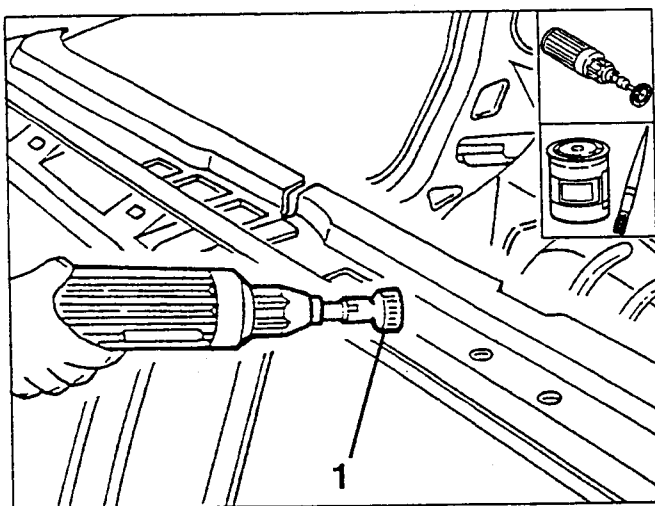
Install the four brackets securing the roof-rack to the new panel as follows:

- Using a rotating brush, clean the area to be welded.
- Apply the specified electroweldable protection to the areas to be spot welded.

1. Position the bracket using the attachment pin as a centering device.
2. Using a spot welder, proceed as shown in the diagram.



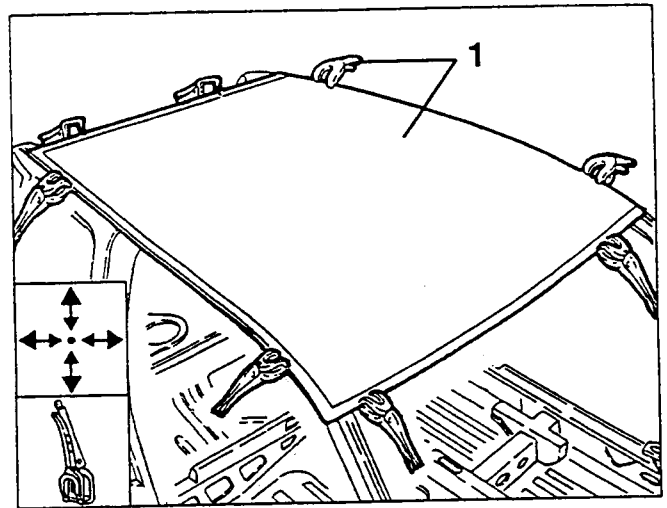
1. Using a rotating brush, clean the area to be welded along the edge of the new roof panel and the body.
- Apply the electroweldable protection to the areas to be spot welded.



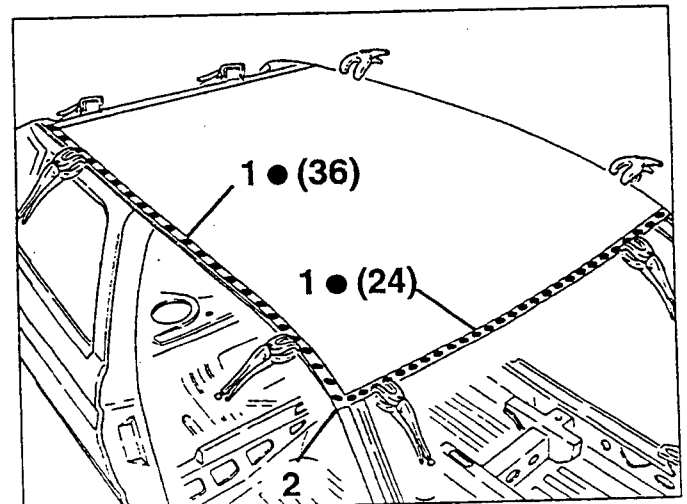
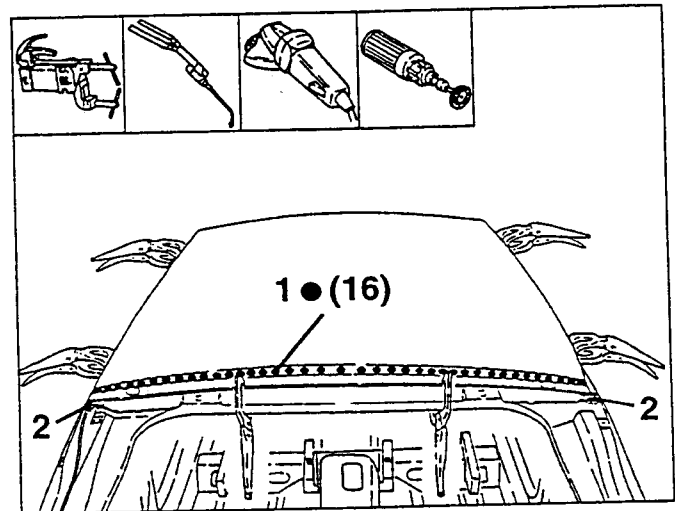
### POSITIONING AND INSPECTION

1. Position the roof panel and join the edges to be welded together and fix using clamps.
- Check parallelism, gaps and angles and refit the mobile components removed previously with their

gaskets and the parts which, when fitted, permit verification of the success of the operations.

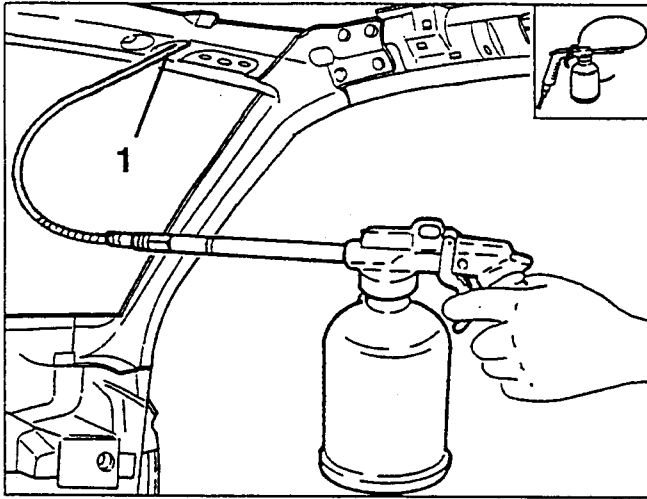


1. Using a spot welder, proceed as shown in the diagram.
2. Using an oxyacetylene torch, brass braze-weld the four corners of the roof panel to the pillars.
- Using an abrasive grinding wheel, remove and flush the residues left by welding.
- Using a rotating brush, clean the welded areas.

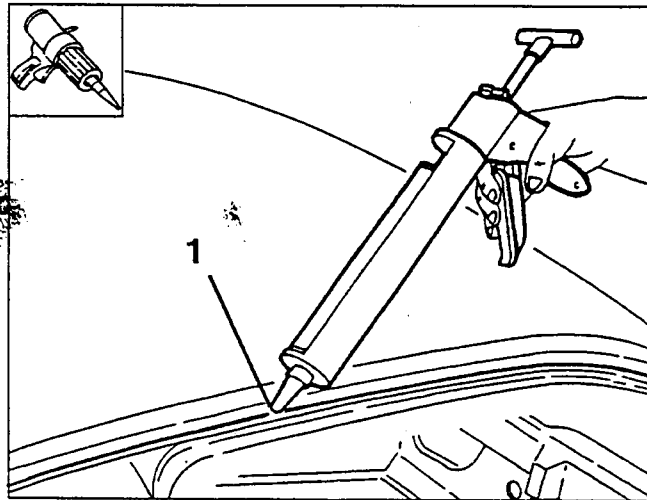


## PROTECTION

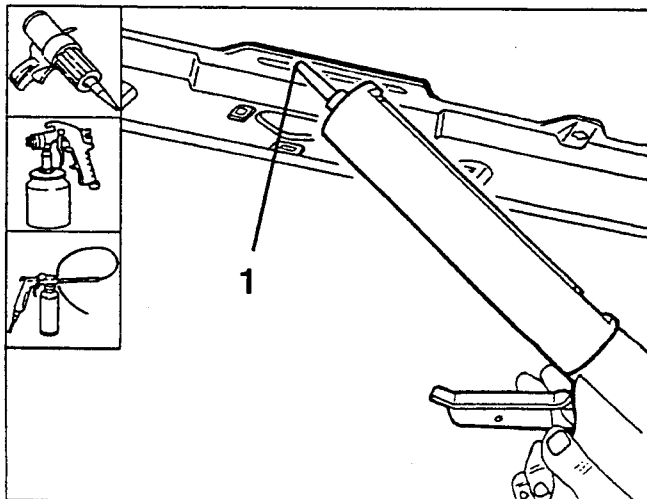
1. Apply the specified corrosion inhibitor to the areas to be braze welded.



1. Apply the specified sealant along the side edge of the roof panel.



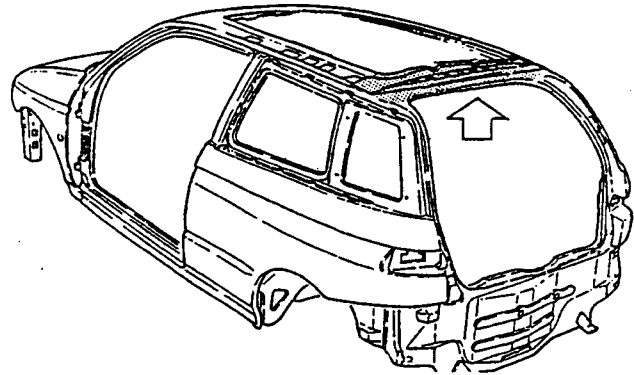
1. Apply the specified sealant to the front inner part of the roof panel along the lines shown in the diagram.



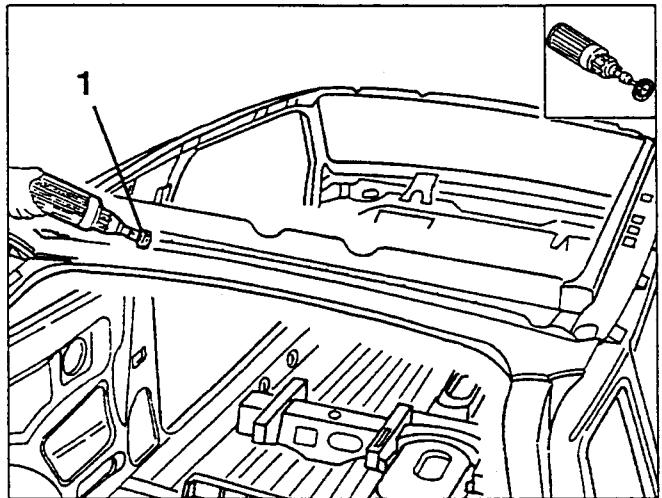
- Proceed to the painting phase.
- Proceed to the wax-treatment phase for the areas to which have been braze welded.

## REAR HOOPS (WITH ROOF PANEL REMOVED)

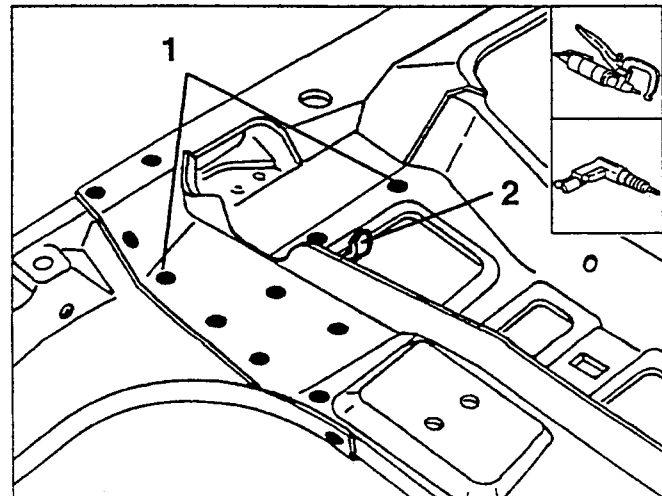
### REMOVAL



1. Using a rotating brush, clean the areas to be spot-cut to highlight the welding points.



1. Using a spot cutter, remove the accessible welding points, remove the remaining welding points using a drill.
2. Open the clinch tabs.



- Remove the rear hoops cutting away the sealant if necessary

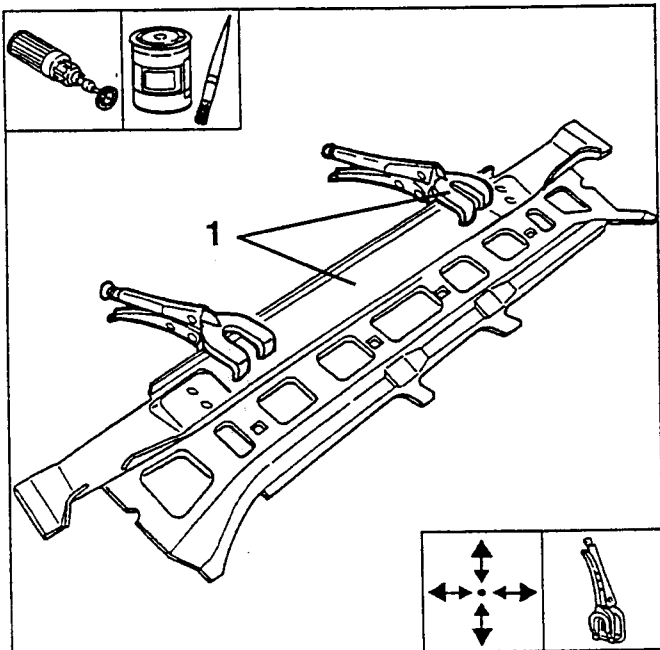
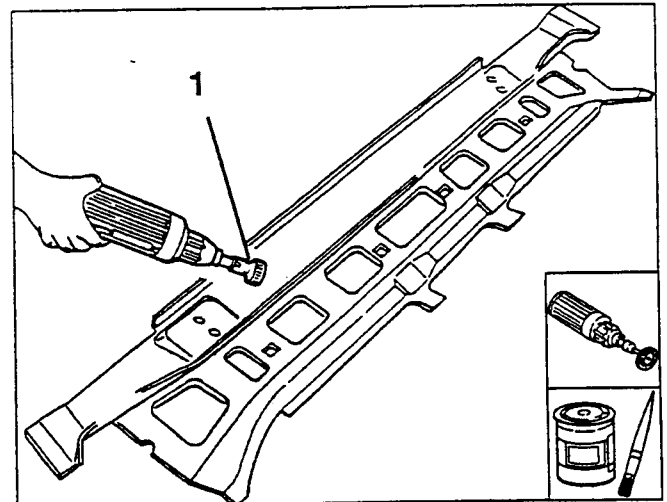
- Apply the electroweldable protection to the areas to be spot welded.

### PREPARATION

Assemble the rear hoops as follows:

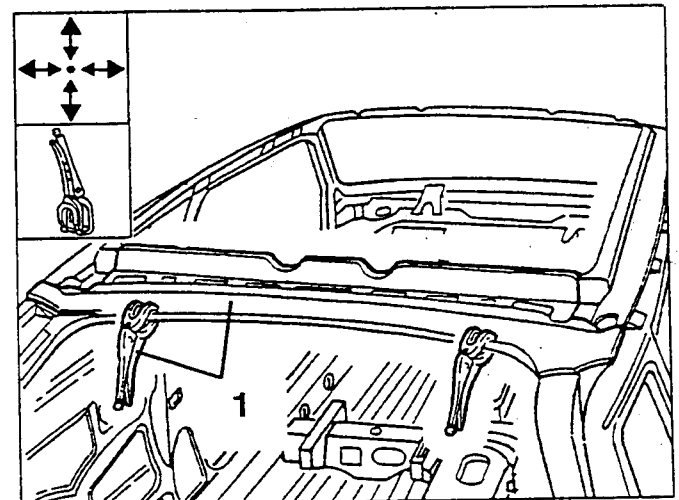
- Using a rotating brush clean the area to be welded.  
 - Apply the specified electroweldable protection to the areas to be spot welded.

1. Assemble the two hoops joining together the edges to be welded and fix them with clamps and using the matching of the attachment holes for the boot with the appropriate pins as a reference.



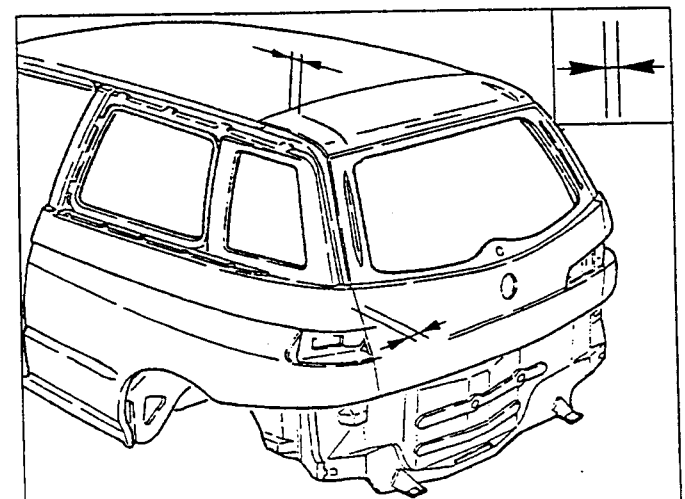
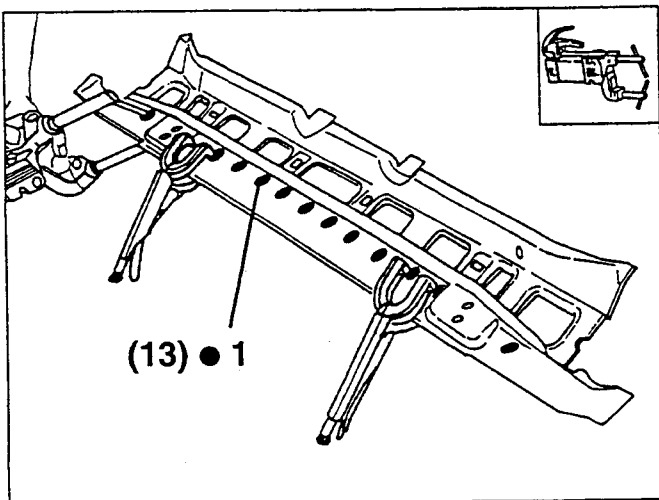
### POSITIONING AND INSPECTION

1. Position the assembled hoops bringing the edges together and secure them with clamps.



1. Using a spot welder, proceed as shown in the diagram.

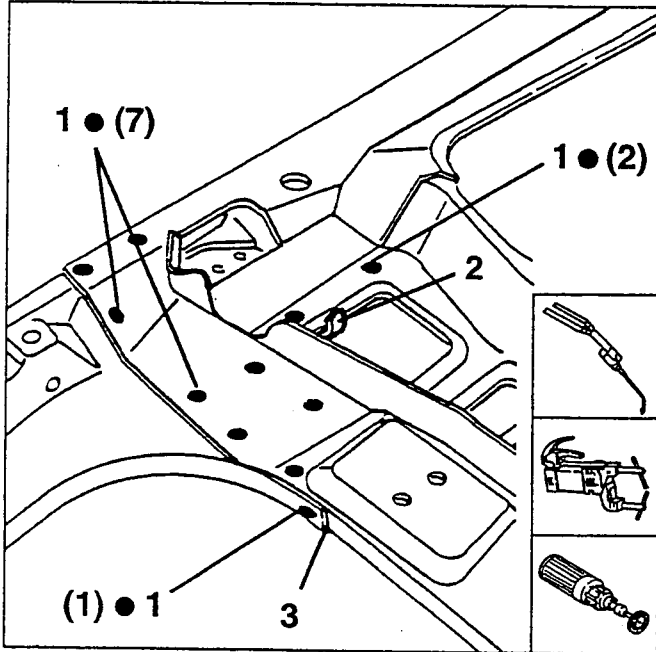
- Check parallelism, gaps and angles and refit the mobile components removed previously with their gaskets and the parts which, when fitted, permit verification of the success of the operations.



1. Using a rotating brush, clean the area to be welded.

## WELDING AND FINISHING THE SHEET METAL

1. Using a spot welder, proceed as shown in the diagram.
  2. Bend the clinch tabs.
  3. Using an oxyacetylene torch, brass braze-weld as shown in the diagram.
- Using a rotating brush, clean the welded areas.

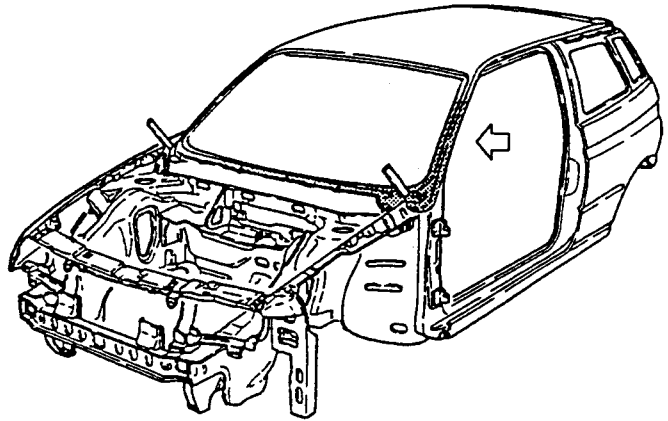


## FRONT WINDSCREEN FRAME (PARTIAL)

### PRELIMINARY OPERATIONS

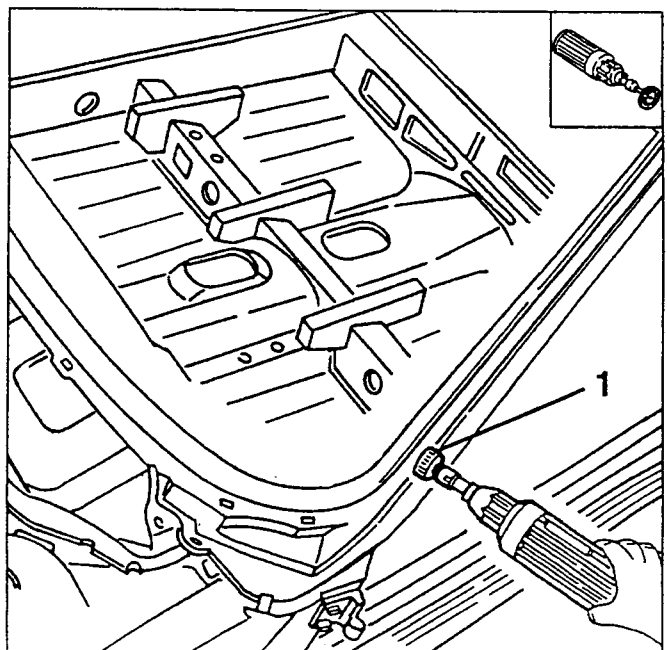
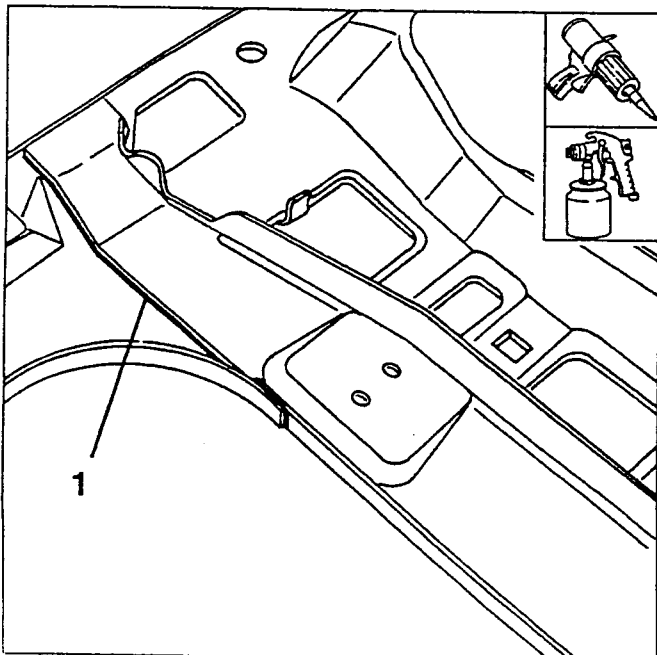
- Disconnect the negative (-) cable from the battery and remove the electronic control units.
- Remove the trim components, electrical and mechanical system which could hinder the repair operations or get damaged during work (see specific paragraphs).
- Remove the following sheet metal parts:
  - bonnet (see specific paragraph).
  - door on affected side (see specific paragraph).
  - front wing (see specific paragraph).
  - dashboard support crossmember (see specific paragraph).

### REMOVAL



### PROTECTION

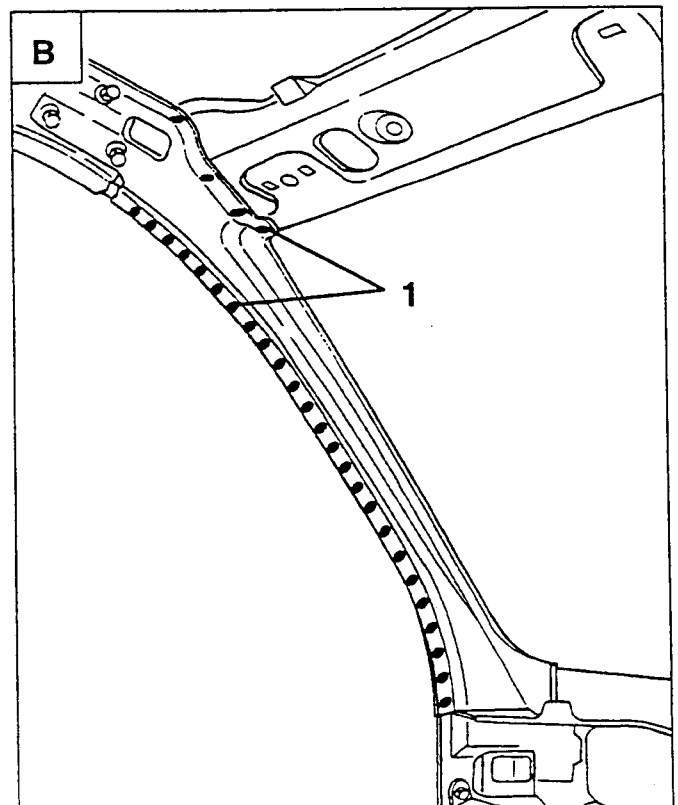
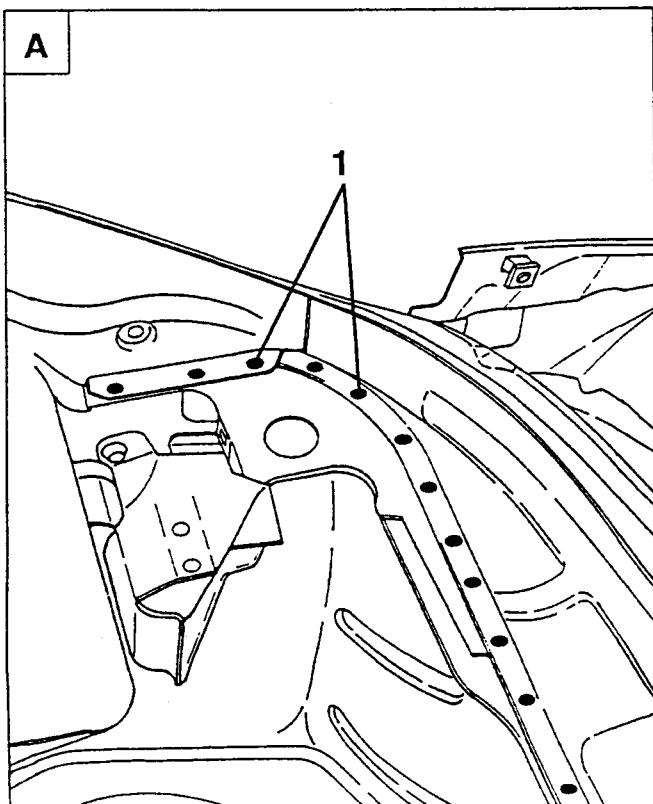
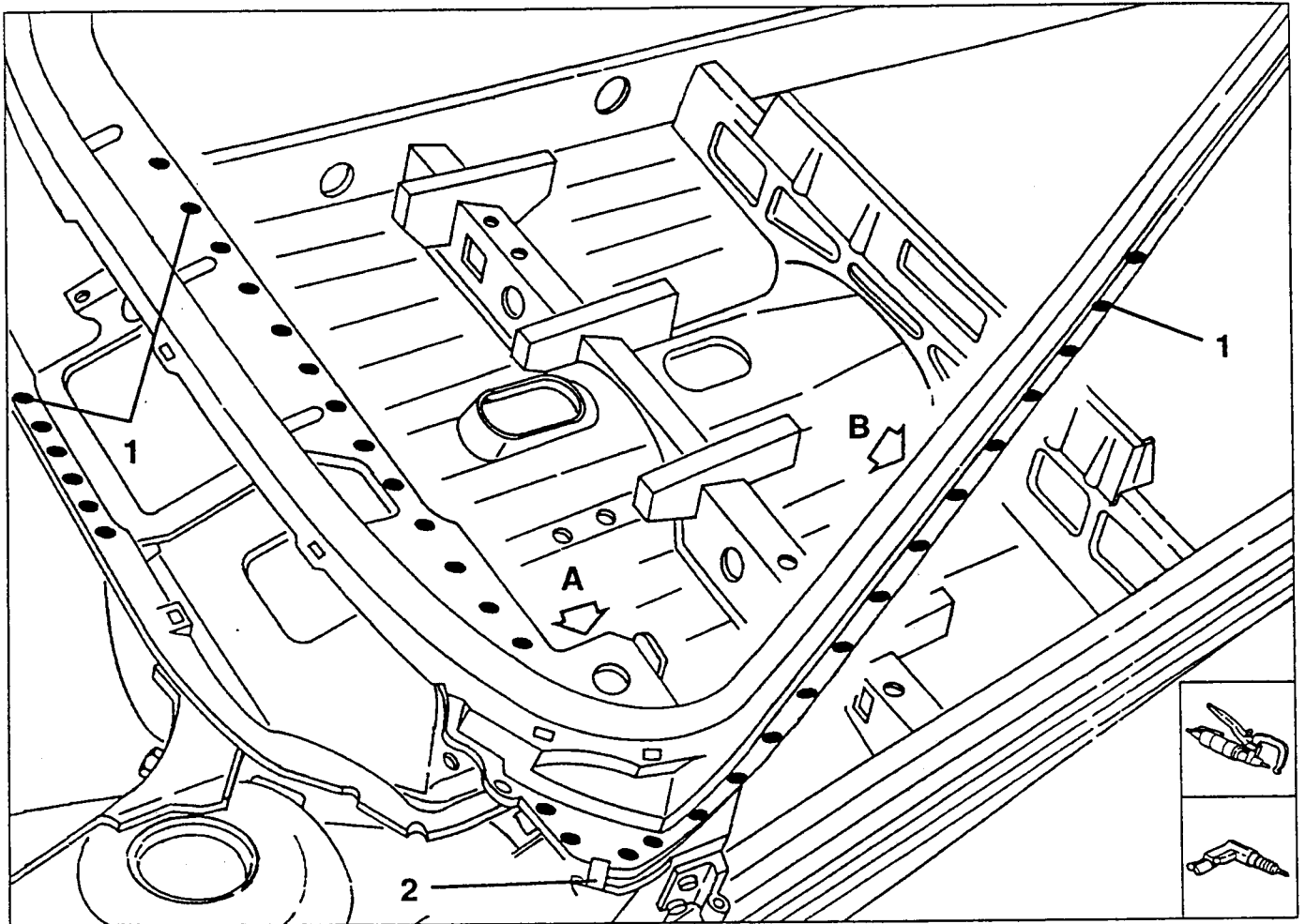
1. Apply the specified sealant along the lines shown in the diagram.
- Proceed to the painting phase.



1. Using a rotating brush, clean the areas to be spot-cut to highlight the welding points.

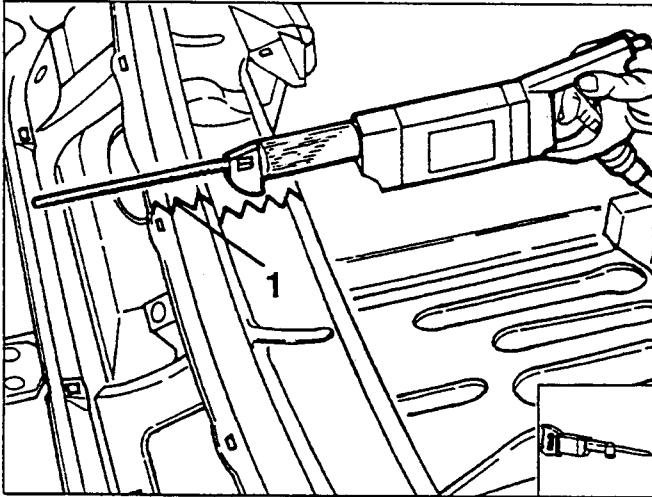
1. Using a spot cutter, remove the accessible welding points; remove the remaining welding points using a drill.

2. Open the clinch tab .

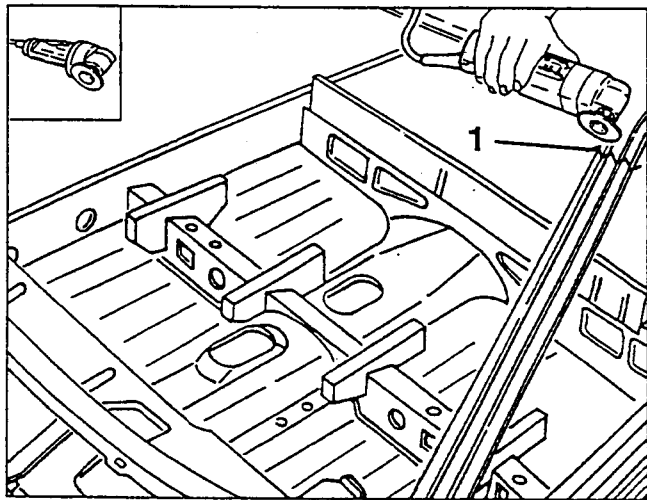




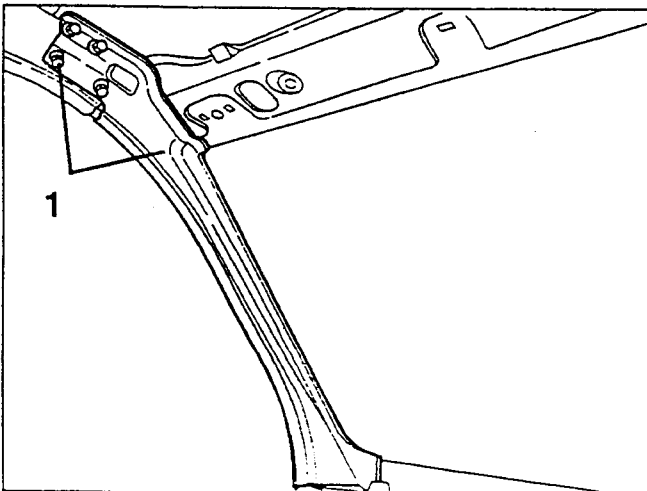
1. Using a jig saw, cut the windscreen frame following the indications given in the diagram without damaging the underlying components.



1. Using a circular saw, cut the front windscreen frame following the lines indicated in the diagram without damaging the underlying components.



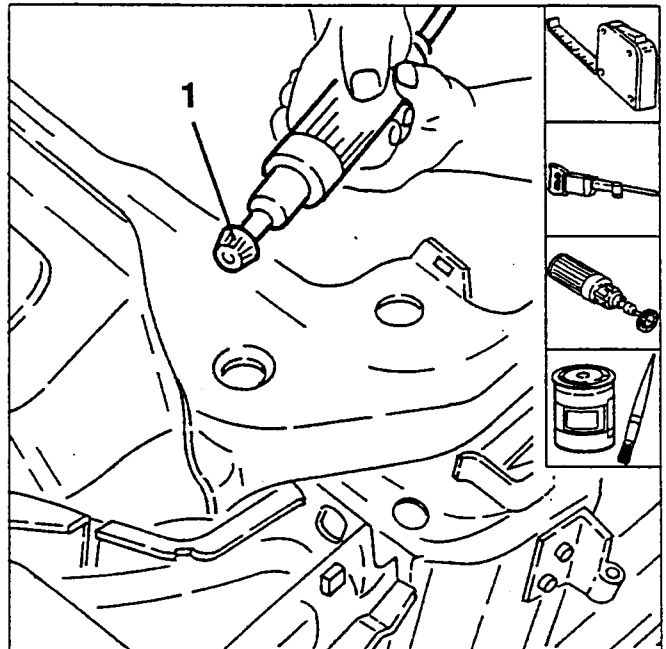
1. Loosen the four screws securing the inner side panel frame to the front windscreen frame and remove the windscreen frame removing the sealant if necessary.



### PREPARATION

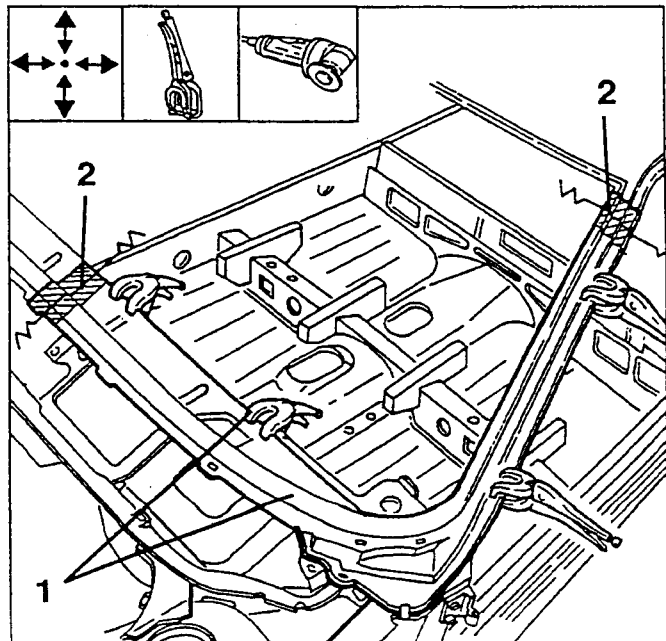
- Working on a bench cut the new front windscreen frame ensuring that enough material is left for overlapping.

1. Using a wire brush, clean the area to be welded.
- Apply the specified electroweldable protection to the areas to be spot welded.



### POSITIONING

1. Position the front windscreen frame and join the edges together and secure with clamps and the four screws securing the inner side panel frame.
- Using the windscreen, check positioning the front windscreen frame
2. Using a circular saw, trim the excess sheet metal parts.

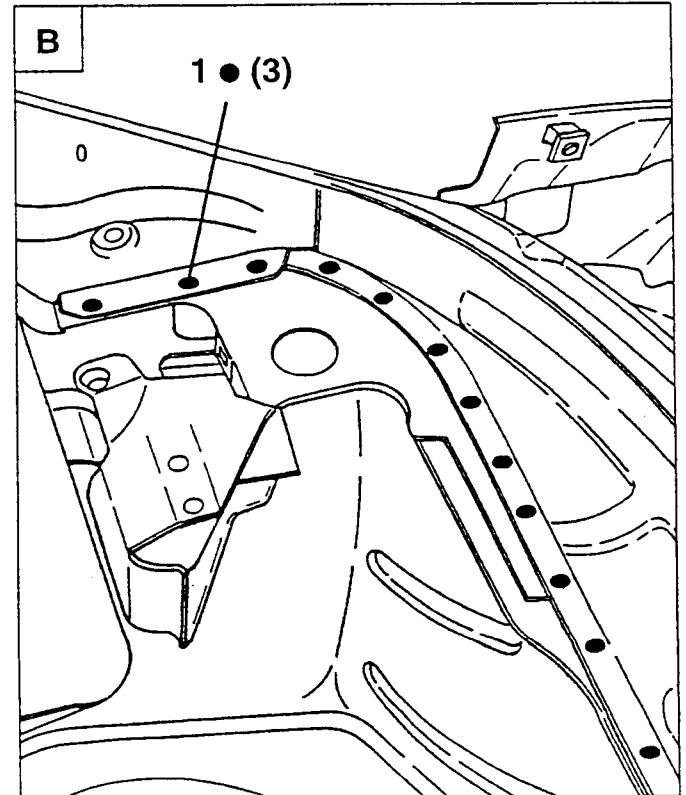
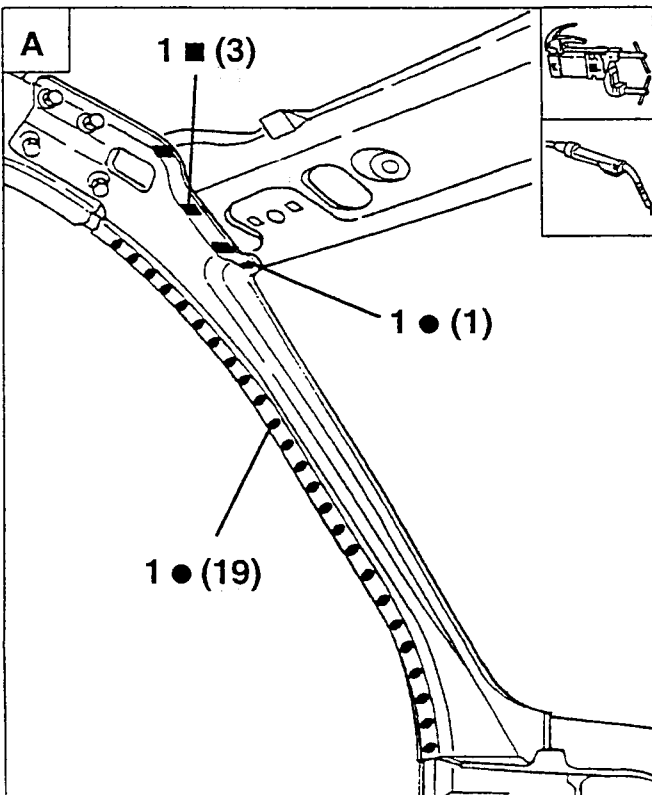
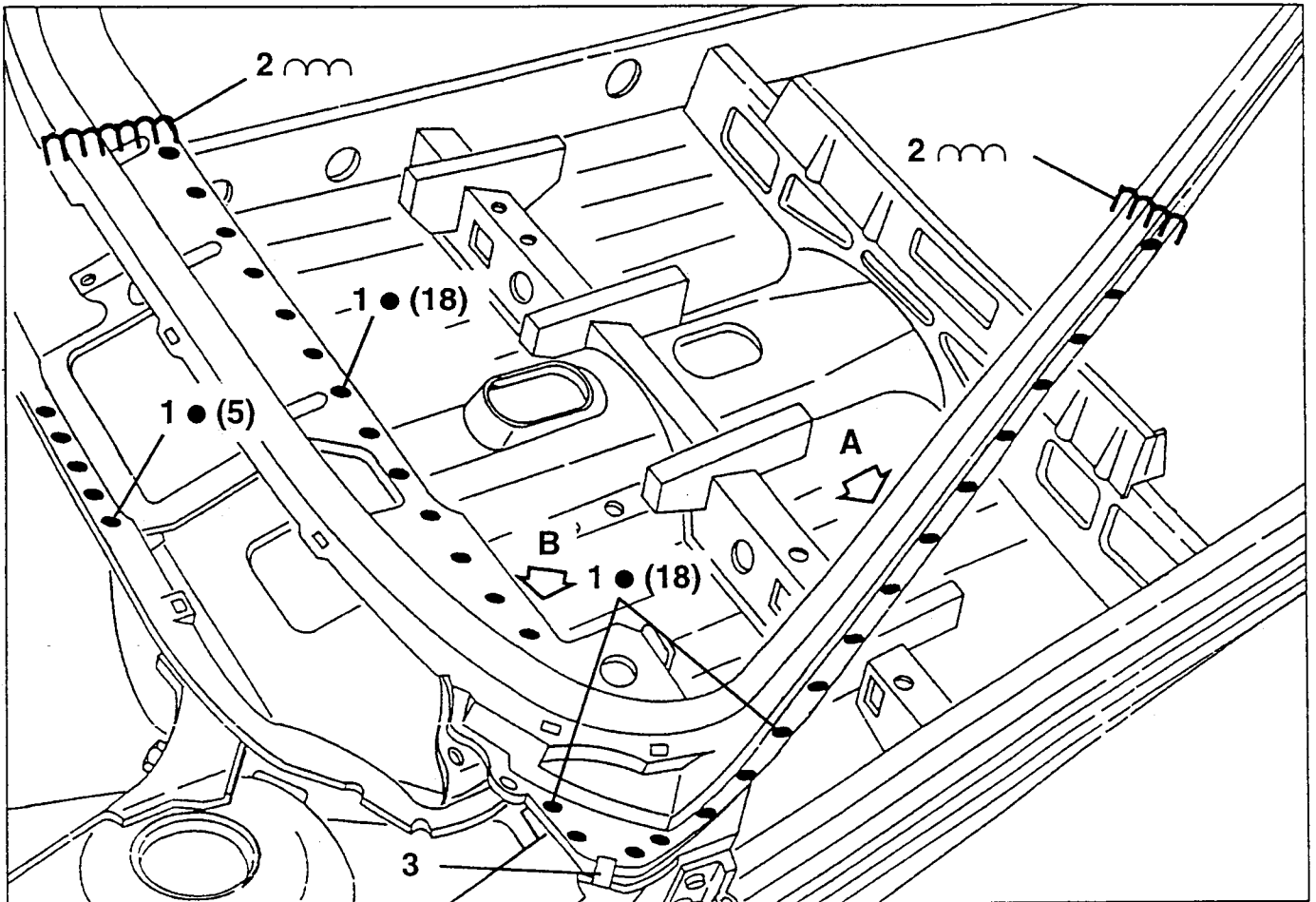


## WELDING AND FINISHING THE SHEET METAL

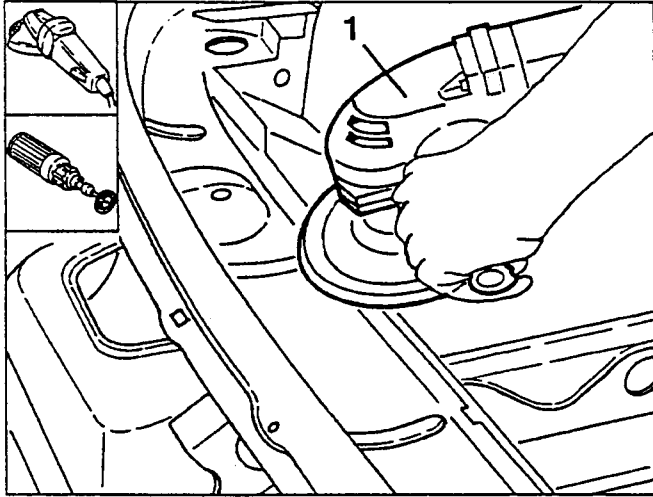
1. Using a spot welder or, where necessary, a MIG welder, proceed as shown in the diagram.

2. Using a MIG welder, weld a seam as shown in the diagram.

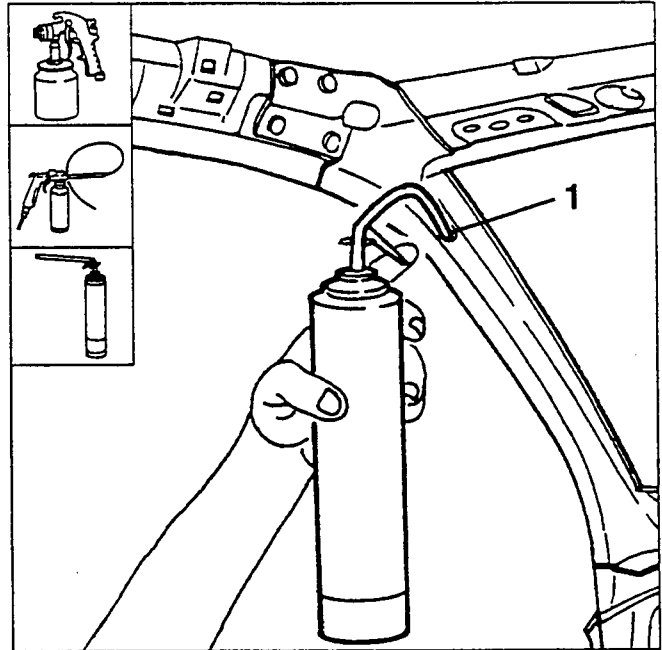
3. Bend the clinch tabs.



- Using an abrasive grinding wheel, remove and flush the residues left by welding.
- Using a rotating brush clean the welded areas.

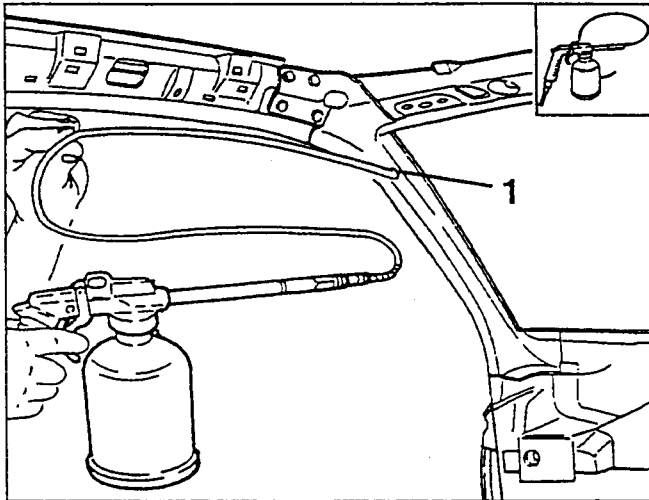


- Proceed to the painting phase.
  - Proceed to the wax-treatment phase for the boxed parts.
- Proceed to the foam treatment phase for the front pillar as shown in the diagram.



### PROTECTION

- Apply the specified corrosion inhibitor to the areas to be MIG welded.

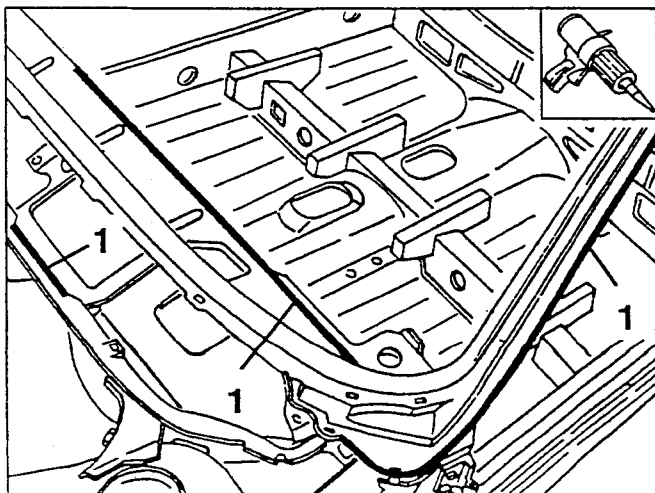


### RIB

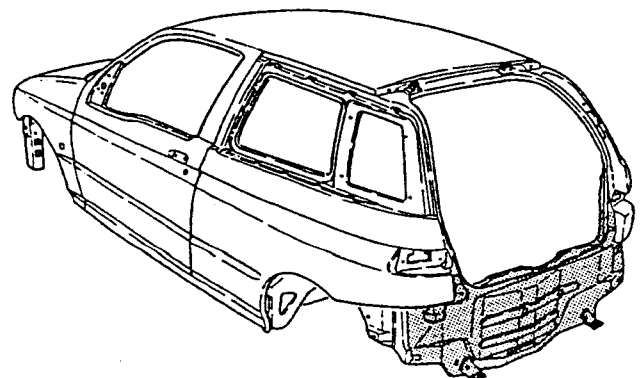
#### PRELIMINARY OPERATIONS

- Disconnect the negative (-) cable from the battery and remove the electronic control units.
- Remove the trim components, electrical and mechanical system which could hinder the repair operations or get damaged during work (see specific paragraphs).
- Remove the following sheet metal parts:
  - boot (see specific paragraph).

- Apply the specified sealant along the lines shown in the diagram.



### REMOVAL

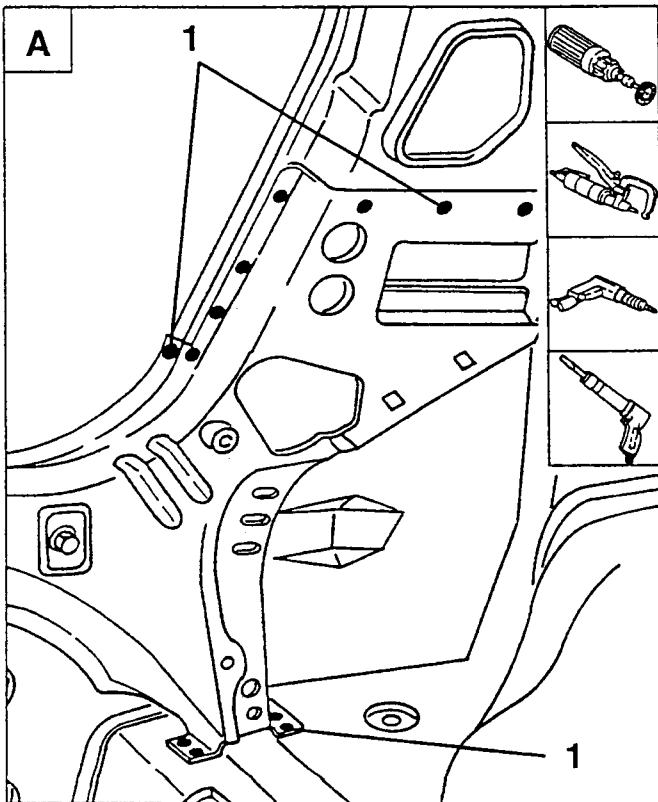
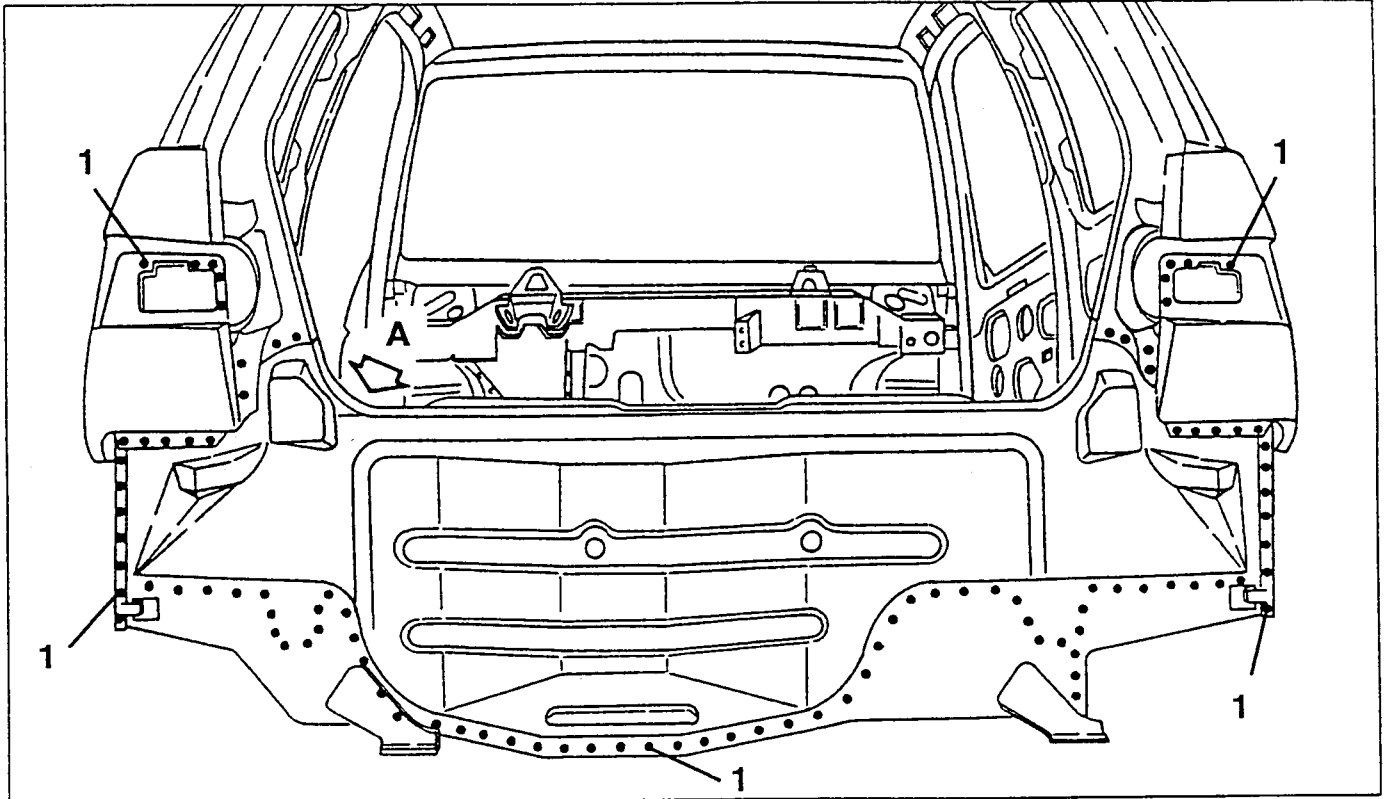


- Using a rotating brush clean the areas to be spot-cut to highlight the welding points.

1. Using a spot cutter, remove the accessible welding points; remove the remaining points using a drill or a chisel.

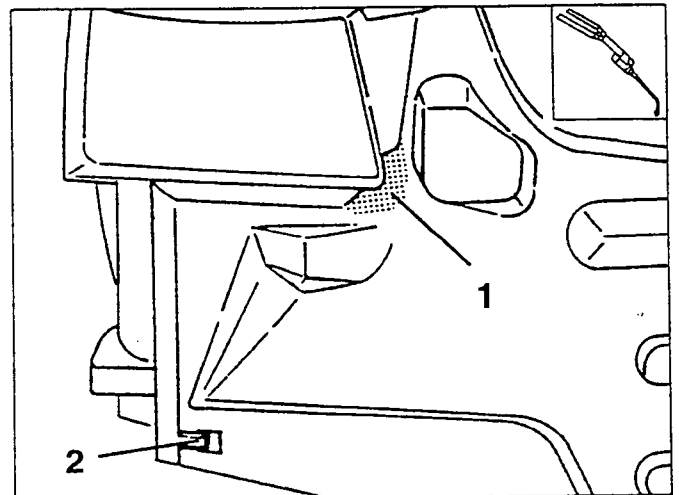
**NOTE:**

If necessary free the sheet metal.



1. Using an oxyacetylene torch, unweld the braze welds shown in the diagram.

2. Open the clinch tabs and remove the rib cutting the sealant if necessary.



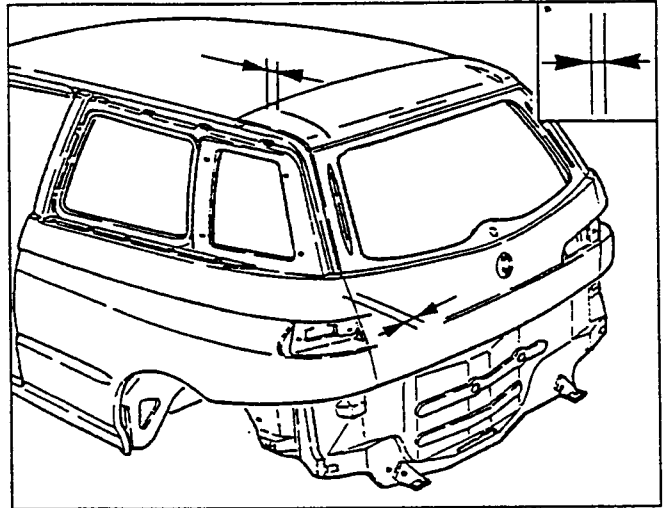
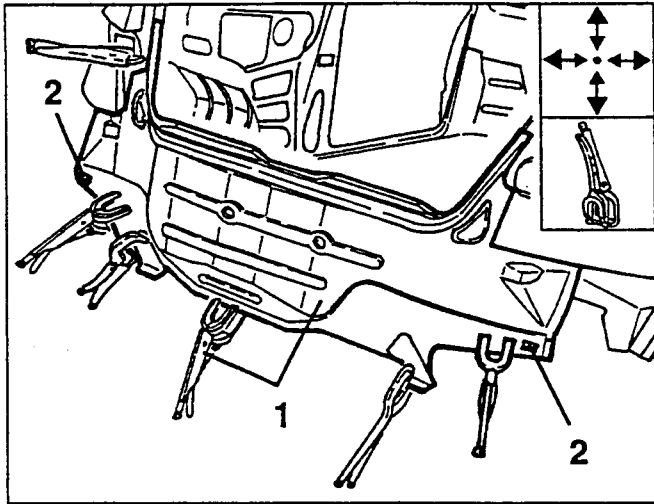
**PREPARATION**

- Using a rotating brush, clean the area to be welded.
- Apply a thick layer of electroweldable protection to the entire lower part of the floor-rib mating surfaces.
- Apply the electroweldable protection with a brush to the remaining areas to the spot welded.

## POSITIONING AND INSPECTION

1. Install the rib ensuring that the upper tabs are bent just enough to facilitate positioning. Join the edges to be welded and fix with clamps.
2. Bend the clinch tabs.

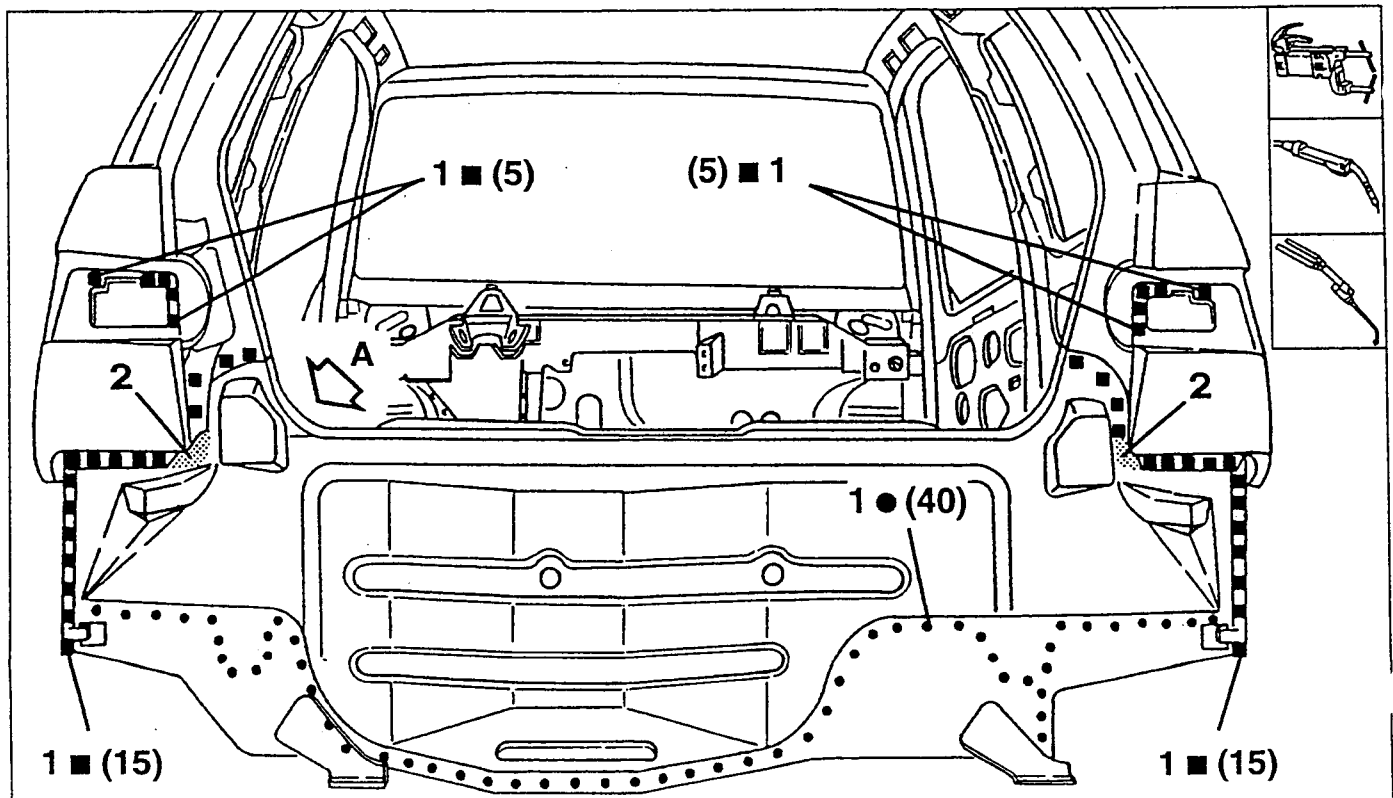
- Check parallelism, gaps and angles and refit the mobile components removed previously with their gaskets and the parts which, when fitted, permit verification of the success of the operations.



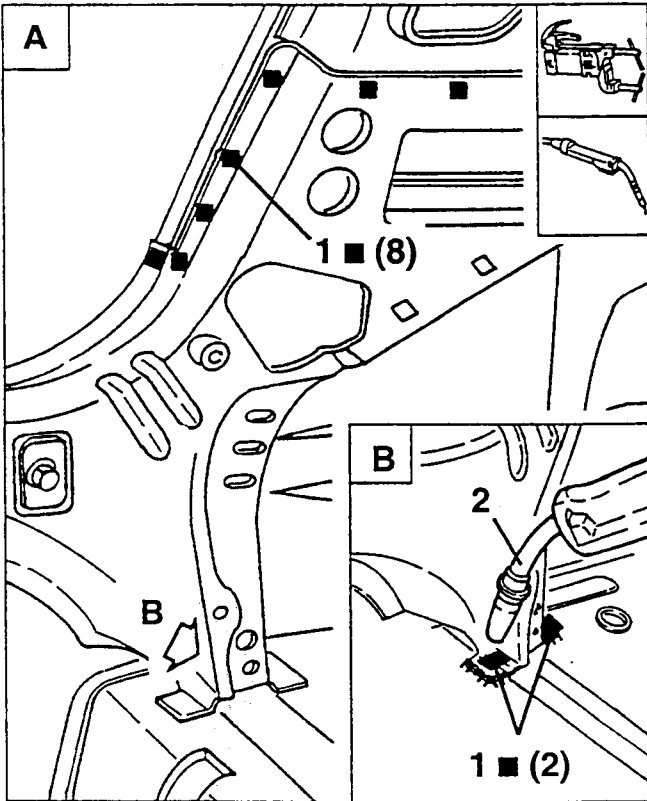
## WELDING AND FINISHING THE SHEET METAL

1. Using a spot welder or, where necessary, a MIG welder, proceed as shown in the diagram.

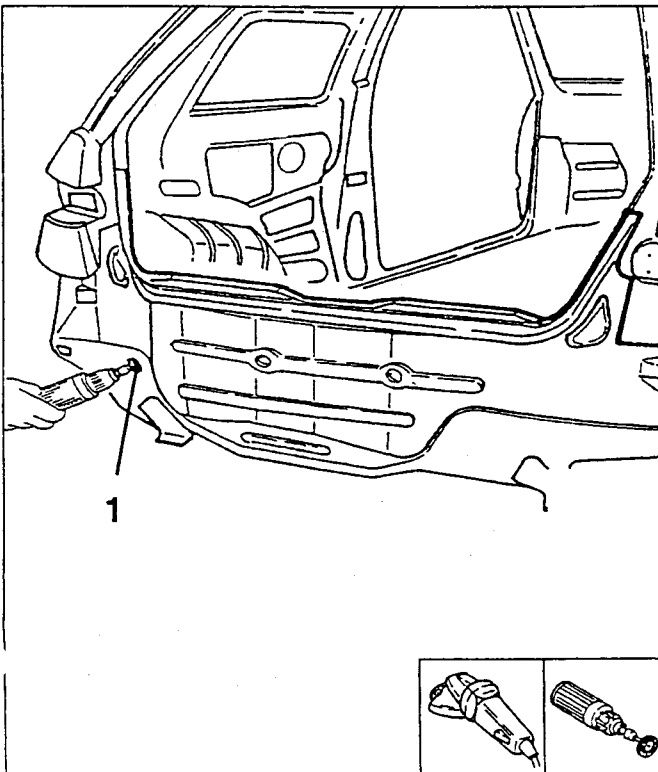
2. Using an oxyacetylene torch brass braze-weld as shown in the diagram.



1. Using a spot welder or, where necessary, a MIG welder, proceed as shown in the diagram.
2. Using a MIG welder, weld a seam as shown in the diagram.

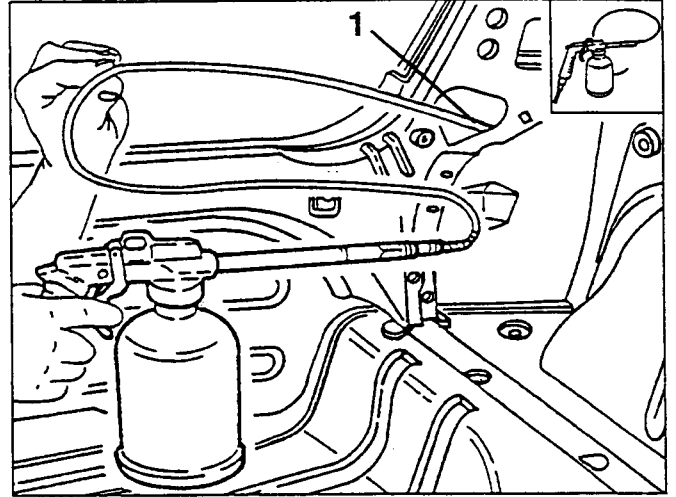


- Using an abrasive grinding wheel, remove and flush the residues left by welding.
1. Using a rotating brush, clean the welded areas.

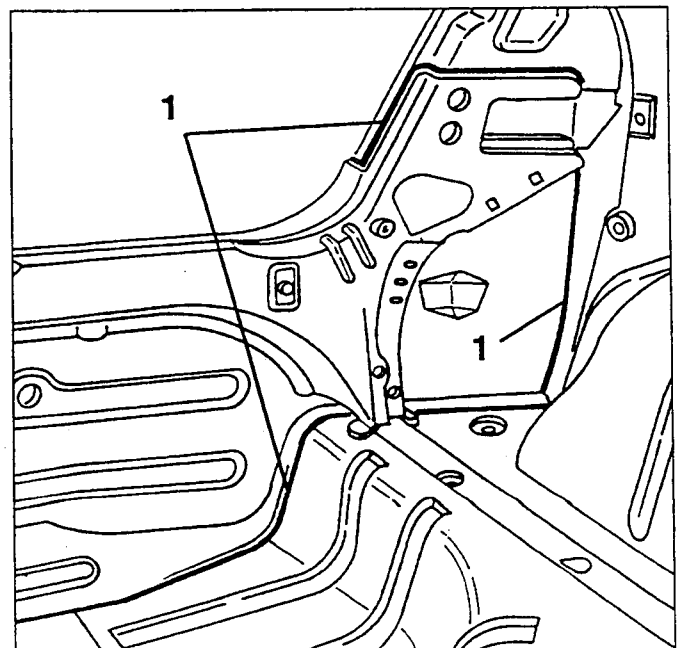
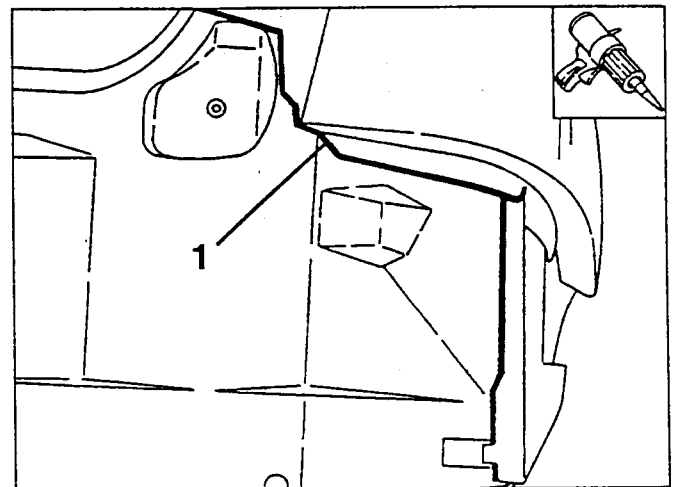


## PROTECTION

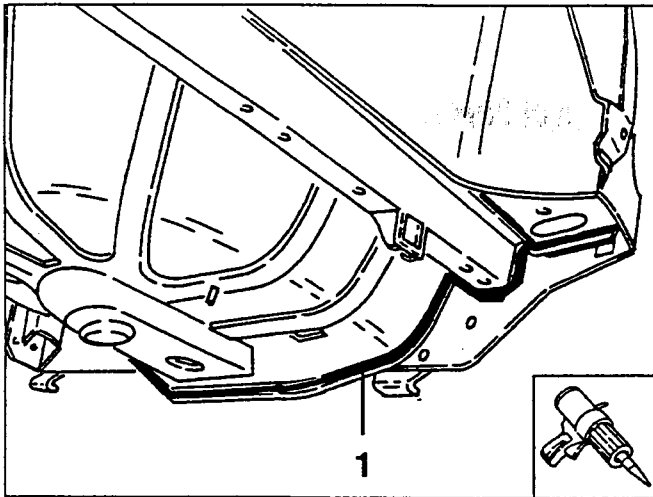
1. Apply the specified corrosion inhibitor to the areas which have been MIG welded.



1. Apply the specified sealant along the lines shown in the diagram.

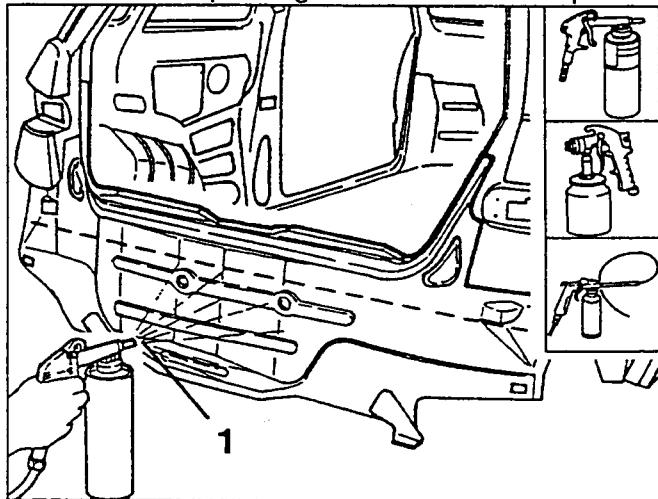


1. Working from under the car, apply the specified sealant along the lines shown in the diagram.



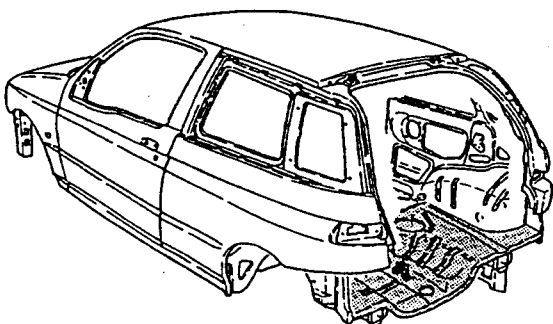
1. Apply the specified underbody sealant to the new areas and on the rib spreading it up to the line shown in the diagram.

- Proceed to the painting and wax-treatment phase.



### REAR PARTIAL FLOOR PANEL (WITH RIB REMOVED)

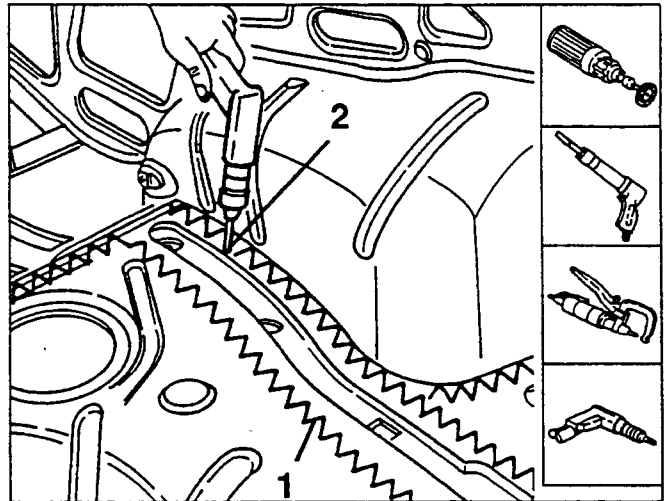
#### REMOVAL



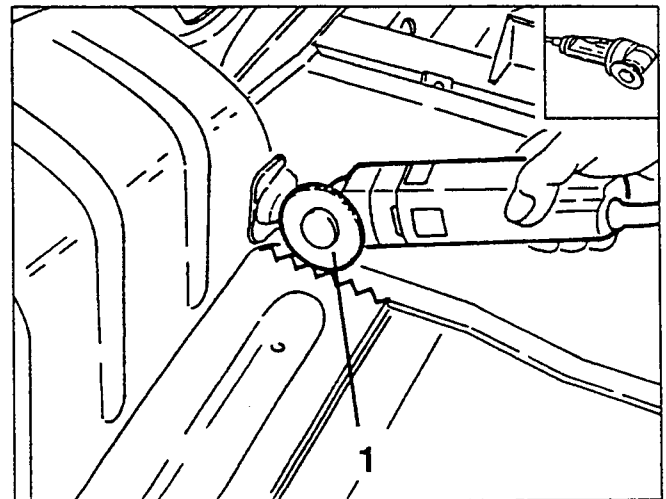
1. Using a chisel free the floor panel as shown in the diagram and remove the sheet metal.

- Using a rotating brush, clean the areas to be spot-cut to highlight the welding points.

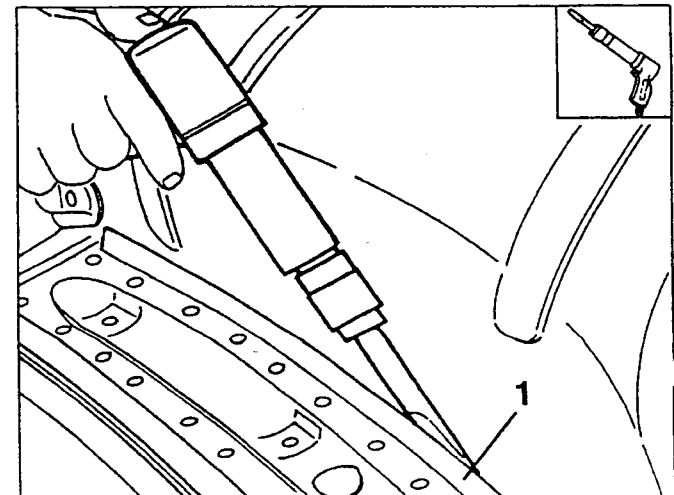
2. Using a spot cutter, remove the accessible welding points, remove the remaining welding points using a drill or a chisel.



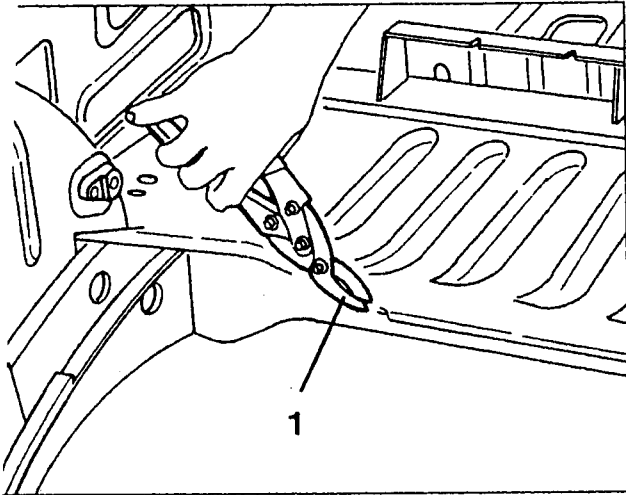
1. Using a circular saw, cut the side edges of the floor panel to be removed as shown in the diagram.



1. Using a chisel remove the side edges of the rear partial floor panel.

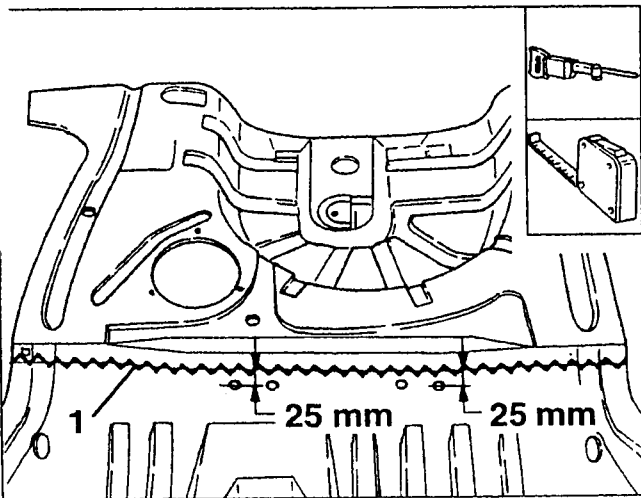


Using shears trim the floor panel so that it is flush with the frame.



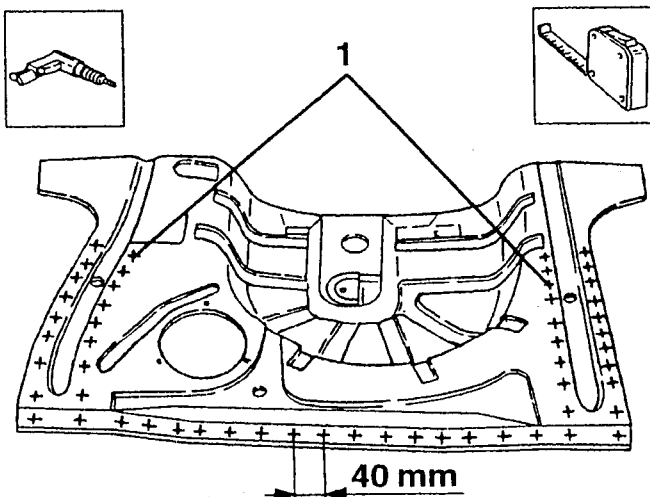
### REPARATION

Working on a bench trace out and cut the new floor panel to the dimensions given in the diagram.

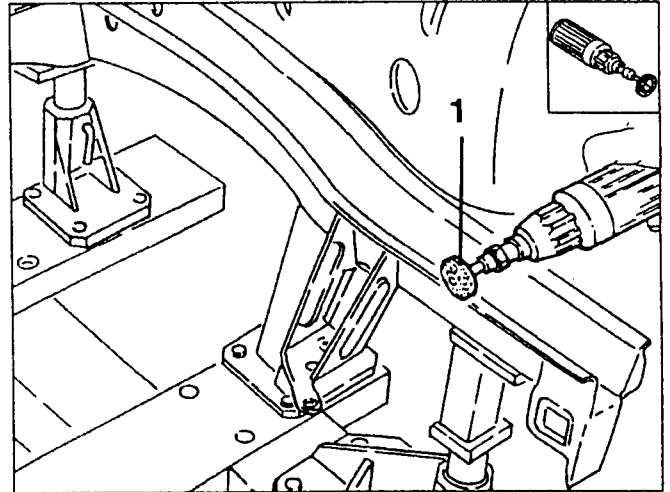


Using shears trim the cut on the partial rear floor panel.

1. Trace out and drill the partial rear floor using a drill and a  $\varnothing 5$  mm bit and leaving space between the holes as shown in the diagram.

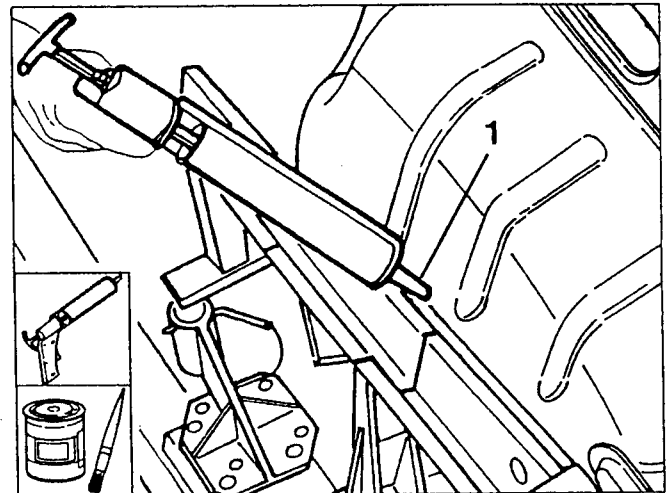


1. Using a rotating brush, clean the area to be welded.



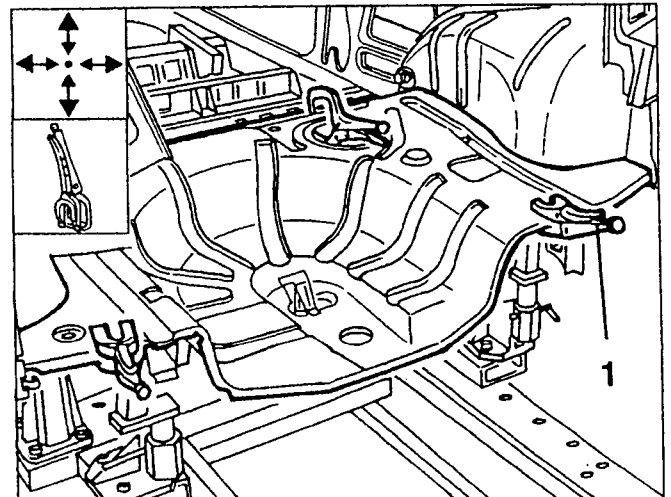
1. Apply a thick layer of electroweldable protection to the area indicated in the diagram.

- Apply the electroweldable protection with a brush to the remaining areas to the spot welded.



### POSITIONING

1. Position the partial rear floor panel and join the edges to be welded together and fix using clamps.

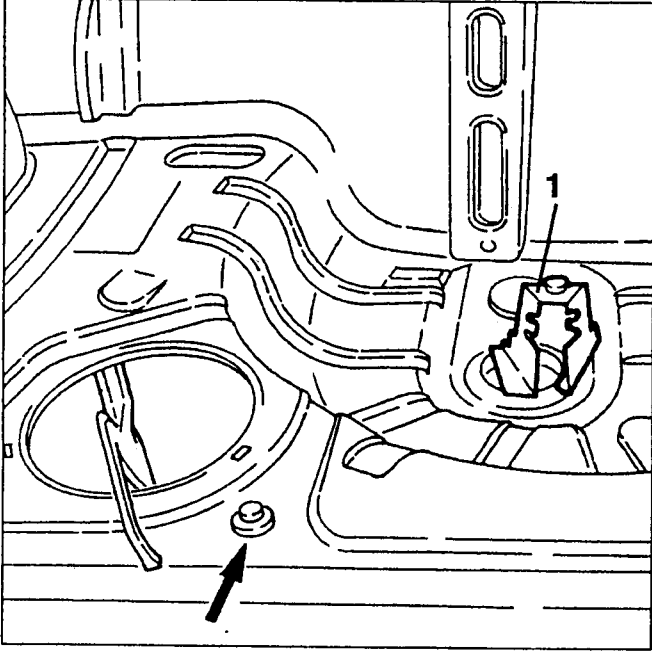




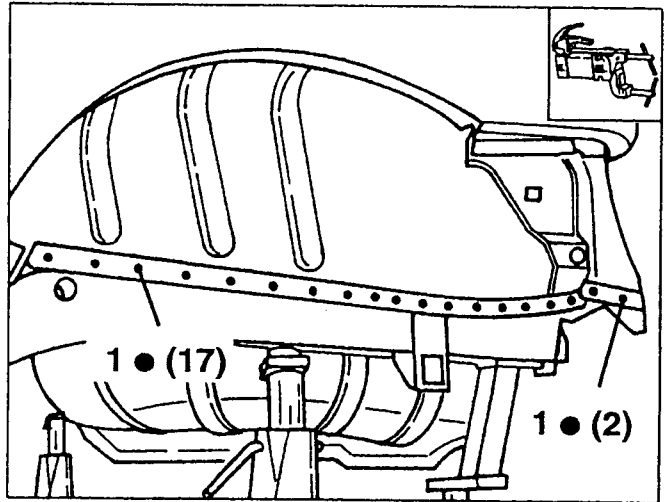
1. Position the well support as indicated in the diagram.

**NOTE:**

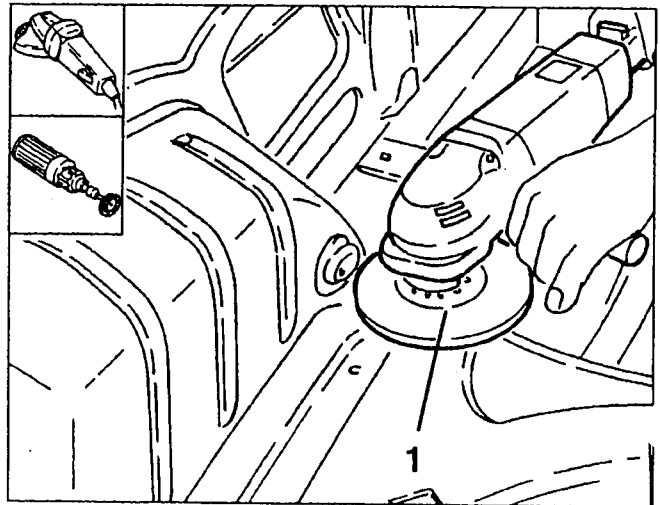
Check the correct position of the partial rear floor panel using a screw in the hole indicated in the diagram as a reference point.



1. Using a spot welder, proceed as shown in the diagram.

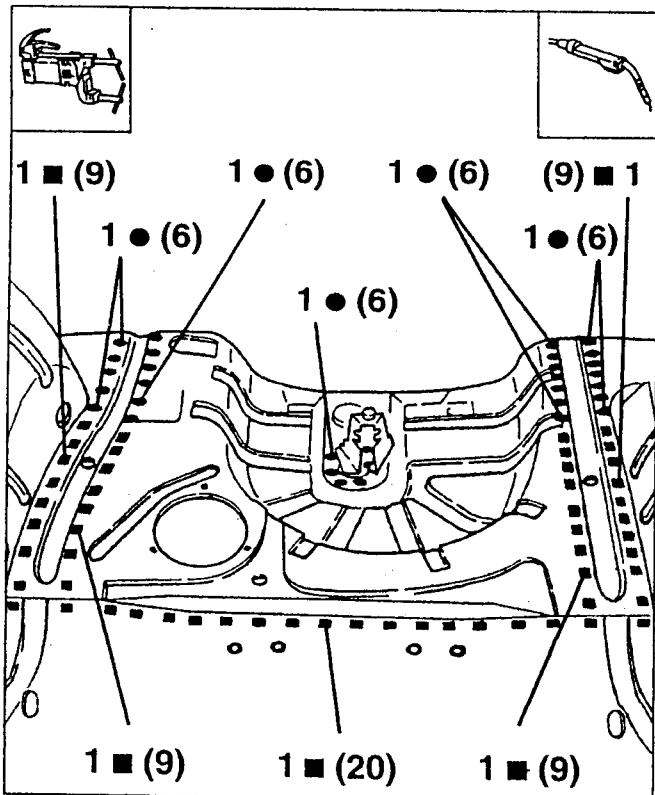


1. Using an abrasive grinding wheel, remove and flush the residues left by welding.  
- Using a rotating brush, clean the welded areas.

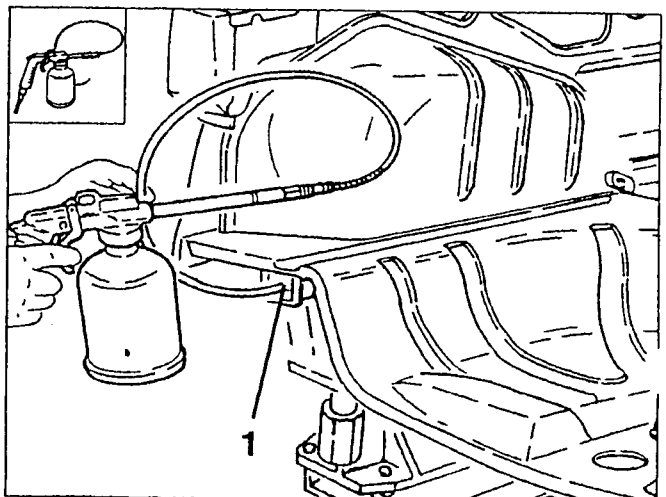


### WELDING AND FINISHING THE SHEET METAL

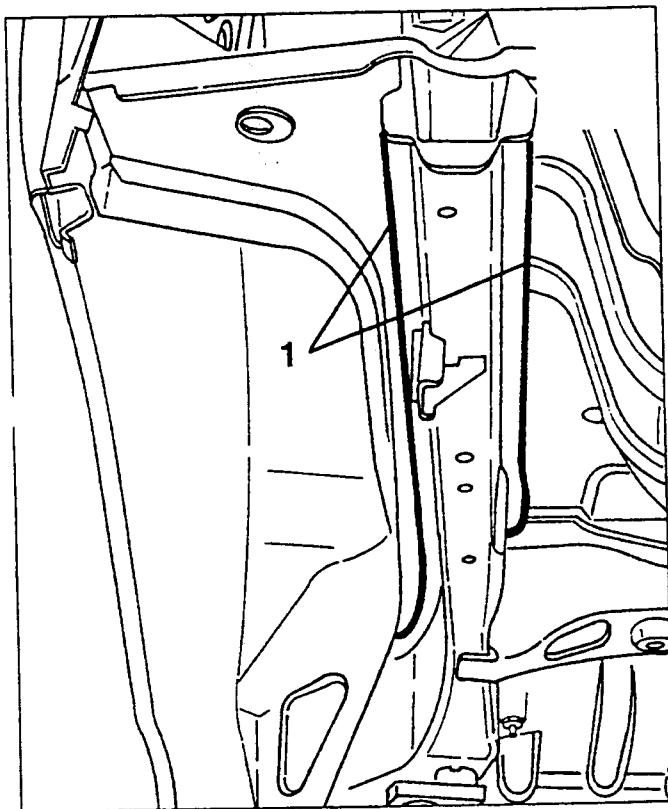
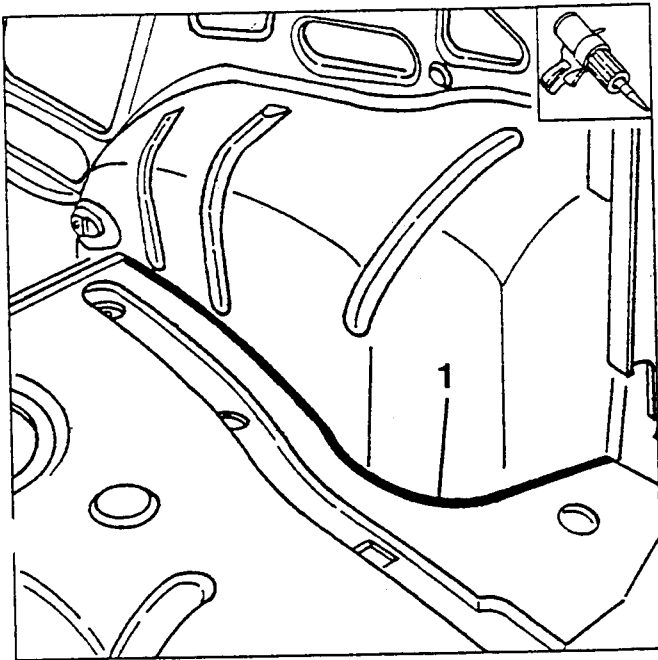
1. Using a spot welder or, where necessary, a MIG welder, proceed as shown in the diagram.



1. Apply the specified corrosion inhibitor to the areas to be MIG welded.

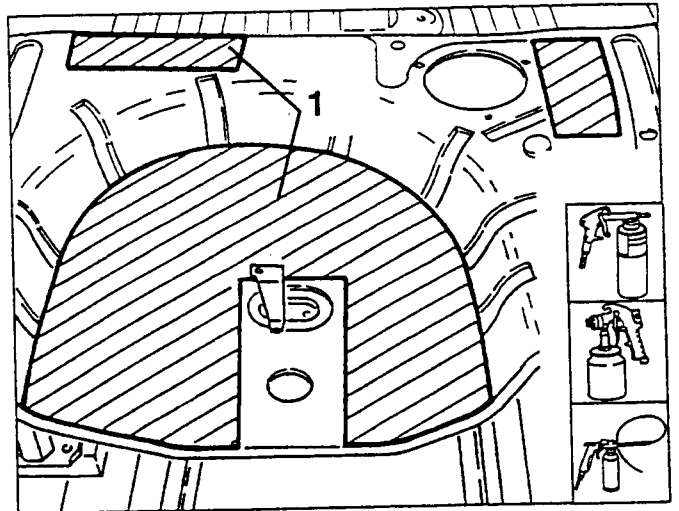


Apply the specified sealant along the lines shown in the diagram.



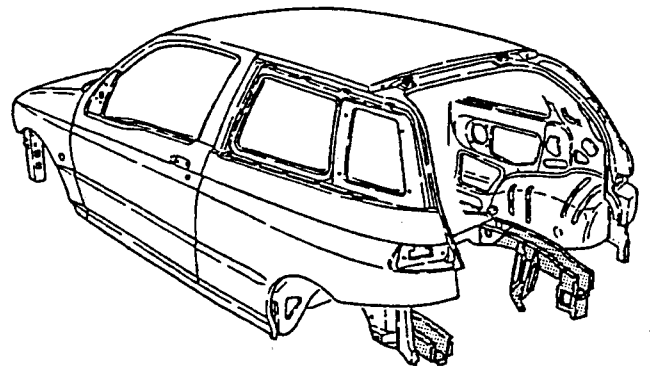
1. Apply the sound-proof panels as shown in the diagram.
- Apply the specified underbody protection to the under-floor areas.
  - Proceed to the painting phase.

Proceed to the wax-treatment phase.

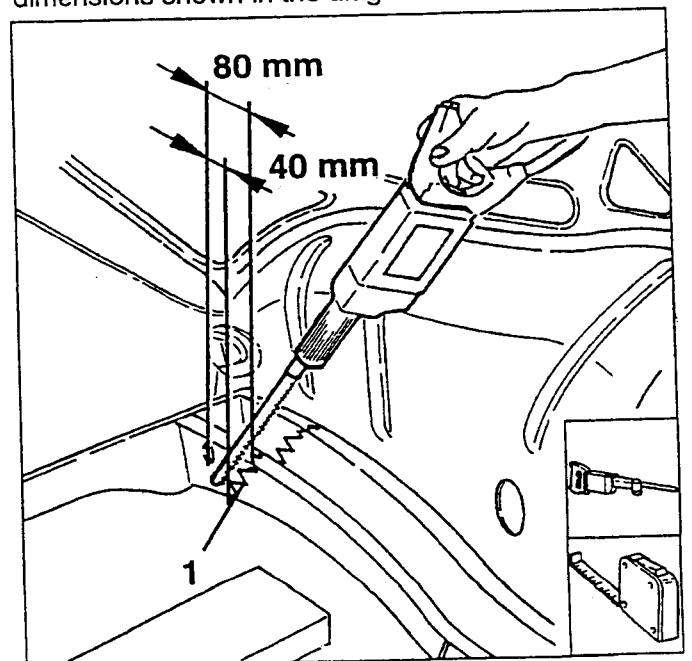


## PARTIAL REAR CROSS-MEMBERS (WITH FLOOR REMOVED)

### REMOVAL



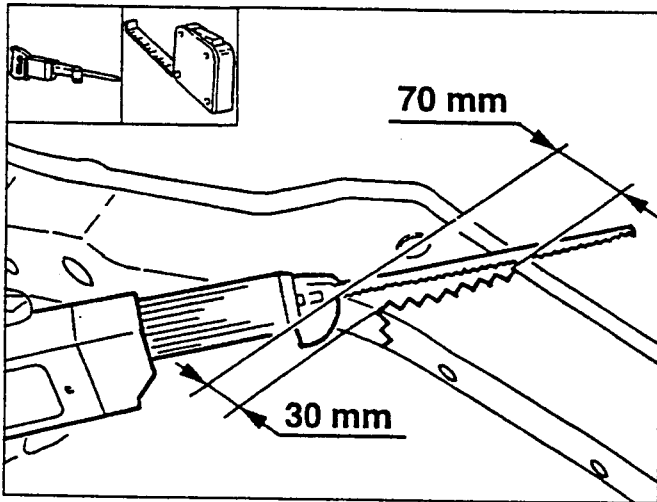
1. Using a jig saw, cut the cross-member to the dimensions shown in the diagram



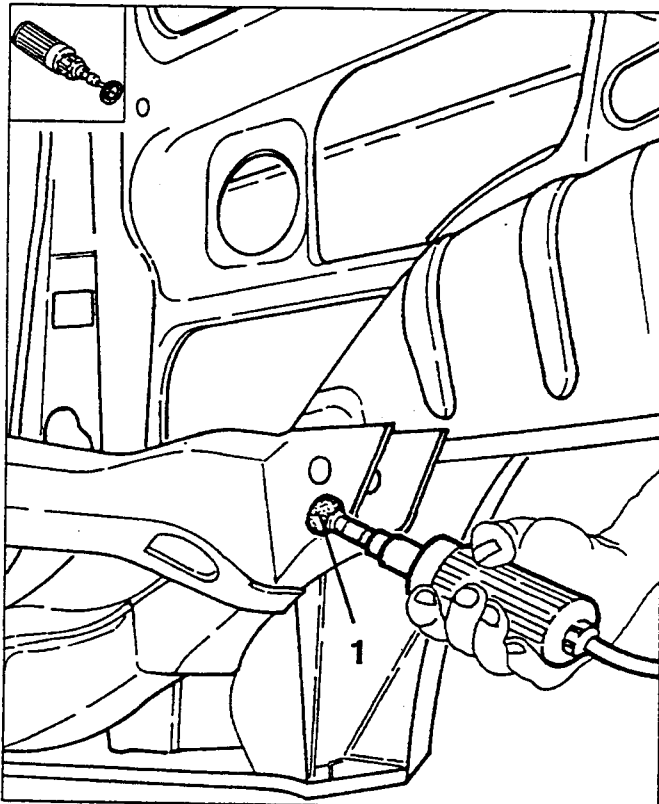
- Remove the partial rear cross-member.

### PREPARATION

1. Working on a bench and using a jig saw cut the new cross-member to the dimensions shown in the diagram.



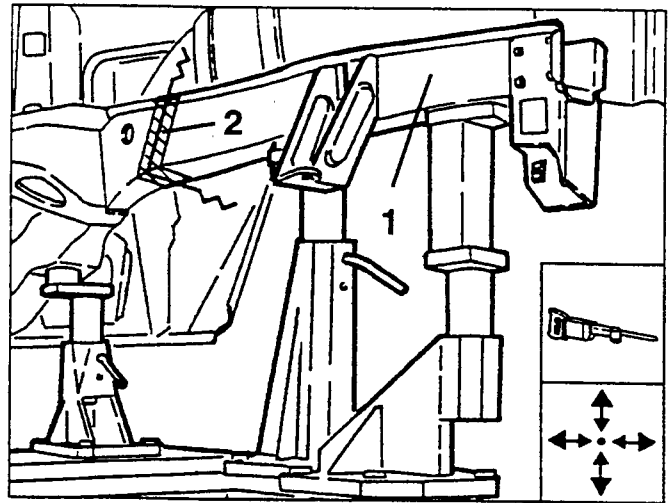
1. Using a rotating brush, clean the area to be welded.



### POSITIONING

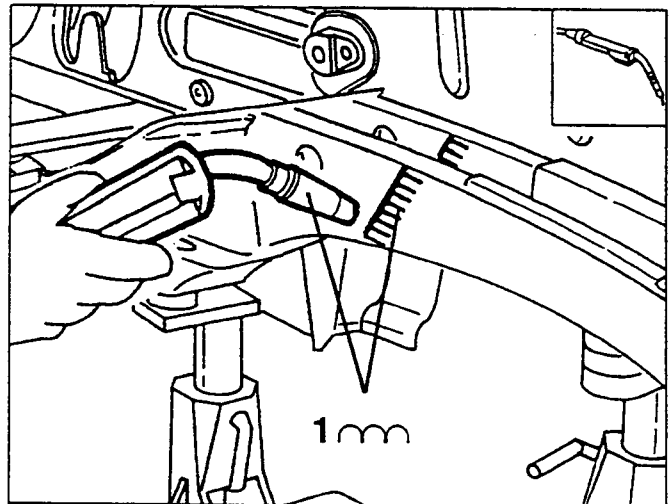
1. Using a jig, correctly position the partial rear cross-member remembering to allow for overlapping.

2. Using a jig saw, trim the excess sheet metal parts.

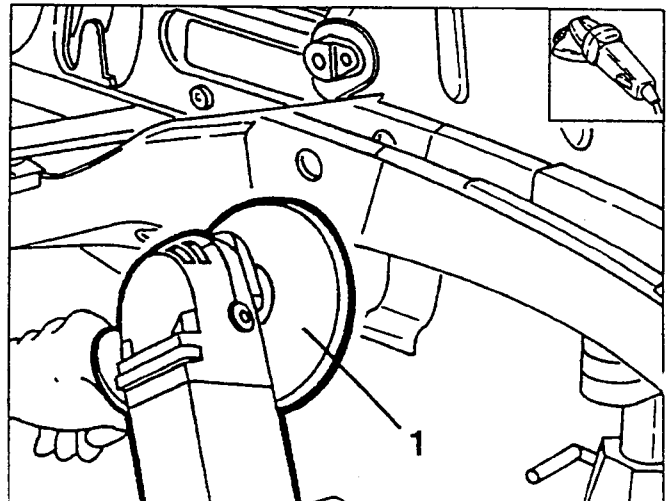


### WELDING AND FINISHING THE SHEET METAL

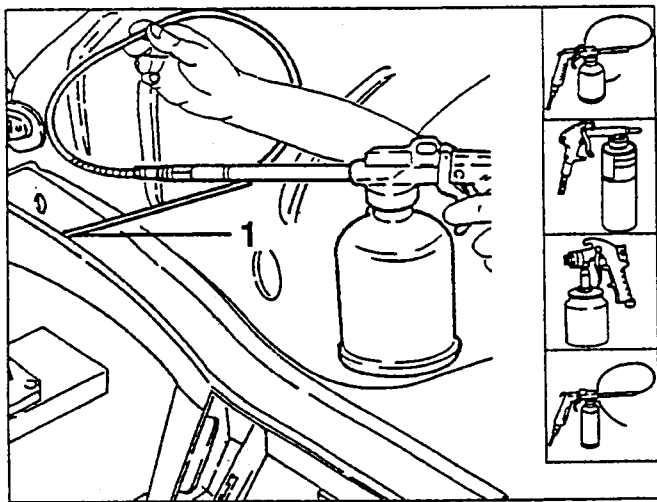
1. Using a MIG welder, proceed as shown in the diagram.



1. Using an abrasive grinding wheel, remove and flush the residues left by welding.

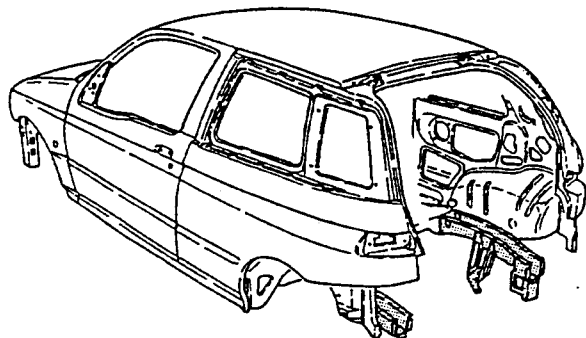


1. Apply the specified corrosion inhibitor to the areas to be welded.
- Apply the underbody protection to the new areas.
  - Proceed to the painting phase.
  - Proceed to the wax-treatment phase.

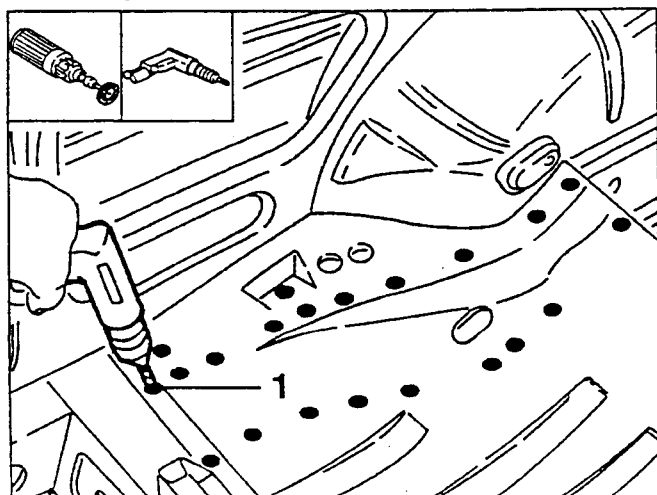


### COMPLETE REAR CROSS-MEMBERS (WITH FLOOR REMOVED)

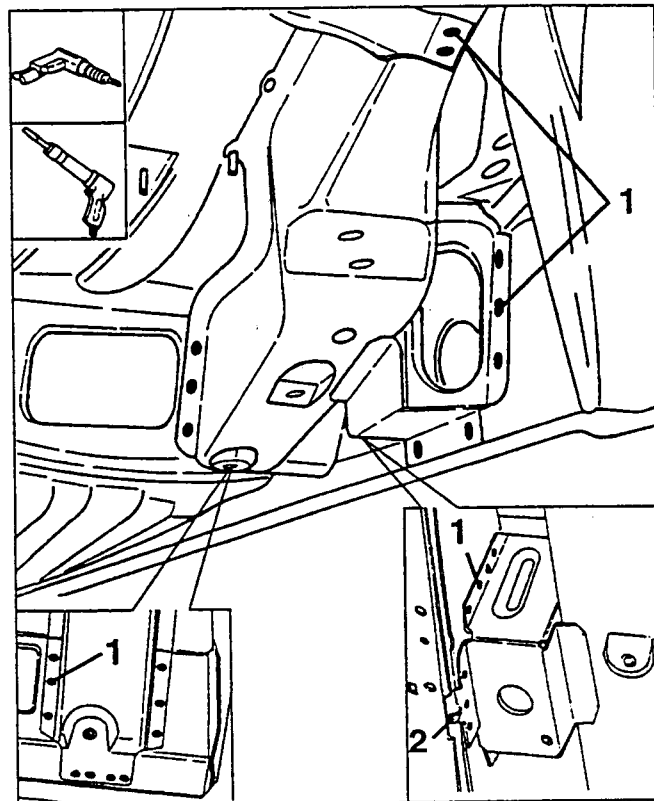
#### REMOVAL



- Using a rotating brush, clean the areas to be spot-cut to highlight the welding points.
  - Remove the sound-proofing carpets from the floor.
1. Using a drill, spot cut the welding points as shown in the diagram.

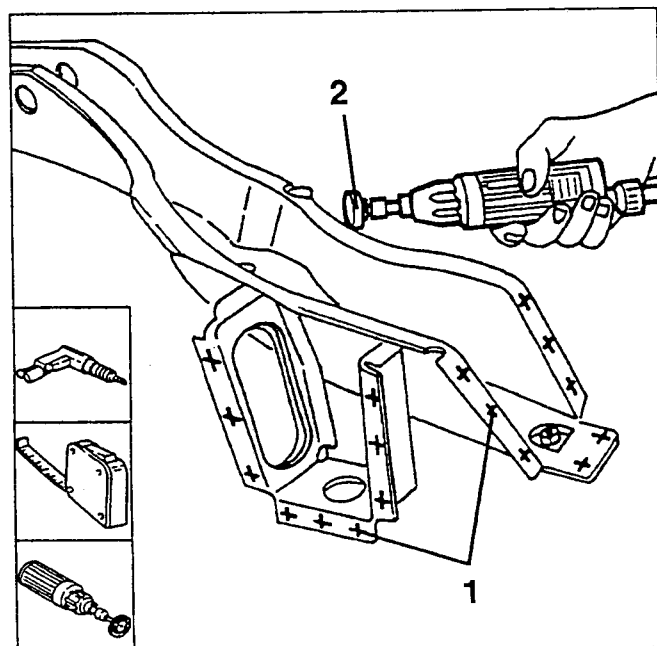


1. Using a drill or, where necessary, a chisel, spot cut as shown in the diagram.
2. Remove cross-member after opening the clinch tab.



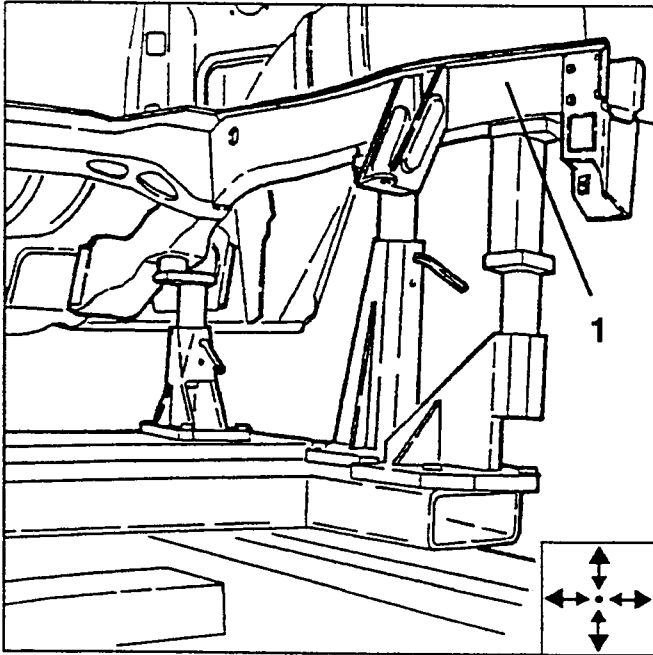
#### PREPARATION

1. Working on a bench trace out and perforate the cross-member with a drill and  $\varnothing$  5 mm bit, as shown in the diagram.
2. Using a rotating brush, clean the area to be welded.

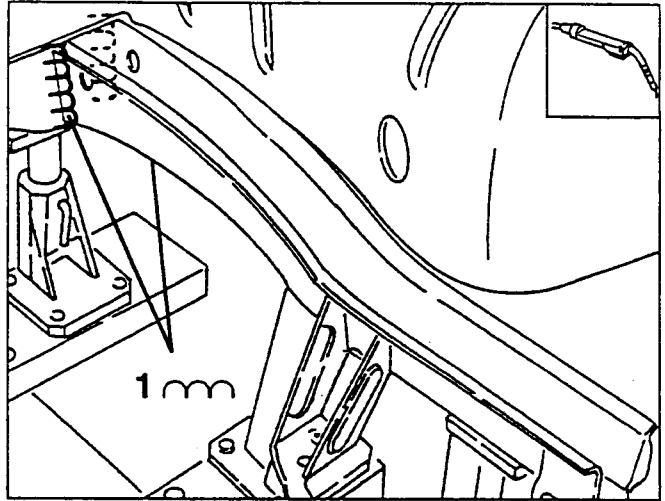


## POSITIONING

1. Install the cross-member using a jig to position it. Join the edges to be welded.

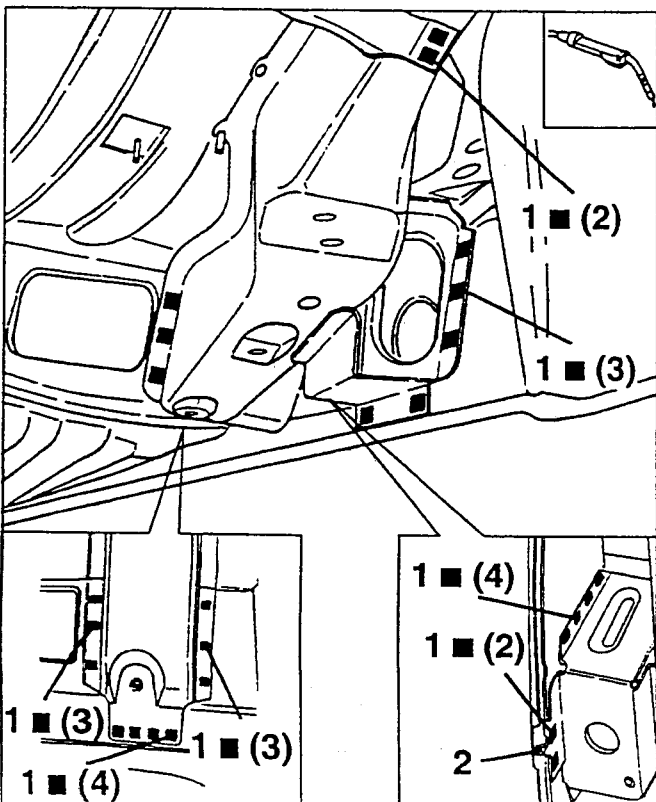
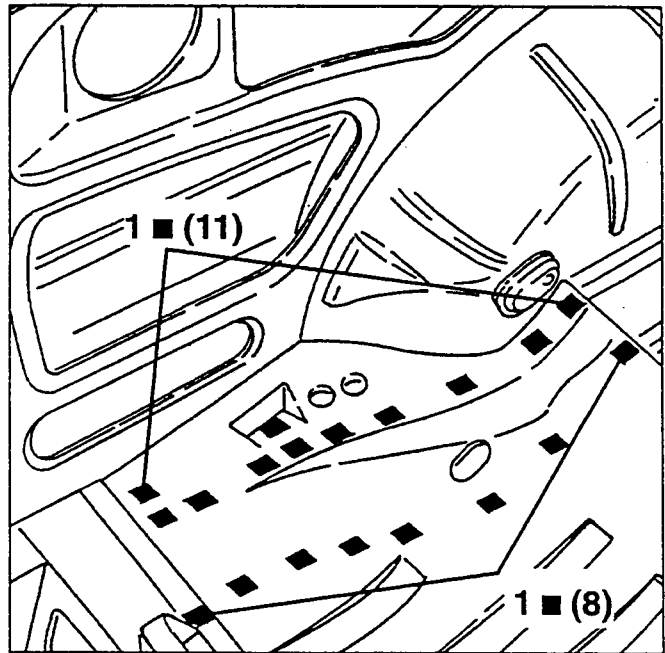


1. Using a MIG welder, proceed as shown in the diagram.

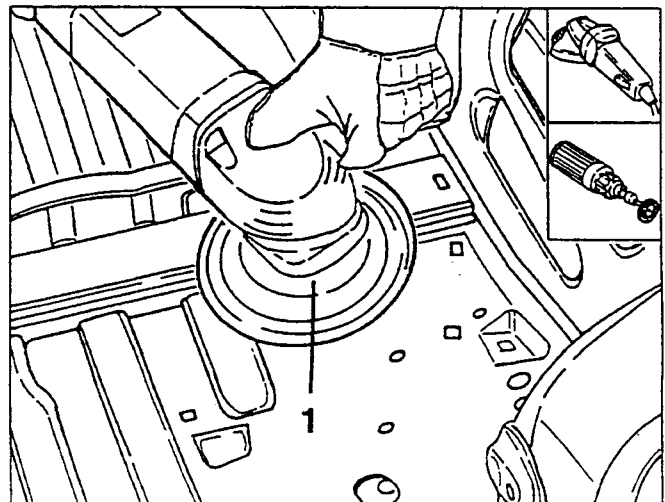


## WELDING AND FINISHING THE SHEET METAL

1. Using a MIG welder, proceed as shown in the diagram.  
2. Bend the clinch tabs.

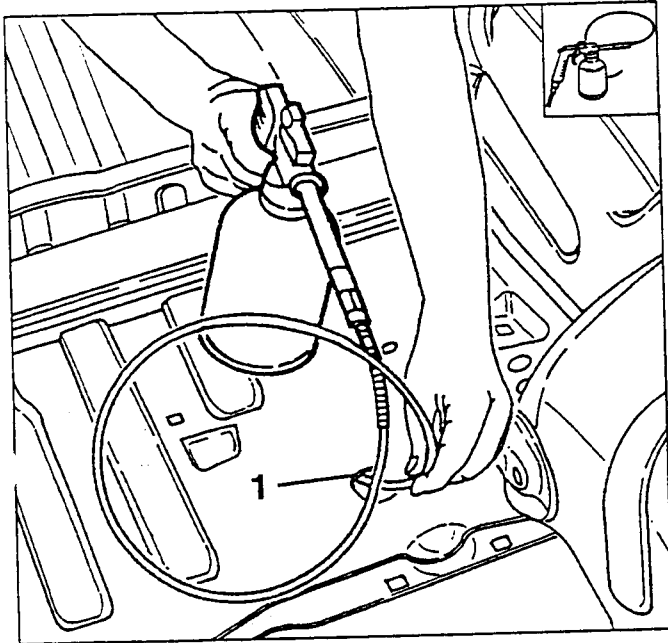


1. Using an abrasive grinding wheel, remove and flush the residues left by welding.  
- Using a rotating brush, clean the welded areas.

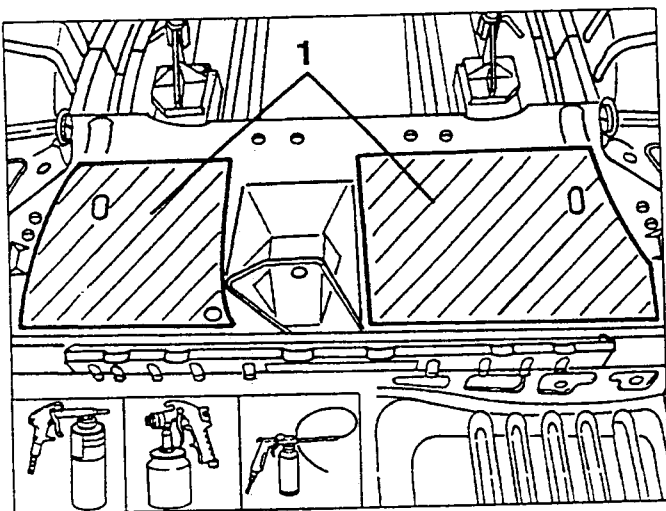


## PROTECTION

1. Apply the specified corrosion inhibitor to the areas which have been MIG welded.



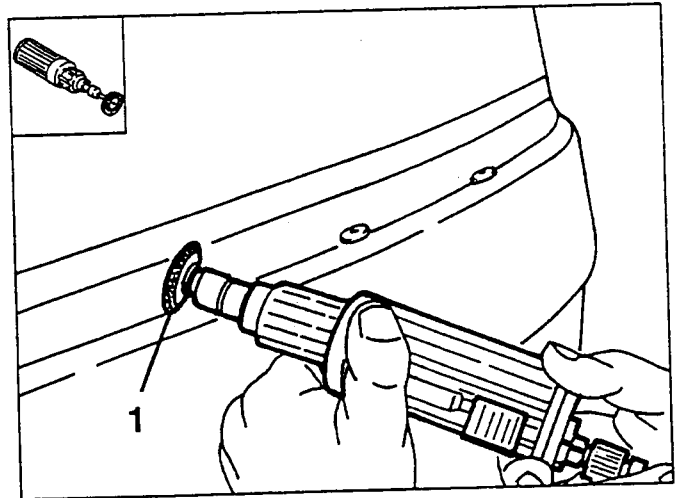
- Apply underbody protection to the new areas.
  - Proceed to the painting phase.
  - Proceed to the wax-treatment phase.
1. Refit the sound-proofing carpets as shown in the diagram.



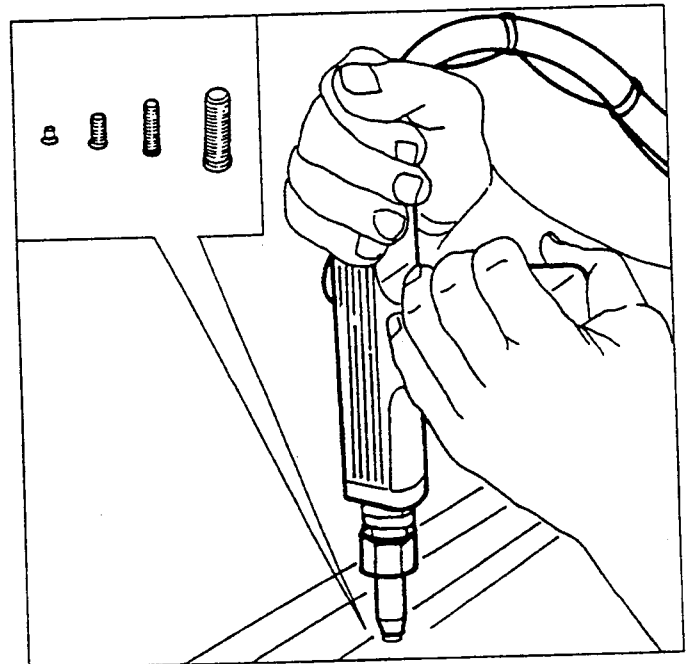
## REPLACING NAILS

- Suitably protect the surrounding areas or the area to be replaced.

1. Using a rotating brush clean the affected areas.



- Insert a nail of the correct size in the gun.
- Install the nail in place of the one removed.



- Sand and respray the new areas.

## Specific for Boxer versions

|                                                        | L  | L <sup>I</sup> | L <sup>II</sup> | L <sup>III</sup> | L <sup>IV</sup> | L <sup>V</sup> | L <sup>VI</sup> | L <sup>VII</sup> | L <sup>VIII</sup> | T         | T <sup>I</sup> | T <sup>II</sup> | T <sup>III</sup> | T <sup>IV</sup> | T <sup>V</sup> | T <sup>VI</sup> | H         | H <sup>I</sup> |
|--------------------------------------------------------|----|----------------|-----------------|------------------|-----------------|----------------|-----------------|------------------|-------------------|-----------|----------------|-----------------|------------------|-----------------|----------------|-----------------|-----------|----------------|
| Lower radiator attachments                             | 1  | 940 ± 1        | 740 ± 1         | 60               |                 |                |                 |                  |                   | 9         | 948 ± 1.5      | 651 ± 1         |                  |                 |                |                 | 216       | 195            |
| Dashboard cross-member and steering column attachments | 2  | 1200           | 40              |                  |                 |                |                 |                  |                   | 520 ± 1   |                |                 |                  |                 |                |                 |           |                |
| Front suspension frame side attachment                 | 3  | 835 ± 1        | 125 ± 0.5       |                  |                 |                |                 |                  |                   | 70        | 808 ± 1        |                 |                  |                 |                |                 |           |                |
| Front suspension frame front attachment                | 4  | 818 ± 1        | 53.5            |                  |                 |                |                 |                  |                   | 70        |                |                 |                  |                 |                |                 | 234       |                |
| Front suspension attachments                           | 5  | 28.4           | 79              | 206.35 ± 1       |                 |                |                 |                  |                   | 178 ± 0.5 | 89             | 11              | 279.4 ± 1        | 156             | 4.54           | 28.58           | 74        | 42             |
| Front suspension frame rear attachment                 | 6  | 625 ± 1.2      | 145 ± 0.2       | 60.5             | 710 ± 1         |                |                 |                  |                   | 308       |                |                 |                  |                 |                |                 | 24 ± 0.5  |                |
| Rear suspension attachments                            | 7  | 1084           | 132.25 ± 1      | 25               | 976             | 11             | 55 ± 0.5        | 12               | 42 ± 0.5          | 43        | 422 ± 1        | 58              | 2269 ± 2         |                 |                |                 | 118       |                |
| Gearbox centering holes                                | 8  |                |                 |                  |                 |                |                 |                  |                   | 50        |                |                 |                  |                 |                |                 |           |                |
| Holes for exhaust pipe support bracket                 | 9  | 495 ± 1        | 280 ± 1         | 150              |                 |                |                 |                  |                   | 612 ± 1   | 250            | 345             | 455              |                 |                |                 | 49.2      |                |
| Holes for flexible support                             | 10 | 84.5           | 147             |                  |                 |                |                 |                  |                   | 19        |                |                 |                  |                 |                |                 |           |                |
| Hand brake attachments                                 | 11 | 90             |                 |                  |                 |                |                 |                  |                   | 233       |                |                 |                  |                 |                |                 |           |                |
| Fuel tank attachments                                  | 12 | 140            | 55              | 420              | 260             | 228            |                 |                  |                   | 750       | 472            | 96              | 152              |                 |                |                 | 141 ± 1.5 | 116            |





## Specific for Turbodiesel versions

|                                                        | L         | L <sup>I</sup> | L <sup>II</sup> | L <sup>III</sup> | L <sup>IV</sup> | L <sup>V</sup> | L <sup>VI</sup> | L <sup>VII</sup> | L <sup>VIII</sup> | T         | T <sup>I</sup> | T <sup>II</sup> | T <sup>III</sup> | T <sup>IV</sup> | T <sup>V</sup> | T <sup>VI</sup> | H         | H <sup>I</sup> |
|--------------------------------------------------------|-----------|----------------|-----------------|------------------|-----------------|----------------|-----------------|------------------|-------------------|-----------|----------------|-----------------|------------------|-----------------|----------------|-----------------|-----------|----------------|
| Lower radiator attachments                             | 115 ± 0.5 | 940 ± 1        | 740 ± 1         | 60               |                 |                |                 |                  |                   | 9         | 948 ± 1.5      |                 |                  |                 |                |                 | 216       | 195            |
| Dashboard cross-member and steering column attachments | 1200      | 40             |                 |                  |                 |                |                 |                  |                   | 520 ± 1   |                |                 |                  |                 |                |                 |           |                |
| Gearbox attachments                                    | 830       | 28             | 60              |                  |                 |                |                 |                  |                   | 372 ± 1   | 128            | 2               | 9                | 132             |                |                 |           |                |
| Engine attachments                                     | 1013.5    | 55             | 35.5            | 30               |                 |                |                 |                  |                   | 5         | 131            |                 |                  |                 |                |                 |           |                |
| Front suspension attachments                           | 28.4      | 79             | 206.35 ± 1      |                  |                 |                |                 |                  |                   | 178 ± 0.5 | 89             | 11              | 279.4 ± 1        | 156             | 4.54           | 28.58           | 74        | 42             |
| Suspension crossmember attachment                      | 145 ± 0.2 | 83             | 625 ± 1.2       | 710 ± 1          | 948 ± 1         | 938            | 5               | 60.5             |                   | 358 ± 1   | 270 ± 1        | 308             |                  |                 |                |                 | 24 ± 0.5  |                |
| Rear suspension attachments                            | 1084      | 132.25 ± 1     | 25              | 976              | 11              | 55 ± 0.5       | 12              | 42 ± 0.5         | 987 ± 0.5         | 43        | 422 ± 1        | 58              | 2269 ± 2         |                 |                |                 | 118       |                |
| Gearbox centering holes                                |           |                |                 |                  |                 |                |                 |                  |                   | 50        |                |                 |                  |                 |                |                 |           |                |
| Holes for exhaust pipe support bracket                 | 495 ± 1   | 280 ± 1        | 150             |                  |                 |                |                 |                  |                   | 612 ± 1   | 250            | 345             | 455              |                 |                |                 | 49.2      |                |
| Holes for flexible support                             | 84.5      | 147            |                 |                  |                 |                |                 |                  |                   | 19        |                |                 |                  |                 |                |                 |           |                |
| Hand brake attachments                                 | 90        |                |                 |                  |                 |                |                 |                  |                   | 233       |                |                 |                  |                 |                |                 |           |                |
| Fuel tank attachments                                  | 140       | 55             | 420             | 260              | 228             |                |                 |                  |                   | 750       | 472            | 96              | 152              |                 |                |                 | 141 ± 1.5 | 116            |



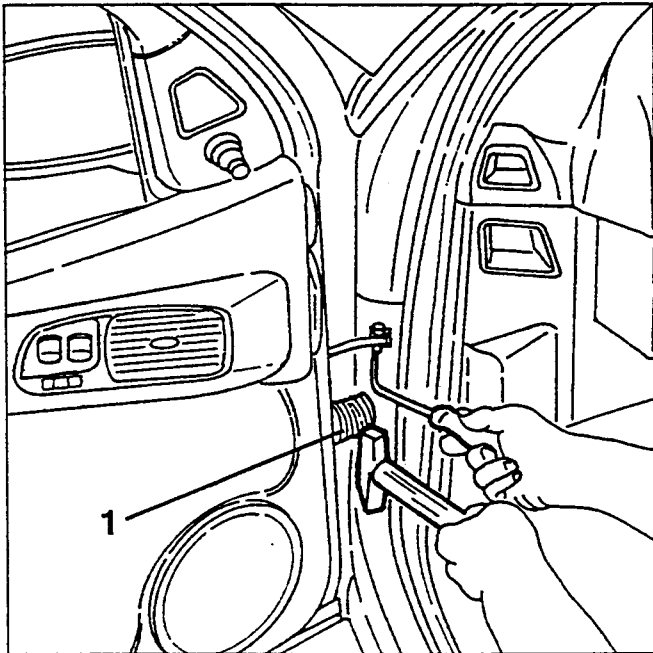
## FRONT DOORS

### REMOVAL AND REFITTING

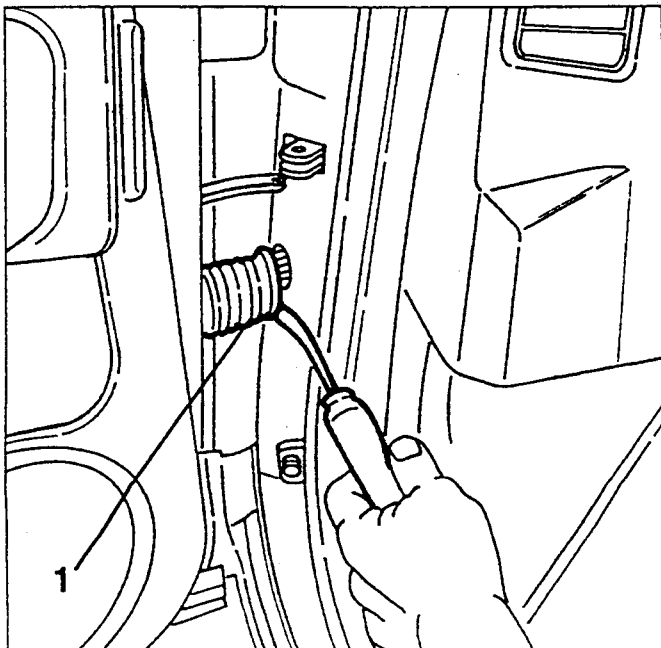
**NOTE:**

When removing or refitting avoid damaging the paintwork.

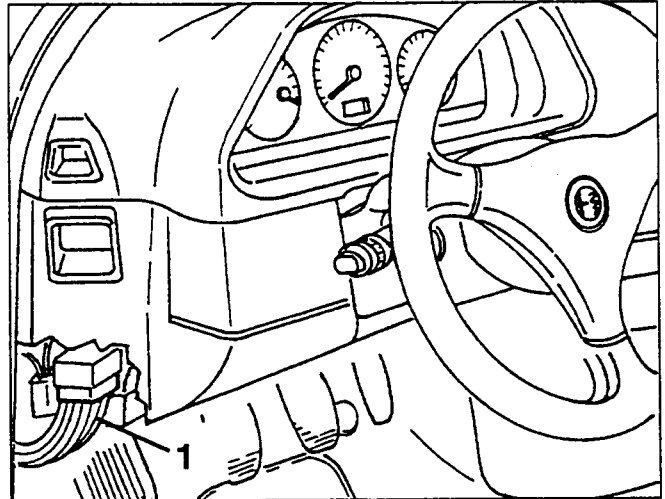
- Disconnect the negative (-) lead from the battery.
- 1. Using a suitable tool withdraw and remove the pin from the door check strap, half-close the door to back-off the rod and then open the door again.



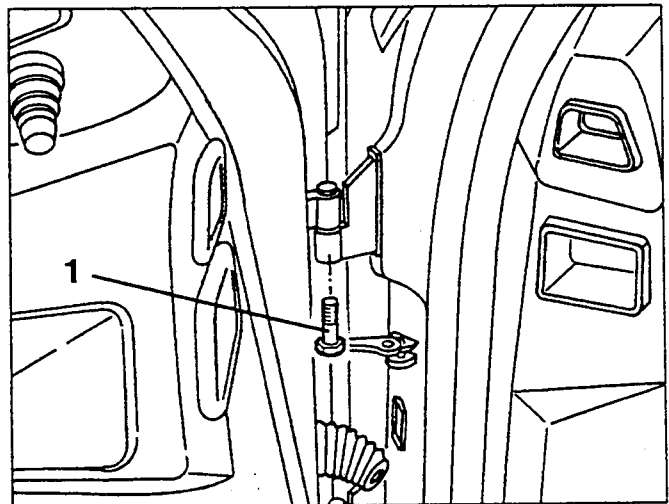
- 1. Disconnect the cable runner from the front pillar.



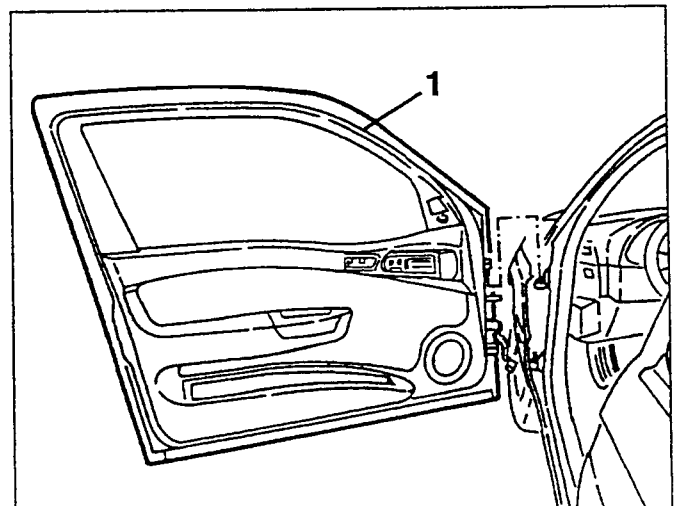
- 1. Working under the dashboard trim, disconnect the electrical connection from the door wiring and withdraw the pillar.



- 1. Loosen the two screws securing the door to the hinge.



- 1. Raise the door until the tapered pins of the hinges can be removed from their seatings and then remove the door.



### Summary

#### HYDRAULIC BRAKING SYSTEM

|                                                                         |     |
|-------------------------------------------------------------------------|-----|
| - Description .....                                                     | 1   |
| - Brake pedal .....                                                     | 3   |
| - Brakes/servobrake pump .....                                          | 4   |
| - Braking correcting device .....                                       | 7   |
| - Air exhaustion from the braking system .....                          | 7/1 |
| - Pipes of the braking system .....                                     | 7/1 |
| - Signal switch of inserted handbrake .....                             | 7/1 |
| - Stoplight switch .....                                                | 7/2 |
| - Brakes/clutch fluid tank<br>(Specific for T. Spark 16V engines) ..... | 7/2 |

#### WHEELS' DISC BRAKES

|                                                               |     |
|---------------------------------------------------------------|-----|
| - Front brakes disc .....                                     | 8   |
| - Front calipers<br>(Specific for versions before mod.) ..... | 8   |
| - Front caliper<br>(Specific for versions after mod.) .....   | 9/1 |
| - Rear brakes disc .....                                      | 10  |
| - Rear caliper .....                                          | 11  |

#### WHEELS' DRUM BRAKES

|                               |    |
|-------------------------------|----|
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#### PARKING BRAKE

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(\*): See ABS BOSCH 5.3



## DESCRIPTION

The braking system is hydraulically-operated with dual diagonally connected circuit with servobrake and braking load proportioning valve for the rear wheels; front disk brakes and rear drum brakes for the "lower" range without A.B.S. and disk brakes for the "higher" range fitted with A.B.S.

The system is of the conventional type and mainly comprises the following components:

1. Brake fluid reservoir (shared with the hydraulic clutch system)
2. Two-stage pump
3. Vacuum servo brake
4. Braking load proportioning valve
5. Front disk brakes
6. Rear drum brakes or disk brakes depending on the versions
7. Floating type brake calipers
8. Mechanical handbrake
9. Four-way distributor

This solution is of the traditional type and obtained employing a series of devices aimed at:

a. meeting the current laws regarding the problems of environmental pollution.

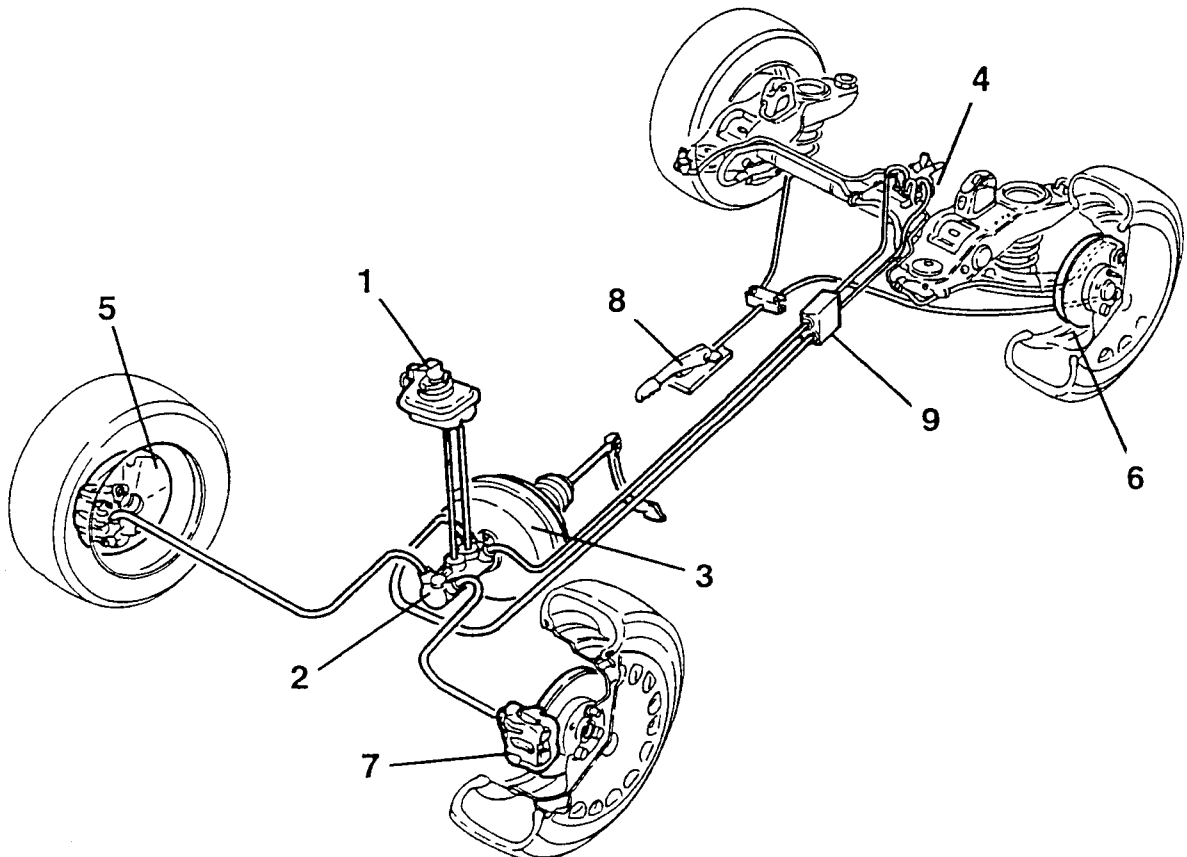
The problem of environmental pollution has been faced by adopting brake linings of an ecological material (asbestos-free) in the same way as for the friction lining of the clutch.

b. reducing the temperature of the brake fluid to keep its chemical/physical characteristics unchanged.

The GIRLING floating type brake calipers with runner pins protected by boots only act on one side of the disk, thereby improving the dispersion of the heat produced during braking. Consequently the temperature of the brake fluid is also considerably reduced in comparison with traditional systems.

c. warranting a braking force suited to the characteristics of the vehicle under all circumstances.

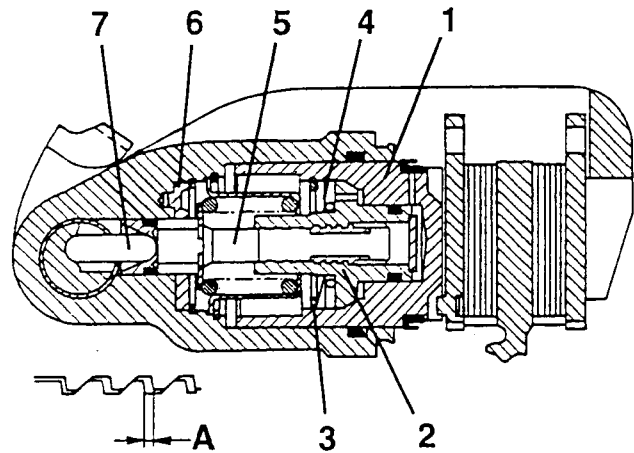
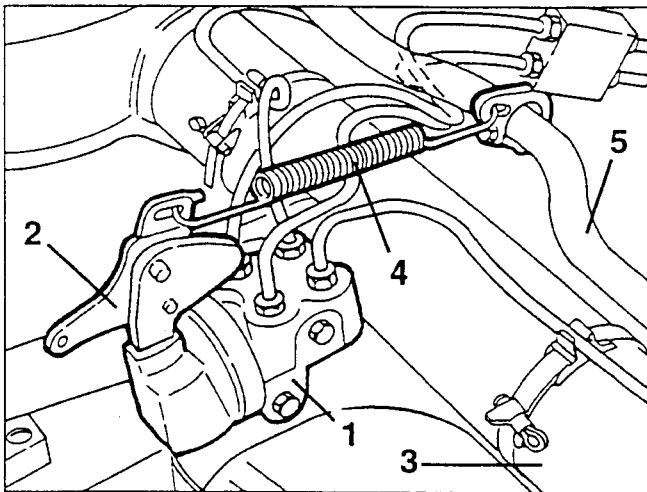
The use of the two-stage pump and diagonal braking circuits makes it possible to still conserve 50% of the braking force in the event of a failure or seizing of a piston.



## BRAKING LOAD PROPORTIONING VALVE (for versions without A.B.S.)

The braking system is fitted with a braking load proportioning valve (1), fastened to a bracket (2) integral with the rear axle (3) and connected by a spring (4) to the stabilizer bar (3), which regulates the pressure of the fluid acting on the rear wheels according to the load on the rear axle of the car.

This adjustment is carried out instant after instant by measuring the distance between the rear wheel axle and the body and its purpose is to prevent the rear wheels from locking if the load on the rear axle is lower causing the wheels to reduce their grip on the road surface.



- |                     |                |
|---------------------|----------------|
| 1. Control cylinder | 4. Cup spring  |
| 2. Lead screw       | 5. Shaft       |
| 3. Safety ring      | 6. Safety lock |
|                     | 7. Rod         |

## AUTOMATIC REAR BRAKE CALIPER ADJUSTMENT DEVICE (for versions with rear disk brakes)

This device, contained in the rear brake caliper cylinder automatically adjusts the distance between the brake disk and the friction lining.

It comprises a lead screw (2) which can rotate on the shaft (5) only in the direction of travel owing to the action of the cup spring (4).

The shaft (5) is unable to turn as it is constrained to the brake caliper body by the safety lock (6).

Between the shaft and the lead screw there is a threaded coupling (with four starts) with a preset clearance (A). During braking the control cylinder (1) pushed by the hydraulic pressure moves towards the braking lining with the lead screw (2), as the latter is constrained to the cylinder itself by the safety ring (3) and by the cup spring (4).

If the brake linings are excessively worn, even if the axial clearance (A) is taken up, it is not sufficient to absorb the whole stroke of the control cylinder (1) alone.

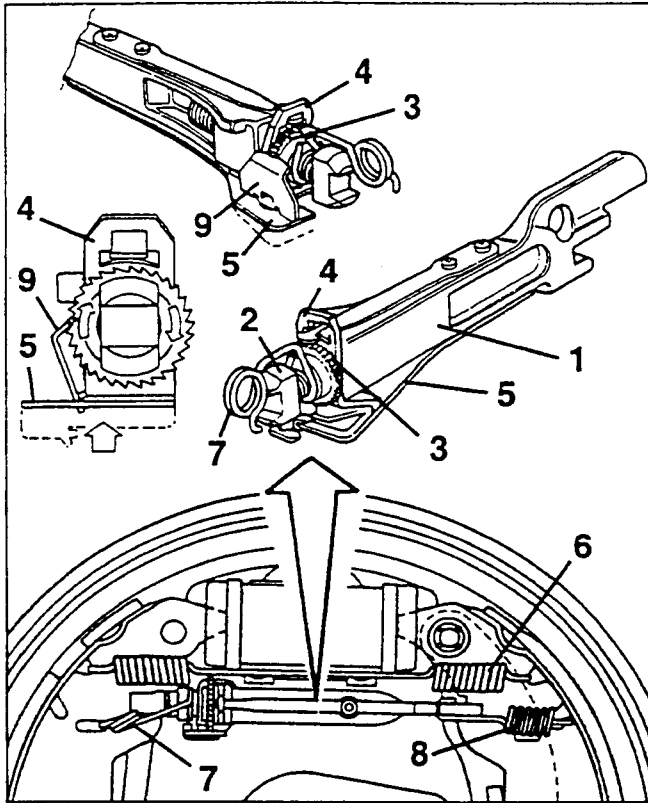
## SELF-ADJUSTING DEVICE FOR PLAY TAKEUP BETWEEN SHOES AND DRUM (for versions with rear drum brakes)

This device automatically and continuously takes up the play between the shoes and drum each time the brakes are operated, if, in that moment, adjustment is necessary. The device comprises the tie-rod (1) inside which the adjustment screw (2) runs freely on which the toothed ring nut (3) is screwed.

In the rest position, the front shoe return spring (6) keeps the device compressed. Therefore, the ring nut (3) pushes the plate (4) into contact with the end of the tie-rod (1).

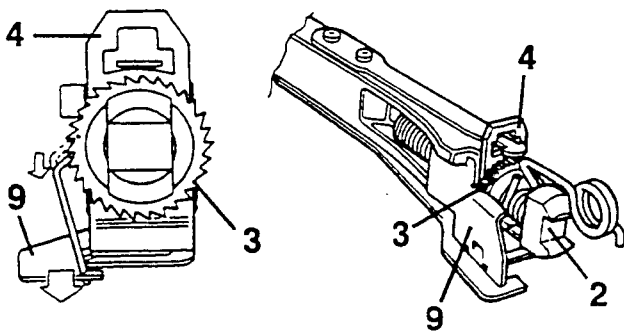
The plate (4) is also subjected to a thrust through the flexible blade (5). During the braking action, the two shoes move away from one another and come into contact with the drum; the two ends of the device are kept in contact with the shoes by springs (7) and (8).

The plate (4) pushed by the flexible blade (5) reacts on the toothed ring nut (3) and the catch (9) permanently in contact with the ring nut, prevents it from turning.



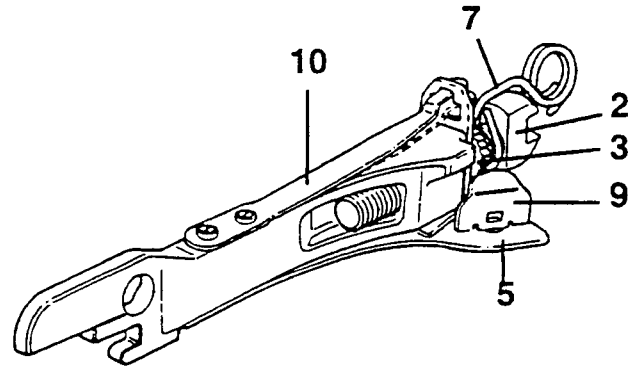
When the brake is released, the self-adjusting device is again compressed by the action of the upper shoe return spring (6): the toothed ring nut (3) stops in the angular position taken during braking.

This stop during rotation is due to the friction between the plate (4) and the toothed ring nut (3). With the toothed ring nut (3) locked during rotation, if the condition of wear of the lining due to previous braking actions is sufficient, the catch (9) engages the next tooth.



The maximum stroke of the toothed ring nut (3) on the adjustment screw (2) is one tooth (0.020 ÷ 0.025 mm): an exception to this is settling of the brakes after dis-assembly, in which case the stroke is two teeth. If after prolonged braking, the brakes overheat and the temperature reaches 100° ÷ 110°C, the flexible

blade (10) comes into action, which flexes and blocks the plate (4) in the neutral position.



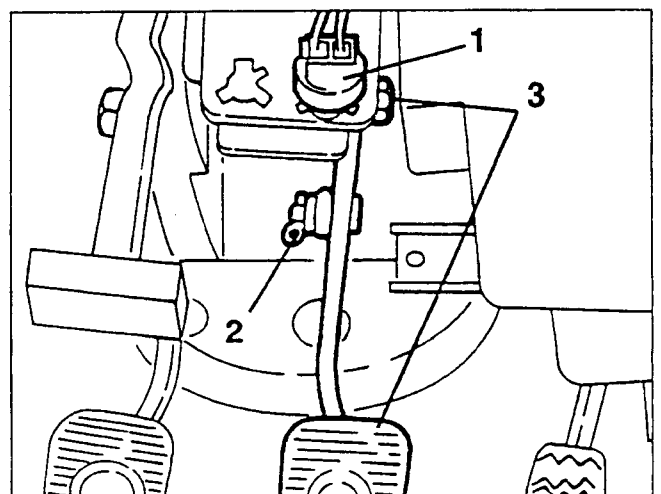
During braking the toothed ring nut (3) will no longer be subjected to the thrust of the flexible blade (5), therefore the catch (9) will take the same angle as the ring nut tooth, which will be free to run with the adjustment screw (2) on the catch (9) without taking up the play caused by the expansion of the drum. When overhauling, before assembly of the brake linings, the toothed ring nut (3) must be moved to contact the spring (7) and slackened one half of a turn.

## BRAKE PEDAL

### REMOVAL/REFITTING

- Remove the fuse box and its support bracket (see GROUP 55).

1. Turn and remove the stop light from its housing.
2. Remove the pin fastening the brake pedal to the servobrake.
3. Slacken the fastening nut and remove the brake pedal.



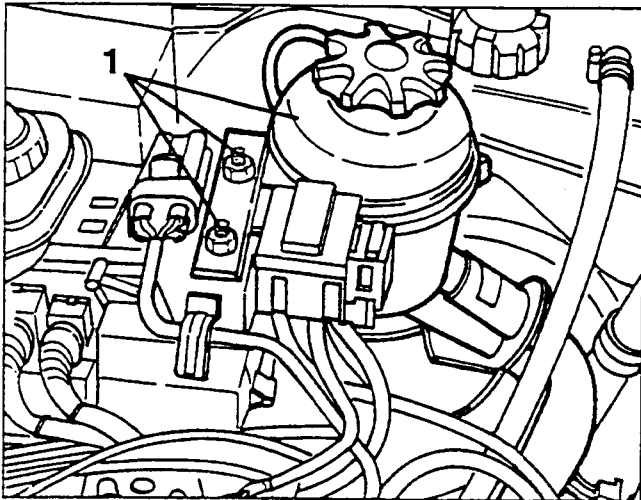


## BRAKE/SERVOBRAKE PUMP

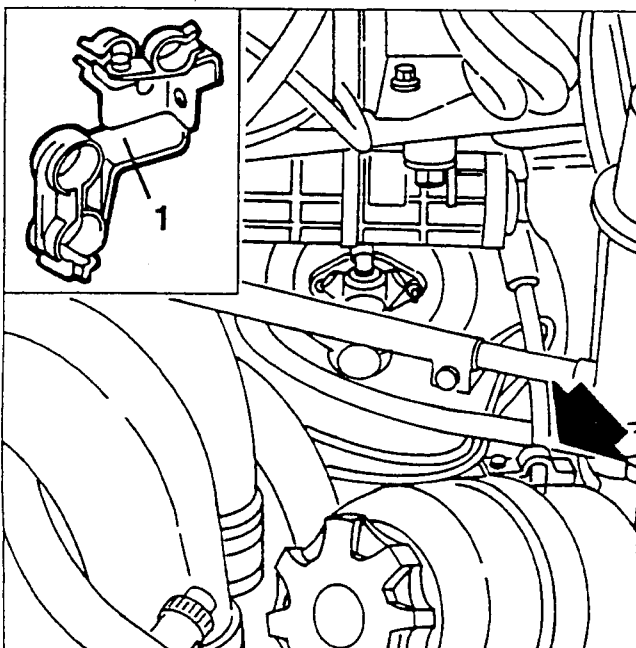
### REMOVING/REFITTING Specific for Boxer engines

- Set the car on a lift.
- Disconnect the battery (-) terminal.
- Using a suitable syringe, empty the brake-clutch fluid reservoir.
- Remove the front left wheel.
- Using a suitable syringe, empty the power steering tank.

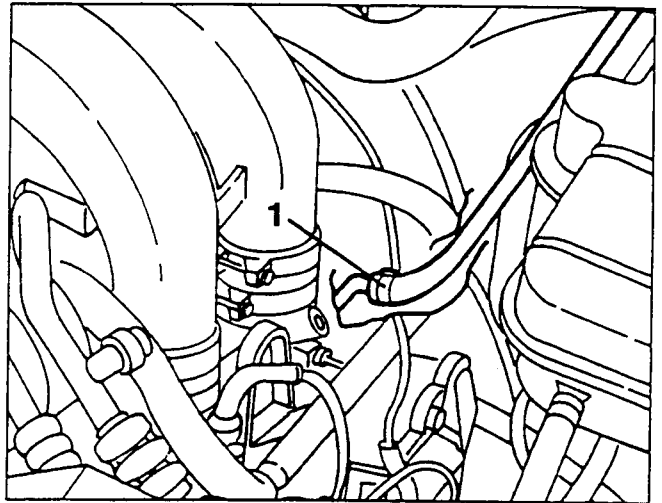
1. Slacken the two fastening nuts and move aside the power steering tank without disconnecting the pipes.



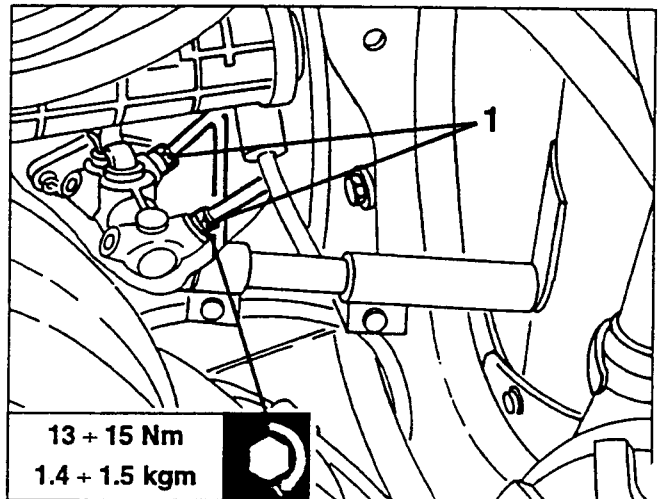
1. Release the power steering pipe, the clutch pipe and the air conditioner pipes from the fastening clamps, then slacken the two fastening screws and remove the bracket supporting the clamps.



1. Disconnect the servobrake vacuum takeoff pipe.

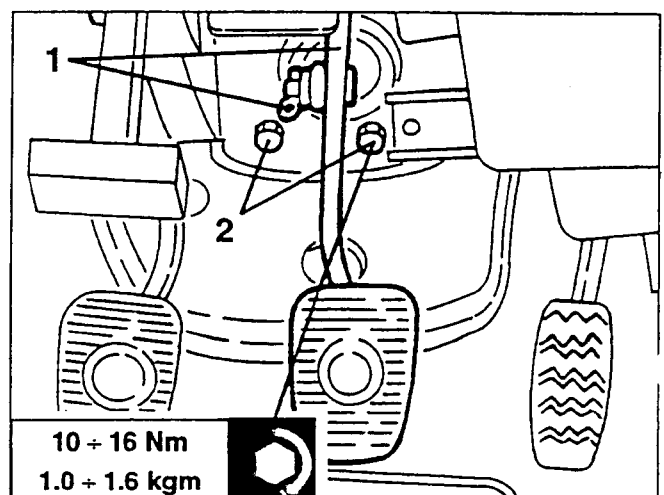


1. Disconnect the two fittings of the stiff delivery pipes from the brake pump.



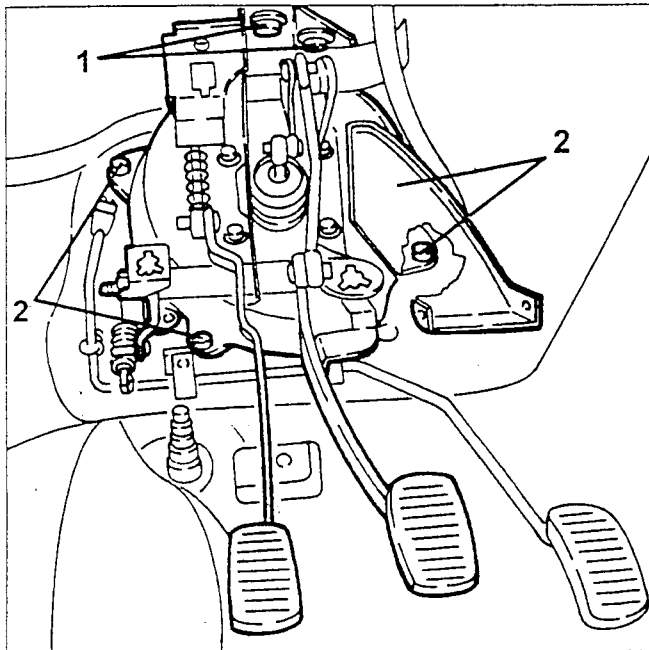
1. Working from the passenger compartment, remove the pin fastening the servobrake prod to the pedal, then disconnect them.

2. Slacken the four servobrake fastening screws.



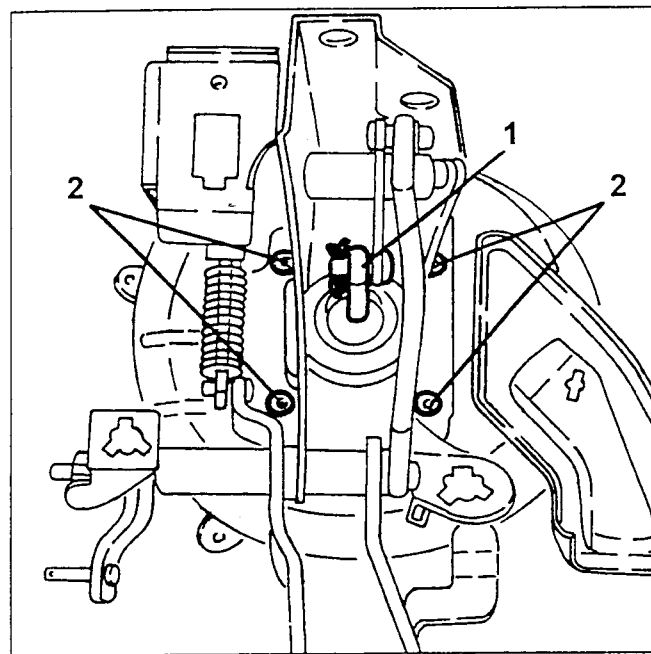


1. Loosen the pedal board fastening screws.
2. Loosen the three brake booster fastening nuts and remove the brake booster, brake pump and pedal board assembly.



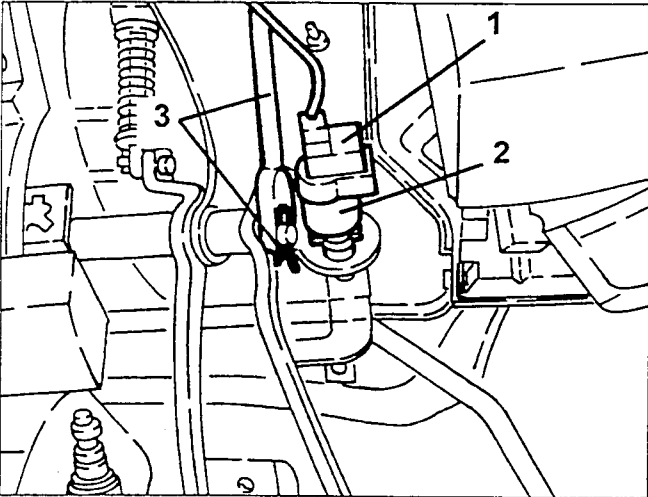
1. Remove the split pin and disconnect the brake pump from the linkage pin.
2. Loosen the four fastening screws and remove the brake pump/booster assembly from the pedal board.

- If required, separate the brake pump from the brake booster by removing the two fastening nuts. Please note that only the brake pump/booster assembly is available as a spare part.

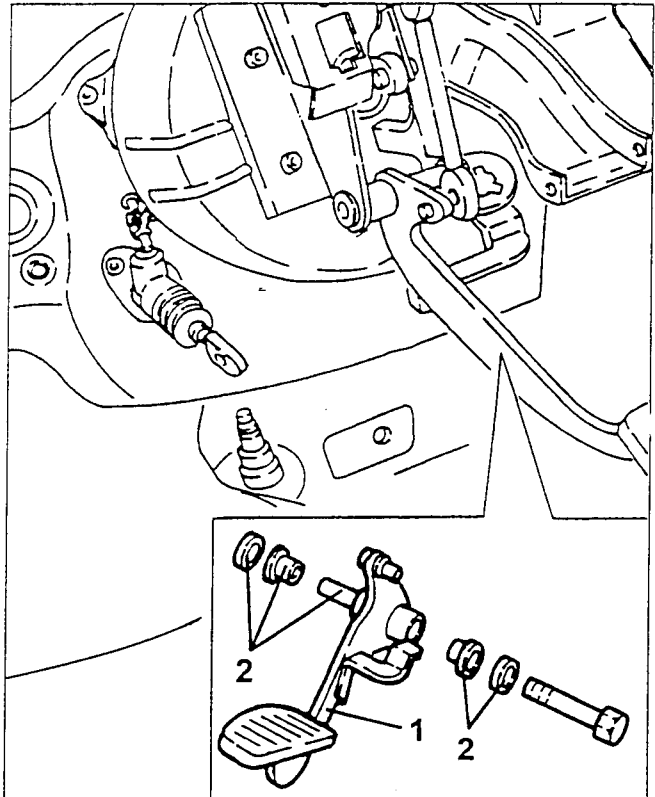


T. S.  
16VT. S.  
16VT. S.  
16V**BRAKE PEDAL ('98 MODELS)****REMOVAL/REFITTING**

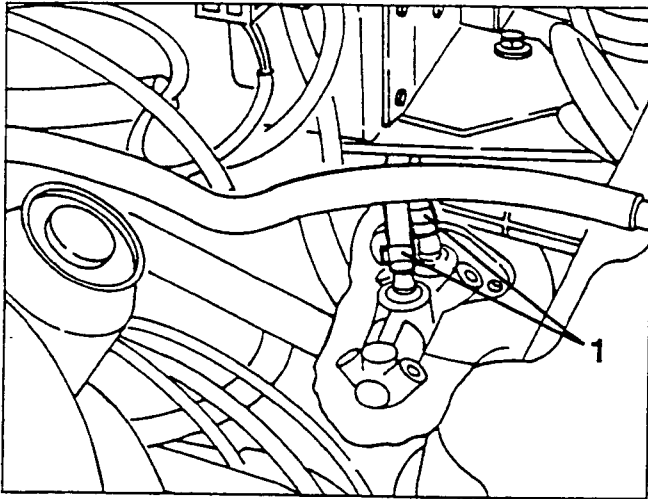
- Make sure the ignition key is at STOP and disconnect the (-) battery terminal.
- Remove the steering column (see ASSEMBLY 41).
- 1. From inside the passenger compartment, disconnect the brake light switch electrical connection.
- 2. Remove the brake light switch by turning it clockwise by 45°.
- 3. Remove the split pin and disconnect the brake pedal tie-rod.



- Loosen the two valve bracket fastening screws.
- Remove the clutch pedal (see specific paragraph).
- 1. Remove the screw and remove the brake pedal.
- 2. At the bench, remove the plastic caps and the brake pedal bushing, if required.



1. Disconnect the two supply hoses from the brake pump.

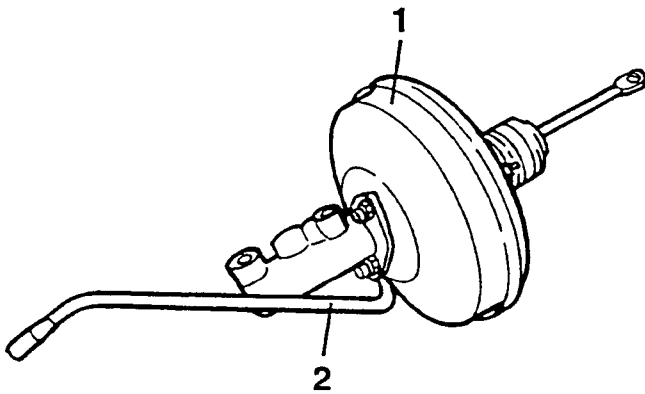


- Raise the car.

1. Remove the pump - servobrake unit retrieving it from the wheelhouse.

2. Remove the vacuum takeoff pipe from the servobrake.

- If necessary, separate the pump from the servobrake slackening the two fastening nuts; Spares only supply the pump-servobrake unit complete.



When refitting relieve the air from the braking system (see specific paragraph).

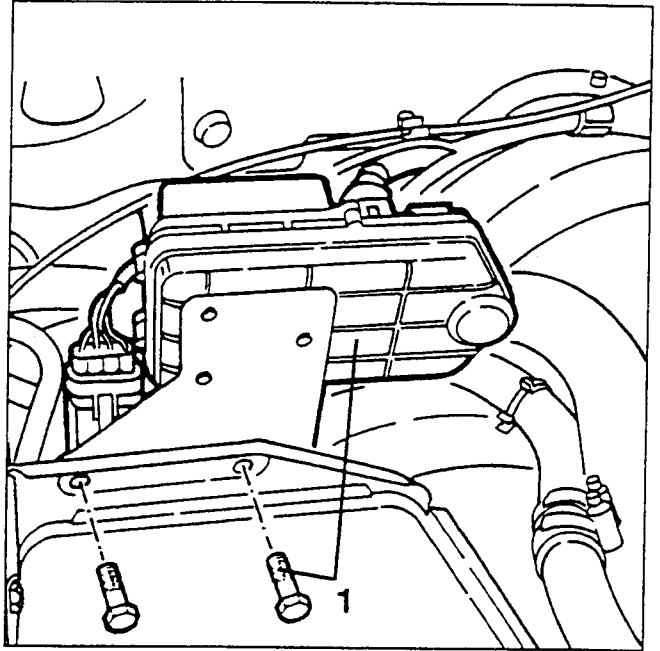
## REMOVING/REFITTING Specific for Turbodiesel engine

- Set the car on a lift.
- Disconnect the battery (-) terminal.
- Using a suitable syringe, empty the brake-clutch fluid reservoir.

- Remove the front left wheel.

- Remove the battery.

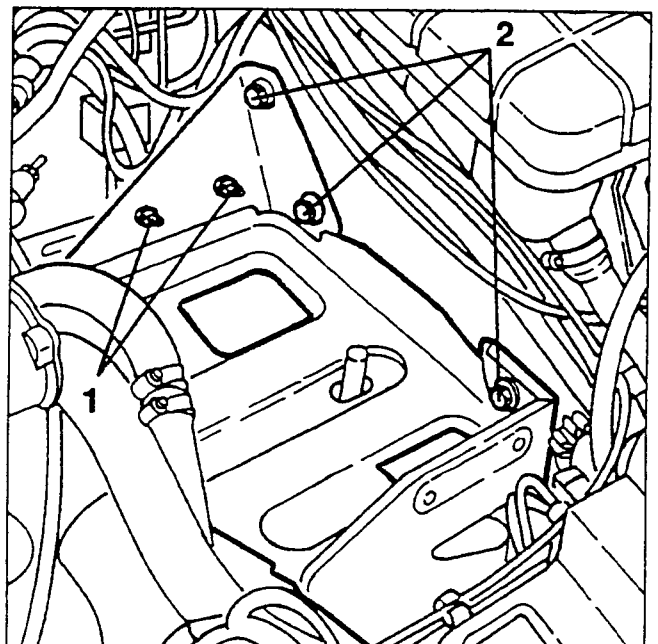
1. Slacken the two fastening screws and move aside the fan relays.



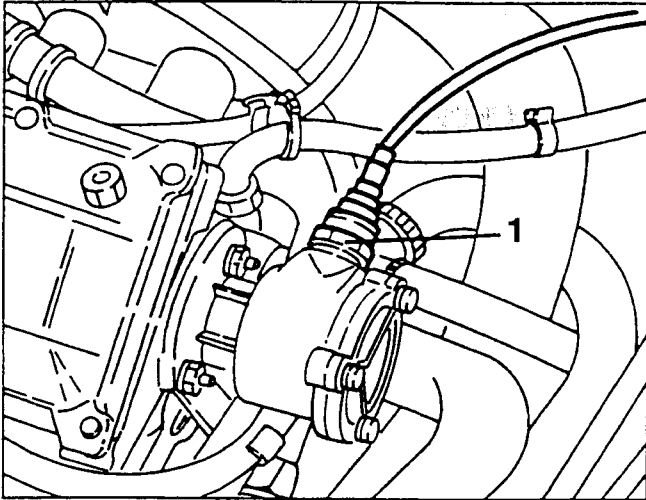
- Remove the duct for draining acid from the battery.

1. Slacken the two nuts fastening the glowplug warming control unit support bracket to the battery support.

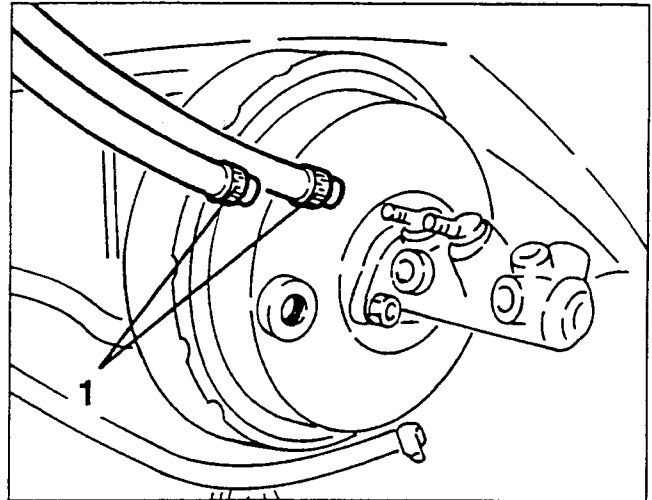
2. Slacken the four fastening screws and remove the battery support.



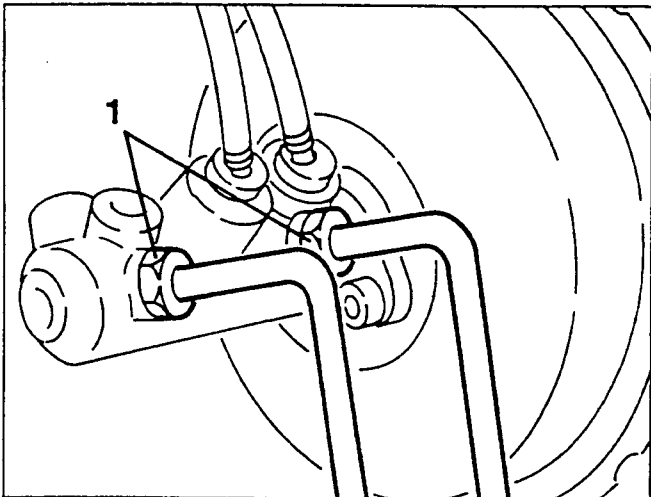
1. Disconnect the vacuum takeoff pipe from the servobrake air pump.



1. Disconnect the two supply hoses from the brake pump.



1. Disconnect the two unions of the stiff delivery pipes from the brake pump.

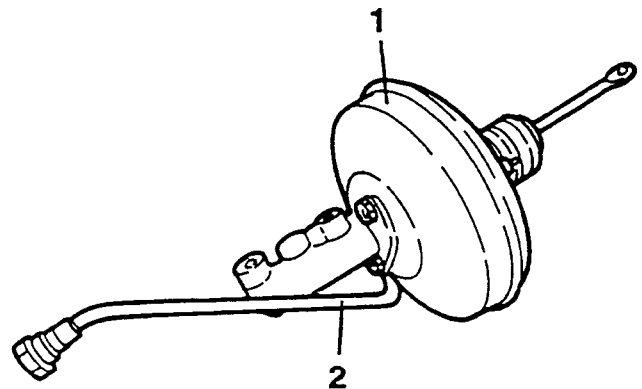


- Raise the car.

1. Remove the pump-servobrake unit retrieving it from the wheelhouse.

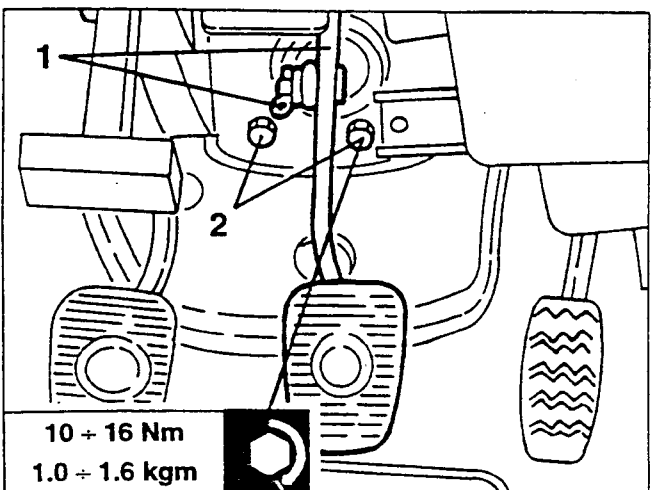
2. Remove the the vacuum takeoff pipe from the servobrake.

- If necessary, separate the pump from the servobrake slackening the two fastening nuts; Spares only supply the pump-servobrake unit complete.



1. Working from the passenger compartment, remove the pin fastening the servobrake prod to the pedal, then disconnect them.

2. Slacken the four servobrake fastening nuts.



10 + 16 Nm  
1.0 ÷ 1.6 kgm

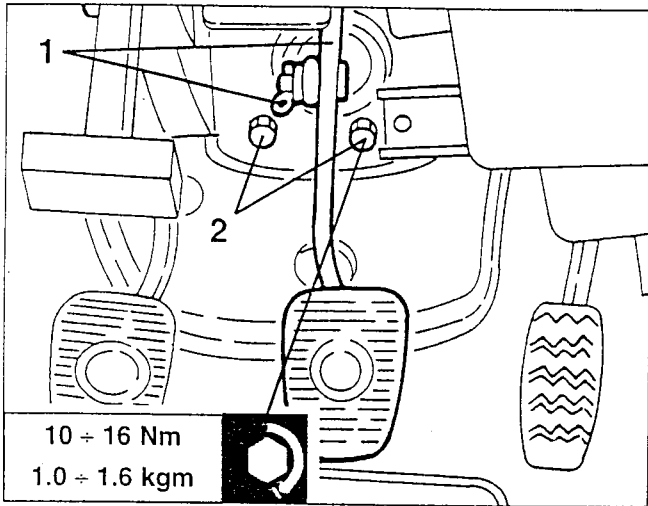
When refitting relieve the air from the braking system (see specific paragraph).

### REMOVING/REFITTING Specific for T. Spark 16V engine

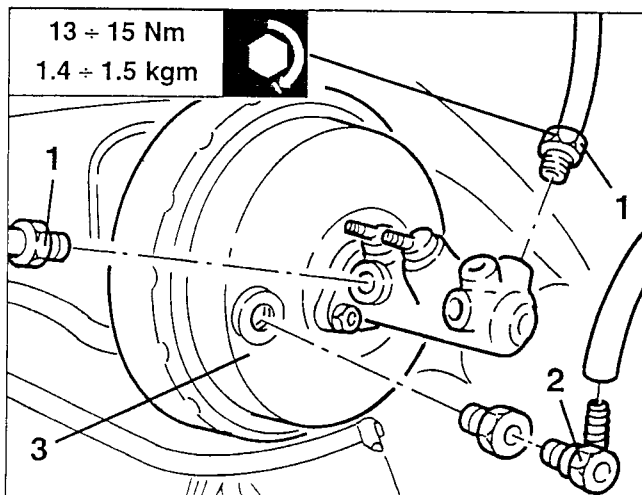
- Disconnect the battery (-) terminal.

- Remove the hydraulic aggregate of the A.B.S. system complete with its support (see specific paragraph).

1. Perform the following operations inside the passenger compartment. Remove the brake booster shoe pin from the pedal and remove the pedal.
2. Remove the four brake booster fastening nuts.



1. Disconnect the two brake pump delivery pipes.
2. Disconnect the brake booster vacuum pipe.
3. Take the pump-brake booster unit.



- If required, split the pump from the brake booster by removing the two fastening nuts. The pump-brake booster, however, is supplied as a single spare part.

After refitting, bleed the air from the braking circuit (see specific chapter).

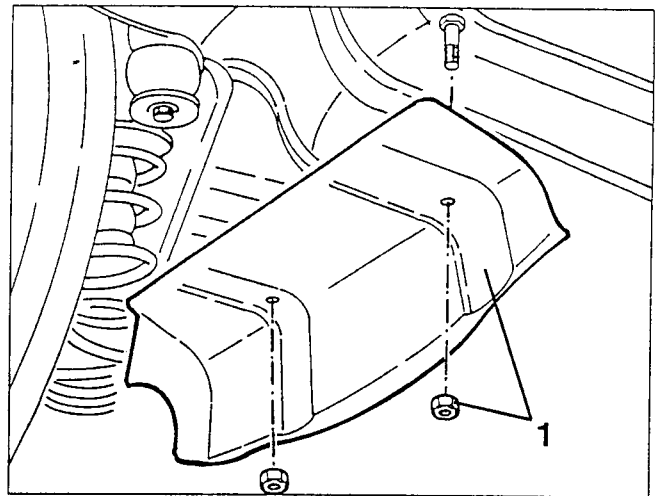
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## BRAKE FORCE DISTRIBUTOR

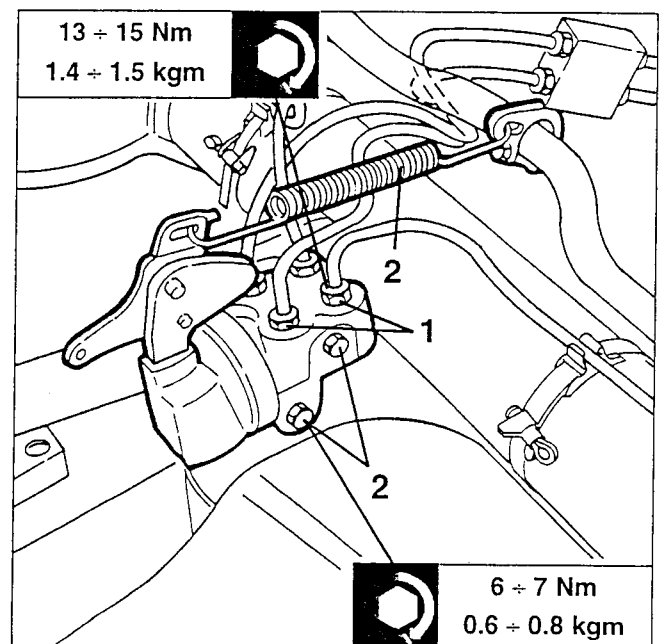
### REMOVAL/REFITTING

- Position the vehicle on a shop jack.
- Empty the brake-clutch reservoir with a suitable syringe.
- Lift the vehicle.
- Remove the rear section of the exhaust pipe (see GROUP 10).

1. Remove the two fastening screws and remove the heat guard from the rear section of the exhaust pipe.



1. Remove the brake force distributor pipe fittings.
2. Remove the two fastening screws and remove the brake force distributor after having disconnected the respective spring.



After refitting, bleed the air from the braking circuit (see specific chapter).

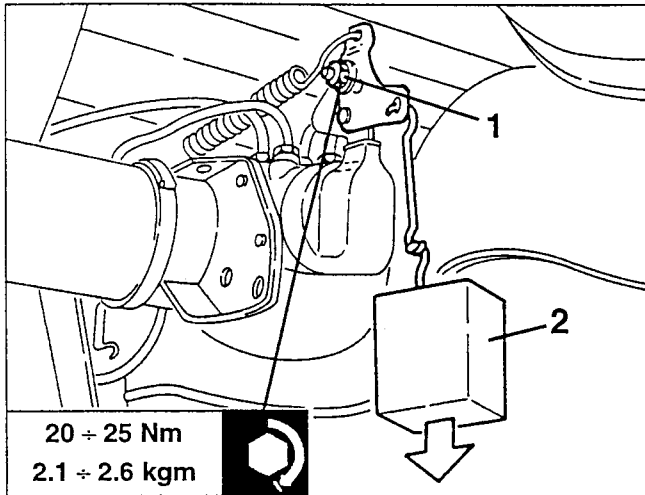
**CALIBRATION**

- Prepare the vehicle in running order and position it on a flat surface with the wheels on the ground to set the suspensions.

1. Loosen the brake force distributor rod fastening screw.

2. Apply a 3.5 kg weight (2 kg from chassis no. 2039142 and 4030708) for versions with rear drum brakes or a 8 kg weight (7 kg from chassis no. 2039142 and 4030708) for versions with rear disc brakes to the rod eye.

- Keep the rod in this position and tighten the fastening screw to the prescribed torque.



NOTE: Bleed each wheel separately.

**IMPORTANT:**

Check that during bleeding operations the fluid level does not drop under the minimum level.

Never re-use the fluid discharged during this operation.

Make sure the fluid does not drip on painted parts to avoid damaging them.

**BRAKE SYSTEM PIPES****TESTS AND CHECKS**

- Check the pipes and hoses are not enlarged, cracked or rusted. Check there are no leaks.

- To replace a pipe, drain the brake-clutch reservoir with a syringe and close the pipe ends to avoid dirt from getting inside the system.

- After refitting, bleed the air from the brake-clutch circuit (see specific chapter).

Never bend nor twist pipes.

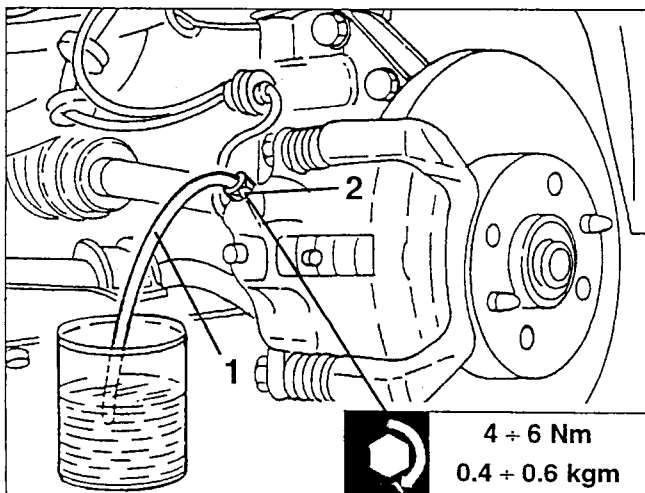
**BRAKE SYSTEM AIR BLEEDING**

- Fill the brake-clutch fluid reservoir to the max. level with the prescribed fluid.

- If required, remove the relevant wheel.

1. Fit a clear pipe to the bleeder valve. Place the other end of the pipe in a bowl containing the prescribed fluid.

2. Loosen the bleeder valve and press the brake pedal repeatedly (waiting a few seconds between presses). When fluid without air bubbles flows into the bowl, press the brake pedal fully and tighten the bleeder valve at the prescribed torque.

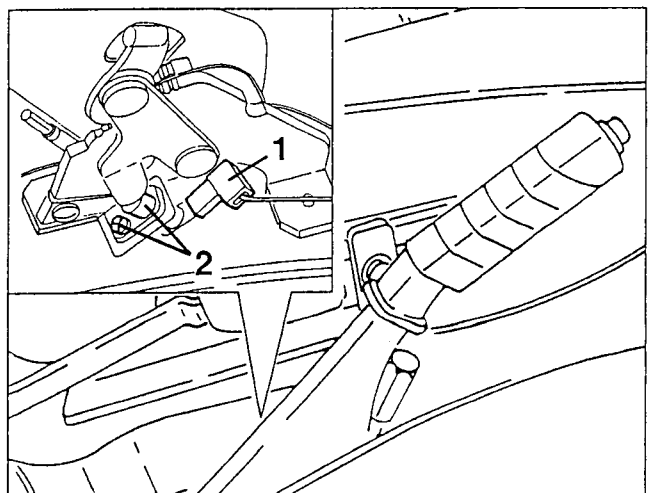
**HANDBRAKE WARNING LIGHT SWITCH****REMOVAL/REFITTING**

- Disconnect the (-) battery terminal.

- Remove the central oddment tray (see GROUP 70).

1. Disconnect the switch electric connection.

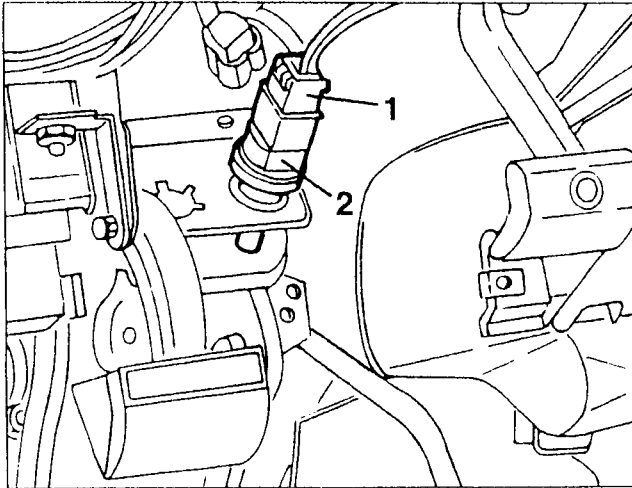
2. Remove the fastening screw and remove the switch.



## STOP LIGHTS SWITCH

### REMOVAL/REFITTING

- Disconnect the battery (-) terminal.
- 1. Disconnect the electrical connection from the switch.
- 2. Turn the switch 45° clockwise and remove it.

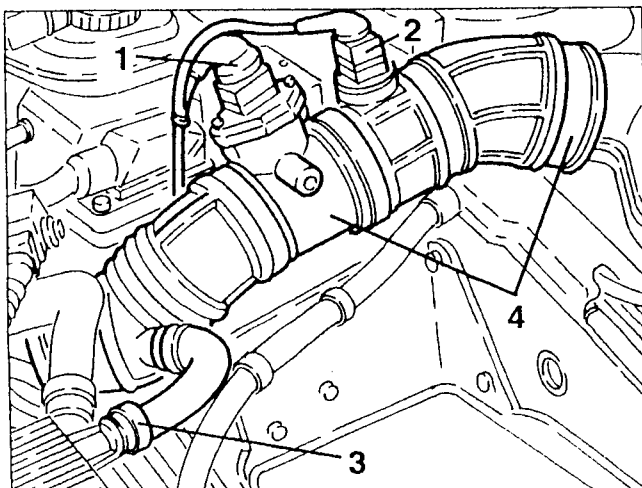


When refitting, adjust the stroke of the "mobile section" using the special ring nut.

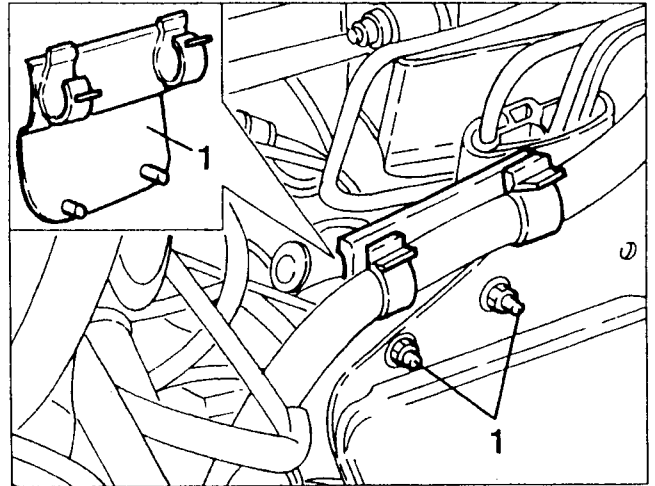
## BRAKE-CLUTCH RESERVOIR (Specific for T. Spark 16V engines)

### REMOVING/REFITTING

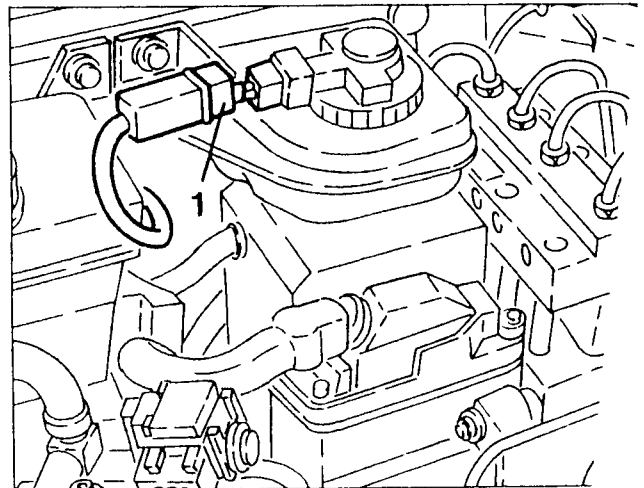
- Remove the battery.
- 1. Disconnect the electrical connection from the air-flow meter.
- 2. Disconnect the electrical connection from the intake air temperature sensor.
- 3. Slacken the fastening clamp and disconnect the oil vapour, recirculation pipe from the cylinder head cover.
- 4. Slacken the fastening clamps and remove the corrugated sleeve complete.



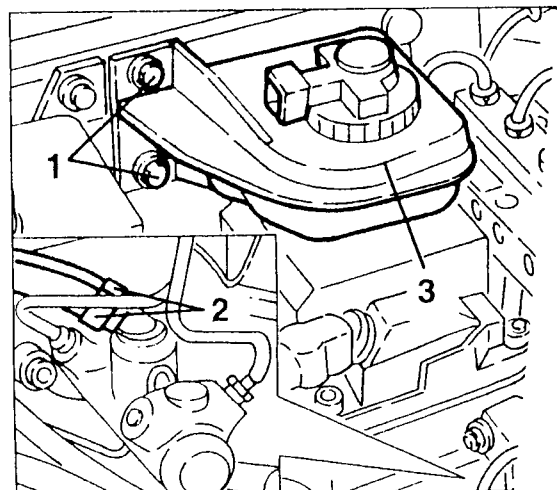
- 1. Slacken the two fastening nuts and remove the cable support bracket from the battery support.



- 1. Disconnect the electrical connection from the brake-clutch fluid minimum level sensor.



- 1. Slacken the two screws fastening the brake-clutch fluid reservoir.
- 2. From the brake pump disconnect the two supply pipes leading from the reservoir.
- 3. Raise the brake-clutch fluid reservoir just enough to disconnect the clutch system supply pipe and remove it.

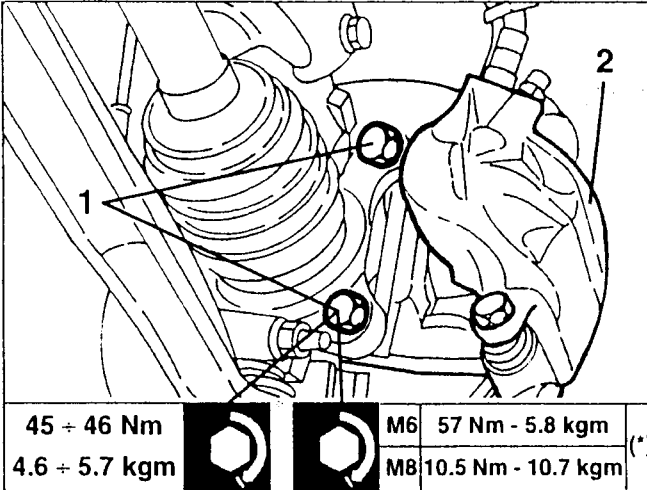




## FRONT DISK BRAKES

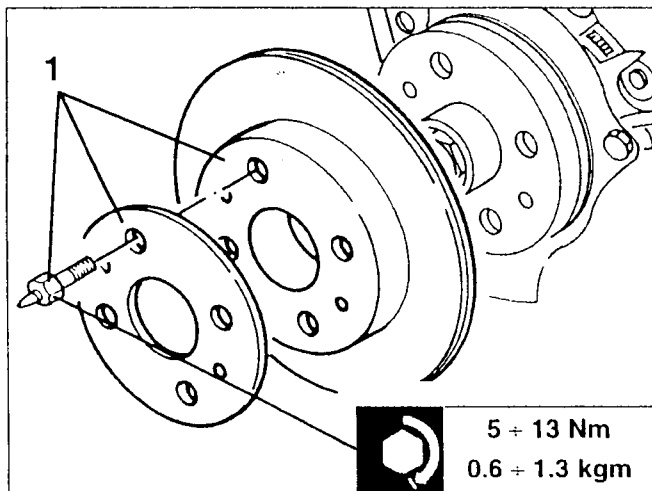
### REMOVAL/REFITTING

- Set the car on a lift.
- Remove the wheel on the side concerned.
- 1. Slacken the two screws fastening the brake caliper support plate.
- 2. Remove the complete brake caliper and move it to one side without disconnecting the hose and wiring.



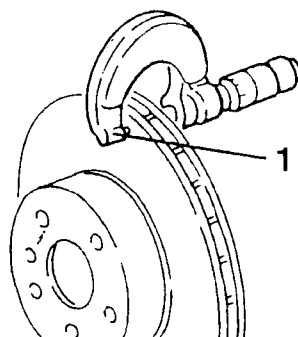
(\*): For screws with "Drilloc"; to be changed each time they are unscrewed or slackened.

1. Slacken the two fastening pins and remove the spacer and the brake disk.



### CHECKS AND INSPECTIONS

1. Check the thickness of the disks and the working surfaces for signs of deep scoring and porosity. If necessary, grind them to within the specified tolerances.

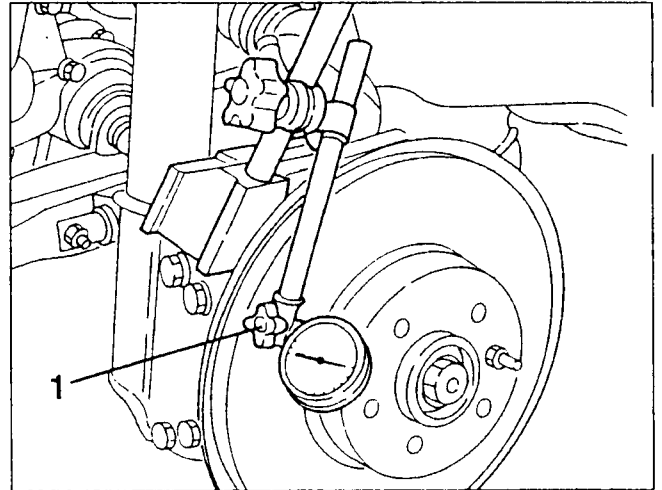


| Thickness of disk | Wear limit | Grinding limit |
|-------------------|------------|----------------|
| Ventilated (*)    | 20.2 mm    | 21.1 mm        |
| Ventilated        | 18.2 mm    | 19.1 mm        |
| Not ventilated    | 10.2 mm    | 11.1 mm        |

(\*): Specific for T. SPARK 16V and T. SPARK 16V

1. When changing the brake pads only, check that oscillation of the disk in relation to the axis of rotation is within the specified limits (0.15 mm max).

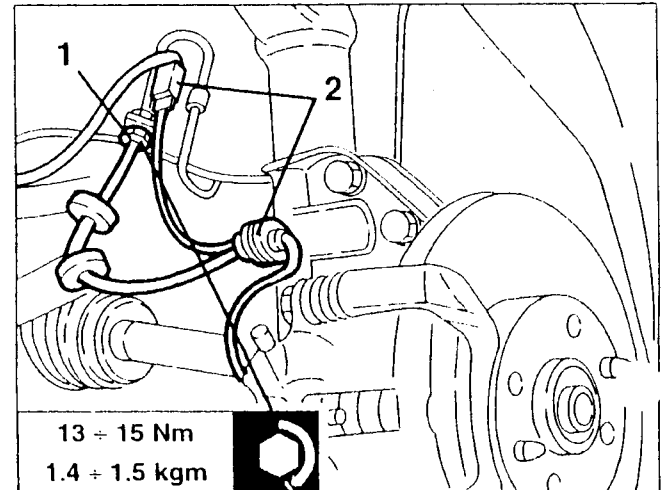
**NOTE:** The value must be measured 2 mm from the outside diameter of the disk.



### FRONT BRAKE CALIPER (Specific for versions before change)

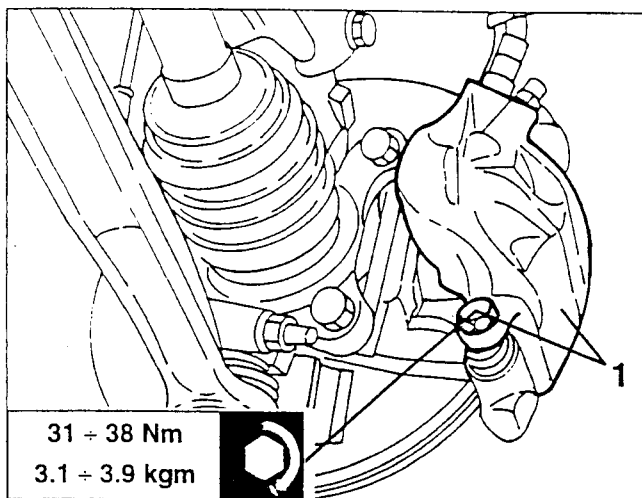
### REMOVAL/REFITTING

- Set the car on a lift.
- Disconnect the battery (-) terminal.
- Remove the wheel on the side concerned.
- 1. Disconnect the intermediate coupling between the stiff pipe and the brake caliper fluid delivery hose.
- 2. Disconnect the electrical connection of the brake pad wear sensor, then free it from the fastening on the shock absorber.



1. Slacken the two fastening screws and remove the brake caliper with its pads.

**NOTE:** When refitting change the caliper fastening screws and tighten them to the specified torque.



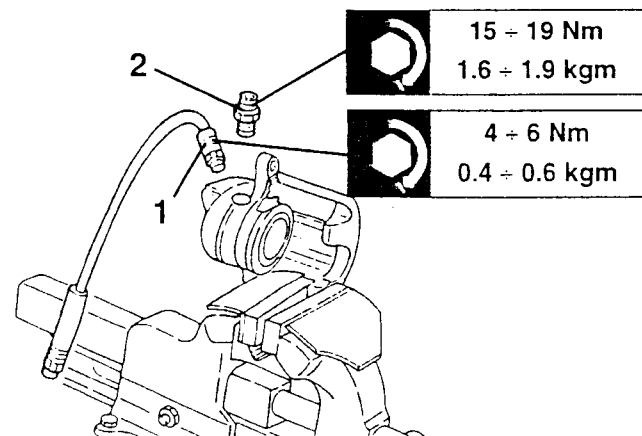
**WARNING:**

When refitting check that the rubber boots protecting the fastening pin threads are intact, if not, change them. When refitting the brake pad with the wear sensor, it must be fitted on the inner side of the disk (brake caliper piston side): also check that the relief on the outer part of the same pad is positioned to the rear of the direction of travel.

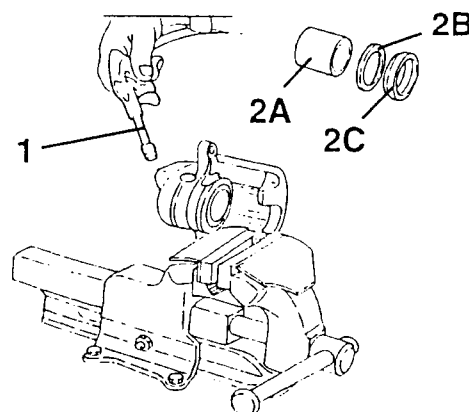
When refitting bleed the air from the brake system (see specific paragraph).

### DIS-ASSEMBLY/REASSEMBLY

1. Disconnect the hose connection from the caliper.
2. Remove the relief screw.



1. Blow a jet of compressed air into the brake fluid inlet hole to bring the piston out.
2. Remove the piston (2A), seal (2B) and the protective boot (2C).

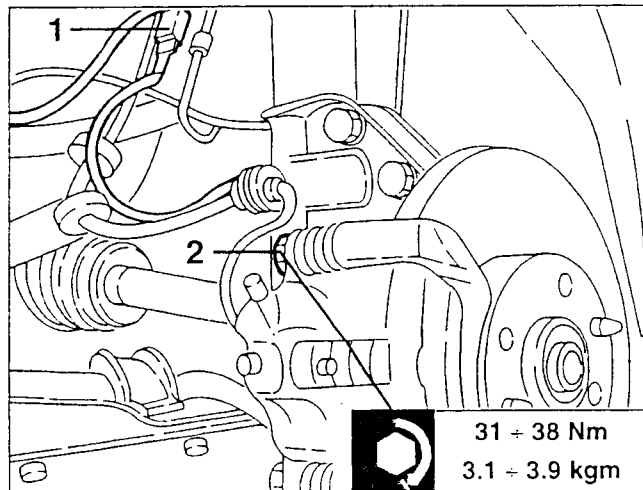


### CHECKS AND INSPECTIONS

- The piston and caliper body must not reveal signs of abrasion or seizing; if they do, change the caliper complete with piston.
- Always change the protective boot and seal.
- Make sure that the relief screw is not clogged.
- Check the hose for swellings and cracks.
- Change the brake pads if the thickness of the friction material is below 1.5 mm.
- Check the brake caliper support bracket for cracks and distortion.

### CHANGING THE FRONT BRAKE PADS

- Remove the front wheel.
1. Disconnect the electrical connection of the brake pad wear sensor.
  2. Slacken the upper screw fastening the caliper body.

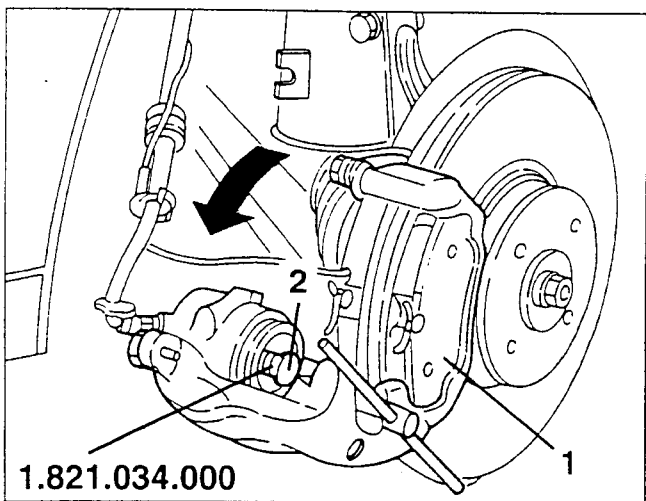


When refitting replace the caliper body fastening screws and tighten them to the specified torque.

1. Turn the caliper as illustrated and replace the brake pads.

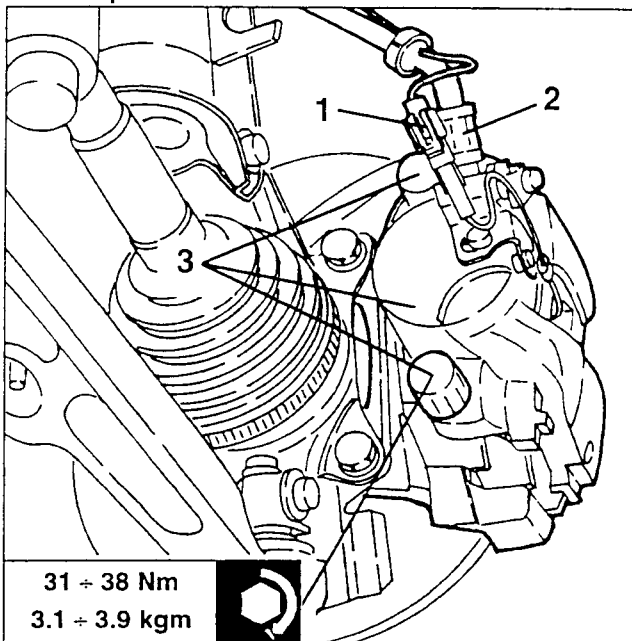
**NOTE:** The brake pad with wear sensor, must be fitted on the inner side of the disk (brake caliper piston side); at the same time check that the relief, on the outer part of the pad is positioned at the rear with respect to the direction of travel.

2. When refitting the caliper adjust the position of the piston using tool no. 1.821.034.000.



1. Disconnect the connection of the brake pad wear sensor.
2. Disconnect the brake fluid delivery pipe from the caliper.
3. Remove the protective caps, slacken the two fastening screws and remove the brake caliper and pads.

**NOTE:** When refitting sostituire caliper body fastening screws and tighten them to the specified torque.

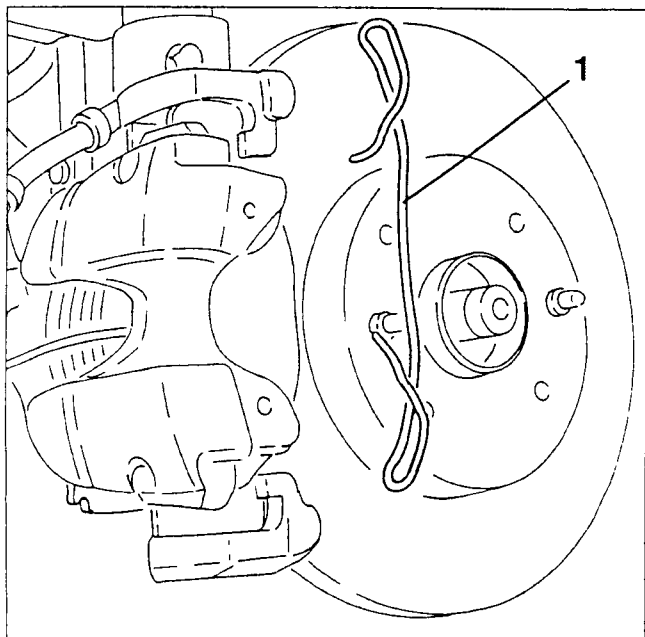


31 ÷ 38 Nm  
3.1 ÷ 3.9 kgm

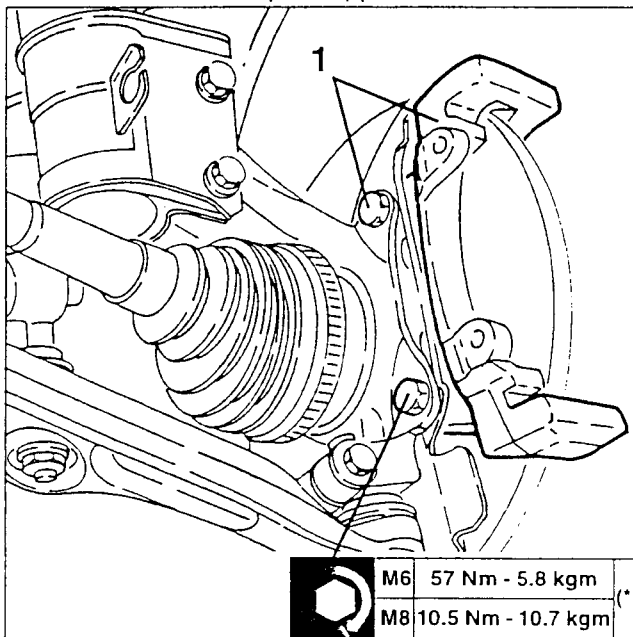
## FRONT BRAKE CALIPER (Specific for versions after change)

### REMOVING/REFITTING

- Set the car on a lift.
  - Disconnect the the battery (-) terminal.
  - Remove the wheel on the side concerned.
1. Remove the spring from the brake caliper.



1. If necessary, slacken the two fastening screws and remove the brake caliper support.



|    |                    |     |
|----|--------------------|-----|
| M6 | 57 Nm - 5.8 kgm    | (*) |
| M8 | 10.5 Nm - 10.7 kgm | (*) |

(\*): For screws with "Driloc"; to be changed every time they are tightened or loosened.

When refitting relieve the air from the braking system (see specific paragraph).

**DISASSEMBLY/REASSEMBLY**

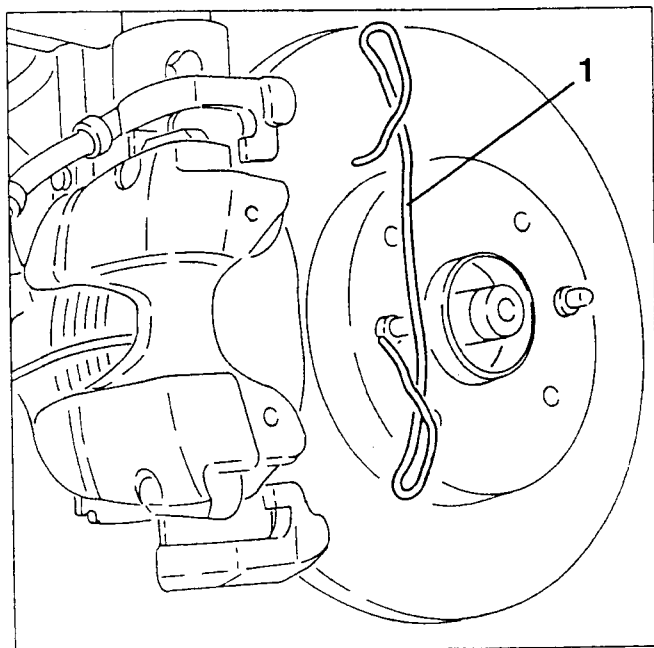
See the instructions for the version before the change

**CHECKS AND INSPECTIONS**

See the instructions for the version before the change

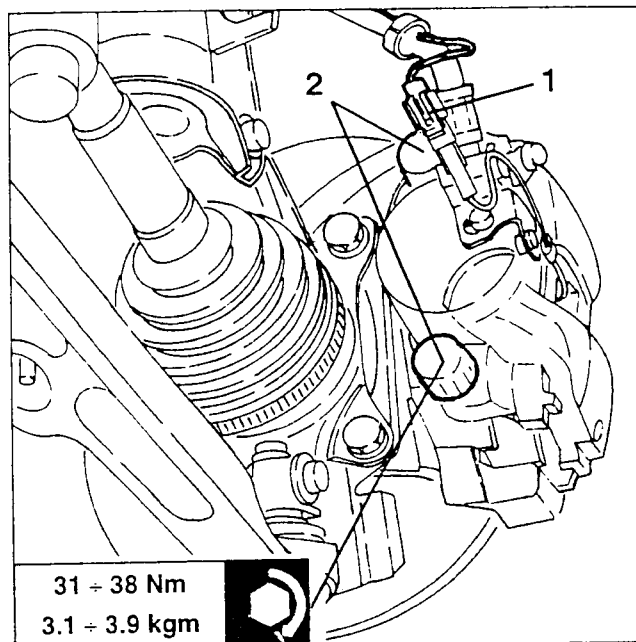
**CHANGING THE FRONT BRAKE PADS**

- Set the car on a lift.
- Remove the wheel on the side concerned.
- 1. Remove the spring from the brake caliper.

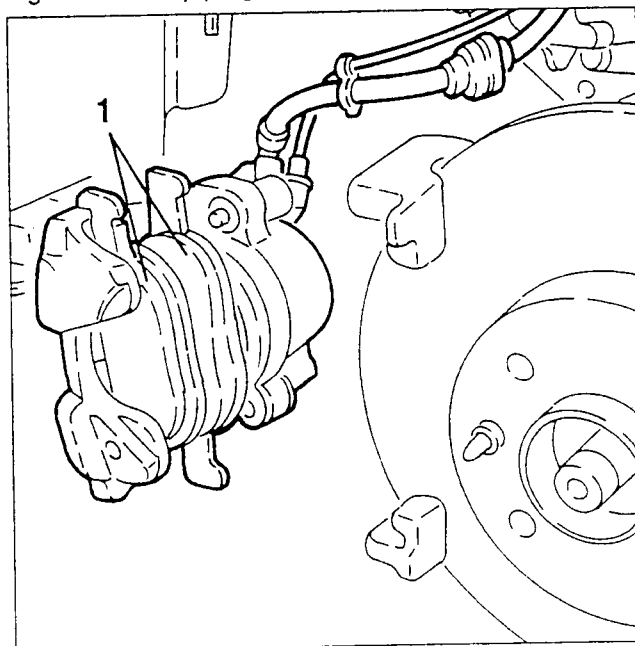


1. Disconnect the brake pad wear sensor electrical connection.
2. Remove the protective caps and slacken the two screws fastening the brake caliper to its support.

NOTE: When refitting change the caliper body fastening screws and tighten them to the specified torque.



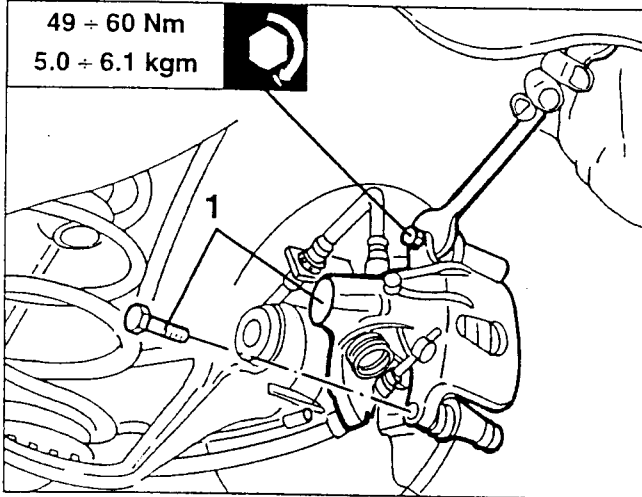
1. Back the caliper off the support, without disconnecting the control piping, then remove the brake pads.



## REAR DISK BRAKE

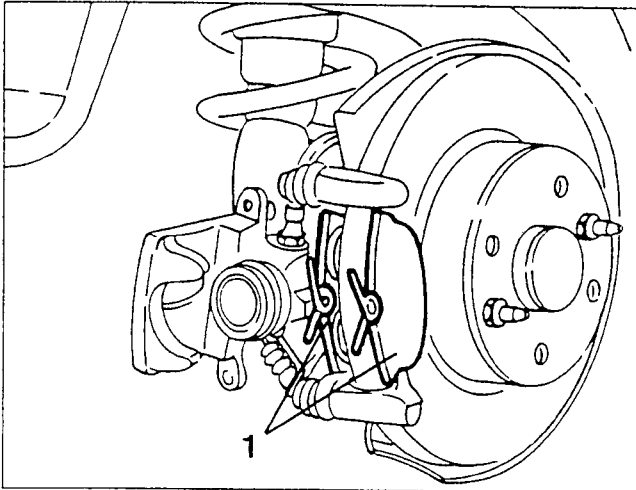
### REMOVING/REFITTING

- Set the car on a lift.
- Remove the wheel on the side concerned.
- 1. Slacken the two screws fastening the brake caliper to its support and move it aside without disconnecting the pipe and the handbrake cable.

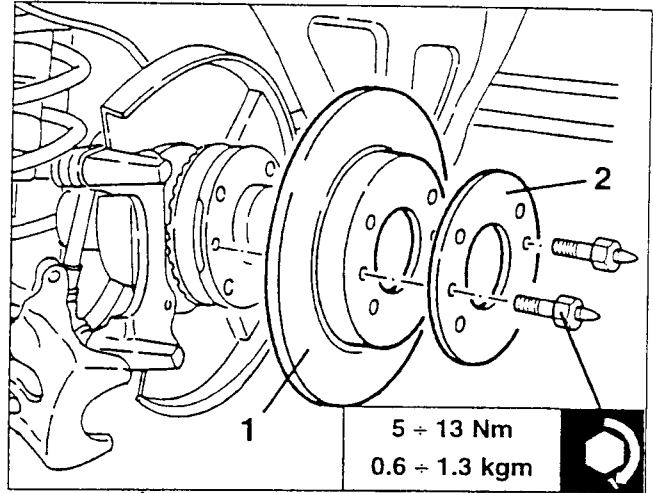


When refitting change the caliper body fastenings screws, tightening them to the specified torque.

1. Remove the brake pads.



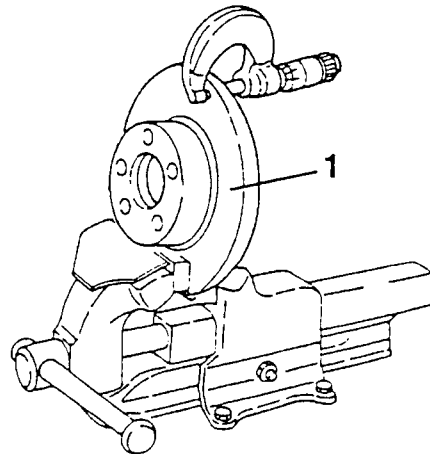
1. Slacken the two fastening pins and remove the brake disk.
2. Retrieve the spacer (where applicable).



### CHECKS AND INSPECTIONS

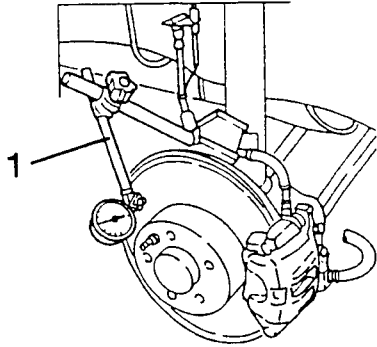
1. Check the thickness of the disks and check that the working surfaces have no deep scores or porosity. If necessary, grind observing the specified tolerances.

| At wear limit | At grinding limit |
|---------------|-------------------|
| 9.2 mm        | 10.1 mm           |



1. When changing the brake pads only, check that oscillation of the disk in relation to the axis of rotation is within the specified limits (0.15 mm max).

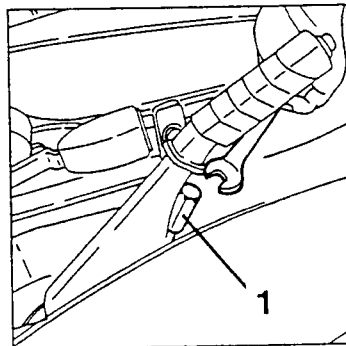
**NOTE:** The value must be measured 2 mm from the outside diameter of the disk.



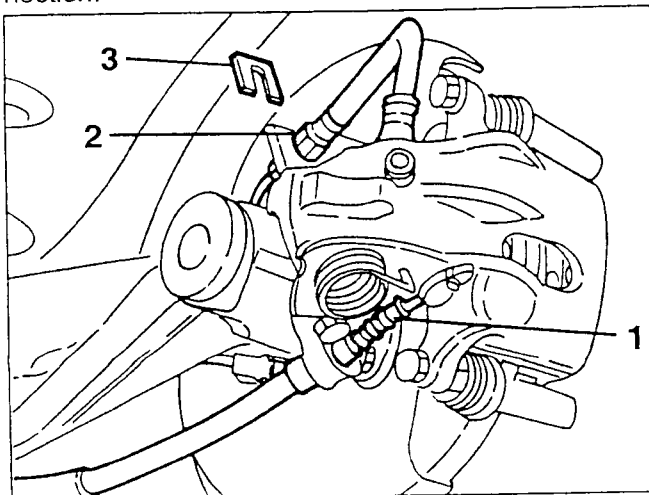
## REAR BRAKE CALIPER

### REMOVAL/REFITTING

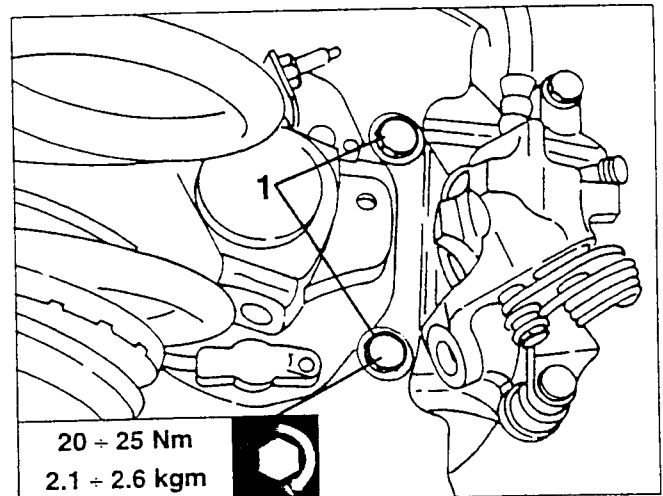
- Set the car on a lift.
- Using a suitable syringe, empty the brake-clutch fluid reservoir.
- Remove the wheel on the side concerned.
- Remove the handbrake lever leather trim.
- 1. Using the handbrake lever adjustment nut, slacken the tension of the cables.



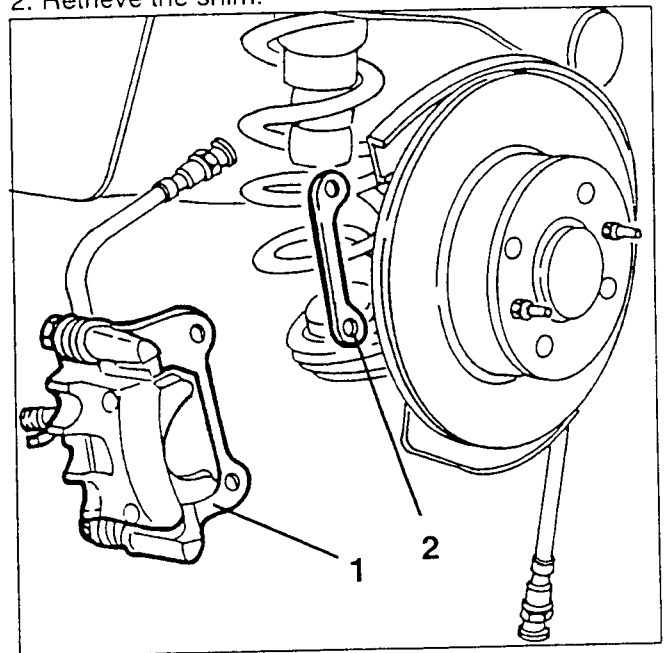
1. Disconnect the handbrake cable from the brake caliper.
2. Slacken the hose connection.
3. Remove the stopper and withdraw the hose connection.



1. Slacken the two screws fastening the complete brake caliper.

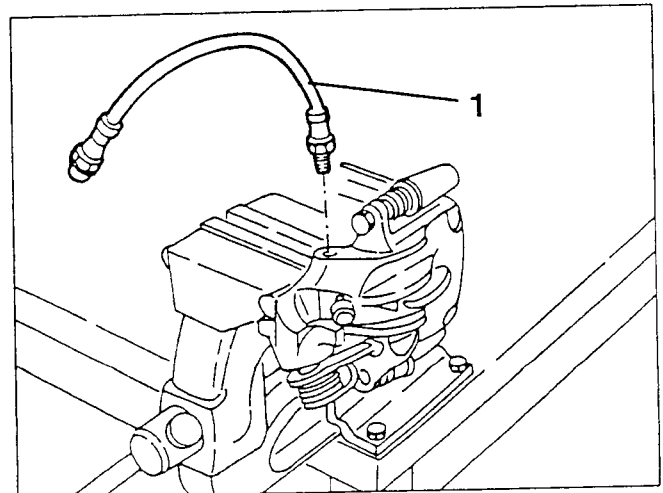


1. Remove the complete brake caliper.
2. Retrieve the shim.

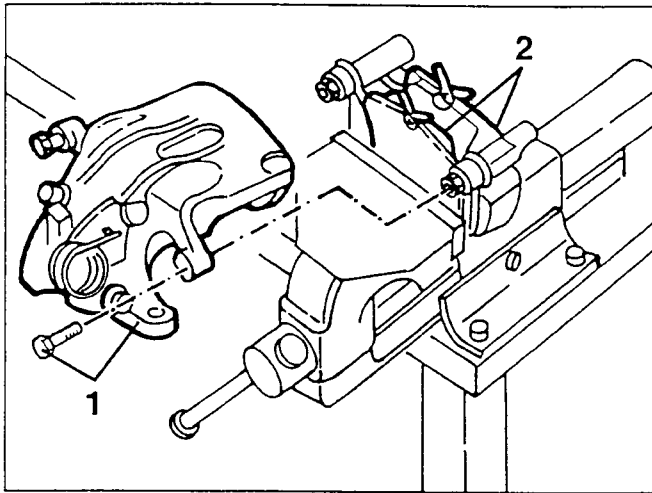


### DIS-ASSEMBLY

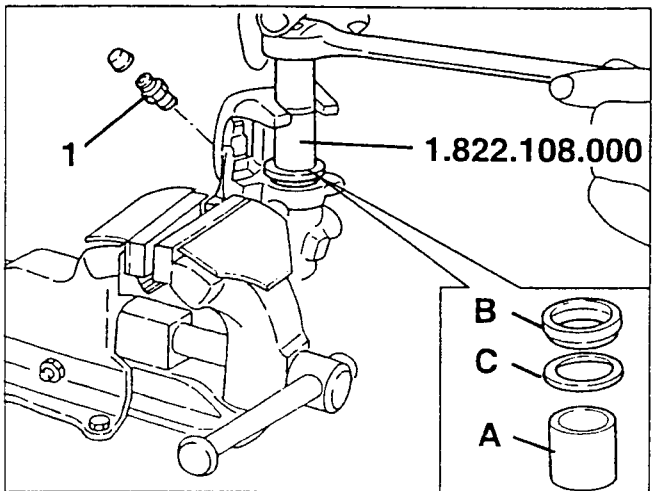
1. Disconnect the hose connection from the brake caliper.



1. Slacken the two screws fastening the brake caliper to its support bracket and remove it.
2. Retrieve the brake pads.



1. Remove the relief screw.
  - Using tool N° 1.822.108.000 (A), dis-assemble the piston (A), the protective boot (B) and the seal (C).

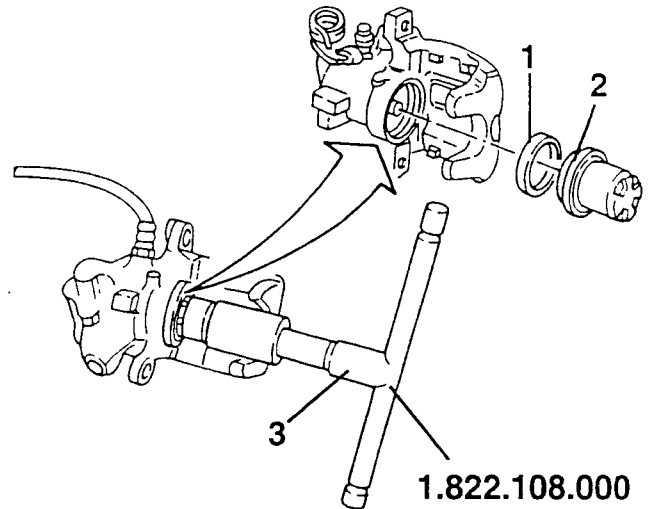


## CHECKS AND INSPECTIONS

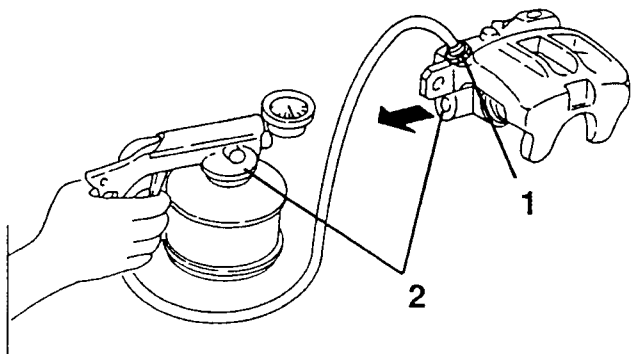
- The piston and caliper body must not reveal signs of abrasion or seizing; if they do, change the caliper complete with piston.
- Always change the protective boot and seal.
- Make sure that the relief screw is not clogged.
- Check the hose for swellings and cracks.
- Change the brake pads if the thickness of the friction material is below 1.5 mm.
- Check the brake caliper support bracket for cracks and distortion.
- If the automatic handbrake cable stroke adjustment device is not working properly, change the complete caliper.

## REASSEMBLY

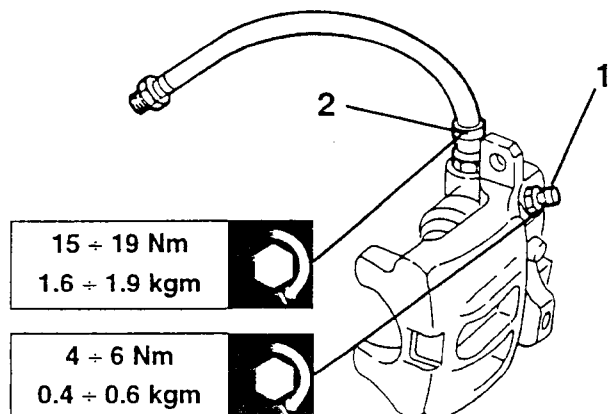
1. Fit the seal ring in the caliper body.
2. Position the protective boot on the rear section of the piston.
3. Fit the piston and adjust the position using tool N° 1.822.108.000.



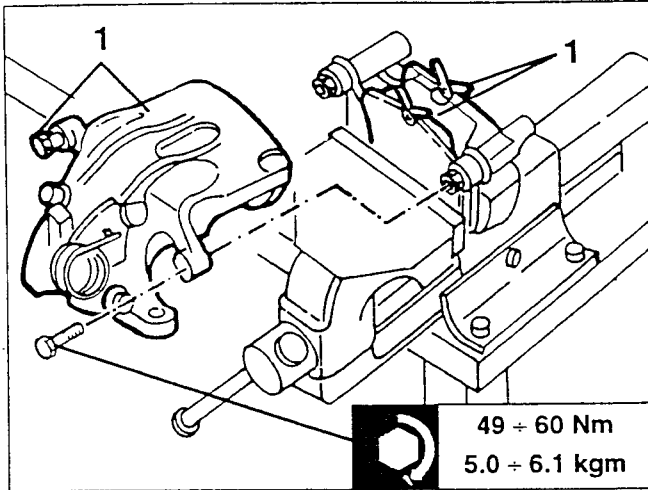
1. Partially tighten the relief screw.
2. Fill the caliper with the specified brake fluid until the fluid comes out of the hose connection hole free of air bubbles.



1. Lock the relief screw to the specified torque.
2. Assemble the hose and lock the connection to the specified torque.



1. Position the brake pads, then assemble the brake caliper on its support bracket tightening the new fastening screws to the specified torque.

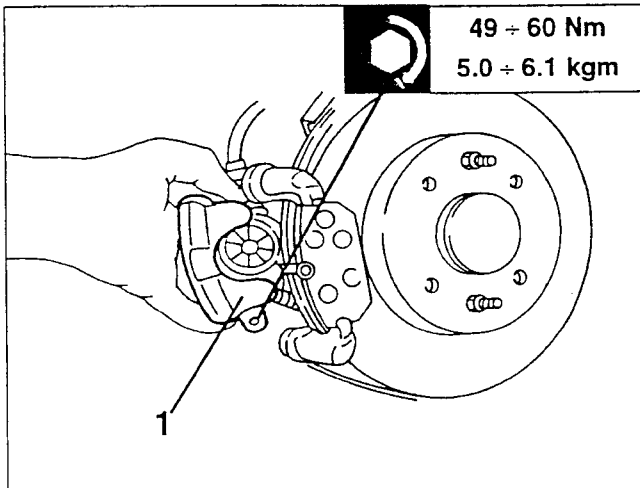


## CHANGING THE REAR BRAKE PADS

- Remove the rear wheel.

1. Slacken the two screws fastening the caliper body and move it aside to simplify changing the pads.

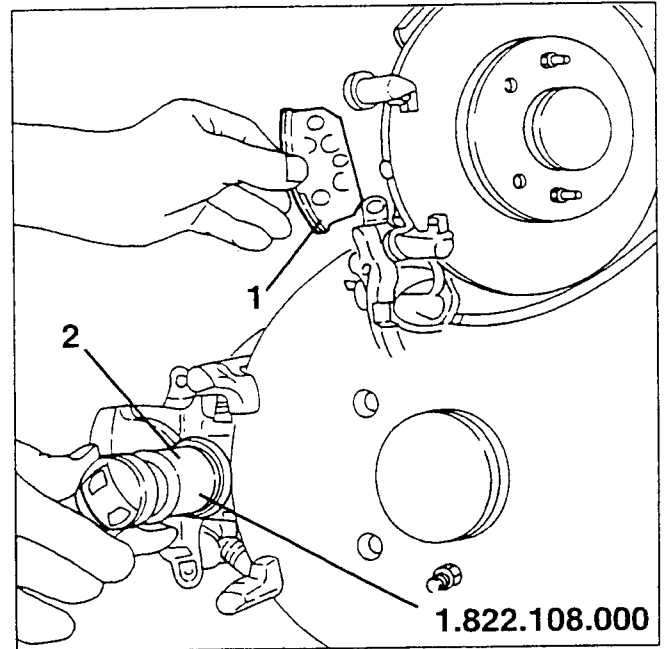
When refitting change the caliper body fastening screws, tightening them to the specified torque.



1. Change the brake pads.

**NOTE:** There is no specific direction for assembling the rear brake pads.

2. Using tool N° 1.822.108.000 move the piston backwards to simplify refitting the caliper, then refit the caliper itself.

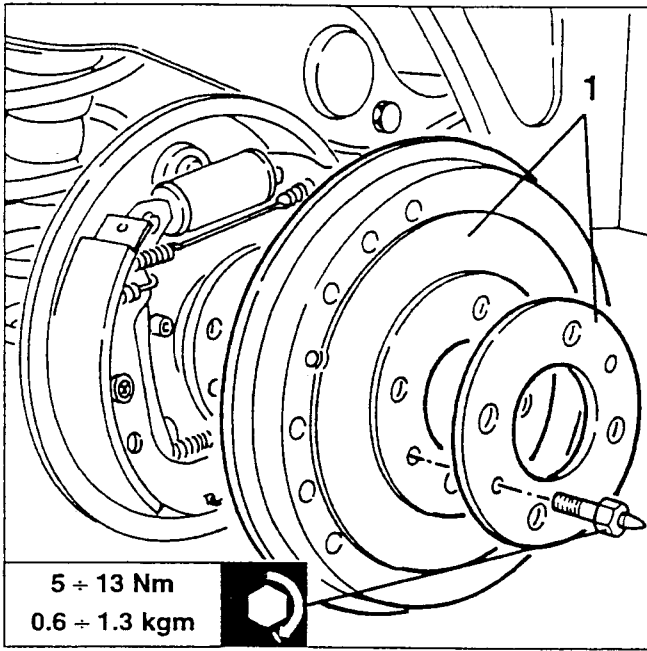




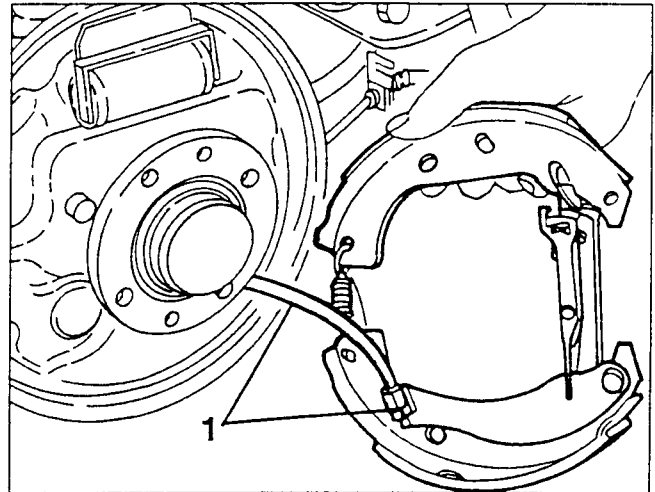
## BRAKE DRUM

### REMOVAL/REFITTING

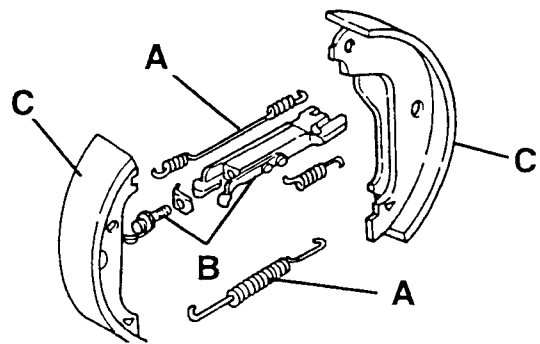
- Set the car on a lift.
- Remove the wheel on the side concerned.
- 1. Slacken the two fastening pins and remove the spacer and drum.



1. Move the shoe unit away just enough to disconnect the handbrake cable.

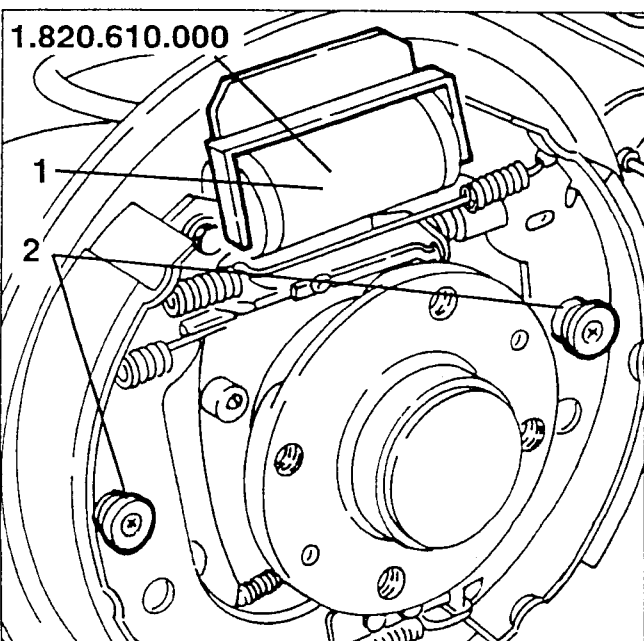


- On the bench remove the two shoe return springs (A) and the self-adjusting play takeup device (B) from the shoes (C).



### CHANGING THE BRAKE SHOES

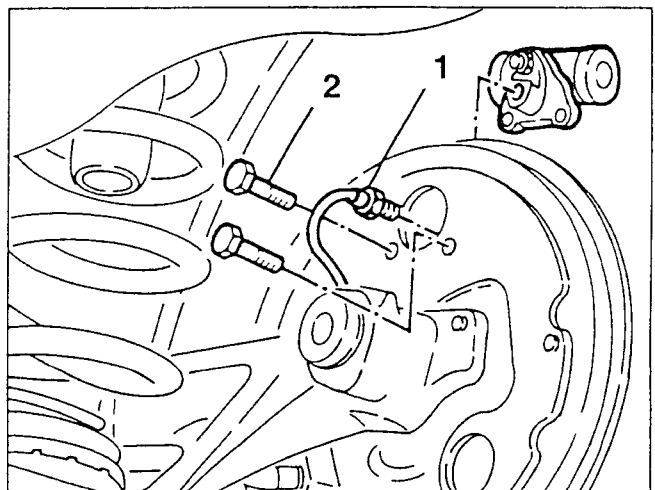
- Remove the drum (see specific paragraph).
- 1. Install tool n° 1.820.610.000 for retaining the brake cylinder piston.
- 2. Slacken the two shoe fastening pins.



### SHOE CONTROL CYLINDER

#### REMOVAL/REFITTING

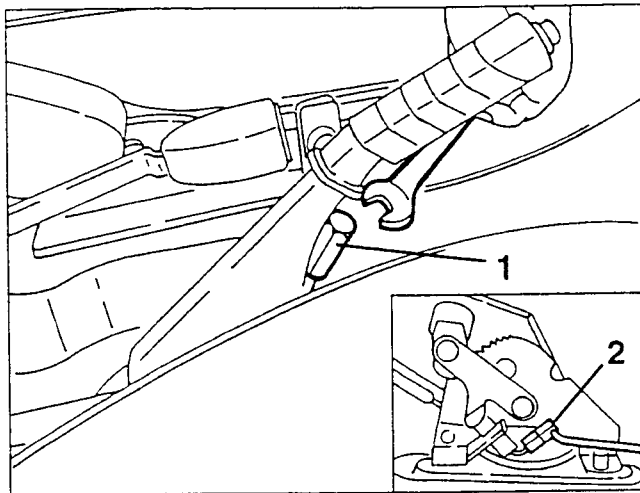
- Remove the rear drum brake shoes.
- 1. Disconnect the hose connection from the shoe control cylinder.
- 2. Slacken the two screws fastening the shoe control cylinder and remove it.



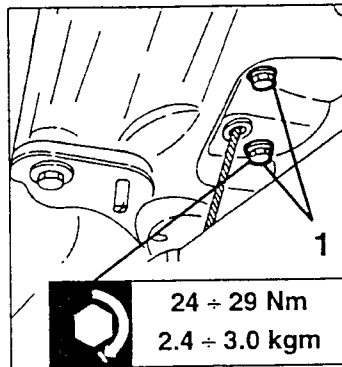
## CONTROL LEVER

### REMOVAL/REFITTING

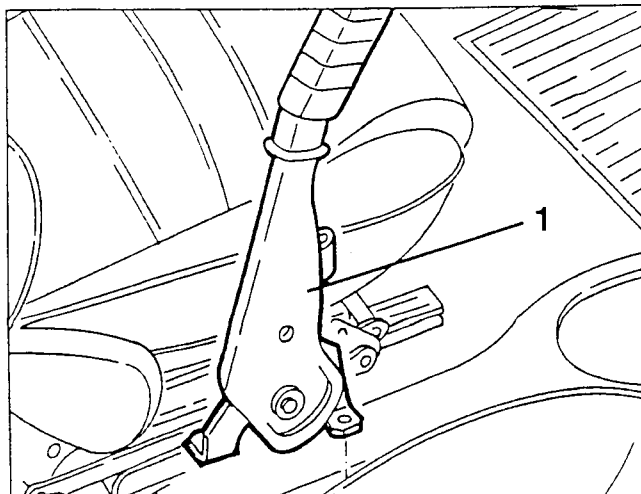
- Set the car on a lift.
- Remove the centre brake console (see GROUP 70).
- 1. Completely unscrew the handbrake lever adjustment nut and free the control cable.
- 2. Disconnect the electrical connection from the handbrake switch.



- Raise the car.
- 1. Slacken the fastenings of the exhaust pipe heat guard and slacken the two screws fastening the handbrake lever.



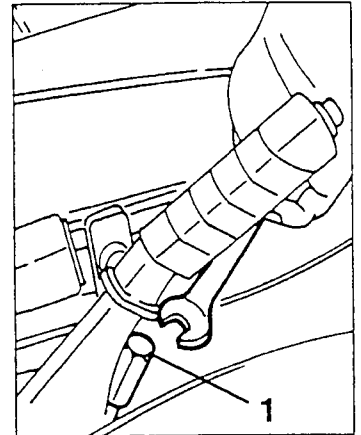
- Lower the car.
- 1. Remove the handbrake lever.



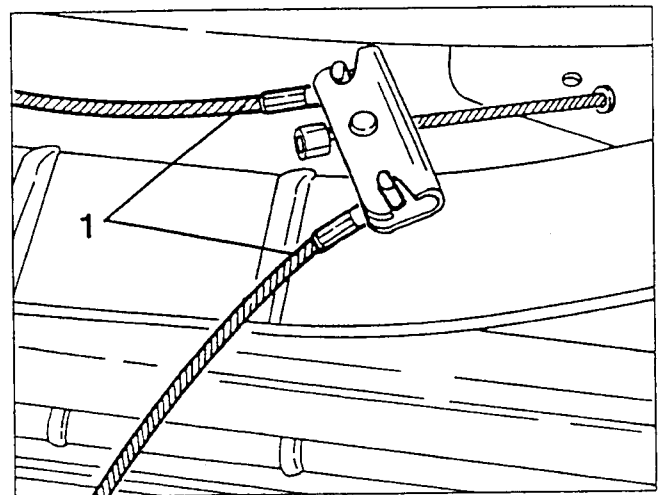
## FRONT CONTROL CABLE

### REMOVAL/REFITTING

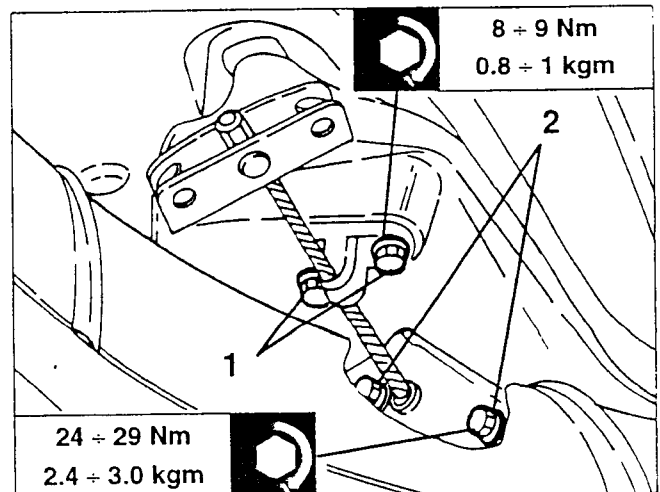
- Set the car on a lift.
- Remove the handbrake lever leather trim.
- 1. Completely unscrew the handbrake lever adjustment nut and free the control cable.



- Raise the car.
- 1. Disconnect the handbrake cables from the hooking bracket.

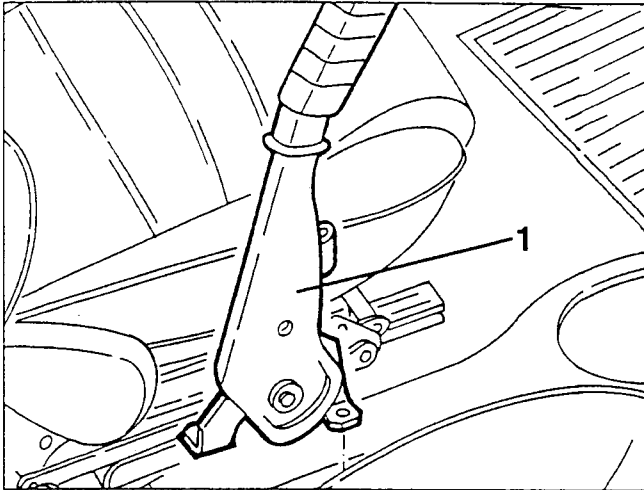


- 1. Slacken the fastenings of the exhaust pipe heat guard and slacken the two screws fastening the handbrake front cable support.
- 2. Slacken the two screws fastening the handbrake lever.

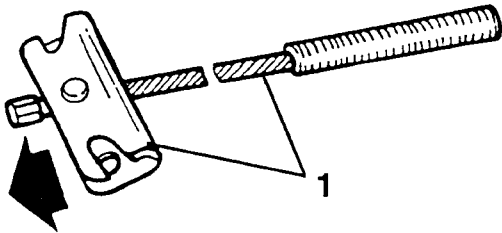


- Lower the car.

1. Remove the handbrake control lever.



1. Raise the car and retrieve the handbrake front cable withdrawing it from the grommet.

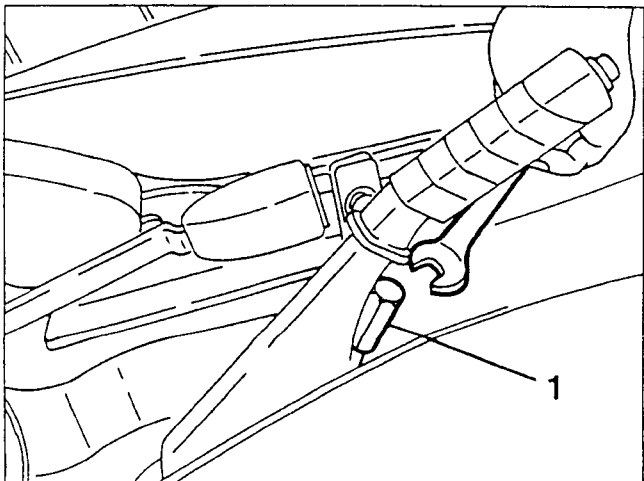


When refitting, make sure that the cable grommet is correctly positioned.

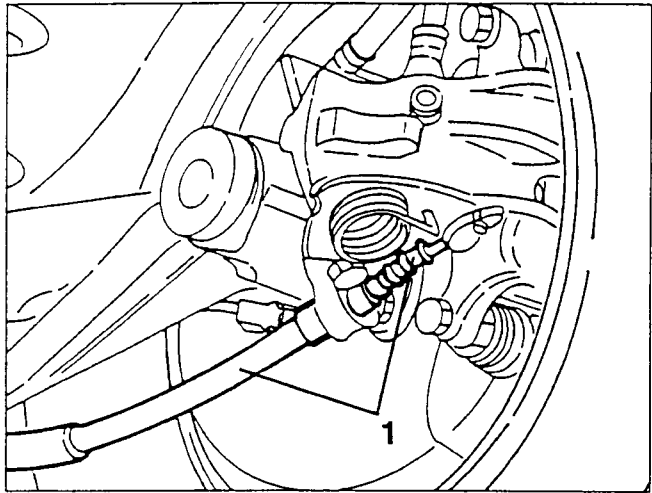
## REAR CONTROL CABLES

### REMOVAL/REFITTING

1. Remove the boot and slacken the tension of the handbrake cables using the special adjustment nut.

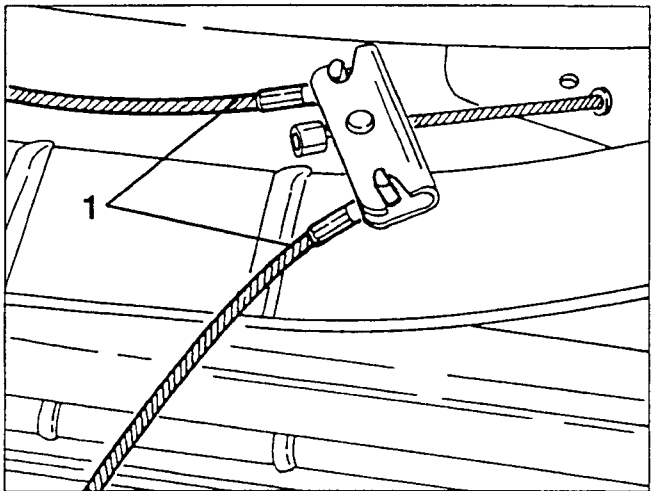


1. Disconnect the handbrake rear cables from the brake calipers.



- Free the handbrake rear cables from the support clamps.

1. Disconnect the handbrake rear cables from the hooking brackets and remove them.



### ADJUSTING THE CONTROL CABLES

The handbrake should be adjusted only after changing the brake pads, or the control cables, or the brake caliper, as wear takeup is automatic.

- Disconnect the handbrake cables from the brake calipers and pump the brake pedal forcefully at least ten times.

- Reconnect the handbrake cables to the calipers.

- Move the handbrake lever to the third position on the toothed sector and tighten the adjustment nut until the rear wheels are braked.

With the lever in the rest position, check that the wheels turn freely.

## BOSCH 2E ABS

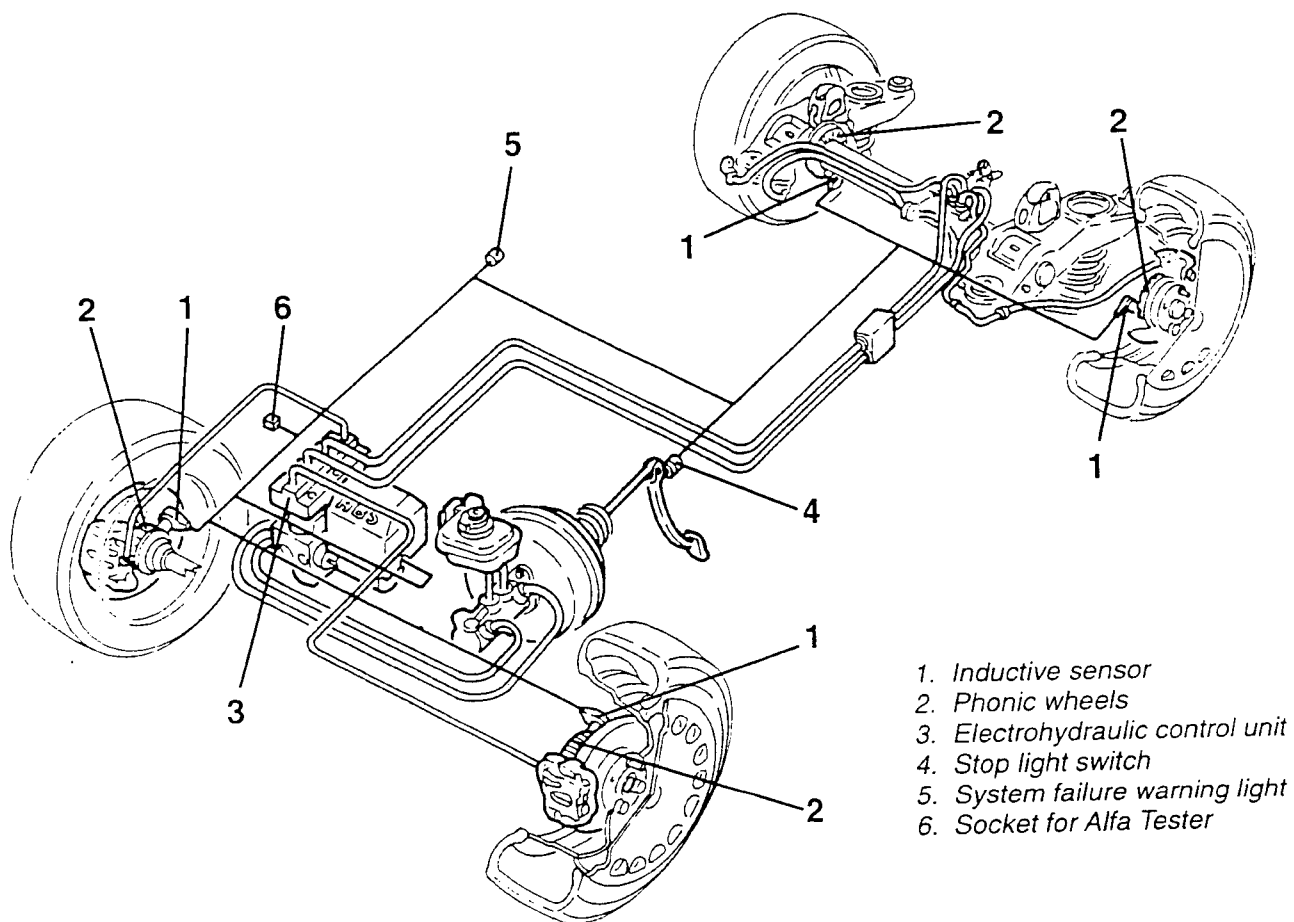
(up to chassis no. ....)

### DESCRIPTION

The BOSCH 2E A.B.S. wheel anti-lock system, integrated with the conventional hydraulically-operated system can be split into the following parts:

- a control unit (3) which, compared with other types of anti-lock systems, integrates the electronic one with the electrohydraulic one controlling both electronic and system management;

- a diagnosis socket (6) for the Alfa Tester;
- four sensors (1), integral with the fixed part suspension facing the same number of phonic wheels (2);
- a switch (4), in correspondence with the brake pedal, for controlling the stop lights;
- a warning light (5), in the instrument cluster, to alert the driver of faults in the A.B.S. system.



1. Inductive sensor
2. Phonic wheels
3. Electrohydraulic control unit
4. Stop light switch
5. System failure warning light
6. Socket for Alfa Tester

### OPERATING PRINCIPLE

During daily use of the vehicle we are used to pressing the brake pedal according to the slowing down required of the vehicle. When the road surface is dry and clean, no particular inconveniences generally occur, as it is possible to reach heavy pressures before the tyre begins to skid.

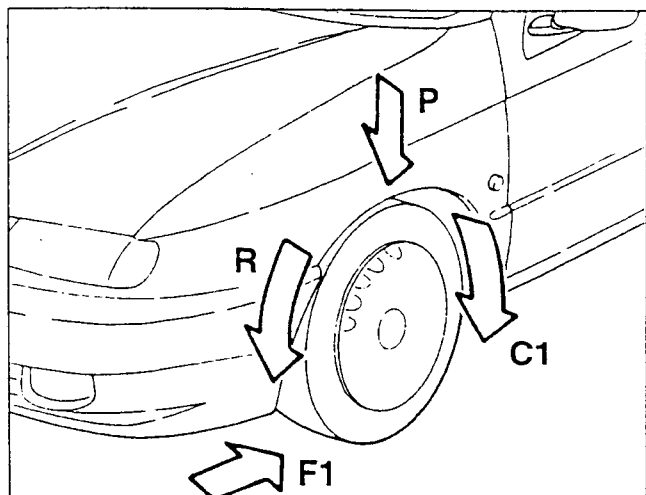
Conversely, if the asphalt and tyre conditions is not perfect, it would be instinctive to keep higher safety distances as lengthening of the braking distance is foreseeable, owing to both physical problems of grip and in considerable difficulty in dosing the braking force in the best way possible.

If one finds oneself in an unexpected situation (such as uneven road surface, braking on road surfaces at the limit of grip, or panic braking) it would be extremely fiddicult to control the vehicle, resulting in longer stopping distances and the possible loss of control. All this takes place because the wheels skid during braking and it is therefore impossible for the tyre to absorb the lateral forces acting on it.

During braking, the peripheral speed of the wheel tends to lower more than that of the vehicle; if the wheel locks and the car is still moving, the difference between these two speeds is at its highest level.

This difference in speed is known as "slipping coefficient" which represents the percentage of difference between the two speeds, therefore:

- slipping coefficient 0% if the wheel is free to roll;
- slipping coefficient 100% if the wheel is locked and the car is moving.



- C1* Braking torque  
*F1* Braking force  
*P* Weight bearing on the tyre  
*R* Tyre rolling radius

During braking, braking friction increases decidedly, for low values of the slipping coefficient, then lowering, gradually as the wheel slows down with respect to the speed of the car. Maximum braking efficiency is therefore obtained with slipping coefficient between 5% and 15% with a maximum of 20% depending on the tyre and road surface.

The purpose of the wheel anti-lock system (A.B.S.) is that of modulating the braking pressure so that the slipping coefficient is always kept between optimum values: this will make it possible to brake with the maximum braking friction and stop the vehicle in the smallest space possible allowed by the condition of the road surface and the wear of the tyres.

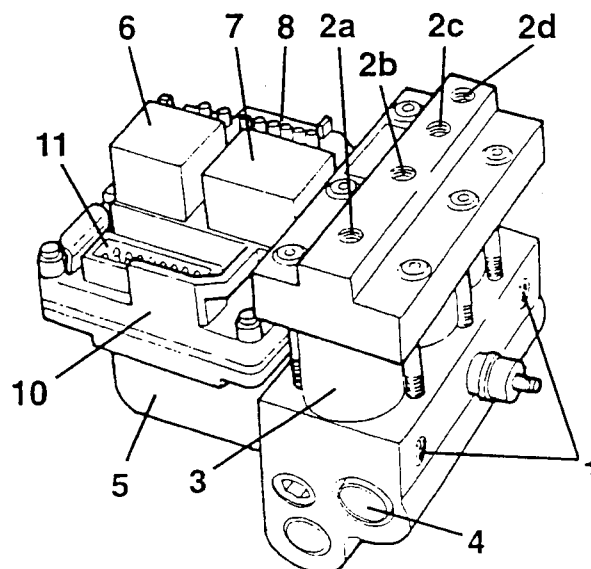
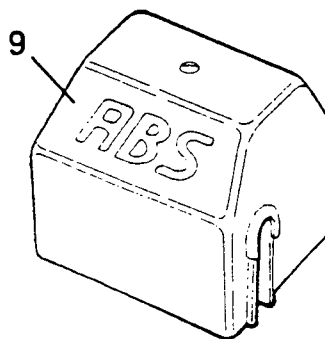
## ELECTROHYDRAULIC CONTROL UNIT

The control unit in the engine compartment is connected through unions (1) to the brake pump and through unions (2) to the braking system pipes.

The unit cannot be overhauled with the exception of relays (6) and (7), and must be changed entirely if a fault is found. To replace the above-mentioned relays and the multiple socket (8), it is necessary to remove the cover (9) after slackening the fastening screw.

From the sensors in correspondence with the phonic wheels, the control unit receives information about the turning speed of the wheels, and processes it electronically. It then generates command signals which make it possible to hydraulically change the pressure of the brake fluid in the caliper cylinders.

Depending on the behaviour of the wheels, the electrohydraulic unit changes the pressure of the brake fluid at the calipers in three separate steps, as described in the previous paragraph.



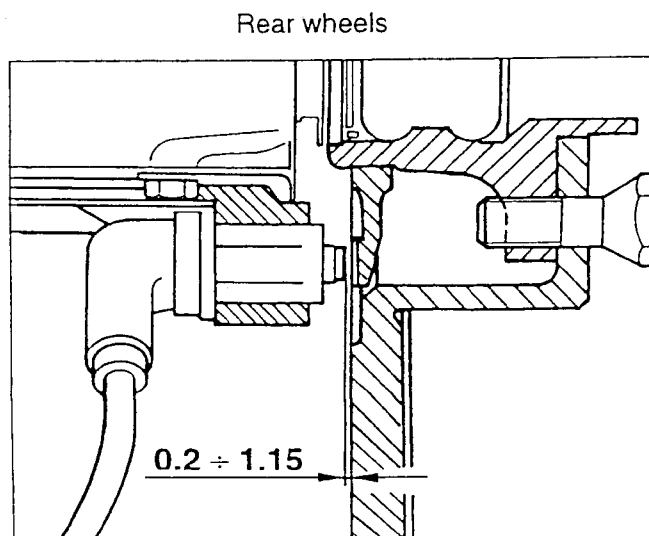
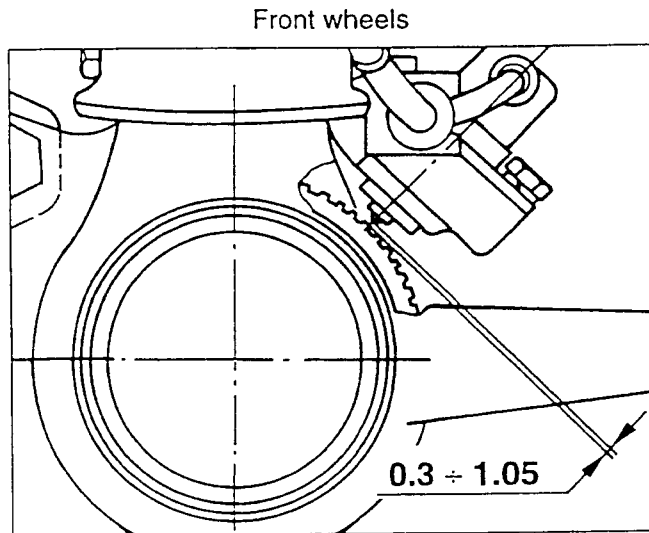
1. Unions for connecting hydraulic unit - brake pump
2. Unions for connecting hydraulic unit - pipes:
  - a) left front caliper (VL)
  - b) right rear caliper (HR)
  - c) left rear caliper (HL)
  - d) right front caliper (VR)
3. Solenoid valves
4. Sequential hydraulic valve
5. Electric recovery pump
6. Electric pump control relay
7. Solenoid valve safety and supply relay
8. Multiple connector
9. Cover
10. Electronic control unit
11. 15-pole connector for hydraulic control unit

### INDUCTIVE SENSORS

The sensors designed to detect the number of revolutions of the wheels of the car supply the control unit with the necessary continuity the information necessary for the control unit to correctly govern the operation of the hydraulic system.

The sensors measure the speed of travel, acceleration, deceleration and wheel slip. They are of the inductance type fitted in special housings on the front wheel uprights and on the rear brake caliper holder plates and it is not possible to adjust them.

As their position cannot be adjusted by shims, if the gap differs from the specified values, they must be changed.

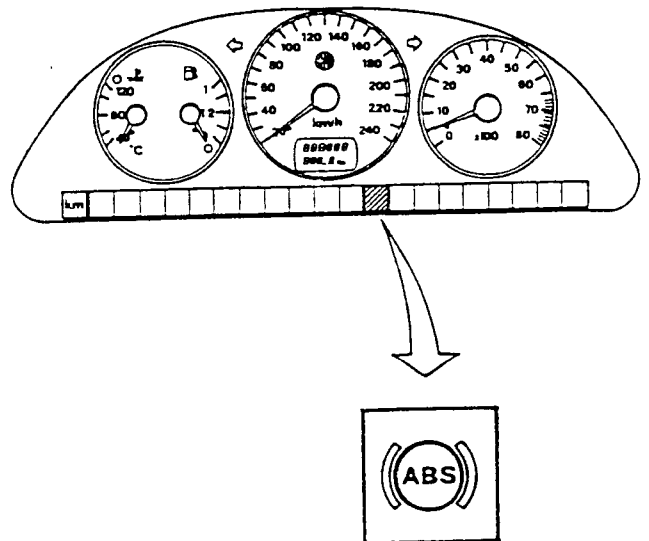


The lines of magnetic flux are closed by the teeth of the phonic wheel facing the sensor and turned by the wheel. The passage from solid to hollow, due to the presence or lack of a tooth causes a change in the magnetic flux sufficient to create an induced electromotive force at the terminals of the sensor and an alternating electric signal at the control unit.

### FAILURE WARNING LIGHT

When the ignition switch is turned to MARCIA, the failure warning light turns on; as soon as the engine is started it will turn off. The control unit receives the engine running signal from the alternator. The A.B.S. device cuts in at appr. 3 kph and at about 6 kph the device performs the test cycle which excludes the wheel revolution sensors.

If the response from the components is positive, the warning light stays off; if the response is negative the warning light turns on and the system will cut out automatically leaving the conventional braking system to slow down the vehicle. In this case the warning light will flash.



### DESCRIPTION OF HOW THE WHEEL ANTI-LOCK DEVICE WORKS

Depending on the pulses received from the electronic control unit, the electrohydraulic unit changes the pressure of the brake fluid on the calipers in three phases:

1. Pressure increase phase
2. Pressure decrease phase
3. Pressure maintaining phase

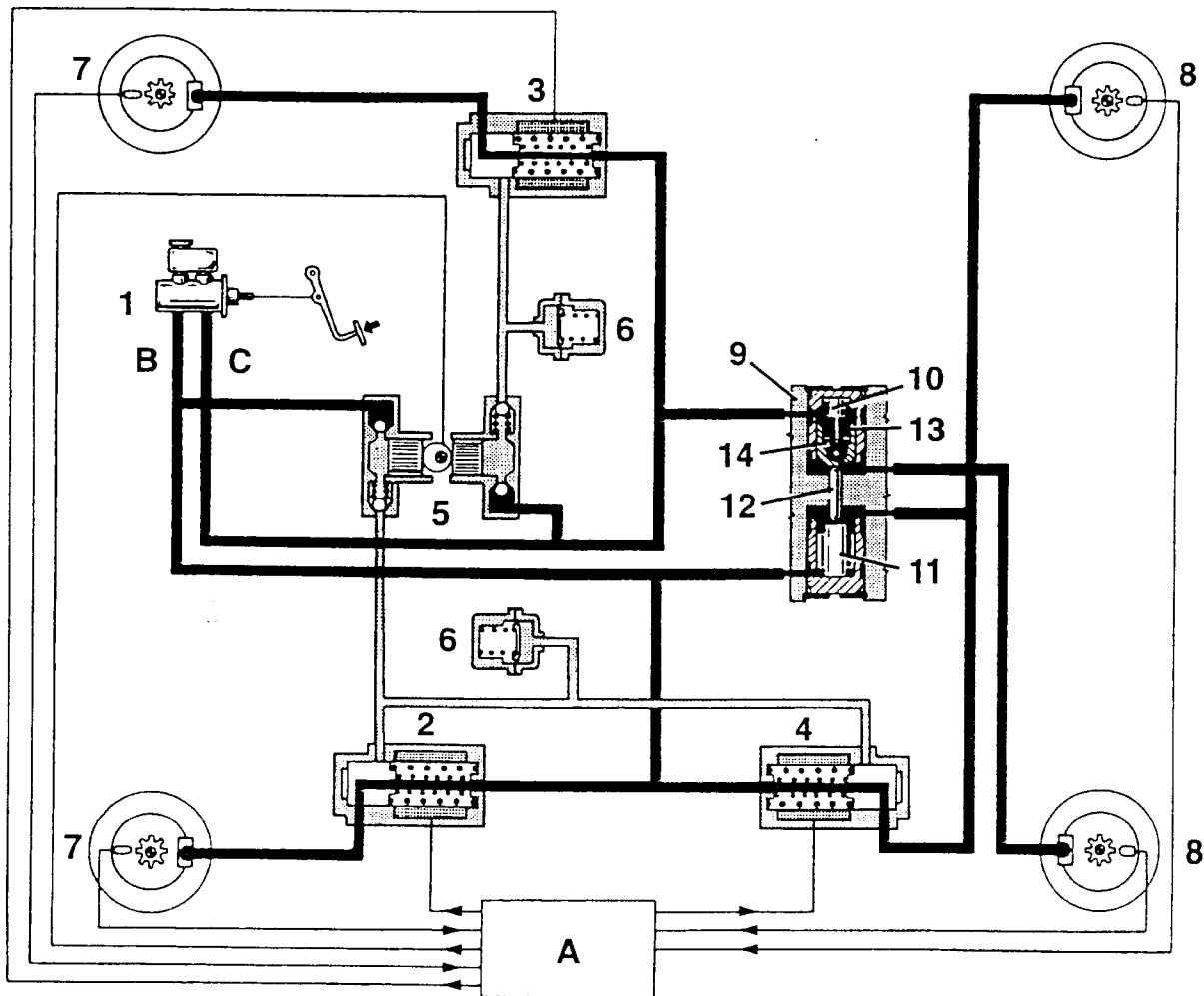
### Pressure increase phase

In this phase the solenoid valves of the electrohydraulic control unit are not energised and the pressure in the calipers originates from the pressure exerted on the brake pedal by the driver.

The pressure of the brake fluid at the outlet of the brake pump hose (B) reaches the left front wheel and the right rear wheel through solenoid valves (2) and (4), while from hose (C) it reaches the right front wheel and the left rear wheel through the solenoid valve (3) and the sequential valve (9).

The pressure of the brake fluid crosses the sequential valve (9) because the piston (10), pushed by the spring (13), keeps the valve (14) in the open position; piston (11) does not intervene as both its surfaces are affected by the same pressure.

The braking force increases and as a result the wheels reduce their speed in relation to that of the car (slipping increases), if a rear wheel tends to lock the sensor detects what is happening and the electronic control unit reduces the pressure.



- A. Electronic control unit
- B. Brake pump outlet hose
- C. Brake pump outlet hose
- 1. Brake pump
- 2. Solenoid valve for front wheel brake circuit
- 3. Solenoid valve for front wheel brake circuit
- 4. Solenoid valve for rear wheel brake circuit
- 5. Electric recovery pump
- 6. Accumulators

- 7. Revolution sensors and phonic wheels for front wheels
- 8. Revolution sensors and phonic wheels for rear wheels
- 9. Hydraulic sequential valve
- 10. Piston
- 11. Piston
- 12. Stiff rod connecting pistons
- 13. Spring
- 14. Valve

### Pressure decreasing phase

The electronic control unit measures the tendency of the wheel to lock and the ABS device comes into operation.

The solenoid valve (4) is energised by a 5 Amp current and the connection between the brake pump and the right rear brake caliper is cut off, while the connection between the brake caliper and the recovery pump (5) is opened, being activated at the same time as the solenoid valve (4).

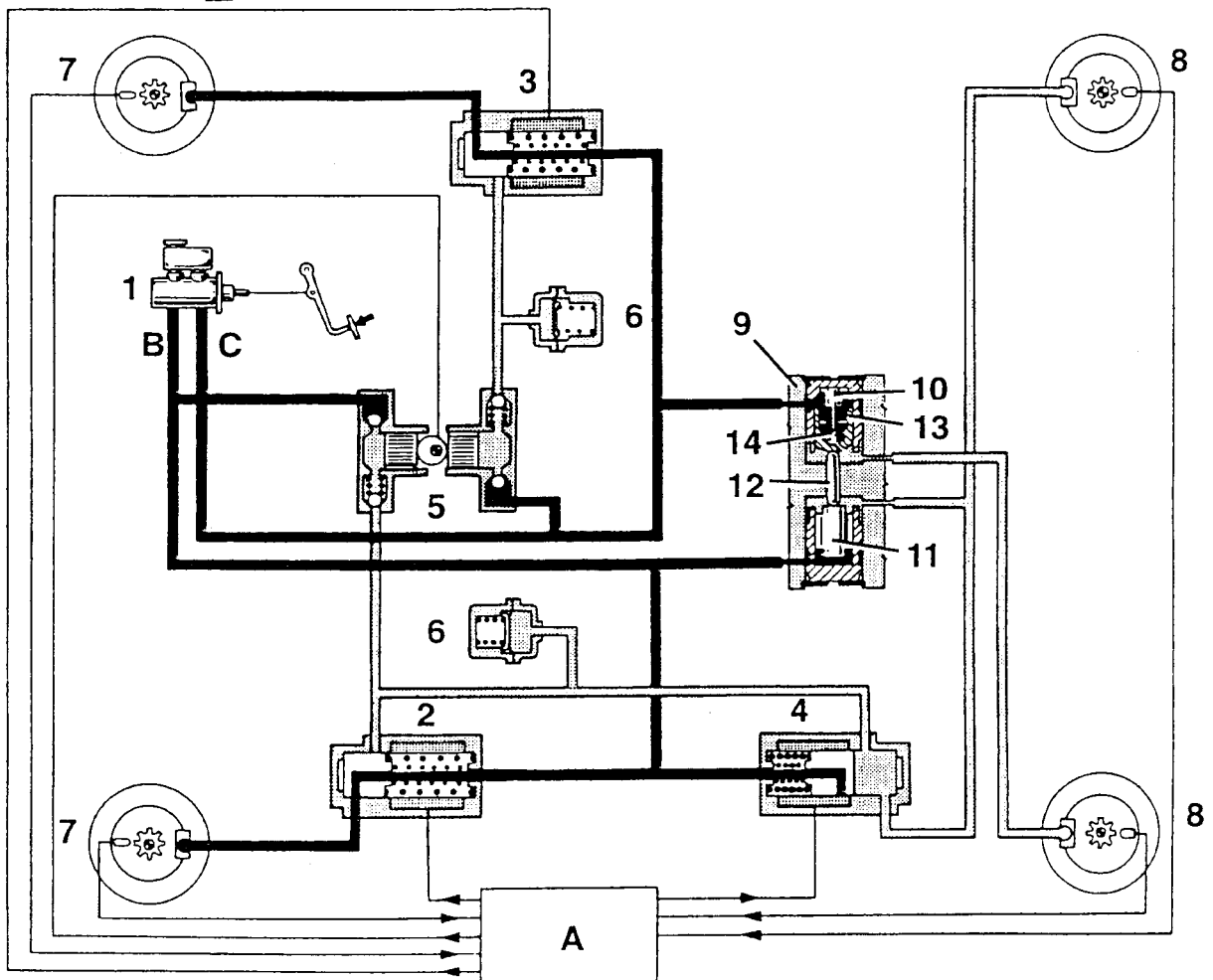
In this way the pressure of the brake fluid in the right rear brake caliper and in the piston chamber (11) connected to it, decreases. The subtracted brake fluid is recirculated into the main circuit through the recovery pump (5). This is the origin of the intermittent hydraulic pulsations which can be perceived by the driver through the brake pedal.

The accumulator (6) in the circuit stores the part of the brake fluid subtracted from the brake caliper and at the same time acts as a damping chamber for the pressure peaks during the recovery phase.

The lack of balance between the forces acting on the piston (11), causes it and the rod (12) to move. Through piston (10) the rod moves piston (11) causing valve (14) to close.

The result is the gradual decrease of the pressure in the left rear brake caliper caused by the increased volume in the piston chamber (10).

The balance of the forces acting on pistons (10) and (11) will be reached when the braking pressures in the rear brake calipers reach the same value.



- A. Electronic control unit
- B. Brake pump outlet hose
- C. Brake pump outlet hose
- 1. Brake pump
- 2. Solenoid valve for front wheel brake circuit
- 3. Solenoid valve for front wheel brake circuit
- 4. Solenoid valve for rear wheel brake circuit
- 5. Electric recovery pump
- 6. Accumulator
- 7. Revolution sensors and phonic wheels for front wheels

- 8. Revolution sensors and phonic wheels for rear wheels
- 9. Sequential hydraulic valve
- 10. Piston
- 11. Piston
- 12. Stiff rod connecting pistons
- 13. Spring
- 14. Valve



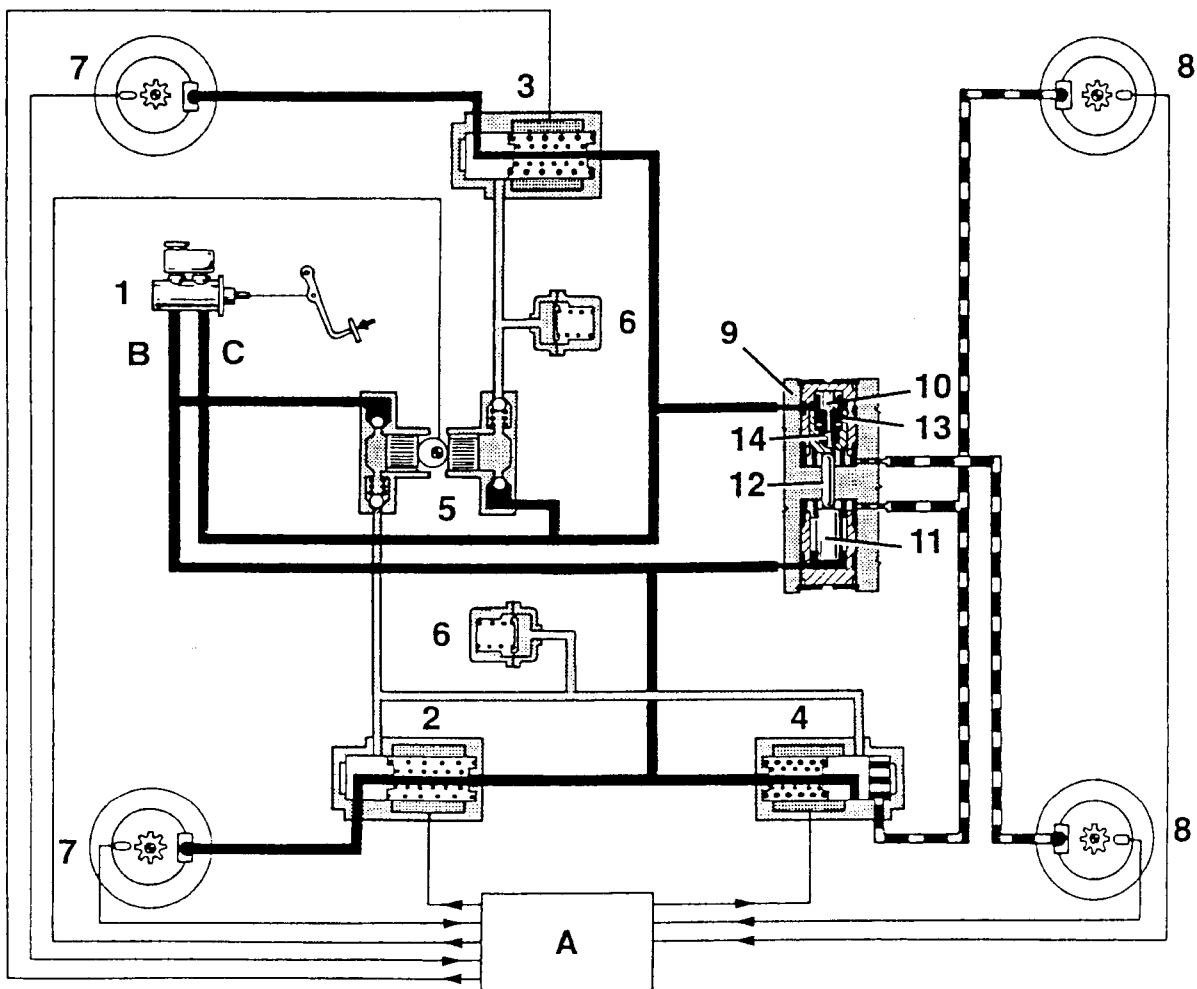
### Pressure maintaining phase

In this phase there is an increase in both the speed and acceleration of the wheel.

The solenoid valve (4) is energised with a 2 Amp current; the connection between the brake pump and the rear brake calipers is still cut off (standby position). The pressure on the rear brake calipers increases slightly as a result of the movement of the solenoid valve and it is then kept at a constant rate.

The braking force continues its slowing action even if the speed of the wheels nears that of the vehicle; once the permitted threshold has been reached it is necessary to increase the braking force again.

This cycle is repeated down to a speed of approximately 6 kph when the ABS system cuts itself off to allow the vehicle to come to a halt.



- |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>A. Electronic control unit</li> <li>B. Brake pump outlet hose</li> <li>C. Brake pump outlet hose</li> <li>1. Brake pump</li> <li>2. Solenoid valve for front wheel brake circuit</li> <li>3. Solenoid valve for front wheel brake circuit</li> <li>4. Solenoid valve for rear wheel brake circuit</li> <li>5. Electric recovery pump</li> <li>6. Accumulators</li> <li>7. Revolution sensors and phonic wheels front wheels</li> </ul> | <ul style="list-style-type: none"> <li>8. Revolution sensors and phonic wheels for rear wheels</li> <li>9. Hydraulic sequential valve</li> <li>10. Piston</li> <li>11. Piston</li> <li>12. Stiff rod connecting pistons</li> <li>13. Spring</li> <li>14. Valve</li> </ul> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### BRAKING LOAD PROPORTIONING VALVE

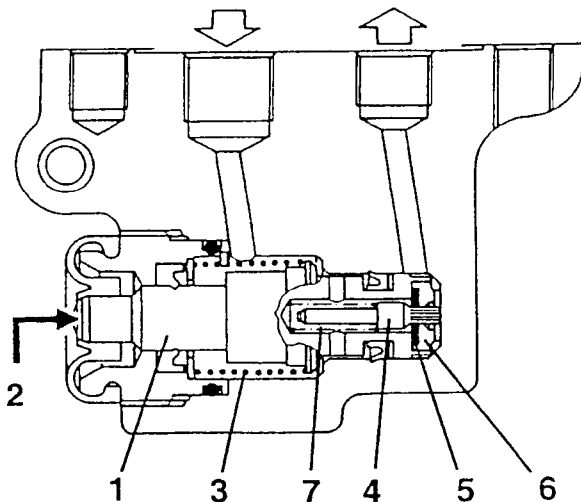
This is fastened on the half shells of the rear axle and differs from the conventional type in its operating system.

The load acting on the suspension arms is measured by the spring (2) which transforms the variation in force applied on the device.

During braking the oil coming from the brake pump enters the proportioning valve, crosses it and moves on to the rear brakes with a pressure which, acting on the grooved plate (6) causes a thrust in the opposite direction to the one acting on the operating piston (1). The operating piston (1) is held in the stop limit position by the combined action of the outer and inner springs (2). When the thrust acting on the grooved plate (6) exceeds that of the opposing force, the operating piston (1) moves to the left thus cutting off the connection between the brake pump and the rear calipers, causing a jump in pressure at a preset ratio of 0.30.

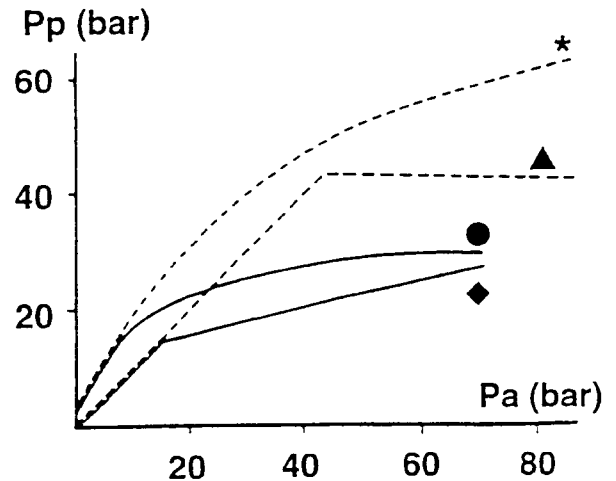
During operation of the ABS device, when the braking action decreases, the pressure in the rear section of the proportioning valve, acting through the grooving of the inner piston (4) overcomes the reaction of the spring (7) and moves the piston (4) to the left in order to balance the pressure inside the proportioning valve and keep the pressure jump constant at the preset ratio of 0.30.

The braking load proportioning valve which is integrated with the two branches of the braking circuit continues to operate even if the pressure on one of the two branches is lowered (breakage of a hose, connection, etc.).



1. Operating piston
2. Force of the outer spring acting on the operating piston
3. Inner spring
4. Inner spring
5. Seal ring
6. Grooved plate
7. Spring for inner piston

Characteristic curves of the pressure distribution between front and rear brakes actuated by the braking load proportioning valve.

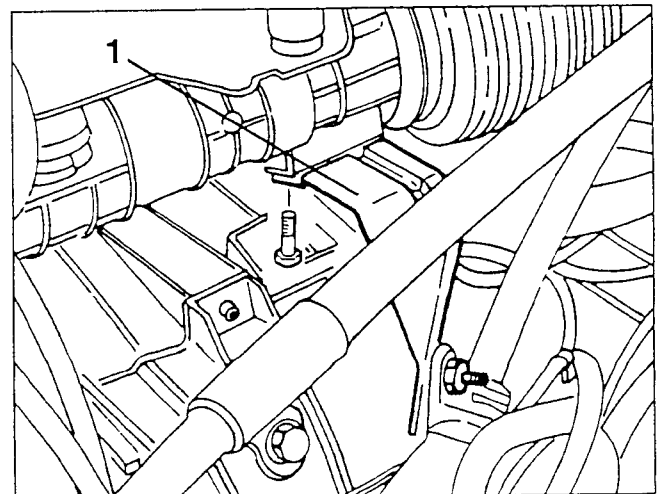


- $P_a$  Braking pressure on the front axle
- $P_p$  Braking pressure on the rear axle
- \* Ideal curve with fully loaded car
- ▲ Reale curve with fully loaded car
- Ideal curve with driver only
- ◆ Real curve with driver only

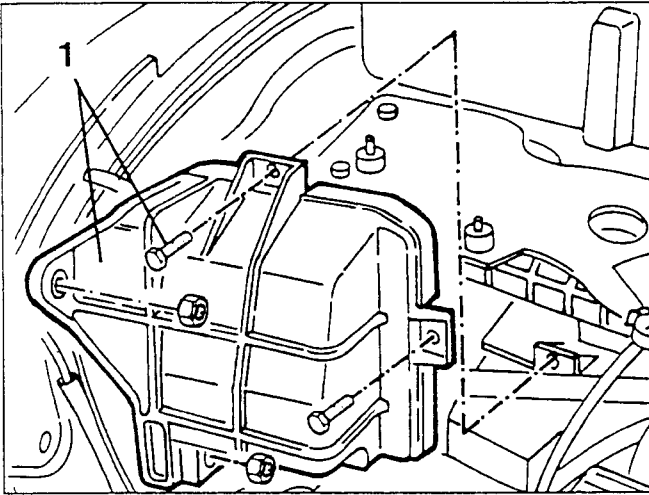
### HYDRAULIC UNIT Boxer engines

#### REMOVAL/REFITTING

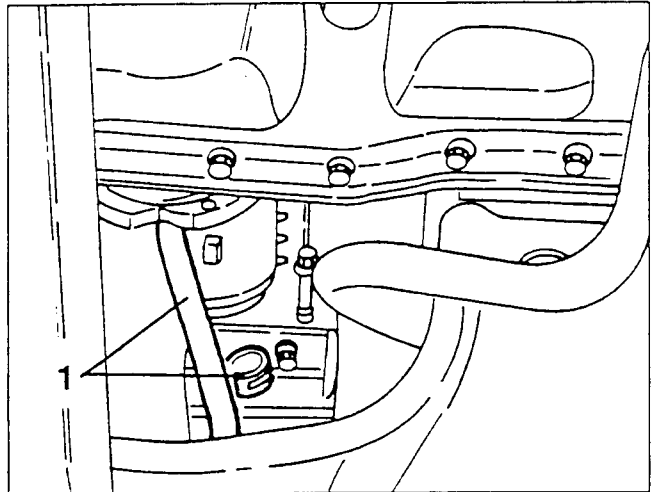
- Set the car on a lift.
- Disconnect the battery (-) terminal.
- Using a suitable syringe, empty the brake-clutch fluid reservoir.
- Remove the right front wheel.
- Remove the air cleaner complete (see GROUP 10).
- 1. Remove the power steering hose support bracket.



1. Slacken the fastening screws and nuts and remove the front half box of the hydraulic unit.

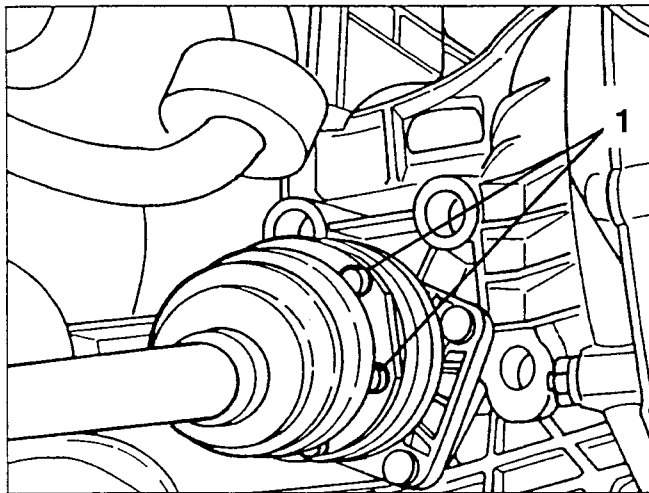


1. Free the cabling from the clamp located under the hydraulic unit.  
- Slacken the fastening nut and disconnect the earth cable from the hydraulic unit.

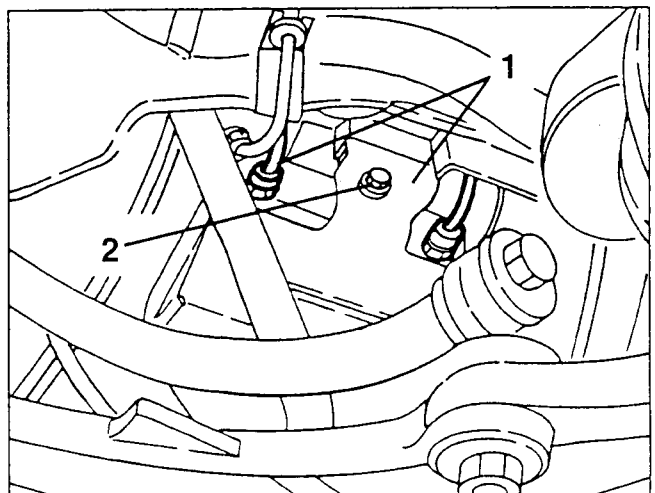


- Raise the car.

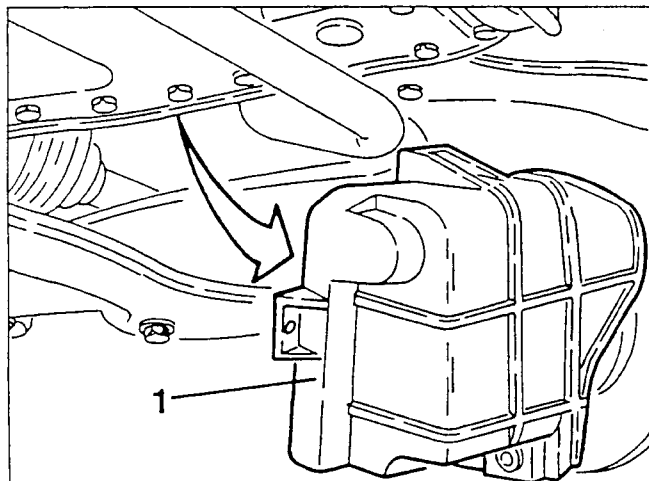
1. Slacken the fastening screws and disconnect the right axle shaft from the differential and move it to one side.



1. Disconnect the two stiff pipe connections to the brake pump from the hydraulic unit.  
2. Slacken the three nuts fastening the hydraulic unit.

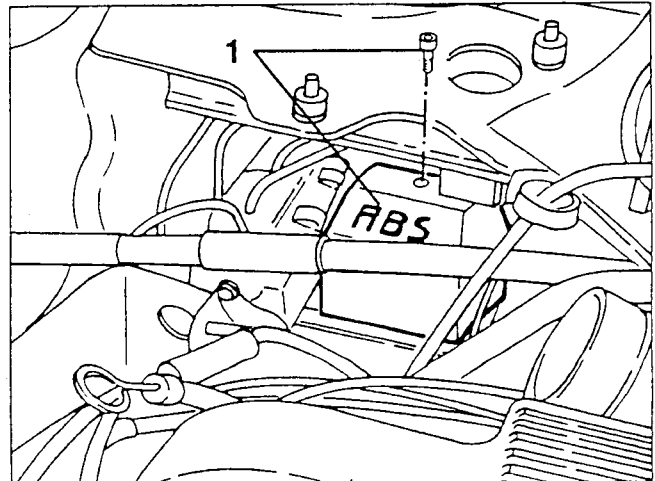


1. Slacken the remaining fastening nut and remove the rear half box from the hydraulic unit.

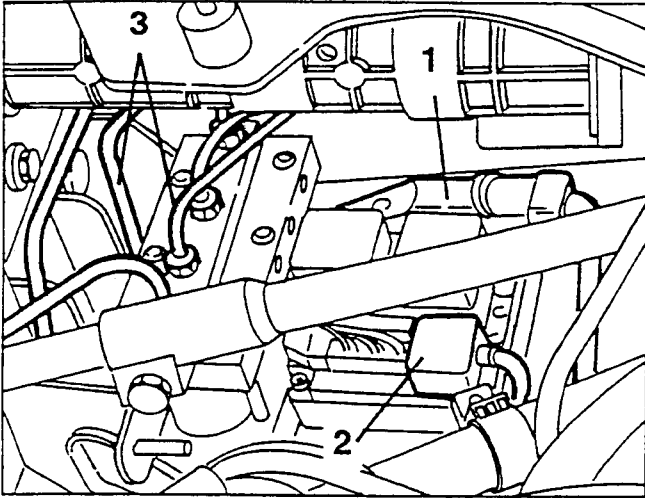


- Lower the car.

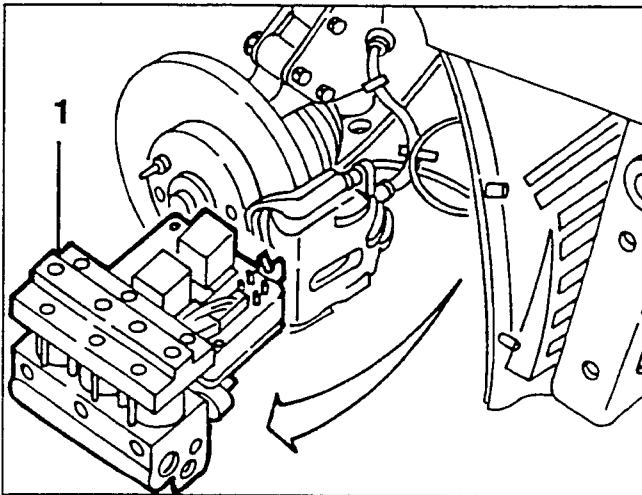
1. Slacken the fastening screw and remove the electronic control unit cover.



1. Disconnect the comb from the control unit wiring.
2. Disconnect the four-pin connector from the control unit.
3. Disconnect from the hydraulic unit the four connections of the brake hoses.



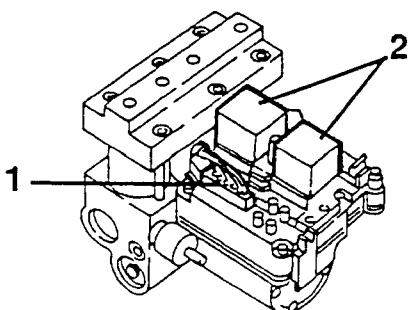
1. Remove the hydraulic unit raising it just enough to free it from its support, then withdraw it through the wheel house.



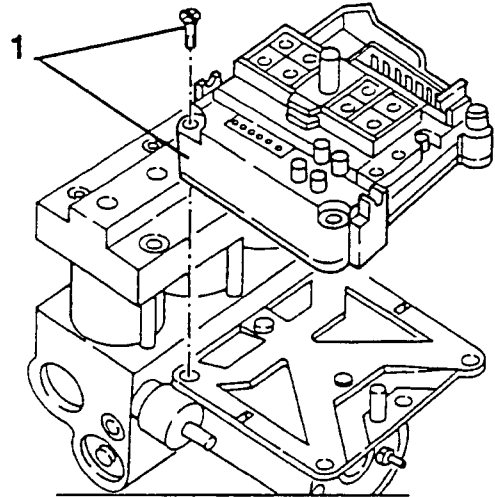
When refitting, bleed the air from the brake system (see specific paragraph).

### DIS-ASSEMBLY/REASSEMBLY

1. Disconnect the electrical connection illustrated from the control unit.
2. Remove the two relays from the control unit.



1. Slacken the fastening screws and remove the control unit.

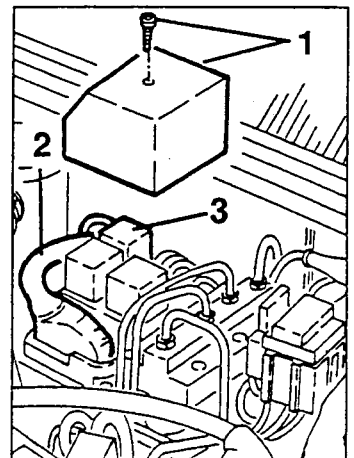


### HYDRAULIC UNIT Turbodiesel engine

### REMOVAL/REFITTING

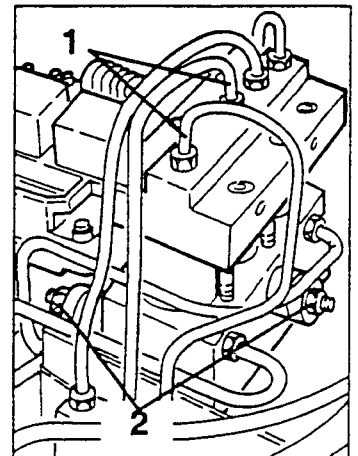
- Disconnect the battery (-) terminal.
- Using a suitable syringe, empty the brake-clutch fluid reservoir and then remove it.

1. Slacken the fastening screw and remove the control unit cover.
2. Disconnect the control unit connection.
3. Disconnect the four-pin electrical connection from the control unit.



1. Disconnect the connections of the unit.
2. Slacken the nuts fastening the flexible mounts of the hydraulic unit, then remove it.

When refitting, bleed the air from the brake system.



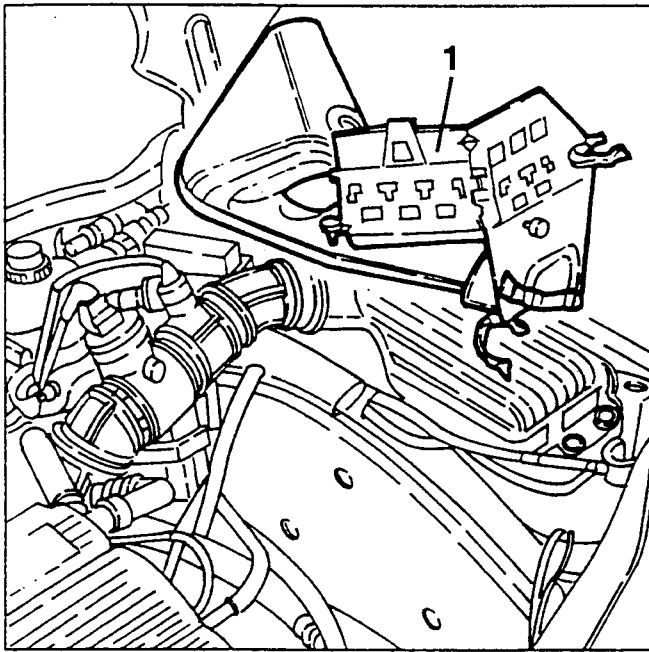
### DIS-ASSEMBLY/REASSEMBLY

Proceed as described for the Boxer engines.

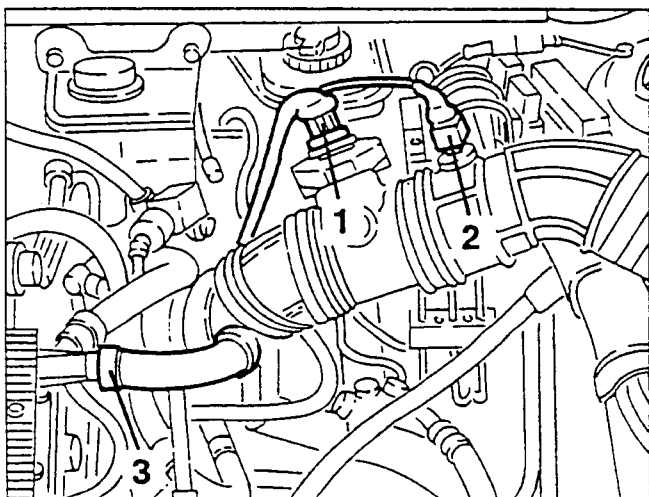
### HYDRAULIC AGGREGATE T. Spark 16V Engine

#### REMOVING/REFITTING

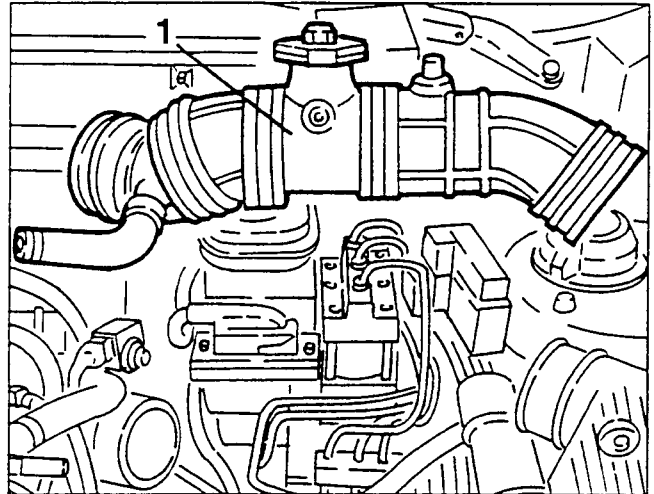
- Remove the battery.
- Remove the relays from the battery support and set them to one side with their wirings to prevent them from hindering the subsequent operations.
- 1. Slacken the fastening screws, then remove the battery support after removing the rear cable support from it.



1. Disconnect the electrical connection from the air-flow meter.
2. Disconnect the electrical connection from the intake air temperature sensor (NTC).
3. Slacken the fastening clamp and disconnect the oil vapour recirculation pipe from the cylinder head.

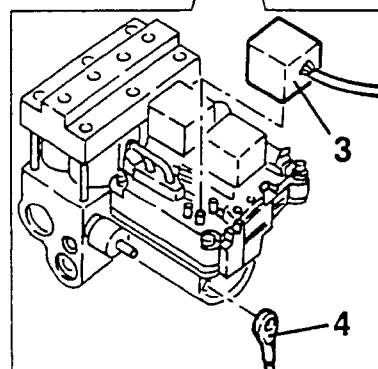
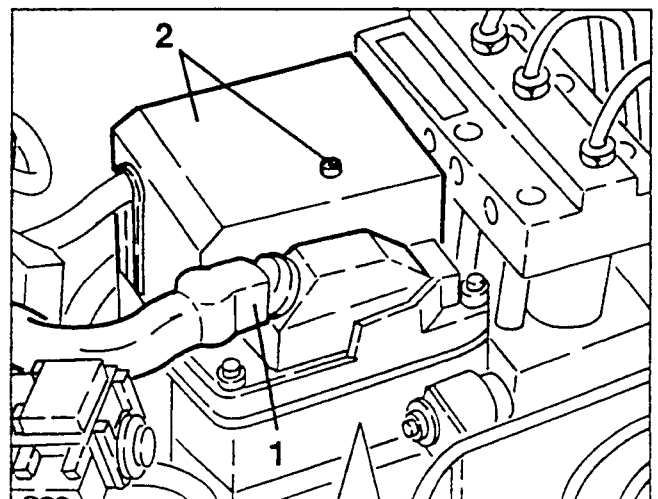


1. Slacken the fastening clamps and remove the corrugated sleeve complete.

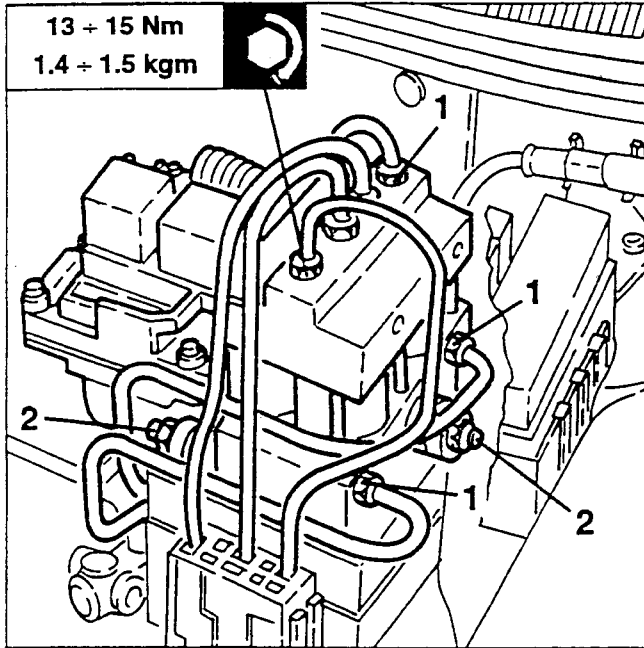


- Move aside the fusebox at the side of the brake-clutch fluid reservoir to prevent it from hindering subsequent operations.
- Remove the brake-clutch fluid reservoir (see specific paragraph).

  1. Disconnect the electrical connection of the A.B.S. control unit.
  2. Slacken the fastening screw and remove the control unit cover.
  3. Disconnect the four pin electrical connection from the control unit.
  4. Disconnect the earth cable.



1. Disconnect the fittings of the pipes of the hydraulic aggregate.
2. Slacken the three nuts fastening the flexible supports of the hydraulic aggregate, then remove it.



When refitting relieve the air from the braking system (see specific paragraph).

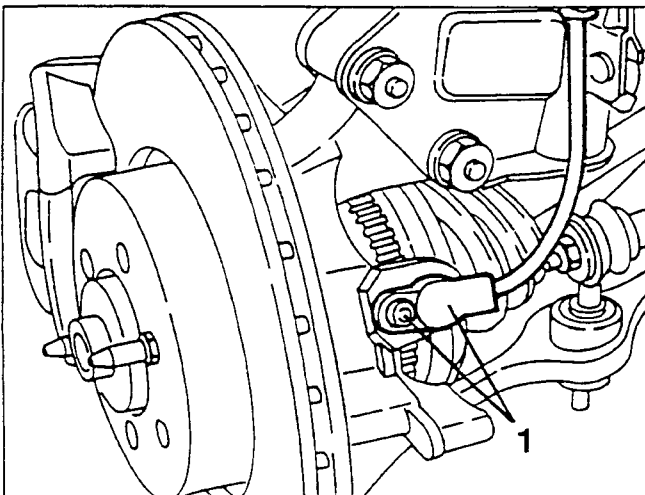
### DISASSEMBLY/RE-ASSEMBLY

Proceed as described for Boxer engines.

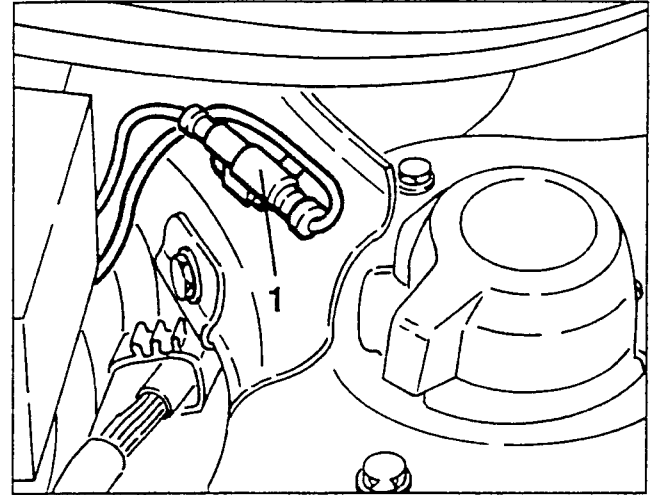
### FRONT INDUCTIVE SENSORS

#### REMOVING/REFITTING

1. Slacken the screw fastening the A.B.S. inductive sensor from the wheel upright.



1. Disconnect the electrical connection near the shock absorber dome and remove the inductive sensor together with the wiring, after releasing it from the fasteners.

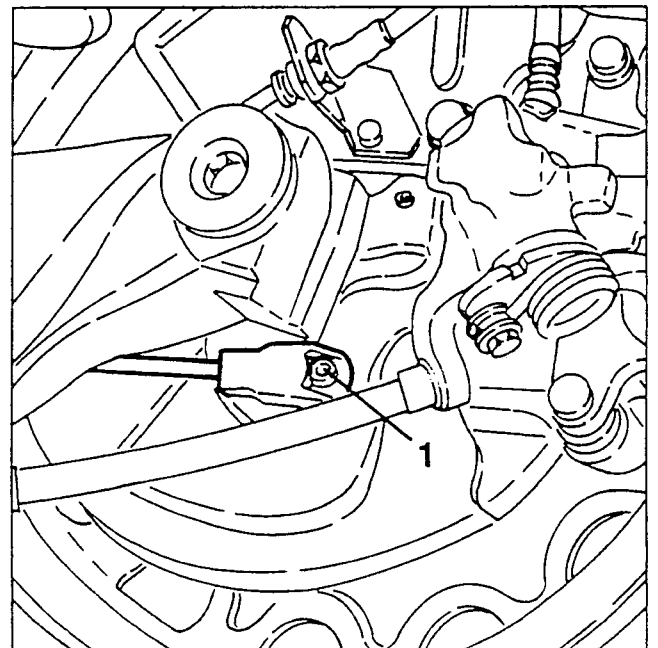


When refitting grease the seat of the inductive sensor with the specified grease.

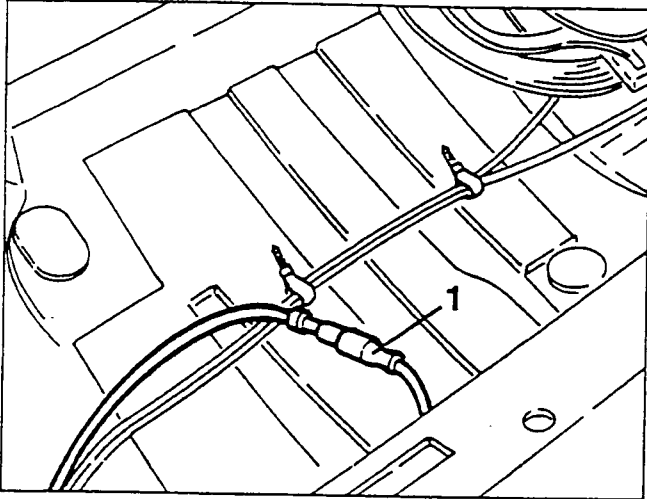
### REAR INDUCTIVE SENSORS

#### REMOVING/REFITTING

1. Slacken the screw fastening the inductive sensor to the brake disk connection.



1. Tilt forward the rear seat cushion, disconnect the electrical connection of the inductive sensor and remove it.



When refitting grease the seat of the inductive sensor with the specified grease.

### CHECKING THE GAP

- Using a thickness gauge, check the gap between the inductive sensor and the corresponding phonic wheel.



|                             |               |
|-----------------------------|---------------|
| Front inductive sensors gap | 0.3 + 1.05 mm |
| Rear inductive sensors gap  | 0.2 + 1.15 mm |



#### CAUTION:

The gap is not adjustable as shims for this purpose are not supplied. Check that the sensor and the teeth of the phonic wheel are intact if the gap is not within the specified tolerance.

**BOSCH 5.3 ABS**

(from chassis no. ....)

**DESCRIPTION**

The Bosch 5.3 A.B.S. further optimises compactness (ease of assembly), lightness and reliability.

The use of new microhybrid electronic components, optimisation of the flows as a result of the study of the new, more compact shapes of the valve bodies and the reduction of the number of hydraulic components since they are pressed directly onto the valve seat of the nozzles which are previously assembled separately have made it possible to improve the characteristics of the solenoid valves.

The main components of the system are:

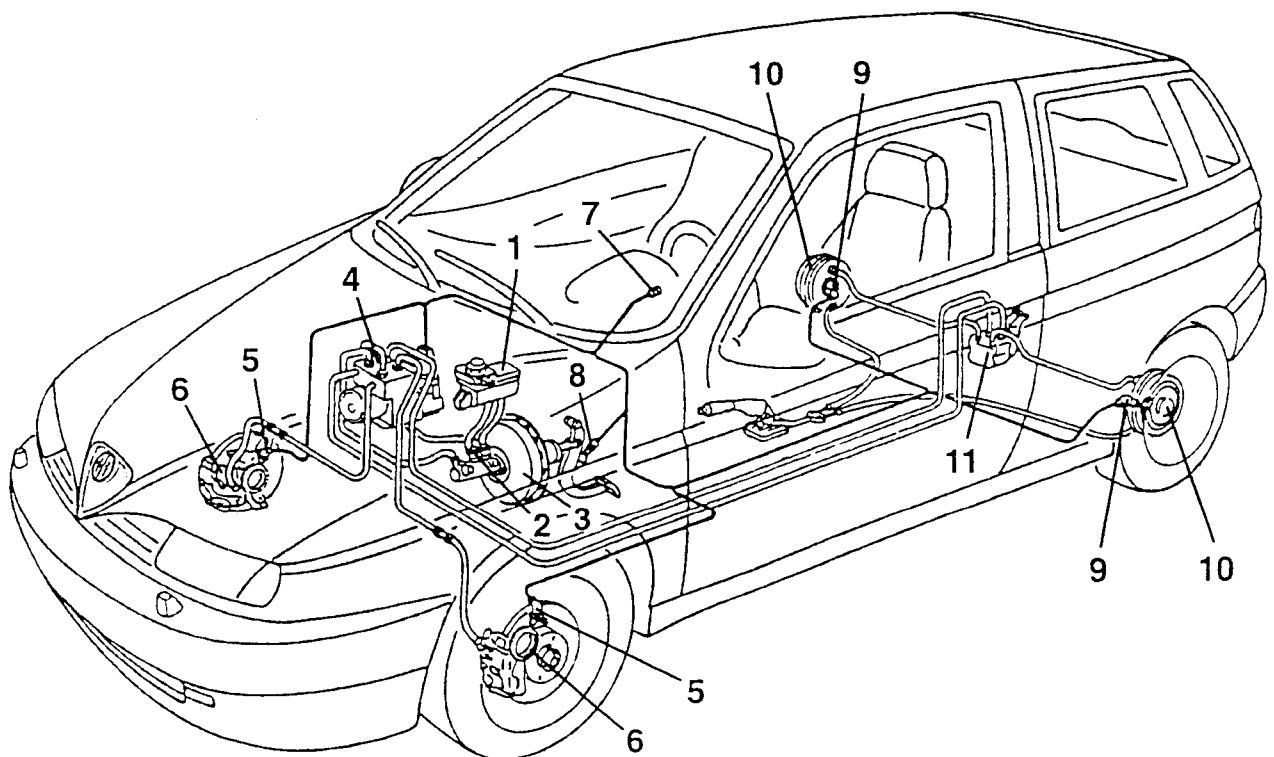
- new electronic control unit, more powerful and versatile than the previous ones;
- electrohydraulic control unit (4) which modulates the braking pressure at the brake calipers through eight solenoid valves, two for each wheel;

- four sensors (5) and (9), one for each wheel, which detect the angular rotation speed of the wheels.

The system is completed by:

- the hydraulic system piping;
- a specific wiring loom;
- a switch on the brake pedal (8) for detecting the braking condition;
- a warning light (7), on the check panel.

In addition, under particular diagnosis conditions, the warning light (7), supplies information about the faults memorised by the control unit through a series of coded flashes (see Electric System Diagnosis").

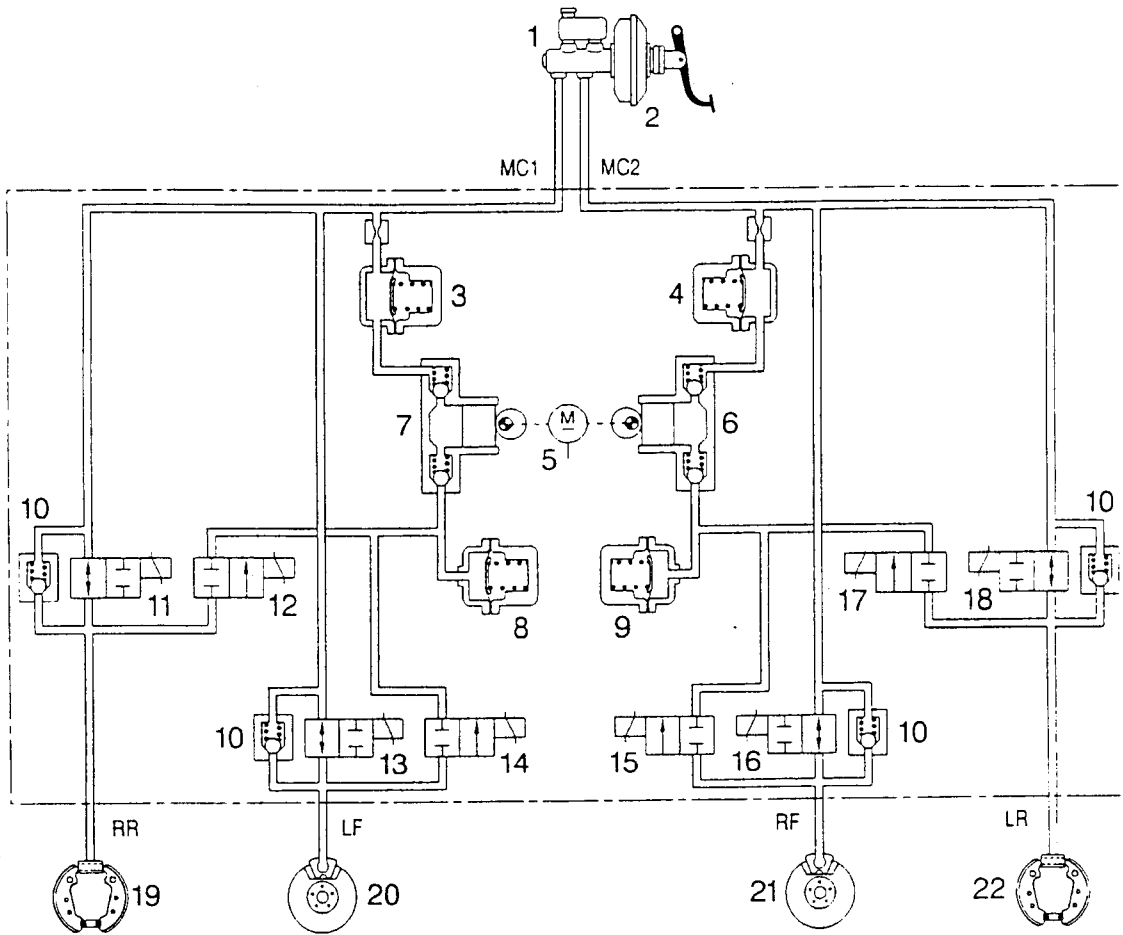


1. Brake fluid reservoir
2. Brake pump
3. Vacuum servobrake
4. Electrohydraulic control unit with electronic control unit incorporated
5. Front wheel rpm sensor

6. Front brakes
7. Failure warning light
8. Stop lights control switch
9. Rear wheel rpm sensor
10. Rear brakes
11. Braking load proportioning valve



### Hydraulic system layout



Braking system with double crossed circuit

1. Brake control pump
2. Servobrake
3. High pressure accumulator (damping chamber)
4. High pressure accumulator (damping chamber)
5. Recovery pump drive motor
6. Recovery pump
7. Recovery pump
8. Low pressure accumulator (reservoir)
9. Low pressure accumulator (reservoir)
10. Fast pressure reduction valve
11. Right rear charge solenoid valve
12. Right rear discharge solenoid valve
13. Left front charge solenoid valve
14. Left front discharge solenoid valve
15. Right front charge solenoid valve

16. Right front discharge solenoid valve
17. Left rear charge solenoid valve
18. Left rear discharge solenoid valve
19. Right rear drum brake
20. Left front disk brake
21. Right front disk brake
22. Left rear drum brake

- MC1. Supply union for brake pump 1st stage  
 MC2. Supply union for brake pump 2nd stage  
 RR. Delivery union to right rear cylinder  
 FL. Delivery union to left front caliper  
 FR. Delivery union to right front caliper  
 RL. Delivery union to left rear cylinder

## COMPONENTS

### Electrohydraulic control unit

The electrohydraulic control unit comprises two sections fastened to one another: an electronic control unit and an electrohydraulic control unit.

On the basis of the signals received from the sensors and with the help of characteristic programmes mapped in its memories, the electronic control unit commands the electrohydraulic control unit.

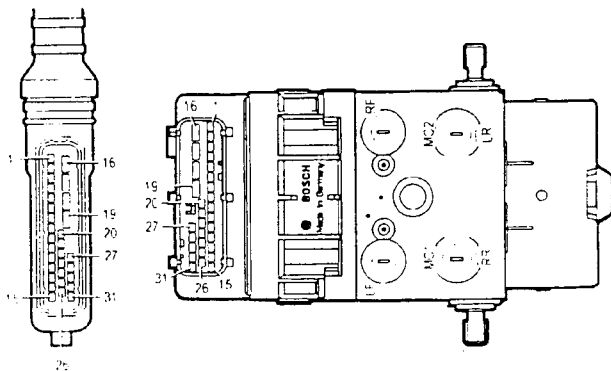
The electrohydraulic control unit is connected to the brake pump and to the A.B.S. system components through the pipes of the braking system.

The main change with respect to the previous versions is the replacement of the three-way valves with two 2-way solenoid valves for each wheel.

### Electronic control unit

The electronic control unit is formed of hybrid circuits with resistances, diodes, transistors and integrated logic circuits. The heart of the system are two CMOS microprocessors with 12K ROM which autonomously carry out the same programme and monitor one another mutually. Both receive the same input signals which each processes individually and only when the results obtained are identical, the control unit sends the operative command to the electrohydraulic control unit.

Conversely, if for example there is a fault in the wheel anti-lock system, the device cuts itself out and braking takes place conventionally: simultaneously, the fault warning light on the check panel comes on.



### Operating logic

The signals (alternate or analogue) sent by the rpm sensors to the electronic control unit are transformed by the input amplifier into square wave signals.

The frequency of these signals gives the control unit the corresponding values of speed, acceleration or deceleration of the single wheels.

From the combination of the single wheel peripheral speeds, a reference speed is processed which is continuously updated and indicates the speed of the car at all times.

When the driver presses the brake pedal the wheels can each decelerate to a different extent: comparison of the peripheral speed of each wheel with the reference speed keeps the skidding of each wheel constantly under control.

If the braking force causes a wheel to skid with respect to the others, the electronic control unit sends the command to the solenoid valves of the electrohydraulic control unit to reduce the braking force on the wheel that has lost grip. This way the wheel concerned regains speed.

The memory of the electronic control unit also contains threshold acceleration and deceleration values that none of the wheels may ever exceed.

Therefore, through systematic, very rapid comparison of the wheel skidding, deceleration and acceleration values, rolling of the tyre during braking is kept under control.

As soon as the foreseen combined acceleration/deceleration and skid values are exceeded, the electronic control unit intervenes with commands to the solenoid valves of the electrohydraulic control unit, in the three adjustment phases to lower, maintain or return the pressure generated by the driver on the brake pedal to the brake calipers, bringing the braking condition to the optimum values set by the system.

These phases determine an intermittent but extremely fast adjustment cycle which is repeated until the car stops. The electronic control unit commands the different phases supplying the solenoid valves pulses with different current intensities. It also makes sure that both rear wheels are given the same braking force applicable to the rear wheel that is more subjected to locking, i.e. the one with lower grip (to ensure stability).

If a fault is detected, the wheel anti-lock device cuts out and alerts the driver by turning on the warning light on the check panel, while however ensuring operation of the conventional braking system.

The electronic control unit is informed that the driver is braking by the signal from the switch on the brake pedal. Besides controlling braking, this information is also helpful under certain particular conditions, such as for example if a sharp acceleration that makes the wheels skid is followed by heavy braking, or in the case of irregular road surfaces (humps, steps) that can involve changes in speed of the wheel due to causes not linked with the braking in progress.

In these conditions the microprocessors process a strategy connected with the changes of speed of the wheels of these particular moments, bringing braking back to the correct parameters. Since these are particular conditions of braking control, the lack of connection of the switch on the brake pedal to the control unit does not compromise the efficiency of the system. For this reason it is not signalled by the warning light, nor is the A.B.S. system disabled.

Further details about the operating principle of the ABS are given below.

The electrohydraulic control unit is connected to the brake pump and to the brake caliper cylinders through the brake system lines and together with the electronic control unit it forms the electrohydraulic control unit.

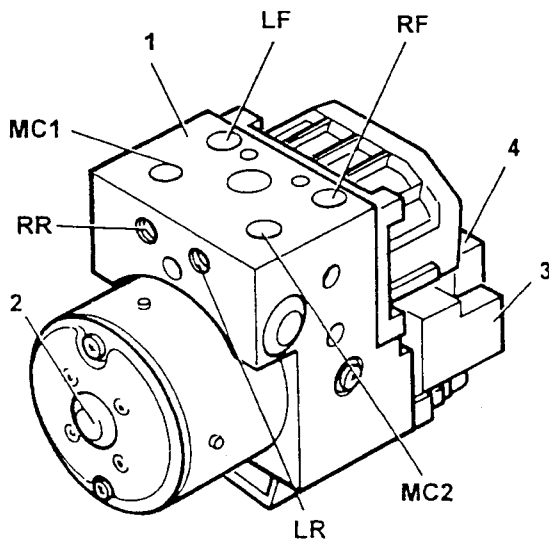
Its task is to change the pressure of the brake fluid in the brake caliper cylinders according to the command signals leading from the electronic control unit.

It comprises eight two-way solenoid valves (two for each hydraulic circuit) and an electric recovery pump (2) with double circuit.

The eight solenoid valves and the electric recovery pump are driven by the electronic control unit depending on the signals of the four rpm sensors. The pump makes it possible to recover the brake fluid during the pressure reduction phase making it available again upstream of the solenoid valves for the next pressure increase phase.

The unit is connected to the braking system through unions identified by the codes stamped on them as illustrated.

### Electrohydraulic control unit



1. Electrohydraulic control unit
2. Electric recovery pump
3. Electronic control unit
4. Control unit connector

### Pipe outlets

- MC1 Supply union from brake pump - circuit 1
- MC2 Supply union from brake pump - circuit 2
- LF Delivery union to left front brake caliper
- LR Delivery union to left rear brake caliper
- RF Delivery union to right front brake caliper
- RR Delivery union to right rear brake caliper

### Inductive sensors

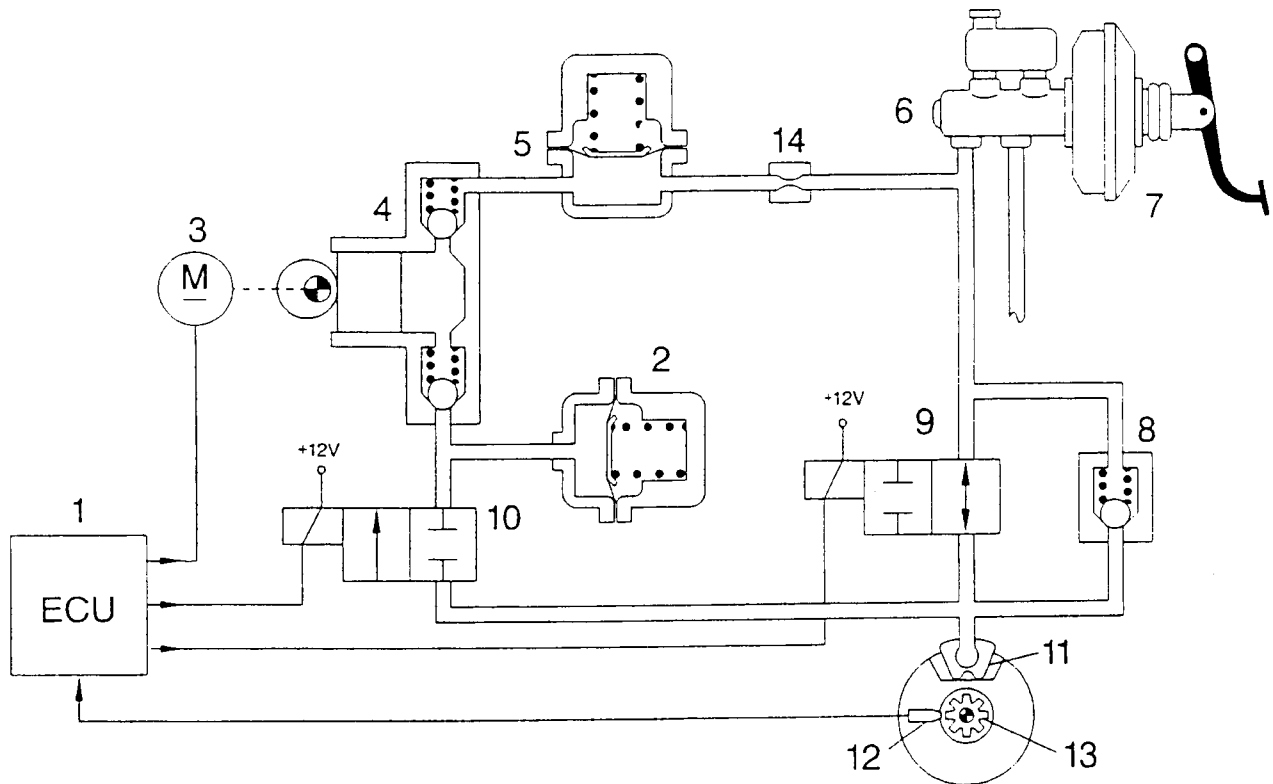
These are quite the same as those used for the previous versions.

**DESCRIPTION OF HOW THE WHEEL ANTI-LOCK SYSTEM WORKS****Rest position**

Each branch of the Bosch 5.3 ABS system is fitted with two 2-way solenoid valves; all the solenoid valves are managed by the control unit (1).

When the charge solenoid valve (9) is deactivated (not connected to earth by the control unit) it is in the opening position, thereby allowing the flow of brake fluid to the brake caliper.

The pressure is maintained by closing this valve, i.e. supplying it electrically.



1. Electronic control unit
2. Low pressure accumulator (reservoir)
3. Recovery pump drive motor
4. Recovery pump
5. High pressure accumulator (damping chamber)
6. Brake control pump
7. Servobrake

8. Fast pressure reduction valve
9. Charge solenoid valve
10. Discharge solenoid valve
11. Brake caliper
12. Revolution sensor
13. Phonic wheel
14. Restrictor

When the discharge solenoid valve (10) is deactivated (not connected to earth by the control unit) it is in the closed position and does not allow the fluid to be discharged on the low pressure accumulator (2).

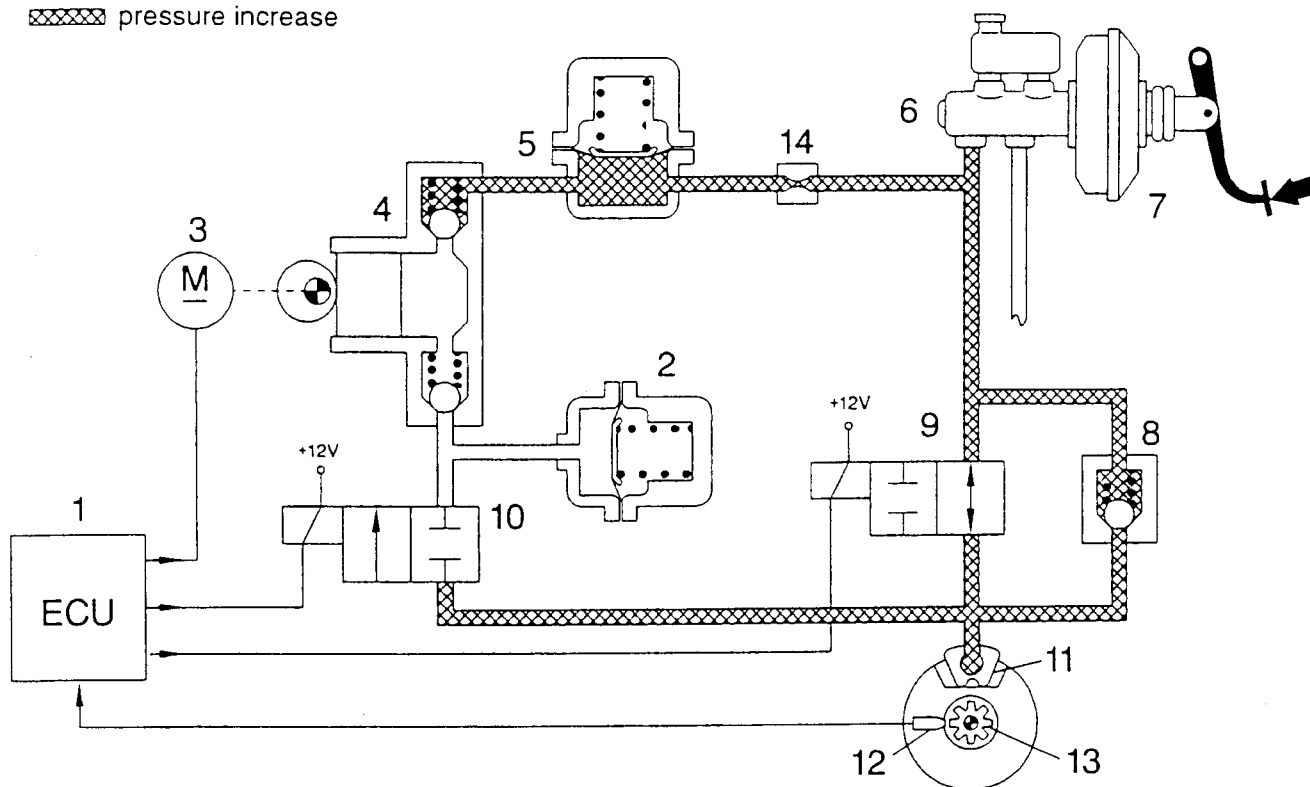
The accumulators (2) and (5) have the task of temporarily storing the brake fluid made available during the pressure reduction phase.

The recovery pump (4) sends the brake fluid that flows back from the brake calipers during pressure reduction to the brake pump via the corresponding accumulator.

On the basis of the signals received from the rpm sensors on the front and rear wheels, the electronic control unit drives the electrohydraulic control unit, which in turn changes the pressure of the brake fluid sent to the calipers according to three phases: increase, maintenance or reduction of the pressure.

### Pressure increase phase

▨ pressure increase



1. Electronic control unit
2. Low pressure accumulator (reservoir)
3. Recovery pump drive motor
4. Recovery pump
5. High pressure accumulator (damping chamber)
6. Brake control pump
7. Servobrake

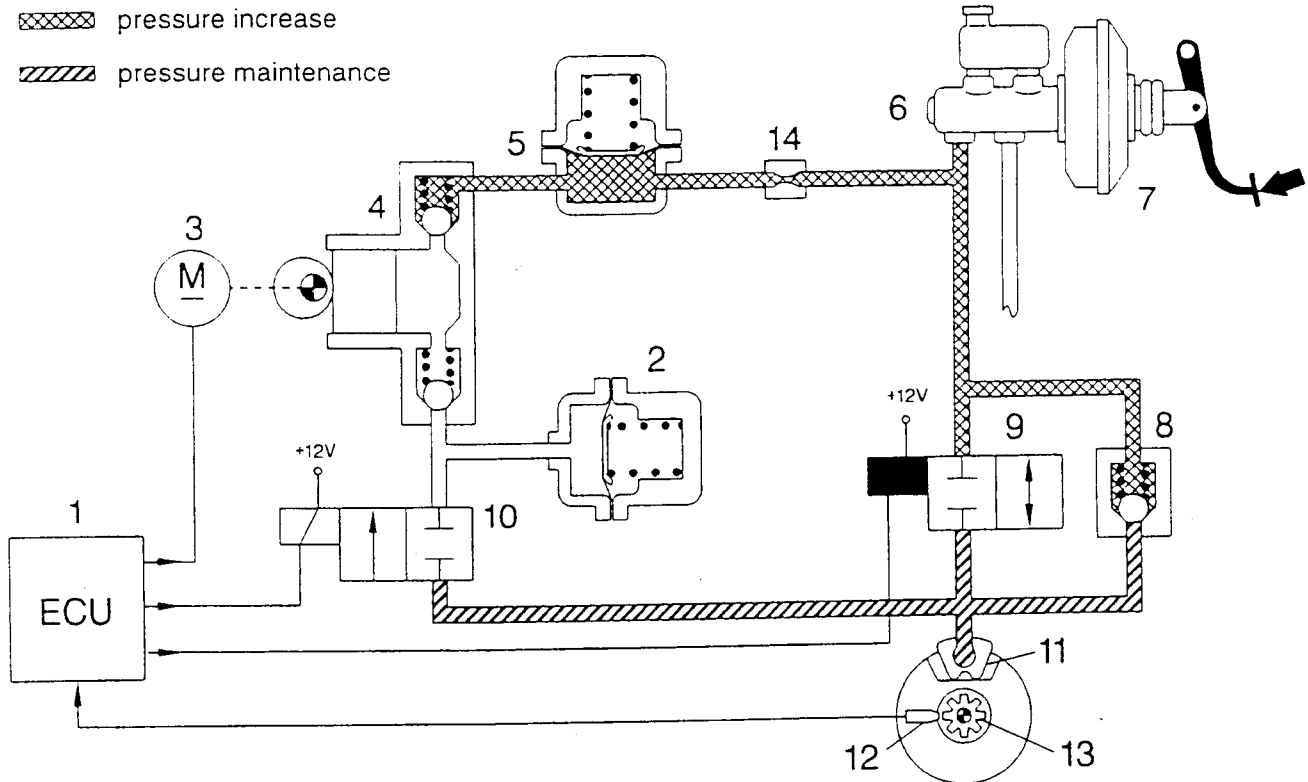
8. Fast pressure reduction valve
9. Charge solenoid valve
10. Discharge solenoid valve
11. Brake caliper
12. Revolution sensor.
13. Phonic wheel
14. Restrictor

When the driver presses the brake pedal, the pressure generated by the brake pump (6) reaches the brake caliper without undergoing changes, as the solenoid valves (9) and (10) of the hydraulic unit are not connected to earth by the electronic control unit. When the braking force increases, deceleration of the wheel increases accordingly; this causes faster deceleration of the car (i.e. wheel slip increases).

The slip rate must not exceed a determinate value beyond which the wheel loses its grip on the ground and starts to slide, losing direction and lengthening braking distances.

The revolution sensor (12) signals that deceleration values have been reached that would compromise the grip of the wheel with the ground: at this point the electronic control unit (1) commands the solenoid valves of the electrohydraulic unit, reducing the braking force and allowing the wheel to increase speed and recover grip.

## Pressure maintenance phase



1. Electronic control unit
2. Low pressure accumulator (reservoir)
3. Recovery pump drive motor
4. Recovery pump
5. High pressure accumulator (damping chamber)
6. Brake control pump
7. Servobrake

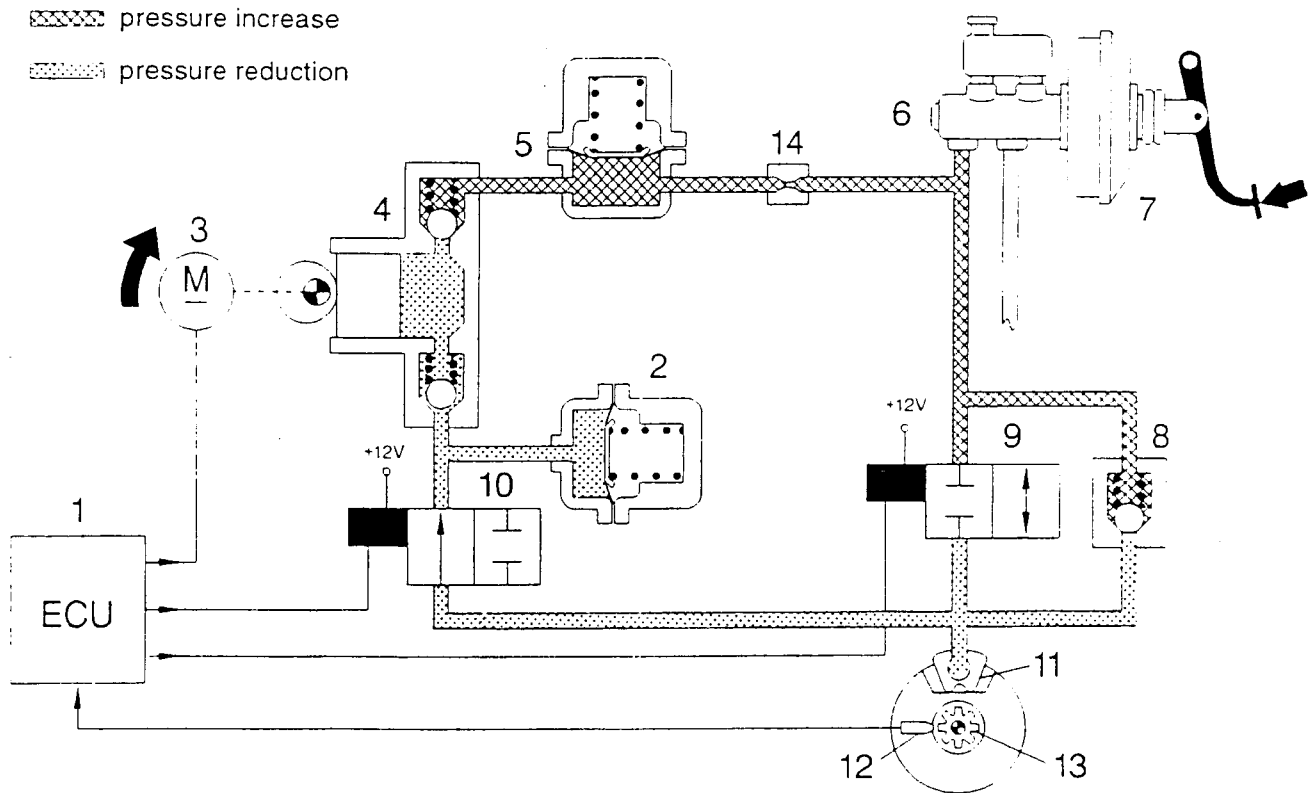
8. Fast pressure reduction valve
9. Charge solenoid valve
10. Discharge solenoid valve
11. Brake caliper
12. Revolution sensor
13. Phonic wheel
14. Restrictor

During this phase, the electronic control unit (1) connects the charge solenoid valve (9) to earth, so it closes, while the discharge solenoid valve (10) that is not connected to earth, is already closed.

The hydraulic connection between the brake pump (6) and the brake caliper (11) is cut off (standby position). The pressure in the brake caliper (11) is kept constant at the rating reached previously, regardless of the pressure on the brake pedal.

Although the braking effort maintains a continuous slowing action, the wheel changes its speed, in relation to the grip on the ground, until the signal of the rpm sensor (12) gives a value similar to the reference speed calculated by the electronic control unit (1). At this point, the control unit passes from the maintenance phase to the pressure increase phase (if the wheel accelerates) or reduction (if the wheel tends to lock).

## Pressure reduction phase



1. Electronic control unit
2. Low pressure accumulator (reservoir)
3. Recovery pump drive motor
4. Recovery pump
5. High pressure accumulator (damping chamber)
6. Brake control pump
7. Servobrake

8. Fast pressure reduction valve
9. Charge solenoid valve
10. Discharge solenoid valve
11. Brake caliper
12. Rpm sensor
13. Phonic wheel
14. Restrictor

The electronic control unit (1) detects the tendency of the wheel to lock and activates the electrohydraulic unit to keep deceleration of the wheel within the thresholds allowed.

The electronic control unit (1) connects to earth the charge (9) and discharge (10) solenoid valves.

The charge solenoid valve (9) remains closed keeping the connection between the brake pump (6) and brake caliper (11) shut; The discharge solenoid valve (10) opens putting the brake caliper (11) into hydraulic connection with the low pressure accumulator (2) and the recovery pump (4), in order to withdraw part of the fluid at the brake caliper (11) and reduce the pressure on the caliper itself.

Simultaneously, the electronic control unit (1) supplies the drive motor (3) of the recovery pump (4) which makes it possible to re-admit the fluid taken from the brake caliper (11) to the main circuit. The accumulator (2) or low pressure reservoir in the circuit has the task of storing part of the brake fluid taken from the calipers. Through the circuit of the recovery pump (4), the fluid

is withdrawn and sent, via the damping chamber (5) and the restrictor (14), into the main circuit of the brake pump (6). In this phase a series of pressure waves (or hydraulic thrusts) are generated which are damped by the presence of the damping chamber (5) and the restrictor (14).

During braking, light pushes on the brake pedal are to be considered normal when the ABS system is operational. During this phase, due to the effect of the lowering of the braking force, the wheel tends to resume the reference speed calculated by the electronic control unit (1).

The type of braking is intermittent or by steps with a succession of the phases depending on the wheel rolling conditions and according to a repetitive cycle that is not perceived by the driver, in the form of jerks, owing to the quickness and frequency with which it occurs and because it is evened out by the inertia of the wheel which is prevented from reaching extreme skidding conditions because of the rapidity of the device.


With the car without A.B.S. the driver is able to act intermittently on the brake pedal with a frequency of 2 cycles per second (2 presses and 2 releases). With the A.B.S. system, the cycles increase to 4, 10 per second (depending on grip). Normally operation of the A.B.S. ceases at speeds below 2.75 km/h to allow the wheels lock completely when the car reaches a halt.

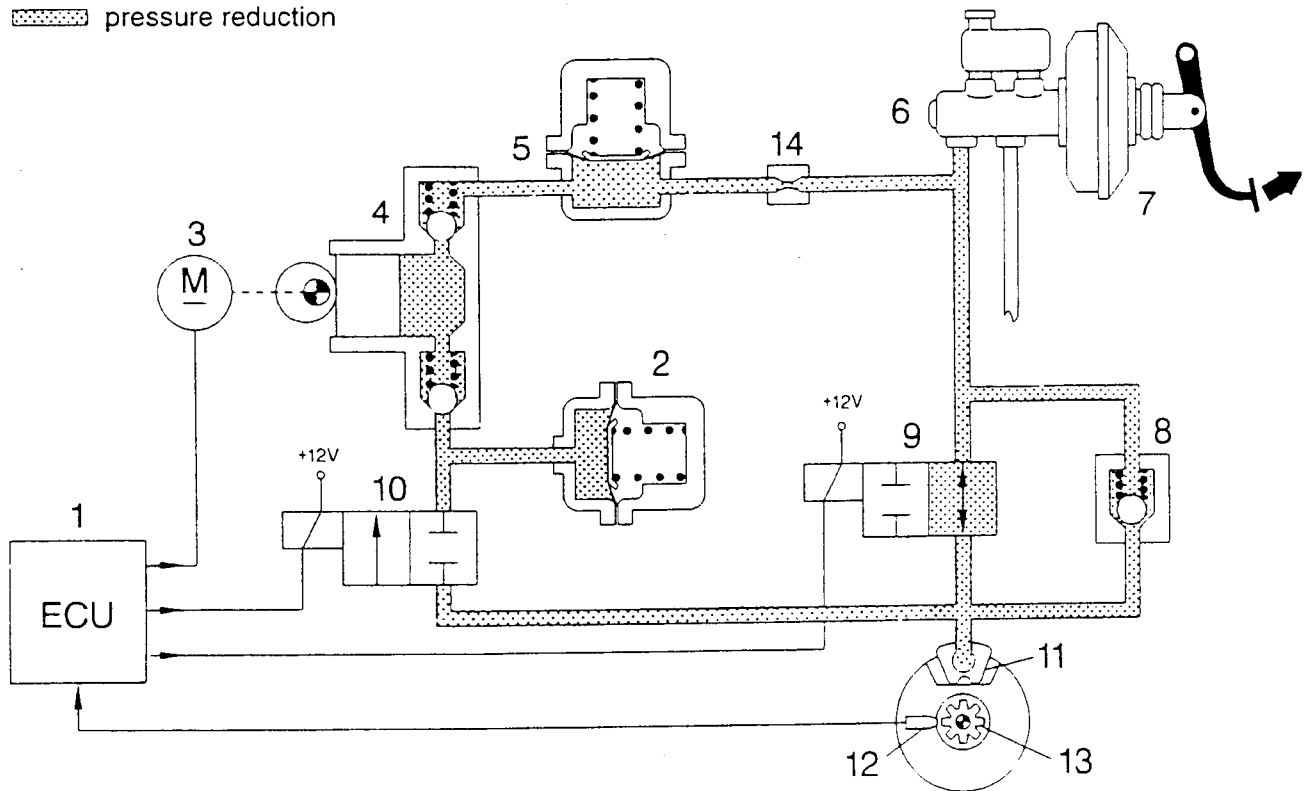
NOTA: The recovery pump is of the free piston type with double circuit, driven by an electric motor that turns constantly during the recovery phase.

The pistons are not coupled with the electric motor but they are moved by the cam, only upon arrival of the brake fluid.

Therefore, the pump can perform only one impelling stroke while suction is not possible owing to the lack of mechanical connection between motor and pump.

### Brake pedal release

 pressure reduction



1. Electronic control unit
2. Low pressure accumulator (reservoir)
3. Recovery pump drive motor
4. Recovery pump
5. High pressure accumulator (damping chamber)
6. Brake control pump
7. Servobrake

8. Fast pressure reduction valve
9. Charge solenoid valve
10. Discharge solenoid valve
11. Brake caliper
12. Revolution sensor
13. Phonic wheel
14. Restrictor

To enable rapid reduction of the pressure on the brake caliper (11) when the brake pedal is released, the

system is fitted with a non return valve (8) in parallel with the inlet solenoid valve (9).



## INSTRUCTIONS FOR REMOVING/REFITTING

The electrohydraulic control unit cannot be overhauled and it is fault-proof until it is tampered with. It must be replaced if found to be faulty.

After each replacement of a hydraulic unit, revolution sensor, electronic control unit or wiring (especially if after an accident) the entire A.B.S. system must be checked with the Tester.

After all operations on the hydraulic system of the A.B.S. or brake system, it is necessary to fill with DOT 4 brake fluid, relieve the air, and check the tightness of all the connection points.

The electrohydraulic control unit is supplied filled with DOT 4 brake fluid and with the solenoid valves not supplied. The operation for filling with fluid and relieving the air is the same as for a conventional system, but requires more time.

During removal of the electrohydraulic unit avoid overturning it to prevent spilling the oil contained in the hydraulic part.

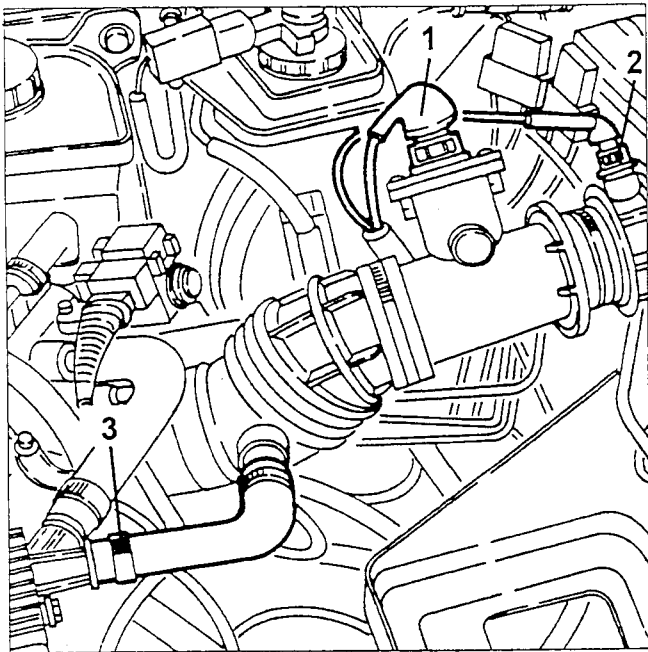
When refitting pay attention to the unions: to prevent mistakes in connecting the various parts of the braking circuit during repair operations, the connections of the hydraulic modulator unit are of different sizes (M10x1 and M12x1), the unions are also identified by the codes stamped on them.

### HYDRAULIC UNIT T. Spark 16V Engines

#### DISCONNECTION/RE-CONNECTION

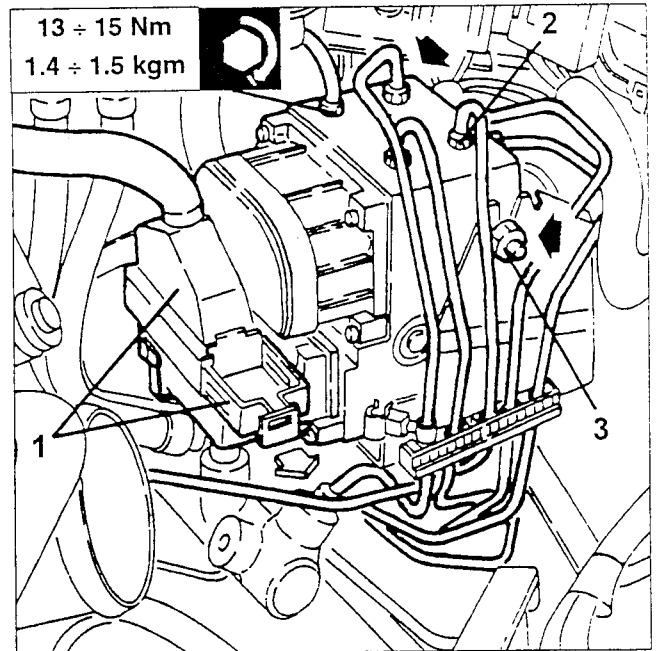
- Disconnect the battery terminals and remove it.

1. Disconnect the electrical connection from the air inflow tester.
2. Disconnect the electrical connection from the temperature sensor of sucked air.
3. Loosen the hose clamp and disconnect the pipe for oil vapours recirculation from the cover of the cylinder head.



- Let the brakes-clutch fluid drain out completely (see specific paragraph).

1. Pull forwards the blocking device of the gearcase comb, hence extract it from its seat.
2. Disconnect the pipe joints from the hydraulic unit.
3. Unscrew the two clamping nuts and remove the hydraulic unit.

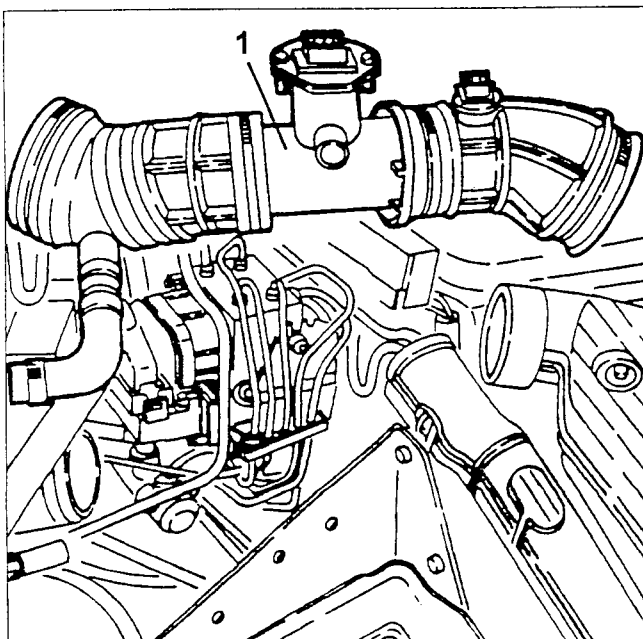


**ATTENTION:** The hydraulic unit is not repairable. In case of defects or failure, it must be replaced.



While reconnecting, perform the air exhaustion operation from the braking system.(see specific paragraph).

1. Loosen the two hose clamps, hence remove the complete corrugated manifold.



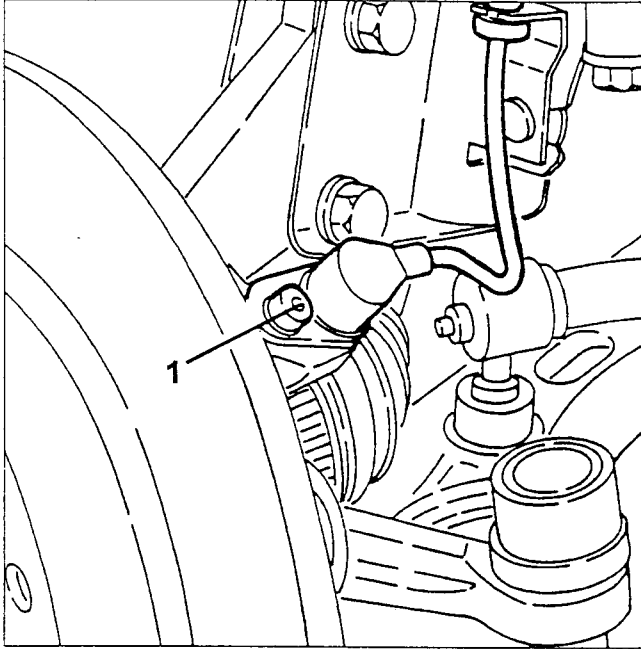
### HYDRAULIC UNIT Turbodiesel Engine

Refer to the corresponding procedure regarding the T. SPARK 16V motorization, considering that the accessibility of the hydraulic unit is different.

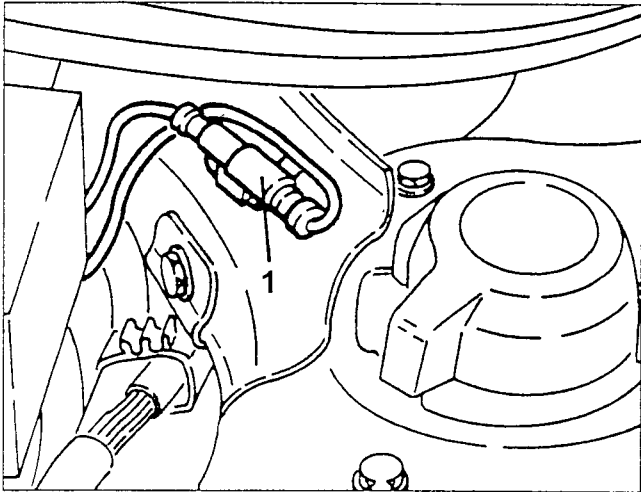
## FRONT INDUCTIVE SENSORS


### DISJOINING/ RE-JOINING

1. Unscrew the clamping screw of the ABS inductive sensor to the wheel post.



1. Disconnect the electrical connection located in proximity of the shock absorber dome and remove the sensor and the wiring after loosening the clamps.

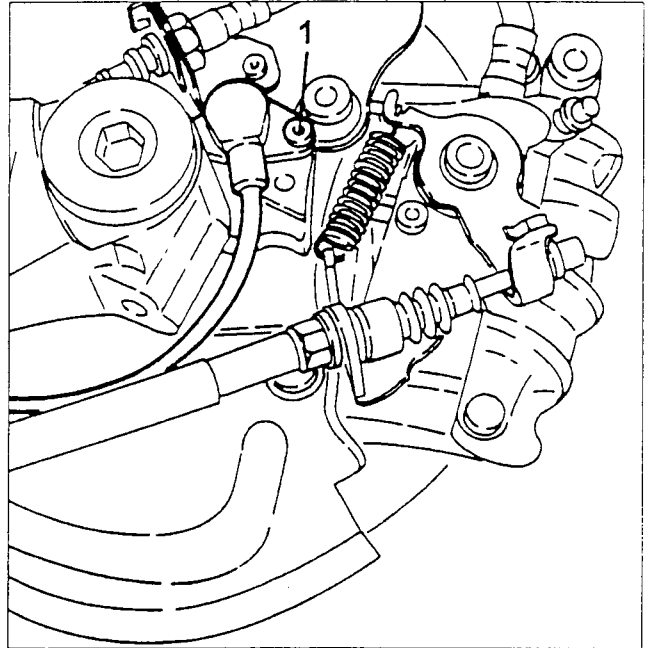


 When re-joining, grease the sensor seat with the prescribed grease.

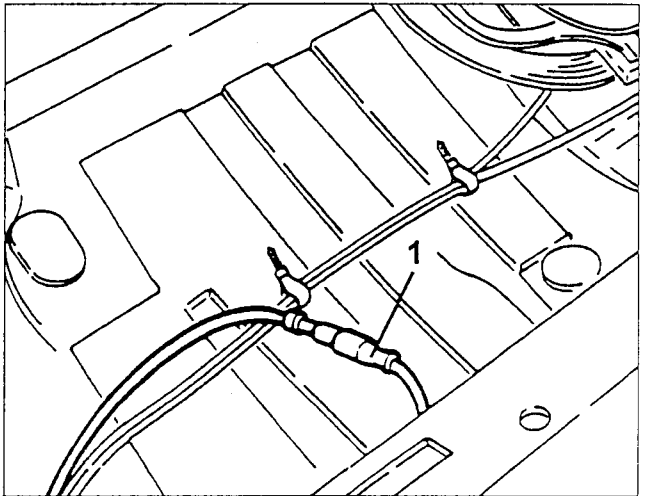
## REAR INDUCTIVE SENSORS


### DISJOINING/RE-JOINING

1. Unscrew the clamping screw of the inductive sensor to the wheel hub.




1. Turn the cushion of the back seat over, disconnect the electrical connection of the inductive sensor and remove it.




 When re-joining, grease the sensor seat with the prescribed grease.

## ENTREFER CHECKING

- Using a thickness gauge, estimate the entrefer value between the inductive sensor and the corresponding phonic wheel.

|                                                                                     |                                  |               |
|-------------------------------------------------------------------------------------|----------------------------------|---------------|
|  | Front inductive entrefer sensors | 0.3 ÷ 1.05 mm |
|                                                                                     | Rear inductive entrefer sensors  | 0.2 ÷ 1.15 mm |

 **WARNING:** The entrefer is not adjustable as compatible thickness is not provided. Check the integrity of the sensor and of the teeth of the phonic wheel in case of a value besides the prescribed tolerance.

**ABS BOSCH 5.3 WITH EBD  
(99s Models)****DESCRIPTION**

This A.B.S. system differs from the "A.B.S. BOSCH 5.3" system because it adopts:

- an electronic braking distribution frame (which replaces the traditional mechanical braking control system)

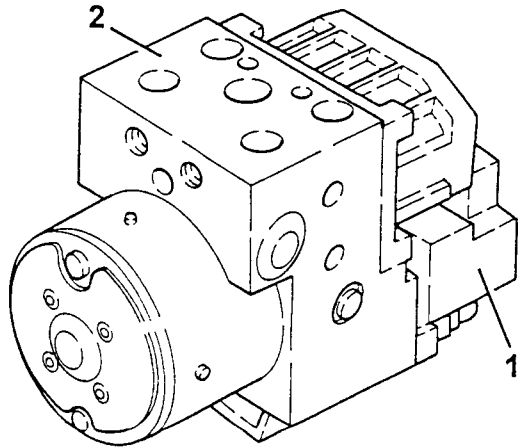
- active sensors in place of inductive ones.

The A.B.S. system is composed by:

- an integrated electronic gearcase
- an electrohydraulic gearcase which modulates the braking pressure through eight electrovalves, two for each wheel.
- four active sensors detecting the angular speed of the wheels rotation.

**COMPONENTS****Electrohydraulic group**

It is made by an electronic gearcase (1) and by an electrohydraulic one (2).

**Electronic gearcase**

The electronic gearcase has the following functions:

- to acquire the data coming from the active sensors of the wheel revolutions.
- to store the checking parameters defined during the vehicle's truing.
- to store the checking software
- to process the acquired data
- to control the braking process
- to detect failures and defects of the braking system components

- to store the failure codes and activate the pilot lights ABS and EBD
- to transmit and to receive data through the diagnostics connectors.

**Electrohydraulic gearcase**

The electrohydraulic gearcase is made by:

- eight two-way electrovalves
- a double-circuit recovery pump
- two low pressure batteries
- two high pressure batteries.

It modulates the fluid's pressure to the calipers through electrovalves and by:

- increasing the brakes fluid pressure
- maintaining the brakes fluid pressure
- discharging the brakes fluid pressure.

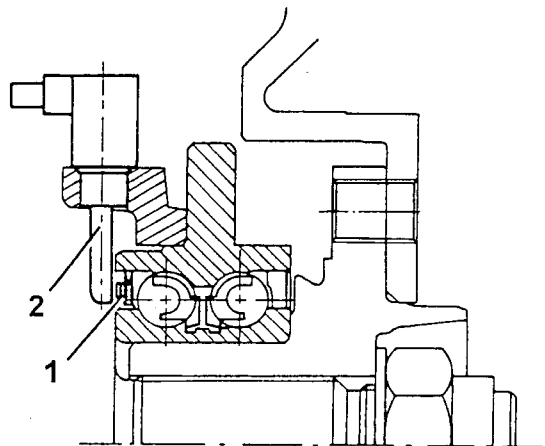
**Active sensors**

They are composed by two main elements:

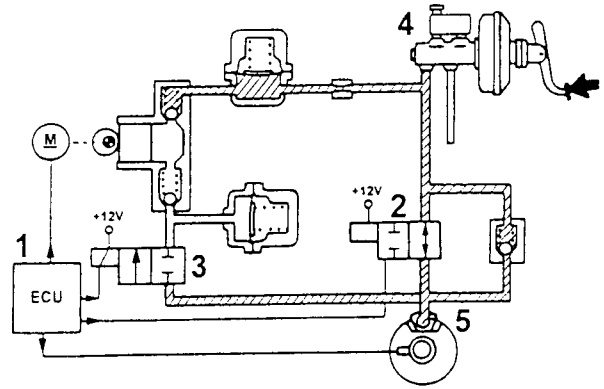
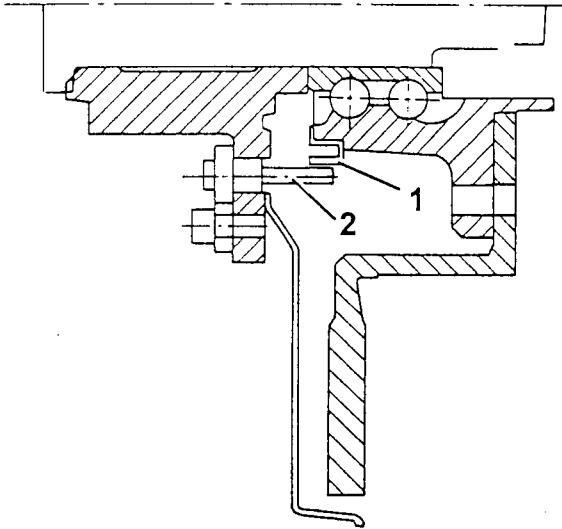
- a magnetic multi-polar coder (1) integrated in the bearing of the wheel hub
- a picker up (2).

The advantages offered by the active sensors are:

- reduction in the electromagnetic sensitivity
- less weight and smaller dimensions
- simplification of transmission joints to eliminate phonic wheels.

**Front active sensors**

## Rear active sensors



## FUNCTIONING DESCRIPTION OF ABS SYSTEM

The electronic gearcase elaborates the signals coming from the active sensors and from the control switch of stoplights and modulates the brakes fluid pressure under the conditions of:

- phase of pressure increase
- phase of pressure holding
- phase of pressure reduction.

### Phase of pressure increase

By pressing of the brake pedal, the electronic gearcase (1):

- does not feed the charging electrovalve (N.A.) (2)
- does not feed the discharging electrovalve (N.C.) (3).

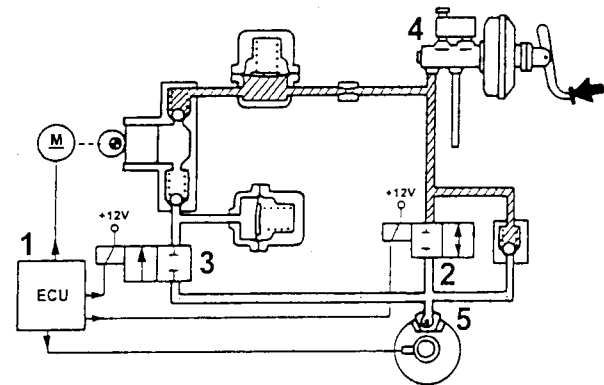
Therefore the pressure produced by the brake (4) reaches the calipers (5) without variations.

### Phase of pressure holding

The electronic gearcase (1):

- feeds the charging electrovalve (N.A.) (2)
- does not feed the discharging electrovalve (N.C.) (3).

Therefore the hydraulic connection between the brakes pump (4) and the calipers (5) is interrupted. The calipers' pressure (5) stays constant even while increasing the pressure onto the brake pedal.



### Phase of pressure reduction

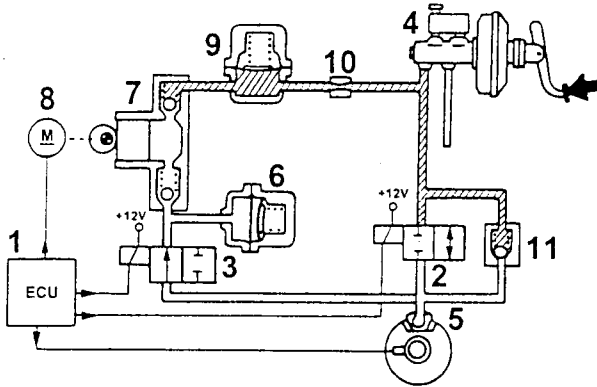
The electronic gearcase (1):

- feeds the charging electrovalve (N.A.) (2)
- feeds the discharging electrovalve (N.C.) (3).

The hydraulic connection between the brakes pump (4) and the calipers (5) is interrupted and the discharging electrovalve (3) opens and puts into connection the caliper (5) with the low pressure battery (6) and the recovery pump (7).

The electronic gearcase (1) feeds, besides, the control motor (8) of the recovery pump (7) so to let the fluid taken away from the caliper (5) flow again. The fluid goes through the high pressure battery (9) and the squeeze (10) which have a damping function.

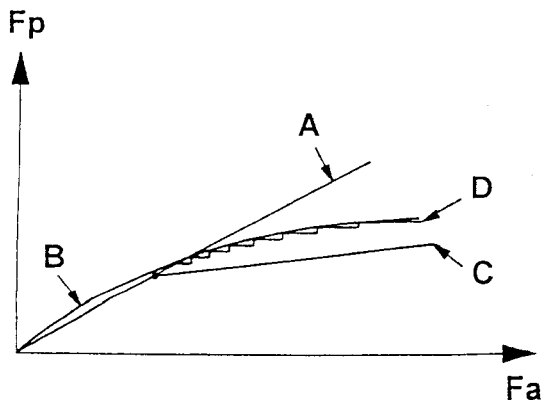
The system is equipped with a one-way valve (11) which is parallel to the charging electrovalve (2) so enabling a fast reduction of the pressure onto the caliper (5) while releasing the brake pedal.



### EBD (Electronic Brake force Distribution)

The EBD controls the distribution of the braking power and therefore replaces the traditional mechanical braking device so enabling to :

- intervene onto the rear calipers.
- improve distribution of the braking power
- intervene under any load condition (both static and dynamical), of running and of car degradation (worn tyres, brakes and suspensions)
- implement a strategy following the ideal distribution curve.



- Fa*. Braking power of the front axle
- Fp*. Braking power of the rear axle
- A. Distribution curve performed by the braking system
- B. Ideal distribution curve
- C. Traditional distribution curve
- D. Distribution curve performed by EDB functioning

The EDB failing functioning is signalled by the simultaneous lighting of the pilot lights of:

- the A.B.S.
- the insufficient brake fluid and /or inserted hand brake

It is therefore necessary to drive the car carefully to the closest authorized service center to have the system checked, should it fail.

### Recovery

The electronic gearcase is equipped with a safety circuit which controls the ABS system's efficiency. With the key inserted for four seconds, the safety circuit controls:

- the functioning of the electronic gearcase
- it starts the electrovalves to check the functioning
- it starts the recovery pump to check the functioning
- it checks the signals from the active sensors.

The safety circuit checks the presence of signal in the active sensors.

The safety circuit, with the car running, acts as follows:

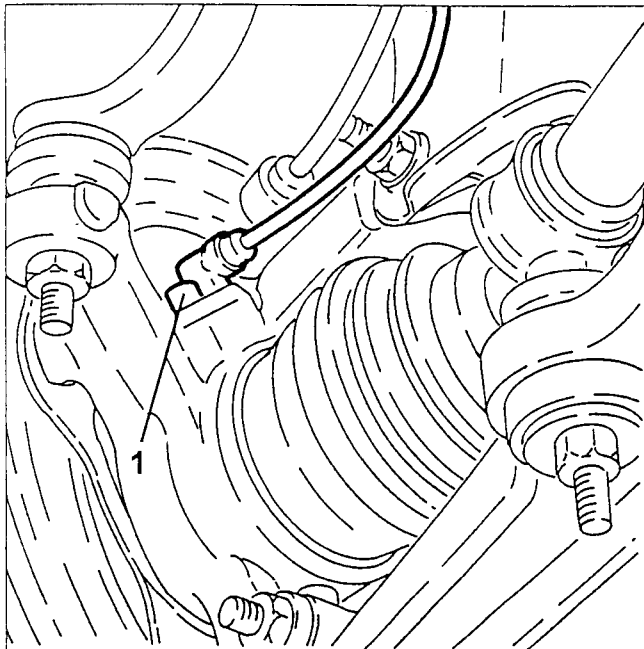
- continuously compares the angular speed of the wheels to the calculated reference speed.
- checks the memory's conditions
- checks the functioning of the two remote control switches and of the electrovalves.
- constantly checks the battery voltage
- checks the efficiency of the brake pedal switch.

If, during the checking phase, the safety circuit has detected defects or failures, it acts as follows:

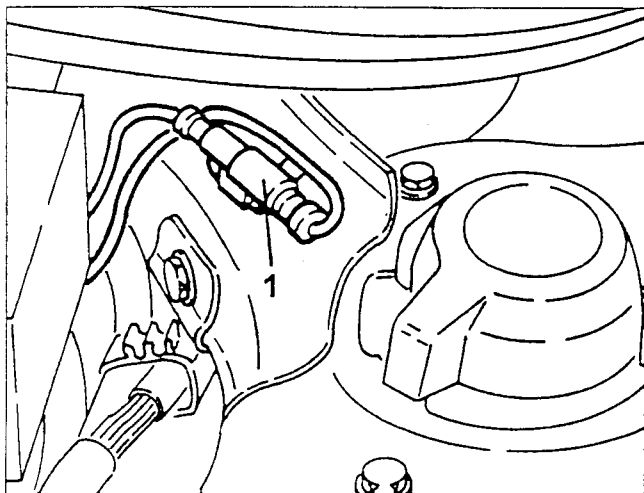
- disconnects the ABS guaranteeing the functioning of the traditional braking system.
- signals the failure condition to the driver through the lighting of the corresponding pilot light aboard.

**FRONT ACTIVE SENSORS****DISCONNECTION/RE-CONNECTION**

1. Unscrew the clamping screw of the active ABS sensor to the wheel riser.



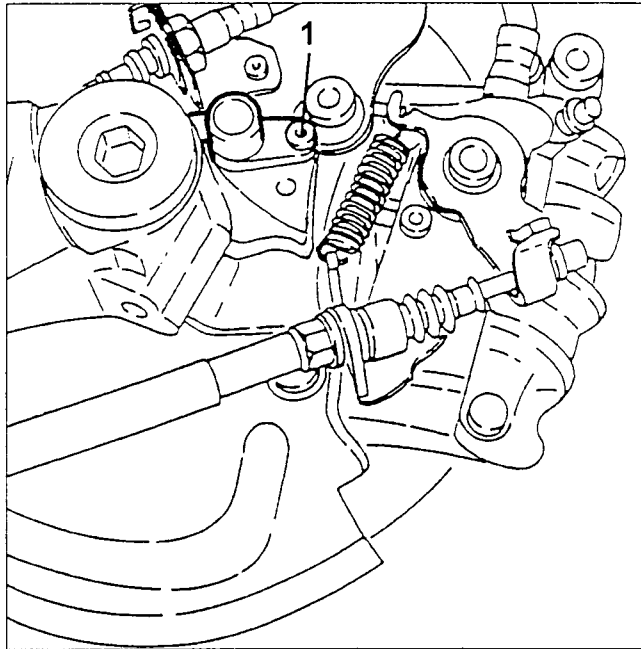
1. Disconnect the electrical connection close to the shock absorber dome and remove the sensor together with the wiring after having loosened the clamps.



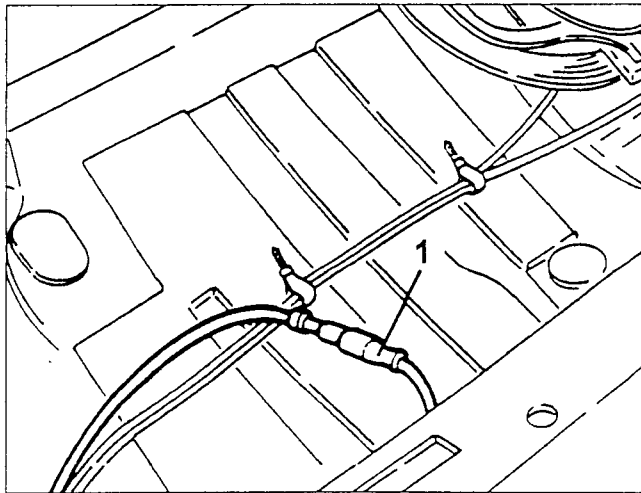
 When re-connecting, grease the seat of the active sensor with the prescribed grease.

**REAR ACTIVE SENSORS****DISCONNECTION/RE-CONNECTION**

1. Unscrew the clamping screw of the active sensor to the wheel's hub.



1. Turn the back seat cushion forwards over, disconnect the electrical connection of the active sensor and remove it.



 When re-connecting, grease the seat of the active sensor with the prescribed grease.



T. S.  
16V



T. S.  
16V



T. S.  
16V

## CLUTCH

### INDEX

#### CLUTCH COMMAND

- Clutch pump .....1
- Clutch pedal.....1
  
- Clutch pump ('98 Models) .....2
- Clutch pedal ('98 Models).....2

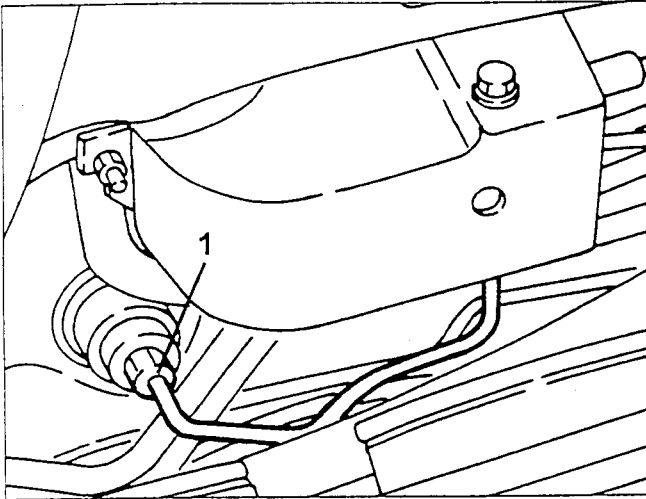
For the information not given here, see the corresponding groups of "145 - 146 - Base Manual".



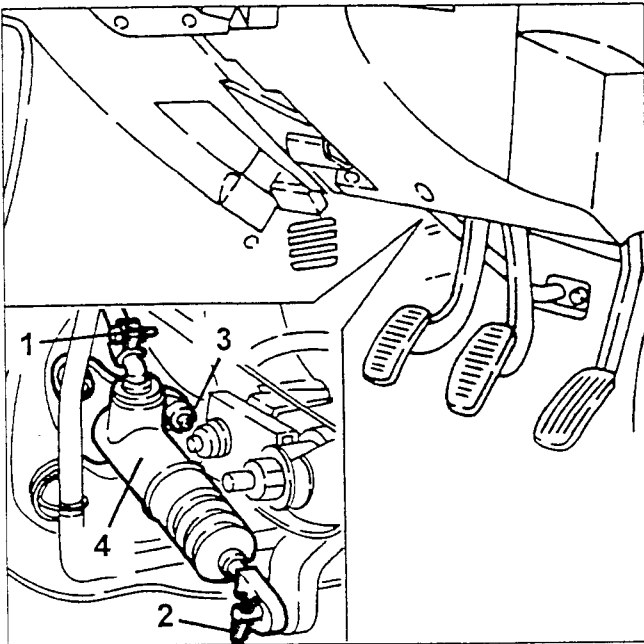


**CLUTCH PUMP****REMOVAL/REFITTING**

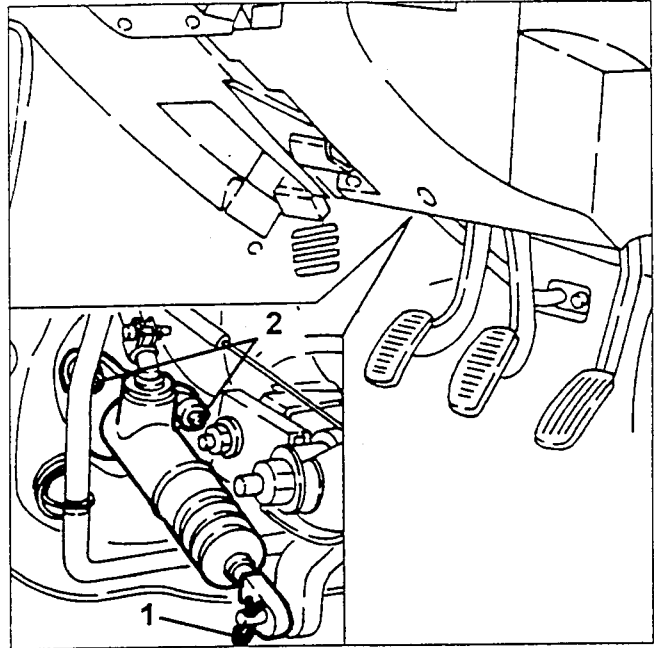
- Empty the brake/clutch fluid reservoir with a suitable syringe.
  - Remove the air intake manifold (see specific paragraph).
1. From inside the engine compartment, disconnect the pipe fitting from the clutch pump.



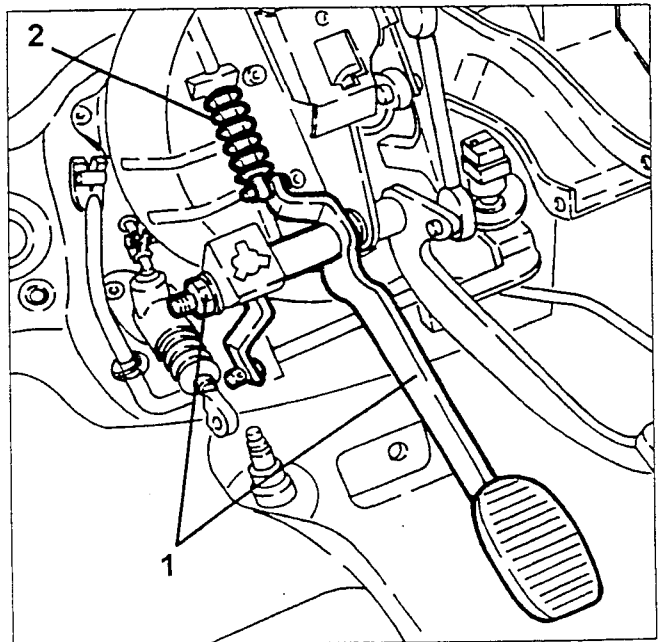
2. Remove the split pin.
3. Remove the two clutch pump fastening nuts.
4. Remove the clutch pump by releasing it from the pedal pin.

**CLUTCH PEDAL****REMOVAL/REFITTING**

- Remove the steering column (see ASSEMBLY 41).
1. Remove the clutch pump retaining split pin from the pedal pin.
  2. Loosen the two clutch pump fastening nuts and release the pump from the pedal pin.



- Loosen the two valve bracket fastening screws.
1. Loosen the fastening bolt and remove the clutch pedal.
  2. Take the clutch pedal return spring.
- At the stand, remove the clutch pedal bushing, if required.

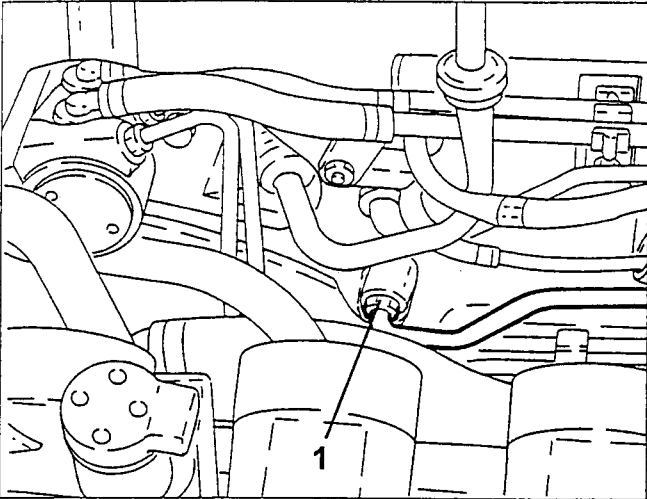


**CLUTCH PUMP ('98 MODELS)****REMOVAL/REFITTING**

- Empty the brake/clutch fluid reservoir with a suitable syringe.

- Remove the modular air intake manifold (see specific paragraph).

1. From inside the engine compartment, disconnect the pipe fitting from the clutch pump.



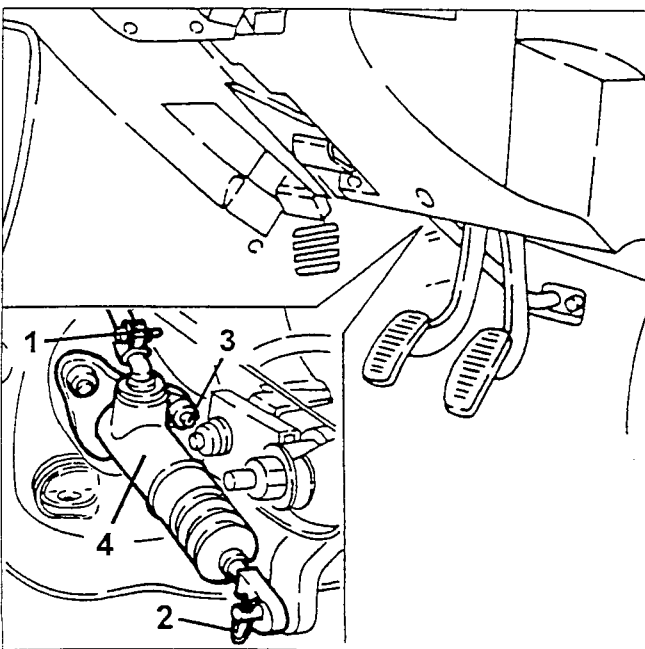
- Remove the accelerator pedal (see specific paragraph).

1. From inside the passenger compartment, disconnect the reservoir feed pump from the clutch pump.

2. Remove the split pin.

3. Remove the two clutch pump fastening nuts.

4. Remove the clutch pump by releasing it from the pedal pin.

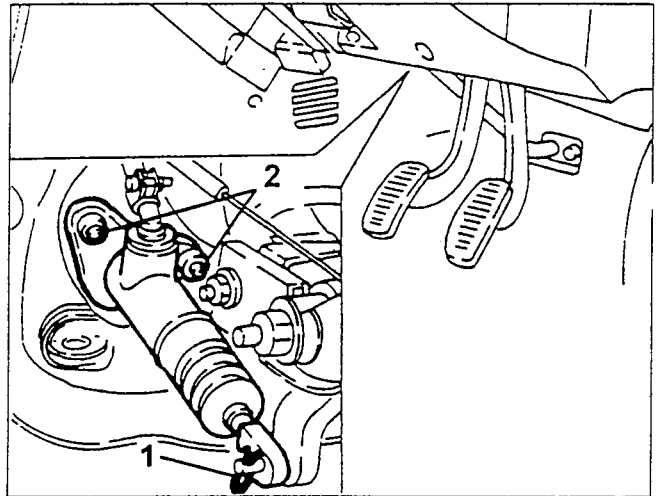
**CLUTCH PEDAL ('98 MODELS)****REMOVAL/REFITTING**

- Loosen the fastening screw and release the steering column from the power steering unit pinion.

- Remove the accelerator pedal (see specific paragraph).

1. Remove the clutch pump split pin from the respective pedal pin.

2. Loosen the two clutch pump fastening nuts and release it from the respective pedal pin.



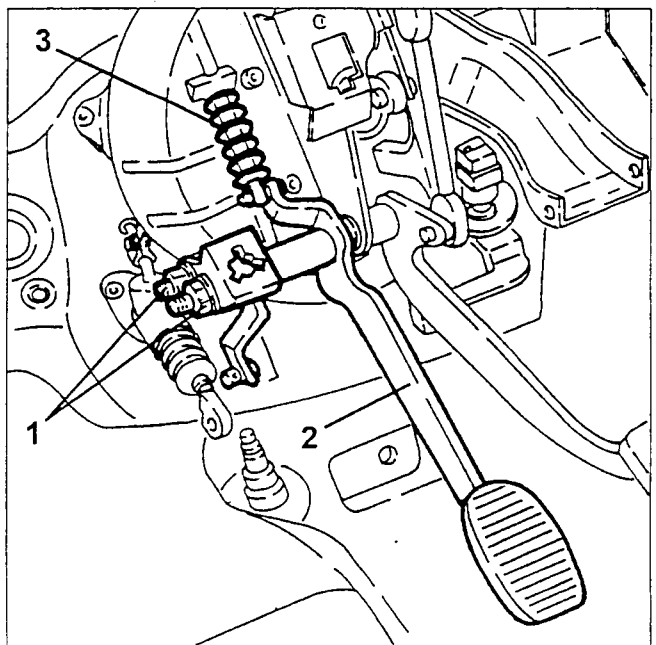
- Loosen the two valve bracket fastening screws.

1. Loosen the nuts and remove the clutch pedal bracket.

2. Release the screw just enough to remove the clutch pedal.

3. Take the clutch pedal return spring.

- At the stand, remove the clutch pedal bushing, if required.



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- Clutch pump . . . . . (\*)
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- Clutch control cylinder . . . . . (▲)
- Bleeding air from the hydraulic system . . . . . (\*)
- Minimum brake - clutch fluid level sensor . . . . . (▲)

(\*): See engine  TD

(▲): See engine  T. SPARK 16V



## DESCRIPTION

The clutch adopted is a dry single-plate type with diaphragm pressure plate springs.

The clutch is released through a hydraulic device formed of a reservoir (1) shared with the braking system, a pump (2) fastened to the pedal unit, a control cylinder (3) fastened to the rear engine cover and a thrust bearing (4).

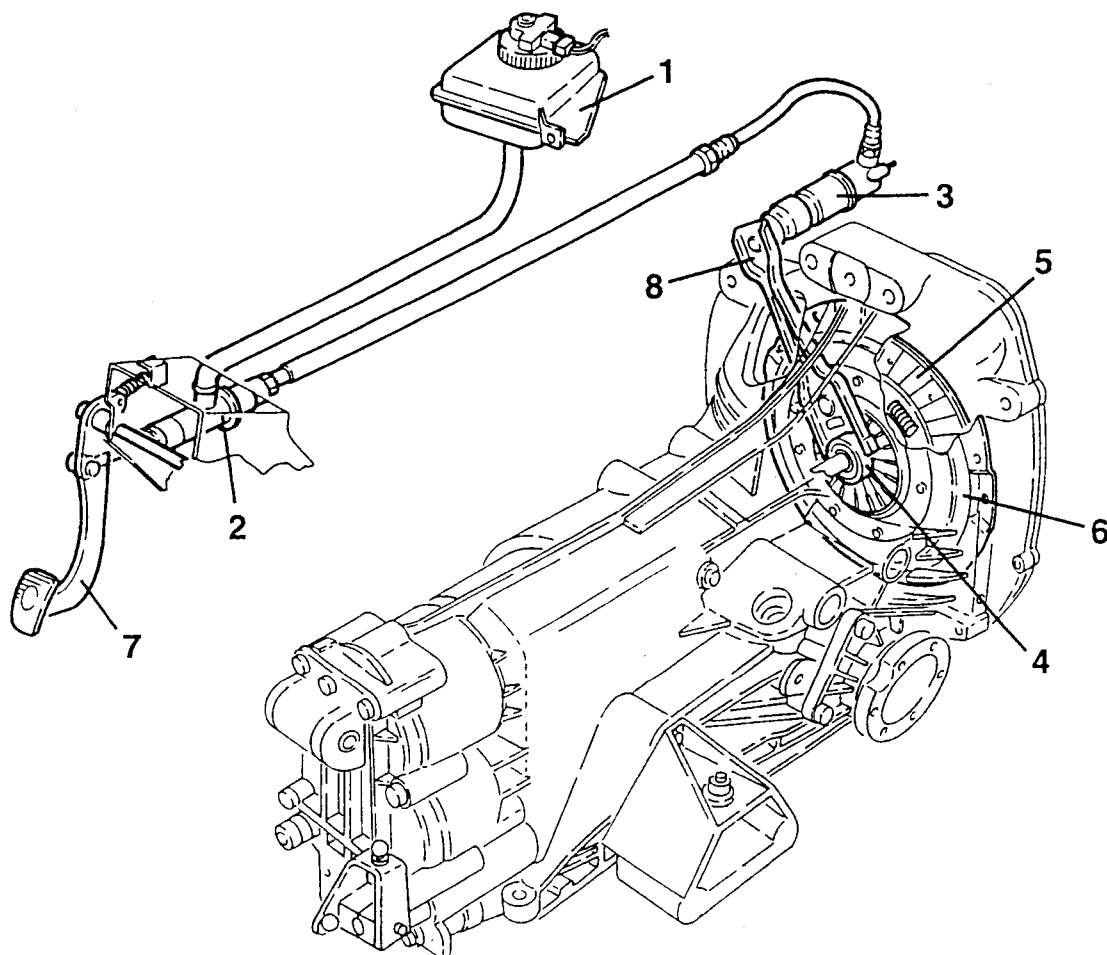
The pedal-operated pump transmits the fluid pressure increase through a hose to the control cylinder.

A prod on the control cylinder acts on the clutch release control fork which moves the self-centering thrust bearing overcoming the action of the diaphragm pressure plate springs.

In addition to reducing the effort exerted on the pedal, the adoption of the hydraulic clutch release device makes it possible to:

- increase reliability of the control compared with the conventional mechanical system.
- improve progression, due to the damping of the hydraulic system during disengagement which prevents jerking, particularly when the torque transmitted is high.
- achieve greater operating precision, as this device enables constant height adjustment of the clutch pedal.
- increase driving comfort because of the reduction of the level of vibrations transmitted from the engine, due to the damping effect of the oil.

In order to comply with current regulations on the subject of environmental pollution, ecological (asbestos-free) clutch plate friction gaskets have been adopted.



1. Brake-clutch system reservoir
2. Clutch pump
3. Clutch control cylinder
4. Thrust bearing

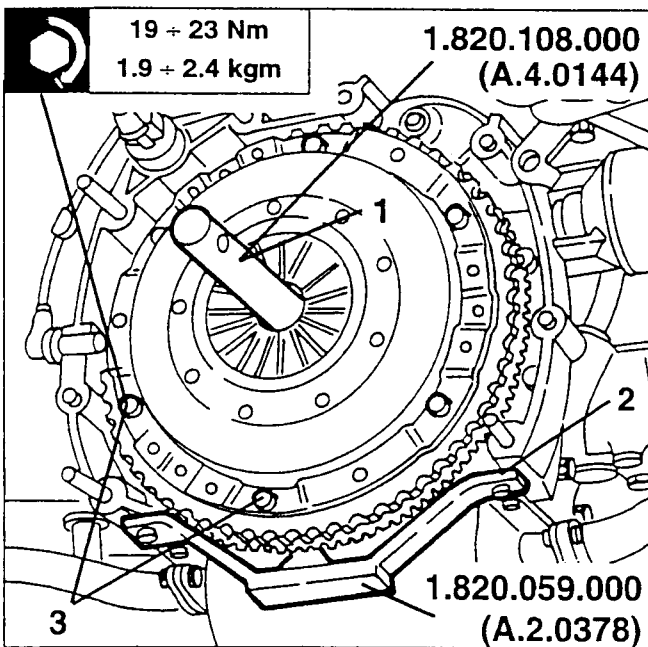
5. Clutch plate
6. Pressure plate
7. Clutch control pedal
8. Fork

## CLUTCH PLATE AND PRESSURE PLATE

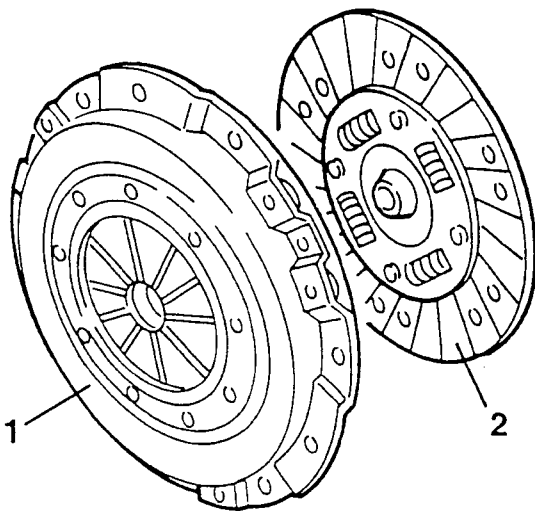
### REMOVAL/REFITTING

- Remove the gearbox-differential unit (see GROUP 21).

1. Install the flywheel locking tool N° 1.820.059.000 (A.2.0378).
2. Install tool N° 1.820.108.000 (A.4.0144) in the clutch plate hub.
3. Slacken the screws fastening the pressure plate to the engine flywheel.



1. Remove the pressure plate.
2. Remove the clutch plate.



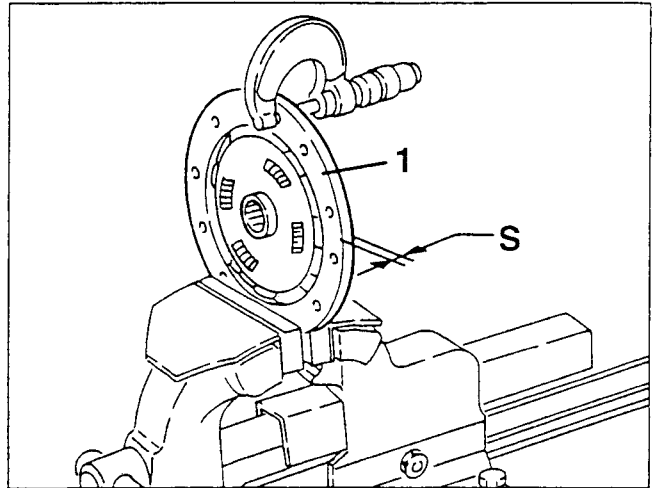
### CHECKS AND INSPECTIONS

1. Check the gaskets for even wear and that the thickness of the clutch plate is not below the minimum specified.



Thickness "S" of clutch plate (mm)

| New | At the wear limit |
|-----|-------------------|
| 7.7 | 6.1               |



- Check that there are no signs of burning or vitrification, that fastening is correct and that the springs are intact.

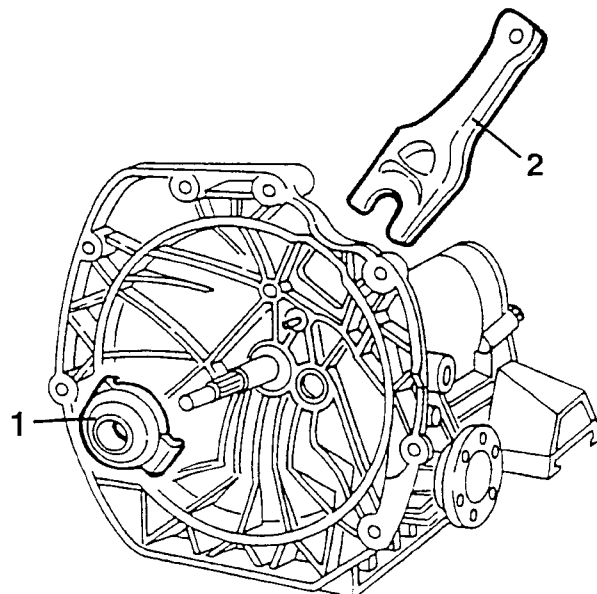
Check that the clutch plate hub is intact, runs smoothly and that there is no excessive play on the drive shaft coupling.

- Check the working surfaces of the flywheel and pressure plate for signs of overheating, uneven wear, nicks or missing parts.

1. Also check the thrust bearing for noise, excessive play and freedom of movement on the drive shaft.

If necessary, change any worn parts.

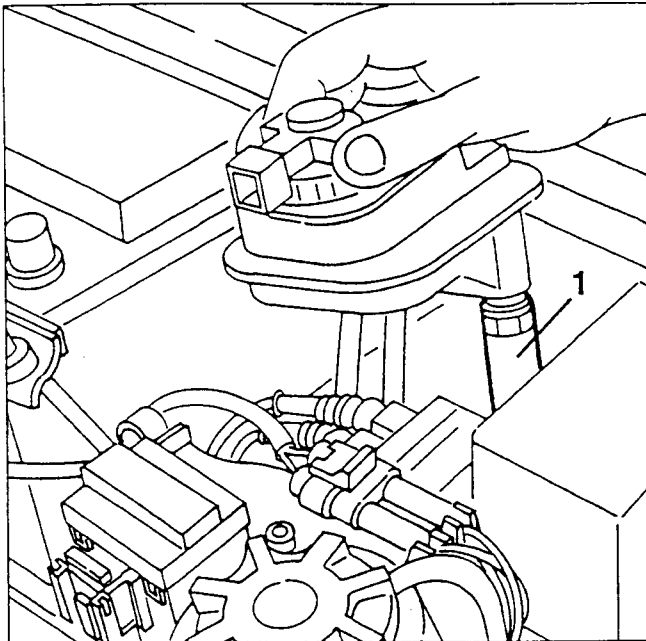
2. Check the clutch control fork for cracks, distortion and excessive wear in the working areas. Change it if necessary.



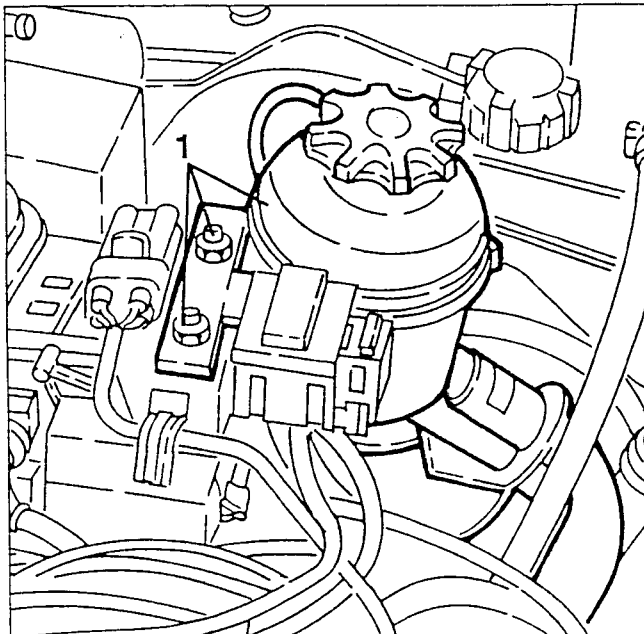
**CLUTCH PUMP****REMOVING/REFITTING**

- Disconnect the battery (-) terminal.
- Empty the brake - clutch fluid reservoir using a suitable syringe.

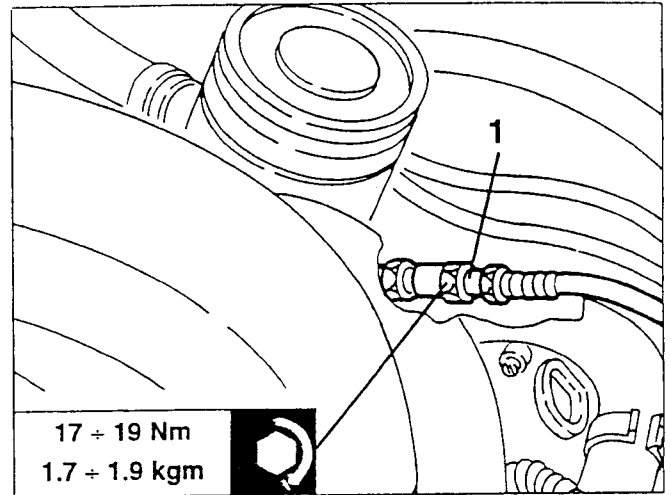
1. Slacken the fastening screw and raise the brake - clutch fluid reservoir just enough to disconnect the connection pipe to the clutch pump from it.



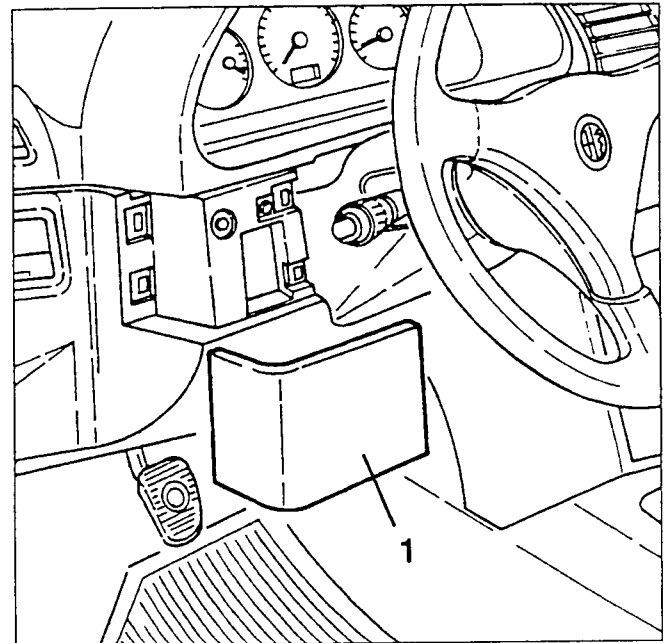
1. Slacken the two fastening nuts and move the power steering tank sideways without disconnecting the hoses.



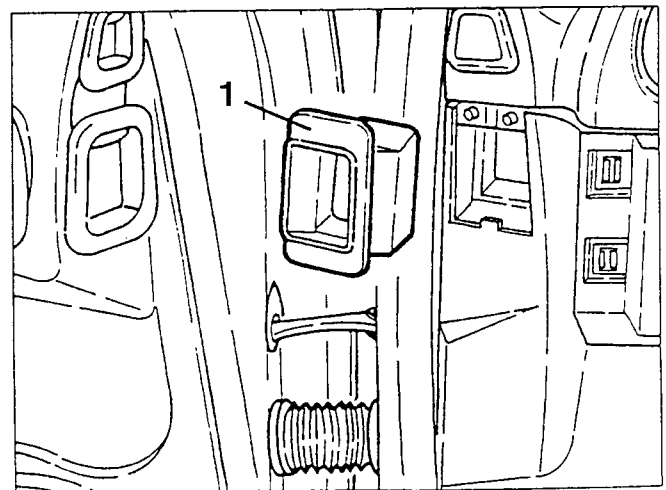
1. Disconnect the intermediate fitting of the hose connecting the pump to the clutch cylinder and free the hoses in question of their hose clamps.



1. Working from the passenger compartment, slacken and remove the left dashboard trim.

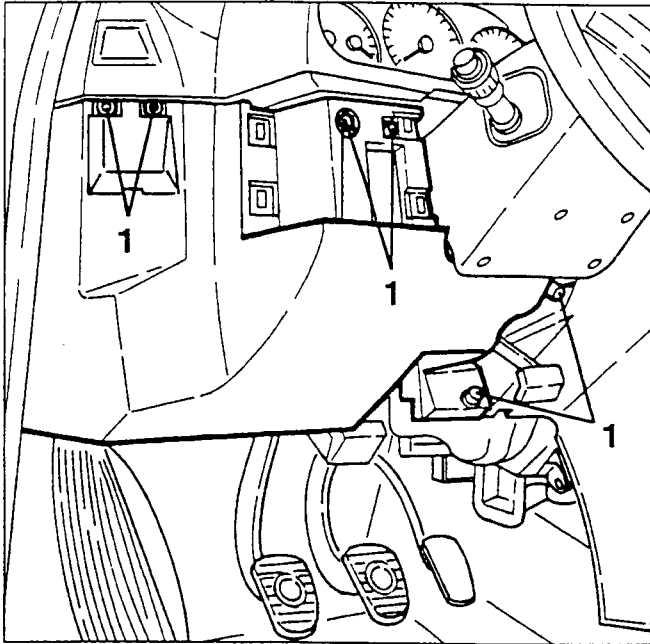


1. Remove the driver's air vent from the dashboard.



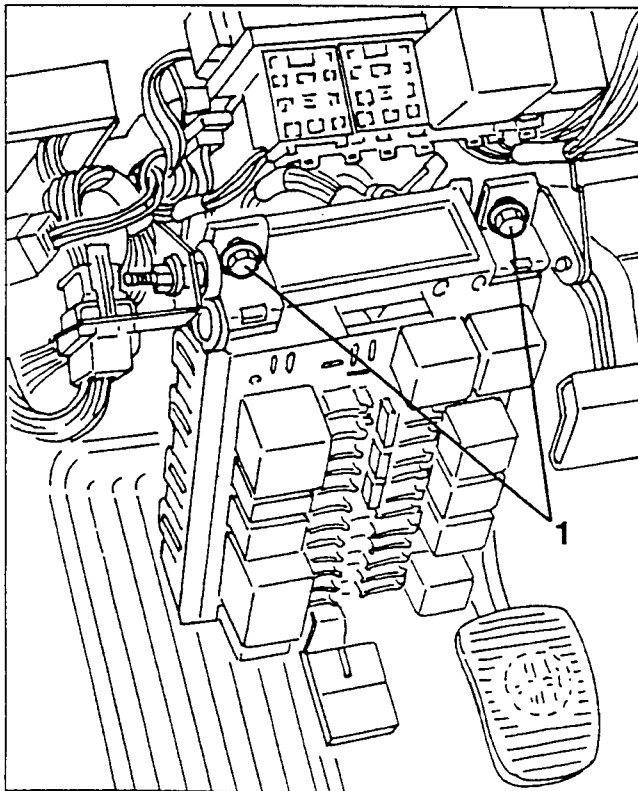


1. Slacken the six fastening screws and remove the fusebox cover.



1. Slacken the fusebox fastening nuts and move it sideways.

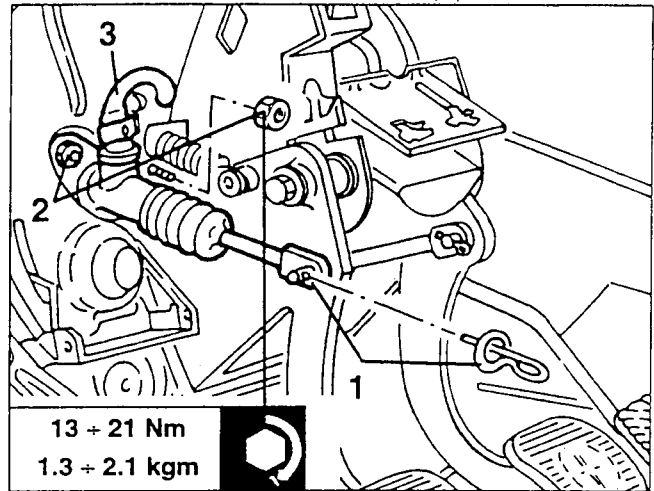
- Slacken the fasteners of the fusebox support bracket and move it sideways.



1. Remove the safety catch and disconnect the clutch pump from the pedal.

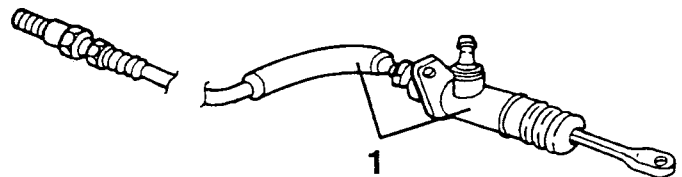
2. Slacken the two clutch pump fastening nuts.

3. Move the clutch pump backwards enough to disconnect the reservoir connection pipe from it.



1. Remove the clutch pump complete with connection pipe to the clutch cylinder.

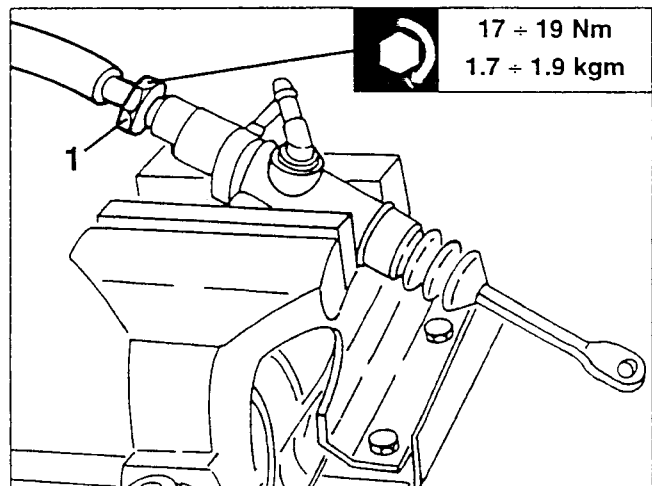
When refitting the pump bleed the air from the system (see specific paragraph).



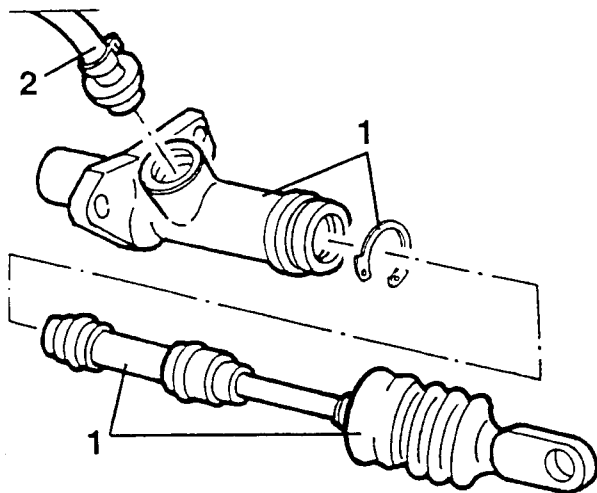
### DIS-ASSEMBLY/RE-ASSEMBLY

- Position the clutch pump in a vice with protective jaws.

1. Slacken and remove the clutch cylinder connection pipe from the pump.



1. Remove the protection boot, remove the retainer ring and withdraw the piston from the pump body.
2. Remove the seal with fluid inlet connection from the reservoir.



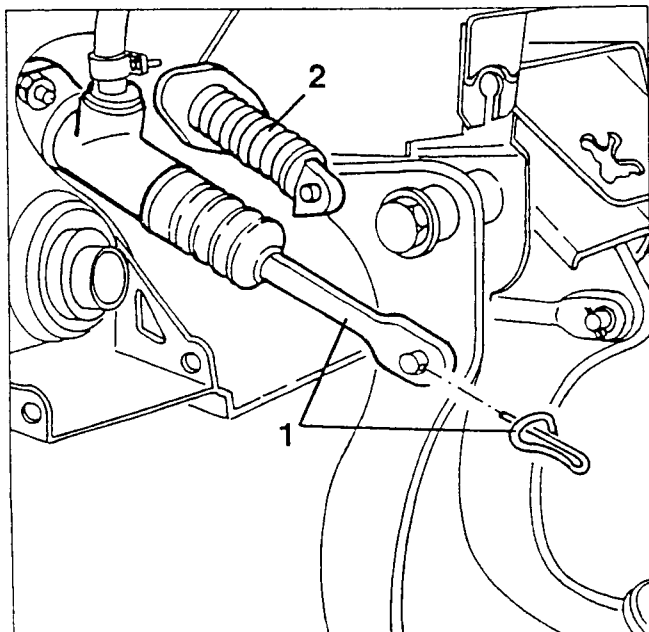
## CHECKS AND INSPECTIONS

- Check that the piston and the inner surface of the cylinder show no signs of marking, scoring, scraping or rust. If the cylinder body reveals signs of scraping or seizure, change the pump assembly.

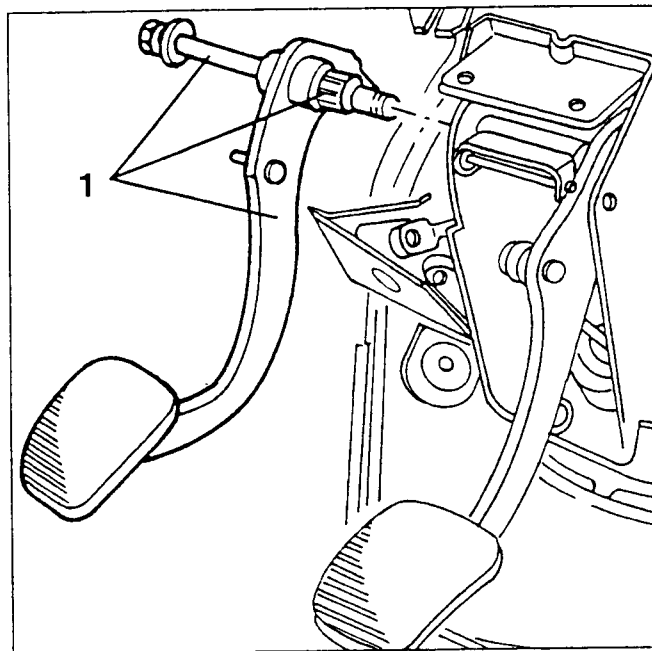
## CLUTCH PEDAL

### REMOVAL/REFITTING

1. Remove the safety catch and disconnect the clutch pump from the pedal.
2. Remove the return spring.



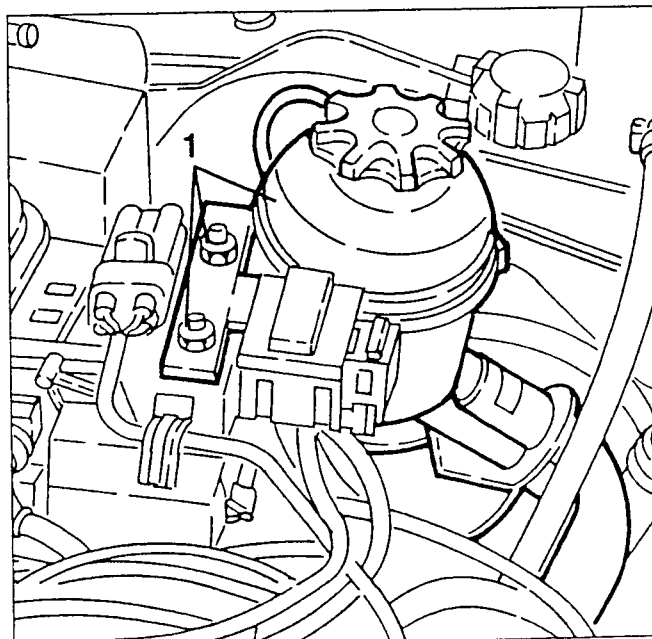
1. Slacken the fastening bolt and withdraw the clutch pedal complete with bush



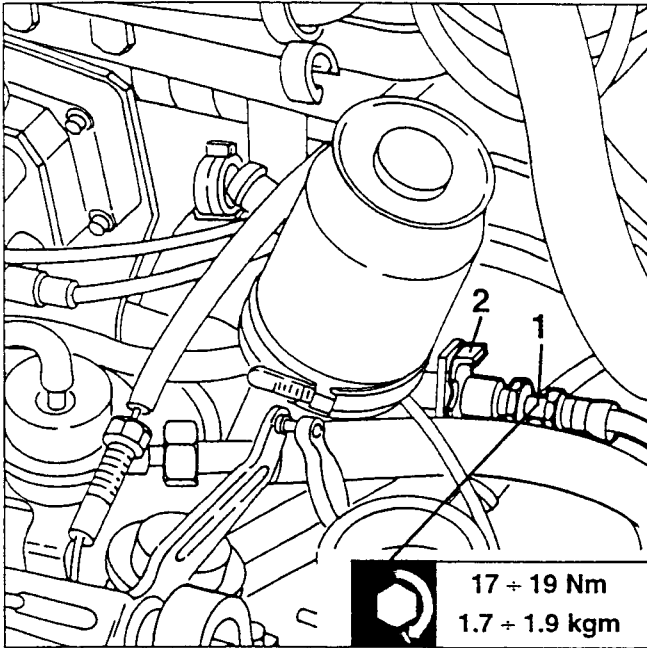
## CLUTCH CONTROL CYLINDER

### REMOVAL/REFITTING

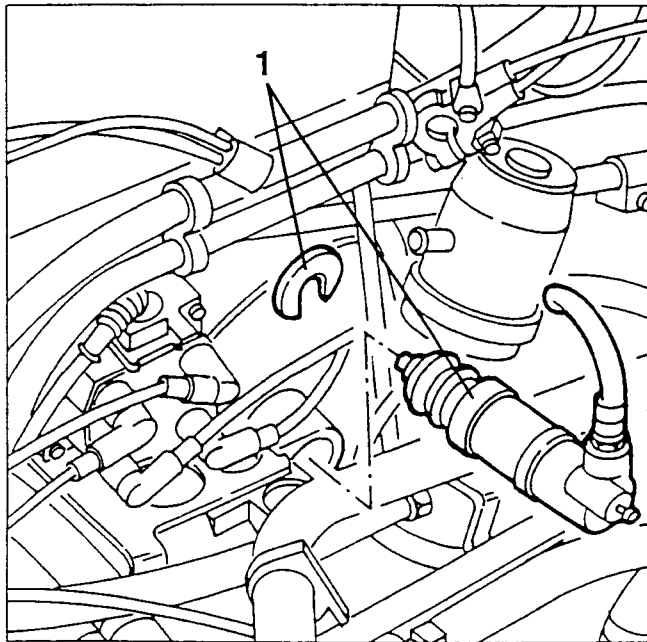
- Remove the intake box (see GROUP 10).
  - Empty the brake - clutch fluid reservoir, using a suitable syringe.
1. Slacken the two fastening nuts and move the power steering tank sideways without removing the hoses.



1. Disconnect the intermediate union of the hose connecting the pump to the clutch cylinder.
2. Remove the pipe fastening plate.



1. Remove the retainer ring and remove the clutch control cylinder.

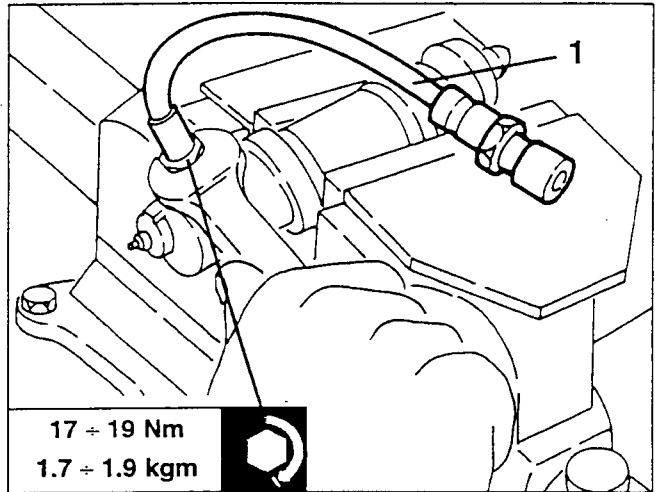


When refitting the cylinder bleed the air from the system (see specific paragraph).

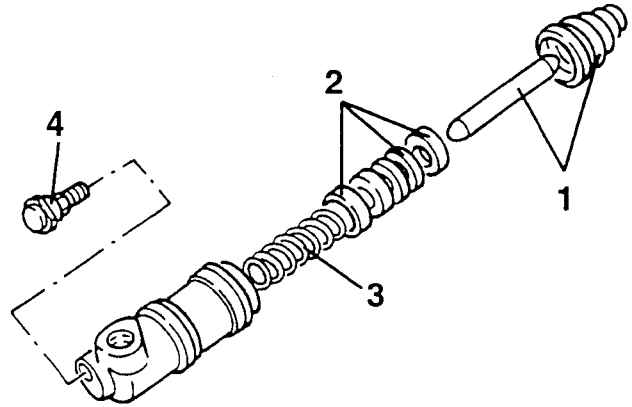
### DIS-ASSEMBLY/RE-ASSEMBLY

- Place the clutch control cylinder in a vice with protective jaws.

1. Slacken and remove the connection pipe to the clutch pump from the clutch control cylinder.

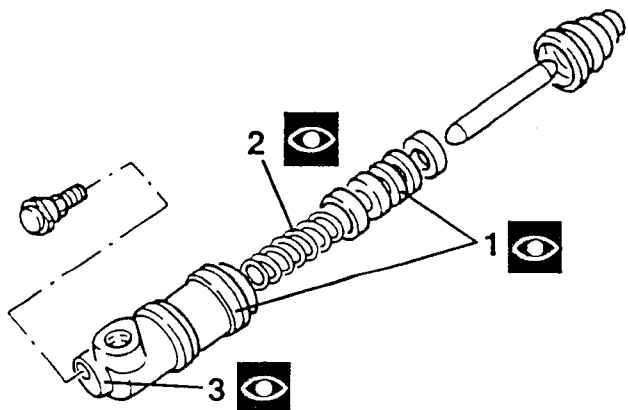


1. Withdraw the prod with its boot from the control cylinder, then separate them.
2. Remove the piston and the corresponding seals.
3. Remove the spring.
4. Only if necessary, remove the bleed screw from the control cylinder body.



### CHECKS AND INSPECTIONS

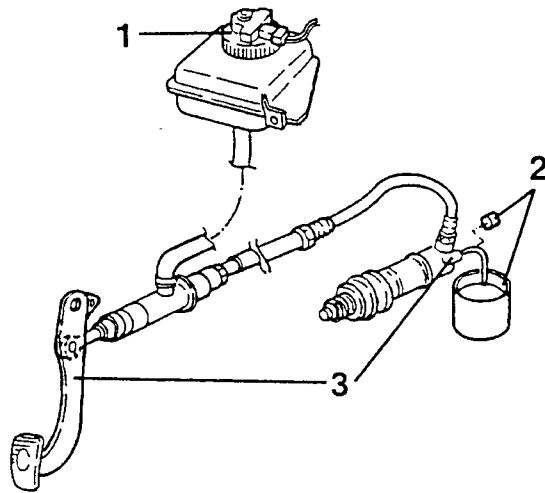
1. Check the piston and inner cylinder surface for signs of scoring and traces of rust.
2. Check that the spring is intact.
3. Check that the air bleeding outlet is not clogged.



**BLEEDING AIR FROM THE HYDRAULIC SYSTEM**

**CAUTION:**  
Never re-use the hydraulic fluid resulting from the bleeding operation.

1. Remove the cap on the clutch and brake fluid supply reservoir and if necessary top up the level with the specified fluid.
  2. Remove the protective cap from the relief screw on the cylinder and push a hose onto the screw with the other end in a transparent container full of the same hydraulic fluid as the circuit.
  3. Slacken the relief screw while pressing the clutch pedal allowing it to return slowly; repeat this operation until all the air trapped in the circuit has been eliminated.
- Then with the clutch pedal completely depressed, tighten the relief screw, remove the hose and refit the protective cap.



**CAUTION:**  
During the bleeding operation, the level of the fluid in the reservoir must never fall below the "MIN" mark.

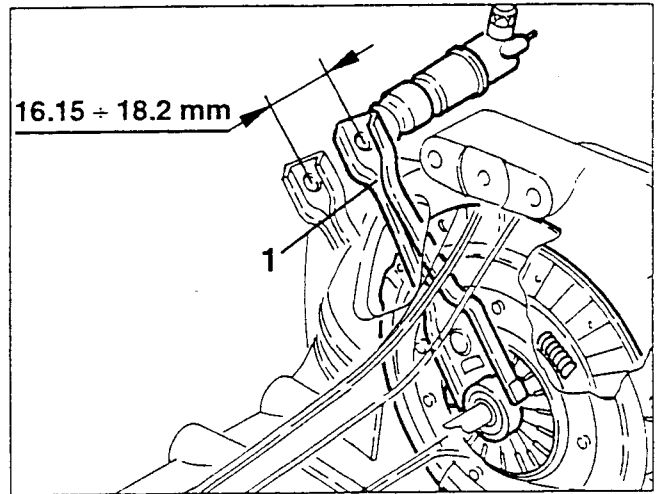
- Top up the level of the fluid in the reservoir and refit the cap.



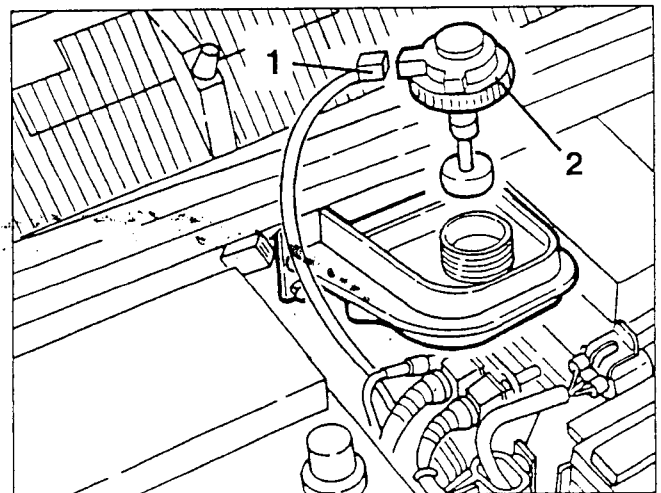
**CAUTION:**  
Brake/clutch fluid can damage the paintwork, therefore proceed with care.

- After bleeding, check that the clutch and gears disengage and engage properly.

1. Also check that the disengagement stroke of the clutch control cylinder is within the specified limits. This stroke is not adjustable and depends on the volume of the fluid displaced by the clutch pump piston.

**MINIMUM BRAKE - CLUTCH FLUID LEVEL SENSOR****REMOVAL/REFITTING**

- Disconnect the battery (-) terminal.
1. Disconnect the electrical connection from the minimum brake - clutch fluid level sensor.
  2. Slacken the cap with the built-in minimum brake - clutch fluid level sensor and remove it.



## DESCRIPTION

The clutch adopted is a dry single-plate type with diaphragm pressure plate springs.

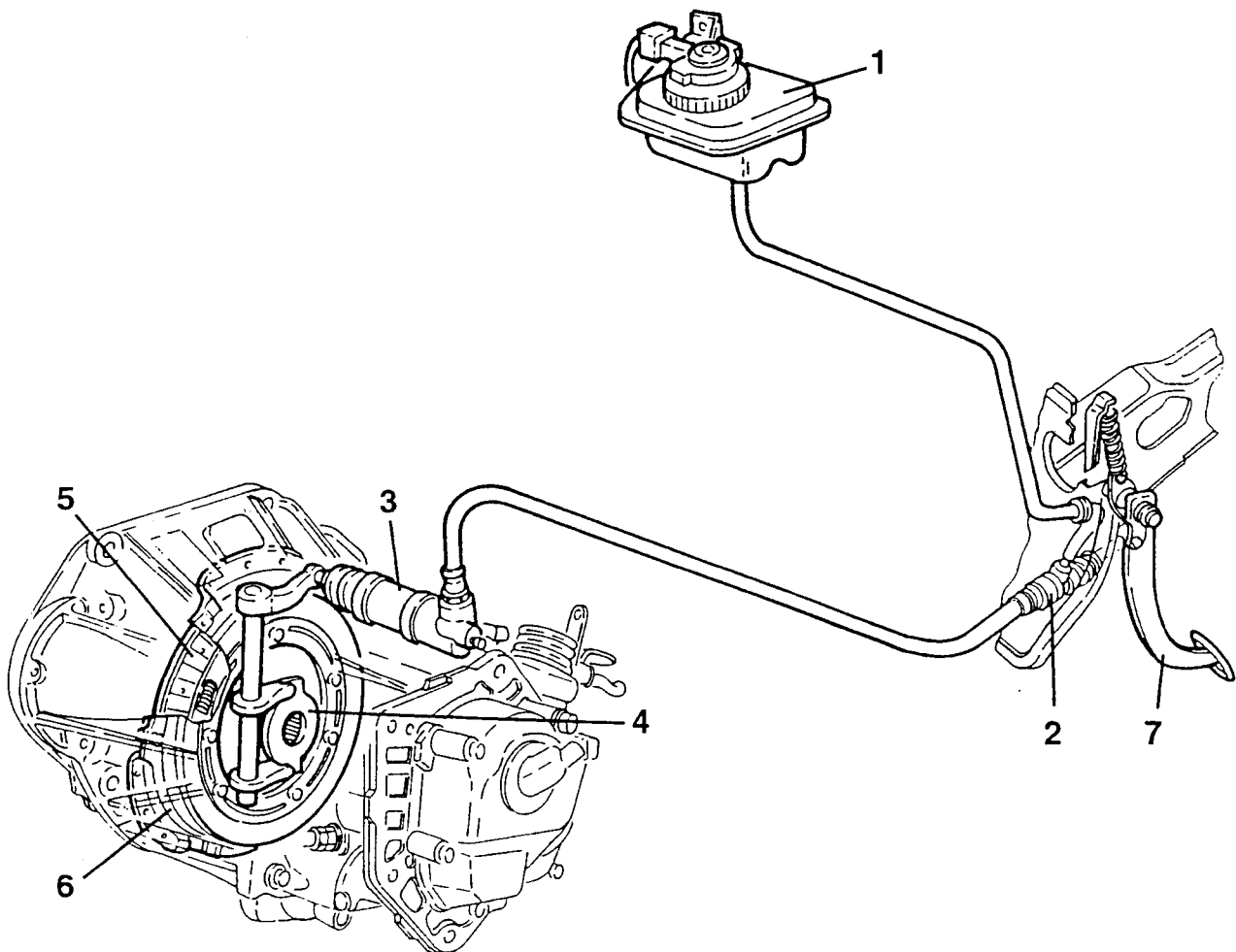
The clutch is released through a hydraulic device formed of a reservoir (1) shared with the braking system, a pump (2) fastened to the pedal unit, a control cylinder (3) fastened to the gearbox cover and a thrust bearing (4).

The pedal-operated pump transmits the fluid pressure increase through a hose to the control cylinder piston. A prod on the latter acts on the control fork which moves the thrust bearing overcoming the action of the diaphragm pressure plate springs.

In addition to reducing the effort exerted on the pedal, the adoption of the hydraulic clutch release device makes it possible to:

- increase reliability of the control compared with the conventional mechanical system.
- improve progression, due to the damping of the hydraulic system during disengagement which prevents jerking, particularly when the torque transmitted is high.
- achieve greater operating precision, as this device enables constant height adjustment of the clutch pedal.
- increase driving comfort because of the reduction of the level of vibrations transmitted from the engine, due to the damping effect of the oil.

In order to comply with current regulations on the subject of environmental pollution, ecological (asbestos-free) clutch plate friction gaskets have been adopted.



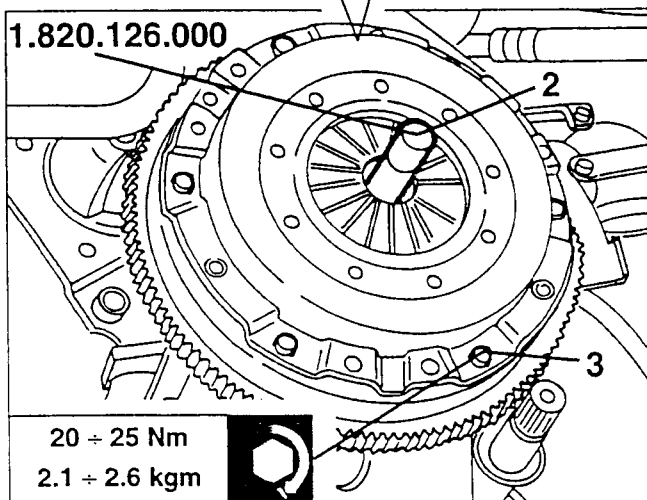
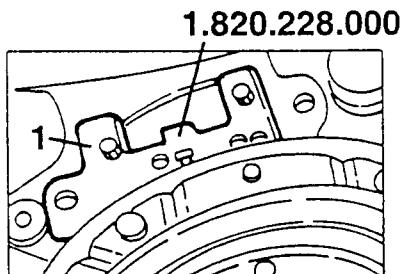
1. Brake-clutch system reservoir
2. Clutch pump
3. Clutch control cylinder
4. Thrust bearing

5. Clutch plate
6. Pressure plate
7. Clutch control pedal

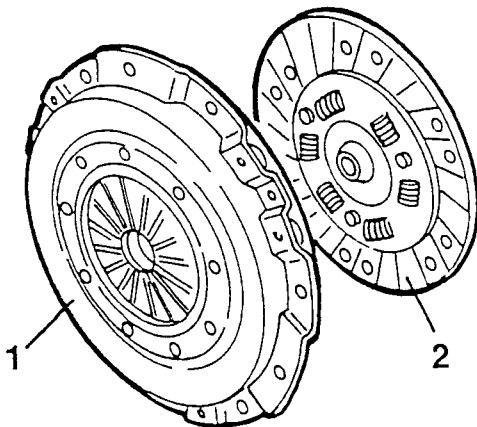
### CLUTCH PLATE AND PRESSURE PLATE

#### REMOVAL/REFITTING

- Remove the gearbox-differential unit (see GROUP 21).
- If only the clutch plate is being replaced, mark its position between the pressure plate and flywheel in order to simplify re-assembly operations.
- 1. Install the flywheel locking tool N° 1.820.228.000.
- 2. Install tool N° 1.820.126.000 in the clutch plate hub.
- 3. Slacken the screws fastening the pressure plate to the flywheel.

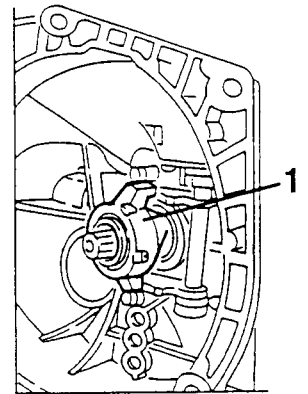


1. Remove the pressure plate.
2. Remove the clutch plate.



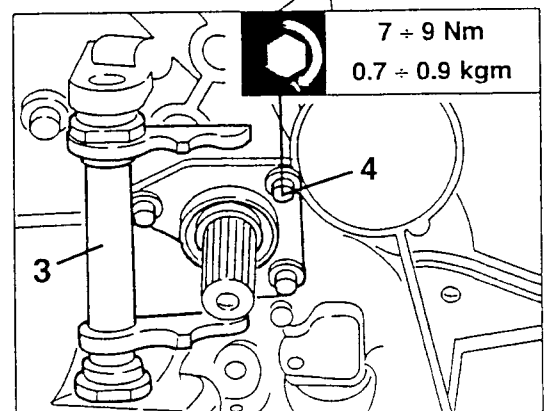
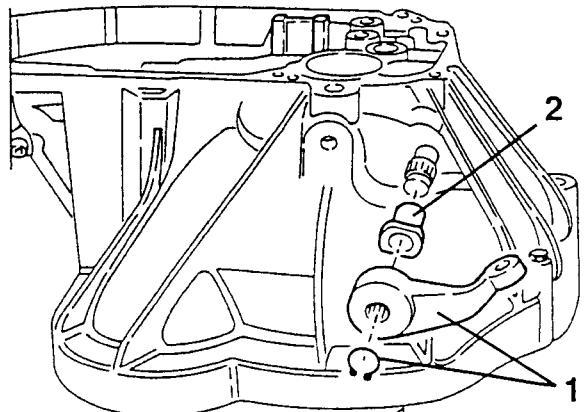
1. Withdraw the thrust bearing from its sleeve in the gearbox cover.

When refitting the bearing, make sure that it runs smoothly and noiselessly, if not, replace it.



- Only if necessary:

1. Remove the seeger locking and withdraw the clutch engagement control lever.
2. Remove the anti-slip bush from the gearbox cover.
3. Working from inside the gearbox cover remove the clutch engagement sleeve control fork and pin.
4. Slacken the screws fastening the thrust bearing sleeve and remove it.



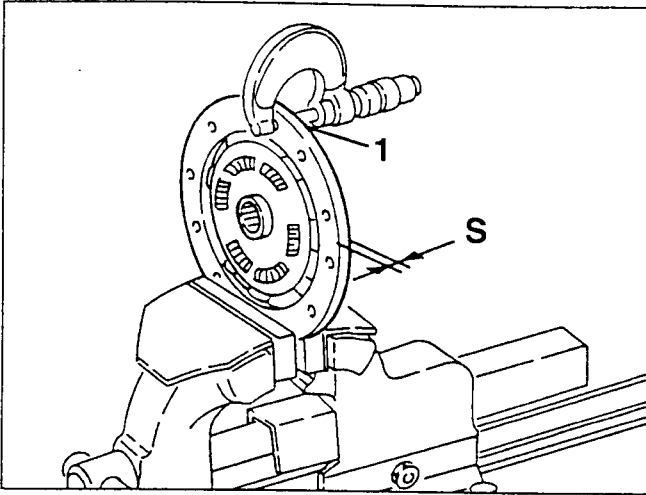
When refitting, install a new anti-slip bush each time the pin has too much play.  
 When refitting, grease the bushes and the sleeve with the specified product.  
 The sleeve complete with oil guard must be changed whenever it leaks oil.

## CHECKS AND INSPECTIONS

1. Check the gaskets for even wear and that the thickness of the clutch plate is not below the minimum specified.



| Thickness "S" of clutch plate (mm) |                   |
|------------------------------------|-------------------|
| New                                | At the wear limit |
| 7.1 + 7.7                          | 6.1               |



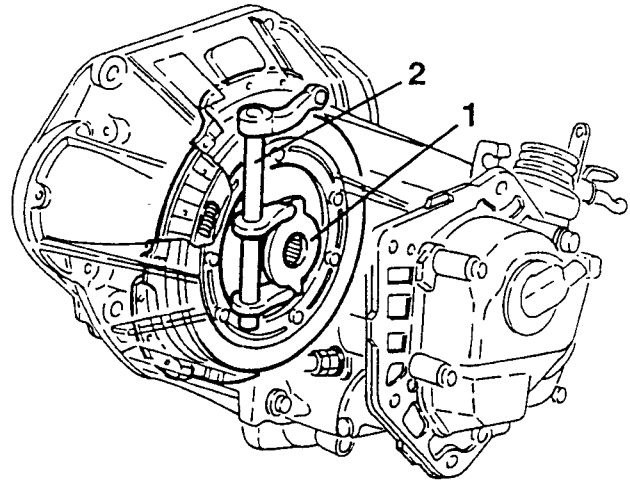
- Check that there are no signs of burning or vitrification, that fastening is correct and that the springs are intact.

Check that the clutch plate hub is intact, runs freely and that there is no excessive play on the drive shaft coupling.

- Check the working surfaces of the flywheel and pressure plate for signs of overheating, uneven wear, nicks or missing parts.

1. Check the thrust bearing for noise, excessive play and freedom of movement on the drive sleeve.

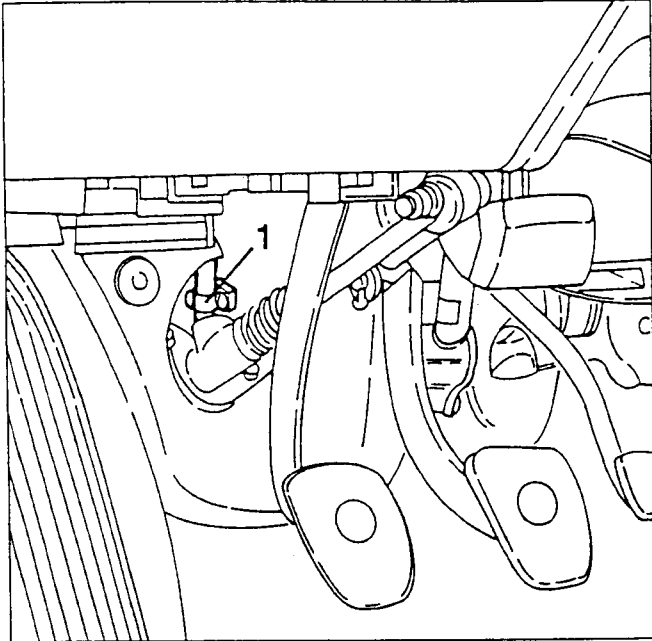
2. Check the fork for cracks, distortion, freedom of movement and excessive wear on the working surfaces.



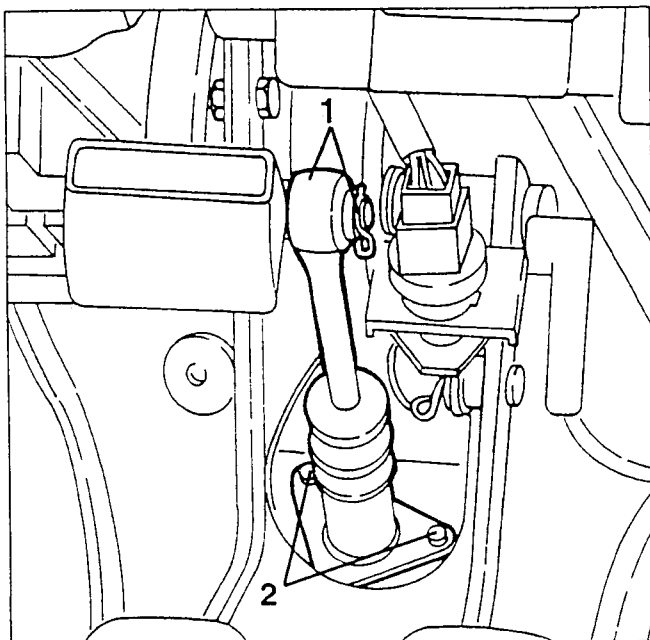
## CLUTCH PUMP

### REMOVAL/REFITTING

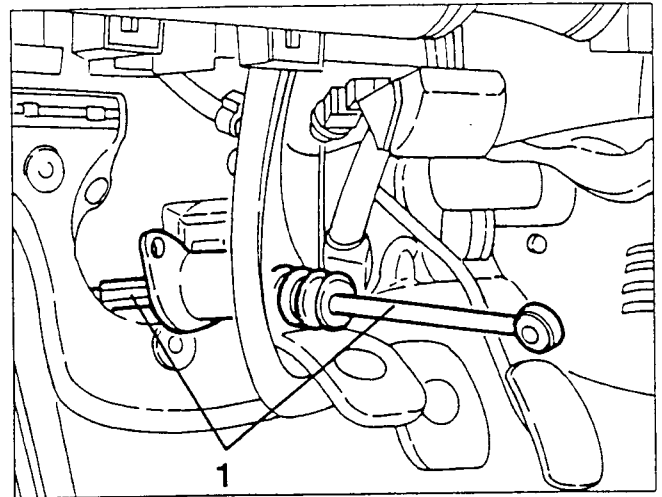
- Disconnect the battery (-) terminal.
- Empty the brake-clutch fluid reservoir using a suitable syringe.
- 1. Disconnect the reservoir connection hoses from the clutch pump.



1. Remove the safety catch and disconnect the clutch pump from the pedal.
2. Slacken the two nuts fastening the clutch pump.

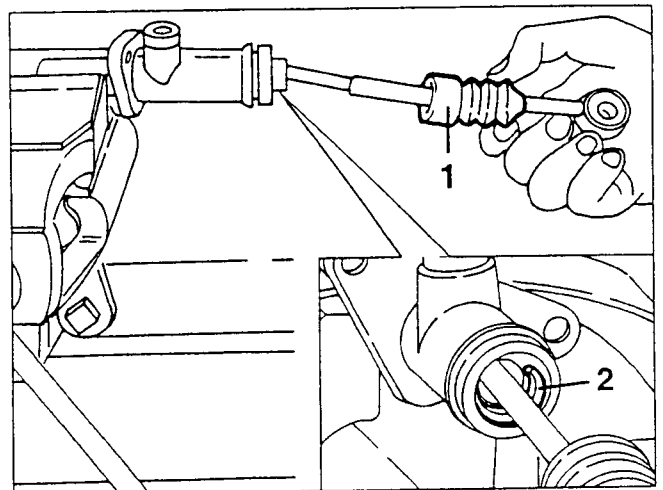


1. Move the clutch pump backwards just enough to disconnect the union of the cylinder connection pipes, then remove it.

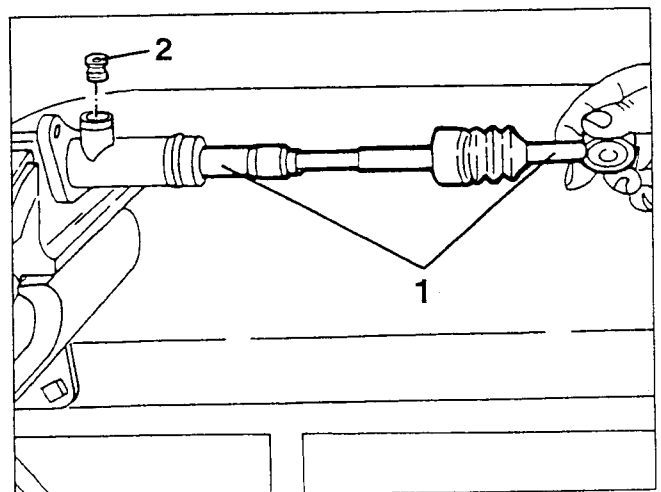


### DIS-ASSEMBLY/RE-ASSEMBLY

1. Prise off the protective boot.
2. Remove the piston retainer ring.



1. Remove the piston and the operating lever.
2. Remove the gasket.



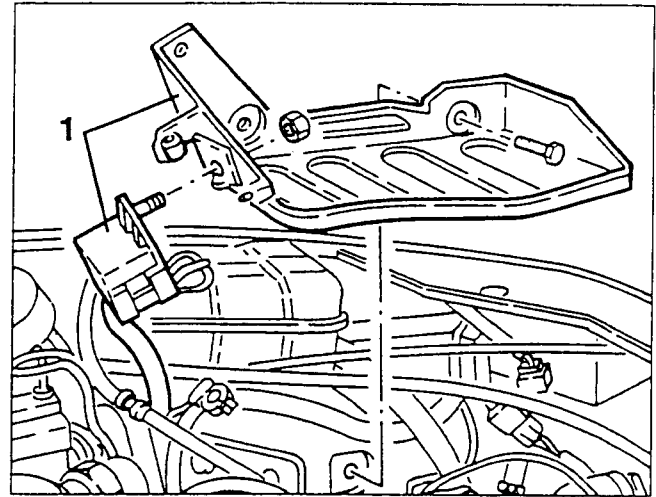
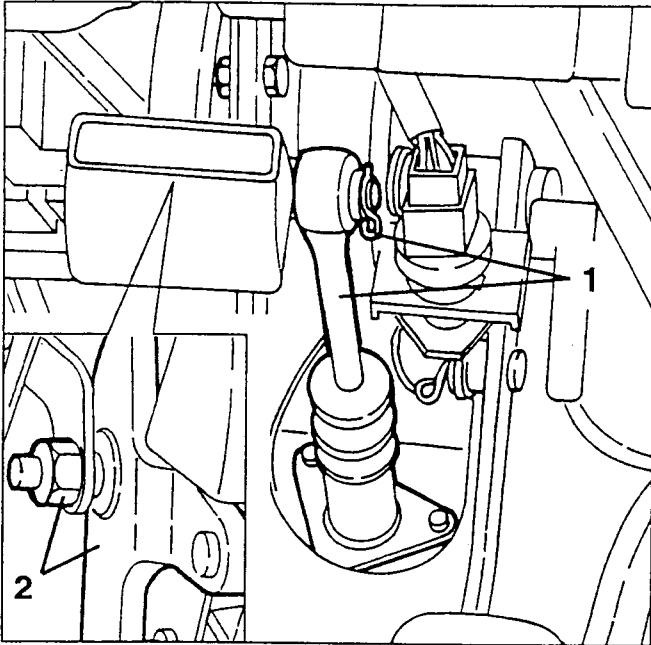
- Check the piston and the cylinder inner surface for marks, scores, scratches or rust and change the pump assembly if necessary.



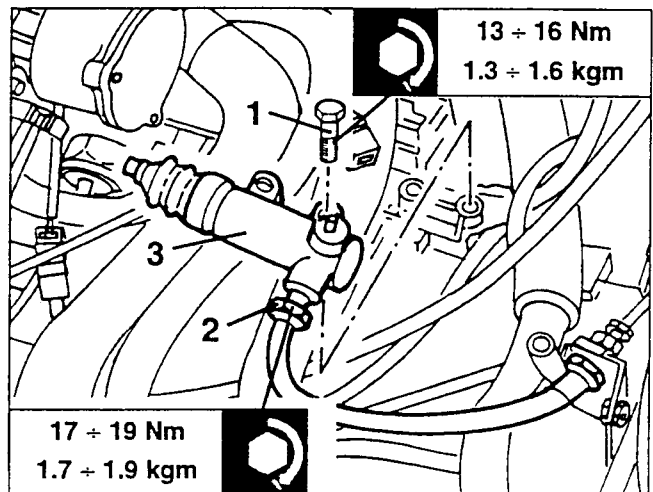
## CLUTCH PEDAL

### REMOVAL/REFITTING

1. Remove the safety catch and disconnect the clutch pump from the pedal.
2. Slacken the fastening bolt and remove the clutch pedal.



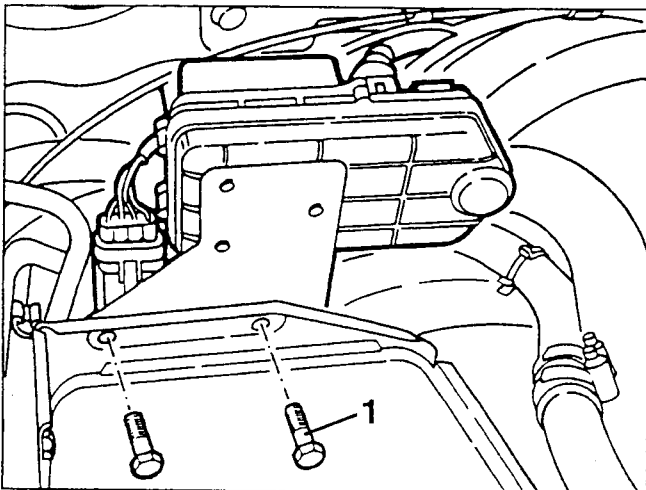
1. Slacken the two screws fastening the clutch control cylinder.
2. Disconnect the pump inlet hose fitting from the clutch control cylinder.
3. Remove the clutch control cylinder.



## CLUTCH CONTROL CYLINDER

### REMOVAL/REFITTING

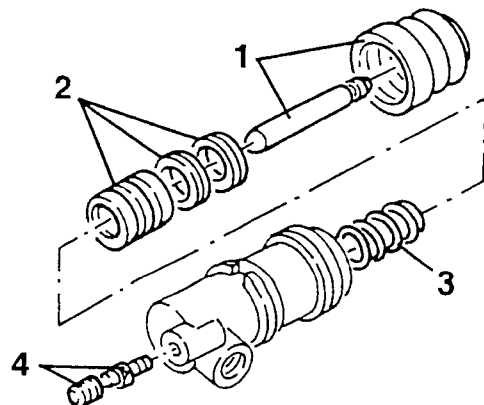
- Remove the battery (see GROUP 55).
  - Empty the brake-clutch fluid reservoir using a suitable syringe.
1. Slacken the two fastening screws and move the fan relays to one side.



- Remove the battery acid drain duct.
1. Slacken the battery bracket fastening screws, then remove it after disconnecting the glow plug control unit cables from it.

### DIS-ASSEMBLY/RE-ASSEMBLY

1. Prise off the rubber boot and remove it together with the control prod.
2. Remove the piston from the cylinder body with its seals.
3. Remove the spring.
4. Only if necessary, remove the air relief screws.





**WARNING**  
Always change the gaskets when re-assembling.

## CHECKS AND INSPECTIONS

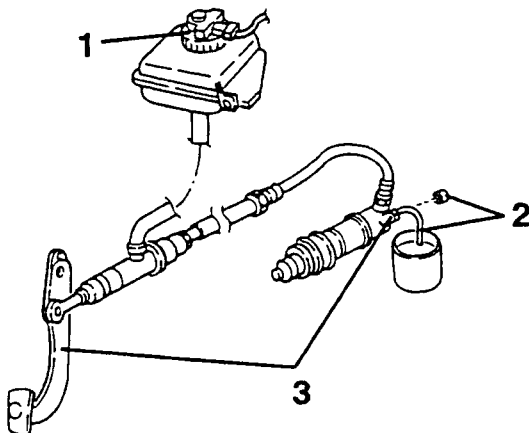
- Check the piston and the cylinder inner surface for scores or traces of rust and change the cylinder assembly if necessary.
- Check that the spring is intact.
- Check that the air relief hole is not clogged.

## BLEEDING AIR FROM THE HYDRAULIC SYSTEM



**WARNING:**  
Never re-use the hydraulic fluid resulting from the bleeding operation.

1. Remove the cap on the clutch and brake fluid reservoir and if necessary top up the level with the specified fluid.
  2. Remove the protective cap from the relief screw on the cylinder and push a hose onto the screw with the other end in a transparent container full of the same hydraulic fluid as the circuit.
  3. Slacken the relief screw while pressing the clutch pedal allowing it to return slowly; repeat this operation until all the air trapped in the circuit has been eliminated.
- Then with the clutch pedal completely depressed, tighten the relief screw, remove the hose and refit the protective cap.

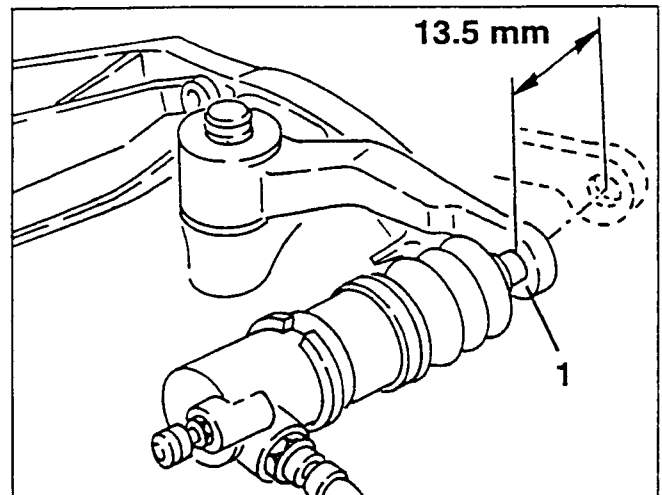


During the bleeding operation, the level of the fluid in the reservoir must never fall below the "MIN" mark.

- Top up the level of the fluid in the reservoir and refit the cap.

Brake/clutch fluid can damage the paintwork, therefore proceed with care.

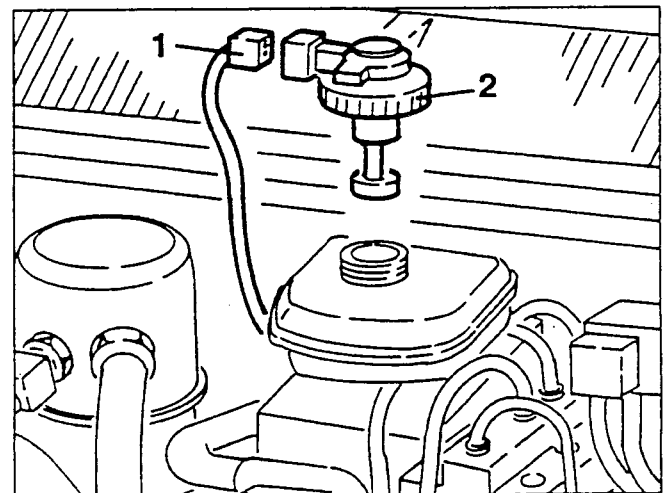
- After bleeding, check that the clutch and gears disengage and engage properly.
1. Also check that the disengagement stroke of the clutch control cylinder is within the specified limits. This stroke is not adjustable and depends on the volume of the fluid displaced by the clutch pump piston.



## MINIMUM BRAKE - CLUTCH FLUID LEVEL SENSOR

### REMOVAL/REFITTING

- Disconnect the battery (-) terminal.
1. Disconnect the electrical connection from the minimum brake-clutch fluid level sensor.
  2. Slacken the cap with the built-in minimum brake-clutch fluid level sensor and remove it.



## DESCRIPTION

Refer to the instructions for the  TD engine.

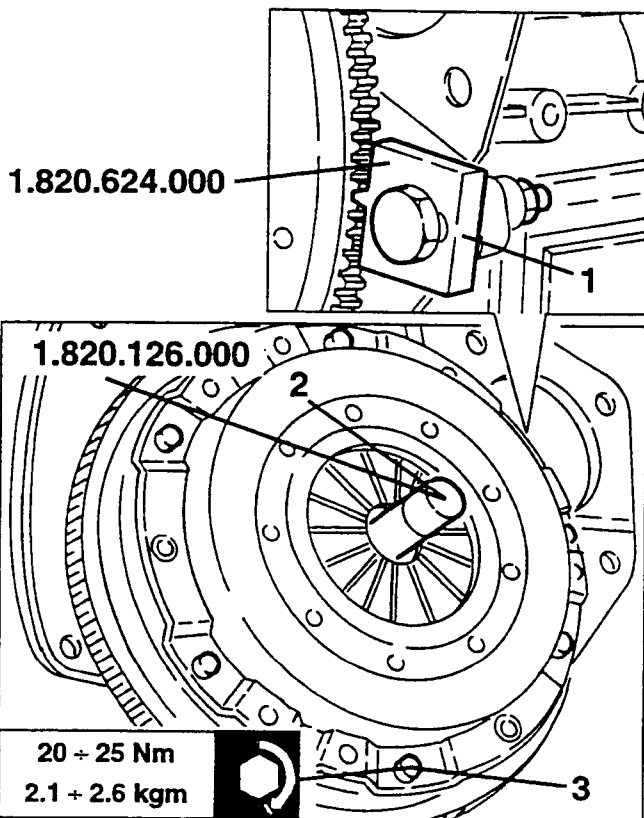
CLUTCH PLATE  
AND PRESSURE PLATE

## REMOVAL/REFITTING

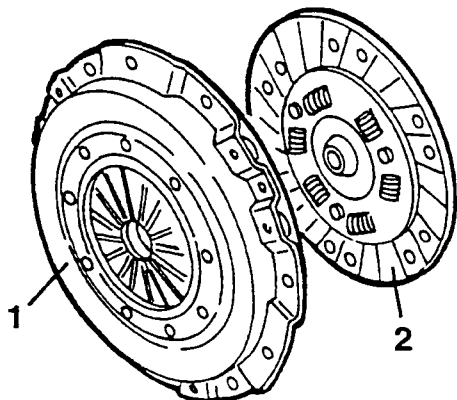
- Remove the gearbox-differential unit (see GROUP 21).

- If only the clutch plate is being replaced, mark its position between the pressure plate and flywheel in order to simplify re-assembly operations.

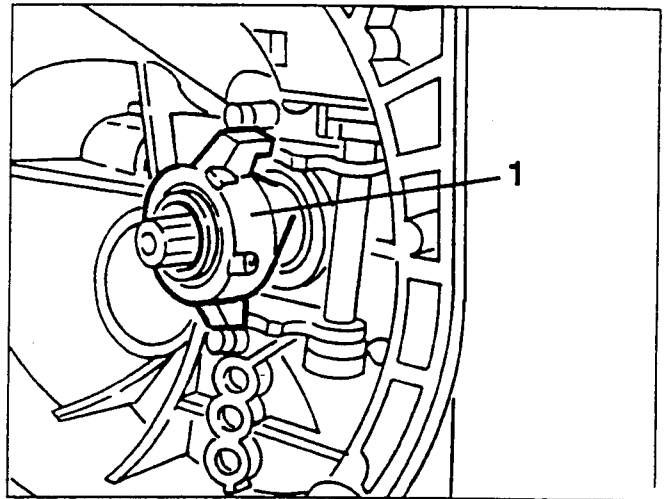
1. Install the flywheel locking tool N° 1.820.624.000.
2. Install tool N° 1.820.126.000 in the clutch plate hub.
3. Slacken the screws fastening the pressure plate to the flywheel.



1. Remove the pressure plate.
2. Remove the clutch plate.



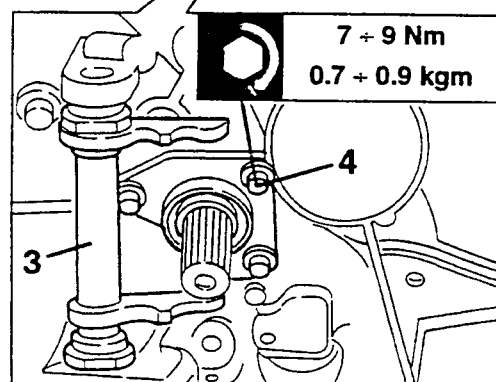
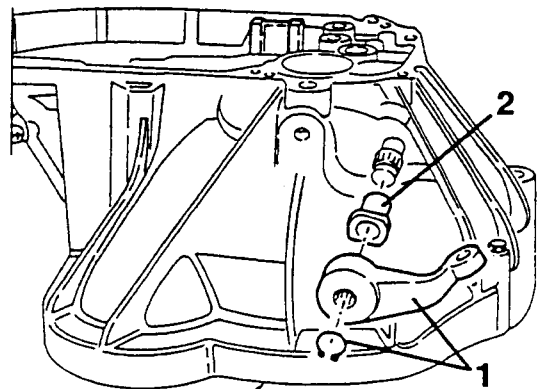
1. Withdraw the thrust bearing from its sleeve in the gearbox cover.



When refitting the bearing, make sure that it runs smoothly and noiselessly, if not, replace it.

- Only if necessary:

1. Remove the seeger locking and withdraw the clutch engagement control lever.
2. Remove the anti-slip bush from the gearbox cover.
3. Working from inside the gearbox cover remove the clutch engagement sleeve control fork and pin.
4. Slacken the screws fastening the thrust bearing sleeve and remove it.





When refitting, install a new anti-slip bush each time the pin has too much play.

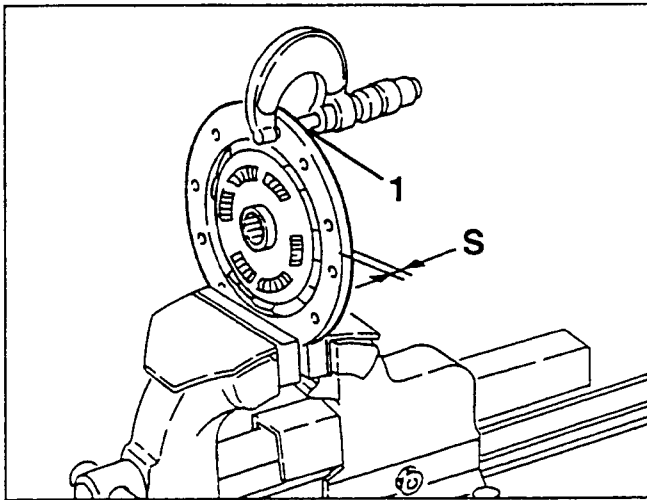
When refitting, grease the bushes and the sleeve with the specified product. The sleeve complete with oil guard must be changed whenever it leaks oil.

## CHECKS AND INSPECTIONS

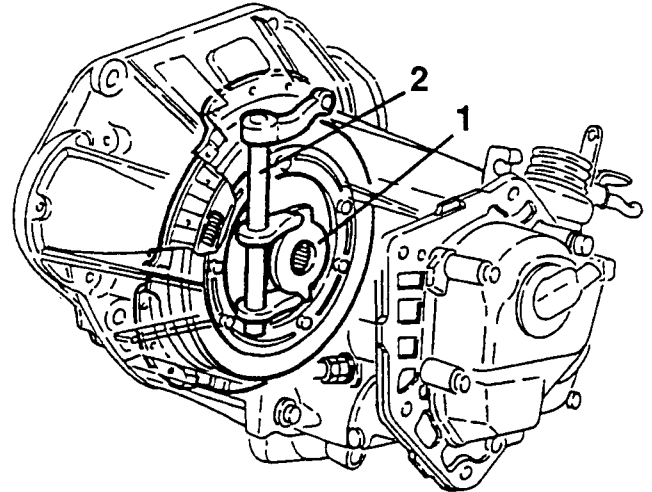
1. Check the gaskets for even wear and that the thickness of the clutch plate is not below the minimum specified.



| Thickness "S" of clutch plate (mm) |                   |
|------------------------------------|-------------------|
| New                                | At the wear limit |
| 7.1 + 7.7                          | 6.3               |



- Check that there are no signs of burning or vitrification, that fastening is correct and that the springs are intact.
- Check that the clutch plate hub is intact, runs freely and that there is no excessive play on the drive shaft coupling.
- Check the working surfaces of the flywheel and pressure plate for signs of overheating, uneven wear, nicks or missing parts.
  1. Check the thrust bearing for noise, excessive play and freedom of movement on the drive sleeve.
  2. Check the fork for cracks, distortion, freedom of movement and excessive wear on the working surfaces.





## CLUTCH PUMP

Refer to the instructions for the TD engine.

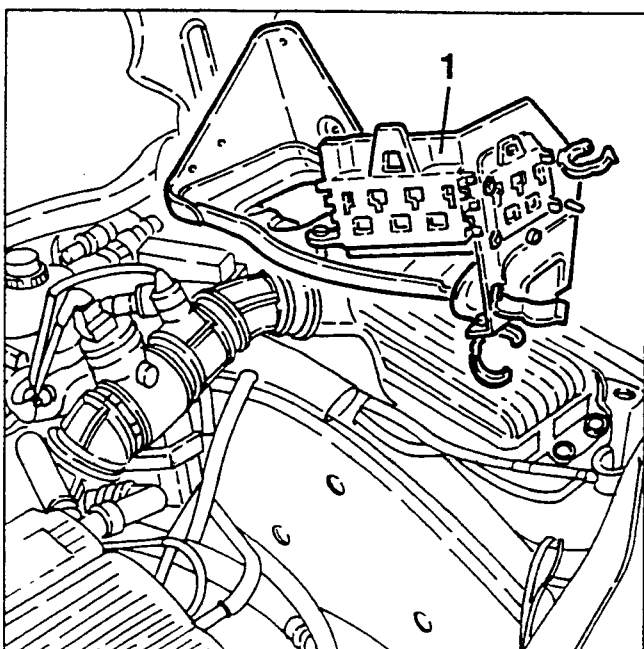
## CLUTCH PEDAL

Refer to the instructions for the TD engine.

## CLUTCH CONTROL CYLINDER

### REMOVAL/REFITTING

- Remove the battery
- Remove the relay from the battery support and set them to one side with their wirings to prevent them from hindering subsequent operations.
- 1. Slacken the fastening screws, then remove the battery support after removing the rear cable support bracket from it.

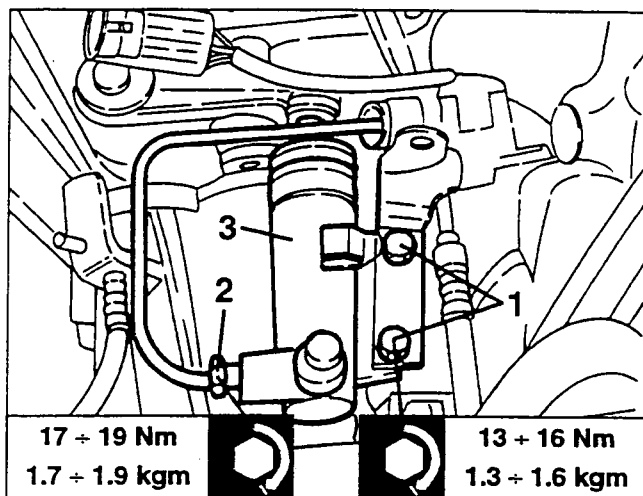


- Using a suitable syringe, empty the brake-clutch fluid reservoir.

Move away the injection wiring to gain access to the clutch control cylinder.

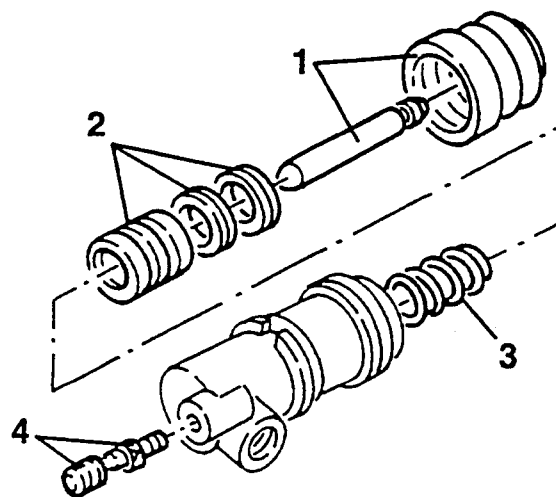
1. Slacken the two screws fastening the clutch control cylinder.
2. Disconnect the fitting of the pump delivery pipe from the clutch control cylinder.

3. Remove the clutch control cylinder.



### DIS-ASSEMBLY/RE-ASSEMBLY

1. Prise off the rubber boot and remove it together with the control prod.
2. Remove the piston from the cylinder body with its seals.
3. Remove the spring.
4. Only if necessary, remove the air relief screws.




**WARNING**  
Always change the gaskets when re-assembling.

### CHECKS AND INSPECTIONS

- Check the piston and the cylinder inner surface for scores or traces of rust and change the cylinder assembly if necessary.
- Check that the spring is intact.
- Check that the air relief hole is not clogged.



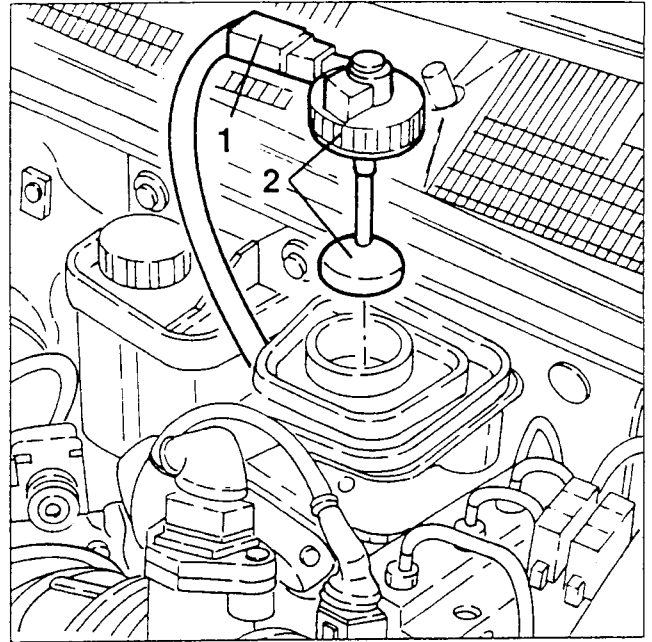
## BLEEDING AIR FROM THE HYDRAULIC SYSTEM

Refer to the instructions for the  TD engine.

## MINIMUM BRAKE - CLUTCH FLUID LEVEL SENSOR

### REMOVAL/REFITTING

- Disconnect the battery (-) terminal.
- 1. Disconnect the electrical connection from the minimum brake-clutch fluid level sensor.
- 2. Slacken the cap with the built-in minimum brake-clutch fluid level sensor and remove it.





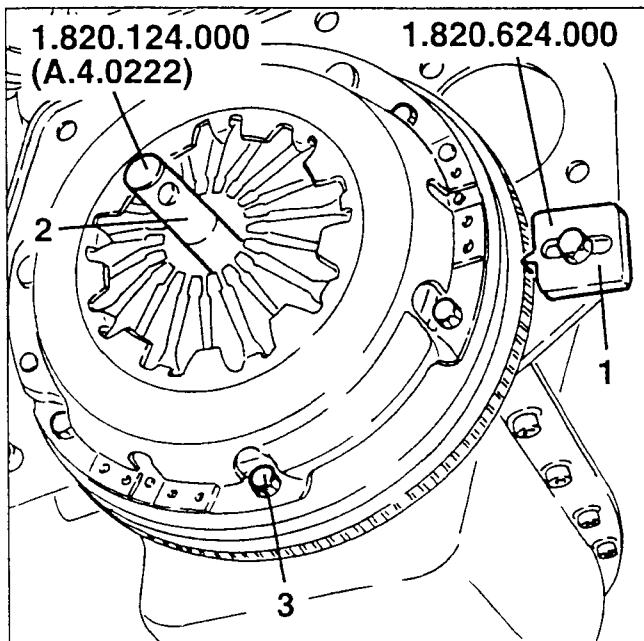
## DESCRIPTION

See the description of the TD engine

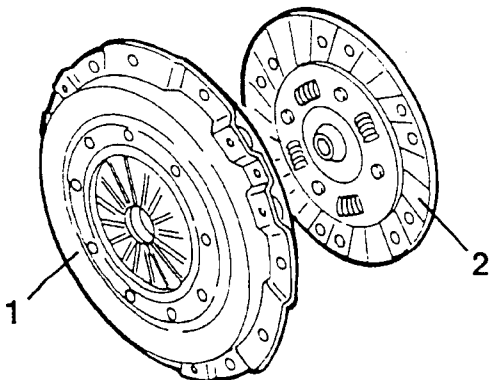
## CLUTCH PLATE AND PRESSURE PLATE

### REMOVING/REFITTING

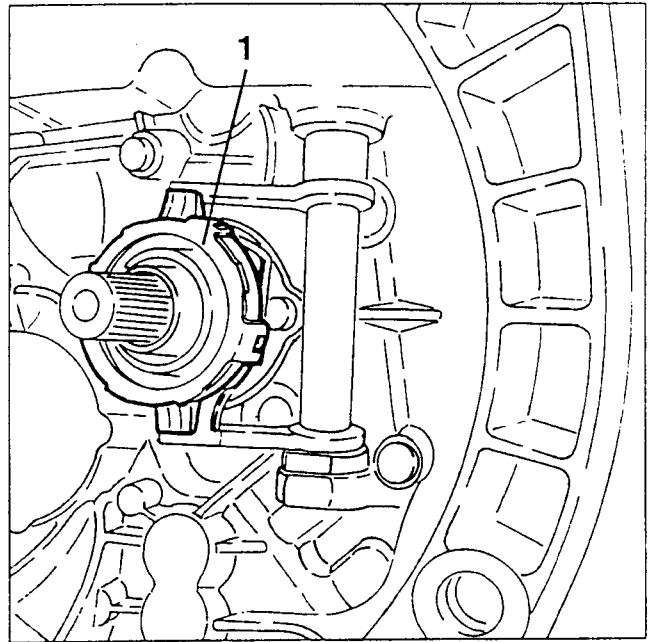
- Remove the gearbox differential unit (see GROUP 21).
- When changing the clutch plate only, mark the position between pressure plate and flywheel to facilitate refitting operations.
- 1. Install flywheel stopper tool no. 1.820.624.000.
- 2. Install tool no. 1.820.124.000 (A.4.0222) in the clutch plate hub.
- 3. Slacken the screws fastening the pressure plate to the flywheel.



1. Remove the pressure plate.
2. Remove the clutch plate.



1. Withdraw the thrust bearing from its sleeve on the gearbox cover.



When refitting the bearing must not stick or turn noisily, otherwise it must be replaced.

### CHECKS AND INSPECTIONS

1. Check that lining wear is even and that the thickness of the clutch plate is not below the minimum specified limit.



#### Thickness "S" of clutch plate (mm)

| New       | at wear limit |
|-----------|---------------|
| 6.7 ÷ 7.3 | 5.9           |

- Check that there are no burns or signs of vitrification, that fastening is correct and that the springs are intact.
- Check that the clutch plate hub is intact, slides freely and that there is no excessive play on the engagement of the power takeoff shaft.
- Check the working surfaces of the flywheel and pressure plate for signs of overheating, uneven wear, nicks or material removal.
- Check the thrust bearing for noise, excessive play and that it runs freely on the guide sleeve.
- Check the fork for cracks, distortion, freedom of movement and excessive wear on the working surfaces.

**FUEL SYSTEM****FUEL (Specific for petrol engines)**

|               |                     |
|---------------|---------------------|
| Unleaded fuel | minimum R.O.N. = 95 |
|---------------|---------------------|

**FUEL TANK**




|                |                  |
|----------------|------------------|
| Total capacity | 51/61 litres (*) |
| Reserve        | 5 ÷ 8 litres     |

(\*) : For Versions/Markets.

**SAFETY VALVE SETTING CHECK (on fuel tank)  
(Specific for petrol engines)**

|                                             |               |
|---------------------------------------------|---------------|
| Opening vacuum for tank ventilation         | ≤ 0.020 bar   |
| Opening pressure for releasing fuel vapours | 0.065 ÷ 0.085 |

**CHECKING FUEL SUPPLY PRESSURE  
(Specific for petrol engines)**

|                                            |  |  |  16V | T. SPARK<br>16V   |
|--------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------|
| Opening vacuum for tank ventilation        | 2.3 ÷ 2.7 bar                                                                       | 2.8 ÷ 3.2 bar                                                                         |                                                                                           | 2.8 ÷ 3.2 bar (*) |
| Opening pressure for relasing fuel vapours | 4 bar (*)                                                                           |                                                                                       |                                                                                           |                   |

(\*) For versions with M1.5.5 injection - ignition system: 3.5 ± 0.2 bar.

**MULTI-PURPOSE VALVE SETTING CHECK (on fuel tank)**

|                                             | Petrol engines    | Turbodiesel engines |
|---------------------------------------------|-------------------|---------------------|
| Opening pressure for releasing fuel vapours | 0.038 ÷ 0.053 bar | 0.055 ÷ 0.075 bar   |
| Opening vacuum for tank ventilation         | - 0.020 bar       | - 0.020 bar         |

**CHECKING THE FUEL WARMING DEVICE THERMAL SWITCH SETTING  
(Specific for 1929 Turbodiesel engine)**

|                             |      |
|-----------------------------|------|
| Contact closing temperature | 6°C  |
| Contact opening temperature | 15°C |

**INJECTOR SETTING CHECK (Specific for 1929 Turbodiesel engine)**

|                                |               |
|--------------------------------|---------------|
| Injector seal control pressure | 130 ÷ 138 bar |
| Injector setting pressure      | 150 ÷ 158 bar |



**CHECKING INJECTION PUMP TIMING**  
(Specific for 1929 Turbodiesel engine)



|                                    |        |
|------------------------------------|--------|
| Injection pump distribution stroke | 0.8 mm |
|------------------------------------|--------|

**CHECKING AUTOMATIC FAST IDLE DEVICE**  
**THERMOSTATIC SENSOR SETTING (Specific for 1929 Turbodiesel engine) (\*)**

|                      |            |
|----------------------|------------|
| Start of stroke      | 60° ± 2 °C |
| Stroke at 75 °C      | 7 mm       |
| MAX stroke at 100 °C | 11 mm      |

(\*): On the version with catalyst, though the injection pump has a fast idle device, use of it is not made (there is no connection with the thermostatic sensor).

**CHECKING AUTOMATIC FAST IDLE AND IDLE SPEED**  
(Specific for Turbodiesel engines)

|                               |  TD |  JTD |
|-------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Idle speed                    | 880 + 920 rpm<br>with control lever in contact<br>with adjustment screw              | 770 + 830 rpm                                                                           |
| Automatic fast idle speed (*) | 1180 + 1220 rpm<br>with gap between control lever<br>& adjustment screw of 5 mm      | -                                                                                       |

(\*): - On the version with catalyst, though the injection pump has a fast idle device, use of it is not made (there is no connection with the thermostatic sensor).

- 1910 JTD versions are not equipped with an automatic fast idling device.

**CHECKING KSB DEVICE THERMAL SWITCH SETTING**  
(Specific for 1929 Turbodiesel engine)

|                             |            |
|-----------------------------|------------|
| Contact closing temperature | 60° ± 2 °C |
| Contact opening temperature | 50° ± 2 °C |

**AIR SUPPLY****FLUXING TEST**  
Specific for Boxer 1596 - MP3.1 engine

|                              |                                     |
|------------------------------|-------------------------------------|
| Throttle on contact (closed) | 80 MAX Scale D - SOLEX flow meter   |
| Throttle adjusted            | 295 ± 10 Scale N - SOLEX flow meter |

**Specific for Boxer 1712 16V engine**

|                                                        |                                      |
|--------------------------------------------------------|--------------------------------------|
| Air leakage with by-pass screws completely tightened   | 120 + 130 Scale K - SOLEX flow meter |
| Air leakage with throttles adjusted and by-passes open | 185 Scale N - SOLEX flow meter       |

## EXHAUST EMISSIONS CONTROL

Specific for Boxer engines (1)

|                     |        |       |
|---------------------|--------|-------|
| CO while exhausting | % vol. | ≤ 0.2 |
| HC while exhausting | p.p.m. | ≤ 50  |



(1): Measured at the end of the exhaust pipe with nominal slow running, warmed up engine, neutral gear and accessories not operating.

## Specific for T. Spark 16V engines

|                           |              |
|---------------------------|--------------|
| CO while exhausting       | ≤ 2.2 g x km |
| HC + NOx while exhausting | 0.5 g x km   |

## CALIBRATION CHECKING OF THE OVERPRESSURE VALVE "WASTE-GATE"

(Specific for Turbodiesel engines)

| Check pressure  | Corresponding actuator's stroke                                                        |
|-----------------|----------------------------------------------------------------------------------------|
|                 |  TD   |
| 0.96 ÷ 1.04 bar | 2 mm                                                                                   |
| 1.10 ÷ 1.19 bar | 4 mm                                                                                   |
|                 |  JTD |
| 0.86 ÷ 0.91 bar | 1 mm                                                                                   |

## SMOKE GRADE CHECKING DURING EXHAUSTION

(Specific for Turbodiesel engines)

|                                             |       |
|---------------------------------------------|-------|
| Limit value of smoke grade while exhausting | < 70% |
|---------------------------------------------|-------|

## SENSORS

### ENTREFER SENSOR OF REVOLUTIONS AND TDC (Specific for Boxer engines)

|              |
|--------------|
| 0.7 ± 0.1 mm |
|--------------|

### ENTREFER PHASE SENSOR (Specific for Boxer 1712 16V engines)

|        |
|--------|
| 1.5 mm |
|--------|

### ENTREFER SENSOR OF REVOLUTIONS (Specific for 1929 Turbodiesel engines)

|               |
|---------------|
| 0.25 ÷ 1.3 mm |
|---------------|

### ENTREFER SENSOR OF REVOLUTIONS AND PHASE

(Specific for T. Spark 16V and 1910 JTD engines)

|              |
|--------------|
| 0.8 ÷ 1.5 mm |
|--------------|



## COOLING SYSTEM

|                                             |                                              |
|---------------------------------------------|----------------------------------------------|
| Check pressure of hydraulic system          | 1.08 bar (1.1 kg/cm <sup>2</sup> )           |
| Calibration pressure of the pressurized cap | 0.98 ± 0.1 bar (1 ± 0.1 kg/cm <sup>2</sup> ) |


## WATER PUMP

|                                     | Boxer engines | Turbodiesel engines |
|-------------------------------------|---------------|---------------------|
| Play between impeller and pump body | 0.5 ÷ 0.8 mm  | 0.53 ÷ 1.37 mm      |

## THERMOSTAT

|                              | Boxer engines    | Turbodiesel engines                                                                  |                                                                                        | T. Spark 16V engines  |
|------------------------------|------------------|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|-----------------------|
|                              |                  |  TD |  JTD |                       |
| Temperature of start opening | 86° ± 2°C        | 83° ± 2°C                                                                            | 80° ± 2°C                                                                              | 83° ± 2°C             |
| Valve stroke                 | (a 100°C) > 7 mm | (a 90°C) ≥ 7.5 mm                                                                    | -                                                                                      | (a 103° ± 2°C) 9.5 mm |







## THERMAL CONTACT OF THE ELECTRIC COOLING FAN

|                          |                        | Petrol engines (**) |  TD |
|--------------------------|------------------------|---------------------|------------------------------------------------------------------------------------------|
| 1 <sup>^</sup> speed     | ON (contacts closing)  | 92° ± 2°C           | 88° ± 2°C                                                                                |
|                          | OFF (contacts opening) | 87° ± 2°C           | 83° ± 2°C                                                                                |
| 2 <sup>^</sup> speed (*) | ON (contacts closing)  | 97° ± 2°C           | 92° ± 2°C                                                                                |
|                          | OFF (contacts opening) | 92° ± 2°C           | 87° ± 2°C                                                                                |

(\*): For cars with Boxer engines, the second  
 (\*\*): Not for T. SPARK 16V with injection- ig:

is present only on air conditioned versions.  
 system M2.10.4 e M1.5.5.

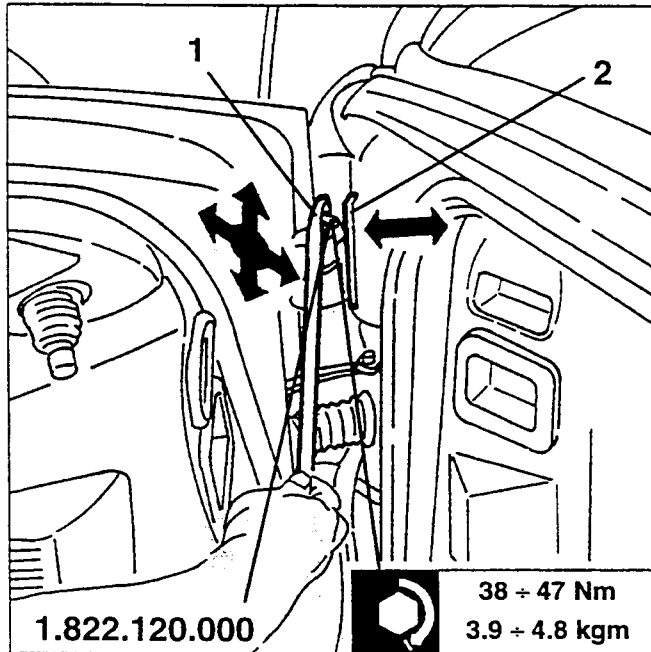
## TRANSMITTER GAUGE FOR TEMPERATURE OF COOLING/CONTACT FLUID PILOT LIGHT OF MAXIMUM TEMPERATURE

| Contact temperature<br>pilot light of max.<br>temperature | Boxer<br>engines | Turbodiesel engines                                                                    |                                                                                         |  T. SPARK 16V |   <br>T. SPARK 16V |
|-----------------------------------------------------------|------------------|----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                           |                  |  TD |  JTD |                                                                                                  |                                                                                                                                                                                                                                                                                   |
| Intervention temperature                                  | 117° ± 3°C       | 115° ± 3°C                                                                             | (*)                                                                                     | 122° ± 2°C                                                                                       | 120° ± 2°C                                                                                                                                                                                                                                                                        |
| Release temperature                                       | 100° ± 3°C       | 85°C                                                                                   | (*)                                                                                     | 112° ± 3°C                                                                                       | 108° ± 3°C                                                                                                                                                                                                                                                                        |

N.B. To check the calibration data of the transmitter, please refer to "ELECTRIC-ELECTRONIC DIAGNOSTICS".  
 (\*): Data which are not available while printing

## ADJUSTMENT

1. Using tool N° 1.822.120.000, loosen the screws securing the hinge to the body and make adjustments for the height and width of the door.
2. If necessary position suitable shims under the hinges to adjust the position of the door.



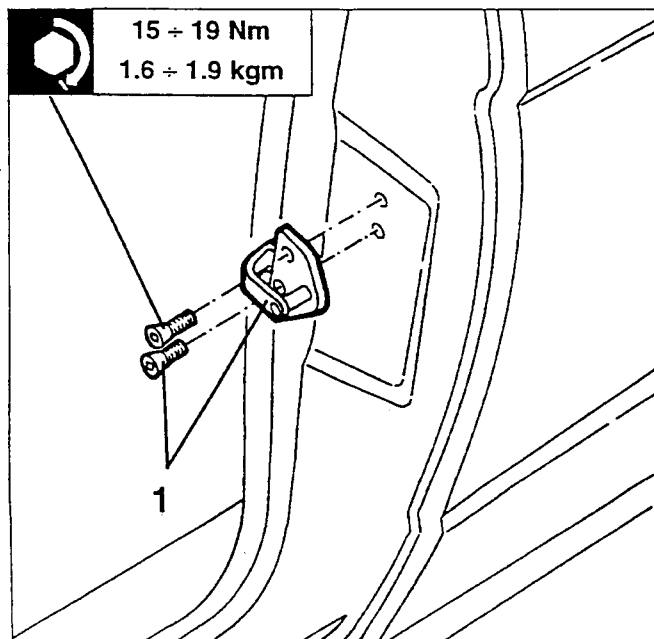
### NOTE:

To gain access to the screws of the upper hinge, disconnect the door check strap.

## DOOR CATCH

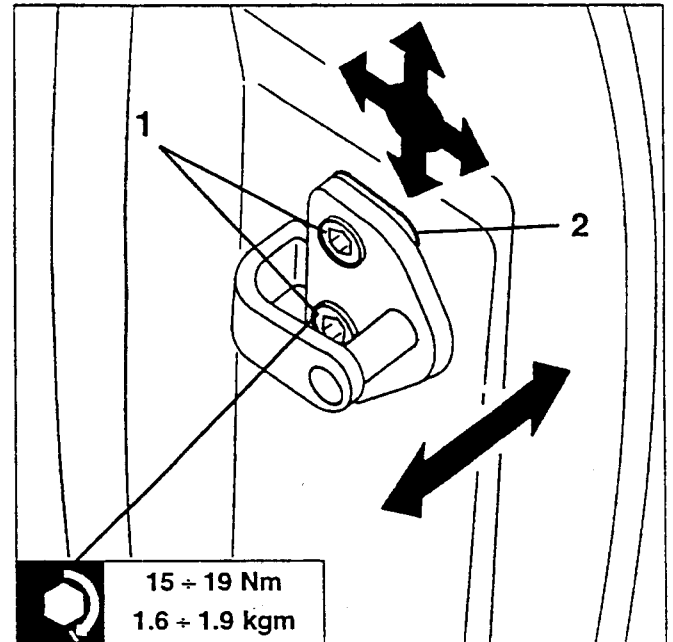
### REMOVAL AND REFITTING

1. Loosen the two screws and remove the catch.



## ADJUSTMENT

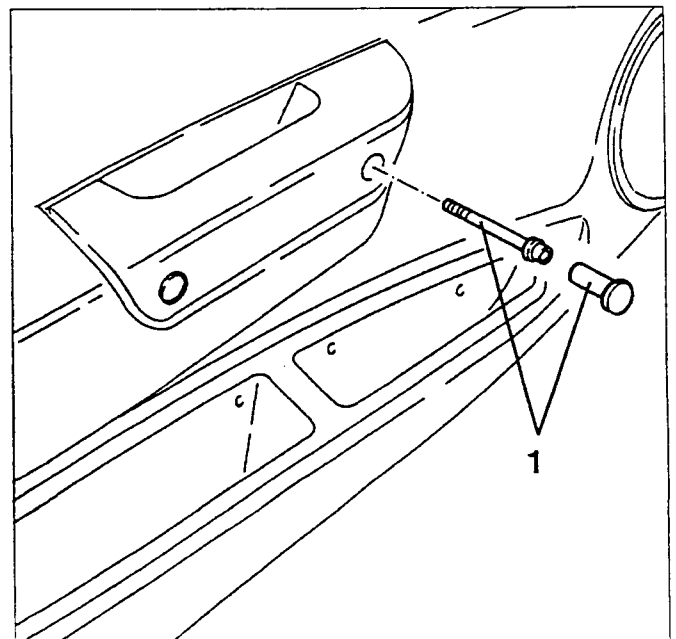
1. Loosen the screws securing the catch and adjust the catch until the door closes correctly. Tighten the screws.
2. If necessary position suitable shims under the catch to adjust the closure of the door.



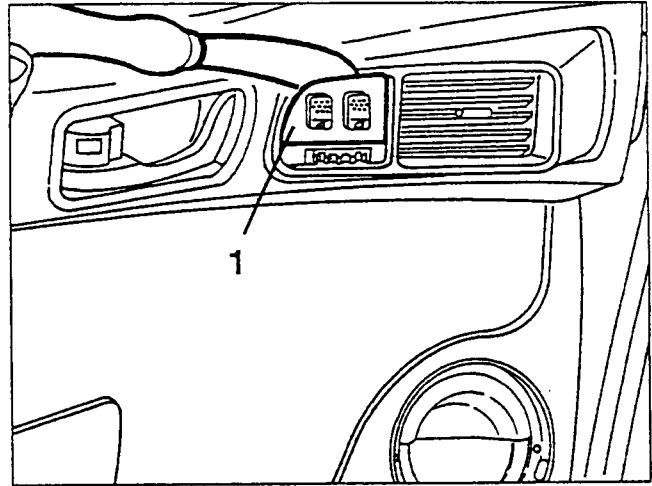
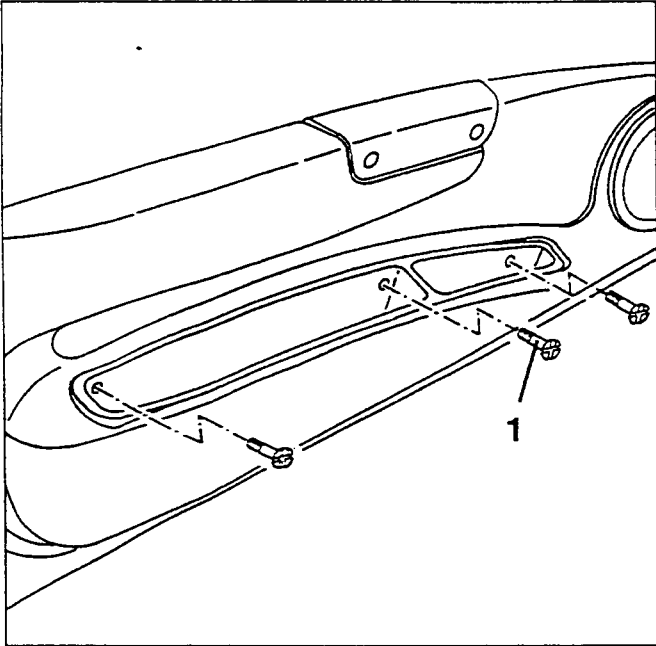
## PANEL

### REMOVAL AND REFITTING

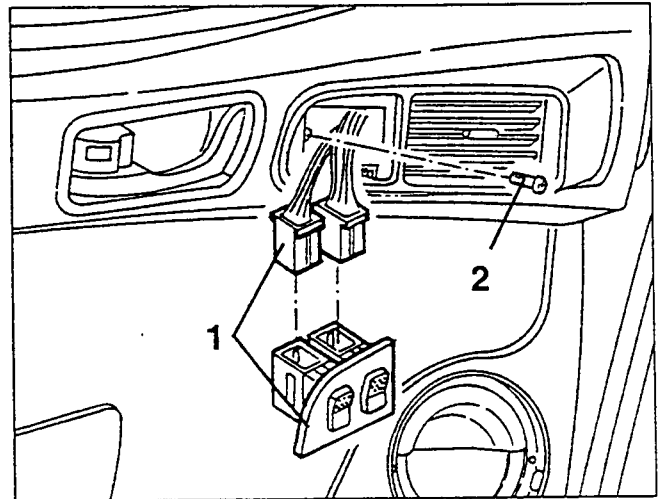
- Disconnect the negative (-) lead from the battery.
- 1. Pull off the plastic caps from the armrest grip and unscrew the underlying screws.



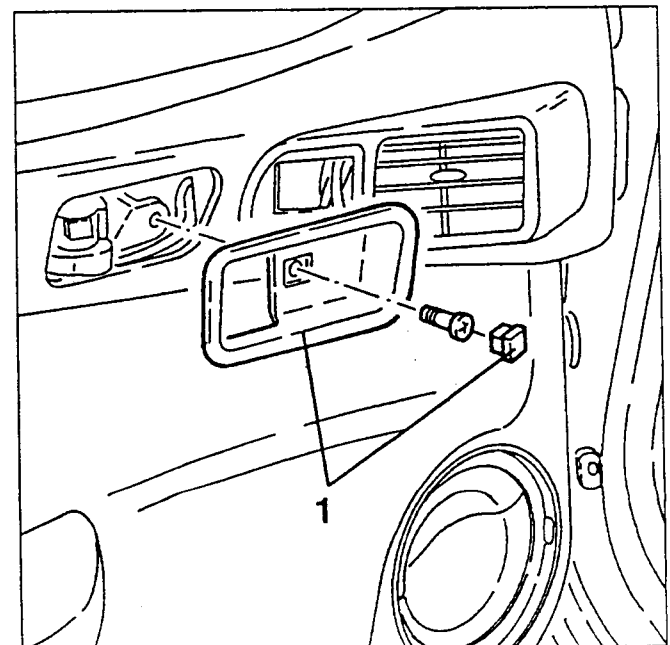
1. Slacken the three upper screws fastening the utility pocket.



1. Disconnect the electrical connections from the power window switches and remove the switches.  
2. Slacken the fastening screw in the switch compartment.



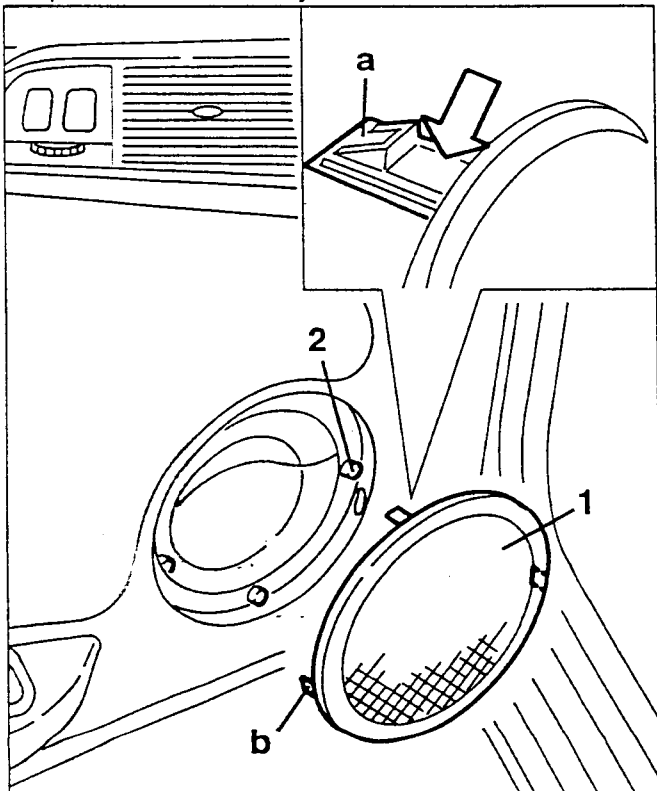
1. Remove the plastic cap, slacken the fastening screw and remove the door opening handle plate.



1. Remove the speaker protection grille proceeding as follows:

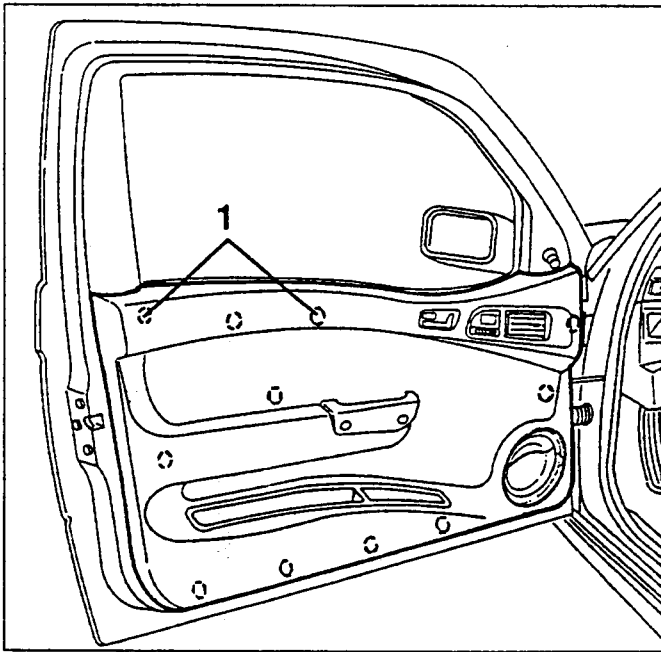
- using a suitable tool (eg. small, flat screwdriver) press on the upper catch (a) hooking the grille to the door panel;
- proceed as described for the previous step on the rear catch (b);
- remove the grille.

2. Slacken the three screws fastening the speaker compartment to the body.



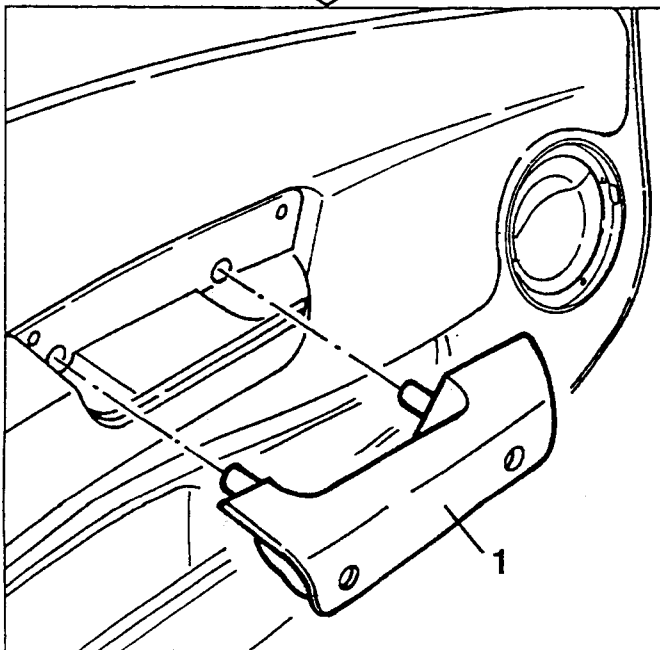
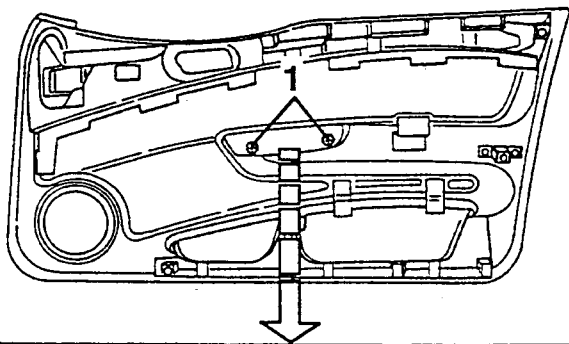
1. Remove the power window switches complete with plate from their housing.

1. Pull the panel away from the plastic buttons positioned as shown in the diagram and remove the panel.

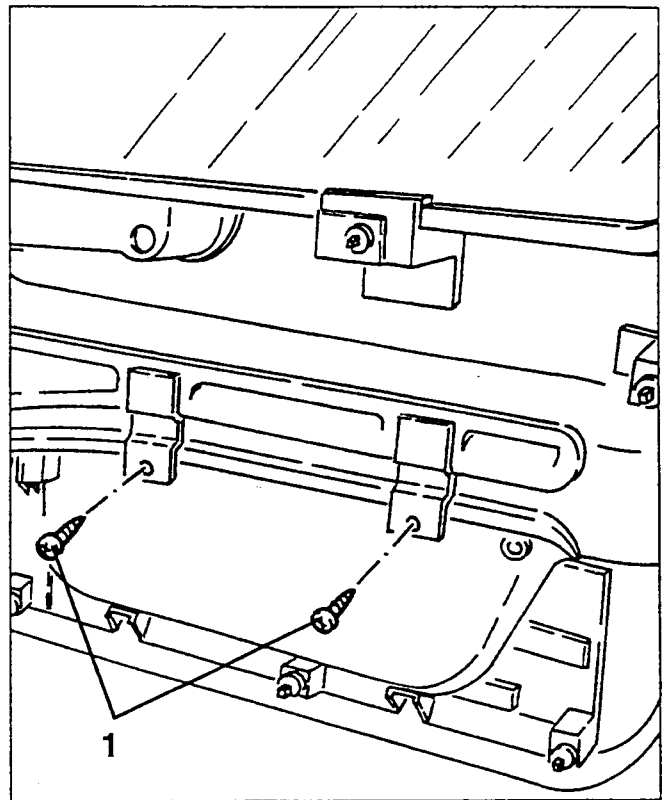


## DISASSEMBLY

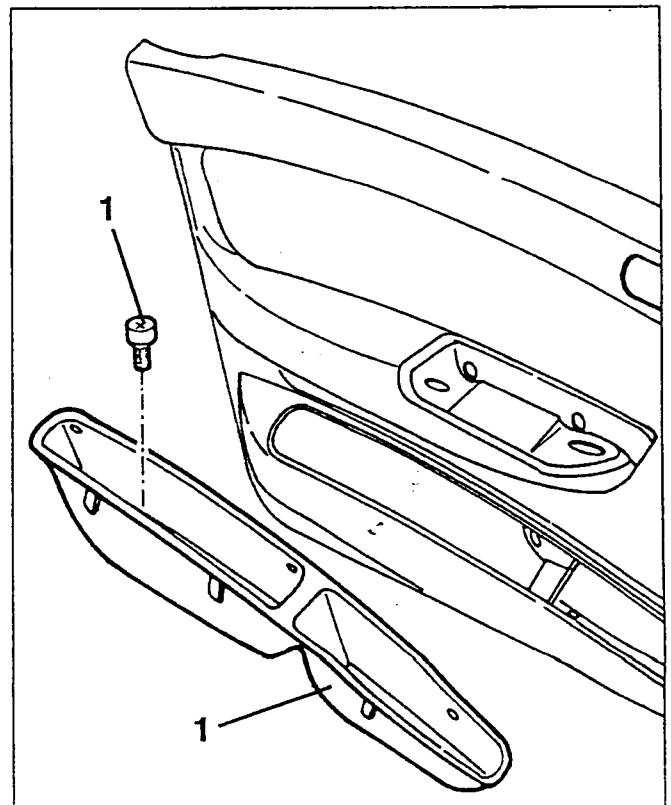
1. Loosen the two screws and remove the armrest handle.



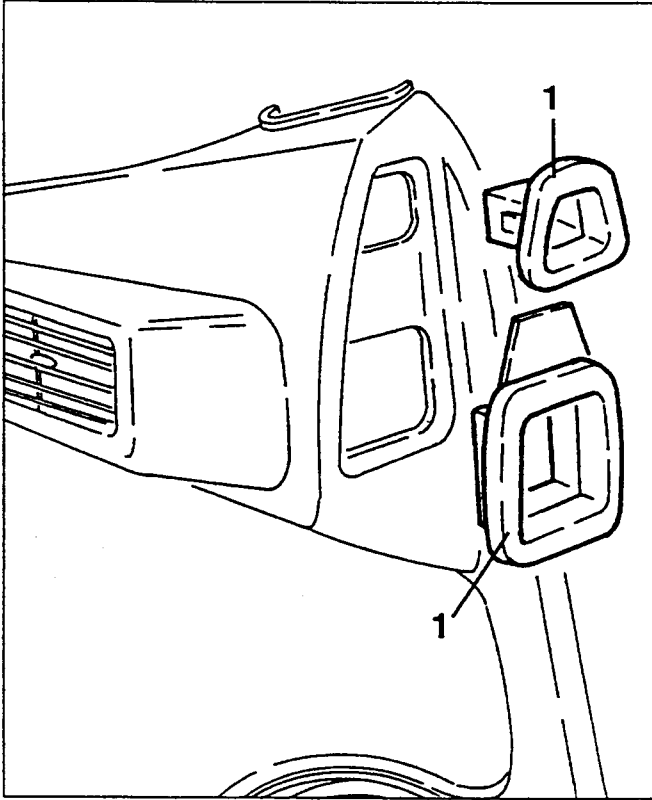
1. Loosen the two rear screws securing the object pouch.



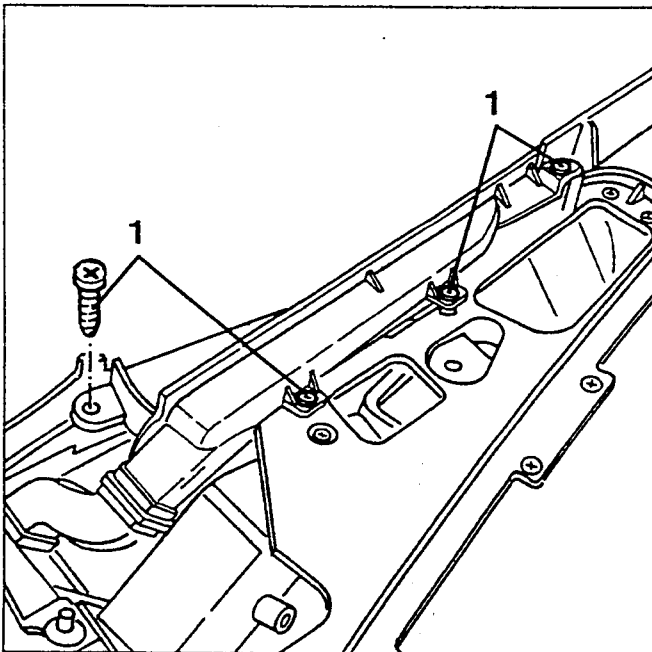
1. Loosen the three rear screws securing the object pouch and remove it.



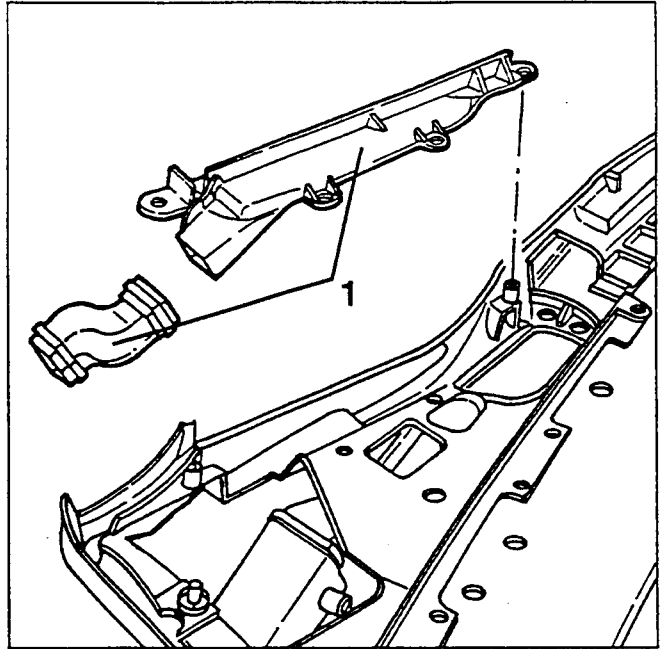
1. Remove the two gaskets from the air vents (these can be removed even if the panel is still installed).



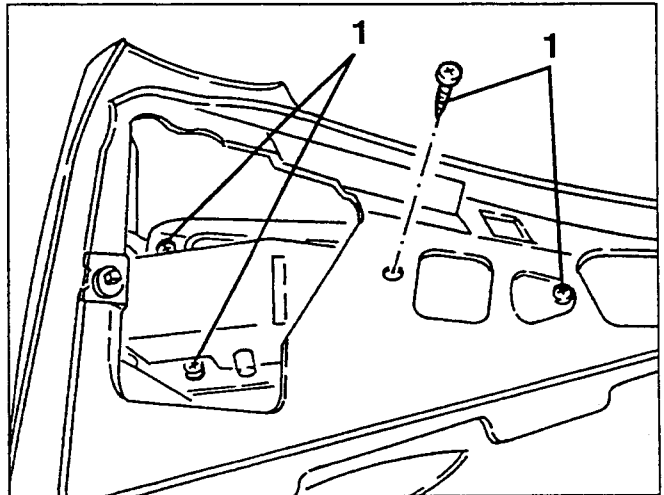
1. Loosen the four screws securing the door window defrosting vent.



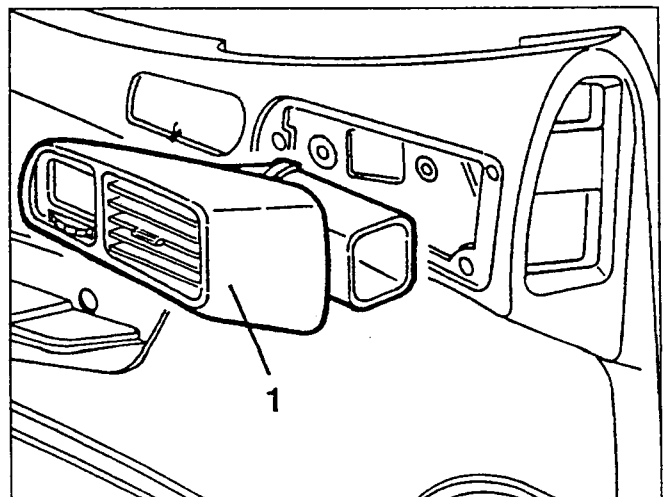
1. Remove the door window defrosting vent.  
- If necessary disassemble the door window defrosting vent.



1. Loosen the four screws securing driver's air delivery vent.



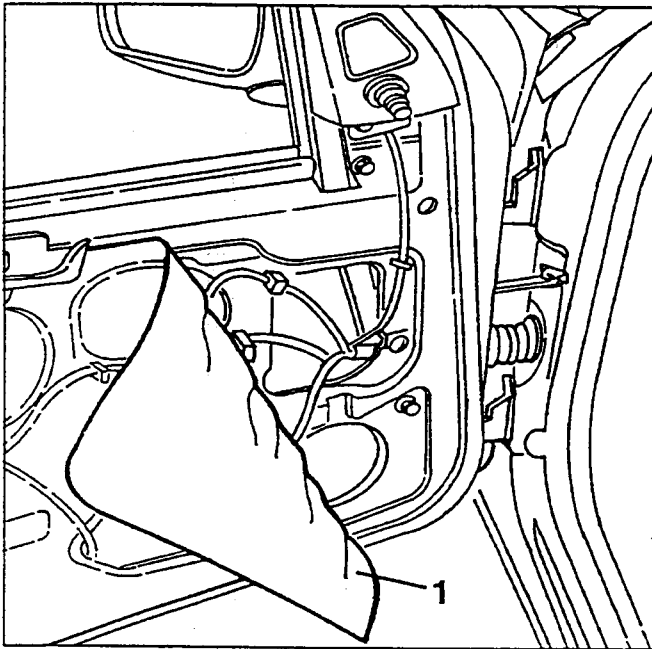
1. Remove the driver's air delivery vent.



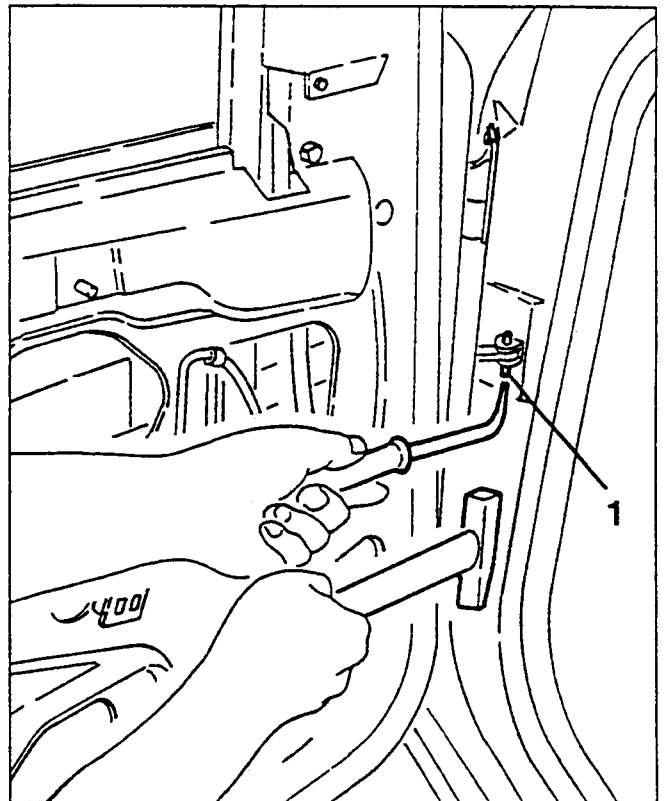
## DOOR CHECK-STRAP

### REMOVAL AND REFITTING

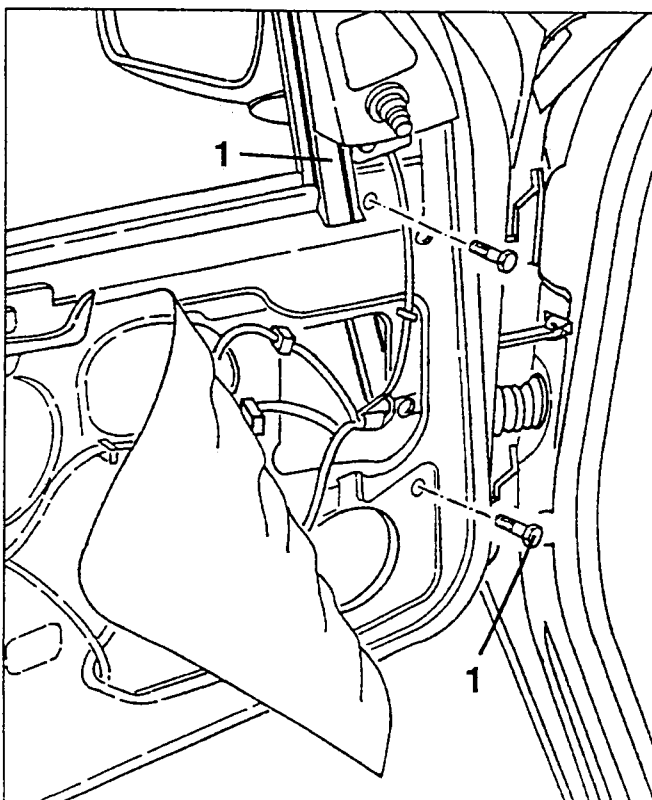
- Remove the panel (see specific paragraph).
- 1. Partially detach the opaline without damaging it.



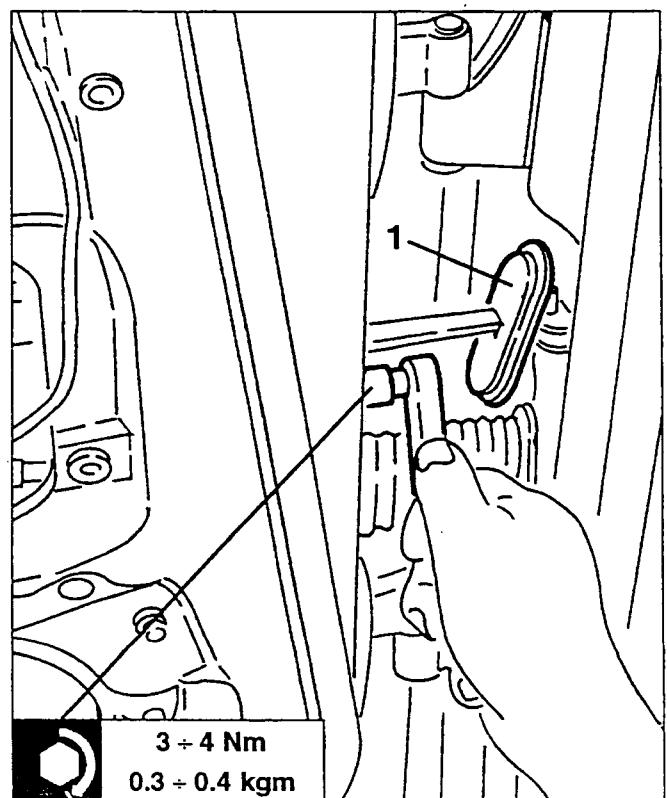
- 1. Using a suitable tool, withdraw and remove the pin from the door check strap, half-close the door to back-off the rod and then open the door once again.



- 1. Loosen the two screws securing the door window runner and move it as required.



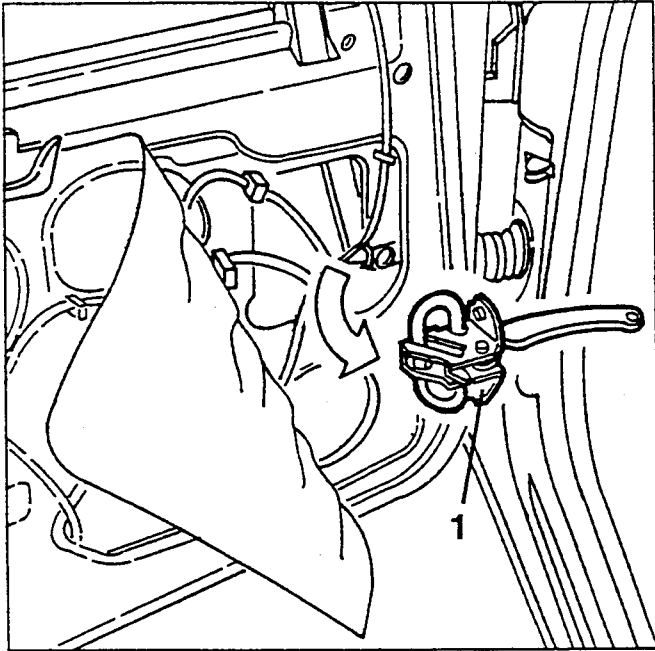
- 1. Pull off the rubber protection and loosen the two screws securing the tie-rod.



**3 ÷ 4 Nm**  
**0.3 ÷ 0.4 kgm**

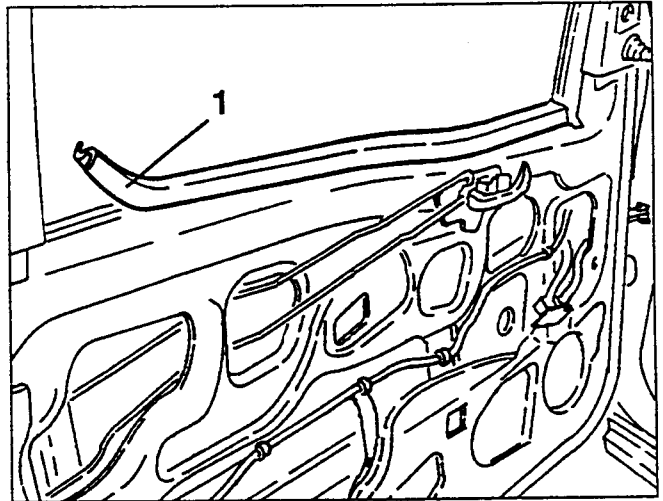


1. Withdraw the check strap from inside the door.



- Detach the opaline ensuring that it does not get damaged.

1. Remove the door window weatherstrip.



When refitting reverse the procedure followed for removal and note the following:

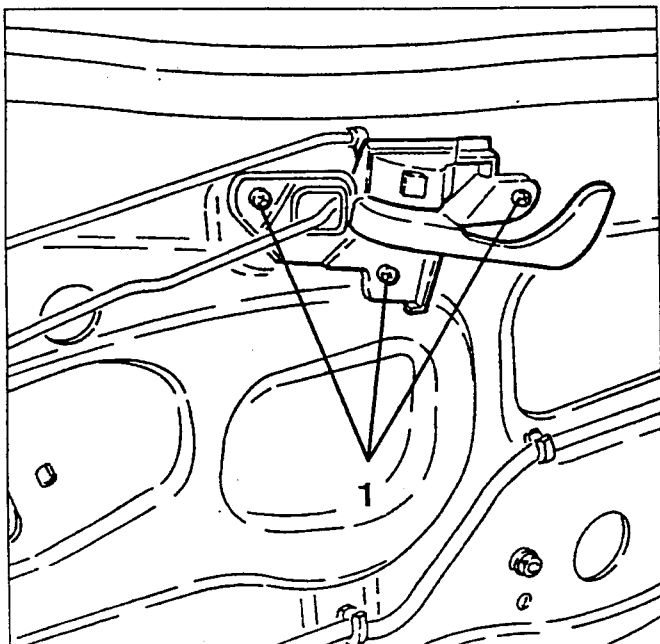
- Before refitting the door check-strap, treat the mating areas of the check strap with primer.
- If the glue of the opaline is no longer able to guarantee perfect bonding, replace it.

## WINDOW

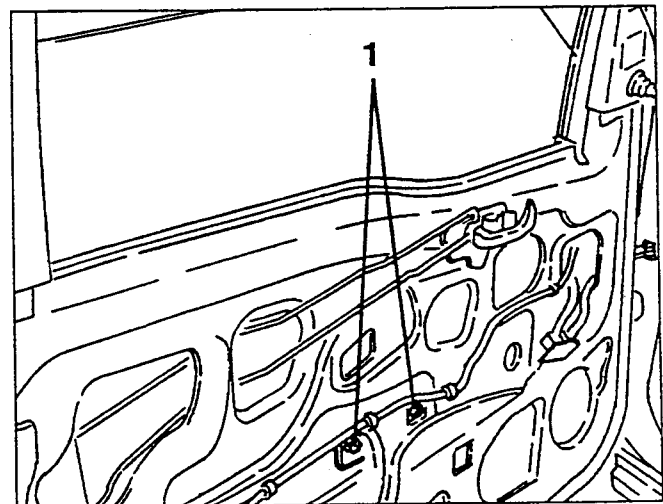
### REMOVAL AND REFITTING

- Remove the panel (see specific paragraph).

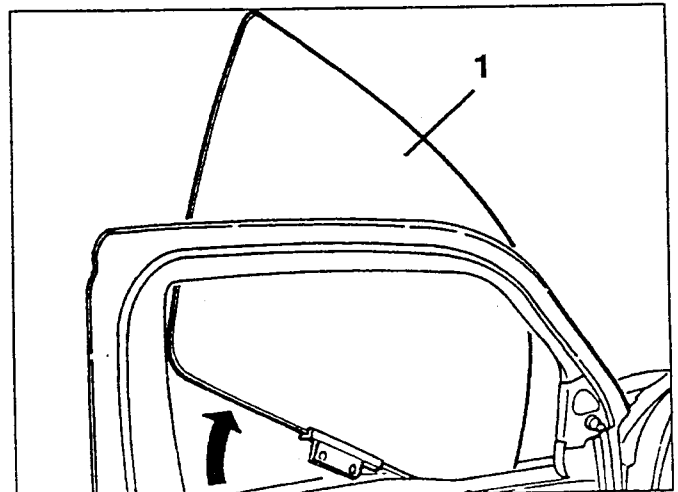
1. Loosen the three screws securing the internal handle and free it from the retaining device.



1. Momentarily connect the battery and the power window buttons and position the window so that access can be gained to the retaining screws as shown in the diagram.



1. Remove the glass by pulling it upwards and mount it to facilitate removal.

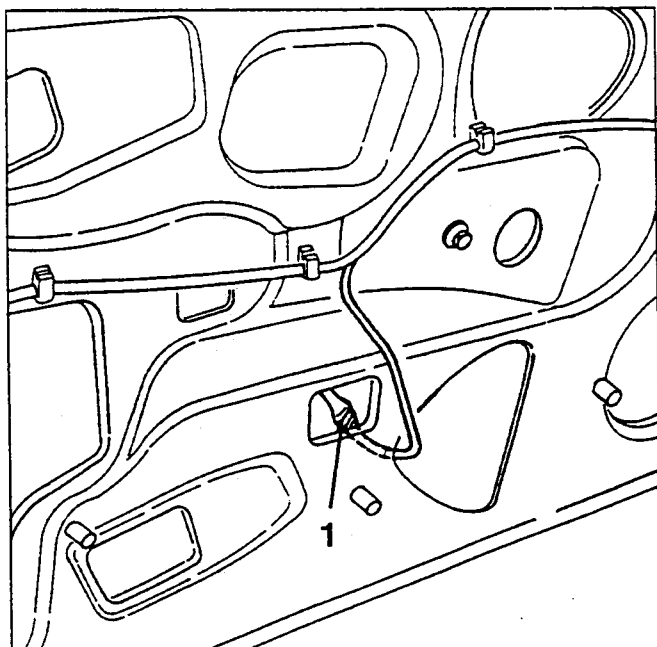


## WINDOW RAISING DEVICE

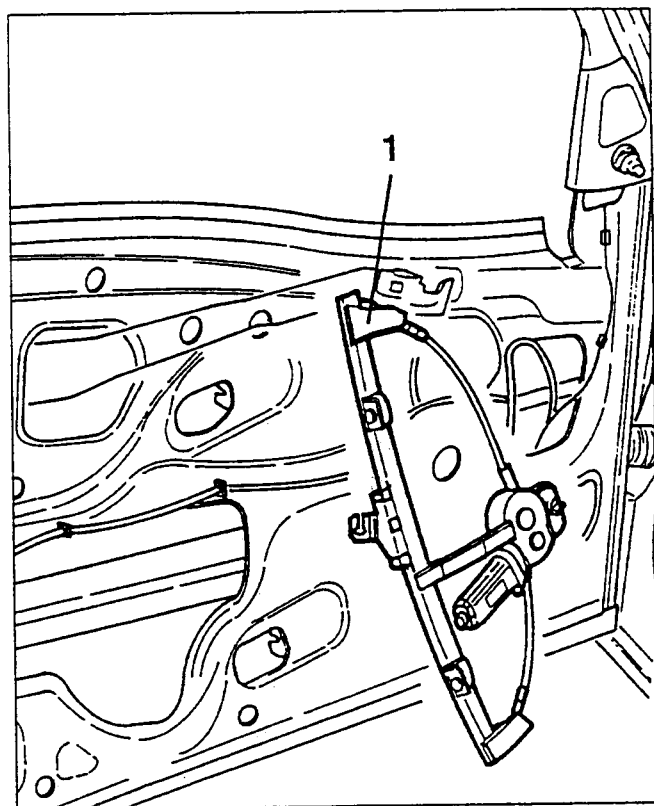
### REMOVAL AND REFITTING

- Remove the window (see specific paragraph).

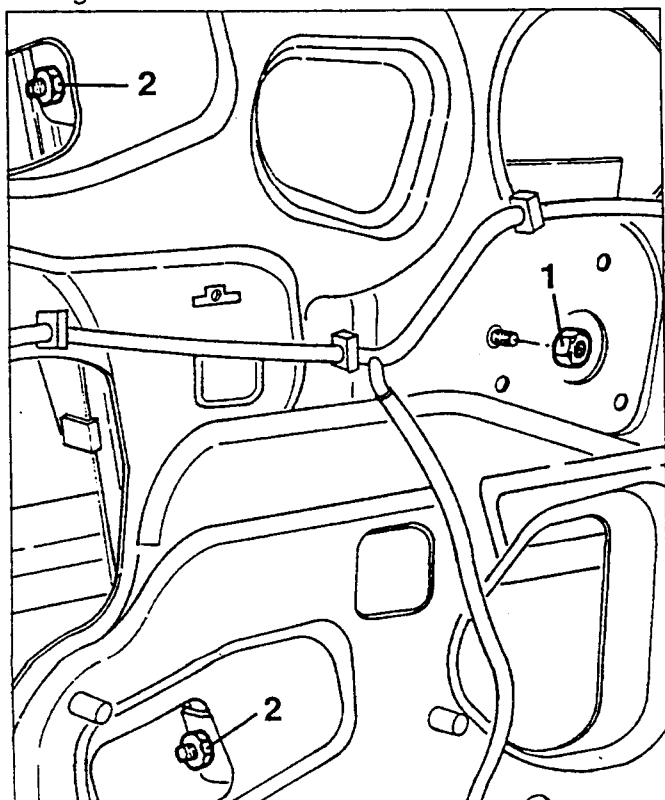
1. Disconnect the electrical connection from the window raising device.



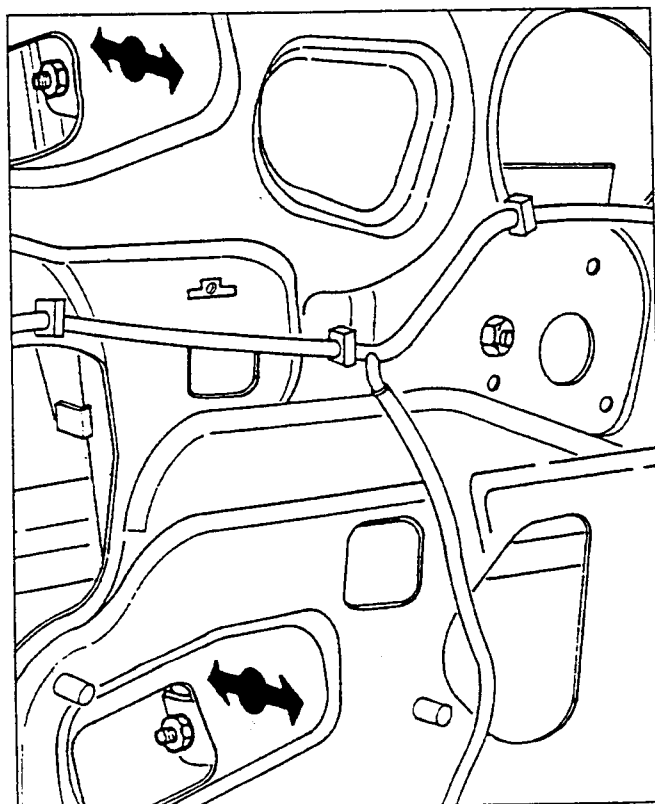
1. Withdraw and remove the window raising device from inside the door.



1. Loosen the front nut securing the window raising device.
2. Loosen the two rear nuts securing the window raising device.



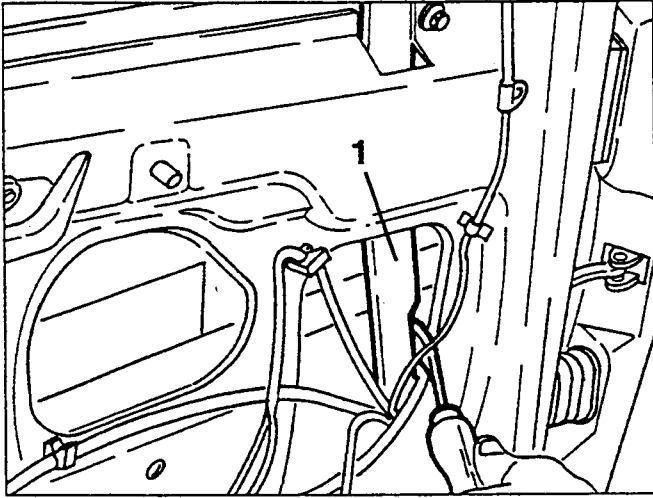
Refit the window raising device by reversing the procedure followed for removal ensuring that its position is adjusted as shown in the diagram.



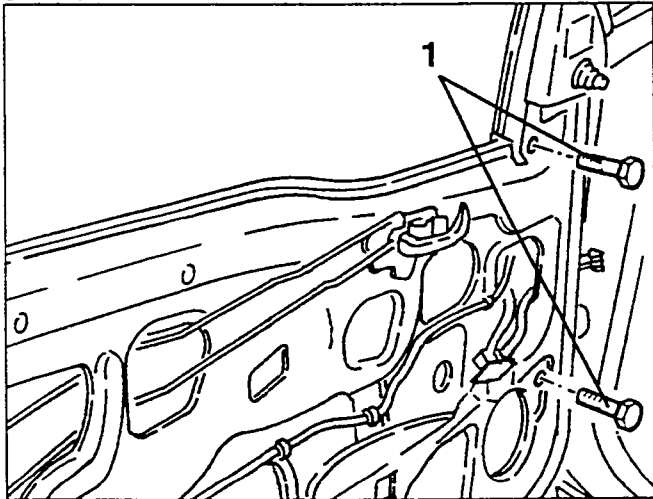
## FRONT GUIDE PAD

### REMOVAL AND REFITTING

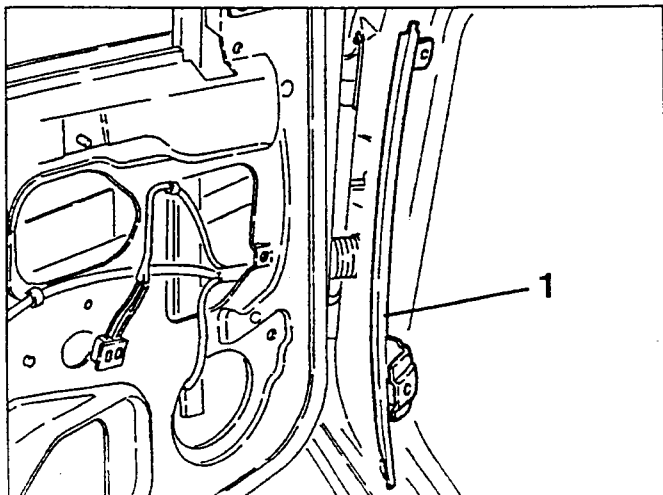
- Remove the window (see specific paragraph).
- 1. Pull off the gasket from the front window guide pad.



- 1. Loosen the two screws securing the front window guide pad.



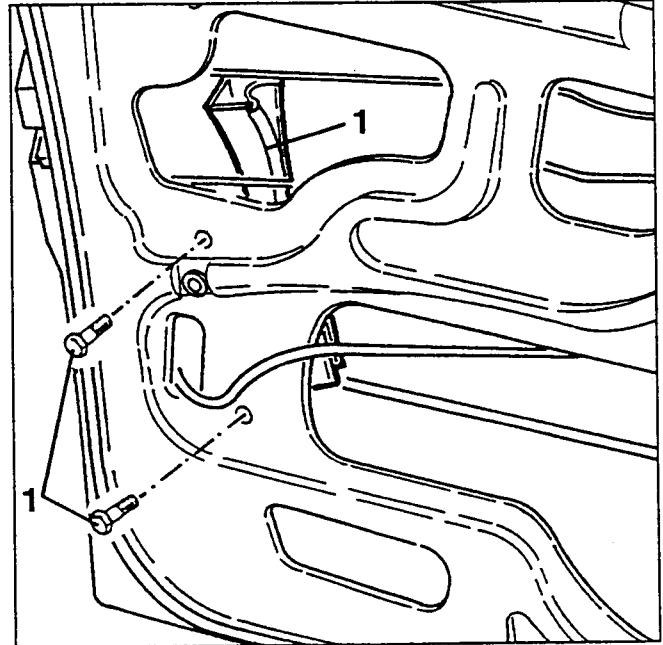
- 1. Remove the front window guide pad by withdrawing it from inside the door.



## REAR GUIDE PAD

### REMOVAL AND REFITTING

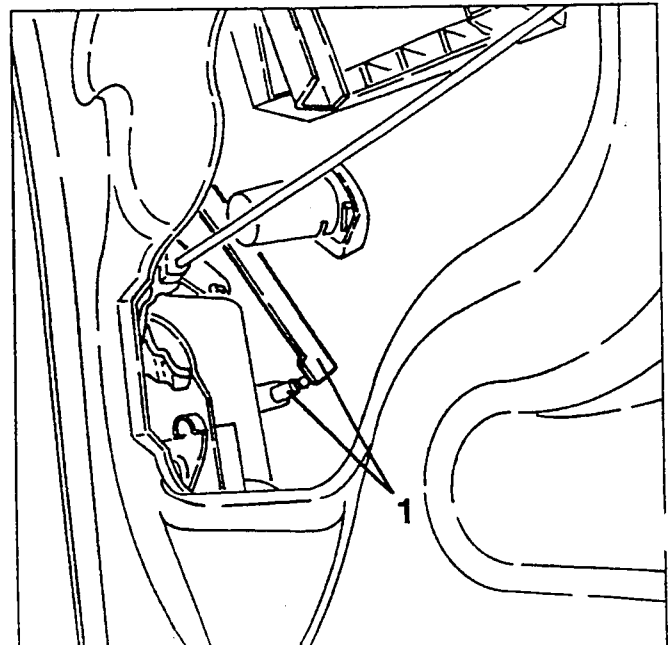
- Remove the panel (see specific paragraph).
- Partially detach the opaline from the upper rear part of the door.
- 1. Loosen the two screws securing the rear window guide pad and remove it.



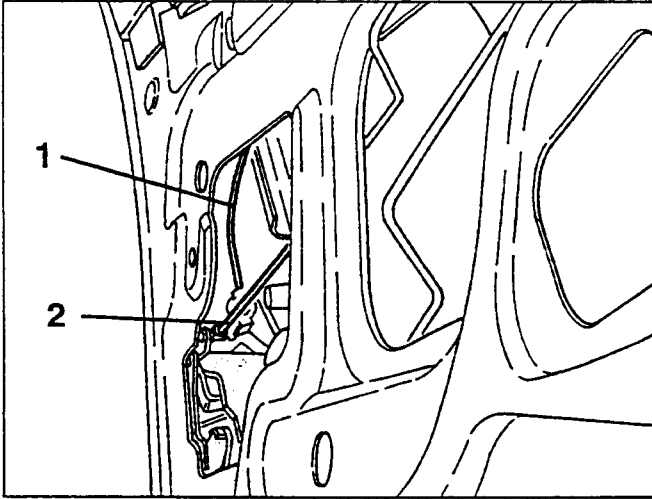
## LOCK DEVICE

### REMOVAL AND REFITTING

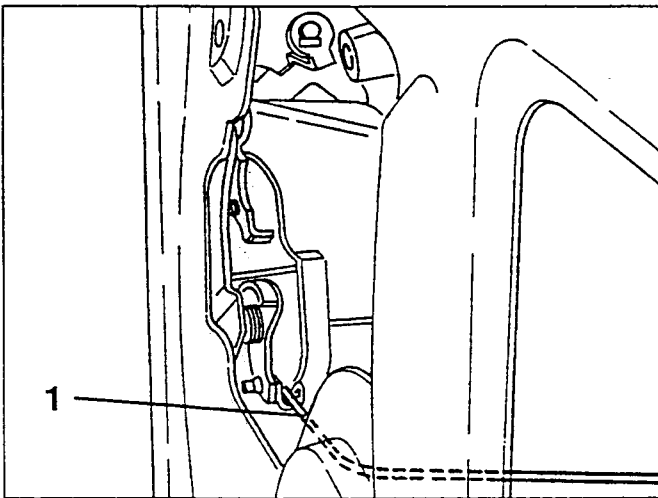
- Remove the rear window guide pad (see specific paragraph).
- 1. Disconnect the check strap from the lock block from the lock device.



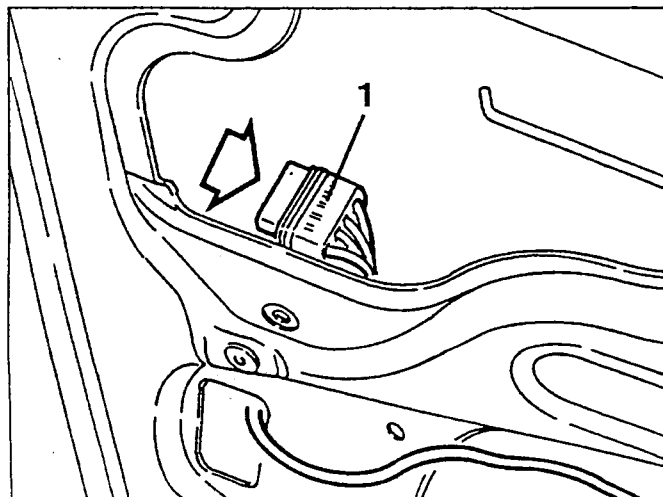
1. Disconnect the lock device from the external handle tie-rod.
2. Disconnect the opening block tie-rod from the lock device.



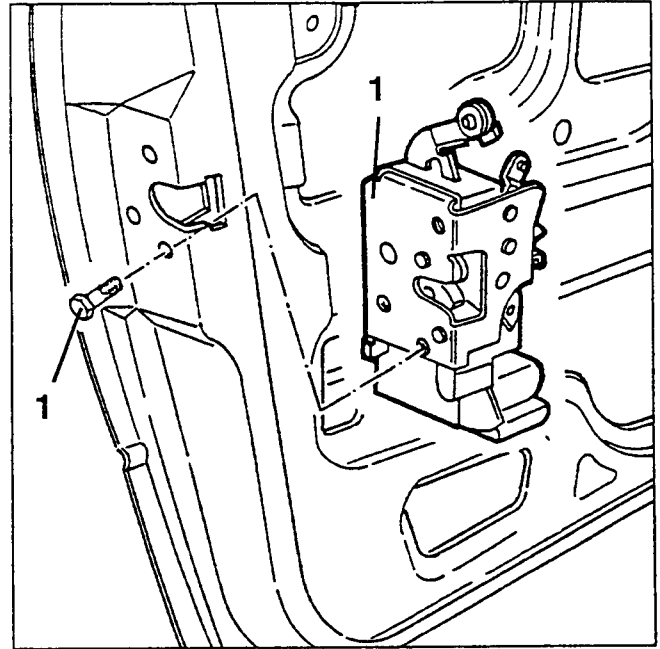
1. Disconnect the tie-rod of the inner handle from the lock device and back-off the lock device to free the tie-rods.



1. Disconnect the electrical connection from the lock device.



1. Loosen the three screws securing the lock device and remove it by withdrawing it from inside the door.

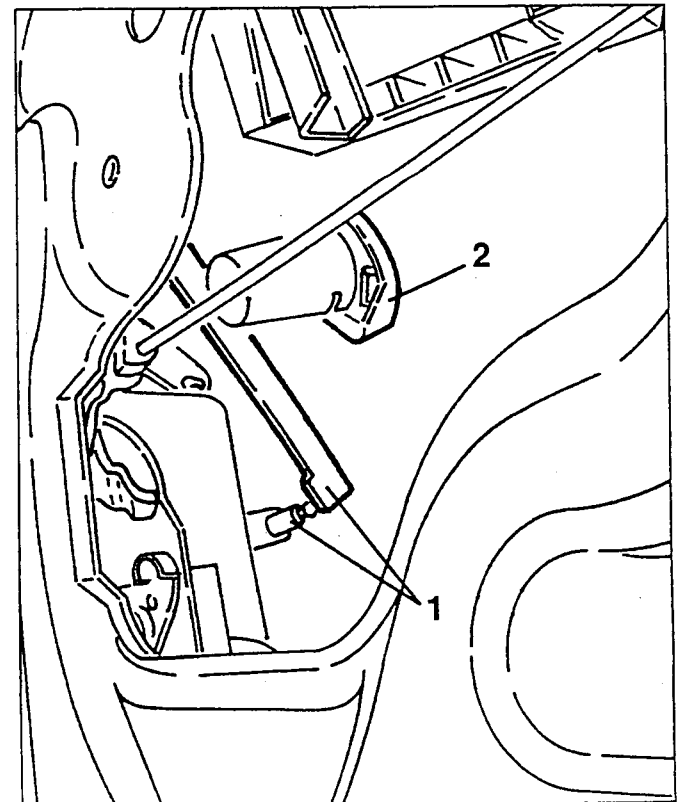


## LOCK UNIT

### REMOVAL AND REFITTING

- Remove the rear window guide pad (see specific paragraph).

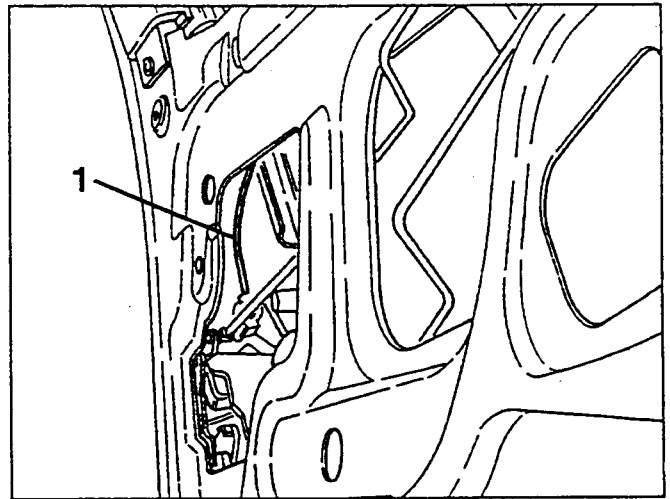
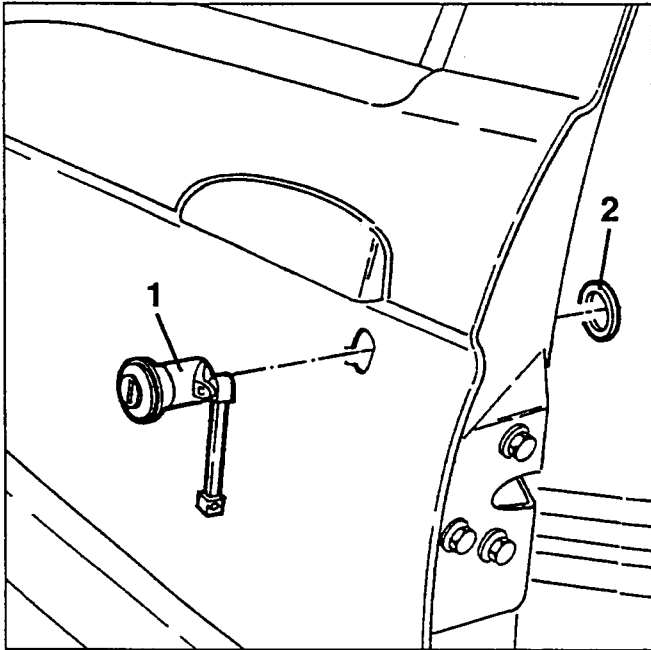
1. Disconnect the tie-rod connecting the lock unit to the lock device.
2. Using a screwdriver as a lever withdraw the clip securing the lock unit.



1. Remove the lock unit from the outside of the door.
2. Remove the spring abutting ring from inside the door.

- Remove the rear window guide pad (see specific paragraph).

1. Disconnect the outside door handle tie-rod from the lock device.



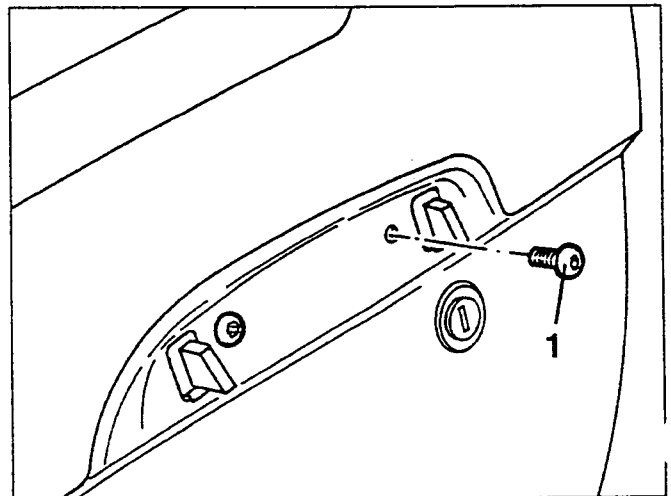
- Working on a bench, if necessary disconnect the tie-rod from the lock unit.

1. Loosen the two outer screws securing the outside door handle device.

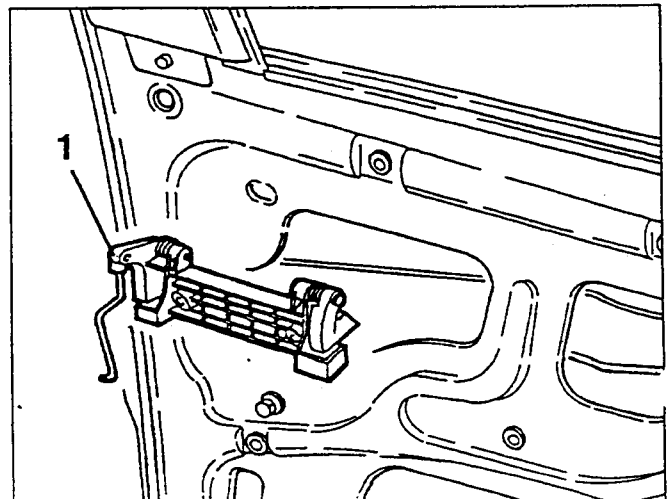
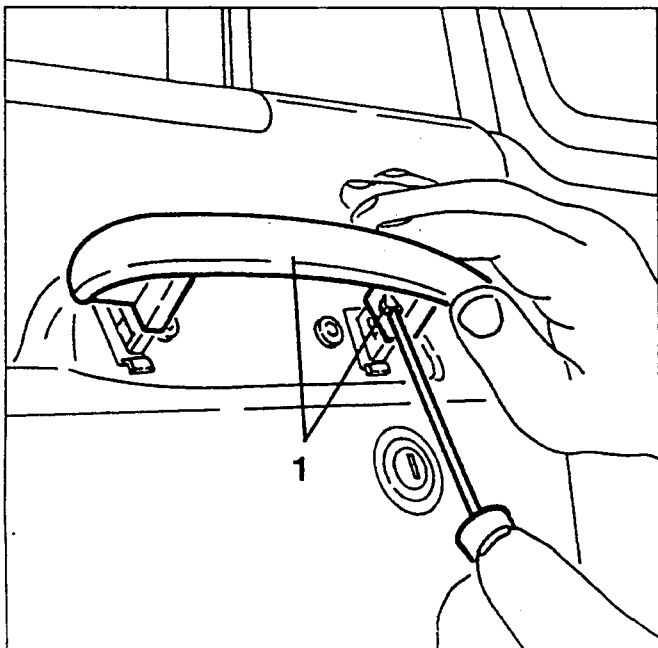
## OUTSIDE DOOR HANDLE

### REMOVAL AND REFITTING

1. Using a screwdriver, free the two clips and remove the outer handle.



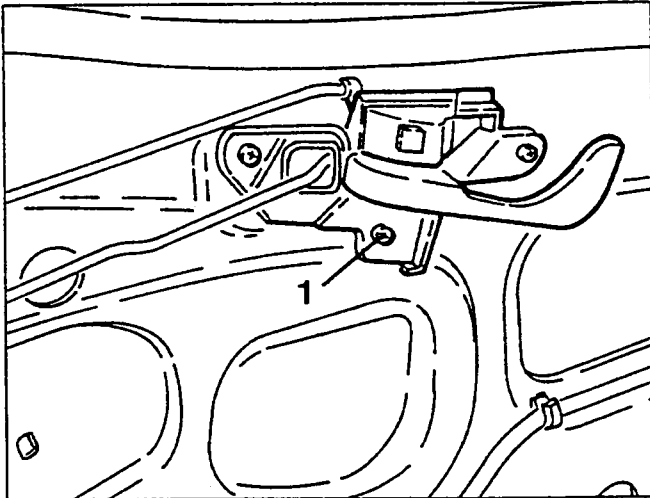
1. Remove the outside door handle device by withdrawing it from inside the door.



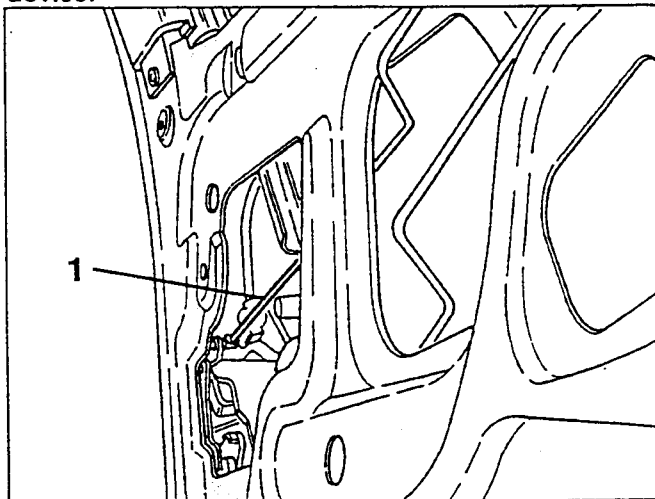
## INSIDE DOOR HANDLE

### REMOVAL AND REFITTING

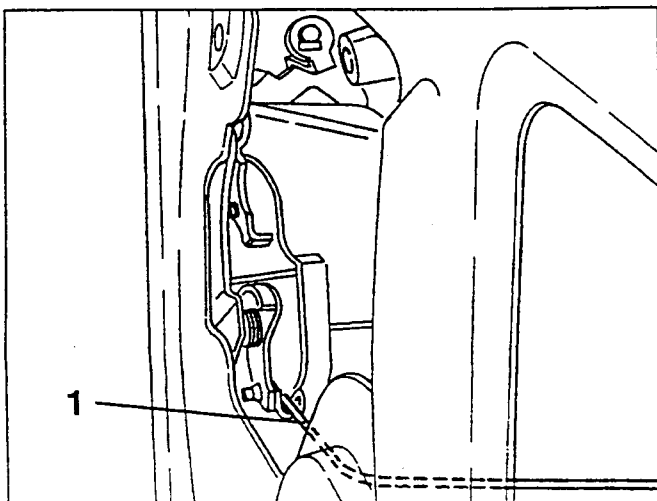
- Remove the panel (see specific paragraph).
- 1. Loosen the three screws securing the inside door handle.



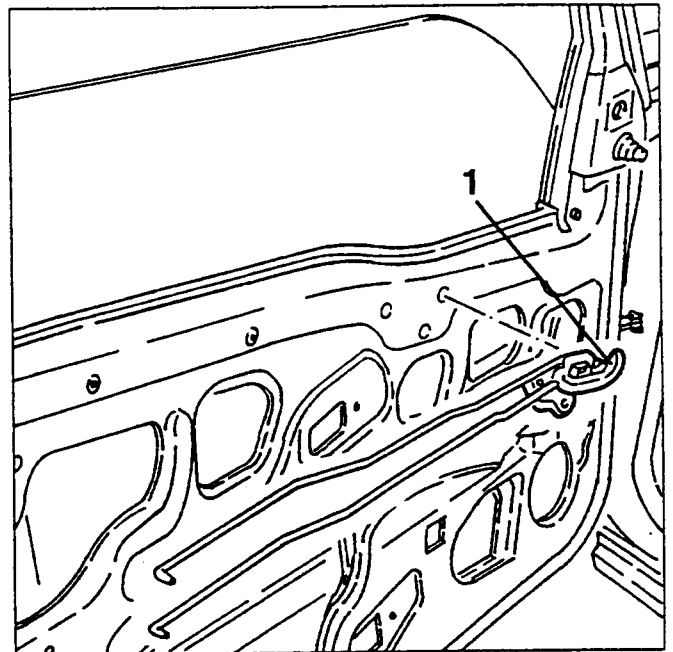
- Pull off the plastic buttons and partially detach the opaline.
- 1. Disconnect the opening unit tie-rod from the lock device.



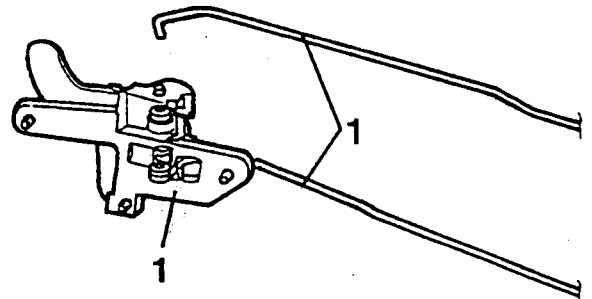
- 1. Disconnect the inside door handle tie-rod from the lock device.



- 1. Free the tie-rods from the two clamps and remove the inside handle.



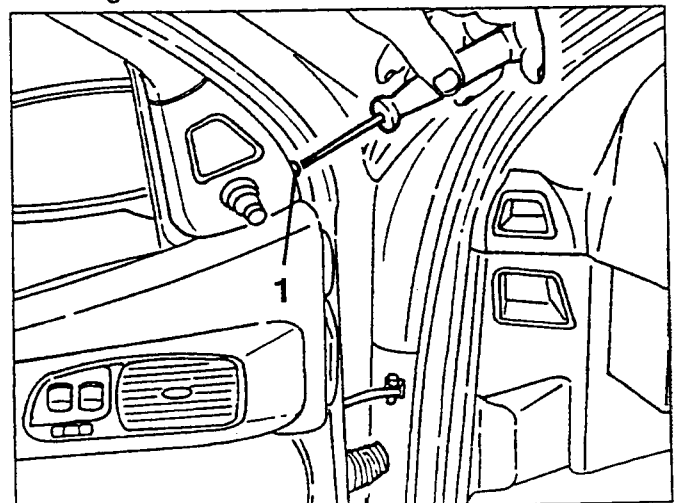
- 1. If necessary, working on a bench, separate the inside handle from the tie-rods.



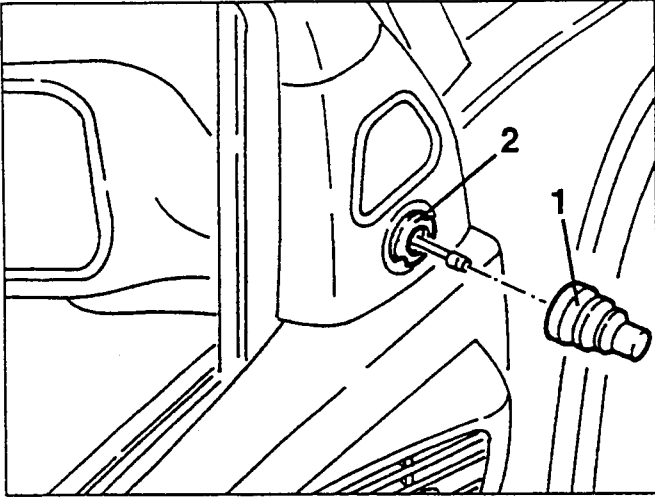
## DOOR MIRROR (manually operated)

### REMOVAL AND REFITTING

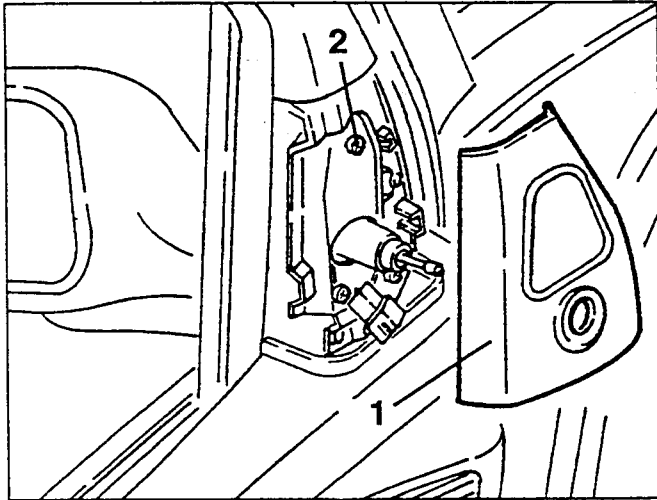
- 1. Loosen the screw securing the door mirror internal moulding.



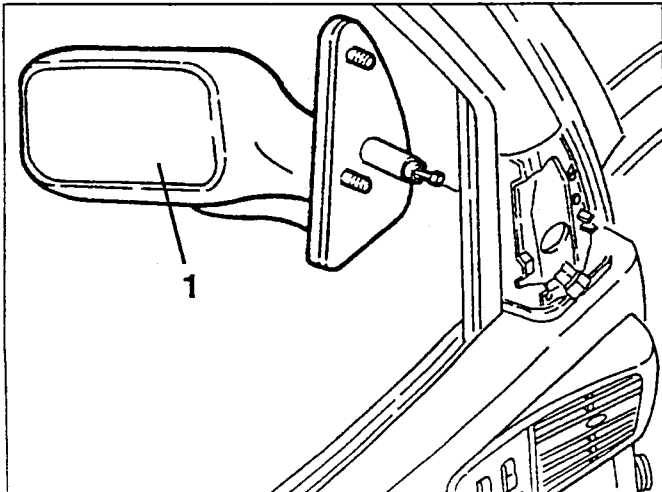
1. Remove the protective bellows.
2. Loosen the ring nut securing the moulding.



1. Remove the door mirror inner moulding.
2. Loosen the three screws securing the door mirror.



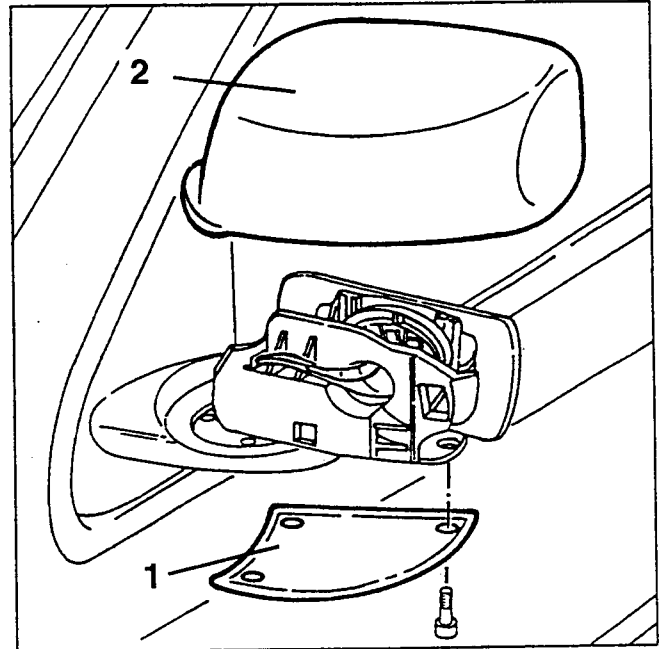
1. Remove the door mirror and relative gasket.



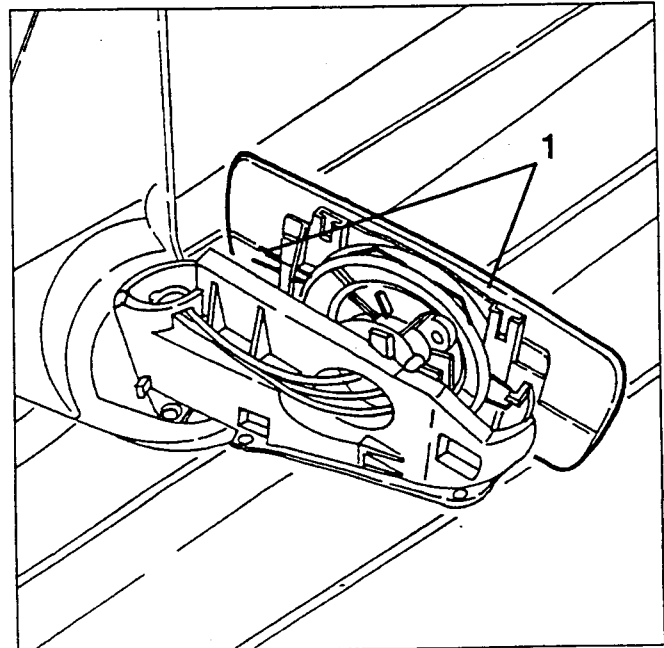
## WING MIRROR (manually-operated)

### REMOVAL/REFITTING

1. Slacken the fastening screws and remove the lower trim.
2. With the mirror facing downwards, remove the outer casing.



1. Release the fastening clip and remove the wing mirror glass.

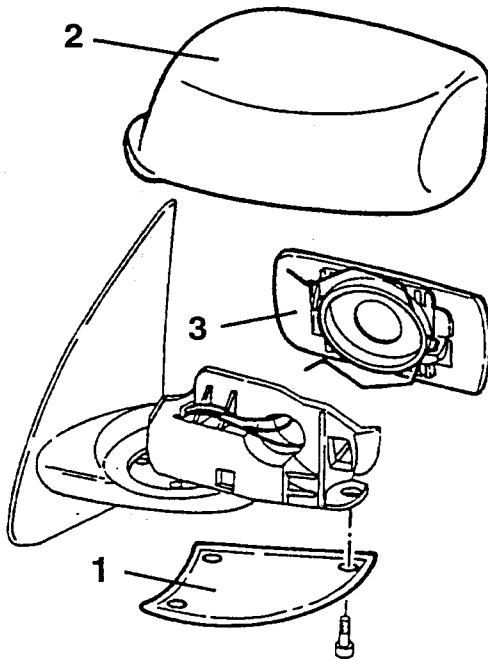


## WING MIRROR TRIM (manually-operated mirror)

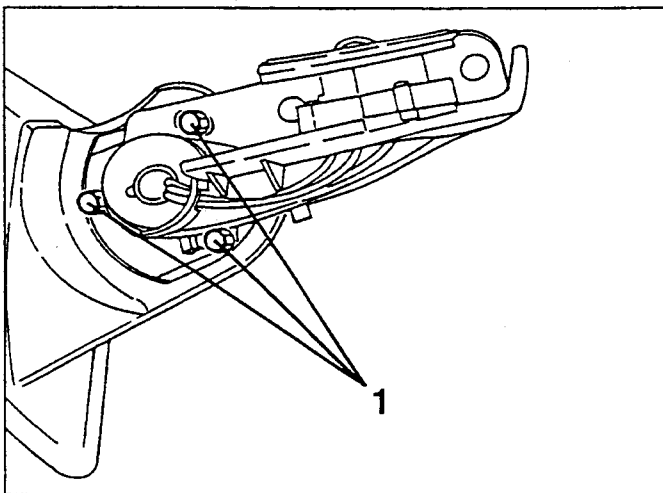
### REMOVAL/REFITTING

- Remove the complete wing mirror (see specific paragraph).

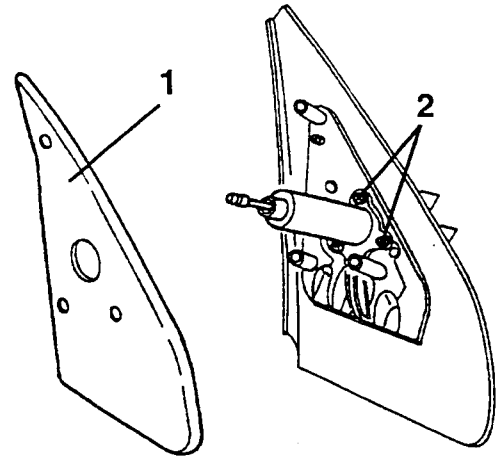
1. On the bench, slacken the fastening screws and remove the lower trim.
2. With the mirror facing downwards, remove the outer casing.
3. Release the fastening clip and remove the wing mirror glass.



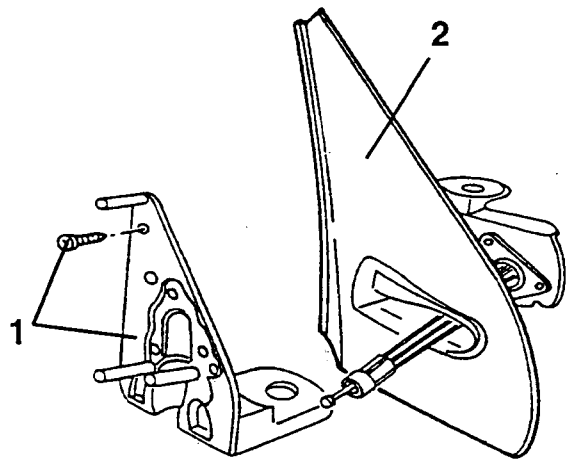
1. Working as shown in the figure, slacken the three screws fastening the wing mirror support.



1. Remove the seal.
2. Slacken the three fastening screws and remove the wing mirror adjustment device support.



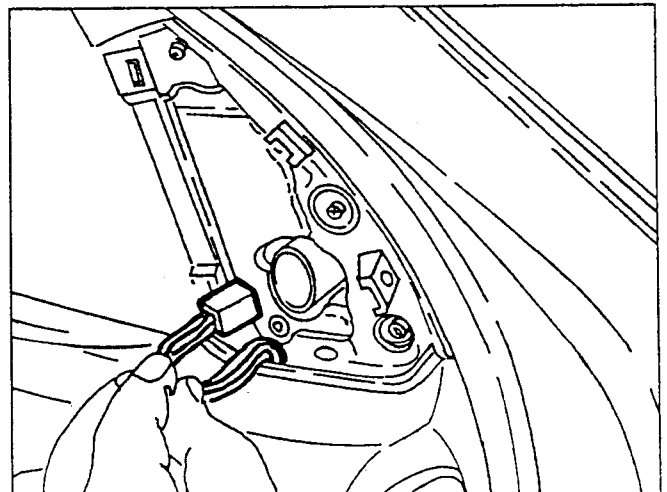
1. Slacken the remaining fastening screws and remove the wing mirror support.
2. Retrieve the wing mirror outer trim.



## WING MIRROR (electrically-operated)

### REMOVAL/REFITTING

- Proceed as described for removal/refitting the manually-operated wing mirror remembering that instead of removing the vellows and ringnut the electrical connection shown in the figure below needs to be removed.

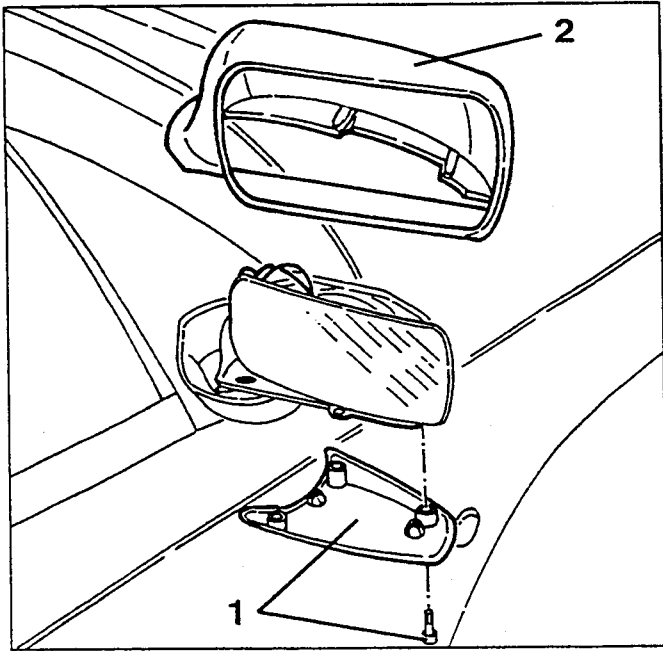




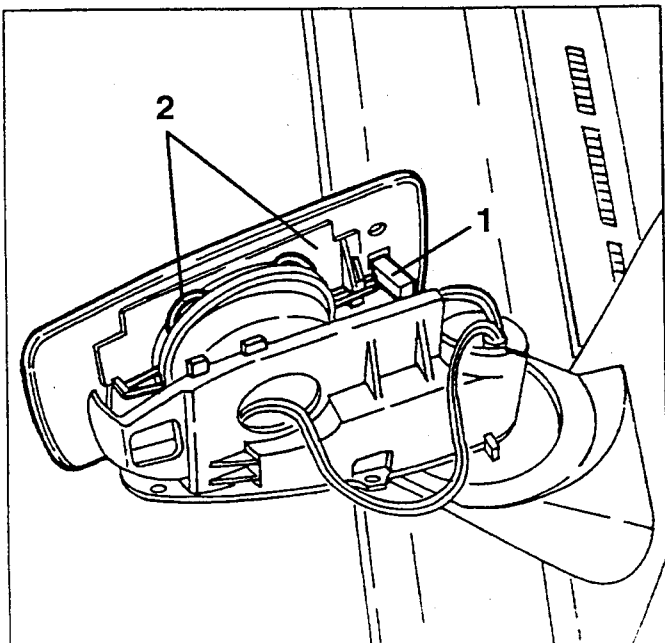
## WING MIRROR (electrically-operated)

### REMOVAL/REFITTING

- Disconnect the battery (-) terminal.
- 1. Slacken the fastening screws and remove the lower trim.
- 2. With the mirror facing downwards, remove the outer casing.



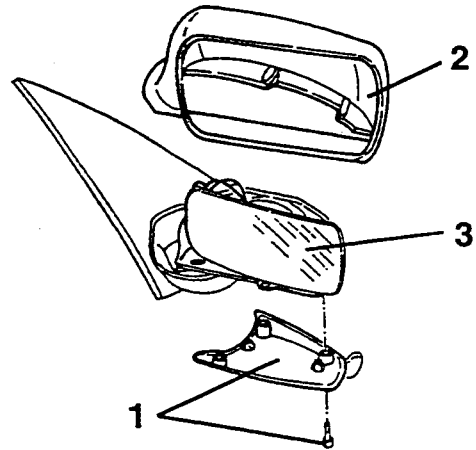
- 1. Disconnect the electrical connection for the mirror defrosting coil.
- 2. Release the fastening clip and remove the wing mirror glass.



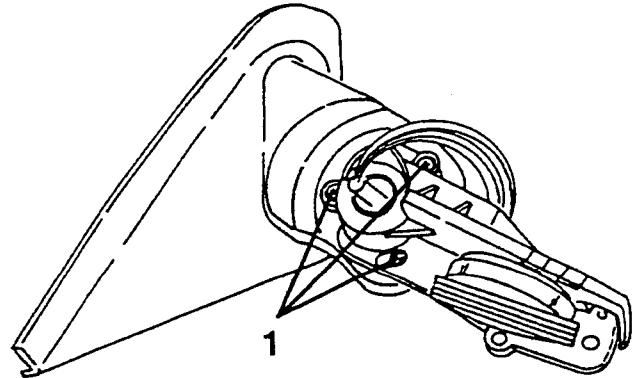
## WING MIRROR TRIM (electrically-operated)

### REMOVAL/REFITTING

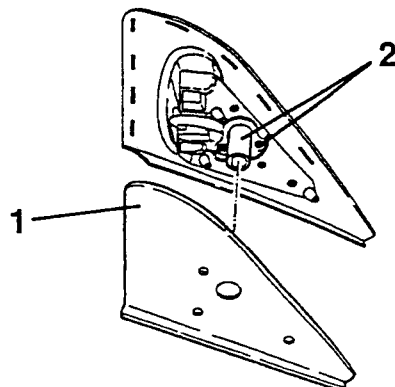
- Remove the complete wing mirror (see specific paragraph).
- 1. On the bench, slacken the fastening screws and remove the lower trim.
- 2. With the mirror facing downwards, remove the outer casing.
- 3. Release the fastening clip and remove the wing mirror glass after disconnecting the electric connection.



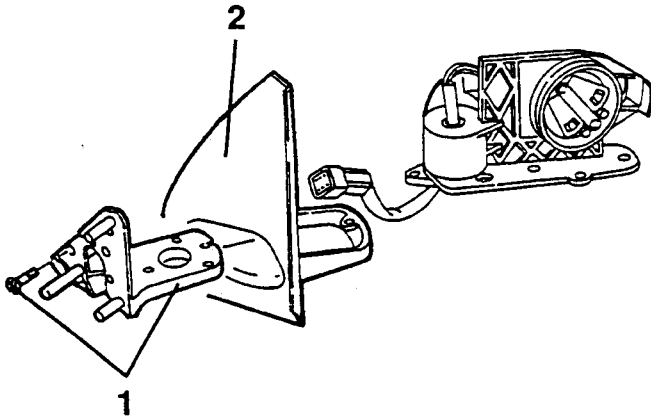
- 1. Working as shown in the figure, slacken the three screws fastening the wing mirror support.



- 1. Remove the seal.
- 2. Slacken the two fastening screws and remove the tube housing the electrical connection.



1. Slacken the remaining fastening screws and remove the wing mirror support.
2. Retrieve the wing mirror outer trim.

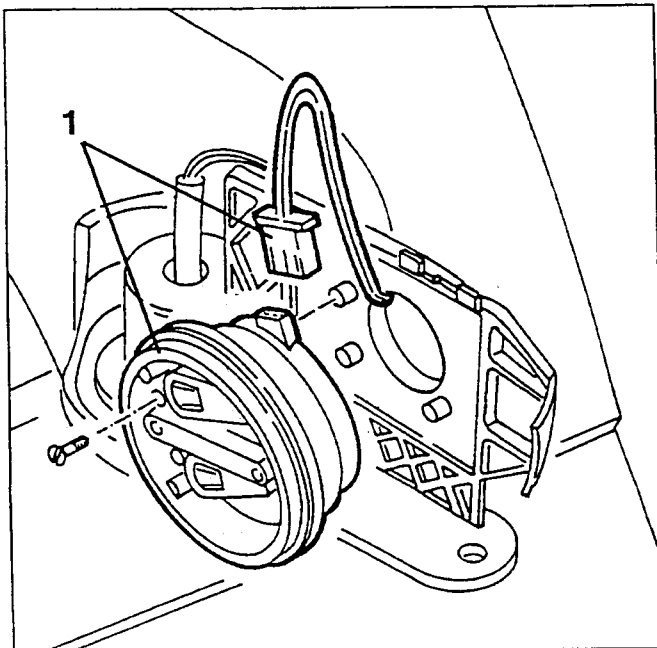


## WING MIRROR MOTOR (electrically-operated)

### REMOVAL/REFITTING

- Proceed as described in the first two steps described in the "WING MIRROR (electrically-operated) paragraph.

1. Slacken the fastening screws and remove the electric motors, after disconnecting the electrical connection.

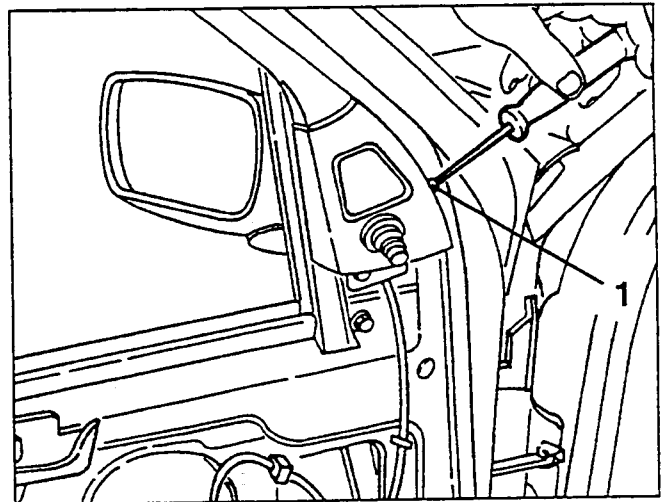


## TRIM MOULDINGS

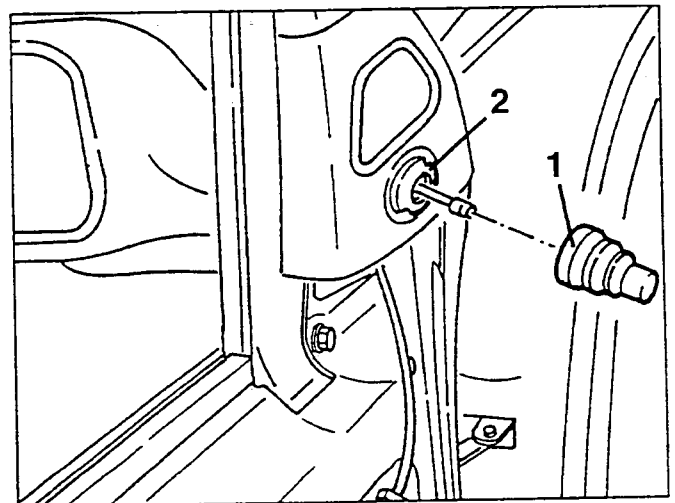
### REMOVAL AND REFITTING

- Remove the panel (see specific paragraph).

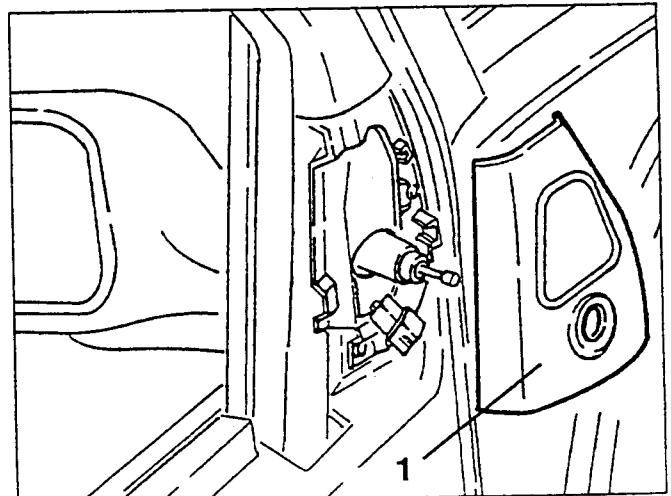
1. Loosen the screw securing the door mirror inner moulding.



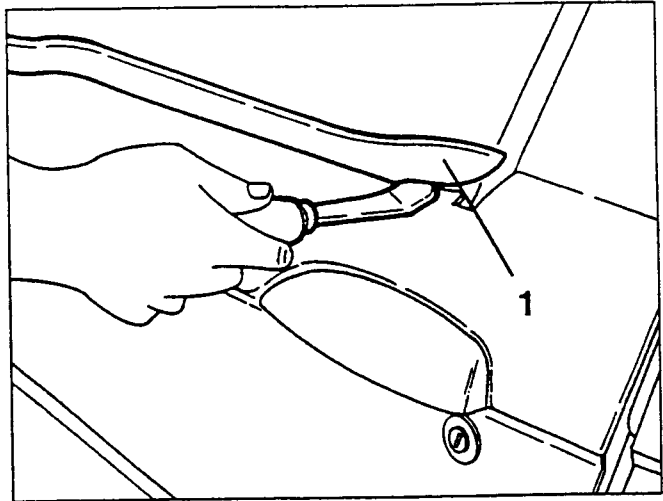
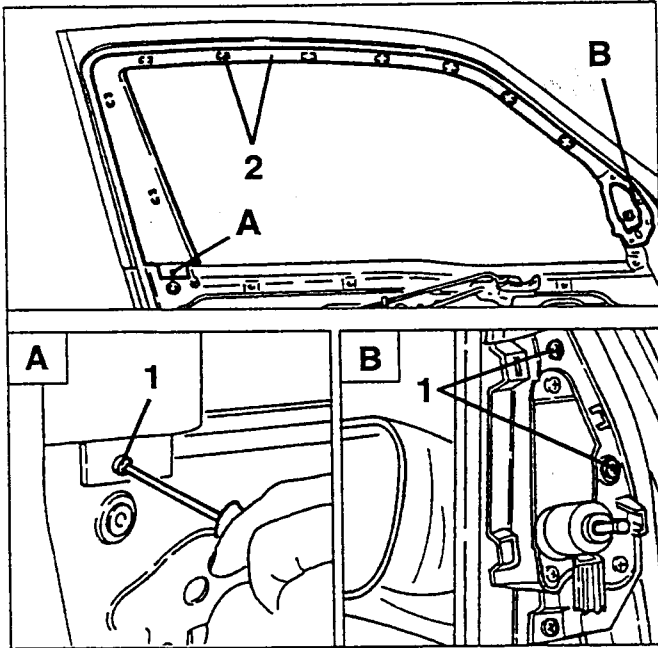
1. Remove the protective bellows.
2. Loosen the ring nut securing the moulding.



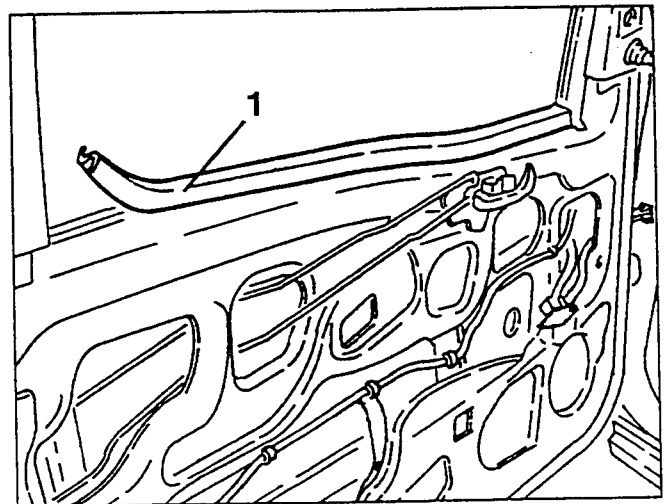
1. Remove the door mirror internal moulding.



1. Loosen the screws securing the moulding.
2. Pull off the moulding from the plastic buttons positioned as shown in the diagram and remove the moulding.



1. Remove the panel and pull off the internal weather strip.

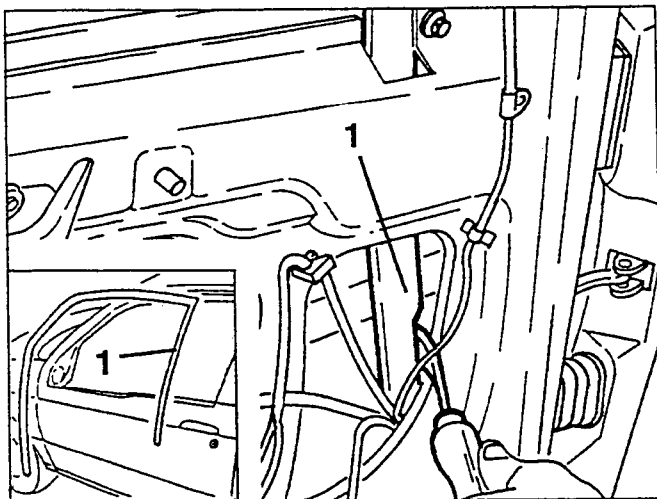


## WINDOW RUNNER SEAL STRIPS

### REMOVAL AND REFITTING

- Remove the trim moulding and the door mirror (see specific paragraphs).
- Remove the weather strip and window (see specific paragraphs).

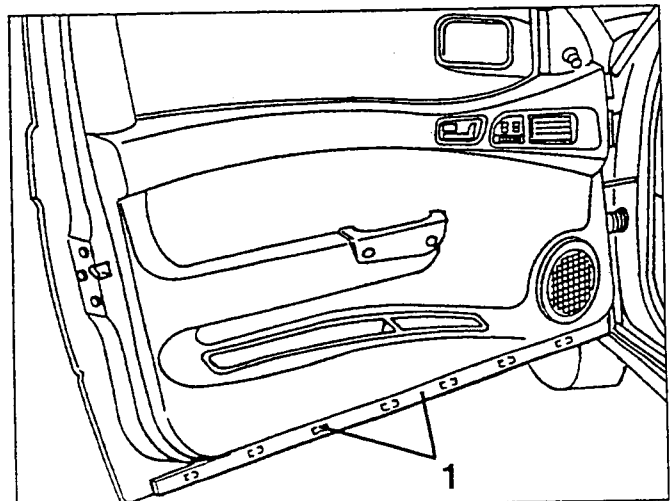
1. Pull off the window runner strips beginning from the front part.



## NOISE REDUCING SEAL STRIP

### REMOVAL AND REFITTING

1. Pull off the plastic buttons and remove the noise reducing seal strip.



## WEATHER STRIPS

### REMOVAL AND REFITTING

1. Remove the external weather strip by pulling it out from its seating.

## BONNET

### REMOVAL/REFITTING

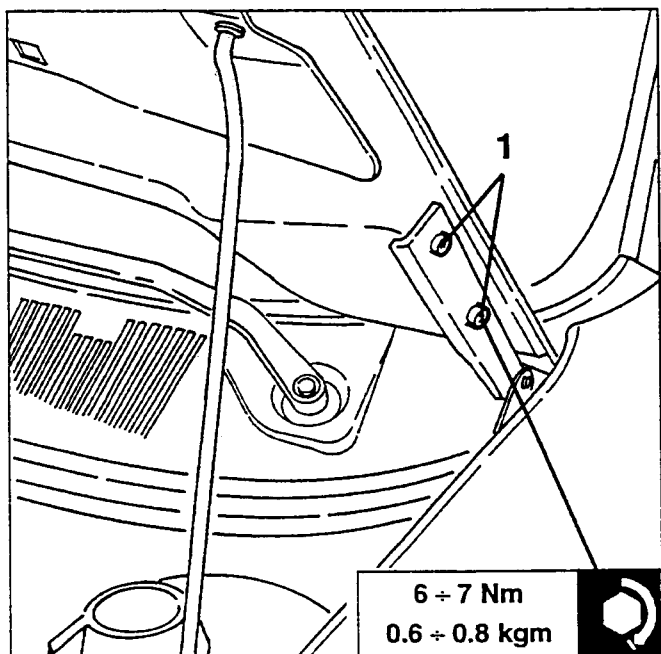
**NOTE:**

Avoid damaging the paintwork during removal or installation of the bonnet.

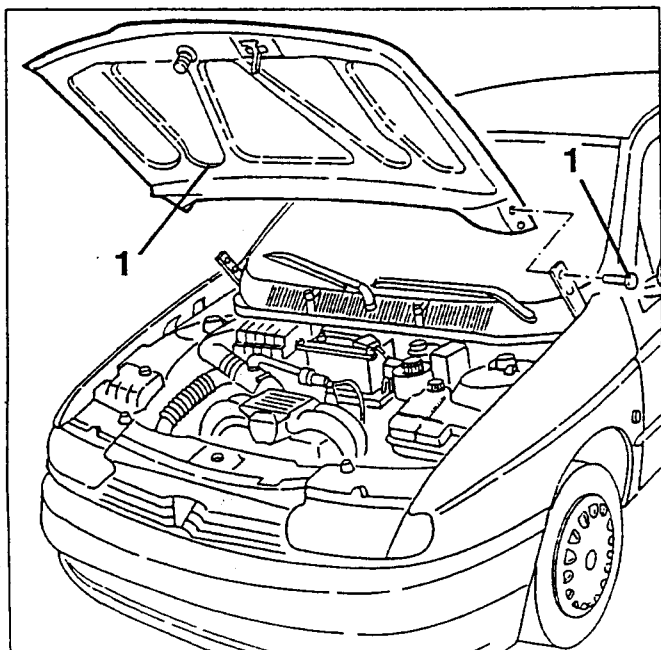
- Open the bonnet and support it properly with the appropriate rod.

- Disconnect the negative cable (-) from the battery.

1. Loosen the screws securing the hinges to the bonnet.

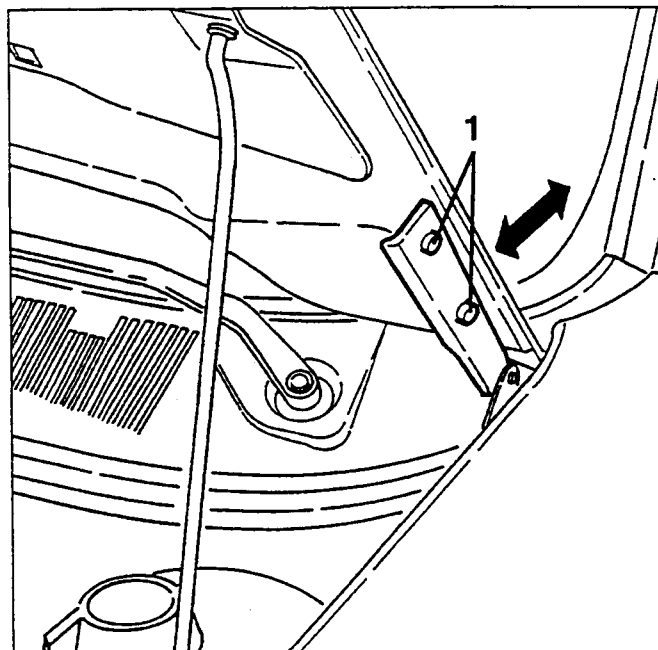


1. Remove the bonnet support rod after completely unscrewing the screws securing the hinges.



### ADJUSTMENT

1. Loosen the screws securing the bonnet to the hinges and adjust for height.



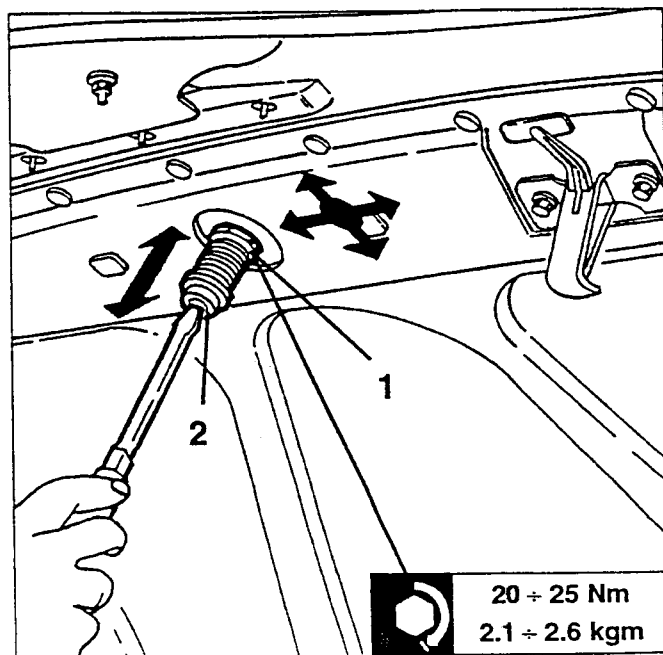
**NOTE:**

If the above adjustment is not sufficient further adjustment can be made following the procedure described in the specific paragraph.

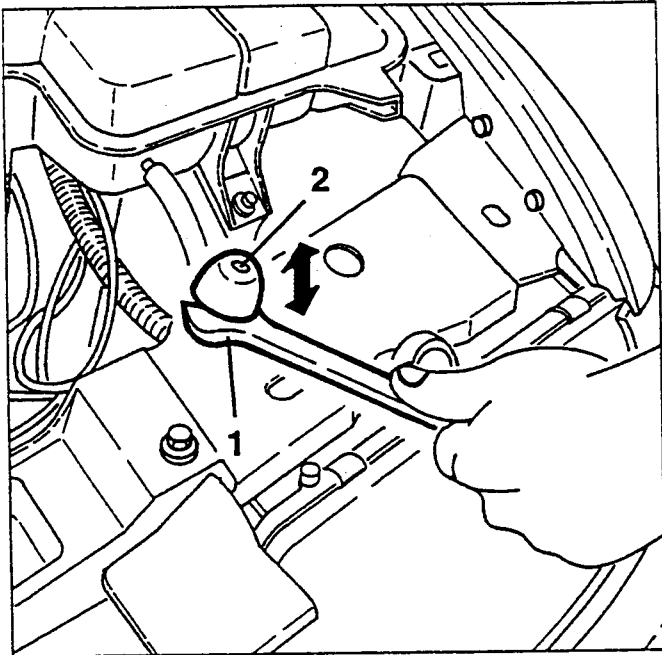
1. Loosen the nut securing the adjustment pin.

2. Tighten or loosen the adjustment rod as required.

- Tighten the locking nut on the adjustment pin after checking that it is in the correct position.



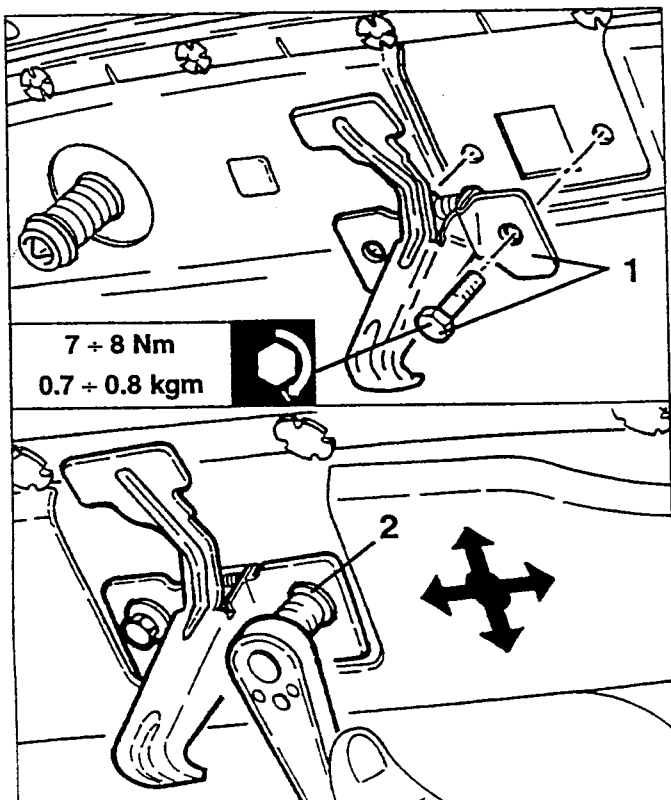
1. Loosen the nut securing the buffer.
2. Manually tighten or loosen the buffer as required; tighten the nut securing.



## BONNET CLOSURE SAFETY DEVICE

### REMOVAL/REFITTING

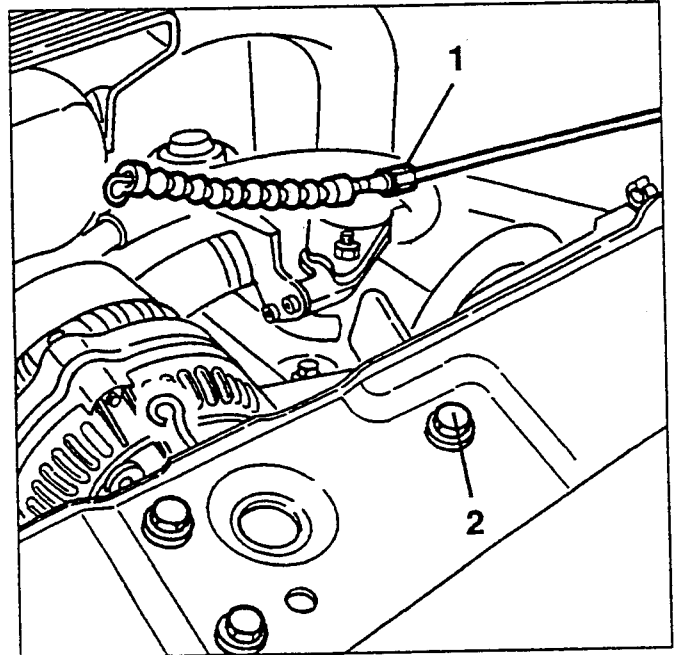
1. Loosen the two screws securing the safety device.
  - Remove the bonnet closure safety device.
2. For adjustment loosen the screws securing the safety device and adjust longitudinally and transversally.



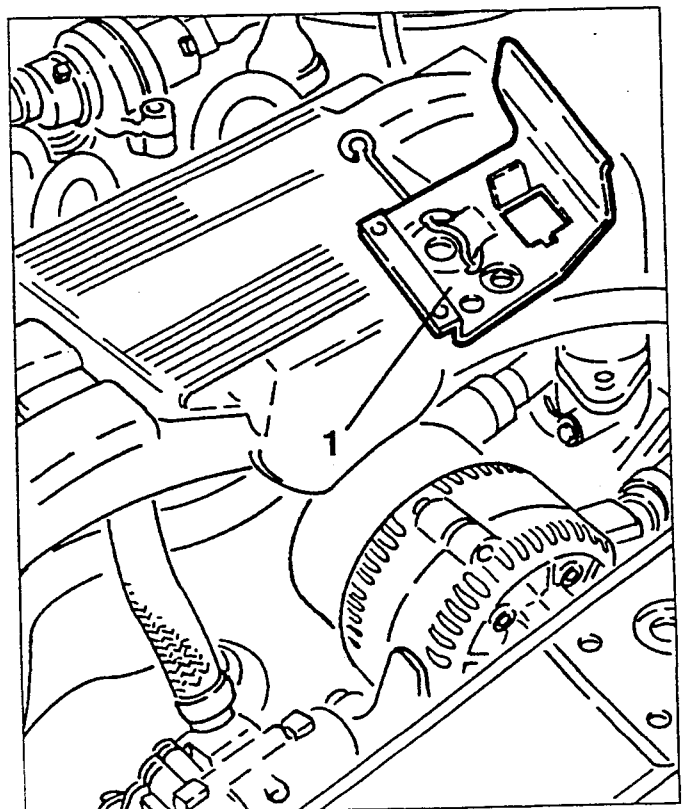
## BONNET CATCH

### REMOVAL/REFITTING

1. Disconnect the bonnet release cable from the catch.
2. Loosen the three screws securing the catch.

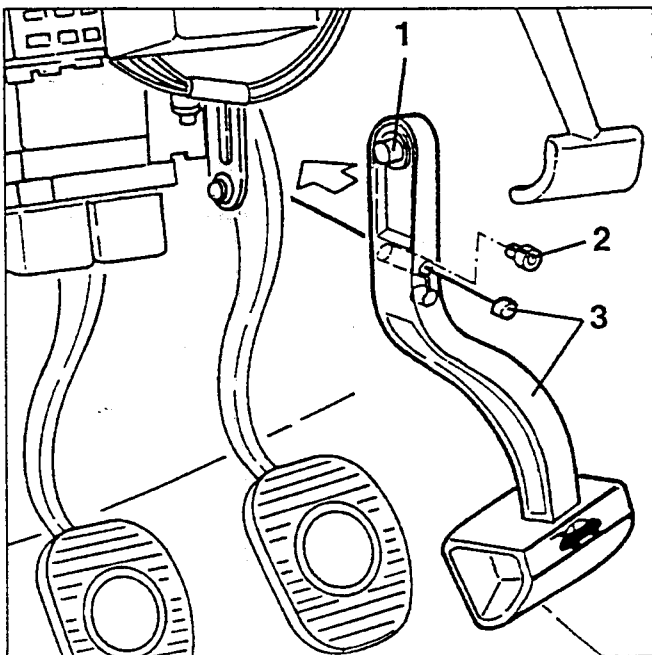


1. Remove the bonnet catch.

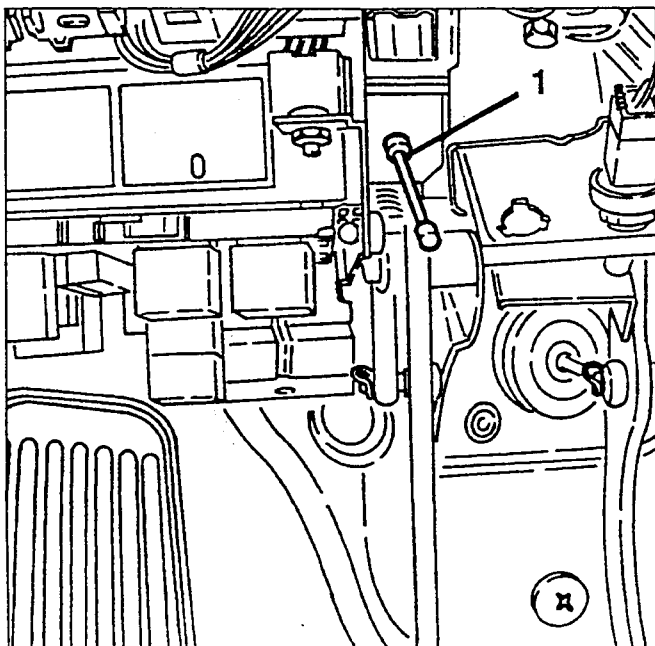


**BONNET RELEASE CABLE****REPLACING**

- Disconnect the bonnet release cable from the catch.
- Remove all the components in the engine bay which may prevent successive access to the bonnet release cable.
- Remove the trim from under the dashboard on the driver's side of the vehicle (see specific paragraph).
  1. Free the bonnet release handle from its pivot.
  2. Remove the cap.
  3. Remove the pawl from the handle of the bonnet release cable and remove the handle.



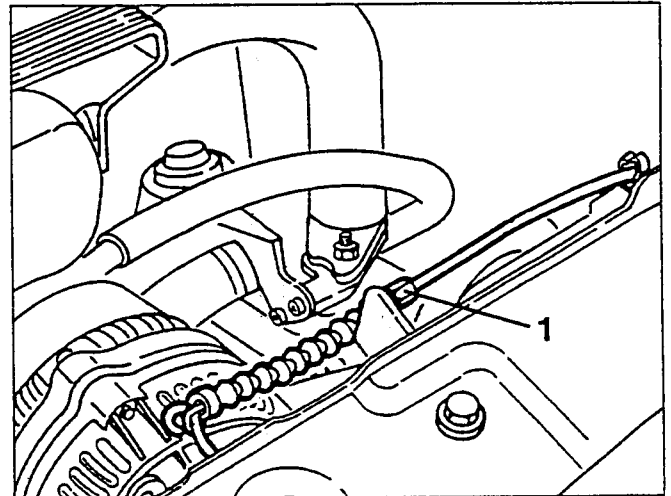
1. Using a pair of pliers free the cable from its attachment bracket.



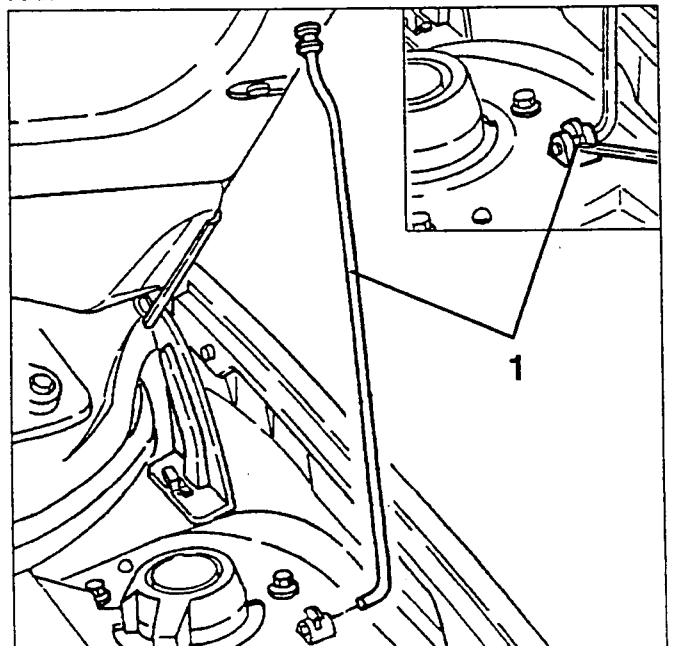
- Free the cable from the clamps inside the engine bay.
- Tie a wire to the end of the cable on the passenger compartment side in order to permit subsequent recovery of the cable.
- Refit a new cable by reversing the procedure followed for removal ensuring that it is adjusted as described in the following paragraph.

**ADJUSTMENT**

1. Working in the engine bay, adjust the tension on the cable by manually acting on the appropriate nut.

**BONNET SUPPORT ROD****REMOVAL/REFITTING**

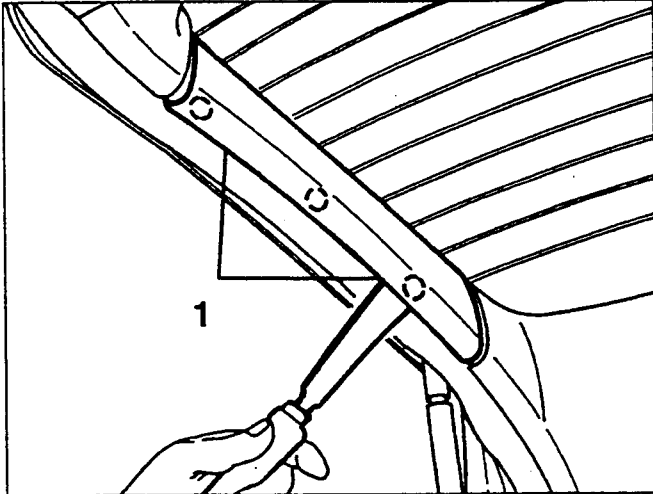
- Open and suitably support the bonnet.
- 1. Using a screwdriver, open the bonnet support rod; withdraw the rod from its support and then remove the rod.



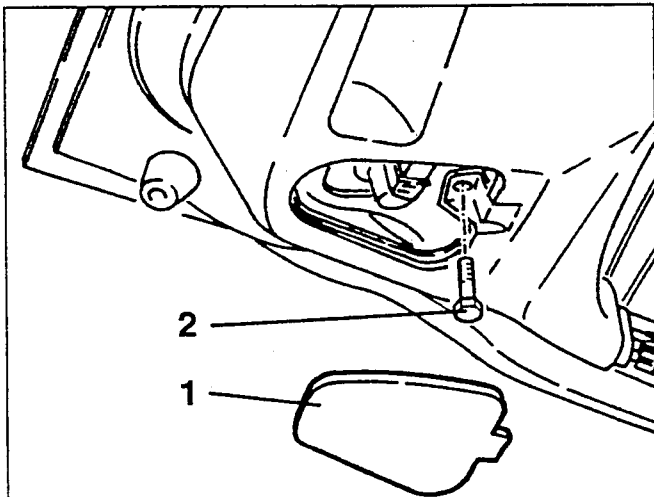
## BOOT

### REMOVAL/REFITTING

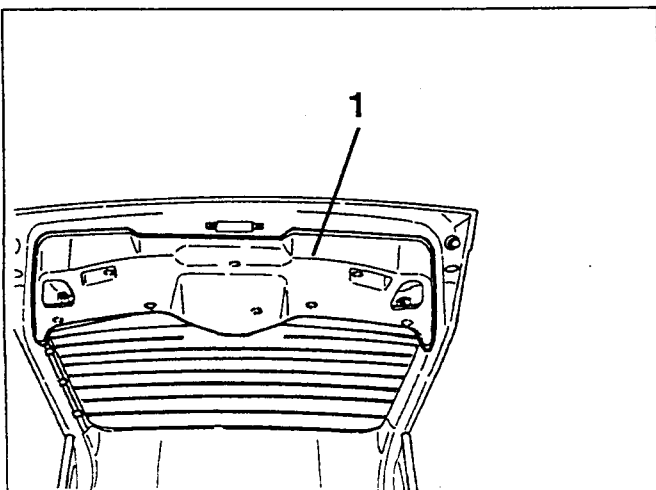
- Disconnect the negative cable (-) from the battery.
- 1. Open the boot. Pull off and remove the two side trim panels from the plastic buttons.



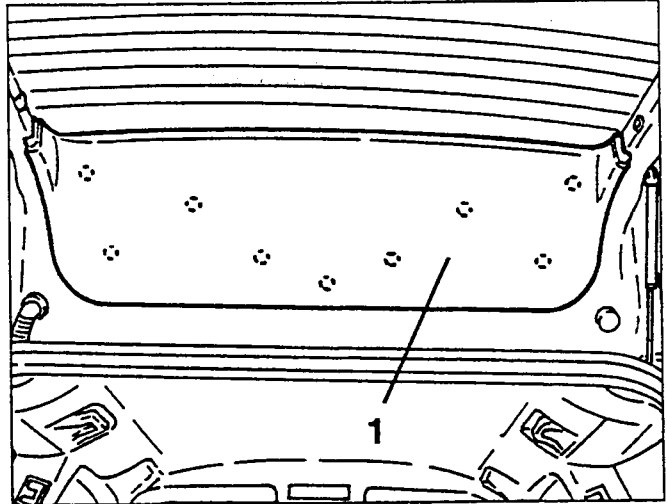
1. Remove the two bulb access panels.
2. Loosen the two screws securing the boot's interior trim.



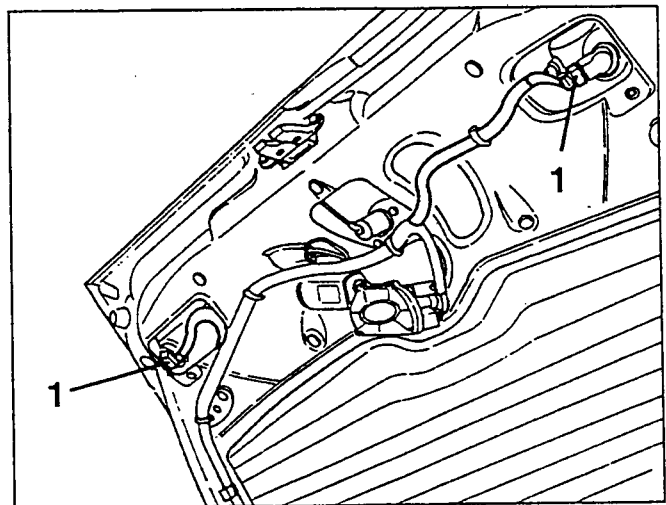
1. Pull the trim away from the plastic buttons in the lower part of the boot and remove.



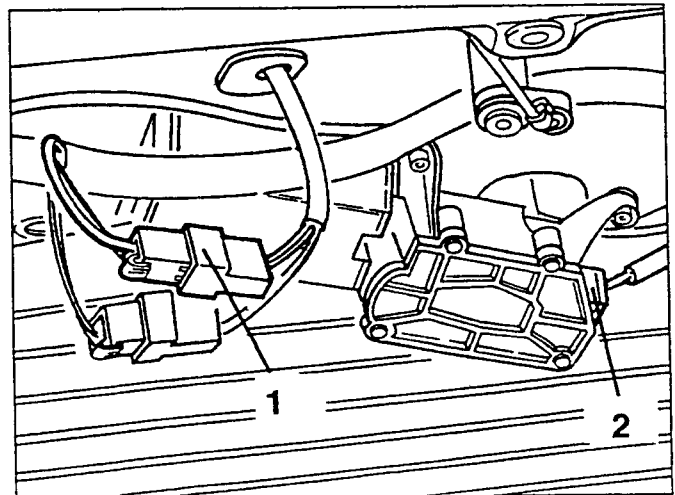
1. Pull the trim away from the plastic buttons (positioned as shown in the diagram) in the upper part of the boot and remove.



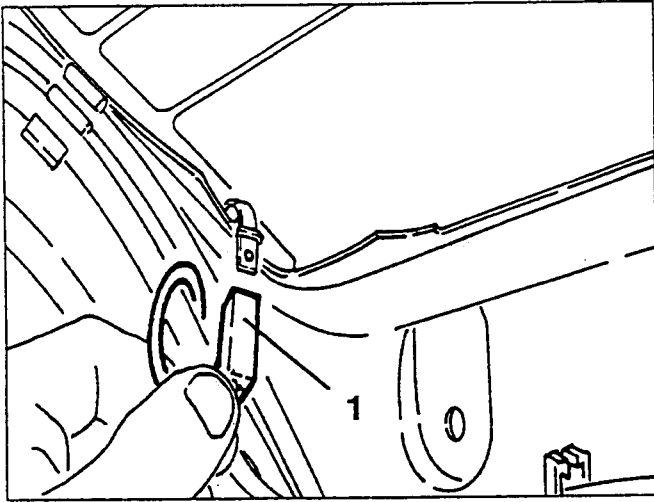
1. Disconnect the electrical connections from the reversing lights and the rear fog lights.



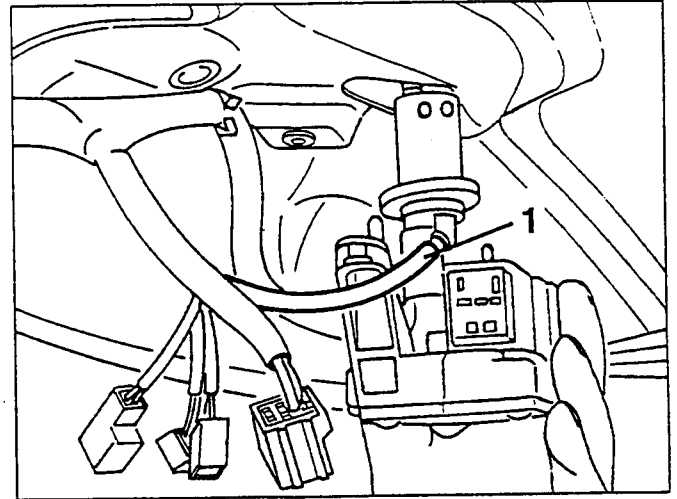
1. Disconnect the electrical connection from the centralized locking.
2. Disconnect the electrical connection from the rear windscreen wiper.



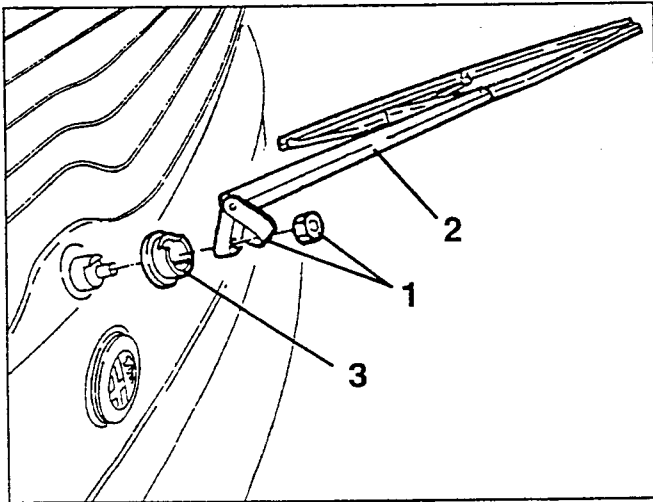
1. Disconnect the two electrical connections from the heated rear windscreen.



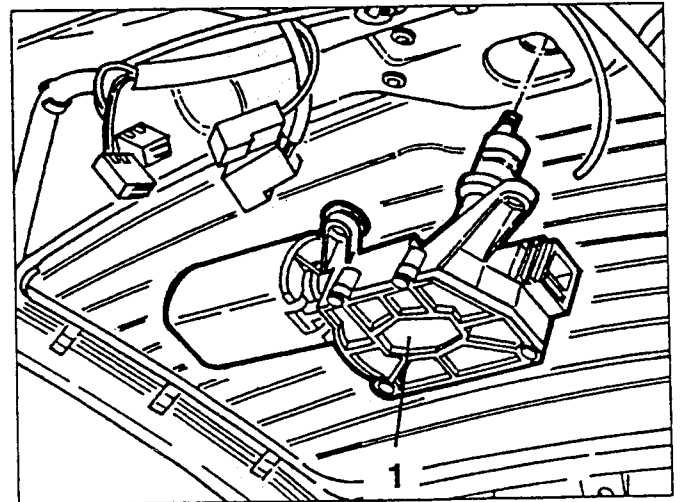
1. Withdraw the rear windscreen wiper motor from the boot just enough to enable the detergent abduction hose to be disconnected.



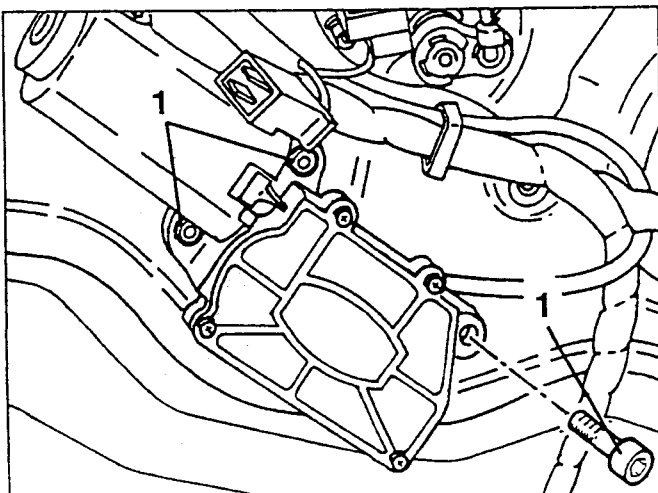
1. Lower the boot, raise the protective cap and unscrew the nut securing the rear windscreen wiper arm.  
2. Remove the rear windscreen wiper arm.  
3. Pull off and remove the rubber protection from the windscreen wiper.



1. Remove the rear windscreen wiper motor.

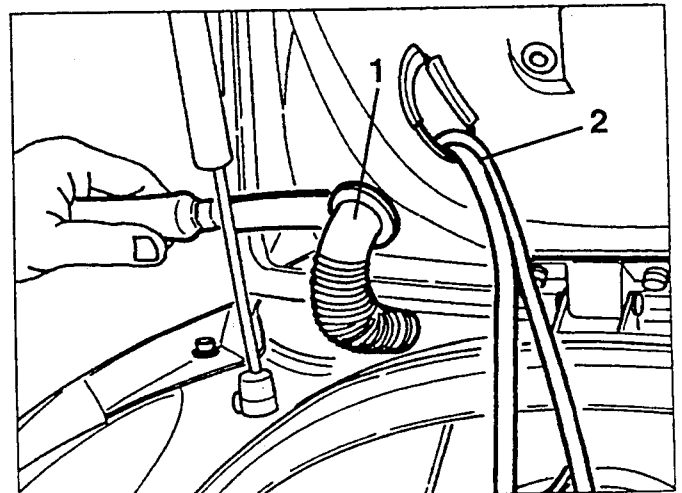


1. Raise the flap and loosen the three screws securing the rear windscreen wiper motor.



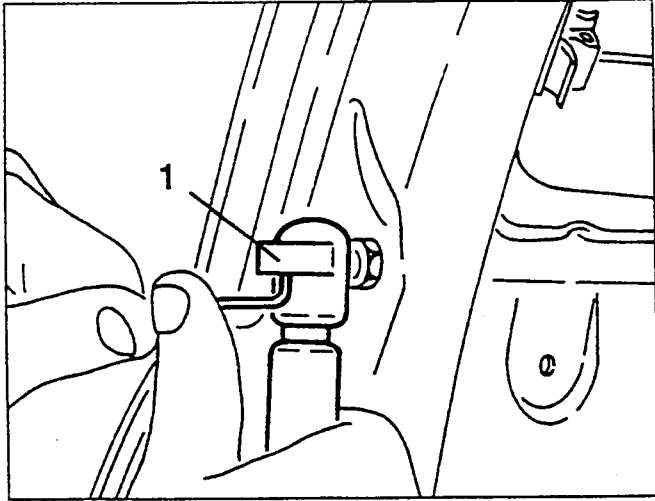
- Free the electrical wiring from the clamps securing it to the boot.

1. Disconnect the cable runner sleeve from the boot.  
2. Withdraw the electrical wiring from its hole.





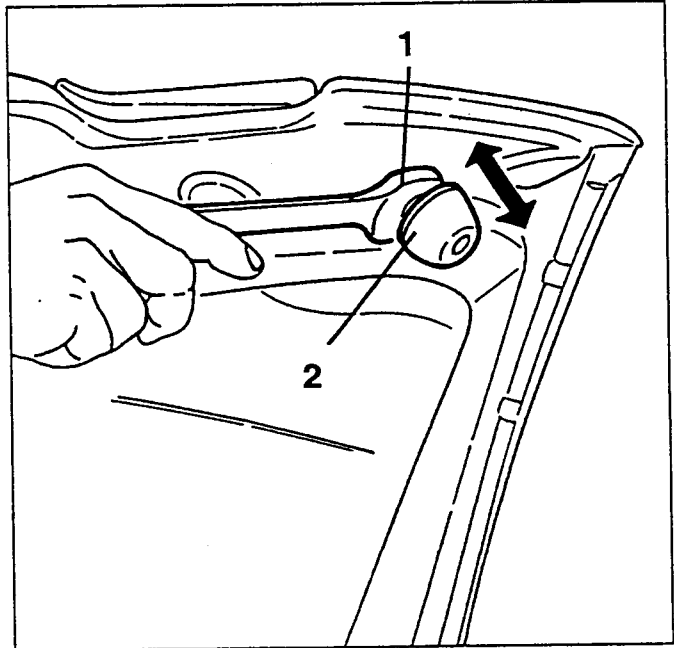
1. Suitably support the boot and disconnect it from the telescopic supports.



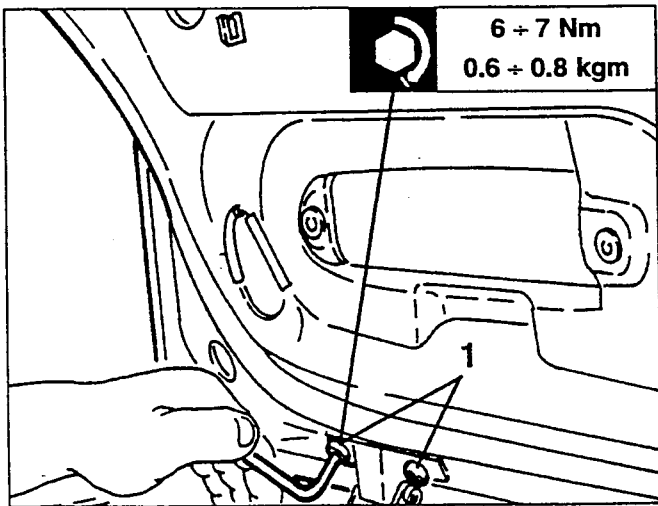
**NOTE:**

If the above adjustment is not sufficient adjust the hinge as described in the specific paragraph.

1. Loosen the nut securing the buffer.
2. Loosen or tighten the buffer as required.



1. Loosen the two screws per hinge securing the boot and remove the boot lid.



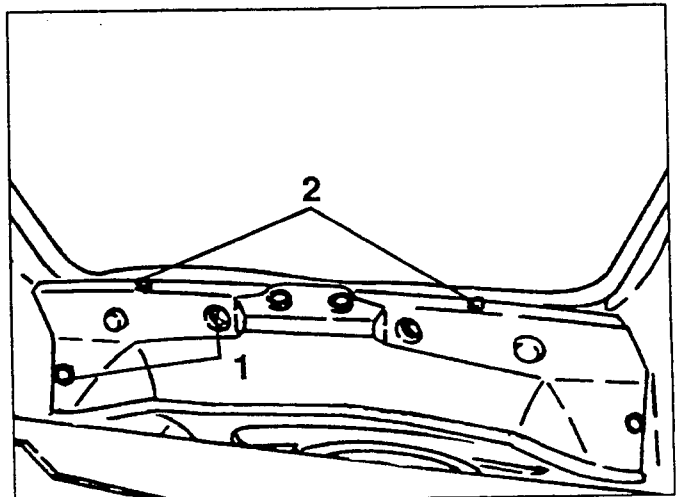
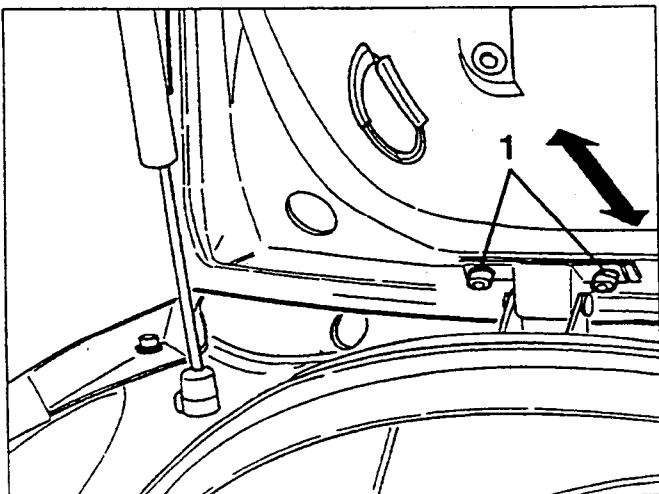
## BOOT CATCH

### REMOVAL/REFITTING

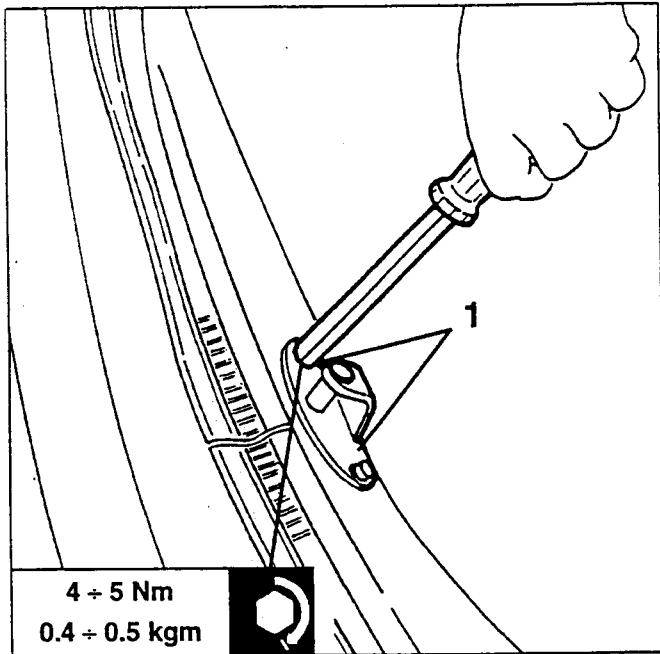
1. Working in the boot, pull off the four plastic buttons securing the protective trim.
2. Loosen the two screws securing the protective trim and remove the protective trim.

## ADJUSTMENT

1. Loosen the screws securing the boot to the hinge and adjust longitudinally.

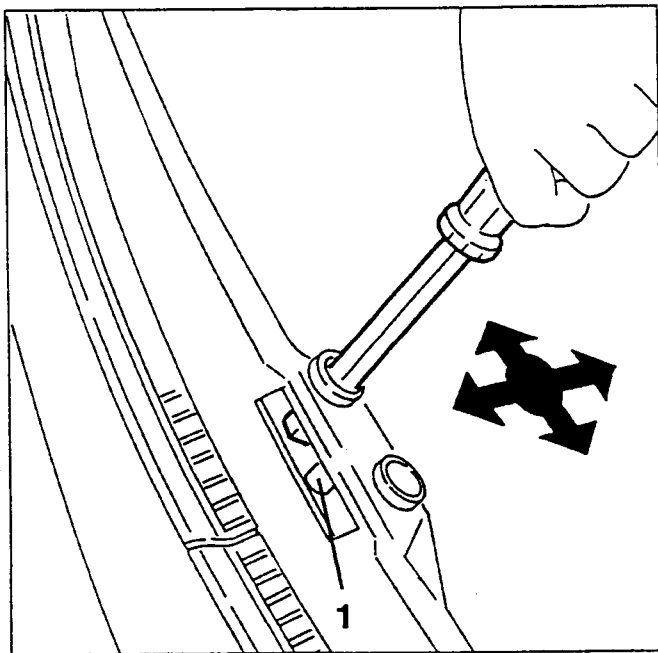


1. Loosen the two screws and remove the boot catch.



## ADJUSTMENT

1. Loosen the two screws securing the boot catch and adjust it until the correct position is reached and then tighten the screws once again.

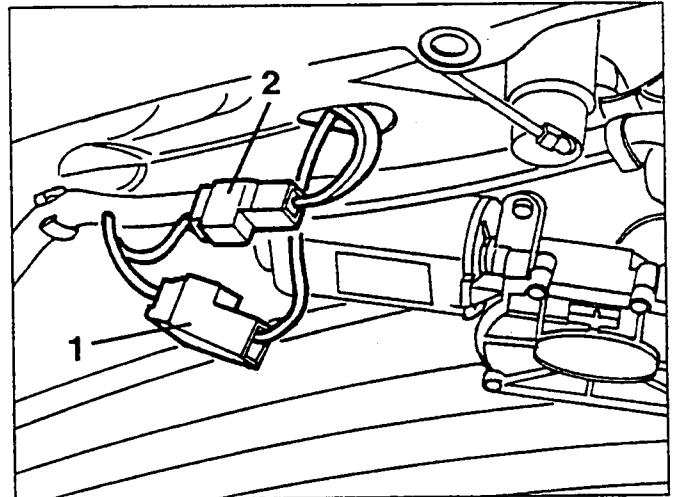


## BOOT LOCK

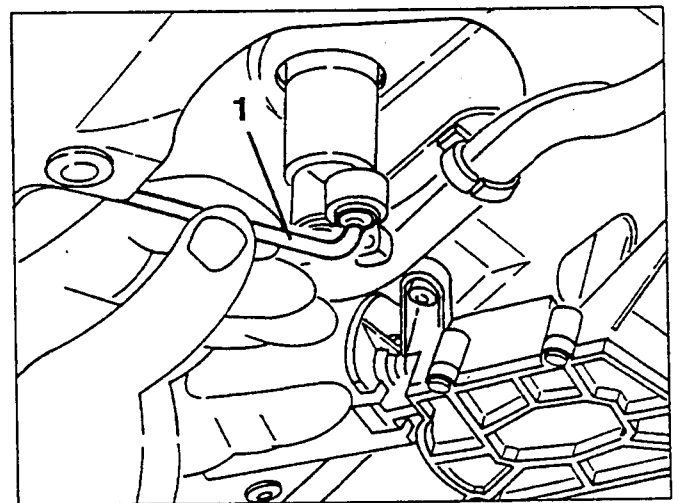
### REMOVAL/REFITTING

- Follow the first three steps described in the "BOOT" paragraph.

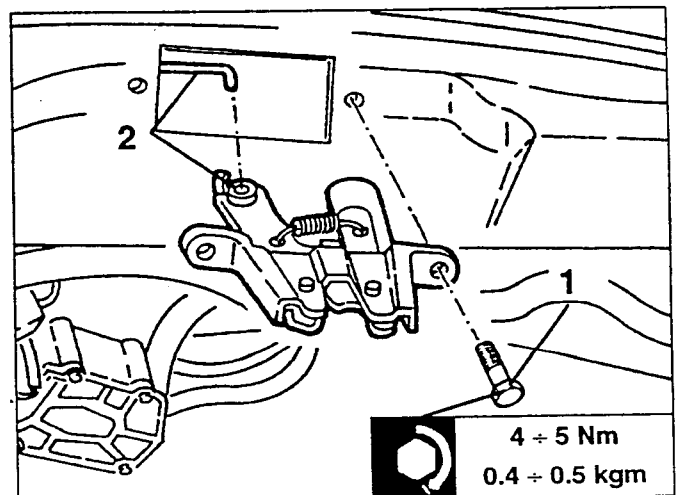
1. Disconnect the electrical connection from the boot open warning light.  
2. Disconnect the electrical connection from the rear windscreen wiper.



1. Disconnect the lock unit from the rod connecting it to the lock device.



1. Loosen the two screws securing the lock.  
2. Lower the lock just enough to permit the tie-rod connected to the actuator to be disconnected and removed.

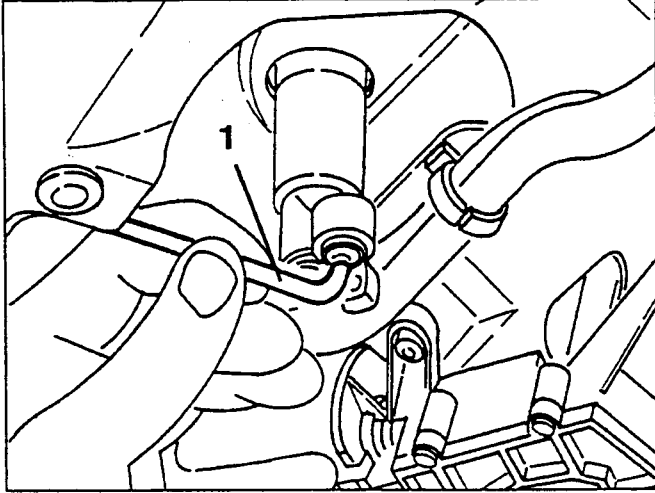


## LOCK UNIT

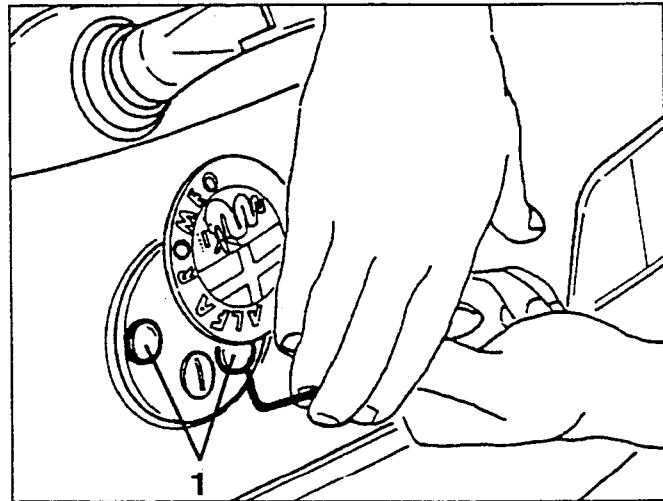
### REMOVAL/REFITTING

- Follow the first three steps described in the "BOOT" paragraph.

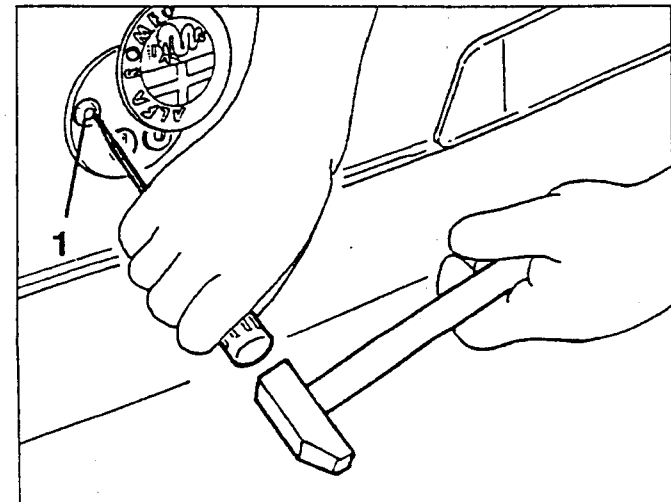
1. Disconnect the tie-rod connecting the lock to the unit.



1. Lower the boot, turn the logo and pull the two protective caps from the attachment screws.



1. Using a suitable punch, loosen the two self-cutting screws securing the lock unit to the boot and remove the lock unit.

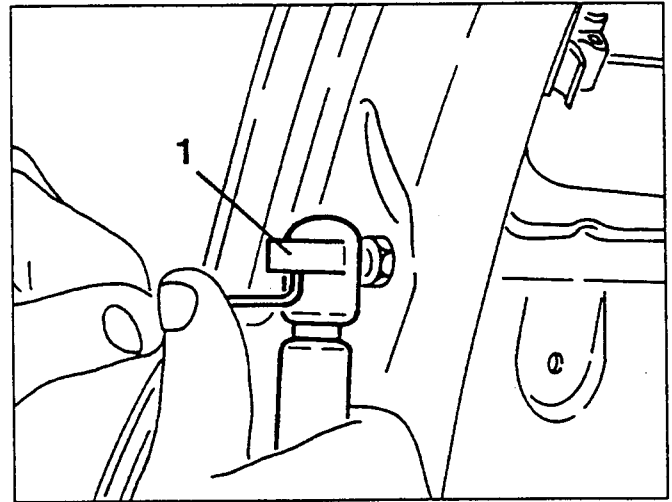


Refit by reversing the procedure followed for removal ensuring that two self-cutting screws are used for the lock unit attachment.

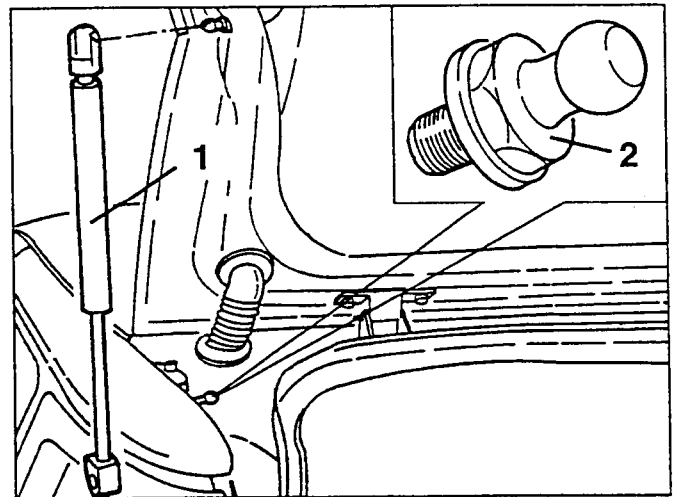
## TELESCOPIC SUPPORTS

### REMOVAL/REFITTING

1. Open the boot, support it adequately and then open the clips securing the supports to the relative balls.



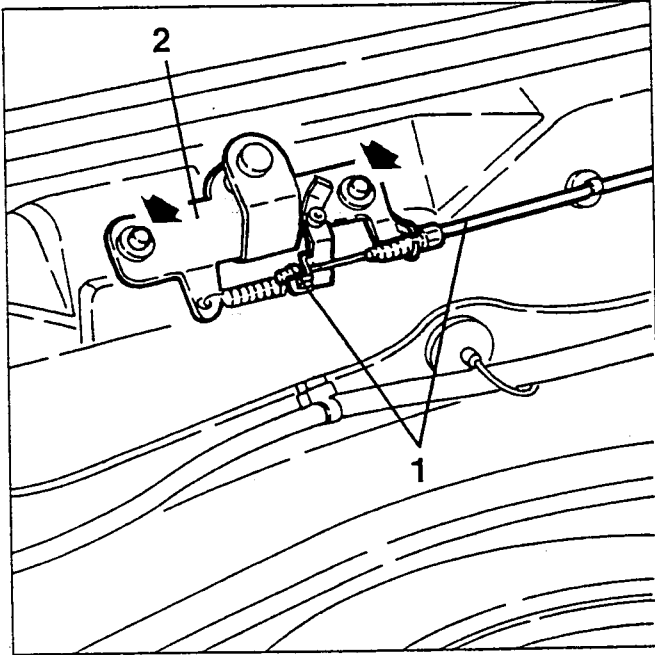
1. Remove the support by freeing it from the two retaining balls.  
2. If necessary loosen and remove the two retaining balls.



## LOCK STRIKER

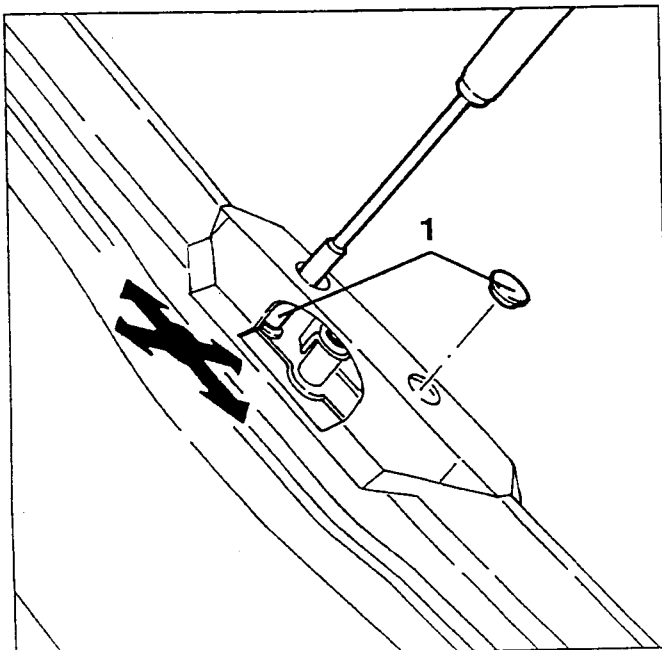
### REMOVING/REFITTING

- Remove the suitcase guard (see specific paragraph).
- 1. Disconnect the boot opening cable from the lock striker.
- 2. Slacken the two fastening screws and remove the lock striker.



### ADJUSTMENT

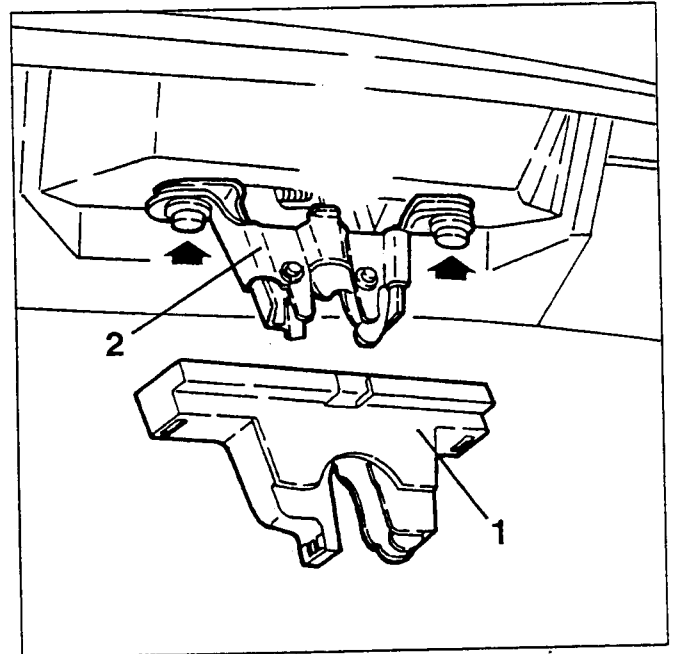
- 1. Remove the two caps from the suitcase guard, then slacken the screws fastening the boot lock striker until the bonnet closes correctly, then tighten the screws.



## BOOT LOCK

### REMOVING/REFITTING

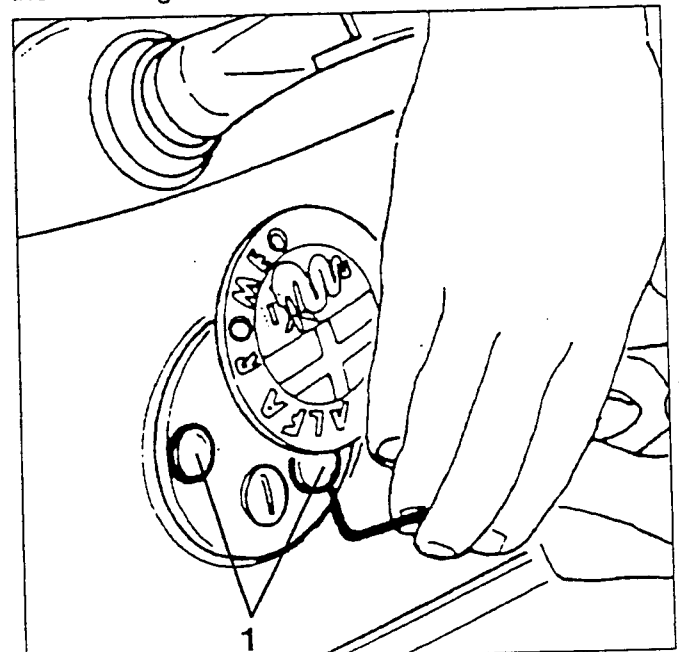
- 1. Prise and remove the plastic cover from the boot lock.
- 2. Slacken the two fastening screws and remove the boot lock.



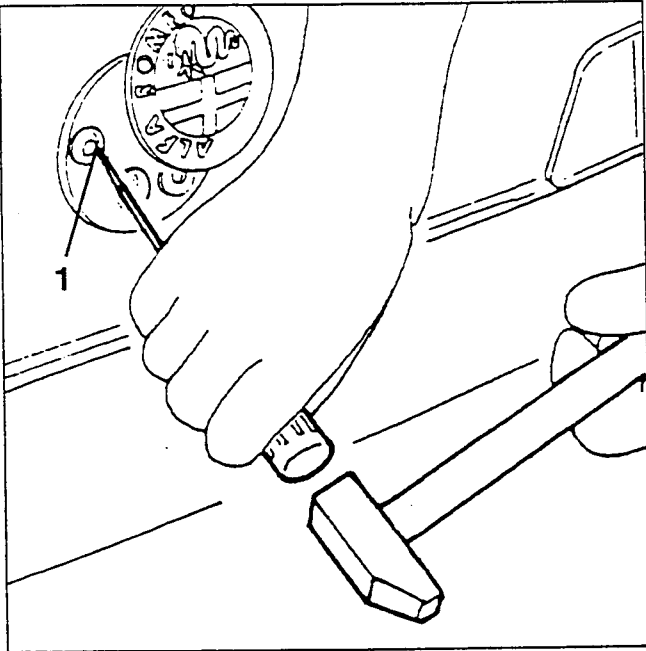
## LOCK BLOCK

### REMOVING/REFITTING

- 1. Turn the badge and remove the two caps protecting the fastening screws.



1. Using a punch, slacken the two self-shearing screws fastening the lock block to the boot and remove it.

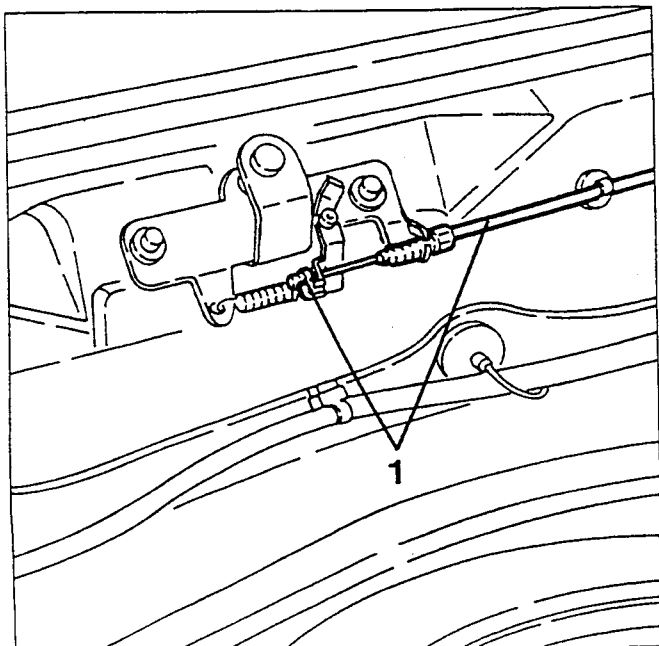


Refit reversing the sequence used for removal taking care to use new self-shearing screws for fastening the lock block.

## REPLACING THE BOOT OPENING CONTROL CABLE

- Remove the suitcase guard (see specific paragraph).

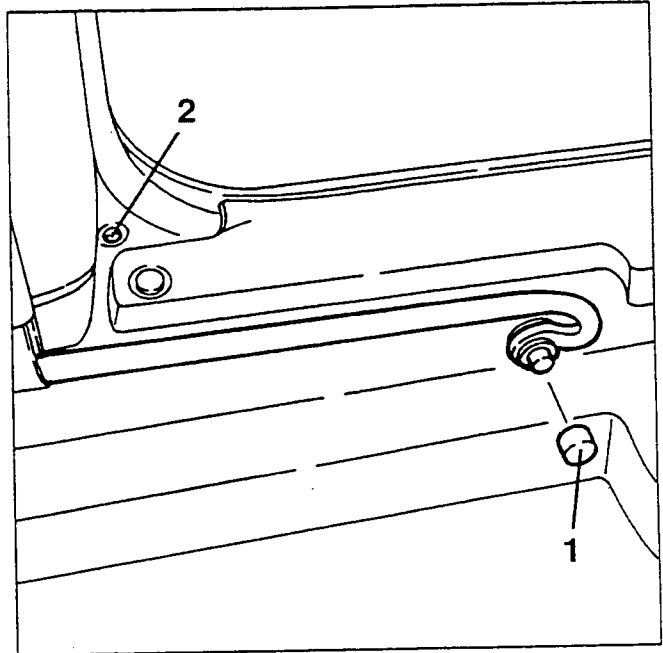
1. Disconnect the boot opening cable from the lock striker and release it from the fastening clamps in the luggage compartment.



- Remove the rear seat cushion (see specific paragraph).

1. Remove the cap and slacken the screw fastening the left front seat belt sliding connection, without withdrawing the belt itself.

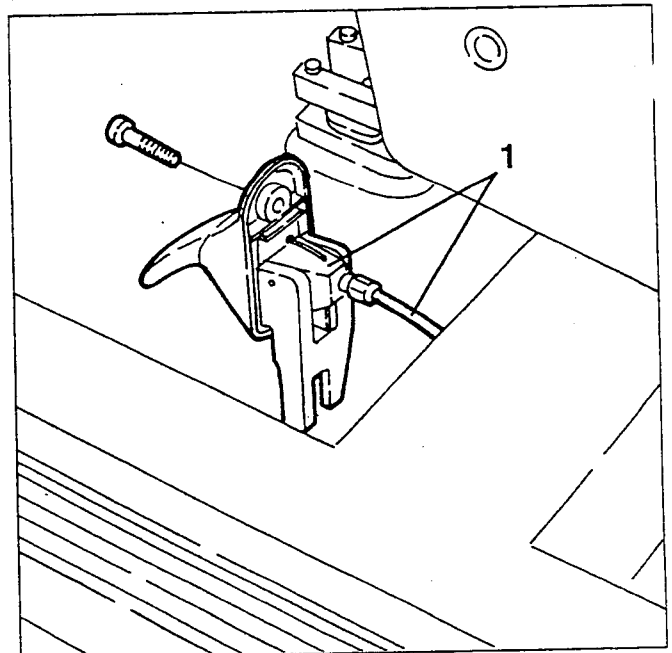
2. Slacken the screw illustrated fastening the side panel to facilitate moving the floor mat.



- Remove the left hand sill board (see specific paragraph).

- Pull away the floor mat and release the cable from the fastening clamps.

1. Slacken the two fastening screws and pull out the boot opening control lever just enough to remove the control cable.



- Remove the boot opening control cable and install a new one reversing the sequence followed for removal.



T. S.  
16V



T. S.  
16V



T. S.  
16V

## BODY

# 70

### INDEX

#### BONNET

- Bonnet opening control cable.....1

#### INTERNAL TRIM

- Dashboard.....3

#### BONNET

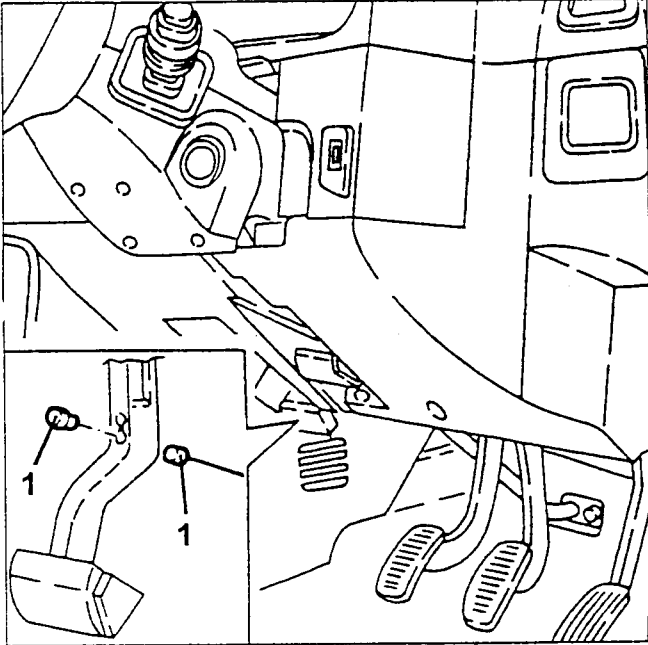
- Bonnet opening wire  
( '98 models).....7

For the information not given here, see the corresponding groups of "145 - 146 - Base Manual".



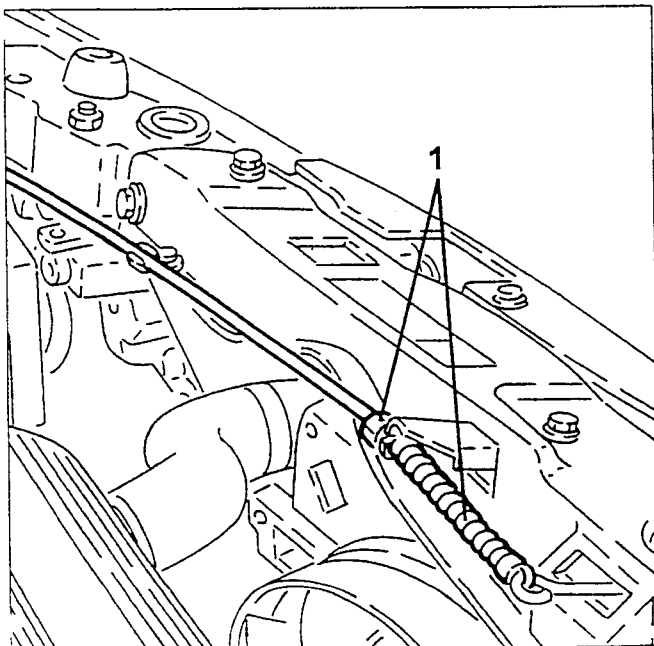
**BONNET OPENING WIRE  
( '98 MODELS )****REPLACEMENT**

1. From inside the passenger compartment, remove the cap and remove the pawl from the bonnet opening wire.

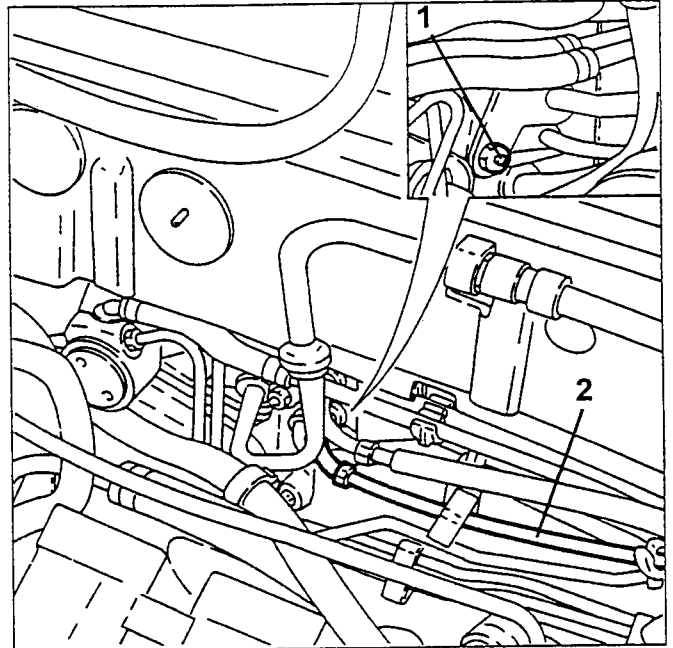


- Remove the intake manifold (see ASSEMBLY 10).

1. Disconnect the bonnet opening wire from the respective lock.

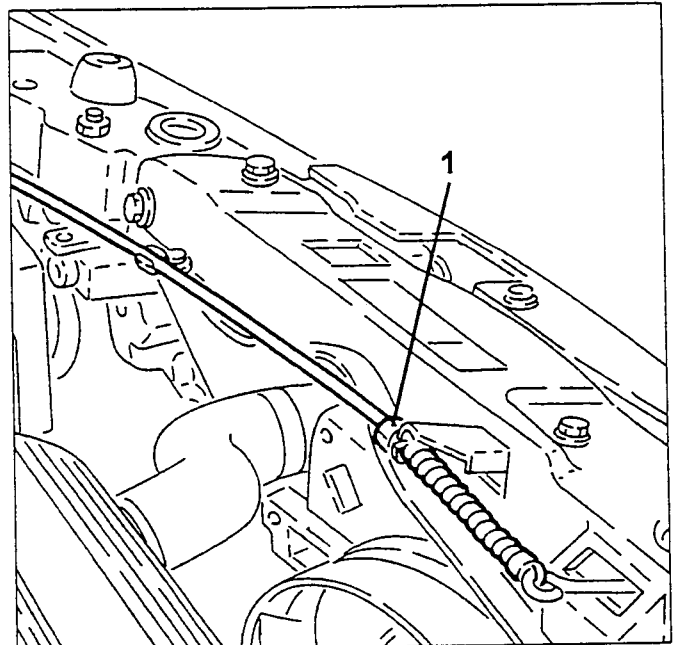


1. Loosen the accelerator wire and bonnet opening wire nut from the engine compartment partition.  
2. Remove the bonnet opening wire from the engine compartment partition.



- Refit a new bonnet opening wire by reversing the removal sequence.

1. Calibrate bonnet opening wire tension by means of the specific nut.










### IGNITION




#### IGNITION COIL (Specific for petrol engines)

|                                 |  |  ▲  16V | T. SPARK 16V |
|---------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Resistance of primary winding   | 550 mΩ ± 10% (*)                                                                  | 0.5 Ω (*)                                                                                                                                                                    | 0.3 Ω ± 12%  |
| Resistance of secondary winding | 7.4 kΩ ± 10% (*)                                                                  | 13.3 kΩ (*)                                                                                                                                                                  | 7 kΩ ± 12%   |

(\*): At a temperature of 23°C ± 5°C

(▲): Only for MP3.1



#### SPARKING PLUGS (Specific for petrol engines)

|      |  |  |  16V | T. SPARK 16V                                                |
|------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------|
| Type | GOLDEN LODGE 25HL                                                                 |                                                                                   | NGH PFR 6B                                                                            | NGK PFR6B + NGK PMR7A (*)<br>[NGK BKR6EKPA + NGK PMR7A (*)] |

(\*): On each cylinder there are two different plugs, one per type




[ ]: Alternative solution

#### PREHEATING GLOW PLUGS (Specific for Turbodiesel engines)





|                                   |  TD |  JTD |
|-----------------------------------|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Nominal voltage                   | 11 V                                                                                   | -                                                                                         |
| Bulb's temperature within 7 secs. | ≥ 850°C                                                                                | -                                                                                         |
| Absorption within 7 secs.         | 14 ± 1.5 A                                                                             | -                                                                                         |
| Bulb's temperature after 30 secs. | ≤ 1140°C                                                                               | -                                                                                         |
| Internal resistance at 20°C       | -                                                                                      | 0.6 Ω                                                                                     |

### STARTING

#### STARTING MOTOR (Specific for Boxer engines)

|                       |                 |  |  |  16V |       |
|-----------------------|-----------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------|
|                       |                 | BOSCH                                                                               | MAGNETI MARELLI                                                                       | DEM                                                                                       | BOSCH |
| Nominal voltage (V)   |                 | 12                                                                                  | 12                                                                                    | 12                                                                                        | 12    |
| Nominal power (kW)    |                 | 0.8                                                                                 | 0.9                                                                                   | 0.5                                                                                       | 1.1   |
| Full load test        | Voltage(V)      | 9                                                                                   | 9.8                                                                                   | 10                                                                                        | 9     |
|                       | Absorption (A)  | 300                                                                                 | 215                                                                                   | 200                                                                                       | 290   |
|                       | Revs.(revs/min) | 1450                                                                                | 1800                                                                                  | ≥ 1450                                                                                    | 1700  |
|                       | Torque (Nm)     | 5.5                                                                                 | 5                                                                                     | 5                                                                                         | 6     |
| Loadless test         | Voltage (V)     | 12                                                                                  | -                                                                                     | -                                                                                         | 12    |
|                       | Absorption (A)  | 30                                                                                  | -                                                                                     | -                                                                                         | 70    |
|                       | Revs.(revs/min) | 5000                                                                                | -                                                                                     | -                                                                                         | 3000  |
| Test in short circuit | Voltage(V)      | 5                                                                                   | 8                                                                                     | 8                                                                                         | -     |
|                       | Absorption (A)  | 400                                                                                 | 400                                                                                   | 380                                                                                       | -     |
|                       | Torque (Nm)     | 5.5                                                                                 | 12                                                                                    | ≥ 11.3                                                                                    | -     |

## STARTING MOTOR (Specific for T. Spark 16V engines)

|                       |                  |  T. SPARK<br>16V |  T. SPARK<br>16V |  T. SPARK<br>16V |  T. SPARK<br>16V |
|-----------------------|------------------|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
|                       |                  | MAGNETI<br>MARELLI                                                                                |                                                                                                   | MAGNETI<br>MARELLI                                                                                 |                                                                                                     |
| Nominal voltage (V)   |                  | 12                                                                                                |                                                                                                   | 12                                                                                                 |                                                                                                     |
| Nominal power (kW)    |                  | 1.4 (*)                                                                                           |                                                                                                   | 1.4 (*)                                                                                            |                                                                                                     |
| Full load test        | Voltage (V)      | 8.2                                                                                               |                                                                                                   | 7 ± 0.1                                                                                            |                                                                                                     |
|                       | Absorption (A)   | 400                                                                                               |                                                                                                   | 325                                                                                                |                                                                                                     |
|                       | Revs. (revs/min) | 1330                                                                                              |                                                                                                   | 1020                                                                                               |                                                                                                     |
|                       | Torque(Nm)       | 11                                                                                                |                                                                                                   | > 10.7                                                                                             |                                                                                                     |
| Loadless test         | Volatge (V)      | 11.3                                                                                              |                                                                                                   | 12 ± 0.1                                                                                           |                                                                                                     |
|                       | Absorption (A)   | 95                                                                                                |                                                                                                   | < 90                                                                                               |                                                                                                     |
|                       | Revs.(revs/min)  | 6000                                                                                              |                                                                                                   | > 4500                                                                                             |                                                                                                     |
| Test in short circuit | Volatge (V)      | 4.4                                                                                               |                                                                                                   | 4 ± 0.1                                                                                            |                                                                                                     |
|                       | Absorption (A)   | 800                                                                                               |                                                                                                   | < 750                                                                                              |                                                                                                     |
|                       | Torque(Nm)       | 25.5                                                                                              |                                                                                                   | > 21.5                                                                                             |                                                                                                     |

(\*): 1.1 kW for BOSCH M70 R.

## STARTING MOTOR (Specific for Turbodiesel engines)

|                       |             | MARELLI       | BOSCH   |
|-----------------------|-------------|---------------|---------|
| Nominal voltage       |             | 12 V          |         |
| Nominal power         |             | 2.2 kW        |         |
| Full load test        | Voltage     | 7.9 V         | -       |
|                       | Absorption  | 600 A         | -       |
|                       | Revolutions | 1400 revs/min | -       |
|                       | Torque      | 16 Nm         | -       |
| Loadless test         | Voltage     | -             | -       |
|                       | Absorption  | -             | -       |
|                       | Revolutions | -             | -       |
| Test in short circuit | Volatge     | 4.4 ÷ 4.6 V   | 4 V     |
|                       | Absorption  | 1110 ÷ 1150 A | 1200 A  |
|                       | Torque      | ≥ 39 Nm       | ≥ 40 Nm |

## RECHARGE

## BATTERY

|                   | Boxer Engines        |                  | Turbodiesel Engines | T. Spark 16V Engines |                   |
|-------------------|----------------------|------------------|---------------------|----------------------|-------------------|
|                   | Non-conditioned cars | Conditioned cars |                     | Non-conditioned cars | Conditioned cars  |
| Nominal voltage   | 12 V                 | 12 V             | 12 V                | 12 V                 | 12 V              |
| Capacity (20 ore) | 45 A/h               | 60 A/h           | 60 A/h              | 45 A/h               | 50 A/h 60 A/h (*) |

(\*) : For Versions/Markets if envisaged

## ALTERNATOR

|                                                                                                  | Boxer Engines | Turbodiesel Engines    |                       | T. Spark 16V Engines |                      |
|--------------------------------------------------------------------------------------------------|---------------|------------------------|-----------------------|----------------------|----------------------|
|                                                                                                  |               | Non-conditioned cars   | Conditioned cars      | Non-conditioned cars | Conditioned cars     |
| Nominal voltage                                                                                  | 14 V          | 14 V                   | 14 V                  | 14 V                 | 14 V                 |
| Nominal current                                                                                  | 80 A          | 70 A 85 A (*)          | 90A 100 A (*)         | 75 A                 | 85 A                 |
| Maximum continous speed                                                                          | -             | 15000 revs/min         | 15000 revs/min        | 18000 revs/min       | 18000 revs/min       |
| Resistance to inductive Winding (measured Between the manifold's rings at a temperature of 25°C) | -             | $2.83 \pm 0.28 \Omega$ | $2.6 \pm 0.15 \Omega$ | $2.6 \pm 5\% \Omega$ | $2.6 \pm 5\% \Omega$ |

(\*) : Specific for 1910 JTD version

**WHITE**



## ENGINE SPECIFICATIONS TECHNICAL DATA

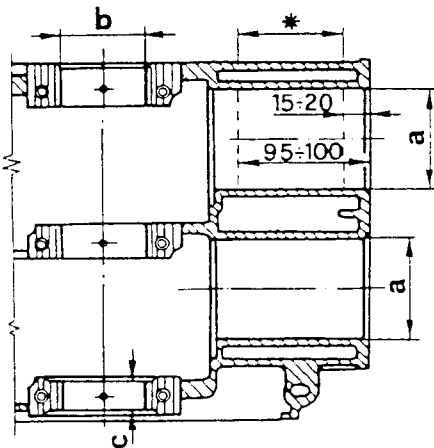
|                                                |                         |                      |                                |
|------------------------------------------------|-------------------------|----------------------|--------------------------------|
| Engine type                                    |                         | AR 33501             | AR 33201                       |
| Cycle                                          |                         | Otto 4-stroke        | Otto 4-stroke                  |
| Fuel system/ignition                           |                         | Multi-Point IAW      | Multi-Point Motronic MP3.1 (Δ) |
| Firing order                                   |                         | 1 - 3 - 2 - 4        |                                |
| Displacement                                   | cm <sup>3</sup>         | 1351                 | 1596                           |
| Number of cylinders                            |                         | 4 horizontal opposed | 4 horizontal opposed           |
| Bore                                           | mm                      | 80                   | 84                             |
| Stroke                                         | mm                      | 67.2                 | 72                             |
| Maximum power                                  | HP CEE (kW CEE)<br>rpm  | 90 (66)<br>6000      | 103 (76)<br>6000               |
| Maximum torque                                 | kgm CEE (Nm CEE)<br>rpm | 11.7 (115)<br>4400   | 13.7 (134)<br>4500             |
| Compression ratio                              |                         | 9.5 : 1              | 9.5 : 1                        |
| Engine oil pressure (with engine oil at 100°C) |                         |                      |                                |
| - At idle speed                                | bar                     | > 0.8                | > 0.8                          |
| - At 4000 rpm                                  |                         | > 4                  | > 4                            |
| Idle r.p.m.                                    | rpm                     | 850 ± 50             | 850 ± 50                       |

(Δ) Multi-Point Rochester for after change version.

## COMPLETE CRANKCASE

### Crankcase

Unit: mm

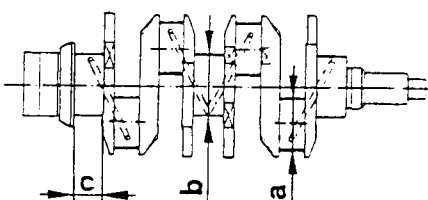


(\*) Area for dimensional control

|                                         |                  | AR 33501        | AR 33201        |
|-----------------------------------------|------------------|-----------------|-----------------|
| Diameter of cylinders "a"               | Class A - Blue   | 80.000 ÷ 80.010 | 84.000 ÷ 84.010 |
|                                         | Class B - Pink   | 80.010 ÷ 80.020 | 84.010 ÷ 84.020 |
|                                         | Class C - Green  | 80.020 ÷ 80.030 | 84.020 ÷ 84.030 |
|                                         | Class D - Yellow | 80.030 ÷ 80.040 | 84.030 ÷ 84.040 |
|                                         | Class E - White  | 80.040 ÷ 80.050 | 84.040 ÷ 84.050 |
|                                         | Oversize 0.2     | 80.200 ÷ 80.210 | 84.200 ÷ 84.210 |
|                                         | Oversize 0.4     | 80.400 ÷ 80.410 | 84.400 ÷ 84.410 |
|                                         | Oversize 0.6     | 80.600 ÷ 80.610 | 84.600 ÷ 84.610 |
| Diameter of main journals "b"           |                  | 63.663 ÷ 63.673 | 63.663 ÷ 63.673 |
| Width of rear main journal shoulder "c" |                  | 23.68 ÷ 23.73   | 23.68 ÷ 23.73   |

### Crankshaft

Unit: mm

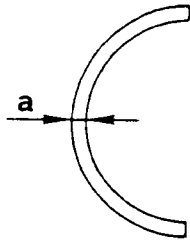


|                                                  |                | AR 33501        | AR 33201        |
|--------------------------------------------------|----------------|-----------------|-----------------|
| Diameter of connecting rod pins "a"              | Class A - Red  | 49.992 ÷ 50.000 | 49.992 ÷ 50.000 |
|                                                  | Class B - Blue | 49.984 ÷ 49.992 | 49.984 ÷ 49.992 |
| Diameter of main bearing journals "b"            | Class A - Red  | 59.944 ÷ 59.957 | 59.954 ÷ 59.964 |
|                                                  | Class B - Blue |                 | 59.944 ÷ 59.954 |
| Length of rear main bearing journal shoulder "c" |                | 28.51 ÷ 28.55   | 28.51 ÷ 28.55   |



## Main half bearings

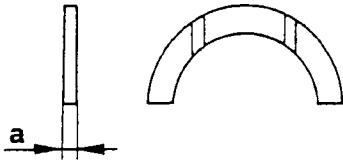
Unit: mm



|                                                             |                | AR 33501      | AR 33201      |
|-------------------------------------------------------------|----------------|---------------|---------------|
| Thickness of main half bearings "a"                         | Class A - Red  | 1.833 ± 1.839 | 1.832 ± 1.838 |
|                                                             | Class B - Blue |               | 1.836 ± 1.842 |
| Operating clearance between main journals and half bearings |                | 0.028 ± 0.063 | 0.023 ± 0.057 |

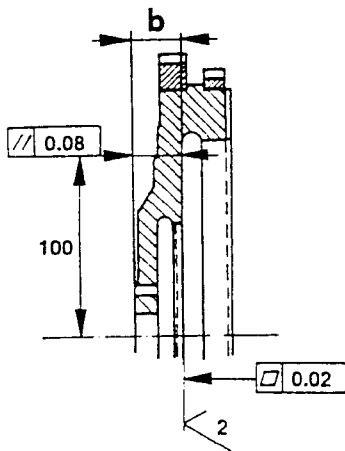
## Half thrust rings

Unit: mm



|                                    |               |
|------------------------------------|---------------|
| Thickness of half thrust rings "a" | 2.310 ± 2.360 |
| Crankshaft end float               | 0.060 ± 0.250 |

## Engine flywheel



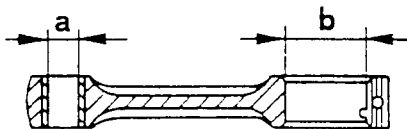
|                                                                                                                                         |              |
|-----------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Flywheel grinding dimension "b" (1)                                                                                                     | ≥ 21.15 mm   |
| Maximum error of parallelism between driven plate rest surface and flywheel rest surface at crankshaft (measured on a radius of 100 mm) | 0.08 mm      |
| Maximum error of flatness of driven plate resting surface                                                                               | 0.02 mm      |
| Roughness of driven plate rest surface                                                                                                  | 2 μm         |
| Heating temperature of ring gears for assembly on engine flywheel                                                                       | 120° ± 140°C |

(1) The removal of material must be the same on both the driven plate rest surface and on the clutch cover rest surface.

## CONNECTING ROD PISTON ASSEMBLY

### Connecting rod

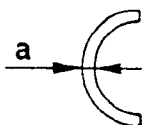
Unit: mm



|                                             |                 |
|---------------------------------------------|-----------------|
| Small end bushing bore "a"                  | 21.007 ± 21.015 |
| Inside diameter of rod big end "b"          | 53.696 ± 53.708 |
| Clearance between small end bushing and pin | 0.007 ± 0.019   |

### Connecting rod half bearings

Unit: mm

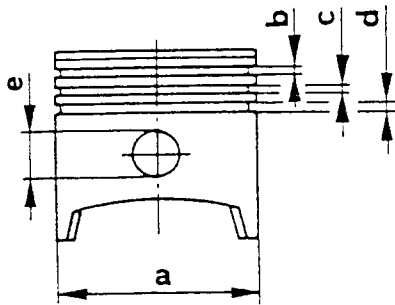


|                                                              |                |               |
|--------------------------------------------------------------|----------------|---------------|
| Thickness of rod half bearings "a"                           | Class A - Red  | 1.826 ± 1.832 |
|                                                              | Class B - Blue | 1.830 ± 1.836 |
| Operating clearance between rod pins and their half bearings |                | 0.032 ± 0.064 |



## Piston

Unit: mm

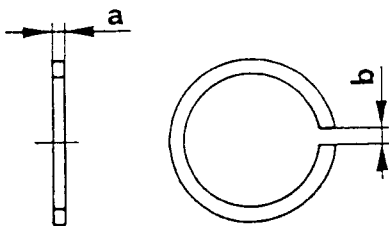


|                                                       | AR 33501         | AR 33201        |                 |
|-------------------------------------------------------|------------------|-----------------|-----------------|
| Diameter of pistons "a" (1)                           | Class A - Blue   | 79.960 ÷ 79.970 | 83.950 ÷ 83.960 |
|                                                       | Class B - Pink   | 79.970 ÷ 79.980 | 83.960 ÷ 83.970 |
|                                                       | Class C - Green  | 79.980 ÷ 79.990 | 83.970 ÷ 83.980 |
|                                                       | Class D - Yellow | 79.990 ÷ 80.000 | 83.980 ÷ 83.990 |
|                                                       | Class E - White  | 80.000 ÷ 80.010 | 83.990 ÷ 84.000 |
|                                                       | Oversize 0.2     | 80.154 ÷ 80.170 | ---             |
|                                                       | Oversize 0.4     | 80.354 ÷ 80.370 | 84.346 ÷ 84.364 |
|                                                       | Oversize 0.6     | 80.554 ÷ 80.570 | ---             |
| Height of first seal ring seat "b"                    | 1.525 ÷ 1.545    | 1.525 ÷ 1.545   |                 |
| Height of second seal ring seat "c"                   | 1.775 ÷ 1.795    | 1.510 ÷ 1.530   |                 |
| Height of oil scraper ring seat "d"                   | 4.015 ÷ 4.035    | 3.510 ÷ 3.530   |                 |
| Diameter of gudgeon pin hole in pistons "e"           | 21.004 ÷ 21.008  |                 |                 |
| Clearance between cylinder and piston (not oversized) | 0.03 ÷ 0.05      |                 |                 |

(1) To be measured perpendicular to the gudgeon pin hole at a distance of 14mm from the lower edge of skirt for "Borgo" pistons and 11.5 mm from the pin axis for "Mondial" pistons.

## Piston rings

Unit: mm

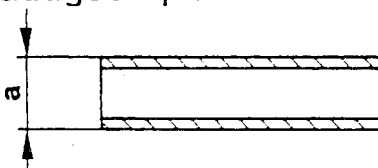


|                                              | AR 33501         | AR 33201      |               |
|----------------------------------------------|------------------|---------------|---------------|
| Thickness of rings "a"                       | First ring       | 1.478 ÷ 1.490 | 1.478 ÷ 1.490 |
|                                              | Second ring      | 1.728 ÷ 1.740 | 1.478 ÷ 1.490 |
|                                              | Oil scraper ring | 3.978 ÷ 3.990 | 3.478 ÷ 3.490 |
| Ring gap "b" (1)                             | First ring       | 0.30 ÷ 0.45   | 0.3 ÷ 0.5     |
|                                              | Second ring      | 0.30 ÷ 0.45   | 0.3 ÷ 0.5     |
|                                              | Oil scraper ring | 0.25 ÷ 0.40   | 0.25 ÷ 0.40   |
| Axial play between piston rings and seatings | First ring       | 0.035 ÷ 0.067 | 0.035 ÷ 0.067 |
|                                              | Second ring      | 0.035 ÷ 0.067 | 0.020 ÷ 0.052 |
|                                              | Oil scraper ring | 0.025 ÷ 0.057 | 0.020 ÷ 0.052 |

(1) To be measured in the checking ring nut or in the cylinder.

## Gudgeon pins

Unit: mm



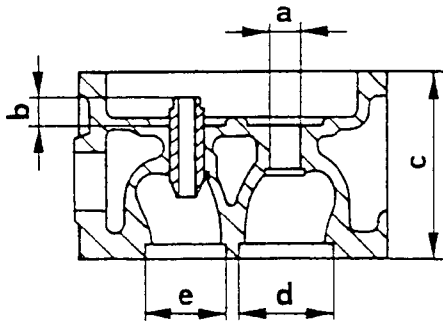
|                                                     |                 |
|-----------------------------------------------------|-----------------|
| Outside diameter of gudgeon pins "a"                | 20.996 ÷ 21.000 |
| Clearance between gudgeon pin and seating on piston | 0.004 ÷ 0.012   |





## CYLINDER HEADS

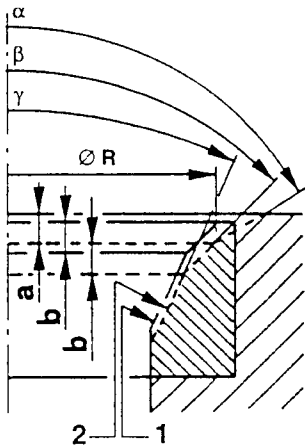
### Heads



Unit: mm

|                                                           |                 |                 |
|-----------------------------------------------------------|-----------------|-----------------|
| Diameter of valve guide seat "a"                          | 13.000 + 13.018 |                 |
| Valve guide protrusion "b"                                | 9.3 + 9.5       |                 |
| Minimum permissible height of head after refacing "c"     | 77.676 + 77.750 |                 |
| Maximum error of flatness of head lower surface           | 0.03            |                 |
| Valve seat diameter                                       | Intake "d"      | 40.000 + 40.025 |
|                                                           | Exhaust "e"     | 33.000 + 33.025 |
| Cylinder head heating temperature for fitting valve seats | 100° + 120°C    |                 |

### Valve seats

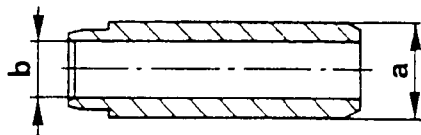


Unit: mm

- (1) Origin profile  
(2) Profile after maximum reconditioning

|                                                 |              |                 |
|-------------------------------------------------|--------------|-----------------|
| Outside diameter of valve seats                 | Intake       | 40.075 + 40.100 |
|                                                 | Exhaust      | 33.075 + 33.100 |
| Reference diameter $\varnothing_R$              | Intake       | 39.0            |
|                                                 | Exhaust      | 31.9            |
| Limit for refacing valve seat upper section "a" | 2.9          |                 |
| Limit for refacing valve seat contact area "b"  | Intake       | 1.07 + 1.37     |
|                                                 | Exhaust      | 1.26 + 1.56     |
| Upper valve seat taper "α"                      | 120°         |                 |
| Valve seat contact area taper "β"               | 90° + 90°30' |                 |
| Valve seat lower section taper "γ"              | Intake       | 70°             |
|                                                 | Exhaust      | 30°             |

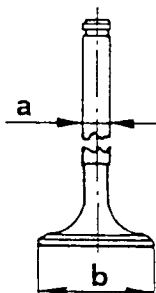
### Valve guides



Unit: mm

|                                             |                 |  |
|---------------------------------------------|-----------------|--|
| Outside diameter of valve guides "a"        | 13.050 + 13.068 |  |
| Inside diameter of valve guides "b" (bore)  | 8.013 + 8.031   |  |
| Interference between valve guides and seats | 0.032 + 0.068   |  |

### Valves

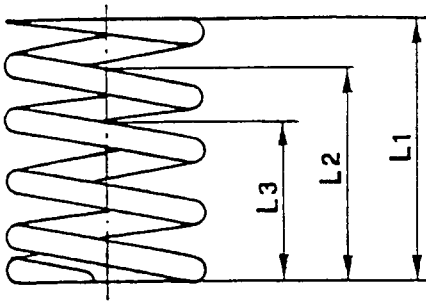


Unit: mm

|                                               |         |                 |
|-----------------------------------------------|---------|-----------------|
| Diameter of valve stem "a"                    | Intake  | 7.985 + 8.000   |
|                                               | Exhaust | 7.968 + 7.983   |
| Diameter of valve mushrooms "b"               | Intake  | 39.700 + 39.990 |
|                                               | Exhaust | 33.000 + 33.200 |
| Radial clearance between valve stem and guide | Intake  | 0.013 + 0.046   |
|                                               | Exhaust | 0.030 + 0.063   |

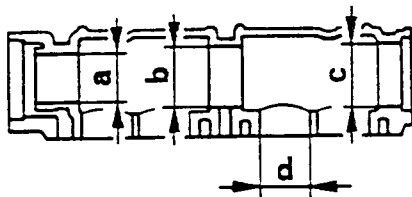


### Valve springs



|                                               | Inner spring   | Outer spring   |
|-----------------------------------------------|----------------|----------------|
| Free length "L1"                              | ~ 45 mm        | ~ 44 mm        |
| Length with valves closed "L2"                | 32.25 mm       | 30.25 mm       |
| Corresponding load at "L2"                    | 23 ÷ 24.4 kg   | 11.6 ÷ 12.5 kg |
| Length with valves open at "L3"               | 23.25 mm       | 21.25 mm       |
| Load corresponding to length with valves open | 43.3 ÷ 46.1 kg | 20.4 ÷ 21.8 kg |

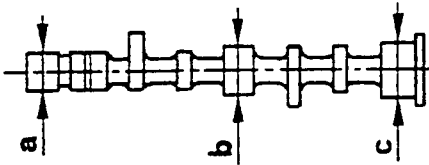
### Camshaft bearings



Unit: mm

|                                 |            |                 |
|---------------------------------|------------|-----------------|
| Diameter of camshaft bearings   | Front "a"  | 35.015 ÷ 35.040 |
|                                 | Centre "b" | 48.000 ÷ 48.025 |
|                                 | Rear "c"   | 49.200 ÷ 49.225 |
| Diameter of valve cup seats "d" |            | 35.000 ÷ 35.025 |

### Camshafts

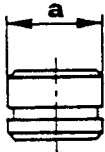


Unit: mm

|                                                        |               |                 |
|--------------------------------------------------------|---------------|-----------------|
| Diameter of camshaft journals                          | Front "a"     | 34.940 ÷ 34.961 |
|                                                        | Centre "b"    | 47.940 ÷ 47.956 |
|                                                        | Rear "c"      | 49.140 ÷ 49.156 |
| Maximum cam lift                                       | Intake        | 9.80 (*)        |
|                                                        | Exhaust       | 9.00            |
| Clearance between camshaft journals and their housings | Front         | 0.054 ÷ 0.100   |
|                                                        | Centre - rear | 0.044 ÷ 0.085   |

(\*) 9.00 for 1351 c.c. engine after change and 1596 c.c. Rochester.

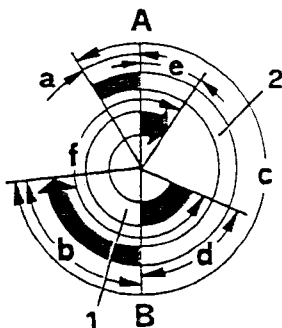
### Hydraulic tappets



Unit: mm

|                                                      |                 |
|------------------------------------------------------|-----------------|
| Outside diameter of hydraulic tappet "a"             | 34.959 ÷ 34.975 |
| Clearance between hydraulic tappets & their housings | 0.025 ÷ 0.066   |

### ANGLES OF ACTUAL TIMING DIAGRAM



(1) Intake      (2) Exhaust  
 (A) T.D.C.    (B) B.D.C.

|         |                       |     |          |
|---------|-----------------------|-----|----------|
| Intake  | Opens (before T.D.C.) | (a) | 30°      |
|         | Closes (after B.D.C.) | (b) | 84° (Δ)  |
|         | Intake angle          | (c) | 294° (□) |
| Exhaust | Opens (before B.D.C.) | (d) | 68°      |
|         | Closes (after T.D.C.) | (e) | 34°      |
|         | Exhaust angle         | (f) | 282°     |

(Δ) 76° (□) 286°: for 1351 c.c. engines after change and 1596 c.c. Rochester

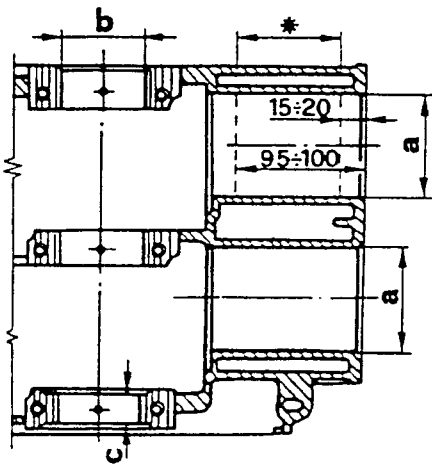
### ENGINE SPECIFICATIONS

#### TECHNICAL DATA

|                                                |                                 |                    |
|------------------------------------------------|---------------------------------|--------------------|
| Engine type                                    | AR 33401                        |                    |
| Cycle                                          | Otto 4-stroke                   |                    |
| Fuel/ignition system                           | Multi - Point Motronic M 2.10.3 |                    |
| Firing order                                   | 1 - 3 - 2 - 4                   |                    |
| Displacement                                   | cm <sup>3</sup>                 | 1712               |
| Number of cylinders                            | 4 horizontal opposed            |                    |
| Bore                                           | mm                              | 87                 |
| Stroke                                         | mm                              | 72                 |
| Maximum power                                  | HP CEE (kW CEE)<br>rpm          | 129 (95)<br>6500   |
| Maximum torque                                 | kgm CEE (Nm CEE)<br>rpm         | 15.1 (148)<br>4300 |
| Compression ratio                              | 10 : 1                          |                    |
| Engine oil pressure (with engine oil at 100°C) |                                 |                    |
| - At idle speed                                | bar                             | > 0.8              |
| - At 4000 rpm                                  |                                 | > 4                |
| Idle r.p.m.                                    | rpm                             | 900 ± 50           |

### COMPLETE CRANKCASE

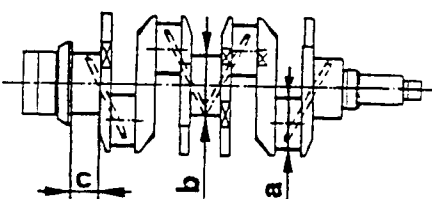
#### Crankcase



(\*) Area for dimensional control

| Unit: mm                                |                  |                 |
|-----------------------------------------|------------------|-----------------|
| Cylinder diameter "a"                   | Class A - Blue   | 87.000 ± 87.010 |
|                                         | Class B - Pink   | 87.010 ± 87.020 |
|                                         | Class C - Green  | 87.020 ± 87.030 |
|                                         | Class D - Yellow | 87.030 ± 87.040 |
|                                         | Class E - White  | 87.040 ± 87.050 |
|                                         | Oversize 0.2     | 87.200 ± 87.210 |
|                                         | Oversize 0.4     | 87.400 ± 87.410 |
|                                         | Oversize 0.6     | 87.600 ± 87.610 |
| Diameter of main bearings "b"           |                  | 63.663 ± 63.673 |
| Width of rear main bearing shoulder "c" |                  | 23.68 ± 23.73   |

#### Crankshaft

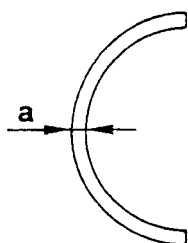


| Unit: mm                                |                |                 |
|-----------------------------------------|----------------|-----------------|
| Diameter of connecting rod pins "a"     | Class A - Red  | 49.992 ± 50.000 |
|                                         | Class B - Blue | 49.984 ± 49.992 |
| Diameter of main bearing journals "b"   | Class A - Red  | 59.954 ± 59.964 |
|                                         | Class B - Blue | 59.944 ± 59.954 |
| Width of rear main bearing shoulder "c" |                | 28.51 ± 28.55   |



### Main half bearings

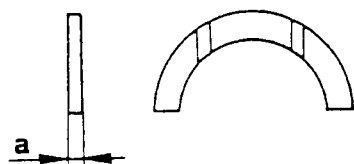
Unit: mm



|                                                             |                |               |
|-------------------------------------------------------------|----------------|---------------|
| Thickness of main half bearings "a"                         | Class A - Red  | 1.832 ÷ 1.838 |
|                                                             | Class B - Blue | 1.836 ÷ 1.842 |
| Operating clearance between main journals and half bearings |                | 0.023 ÷ 0.055 |

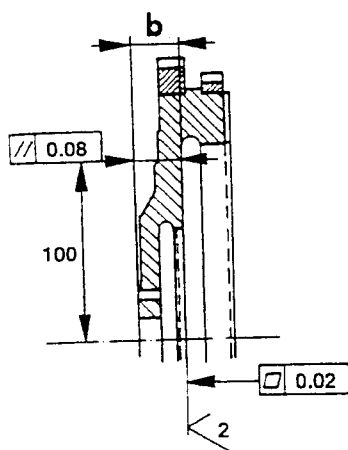
### Half thrust rings

Unit: mm



|                                    |               |
|------------------------------------|---------------|
| Thickness of half thrust rings "a" | 2.310 ÷ 2.360 |
| Crankshaft end float               | 0.06 ÷ 0.25   |

### Engine flywheel



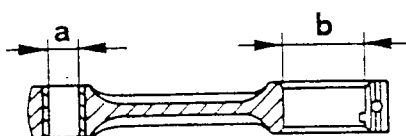
|                                                                                                                                         |              |
|-----------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Flywheel grinding dimension "b" (1)                                                                                                     | ≥ 21.15 mm   |
| Maximum error of parallelism between driven plate rest surface and flywheel rest surface at crankshaft (measured on a radius of 100 mm) | 0.08 mm      |
| Maximum error of flatness of driven plate rest surface                                                                                  | 0.02 mm      |
| Roughness of driven plate rest surface                                                                                                  | 2 μm         |
| Heating temperature of ring gears for fitting on flywheel                                                                               | 120° ÷ 140°C |

(1) The removal of material must be the same on both the driven plate rest surface and on the clutch cover rest surface.

## CONNECTING ROD - PISTON ASSEMBLY

### Connecting rods

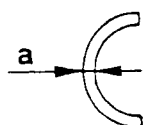
Unit: mm



|                                             |                 |
|---------------------------------------------|-----------------|
| Inside diameter of small end bushing "a"    | 21.007 ÷ 21.015 |
| Inside diameter rod big end "b"             | 53.696 ÷ 53.708 |
| Clearance between small end bushing and pin | 0.007 ÷ 0.019   |

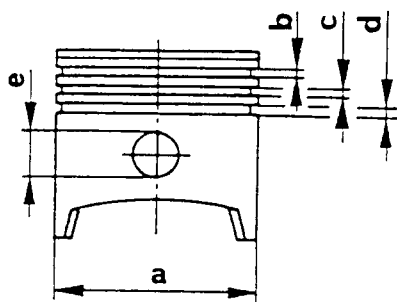
### Connecting rod half bearings

Unit: mm



|                                                              |                |               |
|--------------------------------------------------------------|----------------|---------------|
| Thickness of connecting rod half bearings "a"                | Class A - Red  | 1.826 ÷ 1.832 |
|                                                              | Class B - Blue | 1.830 ÷ 1.836 |
| Operating clearance between rod pins and their half bearings |                | 0.032 ÷ 0.064 |

## Piston

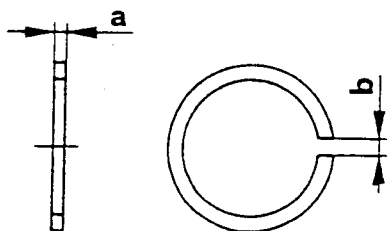


Unit: mm

|                                                         |                  |                 |
|---------------------------------------------------------|------------------|-----------------|
| Diameter of piston "a" (1)                              | Class A - Blue   | 86.950 ÷ 86.960 |
|                                                         | Class B - Pink   | 86.960 ÷ 86.970 |
|                                                         | Class C - Green  | 86.970 ÷ 86.980 |
|                                                         | Class D - Yellow | 86.980 ÷ 86.990 |
|                                                         | Class E - White  | 86.990 ÷ 87.000 |
|                                                         | Oversize 0.2     | 87.144 ÷ 87.160 |
|                                                         | Oversize 0.4     | 87.344 ÷ 87.360 |
|                                                         | Oversize 0.6     | 87.544 ÷ 87.560 |
| Height of first seal ring seats "b"                     |                  | 1.535 ÷ 1.555   |
| Height of second seal ring seats "c"                    |                  | 1.775 ÷ 1.795   |
| Height of oil scraper ring seat "d"                     |                  | 3.015 ÷ 3.035   |
| Diameter of gudgeon pin holes in pistons "e"            |                  | 21.004 ÷ 21.008 |
| Clearance between cylinders and pistons (not oversized) |                  | 004 ÷ 006       |

(1) To be measured perpendicular to the gudgeon pin hole at a distance of 13.9 mm from the gudgeon pin axis.

## Piston rings

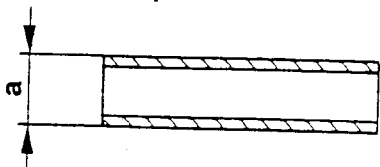


Unit: mm

|                                              |                  |               |
|----------------------------------------------|------------------|---------------|
| Thickness of rings "a"                       | First ring       | 1.478 ÷ 1.490 |
|                                              | Second ring      | 1.728 ÷ 1.740 |
|                                              | Oil scraper ring | 2.978 ÷ 2.990 |
| Ring gap "b" (1)                             | First ring       | 0.30 ÷ 0.50   |
|                                              | Second ring      | 0.30 ÷ 0.50   |
|                                              | Oil scraper ring | 0.25 ÷ 0.50   |
| Axial play between piston rings and housings | First ring       | 0.045 ÷ 0.077 |
|                                              | Second ring      | 0.035 ÷ 0.067 |
|                                              | Oil scraper ring | 0.025 ÷ 0.057 |

(1) To be measured in the checking ring nut or in the cylinder.

## Gudgeon pins



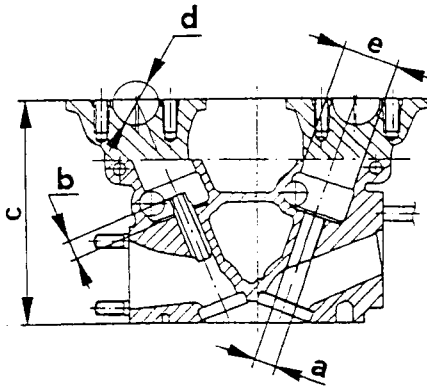
Unit: mm

|                                                   |                 |
|---------------------------------------------------|-----------------|
| Outside diameter of gudgeon pins "a"              | 20.996 ÷ 21.000 |
| Clearance between gudgeon pin and seats on piston | 0.004 ÷ 0.012   |

### CYLINDER HEADS

#### Heads

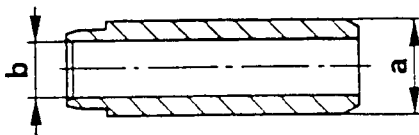
Unit: mm



|                                                           |                 |
|-----------------------------------------------------------|-----------------|
| Diameter of valve guide seats "a"                         | 12.000 + 12.018 |
| Valve guide protrusion "b"                                | 10.35 + 10.65   |
| Minimum permissible height after refacing "c"             | ≥ 127.8         |
| Maximum error of flatness of head lower surface           | 0.03            |
| Diameter of camshaft journals "d"                         | 27.000 + 27.033 |
| Diameter of valve cup seats "e"                           | 33.000 + 33.025 |
| Cylinder head heating temperature for fitting valve seats | 100° + 120°C    |

#### Valve guides

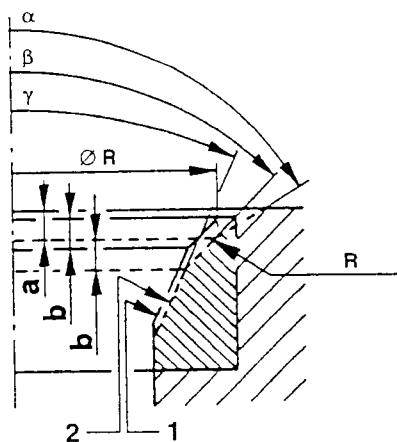
Unit: mm



|                                                   |              |                 |
|---------------------------------------------------|--------------|-----------------|
| Outside diameter of valve guides "a"              | Intake       | 12.040 + 12.051 |
|                                                   | Oversize 0.2 | 12.240 + 12.251 |
|                                                   | Exhaust      | 12.050 + 12.068 |
|                                                   | Oversize 0.2 | 12.250 + 12.268 |
| Inside diameter of valve guides "b"               |              | 7.000 + 7.015   |
| Interference between valve guides and their seats | Intake       | 0.022 + 0.051   |
|                                                   | Exhaust      | 0.032 + 0.068   |

#### Valve seats

Unit: mm

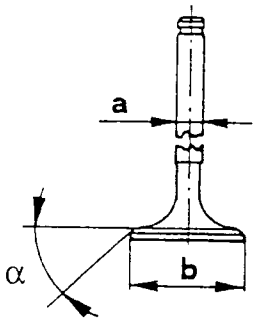


- (1) Origin profile
- (2) Profile after maximum reconditioning

|                                                 |              |                 |
|-------------------------------------------------|--------------|-----------------|
| Outside diameter of valve seats                 | Intake       | 34.100 + 34.116 |
|                                                 | Oversize 0.2 | 34.300 + 34.316 |
|                                                 | Exhaust      | 28.096 + 28.116 |
|                                                 | Oversize 0.2 | 28.296 + 28.316 |
| Reference diameter $\varnothing_R$              | Intake       | 31.0            |
|                                                 | Exhaust      | 24.5            |
| Limit for refacing valve seat upper section "a" | Intake       | 0.4             |
|                                                 | Exhaust      | 1.1             |
| Limit for refacing valve seat contact area      | Intake "R"   | 0.9             |
|                                                 | Exhaust "b"  | 1.1             |
| Upper valve seat taper limit "α"                | Intake       | 150°            |
|                                                 | Exhaust      | 120°            |
| Valve seat contact area taper "β"               |              | 90° ± 20'       |
| Inner valve seat taper limit "γ"                | Intake       | 75°             |
|                                                 | Exhaust      | 60°             |

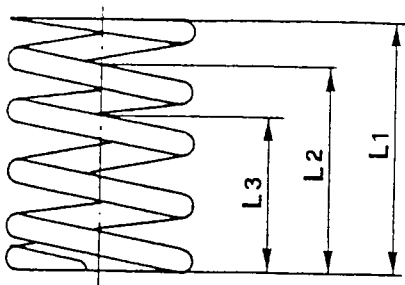
## Valves

Unit: mm



|                                                  |         |                 |
|--------------------------------------------------|---------|-----------------|
| Diameter of valve stems "a"                      | Intake  | 6.965 ÷ 6.980   |
|                                                  | Exhaust |                 |
| Diameter of valve mushrooms "b"                  | Intake  | 31.8 ÷ 32.0     |
|                                                  | Exhaust | 25.8 ÷ 26.0     |
| Valve mushroom angle "α"                         | Intake  | 44°25' ÷ 44°35' |
|                                                  | Exhaust |                 |
| Radial play between valve stems and valve guides | Intake  | 0.02 ÷ 0.05     |
|                                                  | Exhaust |                 |

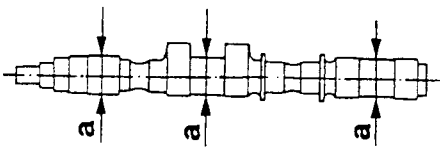
## Valve springs



|                                             | Outer spring     | Inner spring     |
|---------------------------------------------|------------------|------------------|
| Free length "L <sub>1</sub> "               | ~ 51.8 mm        | ~ 38 mm          |
| Length with valves closed "L <sub>2</sub> " | 32.5 mm          | 30.5 mm          |
| Load corresponding to "L <sub>2</sub> "     | 21.4 ÷ 22.6 kg   | 13.6 ÷ 14.4 kg   |
| Length with valves open "L <sub>3</sub> "   | 22.9 mm          | 20.9 mm          |
| Corresponding load at "L <sub>3</sub> "     | 35.52 ÷ 35.72 kg | 31.89 ÷ 33.69 kg |

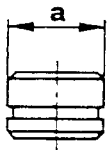
## Camshafts

Unit: mm



|                                                        |                 |      |
|--------------------------------------------------------|-----------------|------|
| Diameter of camshaft journals "a"                      | 26.959 ÷ 26.980 |      |
| Maximum cam lift                                       | Intake          | 9.50 |
|                                                        | Exhaust         | 9.40 |
| Clearance between camshaft journals and their housings | 0.020 ÷ 0.074   |      |

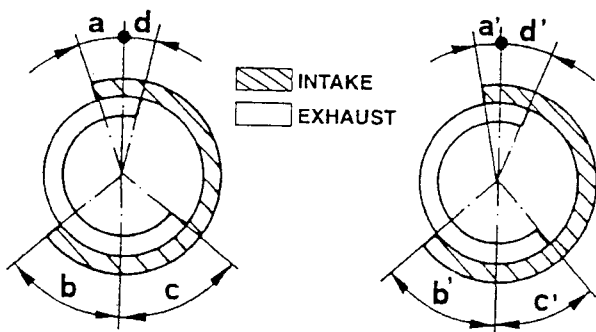
## Hydraulic tappets



Unit: mm

|                                           |                 |
|-------------------------------------------|-----------------|
| Outside diameter of hydraulic tappets "a" | 32.959 ÷ 32.975 |
| Clearance between cup and housing         | 0.025 ÷ 30.066  |

## ANGLES OF ACTUAL TIMING DIAGRAM



TIMING OF FIRST PAIR OF VALVES

TIMING OF SECOND PAIR OF VALVES

|         |                       |    |     |
|---------|-----------------------|----|-----|
| Intake  | Opens (before T.D.C.) | a  | 20° |
|         |                       | a' | 10° |
|         | Closes (after B.D.C.) | b  | 49° |
|         |                       | b' | 49° |
| Exhaust | Opens (before B.D.C.) | c  | 52° |
|         |                       | c' | 42° |
|         | Closes (after T.D.C.) | d  | 12° |
|         |                       | d' | 22° |

### TECHNICAL FEATURES OF THE ENGINE

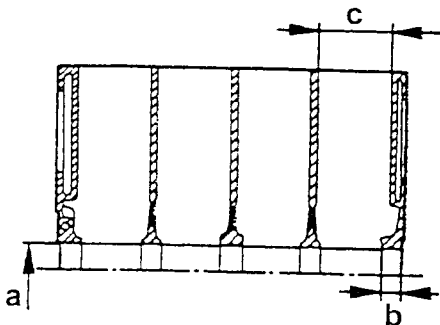
#### SPECIFIC DATA

|                     |                                     |                       |
|---------------------|-------------------------------------|-----------------------|
| Engine              | AR 67501 - AR 33601 (▲)             |                       |
| Cycle               | four-stroke Diesel engine           |                       |
| Feed                | Direct injection with supercharging |                       |
| Piston displacement | cm <sup>3</sup>                     | 1929                  |
| Cylinders' number   | 4 in line                           |                       |
| Boring              | mm                                  | 82.6                  |
| Stroke              | mm                                  | 90                    |
| Maximum Power       | CV CEE (kW CEE)<br>revs/min         | 90 (66)               |
|                     |                                     | 4100 4200 (●)         |
| Pull-in Torque      | kgm CEE (Nm CEE)<br>revs/min        | 19.0 (186)            |
|                     |                                     | 2400 2500 (●)         |
| Compression ratio   | 19.2 : 1                            |                       |
| Firing order        | 1 - 3 - 4 - 2                       |                       |
| Slow running        | revs/min                            | 900 ± 20 900 ± 40 (●) |

(▲): Version with catalyst      (●): For versions/markets envisaged.

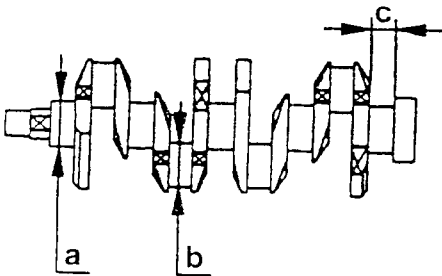
### COMPLETE CYLINDER BLOCK

#### Cylinder block



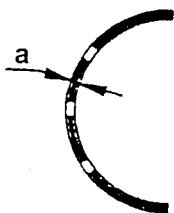
|                                          |                 |                 |
|------------------------------------------|-----------------|-----------------|
|                                          |                 | Unit: mm        |
| Diameter of main bearing "a"             | 56.717 ÷ 56.735 |                 |
| Shoulder length of rear main bearing "b" | 23.12 ÷ 23.20   |                 |
| Diameter of cylinder barrels "c"         | Class A         | 82.600 ÷ 82.610 |
|                                          | Class B         | 82.610 ÷ 82.620 |
|                                          | Class C         | 82.620 ÷ 82.630 |
|                                          | Class D         | 82.630 ÷ 82.640 |
|                                          | Class E         | 82.640 ÷ 82.650 |
|                                          |                 | Oversize by 0.1 |

#### Driving shaft



|                                 |                 |                    |
|---------------------------------|-----------------|--------------------|
|                                 |                 | Unit: mm           |
| Diameter of main journals "a"   | Class 1         | 52.995 ÷ 53.004    |
|                                 | Class 2         | 52.986 ÷ 52.995    |
|                                 |                 | Undersize by 0.127 |
| Diameter of rod pins "b"        | Class 1         | 50.796 ÷ 50.805    |
|                                 | Class 2         | 50.787 ÷ 50.796    |
|                                 |                 | Undersize by 0.127 |
| Length of rear main journal "c" | 27.975 ÷ 28.025 |                    |

#### Half bearings

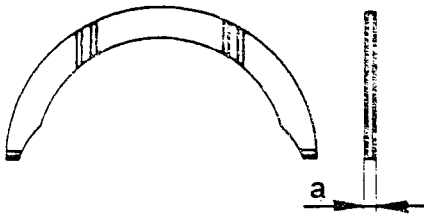


|                                                 |                |                    |
|-------------------------------------------------|----------------|--------------------|
|                                                 |                | Unit: mm           |
| Thickness of half bearings "a"                  | Class A (Red)  | 1.837 ÷ 1.843      |
|                                                 | Class B (Blue) | 1.843 ÷ 1.849      |
|                                                 |                | Undersize by 0.127 |
| Radial clearance between pins and main bearings | Class A (Red)  | 0.027 ÷ 0.066      |
|                                                 | Class B (Blue) | 0.024 ÷ 0.063      |



## Thrust half rings

Unit: mm

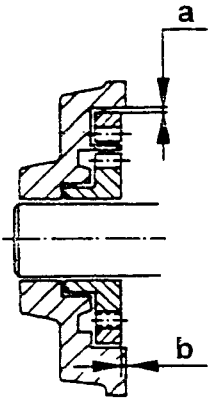


|                                    |                   |
|------------------------------------|-------------------|
| Thickness of thrust half rings "a" | 2.347 ÷ 2.363     |
|                                    | Oversize by 0.127 |
| End play of the driving shaft      | 0.049 ÷ 0.211     |

## Flywheel

|                                                                      |      |
|----------------------------------------------------------------------|------|
| Heating temperature of crown gear for the fitting of engine flywheel | 80°C |
|----------------------------------------------------------------------|------|

## Oil pump

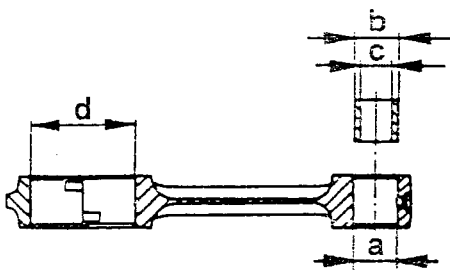


|                                                    |            |                  |
|----------------------------------------------------|------------|------------------|
| Clearance between pump seat and driven gear "a"    |            | 0.080 ÷ 0.186 mm |
| Clearance between face of pump cover and gears "b" |            | 0.025 ÷ 0.056 mm |
| Spring of pressure relief valve                    | Length     | 36 mm            |
|                                                    | Check load | 74 ÷ 82.9 N      |
| Engine oil pressure (with engine oil at 100°C)     | bar        | 3.43 ÷ 4.0       |

## CONNECTING ROD - PISTON GROUP

### Connecting rods

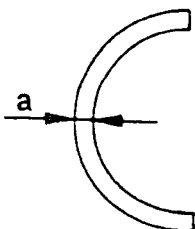
Unit: mm



|                                                             |                     |                            |
|-------------------------------------------------------------|---------------------|----------------------------|
| Diameter of small end "a"                                   |                     | 27.939 ÷ 27.972            |
| External diameter of small end bushings "b"                 |                     | 28.020 ÷ 28.060            |
| Internal diameter of small end bushings (line-boring) "c"   | Version before mod. | Class 1<br>26.004 ÷ 26.007 |
|                                                             | Version after mod.  | Class 2<br>26.007 ÷ 26.010 |
| Diameter of connecting rod heads "d"                        |                     | 53.897 ÷ 53.913            |
| Weight difference between connecting rods                   |                     | ± 2.5 g                    |
| Play among bushings, small ends and piston pins             | Version before mod. | 0.014 ÷ 0.020              |
|                                                             | Version after mod.  | 0.013 ÷ 0.022              |
| Interference among bushings, small ends and bushings' seats |                     | 0.048 ÷ 0.121              |

### Half bearings

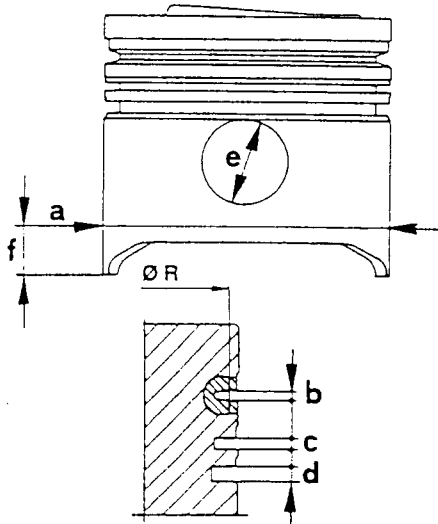
Unit: mm



|                                       |                    |               |
|---------------------------------------|--------------------|---------------|
| Thickness of half bearings "a"        | Class A (Red)      | 1.527 ÷ 1.533 |
|                                       | Class B (Blue)     | 1.533 ÷ 1.539 |
|                                       | Undersize by 0.127 |               |
| Radial play between pins and bearings | Class A (Red)      | 0.026 ÷ 0.063 |
|                                       | Class B (Blue)     | 0.023 ÷ 0.060 |

## Pistons

Unit: mm

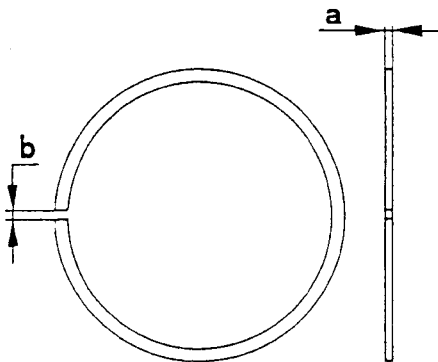


|                                                                           |                       |                                                    |
|---------------------------------------------------------------------------|-----------------------|----------------------------------------------------|
| Diameter of pistons "a" (1)                                               | Class A               | 82.530 ÷ 82.540                                    |
|                                                                           | Class B               | 82.540 ÷ 82.550                                    |
|                                                                           | Class C               | 82.550 ÷ 82.560                                    |
|                                                                           | Class D               | 82.560 ÷ 82.570                                    |
|                                                                           | Class E               | 82.570 ÷ 82.580                                    |
| Oversized by 0.1                                                          |                       |                                                    |
| Height of first piston ring seats "b" (at reference diameter Ø R 79.6 mm) |                       | 2.675 ÷ 2.705                                      |
| Height of second piston ring seats "c"                                    |                       | 2.010 ÷ 2.030                                      |
| Height of oil scraper ring seats "d"                                      |                       | 3.020 ÷ 3.040                                      |
| Diameter of gudgeon pin hole in pistons "e"                               | Version before change | Class 1 25.993 ÷ 25.996<br>Class 2 25.996 ÷ 25.999 |
|                                                                           | Version after change  | 25.994 ÷ 25.999                                    |
| Clearance between liners and pistons                                      |                       | 0.060 ÷ 0.080                                      |
| Difference in weight between pistons                                      |                       | ± 5 g                                              |

(1): To be measured perpendicular to the gudgeon pin hole at a distance of  $f = 15$  mm from lower edge of skirt.

## Seal rings

Unit: mm

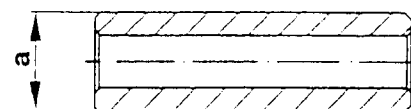


|                                              |                  |               |
|----------------------------------------------|------------------|---------------|
| Thickness of rings "a"                       | First ring       | 2.575 ÷ 2.595 |
|                                              | Oversized by 0.1 |               |
|                                              | Second ring      | 1.978 ÷ 1.990 |
|                                              | Oversized by 0.1 |               |
|                                              | Oil scraper ring | 2.975 ÷ 2.990 |
| Oversized by 0.1                             |                  |               |
| Ring gap "b" (1)                             | First ring       | 0.20 ÷ 0.35   |
|                                              | Second ring      | 0.30 ÷ 0.50   |
|                                              | Oil scraper ring | 0.25 ÷ 0.50   |
| Axial clearance between seats and seal rings | First ring       | 0.080 ÷ 0.130 |
|                                              | Second ring      | 0.020 ÷ 0.052 |
|                                              | Oil scraper ring | 0.030 ÷ 0.065 |

(1) To be measured in the check ring nut or in the cylinder liner.

## Gudgeon pins

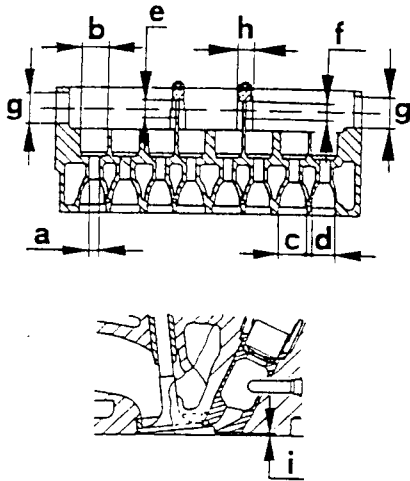
Unit: mm



|                                                 |                       |                                                    |
|-------------------------------------------------|-----------------------|----------------------------------------------------|
| Outside diameter of gudgeon pins "a"            | Version before change | Class 1 25.987 ÷ 25.990<br>Class 2 25.990 ÷ 25.993 |
|                                                 | Version after change  | 25.987 ÷ 25.991                                    |
|                                                 | Oversized by 0.2      |                                                    |
| Clearance between piston holes and gudgeon pins | Version before change | 0.003 ÷ 0.009                                      |
|                                                 | Version after change  | 0.003 ÷ 0.012                                      |

## CYLINDER HEAD

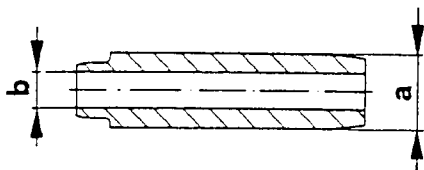
### Head



Unit: mm

|                                                                                           |                   |                 |
|-------------------------------------------------------------------------------------------|-------------------|-----------------|
| Diameter of valve guide seats "a"                                                         | 13.950 ÷ 13.977   |                 |
| Diameter of valve cup seats "b"                                                           | 37.000 ÷ 37.025   |                 |
| Diameter of valve seat housings                                                           | Intake "c"        | 38.989 ÷ 39.014 |
|                                                                                           | Exhaust "d"       | 34.989 ÷ 35.014 |
| Diameter of camshaft centre bearings                                                      | Second "e"        | 25.545 ÷ 25.570 |
|                                                                                           | Third "f"         | 24.045 ÷ 24.070 |
| Diameter of camshaft side bearings "g"                                                    | 43.020 ÷ 43.040   |                 |
| Width of third camshaft bearing shoulder "h"                                              | 18.950 ÷ 19.030   |                 |
| Precombustion chamber protrusion or undercut in relation to the cylinder head surface "i" | - 0.765 ÷ + 0.055 |                 |

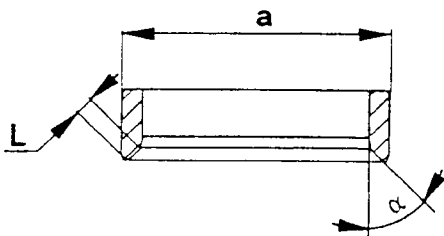
### Valve guides



Unit: mm

|                                             |                   |  |
|---------------------------------------------|-------------------|--|
| Outside diameter of valve guides "a"        | 14.040 ÷ 14.058   |  |
|                                             | Oversized by 0.20 |  |
| Inside diameter of valve guides (bore) "b"  | 8.022 ÷ 8.040     |  |
| Interference between valve guides and seats | 0.063 ÷ 0.108     |  |

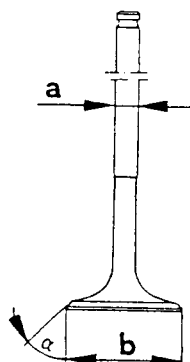
### Valve seats



Unit: mm

|                                                           |             |                 |
|-----------------------------------------------------------|-------------|-----------------|
| Outside diameter of valve seats "a"                       | Intake      | 39.095 ÷ 39.110 |
|                                                           | Exhaust     | 35.085 ÷ 35.100 |
| Valve seat taper "α"                                      | 45° ± 5'    |                 |
| Length "L" of valve seat section with taper at 45°        | ~ 2.7       |                 |
| Interference between valve seats and housings             | Intake      | 0.081 ÷ 0.121   |
|                                                           | Exhaust     | 0.071 ÷ 0.111   |
| Cylinder head heating temperature for fitting valve seats | 80° ÷ 100°C |                 |

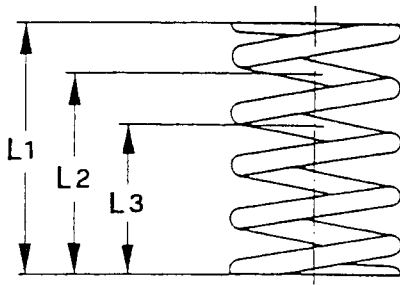
### Valves



Unit: mm

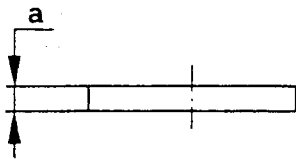
|                                                 |         |                 |
|-------------------------------------------------|---------|-----------------|
| Diameter of valve stems "a"                     | Intake  | 7.974 ÷ 7.992   |
|                                                 | Exhaust |                 |
| Diameter of valve mushrooms "b"                 | Intake  | 37.300 ÷ 37.600 |
|                                                 | Exhaust | 33.300 ÷ 33.600 |
| Valve mushroom angle "α"                        | Intake  | 45°30' ± 7'     |
|                                                 | Exhaust |                 |
| Radial clearance between valve stems and guides | Intake  | 0.030 ÷ 0.066   |
|                                                 | Exhaust |                 |

### Valve springs



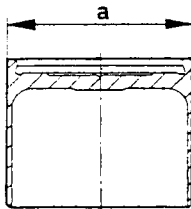
|                                                        |                                     |
|--------------------------------------------------------|-------------------------------------|
| Free length "L1"                                       | 53.9 mm                             |
| Spring length with valves closed "L2"                  | 36 mm                               |
| Load corresponding to spring length with valves closed | 36.7 ÷ 39.6 daN<br>(37.4 ÷ 40.4 kg) |
| Length of springs with valves open "L3"                | 26.5 mm                             |
| Load corresponding to spring length with valves open   | 55.9 ÷ 60.8 daN<br>(57 ÷ 62 kg)     |

### Plates



|                         |                |
|-------------------------|----------------|
| Thickness of plates "a" | 3.25 ÷ 4.40 mm |
|-------------------------|----------------|

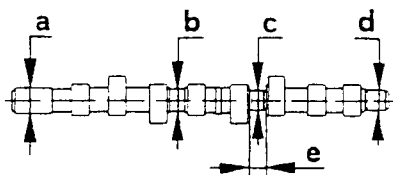
### Valve cups



Unit: mm

|                                                  |                 |
|--------------------------------------------------|-----------------|
| Diameter of valve cups "a"                       | 36.975 ÷ 36.995 |
| Radial clearance between valve cups and housings | 0.005 ÷ 0.050   |

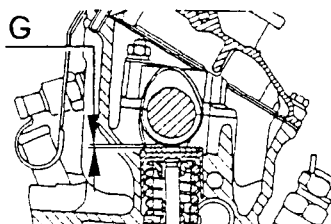
### Camshaft



Unit: mm

|                                                      |            |                 |
|------------------------------------------------------|------------|-----------------|
| Diameter of camshaft journals                        | First "a"  | 29.945 ÷ 29.960 |
|                                                      | Second "b" | 25.500 ÷ 25.515 |
|                                                      | Third "c"  | 24.000 ÷ 24.015 |
|                                                      | Fourth "d" | 23.945 ÷ 23.960 |
| Width of shaft shoulder "e"                          |            | 19.100 ÷ 19.200 |
| Cam lift (on valve spindle without play)             | Intake     | 8.5             |
|                                                      | Exhaust    | 8.5             |
| Radial clearance between camshaft journals and seats |            | 0.03 ÷ 0.07     |
| Camshaft end float                                   |            | 0.1             |

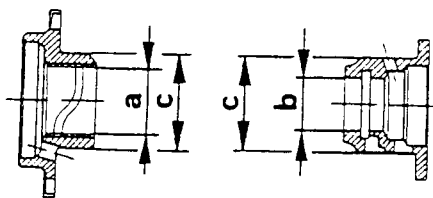
### Valve clearance



Unit: mm

|                                                  |         |             |
|--------------------------------------------------|---------|-------------|
| Valve clearance for checking timing              | Intake  | 0.50        |
|                                                  | Exhaust | 0.50        |
| Operating valve clearance (with cold engine) "G" | Intake  | 0.30 ± 0.05 |
|                                                  | Exhaust | 0.35 ± 0.05 |

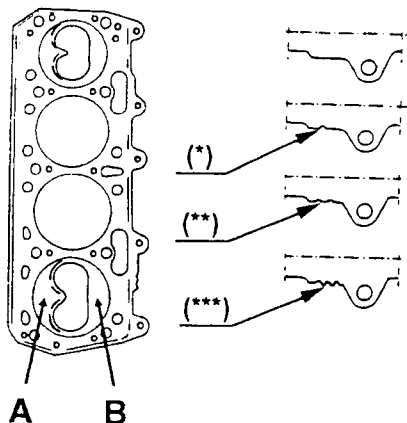
## Side camshaft bearings



Unit: mm

|                                           |           |                 |
|-------------------------------------------|-----------|-----------------|
| Inside diameter of camshaft bearings      | front "a" | 29.990 ÷ 30.015 |
|                                           | rear "b"  | 23.990 ÷ 24.015 |
| Outside diameter of camshaft bearings "c" |           | 42.995 ÷ 43.015 |

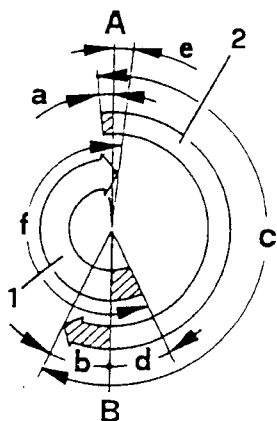
## Cylinder head seal



| Mean piston protrusion (1) |                          | Thickness of cylinder head seal to be used |
|----------------------------|--------------------------|--------------------------------------------|
| from engine no. 1762797    | up to engine no. 1762798 |                                            |
| < 0.7 mm                   | < 1.05 mm                | 1.67 mm                                    |
| 0.7 ÷ 0.8 mm               | 1.05 ÷ 1.15 mm           | 1.75 mm (*)                                |
| 0.8 ÷ 0.9 mm               | 1.15 ÷ 1.25 mm           | 1.85 mm (**)                               |
| > 0.9 mm                   | > 1.25 mm                | 1.93 mm (***)                              |

(1): To be found by measuring it for each cylinder in points A and B of the piston; calculate the mean between the two values and consider the highest mean between the pistons to define the seal to be used.

## ANGULAR VALUES OF ACTUAL TIMING DIAGRAM



- (1) Exhaust
- (2) Intake
- (A) T.D.C.
- (B) B.D.C.

|         |                       |     |      |
|---------|-----------------------|-----|------|
| Intake  | Opens (before T.D.C.) | "a" | 6°   |
|         | Closes (after B.D.C.) | "b" | 26°  |
|         | Intake angle          | "c" | 212° |
| Exhaust | Opens (before B.D.C.) | "d" | 26°  |
|         | Closes (after T.D.C.) | "e" | 6°   |
|         | Exhaust angle         | "f" | 212° |

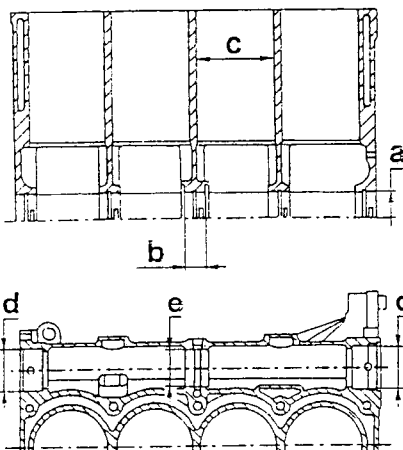
## TECHNICAL FEATURES OF THE ENGINE

### SPECIFIC DATA

|                                         |                                  |                                  |                                 |
|-----------------------------------------|----------------------------------|----------------------------------|---------------------------------|
| Engine                                  | AR 67204                         |                                  | AR 32301                        |
| Cycle                                   | four-stroke Otto                 |                                  |                                 |
| Feed / Ignition                         | Multi-Point Motronic<br>M 2.10.3 | Multi-Point Motronic<br>M 2.10.4 | Multi-Point Motronic<br>M 1.5.5 |
| Firing order                            | 1 - 3 - 4 - 2                    |                                  |                                 |
| Piston displacement                     | cm <sup>3</sup>                  | 1970                             |                                 |
| Cylinders' number                       | 4 in line                        |                                  |                                 |
| Boring                                  | mm                               | 83                               |                                 |
| Stroke                                  | mm                               | 91                               |                                 |
| Maximum power                           | CV CEE (kW CEE)<br>revs/min      | 150 (110)<br>6200                | 155 (114)<br>6400               |
| Pull-in Torque                          | kgm CEE (Nm CEE)<br>revs/min     | 19 (187)<br>4000                 | 19.1 (187)<br>3500              |
| Compression ratio                       | 10 : 1                           |                                  |                                 |
| Pressure of the engine oil              | bar                              | ≥ 1.5                            |                                 |
| - At slow running<br>- At 4000 revs/min |                                  | ≥ 4.5                            |                                 |
| Slow running                            | revs/min                         | 800 ± 50                         | 840 ± 50                        |

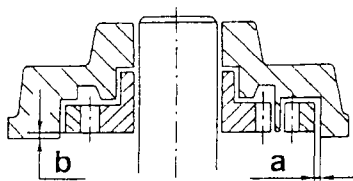
## COMPLETE CYLINDER BLOCK

### Cylinder block



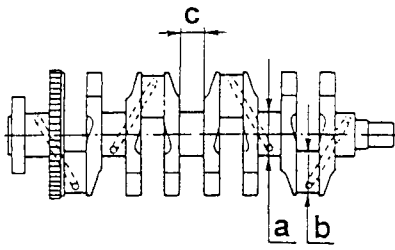
| Unit: mm                                         |                    |                 |
|--------------------------------------------------|--------------------|-----------------|
| Diameter of main bearings "a"                    | 56.705 ÷ 56.718    |                 |
| Length of shoulders for central main bearing "b" | 21.720 ÷ 21.800    |                 |
| Cylinders' diameter "c"                          | Class A - Blue     | 83.000 ÷ 83.010 |
|                                                  | Class B - Pink     | 83.010 ÷ 83.020 |
|                                                  | Class C - Green    | 83.020 ÷ 83.030 |
|                                                  | Oversize by 0.1    |                 |
| Diameter of shoulder for counter-rotating shafts | Front and rear "d" | 46.975 ÷ 47.000 |
|                                                  | Central "e"        | 39.979 ÷ 40.009 |

### Oil pump



|                                                                      |                  |              |
|----------------------------------------------------------------------|------------------|--------------|
| Clearance between pump seat and driven gear "a"                      | 0.080 ÷ 0.186 mm |              |
| Clearance between face of the pump cover and upper side of gears "b" | 0.025 ÷ 0.070 mm |              |
| Spring of pressure relief valve                                      | Check load       | 6.4 ÷ 7.2 kg |
|                                                                      | Spring length    | 36 mm        |

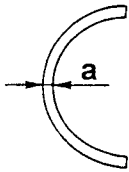
## Driving shaft



Unit: mm

|                                                                |                  |                 |
|----------------------------------------------------------------|------------------|-----------------|
| Diameter of main journals "a"                                  | Class A - Red    | 52.994 ÷ 53.000 |
|                                                                | Class B - Blue   | 52.988 ÷ 52.994 |
|                                                                | Class C - Yellow | 52.982 ÷ 52.988 |
| Undersize by 0.127                                             |                  |                 |
| Diameter of connecting rod pins "b"                            | Class A - Red    | 50.799 ÷ 50.805 |
|                                                                | Class B - Blue   | 50.793 ÷ 50.799 |
|                                                                | Class C - Yellow | 50.787 ÷ 50.793 |
| Undersize by 0.127                                             |                  |                 |
| Length of central main journal "c"                             | 26.575 ÷ 26.625  |                 |
| Maximum taper of main journals and rod pins                    | 0.0045           |                 |
| Maximum concentricity error between main journals and rod pins | 0.003            |                 |

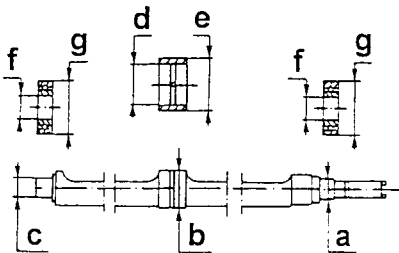
## Half bearings



Unit: mm

|                                                 |                  |               |
|-------------------------------------------------|------------------|---------------|
| Thickness of half bearings "a"                  | Class A - Red    | 1.836 ÷ 1.840 |
|                                                 | Class B - Blue   | 1.839 ÷ 1.843 |
|                                                 | Class C - Yellow | 1.842 ÷ 1.846 |
| Undersize by 0.127                              |                  |               |
| Functioning play between pins and half bearings | 0.025 ÷ 0.052    |               |

## Counter-rotating shafts

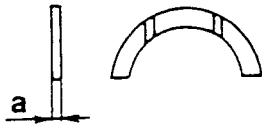


Unit: mm

|                                                                                |                 |                 |
|--------------------------------------------------------------------------------|-----------------|-----------------|
| Pins' diameter of counter-rotating shafts                                      | Front "a"       | 19.980 ÷ 19.993 |
|                                                                                | Central "b"     | 36.945 ÷ 36.960 |
|                                                                                | Rear "c"        | 19.990 ÷ 20.010 |
| Diameter of central bushings                                                   | Internal "d"    | 37.020 ÷ 37.040 |
|                                                                                | External "e"    | 40.065 ÷ 40.090 |
| Diameter of ball bearings                                                      | Internal "f"    | 19.990 ÷ 20.000 |
|                                                                                | External "g"    | 46.989 ÷ 47.000 |
| Interference between central bushings and corresponding seats                  | 0.056 ÷ 0.111   |                 |
| Radial play between bushings and central pins                                  | 0.060 ÷ 0.095   |                 |
| Play / Interference between ball bearings and corresponding seats on the block | +0.011 ÷ -0.025 |                 |
| Play / Interference between ball bearings and pins of counter-rotating shafts  | Front           | +0.020 ÷ -0.003 |
|                                                                                | Rear            | +0.010 ÷ -0.020 |

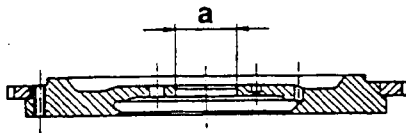
## Half thrust rings

Unit: mm



|                                    |                |
|------------------------------------|----------------|
| Thickness of half thrust rings "a" | 2.342 ÷ 2.358  |
|                                    | Oversize 0.127 |
| Crankshaft end float               | 0.059 ÷ 0.221  |

## Engine flywheel

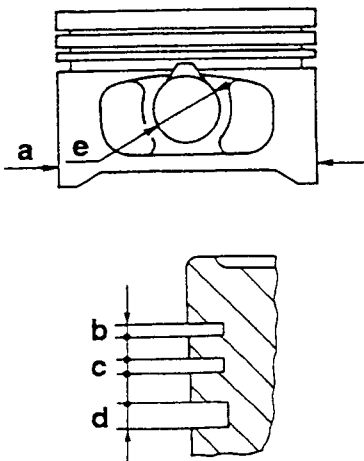


|                                                           |                    |
|-----------------------------------------------------------|--------------------|
| Inside diameter of centre bush (bore) "a"                 | 47.010 ÷ 47.035 mm |
| Heating temperature of ring gear for assembly on flywheel | 80° + 100°C        |

## CONNECTING ROD - PISTON ASSEMBLY

### Piston

Unit: mm

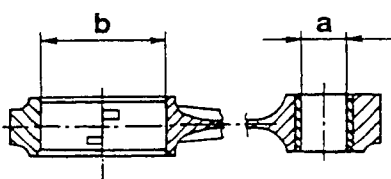


|                                              |                 |                 |
|----------------------------------------------|-----------------|-----------------|
| Diameter of pistons "a" (1)                  | Class A - Blue  | 82.952 ÷ 82.962 |
|                                              | Class B - Pink  | 82.959 ÷ 82.971 |
|                                              | Class C - Green | 82.968 ÷ 82.978 |
| Height of first seal ring seats "b"          | 1.220 ÷ 1.240   |                 |
| Height of second seal ring seats "c"         | 1.510 ÷ 1.530   |                 |
| Height of oil scraper ring seats "d"         | 3.010 ÷ 3.030   |                 |
| Diameter of gudgeon pin holes in pistons "e" | 20.002 ÷ 20.007 |                 |
| Clearance between cylinders and pistons      | 0.038 ÷ 0.062   |                 |
| Difference in weight between pistons         | ± 5 g           |                 |

(1) To be measured perpendicular to the gudgeon pin hole at a distance of 12.5 mm from lower edge of skirt.

### Connecting rods

Unit: mm



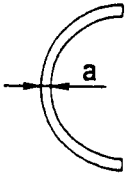
|                                               |                 |
|-----------------------------------------------|-----------------|
| Diameter of small end bushing bore "a"        | 20.006 ÷ 20.012 |
| Inside diameter of rod big ends "b"           | 53.897 ÷ 53.909 |
| Difference in weight between rods             | ≤ 5 g           |
| Clearance between small end bushings and pins | 0.006 ÷ 0.016   |
| Small end end float                           | 0.25 ÷ 0.6      |





## Connecting rod half bearings

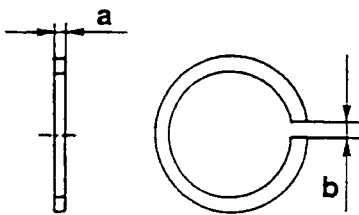
Unit: mm



|                                                                 |                  |               |
|-----------------------------------------------------------------|------------------|---------------|
| Thickness of connecting rod half bearings "a"                   | Class A - Red    | 1.527 ÷ 1.531 |
|                                                                 | Class B - Blue   | 1.530 ÷ 1.534 |
|                                                                 | Class C - Yellow | 1.533 ÷ 1.537 |
|                                                                 | Undersize 0.127  |               |
| Operating clearance connecting rod pins and their half bearings | Class A - Red    | 0.03 ÷ 0.056  |
|                                                                 | Class B - Blue   |               |
|                                                                 | Class C - Yellow |               |

## Seal rings

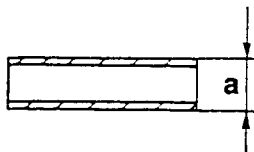
Unit: mm



|                                         |                  |               |
|-----------------------------------------|------------------|---------------|
| Thickness of rings "a"                  | First ring       | 1.170 ÷ 1.190 |
|                                         |                  | Overdose 0.1  |
|                                         | Second ring      | 1.475 ÷ 1.490 |
|                                         |                  | Overdose 0.1  |
| Oil scraper ring                        | 2.975 ÷ 2.990    |               |
|                                         | Overdose 0.1     |               |
| Ring gap "b" (1)                        | First ring       | 0.25 ÷ 0.50   |
|                                         | Second ring      | 0.30 ÷ 0.50   |
|                                         | Oil scraper ring | 0.25 ÷ 0.45   |
| Axial play between seal rings and seats | First ring       | 0.030 ÷ 0.070 |
|                                         | Second ring      | 0.020 ÷ 0.055 |
|                                         | Oil scraper ring | 0.020 ÷ 0.055 |

(1) To be measured in the checking ring nut or in the cylinder

## Gudgeon pins

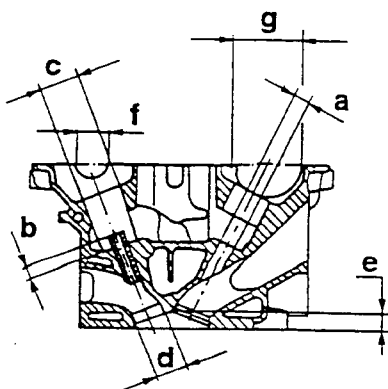


Unit: mm

|                                                           |                 |
|-----------------------------------------------------------|-----------------|
| Outside diameter of gudgeon pins "a"                      | 19.996 ÷ 20.000 |
| Clearance between gudgeon pins and their seats on pistons | 0.002 ÷ 0.011   |

## CYLINDER HEAD

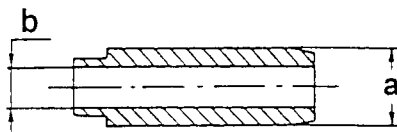
### Head



Unit: mm

|                                                 |                 |                 |
|-------------------------------------------------|-----------------|-----------------|
| Diameter of sedi valve guide seats "a"          | 12.950 ÷ 12.977 |                 |
| Valve guide protrusion "b"                      | 11.25 ÷ 11.75   |                 |
| Diameter of valve cup seats "c"                 | 33.000 ÷ 33.025 |                 |
| Diameter of valve seat housing "d"              | Intake          | 34.989 ÷ 35.014 |
|                                                 | Exhaust         | 28.991 ÷ 29.012 |
| Minimum depth of combustion chamber "e"         | 13 ± 0.2        |                 |
| Maximum error of flatness of head lower surface | 0.1             |                 |
| Diameter of camshaft supports "f"               | 26.045 ÷ 26.070 |                 |
| Diameter of timing variator support "g"         | 55.990 ÷ 56.015 |                 |

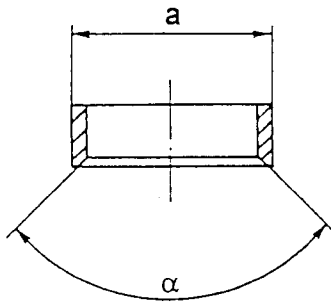
### Valve guides



Unit: mm

|                                                           |                  |
|-----------------------------------------------------------|------------------|
| External diameter of valve guides "a"                     | 13.010 ÷ 13.030  |
|                                                           | Oversize by 0.20 |
| Internal diameter of valve guides (line-boring) "b"       | 7.022 ÷ 7.040    |
| Interference between valve guides and corresponding seats | 0.033 ÷ 0.080    |

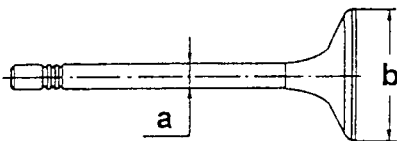
### Valve seats



Unit: mm

|                                                                |         |                 |
|----------------------------------------------------------------|---------|-----------------|
| External diameter of valve seats "a"                           | Intake  | 35.135 ÷ 35.150 |
|                                                                | Exhaust | 29.142 ÷ 29.157 |
| Contact taper with valves "α"                                  |         | 90° ± 10'       |
| Interference between valve seats and respective seats          | Intake  | 0.121 ÷ 0.146   |
|                                                                | Exhaust | 0.130 ÷ 0.166   |
| Heating temperature of cylinders' head for valve seats fitting |         | 80°C            |

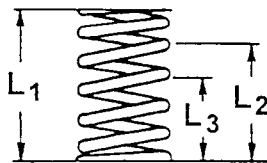
### Valves



Unit: mm

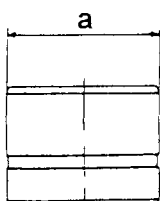
|                                                  |         |               |
|--------------------------------------------------|---------|---------------|
| Diameter of valve stems "a"                      | Intake  | 6.975 ÷ 6.990 |
|                                                  | Exhaust | 6.960 ÷ 6.975 |
| Diameter of valve heads "b"                      | Intake  | 33.4 ÷ 33.7   |
|                                                  | Exhaust | 27.9 ÷ 28.2   |
| Radial play between valve stems and valve guides | Intake  | 0.032 ÷ 0.065 |
|                                                  | Exhaust | 0.047 ÷ 0.080 |

### Valve springs



|                                             | External Spring                 | Internal Spring                 |
|---------------------------------------------|---------------------------------|---------------------------------|
| Free length "L <sub>1</sub> "               | 46 mm                           | 39 mm                           |
| Length with closed valves "L <sub>2</sub> " | 34 mm                           | 29.5 mm                         |
| Load corresponding to "L <sub>2</sub> "     | 271 ÷ 294 N<br>(27.6 ÷ 30 kg)   | 96 ÷ 106 N<br>(9.8 ÷ 10.8 kg)   |
| Length with open valves "L <sub>3</sub> "   | 24.5 mm                         | 20 mm                           |
| Load corresponding to "L <sub>3</sub> "     | 485 ÷ 524 N<br>(49.4 ÷ 53.4 kg) | 201 ÷ 221 N<br>(20.5 ÷ 22.5 kg) |

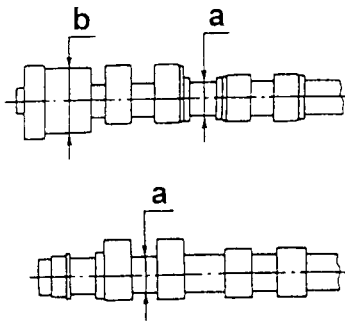
### Hydraulic tappets



Unit: mm

|                                                               |                 |
|---------------------------------------------------------------|-----------------|
| External diameter of hydraulic tappets "a"                    | 32.959 ÷ 32.975 |
| Radial play between hydraulic tappets and corresponding seats | 0.025 ÷ 0.066   |

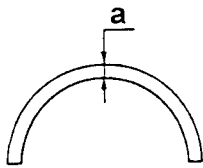
### Camshafts



Unit: mm

|                                                      |         |                 |
|------------------------------------------------------|---------|-----------------|
| Diameter of camshafts' pins "a"                      |         | 26.000 ÷ 26.015 |
| Diameter of phase transformer pin "b"                |         | 49.985 ÷ 50.000 |
| Nominal cam lift                                     | Intake  | 9.50            |
|                                                      | Exhaust | 9.50            |
| Play between camshafts' pins and corresponding seats |         | 0.03 ÷ 0.07     |
| Camshafts' end play                                  |         | 0.10 ÷ 0.23     |

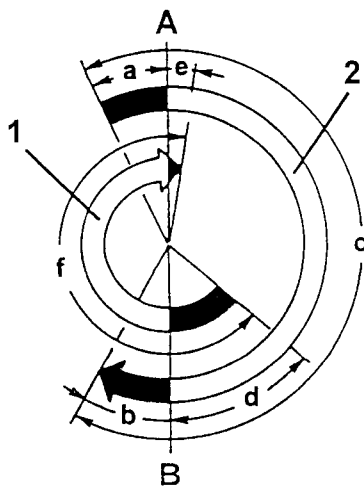
### Phase transformer's half bearings



Unit: mm

|                                                            |               |
|------------------------------------------------------------|---------------|
| Thickness of phase transformer half bearings "a"           | 2.992 ÷ 2.998 |
| Play between phase transformers and corresponding bearings | 0.034 ÷ 0.086 |

### ANGULAR VALUES OF THE TRUE DIAGRAM OF THE TIMING SYSTEM (applying a check play of 0.45 mm)



|         |                       |     | Engines<br>AR 67204 | Engines<br>AR 32301 |
|---------|-----------------------|-----|---------------------|---------------------|
| Intake  | Opening (before TDC)  | "a" | 0° 25°(*)           | -3° 22°(*)          |
|         | Closing (after BDC)   | "b" | 55° 30°(*)          | 51° 26°(*)          |
|         | Angular intake value  | "c" | 235°                | 228°                |
| Exhaust | Opening (before BDC)  | "d" | 50°                 | 47°                 |
|         | Closing (after TDC)   | "e" | 8°                  | 4°                  |
|         | Angular exhaust value | "f" | 238°                | 231°                |

(\*): Values obtained with operating phase transformer

- (1) Scarico
- (2) Intake
- (A) P.M.S.
- (B) BDC

## TECHNICAL FEATURES OF THE ENGINE

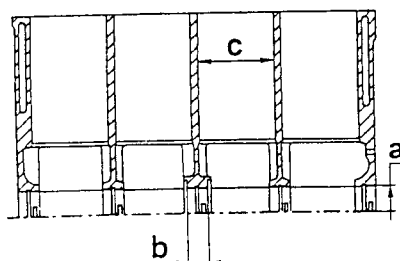
### SPECIFIC DATA

| Engine                     | AR 33503                                  | AR 67601                                  | AR 67106            | AR 32201           |
|----------------------------|-------------------------------------------|-------------------------------------------|---------------------|--------------------|
| Cycle                      | Four-stroke Otto                          |                                           |                     |                    |
| Feed / Ignition            | Motronic<br>M2.10.4<br>Motronic<br>M1.5.5 | Motronic<br>M2.10.4<br>Motronic<br>M1.5.5 | Motronic<br>M2.10.4 | Motronic<br>M1.5.5 |
| Firing order               | 1 - 3 - 4 - 2                             |                                           |                     |                    |
| Piston displacement        | cm <sup>3</sup>                           | 1370                                      | 1598                | 1747               |
| Cylinders' number          | 4 in line                                 |                                           |                     |                    |
| Boring                     | mm                                        | 82                                        | 82                  | 82                 |
| Stroke                     | mm                                        | 64.87                                     | 75.65               | 82.7               |
| Maximum power              | CV CEE (kW CEE)<br>revs/min               | 103 (76)<br>6300                          | 120 (88)<br>6300    | 140 (103)<br>6300  |
| Pull-in torque             | kgm CEE (Nm CEE)<br>revs/min              | 12.7 (124)<br>4600                        | 14.7 (144)<br>4500  | 16.8 (165)<br>4000 |
| Compression ratio          |                                           | 10.5 : 1                                  | 10.3 : 1            | 10.3 : 1           |
| Pressure of the engine oil | bar                                       | ≥ 1.5                                     | ≥ 1.5               | ≥ 1.5              |
| - At slow running          |                                           | ≥ 4.5 (*)                                 | ≥ 4.5               | ≥ 4.5              |
| - At 4000 revs/min         |                                           |                                           |                     |                    |
| Slow running               | revs/min                                  | 880 ± 50                                  | 840 ± 50            | 840 ± 50           |

(\*): For engines of the type AR33503 with injection system - Motronic ignition M1.5.5: > 4.0

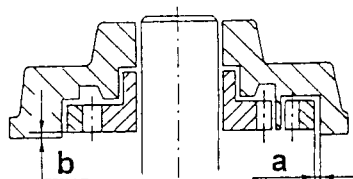
## COMPLETE CYLINDER BLOCK

### Cylinder block



|                                              |         | Unit: mm        |
|----------------------------------------------|---------|-----------------|
| Diameter of main bearing "a"                 |         | 56.705 ÷ 56.718 |
| Length of shoulder for rear main bearing "b" |         | 21.720 ÷ 21.800 |
| Cylinders' diameter "c"                      | Class A | 82.000 ÷ 82.010 |
|                                              | Class B | 82.010 ÷ 82.020 |
|                                              | Class C | 82.020 ÷ 82.030 |
|                                              |         | Oversize by 0.1 |

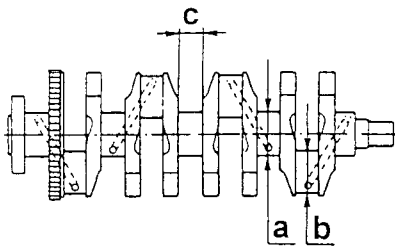
### Oil pump



|                                                                  |               |                  |
|------------------------------------------------------------------|---------------|------------------|
| Clearance between pump seat and driven gear "a"                  |               | 0.080 ÷ 0.186 mm |
| Clearance between face of pump cover and upper side of gears "b" |               | 0.025 ÷ 0.070 mm |
| Spring of pressure relief valve                                  | Check load    | 6.4 ÷ 7.2 kg     |
|                                                                  | Spring length | 36 mm            |

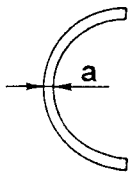
## Driving shaft

Unit: mm



| Diameter of main journal "a"                                   | Class A - Red      | 52.994 ÷ 53.000 |                 |                 |
|----------------------------------------------------------------|--------------------|-----------------|-----------------|-----------------|
|                                                                | Class B - Blue     | 52.988 ÷ 52.994 |                 |                 |
|                                                                | Class C - Yellow   | 52.982 ÷ 52.988 |                 |                 |
|                                                                | Undersize by 0.127 |                 |                 |                 |
| Diameter of rod pins "b"                                       | Class A - Red      | 40.884 ÷ 40.890 | 48.238 ÷ 48.244 | 50.799 ÷ 50.805 |
|                                                                | Class B - Blue     | 40.878 ÷ 40.884 | 48.232 ÷ 48.238 | 50.793 ÷ 50.799 |
|                                                                | Class C - Yellow   | 40.872 ÷ 40.878 | 48.226 ÷ 48.232 | 50.787 ÷ 50.793 |
|                                                                | Undersize by 0.127 |                 |                 |                 |
| Length of middle main journal "c"                              | 26.575 ÷ 26.625    |                 |                 |                 |
|                                                                | Oversize by 0.254  |                 |                 |                 |
| Maximum taper of main journals and rod pins                    | 0.0045             |                 |                 |                 |
| Maximum concentricity error between main journals and rod pins | 0.03               |                 |                 |                 |

## Half bearings



Unit: mm

| Thickness of later half bearings "a"     | Class A - Red      | 1.836 ÷ 1.840 | 1.831 ÷ 1.837 |  |
|------------------------------------------|--------------------|---------------|---------------|--|
|                                          | Class B - Blue     | 1.839 ÷ 1.843 | 1.836 ÷ 1.844 |  |
|                                          | Class C - Yellow   | 1.842 ÷ 1.846 | 1.843 ÷ 1.849 |  |
|                                          | Undersize by 0.127 |               |               |  |
| Thickness of central half bearings "a"   | Class A - Red      | 1.831 ÷ 1.835 | 1.826 ÷ 1.832 |  |
|                                          | Class B - Blue     | 1.834 ÷ 1.838 | 1.831 ÷ 1.839 |  |
|                                          | Class C - Yellow   | 1.837 ÷ 1.841 | 1.838 ÷ 1.844 |  |
|                                          | Undersize by 0.127 |               |               |  |
| Clearance between pins and half bearings | Lateral            | 0.025 ÷ 0.052 | 0.019 ÷ 0.062 |  |
|                                          | Central            | 0.035 ÷ 0.062 | 0.029 ÷ 0.072 |  |

## Thrust half rings

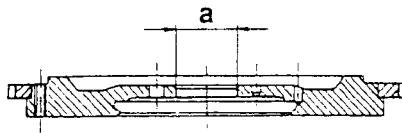


Unit: mm

|                                    |                   |
|------------------------------------|-------------------|
| Thickness of thrust half rings "a" | 2.342 ÷ 2.358     |
|                                    | Oversize by 0.127 |
| End play of the driving shaft      | 0.059 ÷ 0.221     |



### Flywheel

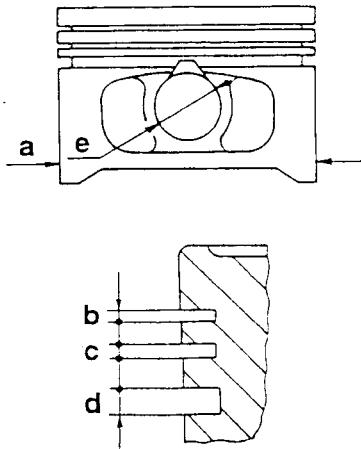


|                                                          |                    |
|----------------------------------------------------------|--------------------|
| Inside diameter of centre bush (bore) "a"                | 47.010 ÷ 47.035 mm |
| Crown wheel heating temperature for assembly on flywheel | 80° ÷ 100°C        |

## CONNECTING ROD - PISTON ASSEMBLY

### Piston

Unit: mm

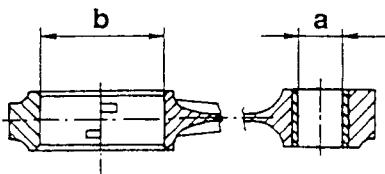


|                                         |                   |                 |
|-----------------------------------------|-------------------|-----------------|
| Piston diameter "a" (1)                 | Class A - Blue    | 81.952 ÷ 81.962 |
|                                         | Class B - Pink    | 81.960 ÷ 81.970 |
|                                         | Class C - Green   | 81.968 ÷ 81.978 |
|                                         | Oversize 0.1      |                 |
| Height of seats of first seal ring "b"  | 1.520 ÷ 1.540     |                 |
| Height of seats of second seal ring "c" | 1.510 ÷ 1.530     |                 |
| Height of seats of scraper ring "d"     | 3.010 ÷ 3.030     |                 |
| Pin hole diameter in pistons "e"        | 20.002 ÷ 20.007   |                 |
| Clearance between pistons and cylinders | 0.038 ÷ 0.062 (*) |                 |
| Difference in weight between pistons    | ± 5 g             |                 |

(1): To be measured at right angles to the pin hole at a distance of 12.5 mm from the lower edge of the skirt. (\*) : 0.040 ÷ 0.060 for engine AR33503.

### Connecting rods

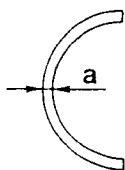
Unit: mm



| Small end bush hole diameter "a"             | 20.006 ÷ 20.012 |                 |                 |
|----------------------------------------------|-----------------|-----------------|-----------------|
| Inside diameter of big ends "b"              | 44.000 ÷ 44.012 | 51.354 ÷ 51.366 | 53.897 ÷ 53.909 |
| Difference in weight between connecting rods | ≤ 5 g           |                 |                 |
| Clearance between pins and small end bushes  | 0.006 ÷ 0.016   |                 |                 |
| Small end end float                          | 0.25 ÷ 0.6      |                 |                 |

### Connecting rod half bearings

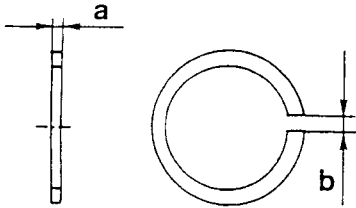
Unit: mm



| Thickness of connecting rod half bearings "a"                         | Class A - Red    | 1.536 ÷ 1.540 | 1.527 ÷ 1.531 |
|-----------------------------------------------------------------------|------------------|---------------|---------------|
|                                                                       | Class B - Blue   | 1.539 ÷ 1.543 | 1.531 ÷ 1.535 |
|                                                                       | Class C - Yellow | 1.542 ÷ 1.546 | 1.535 ÷ 1.539 |
| Undersize 0.127                                                       |                  |               |               |
| Clearance between connecting rod pins and corresponding half bearings | Class A - Red    | 0.030 ÷ 0.056 | 0.026 ÷ 0.056 |
|                                                                       | Class B - Blue   |               |               |
|                                                                       | Class C - Yellow |               |               |



## Seal rings

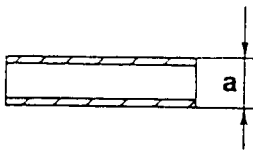


Unit: mm

|                                         |              |                    |
|-----------------------------------------|--------------|--------------------|
| Ring thickness "a"                      | First ring   | $1.470 \div 1.490$ |
|                                         |              | Oversize 0.1       |
|                                         | Second ring  | $1.475 \div 1.490$ |
|                                         |              | Oversize 0.1       |
|                                         | Scraper ring | $2.975 \div 2.990$ |
|                                         |              | Oversize 0.1       |
| Ring gap "b" (1)                        | First ring   | $0.25 \div 0.50$   |
|                                         | Second ring  | $0.30 \div 0.50$   |
|                                         | Scraper ring | $0.25 \div 0.50$   |
| End float between rings and their seats | First ring   | $0.030 \div 0.070$ |
|                                         | Second ring  | $0.020 \div 0.055$ |
|                                         | Scraper ring | $0.020 \div 0.055$ |

(1) To be measured in the checking nut or in the cylinder

## Gudgeon pins

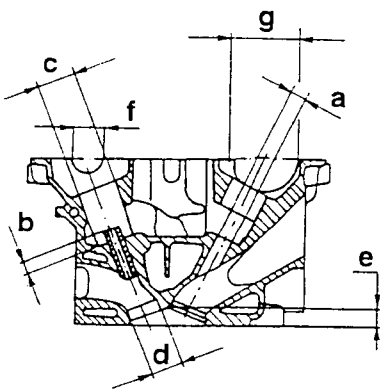


Unit: mm

|                                                              |                      |
|--------------------------------------------------------------|----------------------|
| Outside diameter of gudgeon pins "a"                         | $19.996 \div 20.000$ |
| Clearance between gudgeon pins and their housings on pistons | $0.002 \div 0.011$   |

## CYLINDER HEADS

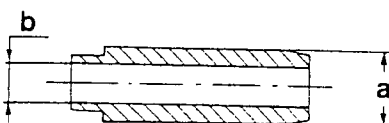
### Head



Unit: mm

| Valve guide seat diameter "a"                |         | $12.950 \div 12.977$ |                      |  |
|----------------------------------------------|---------|----------------------|----------------------|--|
| Valve guide protrusion "b"                   |         | $11.25 \div 11.75$   |                      |  |
| Valve cup seat diameter "c"                  |         | $33.000 \div 33.025$ |                      |  |
| Valve seat housing diameter "d"              | Intake  | $31.519 \div 31.544$ | $35.019 \div 35.044$ |  |
|                                              | Exhaust | $27.021 \div 27.042$ | $29.021 \div 29.042$ |  |
| Combustion chamber minimum depth "e"         |         | $13 \pm 0.2$         |                      |  |
| Maximum flatness error of lower head surface |         | 0.1                  |                      |  |
| Diameter of camshaft bearings "f"            |         | $26.045 \div 26.070$ |                      |  |
| Diameter of timing variator support "g"      |         | $55.990 \div 56.015$ |                      |  |

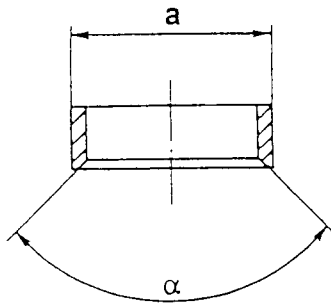
## Valve guides



Unit: mm

|                                                      |                      |
|------------------------------------------------------|----------------------|
| Outside diameter of valve guides "a"                 | $13.010 \div 13.030$ |
|                                                      | Oversize 0.20        |
| Inside diameter of guide valves (bore) "b"           | $7.022 \div 7.040$   |
| Interference between valve guides and their housings | $0.033 \div 0.080$   |

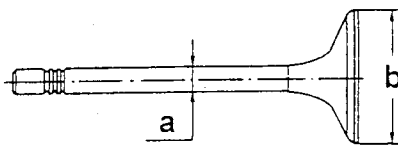
## Valve seats



Unit: mm

| External diameter of valve seats "a"                           | Intake  | 31.635 ÷ 31.650 |  | 35.135 ÷ 35.150 |
|----------------------------------------------------------------|---------|-----------------|--|-----------------|
|                                                                | Exhaust | 27.142 ÷ 27.157 |  | 29.142 ÷ 29.157 |
| Contact taper with valves "α"                                  |         | 90° ± 10'       |  |                 |
| Interference between valve seats and respective seats          | Intake  | 0.124 ÷ 0.131   |  | 0.091 ÷ 0.131   |
|                                                                | Exhaust | 0.100 ÷ 0.136   |  | 0.100 ÷ 0.136   |
| Heating temperature of cylinders' head for valve seats fitting |         | 80°C            |  |                 |

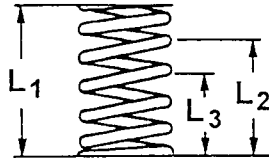
## Valves



Unit: mm

| Diameter of valve stems "a"                           | Intake  | 6.975 ÷ 6.990 |             |  |
|-------------------------------------------------------|---------|---------------|-------------|--|
|                                                       | Exhaust | 6.960 ÷ 6.975 |             |  |
| Diameter of valve heads "b"                           | Intake  | 29.9 ÷ 30.2   | 33.4 ÷ 33.7 |  |
|                                                       | Exhaust | 25.9 ÷ 26.2   | 27.9 ÷ 28.2 |  |
| Radial clearance between valve stems and valve guides | Intake  | 0.032 ÷ 0.065 |             |  |
|                                                       | Exhaust | 0.047 ÷ 0.080 |             |  |

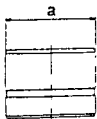
## Valve springs



Unit: mm

|                                             | External spring                 | Internal spring                 |
|---------------------------------------------|---------------------------------|---------------------------------|
| Free length "L <sub>1</sub> "               | 46 mm                           | 39 mm                           |
| Length with closed valves "L <sub>2</sub> " | 34 mm                           | 29.5 mm                         |
| Load corresponding to "L <sub>2</sub> "     | 271 ÷ 294 N<br>(27.6 ÷ 30 kg)   | 96 ÷ 106 N<br>(9.8 ÷ 10.8 kg)   |
| Length with open valves "L <sub>3</sub> "   | 24.5 mm                         | 20 mm                           |
| Load corresponding to "L <sub>3</sub> "     | 485 ÷ 524 N<br>(49.4 ÷ 53.4 kg) | 201 ÷ 221 N<br>(20.5 ÷ 22.5 kg) |

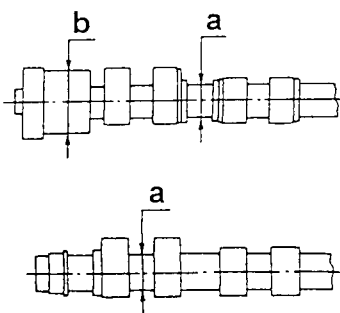
## Hydraulic tappets



Unit: mm

|                                                                    |                 |
|--------------------------------------------------------------------|-----------------|
| External diameter of hydraulic tappets "a"                         | 32.959 ÷ 32.975 |
| Radial clearance between hydraulic tappets and corresponding seats | 0.025 ÷ 0.066   |

## Camshaft



Unit: mm

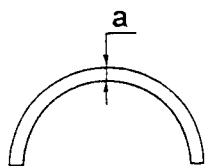
| Diameter of camshafts pins "a"                            |         | 26.000 ÷ 26.015 |         |     |
|-----------------------------------------------------------|---------|-----------------|---------|-----|
| Diameter of phase transformer pin "b"                     |         | 49.985 ÷ 50.000 |         |     |
| Nominal cam lift                                          | Intake  | 8.3             | 9.0 (*) | 9.5 |
|                                                           | Exhaust | 7.5             |         | 9.5 |
| Clearance between camshafts' pins and corresponding seats |         | 0.03 ÷ 0.07     |         |     |
| Camshafts' end play                                       |         | 0.10 ÷ 0.23     |         |     |

(\*): For 98's models with M1.5.5. injection




### Phase transformer's half bearings

Unit : mm




|                                                                                 |               |
|---------------------------------------------------------------------------------|---------------|
| Thickness of phase transformer half bearings "a"                                | 2.992 ÷ 2.998 |
| True functioning clearance between phase transformer and corresponding bearings | 0.034 ÷ 0.086 |

### ANGULAR VALUES OF THE TRUE DIAGRAM OF THE TIMING SYSTEM (Applying a checking play of 0.45 mm)



|         |                       |     |             |
|---------|-----------------------|-----|-------------|
| Intake  | Opening (before TDC)  | "a" | -8° 17° (*) |
|         | Closing (after BDC)   | "b" | 40° 15° (*) |
|         | Angular intake value  | "c" | 212°        |
| Exhaust | Opening (before BDC)  | "d" | 26°         |
|         | Closing (after TDC)   | "e" | 1°          |
|         | Angular exhaust value | "f" | 207°        |


(\*): Values obtained with operating phase transformer



|         |                       |     |                                  |
|---------|-----------------------|-----|----------------------------------|
| Intake  | Opening (before TDC)  | "a" | -8° 17° (*)                      |
|         | Closing (after BDC)   | "b" | 40° 15° (*)<br>46° (**) 21° (**) |
|         | Angular intake value  | "c" | 212°                             |
| Exhaust | Opening (before BDC)  | "d" | 26°                              |
|         | Closing (after TDC)   | "e" | 1°                               |
|         | Angular exhaust value | "f" | 207°                             |

(\*): Values obtained with operating phase transformer

(\*\*): For 98's models with M1.5.5. injection



|         |                       |     |             |
|---------|-----------------------|-----|-------------|
| Intake  | Opening (before TDC)  | "a" | -3° 22° (*) |
|         | Closing (after BDC)   | "b" | 51° 26° (*) |
|         | Angular intake value  | "c" | 228°        |
| Exhaust | Opening (before BDC)  | "d" | 47°         |
|         | Closing (after TDC)   | "e" | 4°          |
|         | Angular exhaust value | "f" | 231°        |

(\*): Values obtained with operating phase transformer

**TECHNICAL FEATURES OF THE ENGINE**
**SPECIFIC DATA**

|                       |                              |                                               |
|-----------------------|------------------------------|-----------------------------------------------|
| Engine                |                              | AR 32302                                      |
| Cycle                 |                              | Diesel                                        |
| Feed                  |                              | Direct injection<br>BOSCH COMMON RAIL EDC-15C |
| Cylinder displacement | cm <sup>3</sup>              | 1910                                          |
| Cylinder number       |                              | 4 in line                                     |
| Boring                | mm                           | 82                                            |
| Stroke                | mm                           | 90.4                                          |
| Max Power             | CV CEE (kW CEE)<br>revs/min  | 105 (77)<br>4000                              |
| Max torque            | kgm CEE (Nm CEE)<br>revs/min | 26 (255)<br>2000                              |
| Compression Ratio     |                              | 18.45 : 1                                     |
| Injection order       |                              | 1 - 3 - 4 - 2                                 |
| Regime minimo         | revs/min                     | 800 ± 30                                      |

**COMPLETE CYLINDER BLOCK**
**Cylinder block**

|                                    |                    |                    |
|------------------------------------|--------------------|--------------------|
| Diameter of the main journal seats |                    | 63.691 ÷ 63.732 mm |
| Diameter of the cylinder barrels   | Class A            | 82.000 ÷ 82.010 mm |
|                                    | Class B            | 82.010 ÷ 82.020 mm |
|                                    | Class C            | 82.020 ÷ 82.030 mm |
|                                    | Oversize by 0.1 mm |                    |
| Cylinder's head face's flatness    |                    | < 0.1 mm           |

**Driving shaft**

|                           |                       |                    |
|---------------------------|-----------------------|--------------------|
| Diameter of main journals | Class A               | 59.994 ÷ 60.000 mm |
|                           | Class B               | 59.988 ÷ 59.994 mm |
|                           | Class C               | 59.982 ÷ 59.988 mm |
|                           | Undersize by 0.127mm  |                    |
| Diameter of rods' pins    | Class A               | 50.799 ÷ 50.805 mm |
|                           | Class B               | 50.793 ÷ 50.799 mm |
|                           | Class C               | 50.787 ÷ 50.793 mm |
|                           | Undersize by 0.127 mm |                    |
| End play                  |                       | 0.049 ÷ 0.211 mm   |

### Main bearings

|                                |                       |                  |
|--------------------------------|-----------------------|------------------|
| Thickness of the main bearings | Class A               | 1.836 ÷ 1.840 mm |
|                                | Class B               | 1.839 ÷ 1.843 mm |
|                                | Class C               | 1.842 ÷ 1.846 mm |
|                                | Undersize by 0.127 mm |                  |

### Oil Pump

|                                        |                  |                   |
|----------------------------------------|------------------|-------------------|
| Play between pump bay and driven gear  | 0.080 ÷ 0.186 mm |                   |
| Play between pump cover face and gears | 0.025 ÷ 0.070 mm |                   |
| Spring of oil pressure relief valve    | Height           | 35 mm             |
|                                        | Check load       | 11.73 ÷ 12.51 daN |
| Engine oil pressure                    | At slow running  | 0.6 ÷ 0.7 bar     |
|                                        | At 4000 revs/1'  | 2.5 ÷ 3.0 bar     |

## CONNECTING ROD - PISTON GROUP

### Connecting rods

|                                                              |                    |
|--------------------------------------------------------------|--------------------|
| Inner diameter of the connecting rods bushings (line-boring) | 26.006 ÷ 26.012 mm |
| Diameter of the connecting rods heads                        | 53.883 ÷ 53.923 mm |
| Weight difference between the connecting rods                | ± 2.5 g            |

### Connecting rods' bearings

|                                            |         |                  |
|--------------------------------------------|---------|------------------|
| Thickness of the connecting rods' bearings | Class A | 1.527 ÷ 1.531 mm |
|                                            | Class B | 1.530 ÷ 1.534 mm |
|                                            | Class C | 1.533 ÷ 1.537 mm |

### Pistons

|                                                  |                    |                    |
|--------------------------------------------------|--------------------|--------------------|
| External diameter of pistons                     | Class A            | 81.783 ÷ 81.797 mm |
|                                                  | Class B            | 81.793 ÷ 81.807 mm |
|                                                  | Class C            | 81.803 ÷ 81.817 mm |
| Internal diameter of the bushings in the pistons | 25.999 ÷ 26.004 mm |                    |
| Weight difference among pistons                  | ± 5 g              |                    |

**Gas rings**

|                                      |                  |                  |
|--------------------------------------|------------------|------------------|
| Rings'port                           | First ring       | 0.25 ÷ 0.40 mm   |
|                                      | Second ring      | 0.25 ÷ 0.50 mm   |
|                                      | Oil scraper ring | 0.25 ÷ 0.50 mm   |
| End play between seats and gas rings | First ring       | -                |
|                                      | Second ring      | 0.020 ÷ 0.060 mm |
|                                      | Oil scraper ring | 0.030 ÷ 0.065 mm |

**Piston pins**

|                                  |                    |
|----------------------------------|--------------------|
| External diameter of piston pins | 25.982 ÷ 25.988 mm |
|----------------------------------|--------------------|

**Cylinders' head****Head**

|                                         |                    |
|-----------------------------------------|--------------------|
| Diameter of transmission tappets seats  | 37.000 ÷ 37.025 mm |
| Diameter of transmission shaft supports | 26.045 ÷ 26.070 mm |
| Lower plan's flatness                   | 0.1 mm             |
| Minimum height allowed after flattening | 141.00 ± 0.15 mm   |

**Valves' guides**

|                                     |                  |                                   |
|-------------------------------------|------------------|-----------------------------------|
| External diameter of valves' guides | Intake           | 14.010 ÷ 14.030 mm                |
|                                     | Exhaust          |                                   |
|                                     |                  | Oversize by 0.05 - 0.10 - 0.25 mm |
| Internal diameter of valves' guides | 8.022 ÷ 8.040 mm |                                   |

**Valves' seats**

|                                 |           |                    |
|---------------------------------|-----------|--------------------|
| External diameter of valve seat | Intake    | 36.135 ÷ 36.150 mm |
|                                 | Exhaust   | 35.142 ÷ 35.157 mm |
| Taper of valves' seats          | 90° ± 20' |                    |

**Valves**

|                             |              |                  |
|-----------------------------|--------------|------------------|
| Diameter of the valve stem  | Intake       | 7.974 ÷ 7.992 mm |
|                             | Exhaust      |                  |
| Angle of the valve head     | 90° ± 20'    |                  |
| Embedding of the valve head | 0.1 ÷ 0.5 mm |                  |

### Valve springs

|                                      |         |
|--------------------------------------|---------|
| Loose height                         | 53.9 mm |
| Height with check load 36.7 ÷ 39.6 N | 36 mm   |
| Height with check load 56.0 ÷ 61.0 N | 26.5 mm |

### Transmission tappets

|                         |                    |                |
|-------------------------|--------------------|----------------|
| External diameter       | 36.975 ÷ 36.995 mm |                |
| Play with closed valves | Intake             | 0.25 ÷ 0.35 mm |
|                         | Exhaust            | 0.30 ÷ 0.40 mm |

### Propeller shaft

|                                         |                    |        |
|-----------------------------------------|--------------------|--------|
| Diameter of pins of the propeller shaft | 26.000 ÷ 26.015 mm |        |
| Nominal cam's lift                      | Intake             | 8.5 mm |
|                                         | Exhaust            | 8.5 mm |
| End play of the propeller shaft         | 0.100 ÷ 0.230 mm   |        |

### Valves play

|                          |         |                |
|--------------------------|---------|----------------|
| Play to check the timing | 0.50 mm |                |
| Play with closed valves  | Intake  | 0.25 ÷ 0.35 mm |
|                          | Exhaust | 0.30 ÷ 0.40 mm |

### Cylinder's head gasket

|                                      |                                                  |
|--------------------------------------|--------------------------------------------------|
| Average max protrusion of the piston | Thickness of the cylinder head gasket to be used |
| 0.795 ÷ 0.881 mm                     | 1.55 ÷ 1.65 mm (no notch)                        |
| 0.881 ÷ 0.967 mm                     | 1.65 ÷ 1.75 mm (one notch)                       |
| 0.967 ÷ 1.055 mm                     | 1.75 ÷ 1.85 mm (two notches)                     |

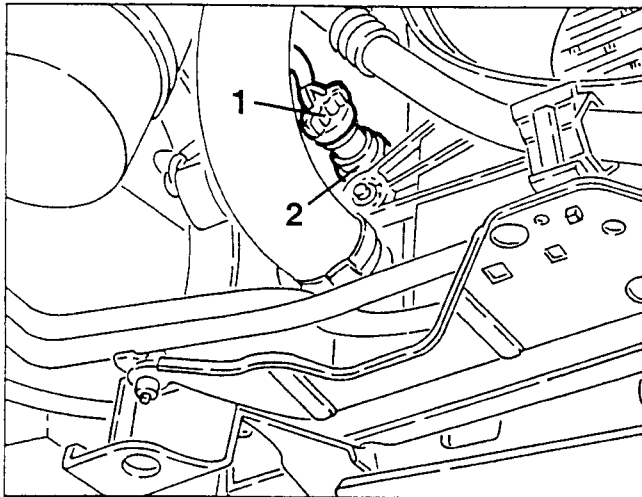
### ANGULAR VALUES OF THE TRANSMISSION DIAGRAM (Obtained with a test play of 0.50 mm)

|         |                       |      |
|---------|-----------------------|------|
| Intake  | Opening (before TDC)  | 0°   |
|         | Closing (after BDC)   | 32°  |
|         | Angular intake value  | 212° |
| Exhaust | Opening (before BDC)  | 32°  |
|         | Closing (after TDC)   | 0°   |
|         | Angular exhaust value | 212° |

## FAN CONTROL THERMAL CONTACT (Specific for versions with M2.10.3 injection - ignition system)

### REMOVING/REFITTING

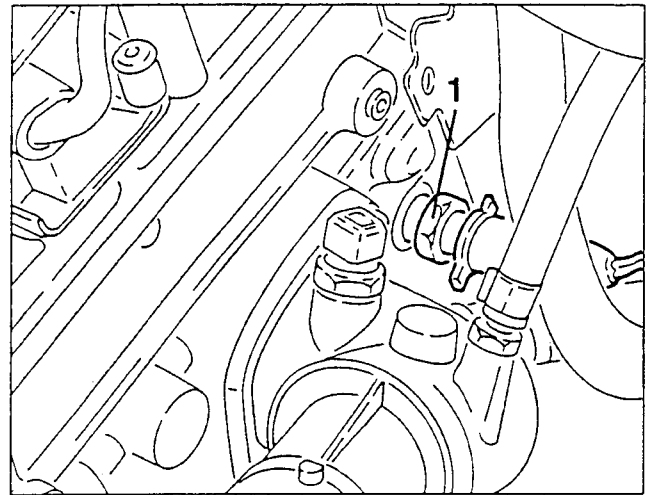
- Set the car on a lift.
- Disconnect the battery (-) terminal.
- 1. Raise the car and disconnect the electrical connection from the fan control thermal contact.
- 2. Slacken and remove the fan control thermal contact and recover the coolant that comes out.



## COOLANT TEMPERATURE GAUGE TRANSMITTER AND MAXIMUM TEMPERATURE WARNING LIGHT CONTACT

### REMOVING/REFITTING

- Disconnect the battery (-) terminal.
- Disconnect the electrical connection from the coolant temperature sensor (NTC).
- 1. Disconnect the electrical connection from the coolant temperature gauge transmitter and maximum temperature warning light contact, then remove it recovering the coolant that comes out.



### CHECKS AND INSPECTIONS

Check the setting of the thermal contact referring to the wiring diagram of the specific manual.

| Cooling fan cut-in/cut-out temperature |                         |                            |
|----------------------------------------|-------------------------|----------------------------|
| 1st speed                              | Cut in (contacts close) | $92 \pm 2^{\circ}\text{C}$ |
|                                        | Cut out (contacts open) | $87 \pm 2^{\circ}\text{C}$ |
| 2nd speed                              | Cut in (contacts close) | $97 \pm 2^{\circ}\text{C}$ |
|                                        | Cut out (contacts open) | $92 \pm 2^{\circ}\text{C}$ |

- If the values are not as specified, change the thermal contact.

### CHECKS AND INSPECTIONS

Check the setting of the transmitter referring to the wiring diagram of the specific manual.

| Temperature ( $^{\circ}\text{C}$ ) | Resistance ( $\Omega$ ) |
|------------------------------------|-------------------------|
| 60<br>(Water test liquid)          | $525 \div 605$          |
| 90<br>(Water test liquid)          | $195 \div 245$          |
| 120<br>(Glycerine test liquid)     | $82 \div 94$            |

|                             |                             |
|-----------------------------|-----------------------------|
| Contact closing temperature | $122 \pm 2^{\circ}\text{C}$ |
| Contact opening temperature | $112 \pm 3^{\circ}\text{C}$ |



T. SPARK  
16V



T. SPARK  
16V



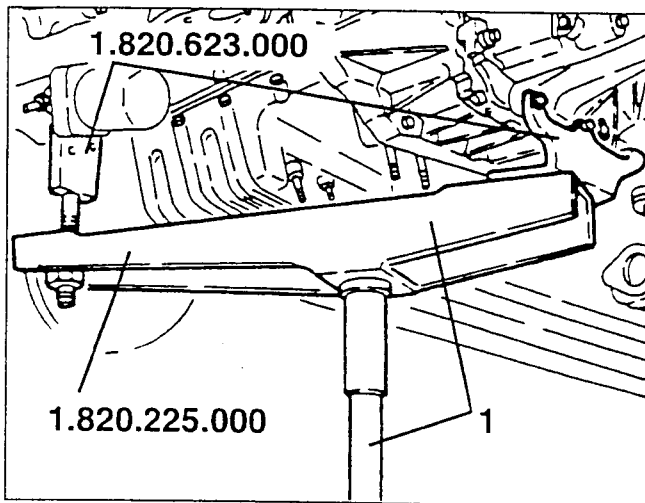
T. SPARK  
16V

THE FOLLOWING PROCEDURE IS VALID FOR ALL ENGINES T. SPARK 16V AND T. SPARK 16V WHILE FOR ENGINE T. SPARK 16V IT IS VALID ONLY FOR VERSIONS WITH GEARBOX C.510.5 (UP TO CHASSIS NO. ....)

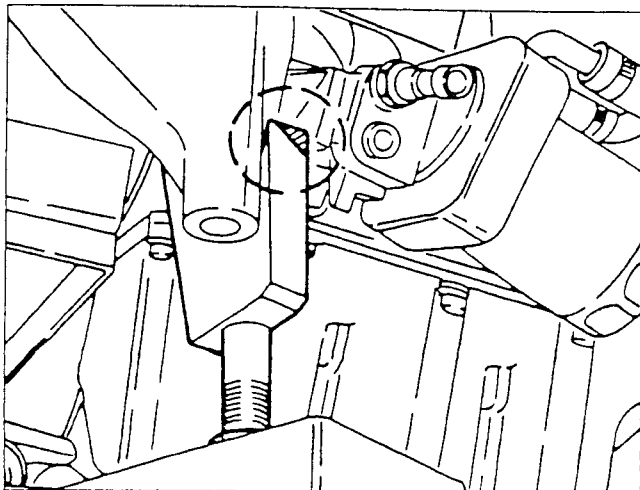
## REMOVAL

Proceed as described for T. SPARK 16V engine removal with the exception of the following steps.

1. Set a hydraulic jack complete with tools no. 1.820.225.000 and no. 1.820.623.000 as illustrated.



**NOTE:** The camshaft side engine support part of tool no. 1.820.623.000, is to be relieved in the area illustrated to avoid interference with the oil filter support.

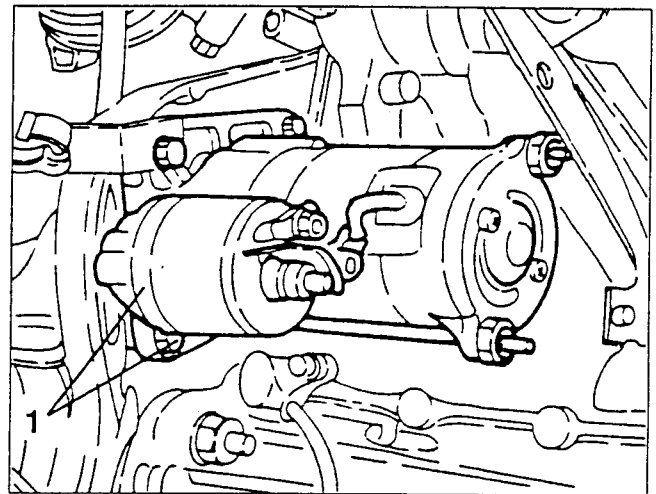


Complete removal of the engine from the car working as described for T. SPARK 16V engine.

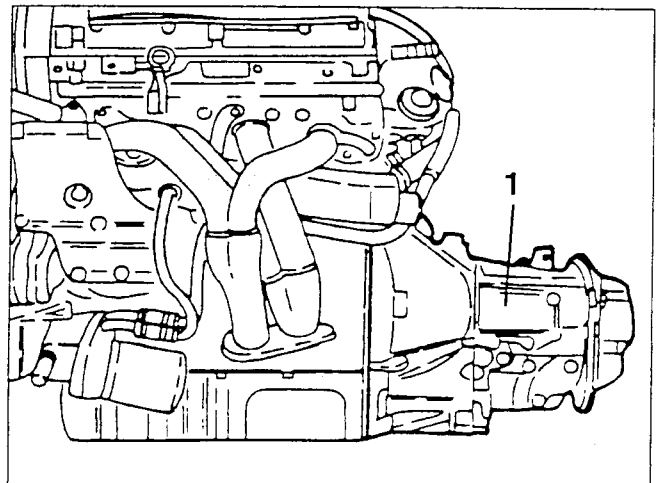
Once on the bench, remove the components as described below to make it possible to set the engine on the overhauling stand.

- Free the power unit from the support tools, then position it on a special work bench.

1. Slacken the fastening screws and remove the starter motor.



1. Slacken the fastening nuts and remove the gearbox and differential unit.





T. SPARK  
16V

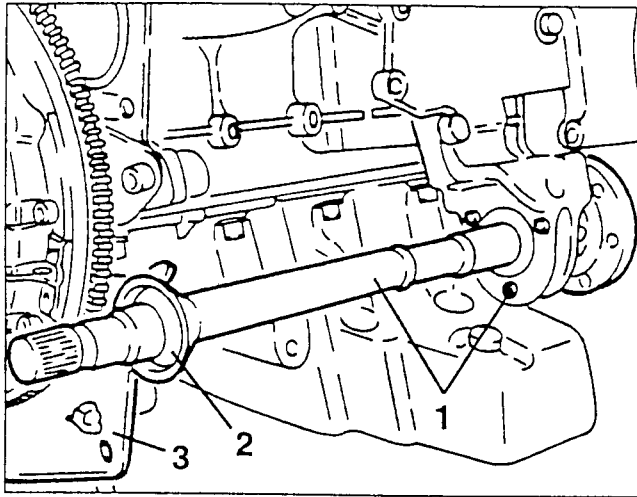


T. SPARK  
16V

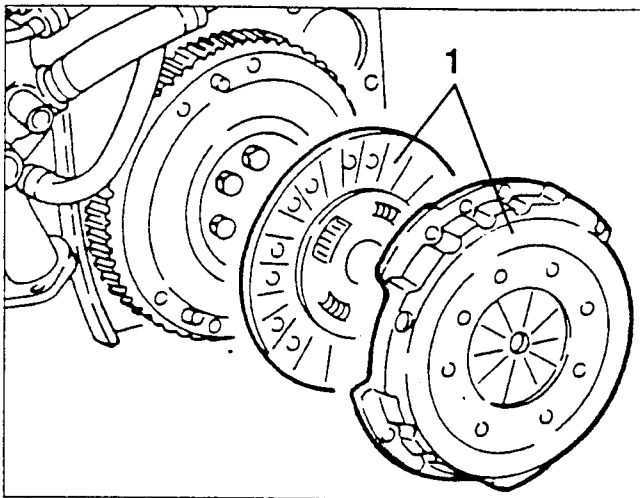


T. SPARK  
16V

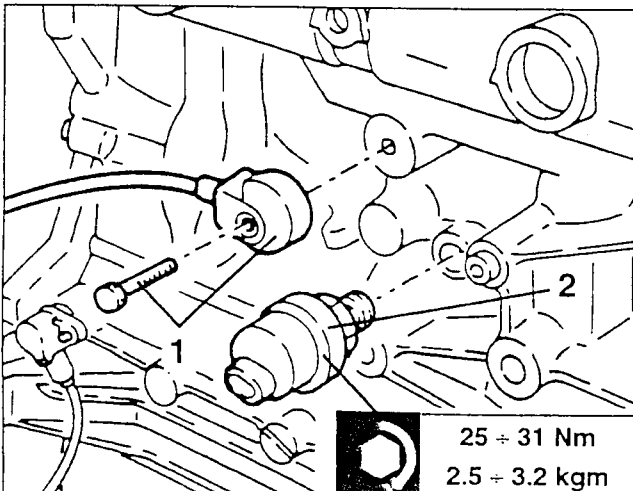
1. Slacken the three fastening screws and remove the intermediate shaft.
2. Remove the dust guard ring.
3. Retrieve the lower flywheel guard.



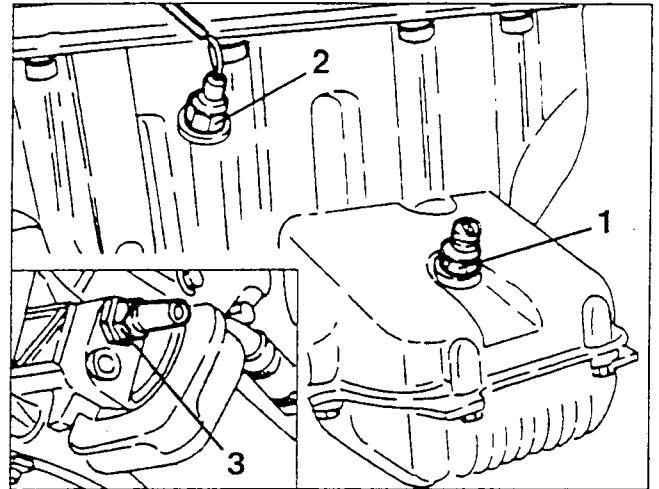
1. Slacken the fastening screws and remove the pressure plate body and clutch plate.



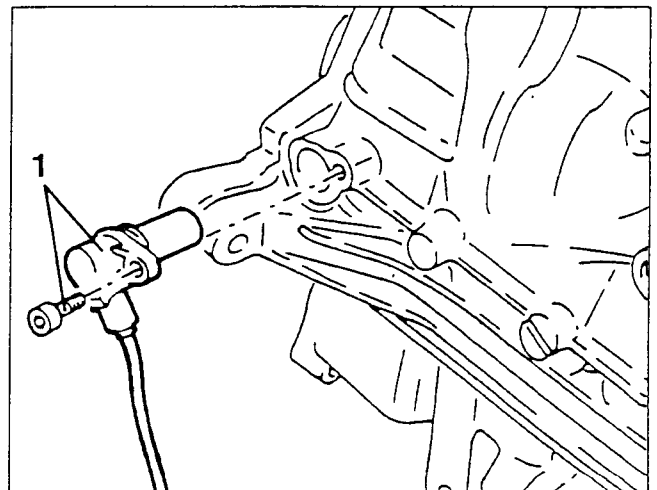
1. Slacken the fastening screw and remove the ping-pong sensor from the crankcase.
2. Remove the engine oil pressure meter.



1. Slacken and remove the engine oil temperature sensor.
2. Slacken and remove the engine oil minimum level sensor.
3. Slacken and remove the engine oil minimum pressure sensor.



1. Slacken the fastening screw and remove the rpm sensor.





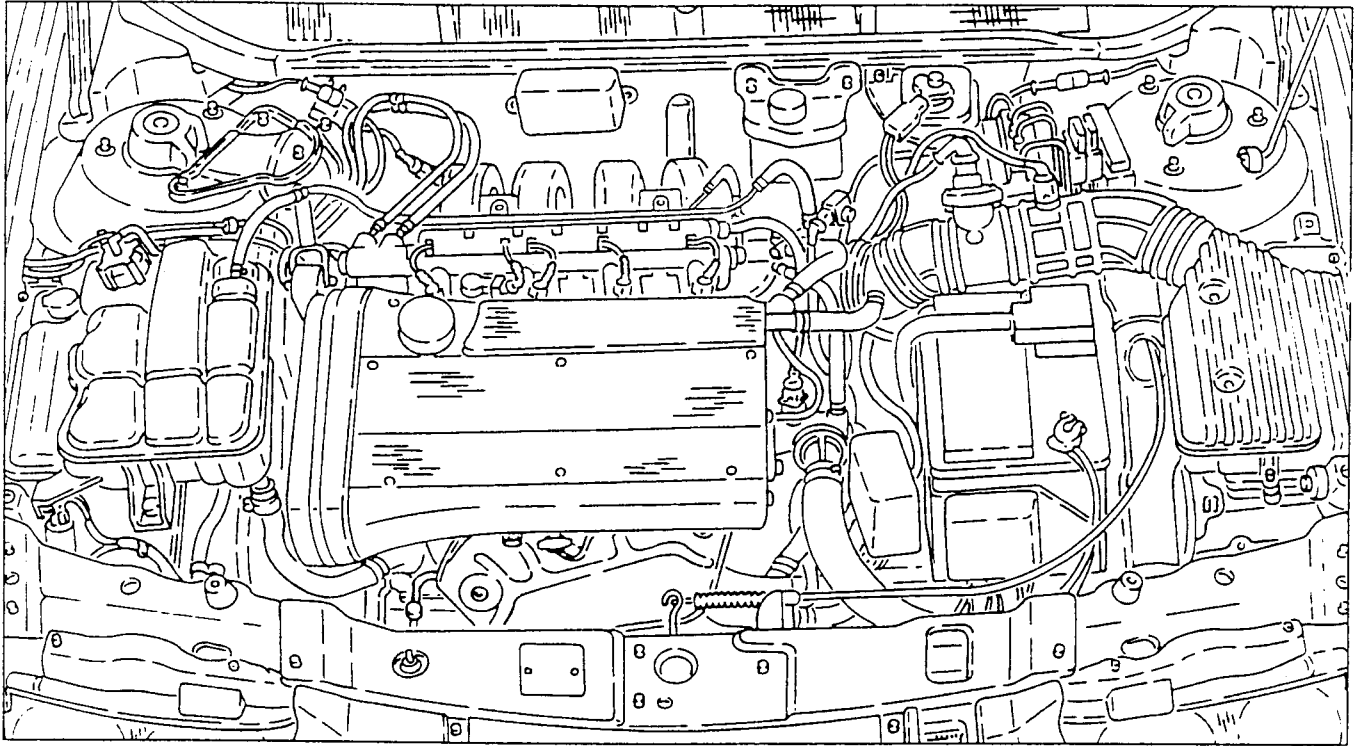
THE FOLLOWING PROCEDURE IS VALID ONLY FOR VERSIONS WITH GEARBOX C.513.5 (FROM CHASSIS NO.....)

## GENERAL

The information and illustrations given below make it possible to quickly remove the power plant from its housing and subsequent refitting.  
Disassembly of the single components on the bench is described in volume "ENGINE OVERHAULING".

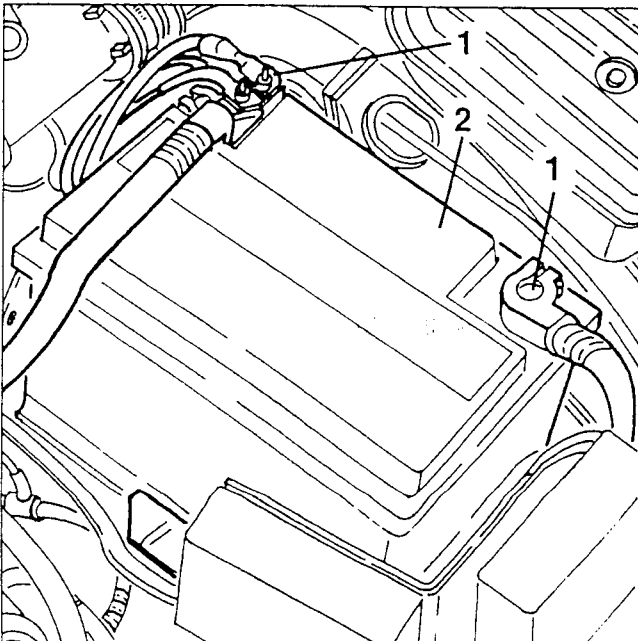
The following procedure may be used only in part according to necessity.

For further information and details, see the chapters concerning specific components or units.

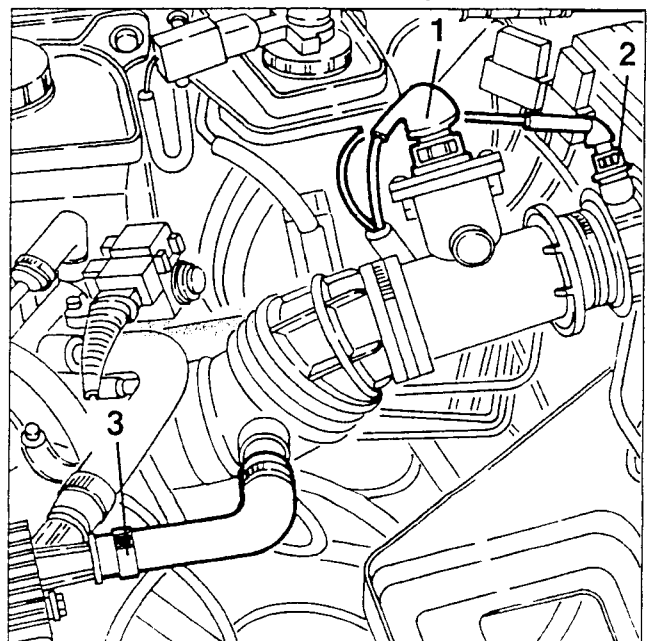


## REMOVAL

- Set the car on a two column lift.
- 1. Disconnect the battery terminals, also disconnecting the two starter motor supply cables from the positive terminal.
- 2. Remove the battery.

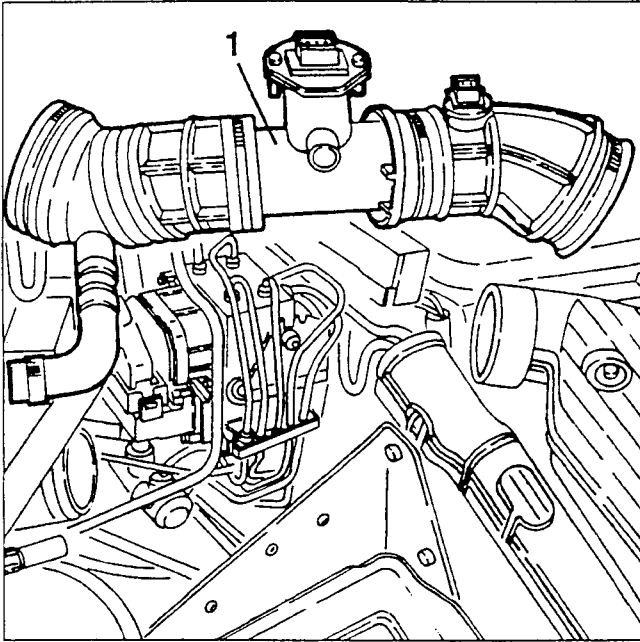


- Remove the front wheels and mud flaps.
- 1. Disconnect the electrical connection from the air flow meter.
- 2. Disconnect the electrical connection from the intake air temperature sensor.
- 3. Loosen the fastening clamp and disconnect the oil vapour recirculation pipe from the cylinder head cover.

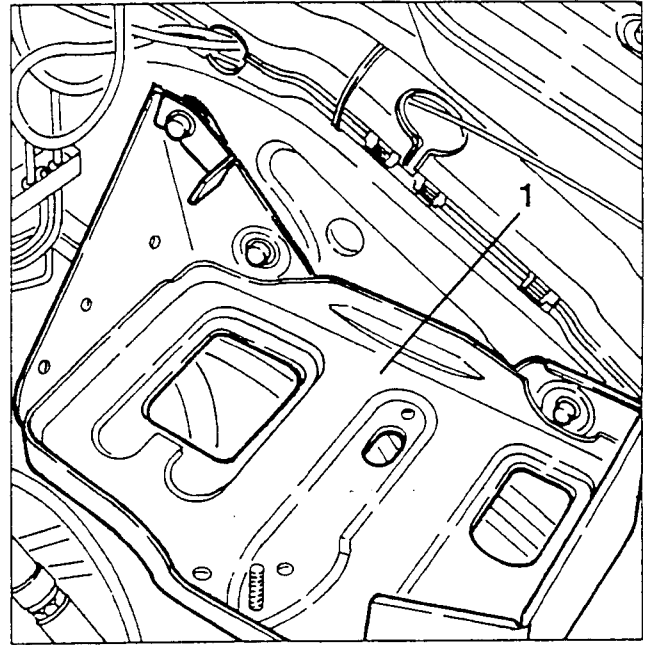




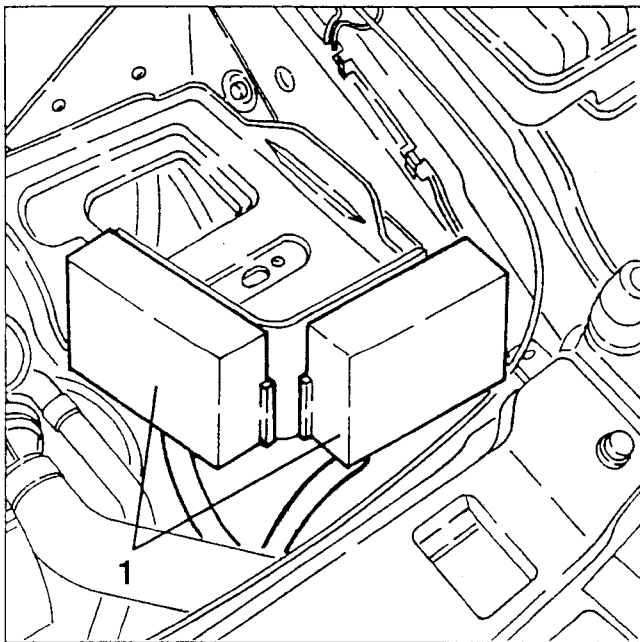
1. Loosen the two fastening clamps, then remove the corrugated sleeve complete.



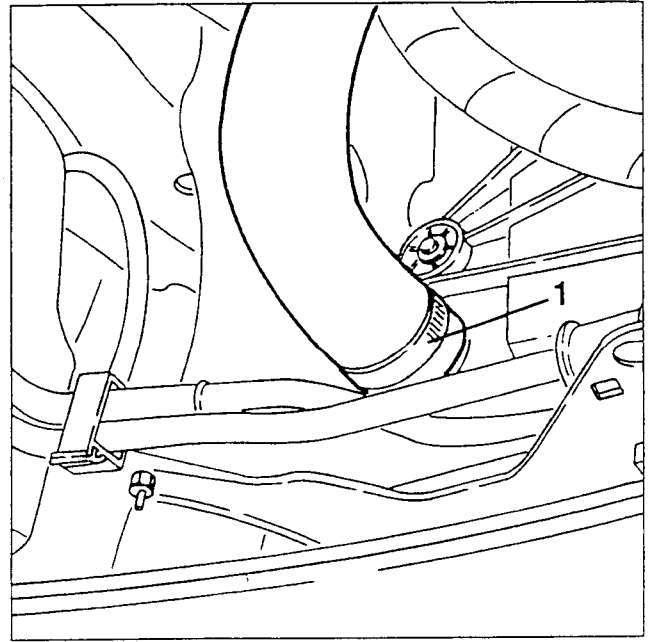
1. Slacken the fastening screws and remove the battery support complete with drainage tube after freeing this from the wheel house.



1. From the battery support release the two relay boxes and set them aside.

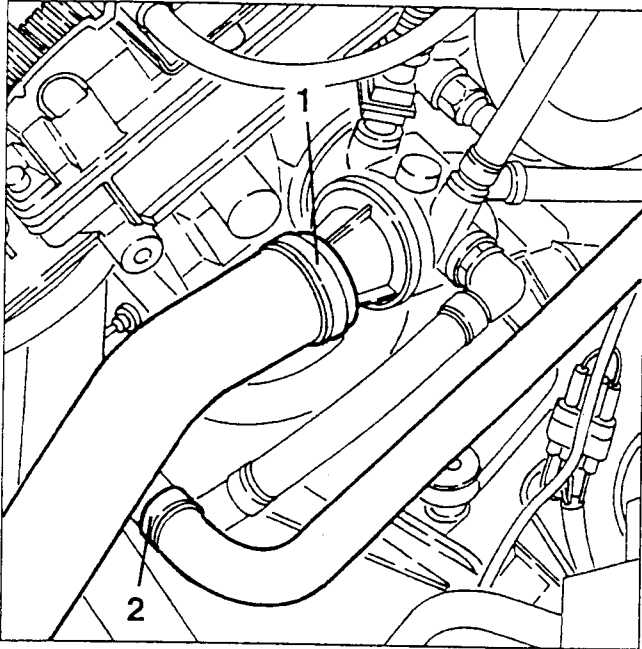


1. Raise the car and drain the engine coolant fluid disconnecting the outlet sleeve from the radiator.

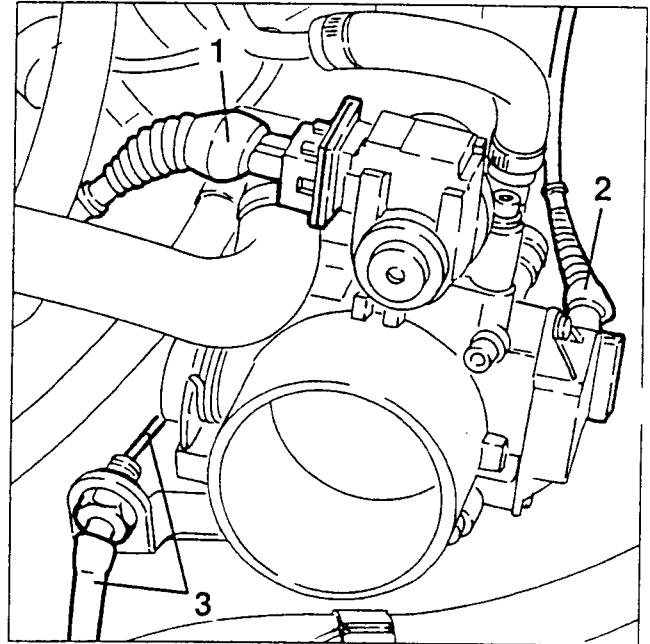




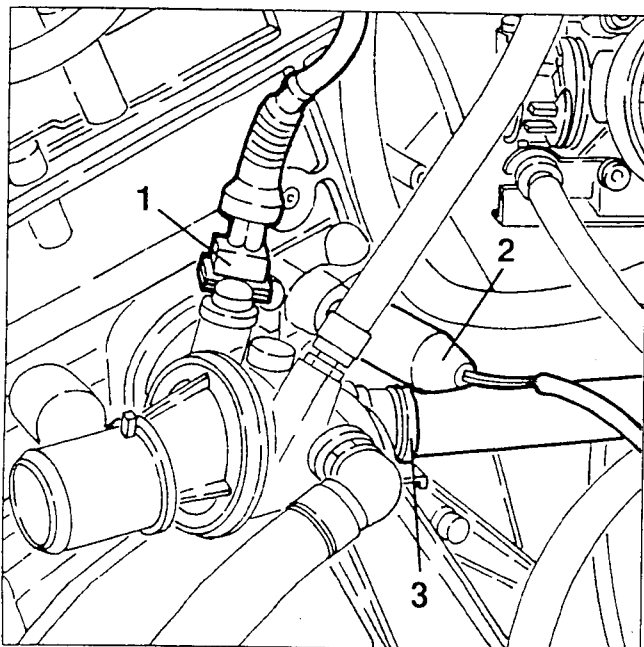
1. Lower the car then disconnect the radiator coolant delivery sleeve from the thermostatic cup.
2. Disconnect the coolant fluid return pipe from the climate control system heater from the longitudinal manifold.



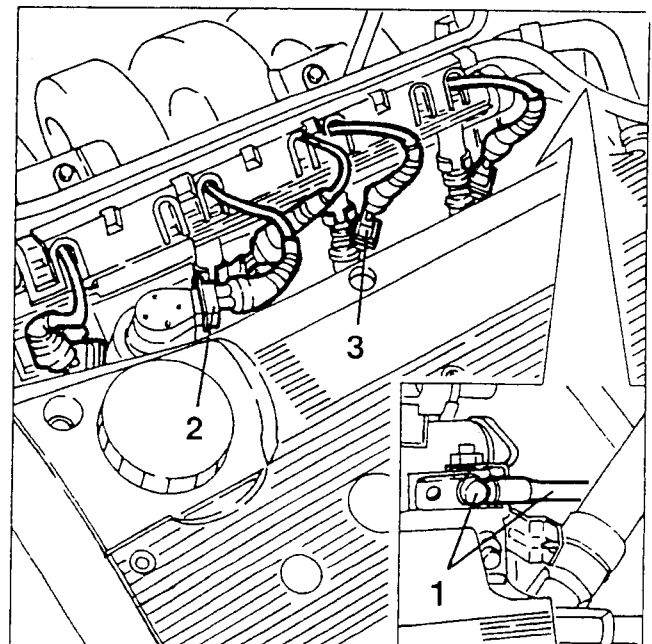
1. Disconnect the electrical connection from the constant idle speed actuator.
2. Disconnect the electrical connection from the throttle potentiometer.
3. Disconnect the accelerator cable from the throttle body.



1. Disconnect the electrical connection from the coolant fluid temperature sensor NTC).
2. Disconnect the electrical connection from the engine coolant temperature gauge transmitter and maximum temperature warning light contact.
3. Disconnect the coolant delivery pipe to the climate control heater from the thermostatic cup.

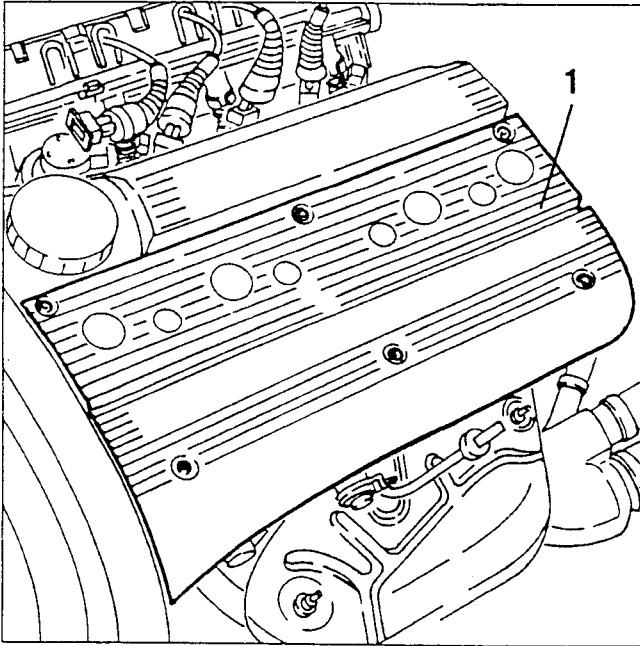


1. Disconnect the earth cable from the air intake manifold.
2. Disconnect the electrical connection from the timing variator electromagnet.
3. Disconnect the electrical connections from the injectors.

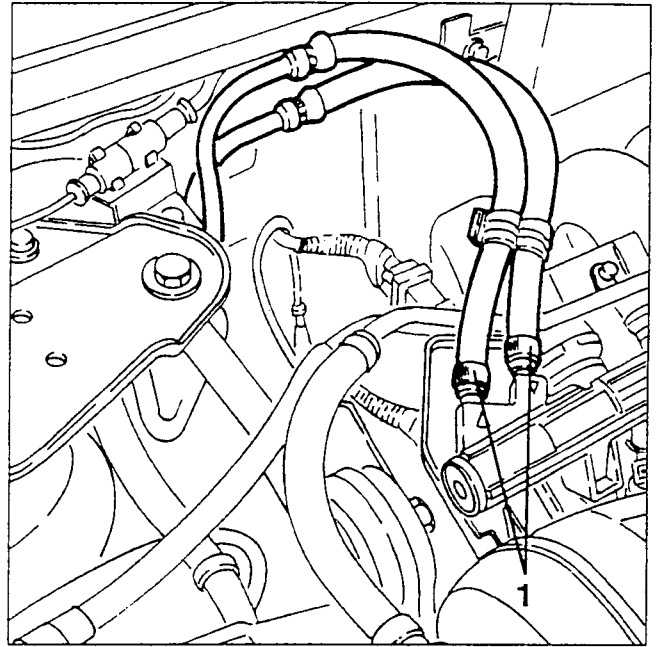




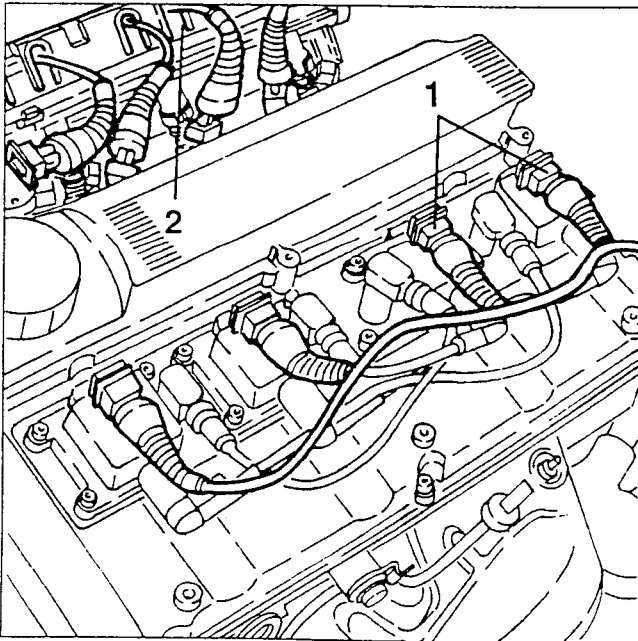
1. Slacken the fastening screws and remove the ignition coils cover.



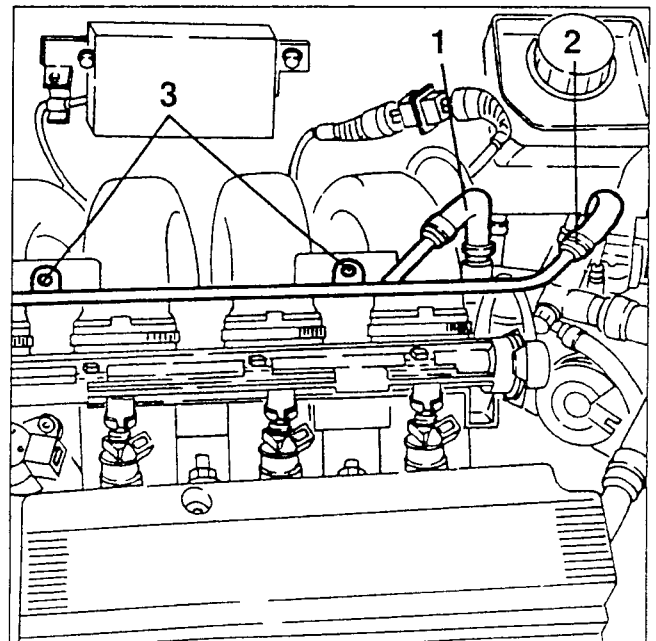
1. Disconnect the fuel inlet and outlet pipes from the distributor manifold.



1. Disconnect the electrical connections from the ignition coils.  
2. Release the cable race from the fuel distributor manifold, then withdraw the electric wiring and move it aside to prevent it from hindering the following operations.

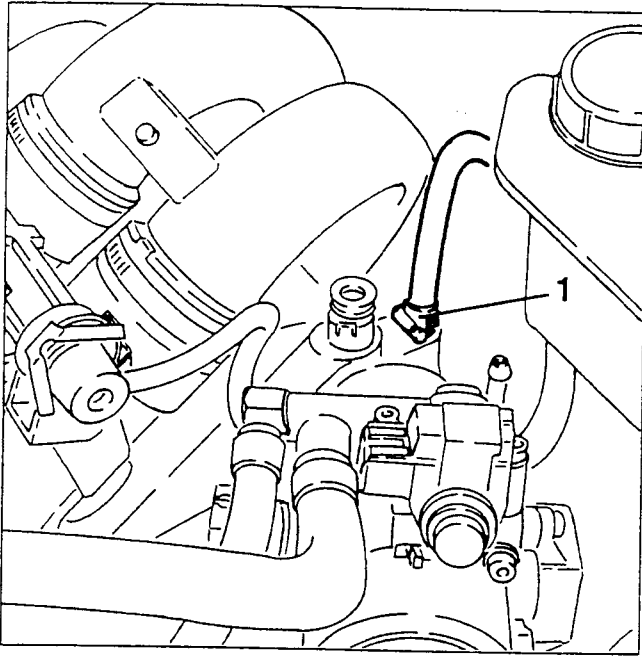


1. Disconnect the fuel vapour inlet pipe from the intake box.  
2. Disconnect the the coolant return pipe to the header tank from the throttle body.  
3. Slacken the two screws fastening to the intake box then turn aside the two stiff pipes.

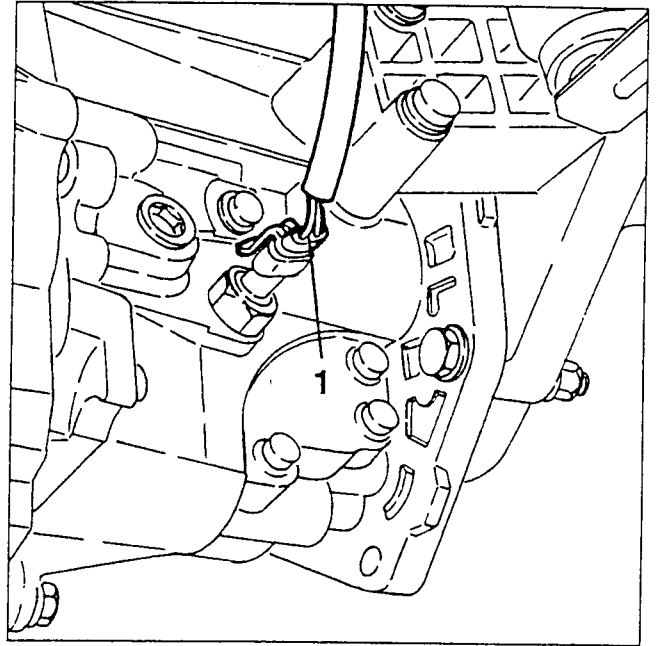




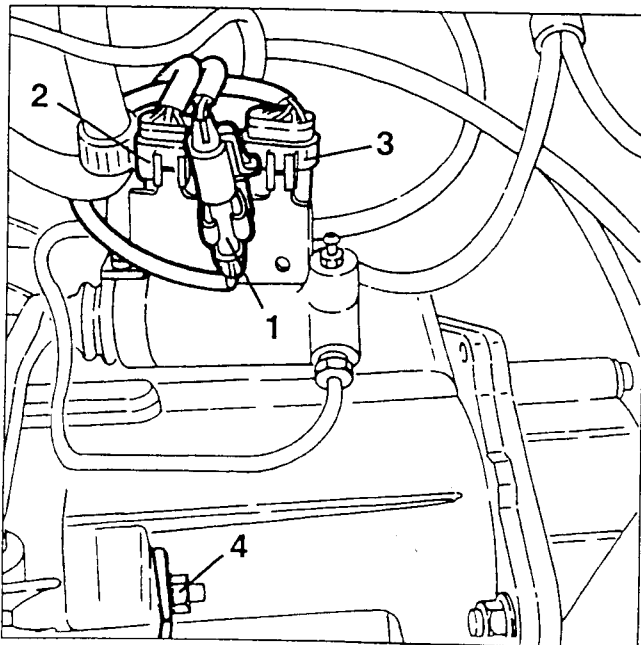
1. Disconnect the servobrake vacuum takeoff pipe from the intake box.



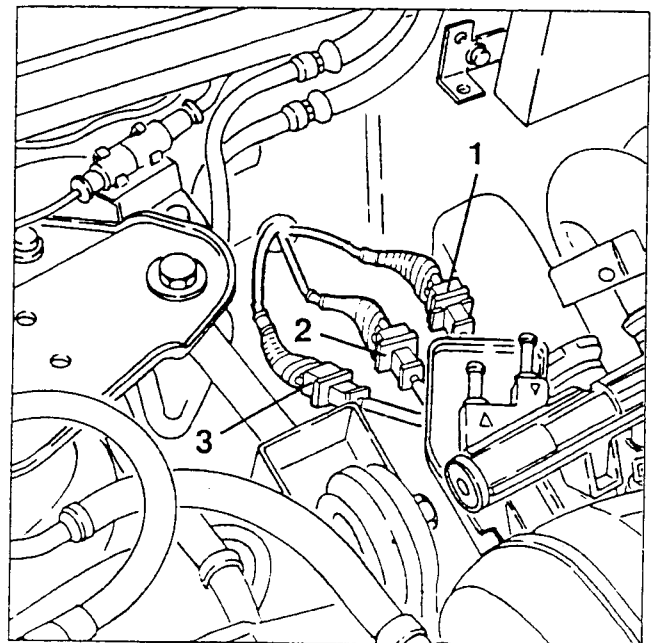
1. Disconnect the electrical connection from the reversing switch.



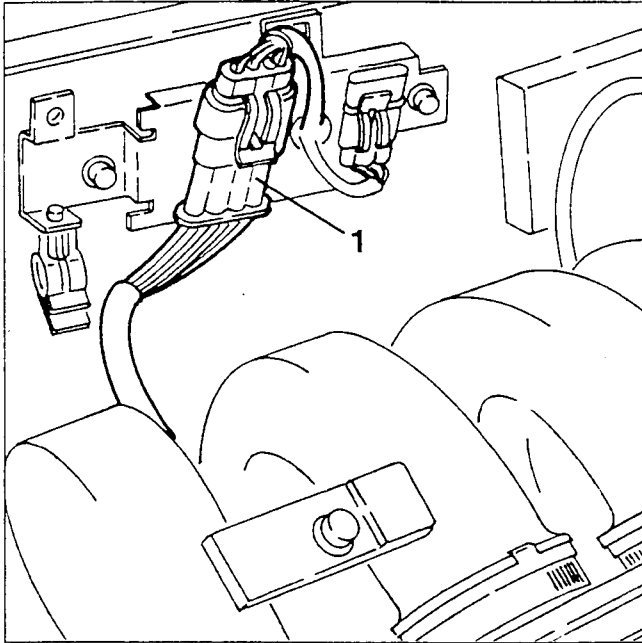
1. Disconnect the electrical connection of the starter motor.
2. Disconnect the electrical connection of the tachometric sensor.
3. Disconnect the electrical connection of the injection system.
4. Disconnect the earth cable from the gearbox cover.



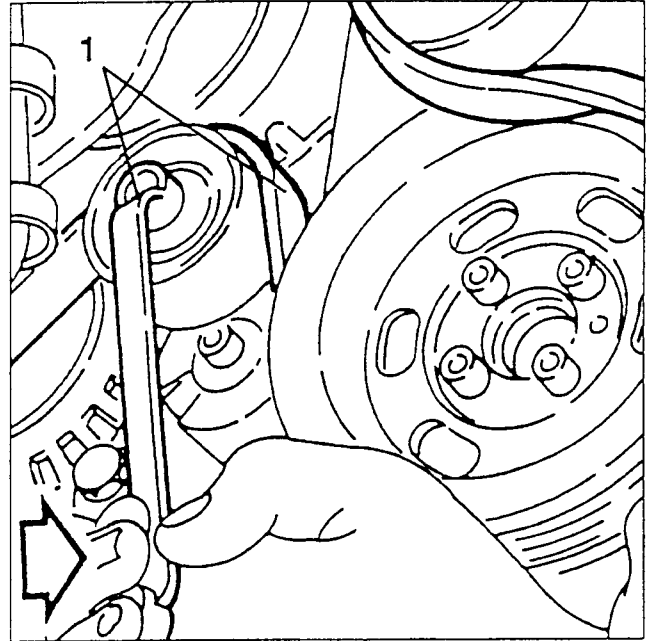
1. Disconnect the electrical connection of the timing sensor (blue).
2. Disconnect the electrical connection of the pinging sensor (white).
3. Disconnect the electrical connection of the rpm and timing sensor (brown).



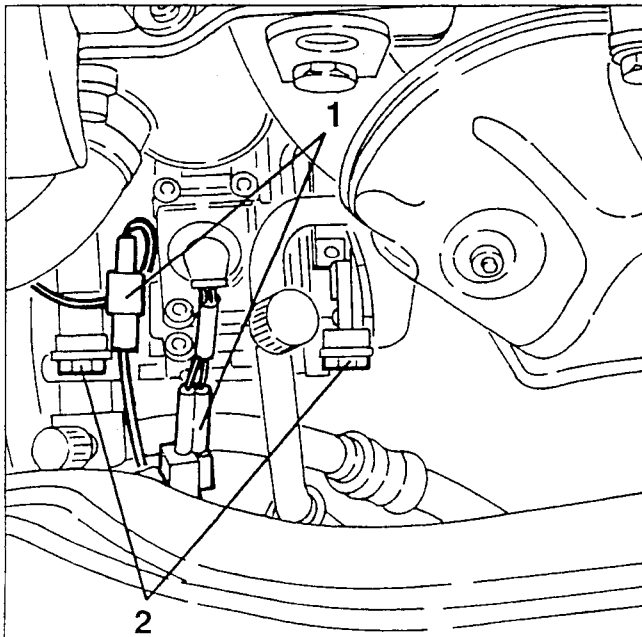
1. Remove the plastic protection, then disconnect the electrical connection of the lambda sensor.



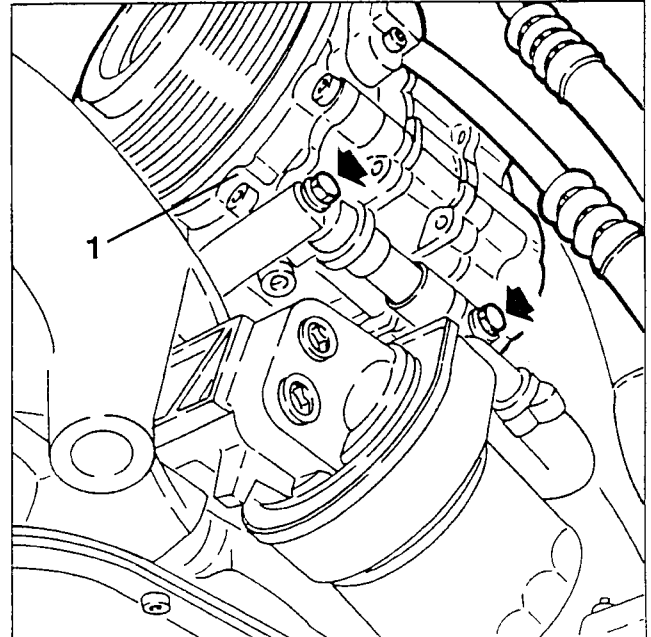
1. Working as illustrated on the pulley guide, loosen the tension of the auxiliary components drive belt and remove it.



1. Disconnect the two electrical connections from the climate control system compressor.  
2. Slacken the two upper compressor fastening screws.

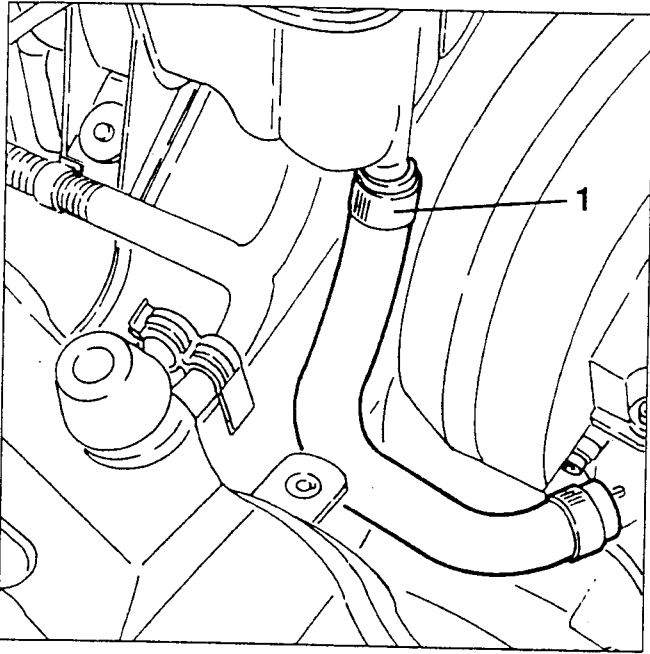


1. Slacken the two lower screws fastening the climate control system compressor, then without disconnecting the pipes, remove it and fasten it to one side so that it does not hinder the following operations.



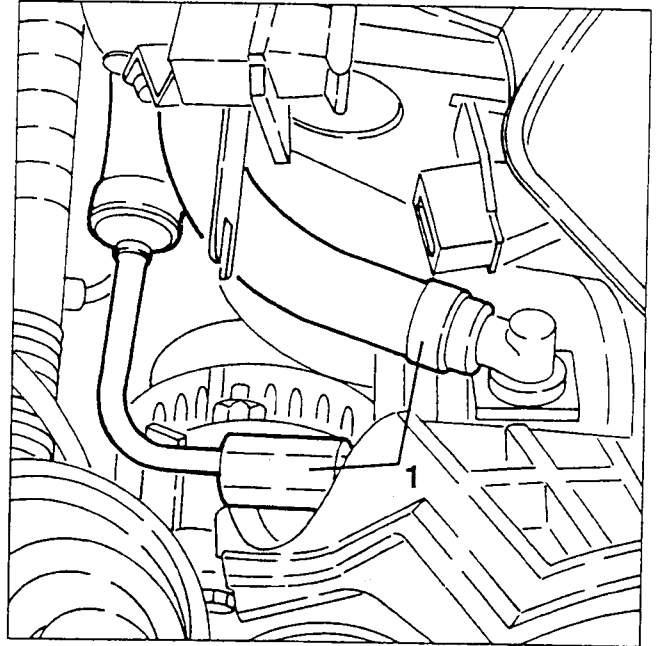


1. Lower the car and disconnect the system supply pipe from the header tank.

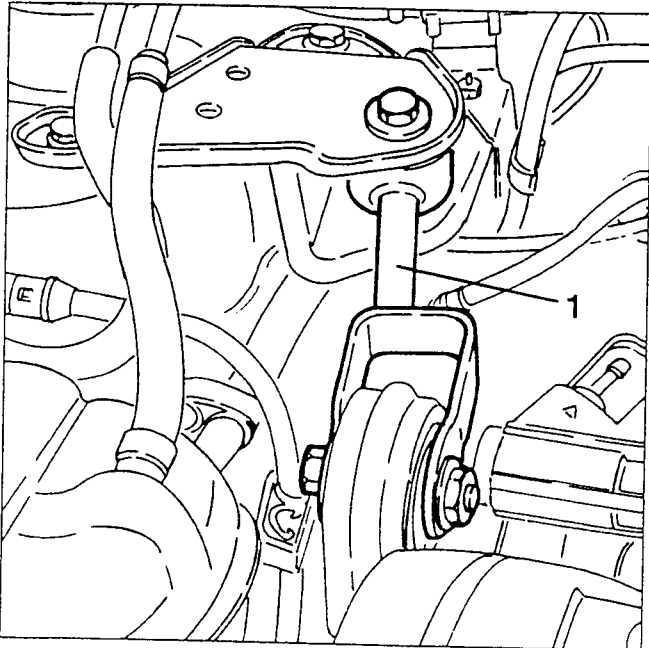


- Using a suitable syringe, withdraw the oil from the power steering tank.

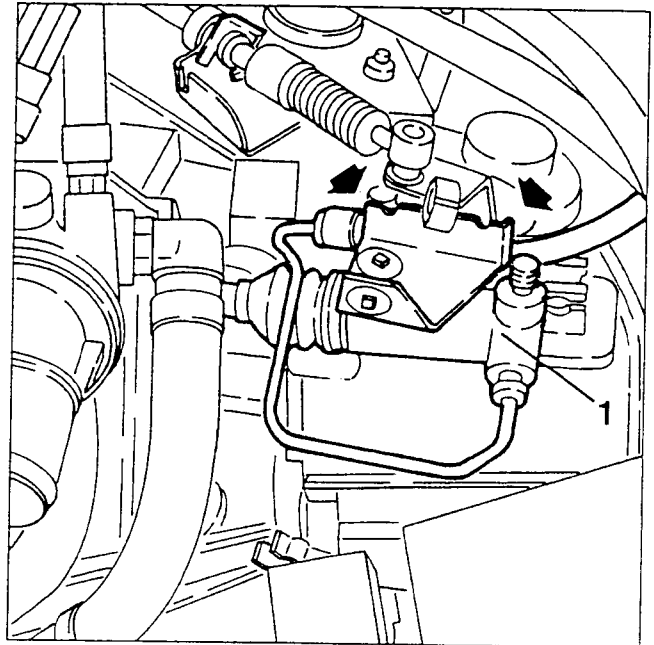
1. Disconnect the two oil intake and delivery pipes from the power steering pump.



1. Slacken the fasteners and remove the engine stay rod.

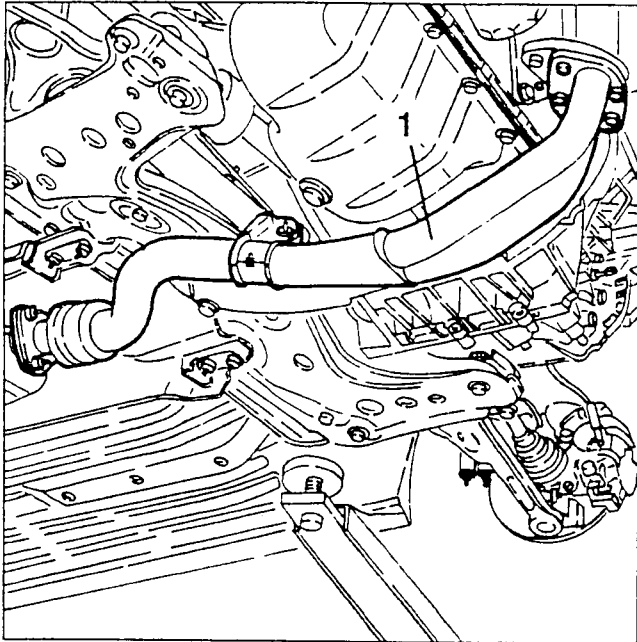


1. Slacken the fastening screws, then move the clutch control cylinder without disconnecting the associated pipes.

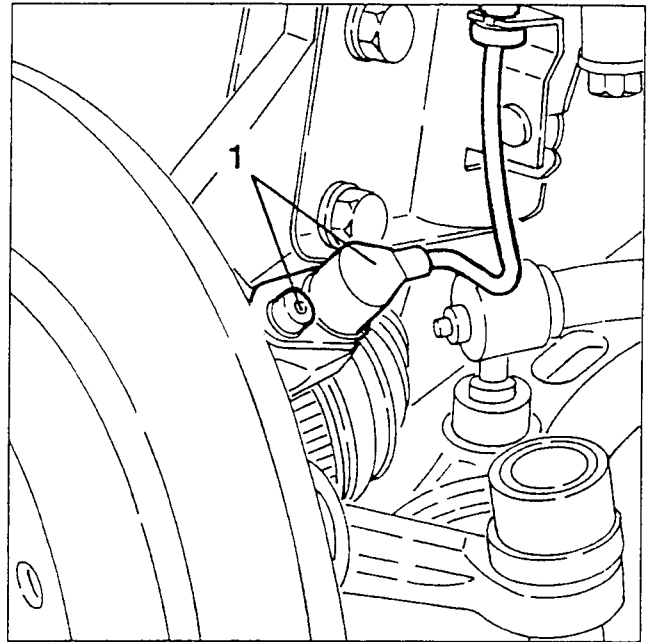




1. Slacken the fasteners and remove the front section of the exhaust pipe complete with lambda sensor.

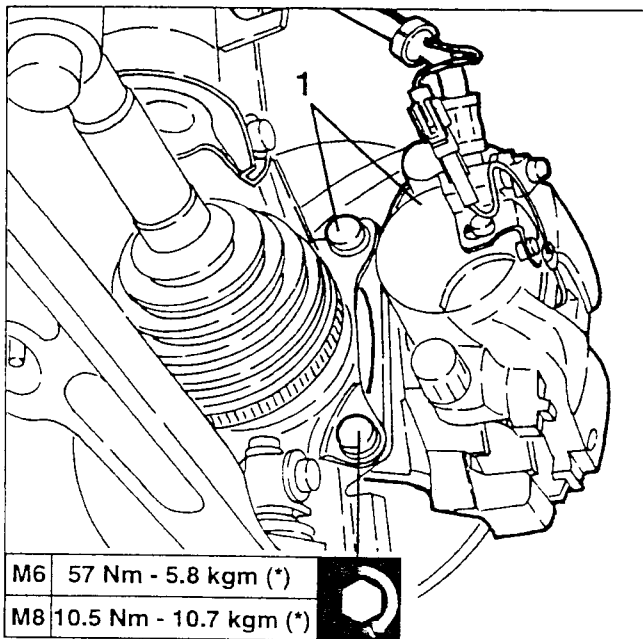


1. Slacken the fastening screw and remove the A.B.S. inductive sensor from the wheel upright.



The following operations concerning removal of the complete axle shaft, wheel upright and brake disk are shown for the left hand side of the car, proceed in the same way for the right hand side.

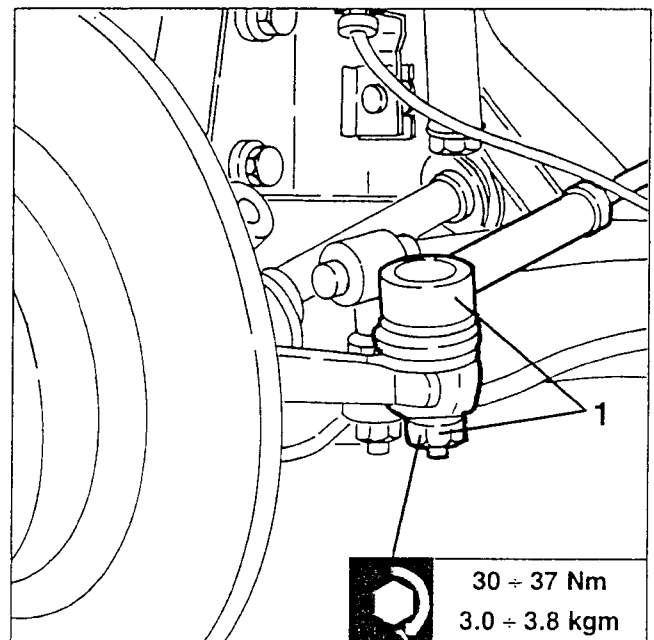
1. Slacken the two fastening screws and remove the brake caliper complete without disconnecting the associated pipes and fasten it to one side so that it does not hinder the following operations.



|    |                        |
|----|------------------------|
| M6 | 57 Nm - 5.8 kgm (*)    |
| M8 | 10.5 Nm - 10.7 kgm (*) |

(\*): Screws with "Drilloc"; must be changed each time they are tightened or loosened.

1. Slacken the fastening nut and disconnect the track rod from the wheel upright.

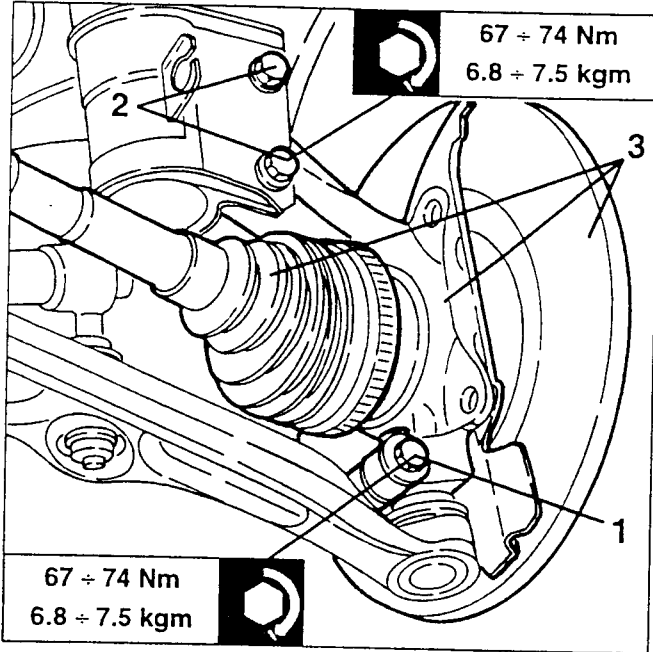


30 - 37 Nm  
3.0 - 3.8 kgm

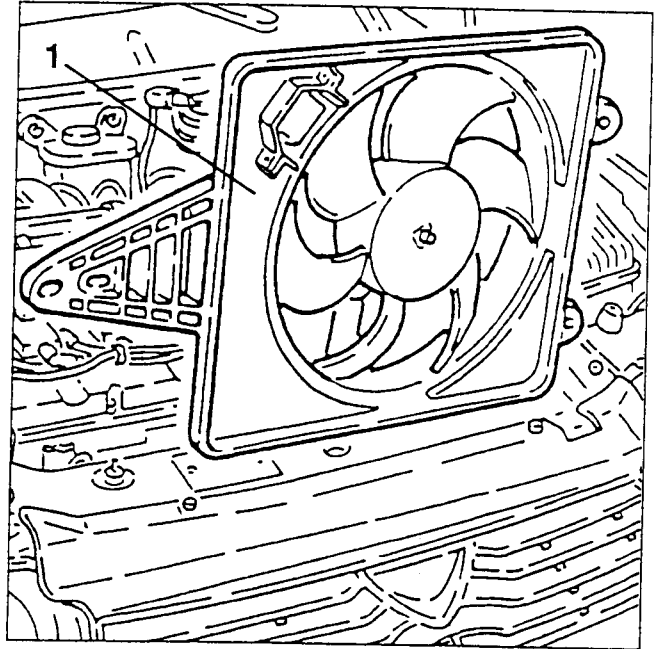




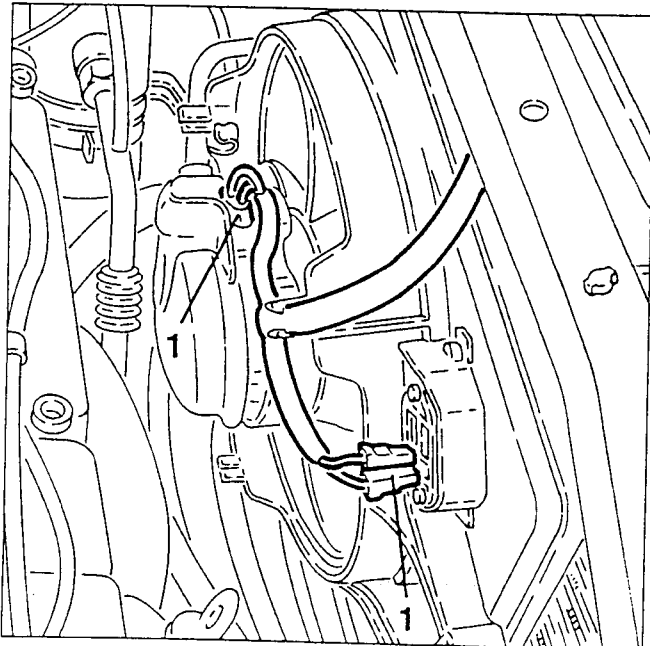
1. Slacken the bolt fastening the wishbone to the wheel upright.
2. Slacken the two bolts fastening the upright to the shock absorber.
3. Withdraw the axle shaft complete with wheel upright and brake disk after releasing the axle shaft boot from the differential.



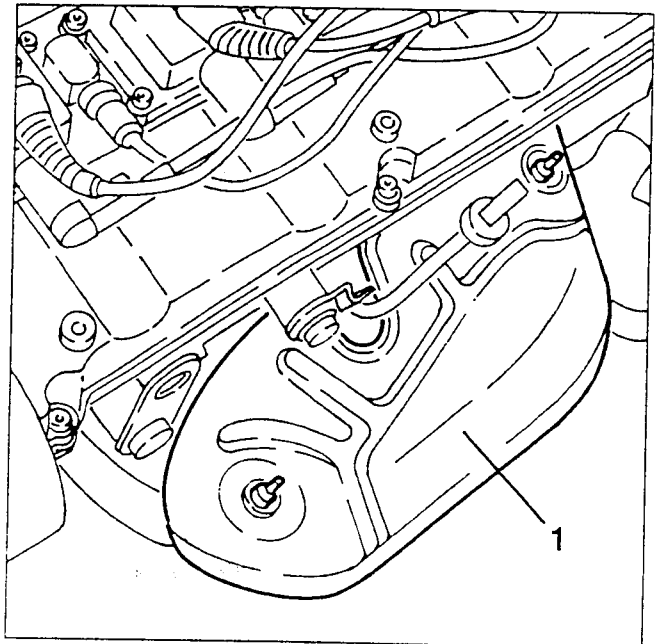
1. Slacken the fastening screws and remove the cooling fan.



1. Disconnect the electrical connections from the cooling fan.

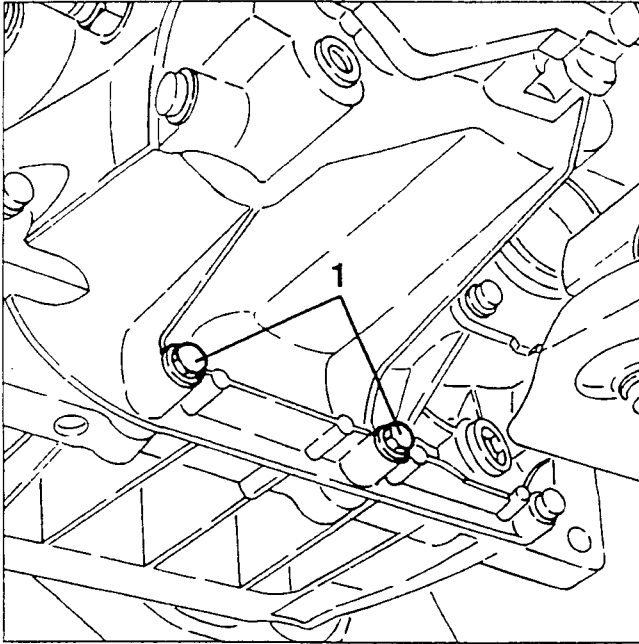


1. Remove the heat guard from the exhaust manifold.

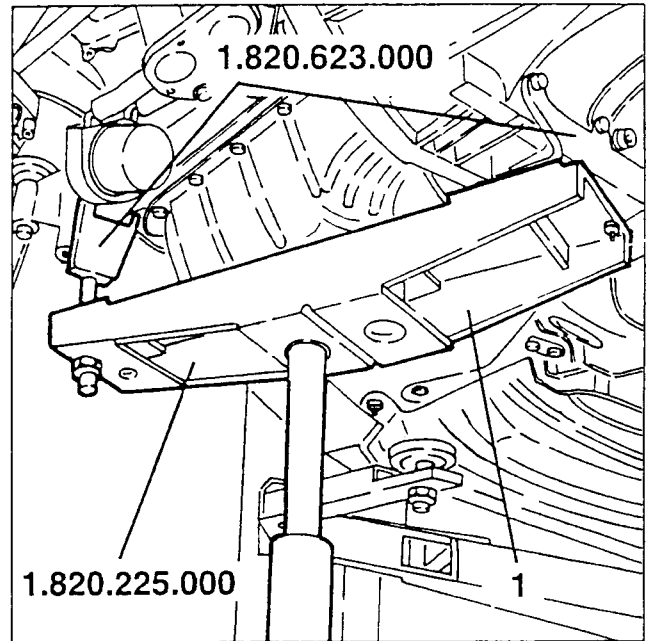




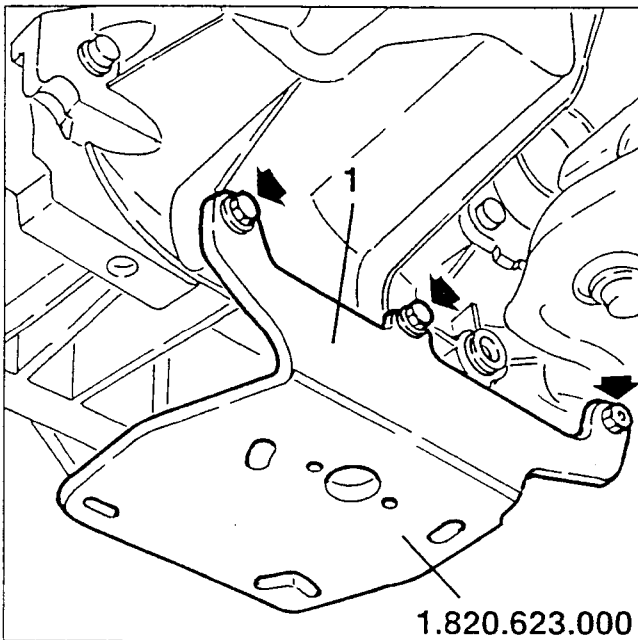
1. Slacken the two screws illustrated fastening the gearbox.



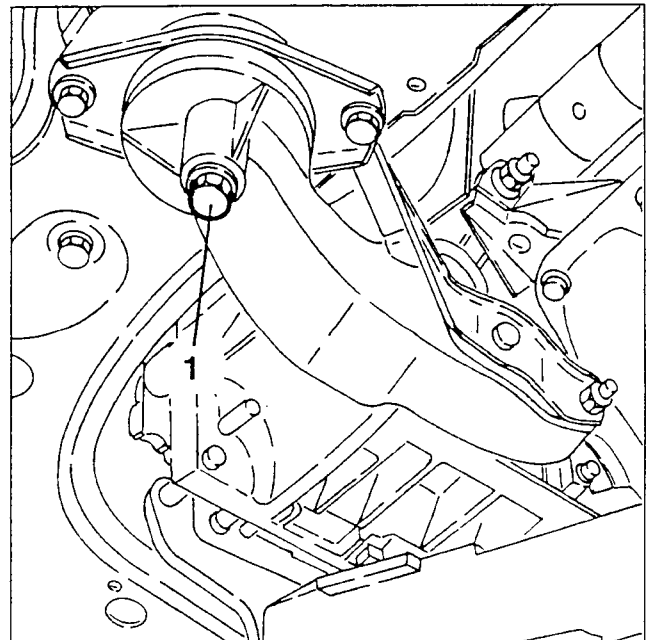
1. On hydraulic jack install support no. 1.820.225.000 complete with fork no. 1.820.623.000 and set it under the power unit as illustrated fastening the support to the bracket previously fitted on the gearbox.



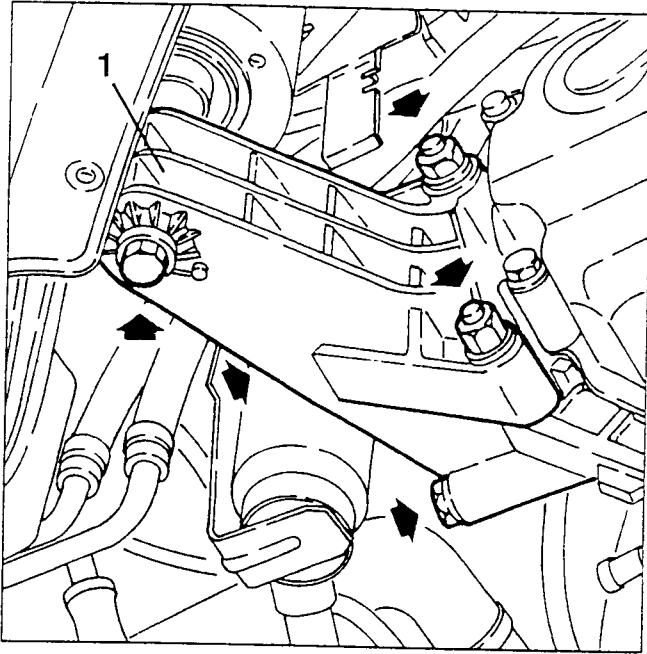
1. Position the bracket of tool no. 1.820.623.000 fastening it to the gearbox using the two screws removed previously and with a bolt in the hole already existing on the gearbox as illustrated.



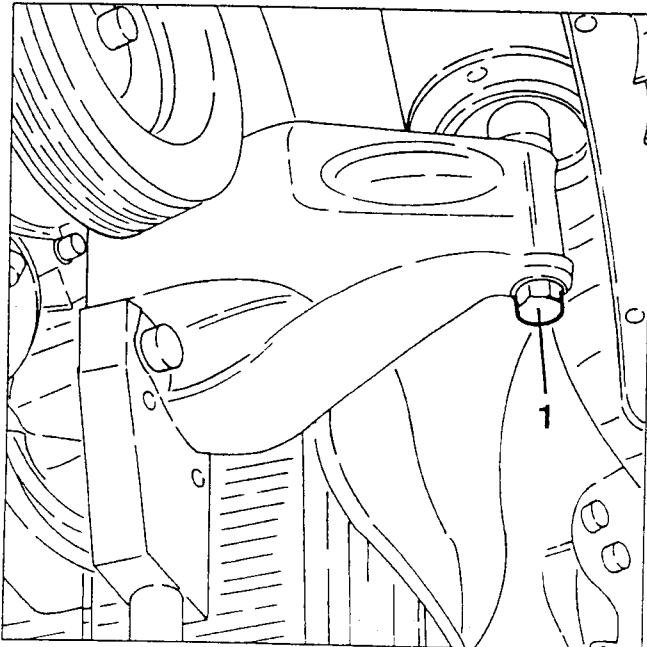
1. Slacken the fastening screw of the rear power unit support.



1. Slacken the fasteners and remove the power unit support on the gearbox side.

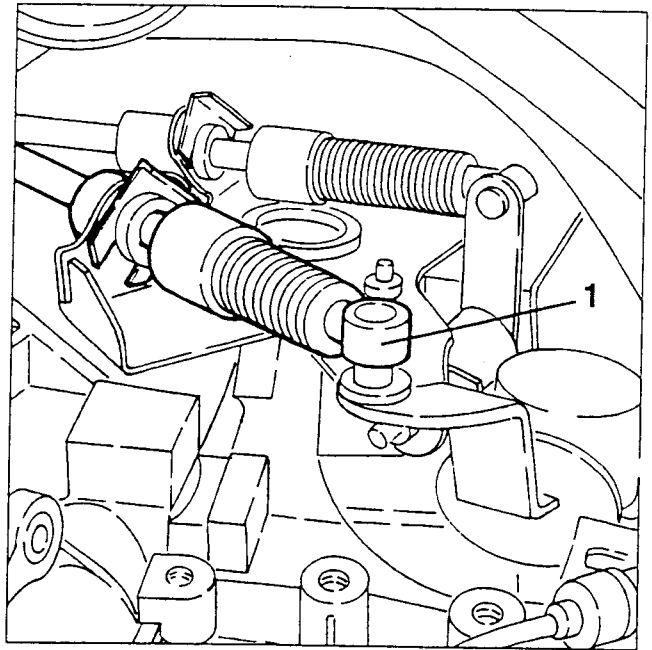


1. Slacken the screw fastening the camshaft side power unit support to the body.

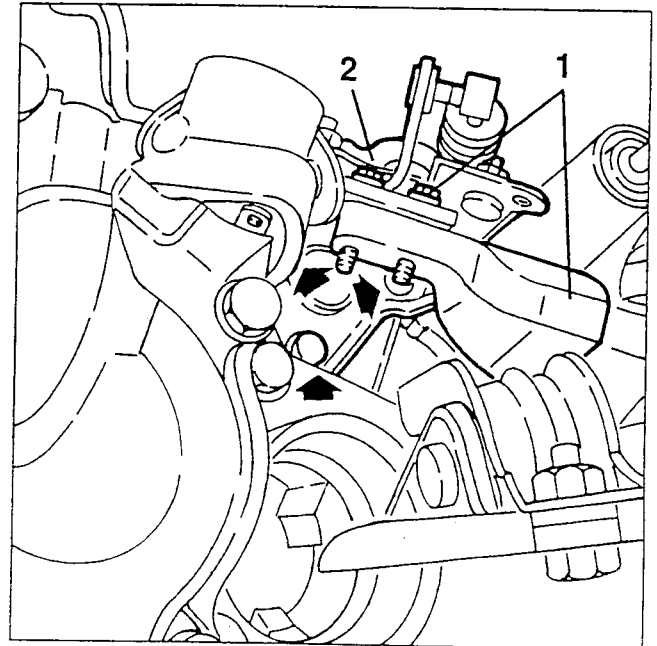


### Specific for versions with bpwden gearbox control

1. Lower the power unit as far as necessary and disconnect the gearshift control bowden illustrated.



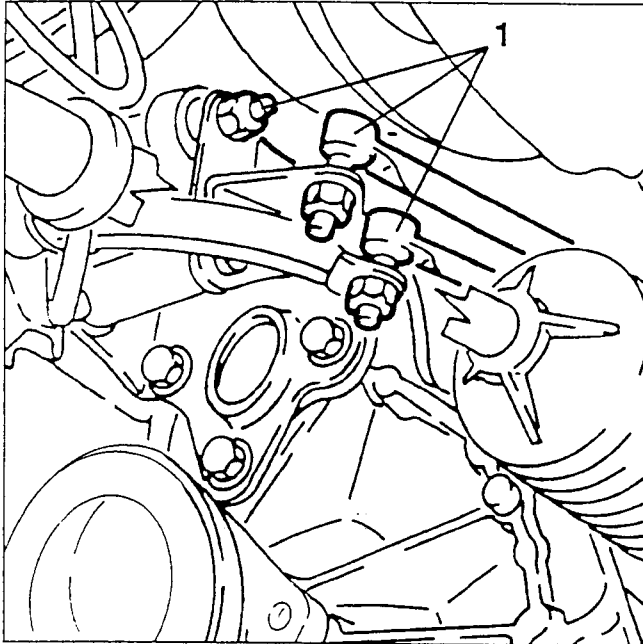
1. Slacken the two fastening screws and remove the damping mass.
2. Slacken the fastening screws and remove the gearshift control bowden connection bracket from the gearbox.





Specific for versions with rod gearbox control

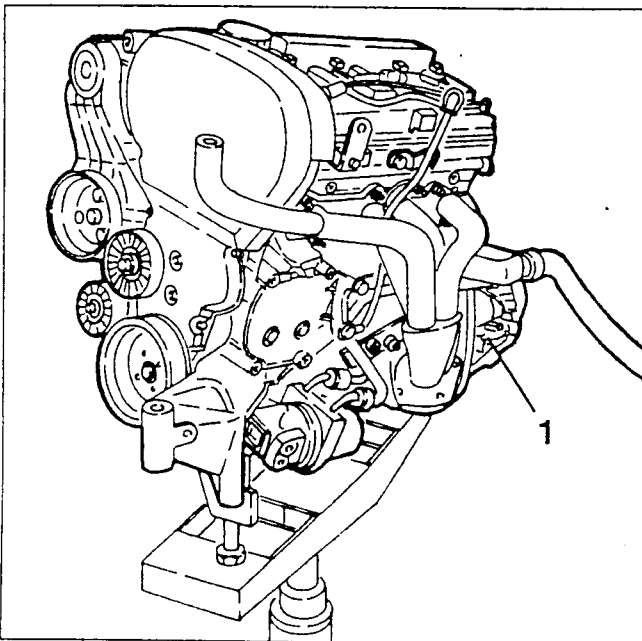
1. Slacken the fastening nuts and disconnect the gearshift control rods.



1. Lower the hydraulic jack completely and remove the power unit from the engine compartment.



**WARNING:**  
The hydraulic jack must have a capacity of at least 1000 kg.



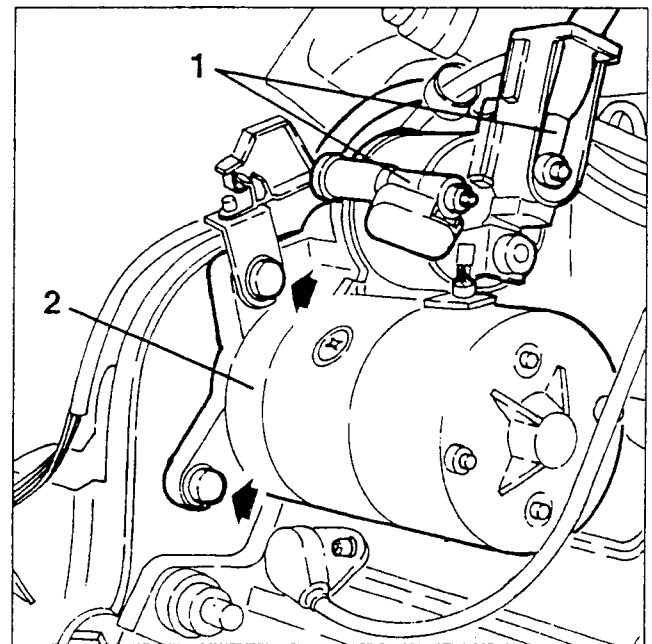
- Support the power unit with a hydraulic hoist in addition to the hydraulic jack used for removal.



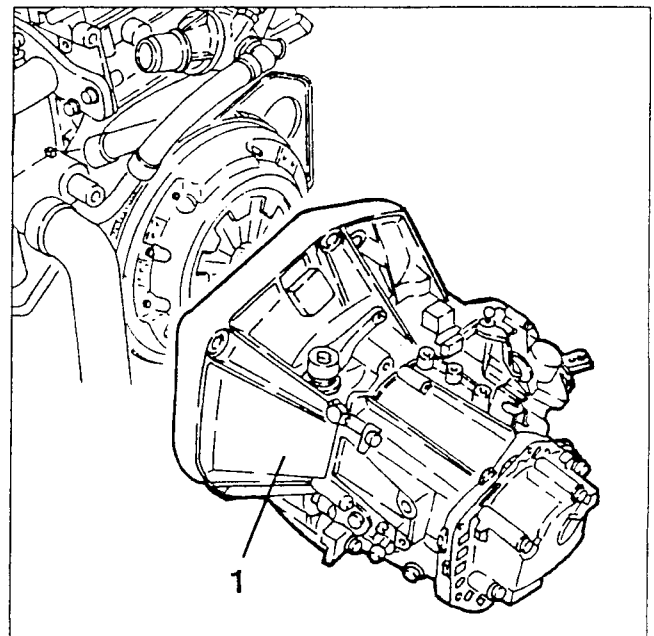
**WARNING:**  
For handling the power unit use a hydraulic hoist after firstly releasing it from the hydraulic jack.

- Release the power unit from the support tools, then set it on a special work bench.

1. Disconnect the electrical connections from the starter motor.
2. Slacken the fastening screws and remove the starter motor.

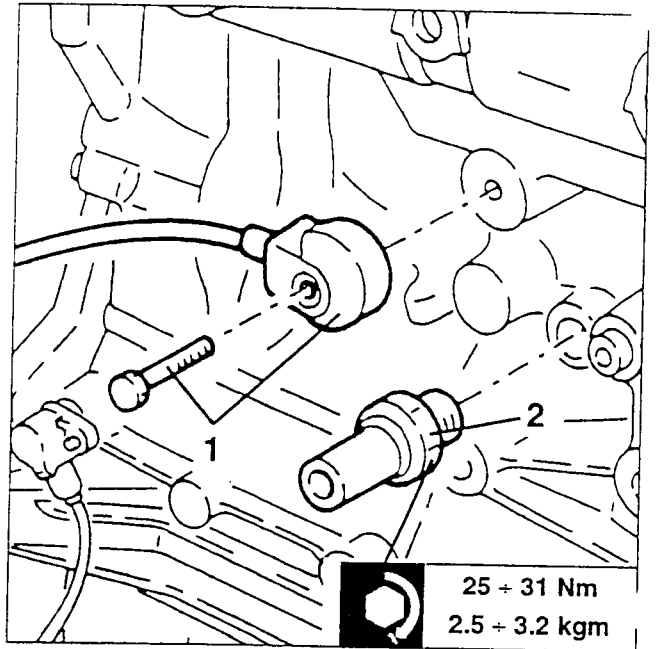
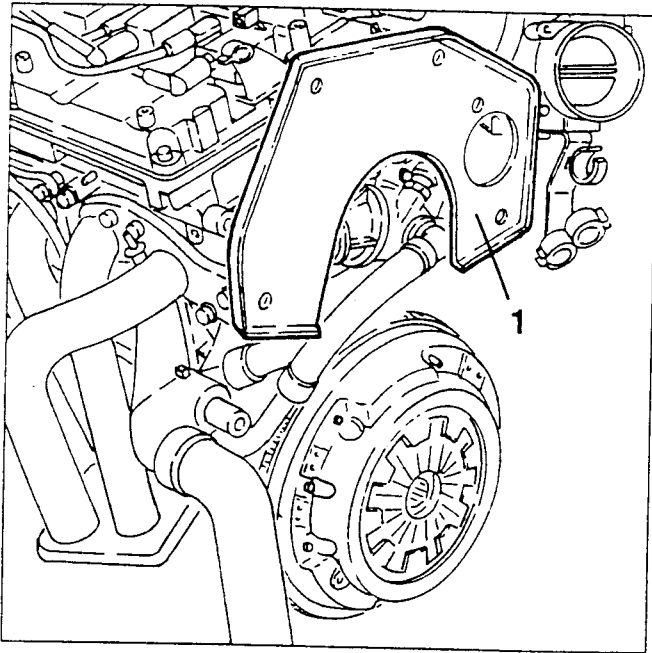


1. Slacken the fasteners and remove the gearbox-differential unit.





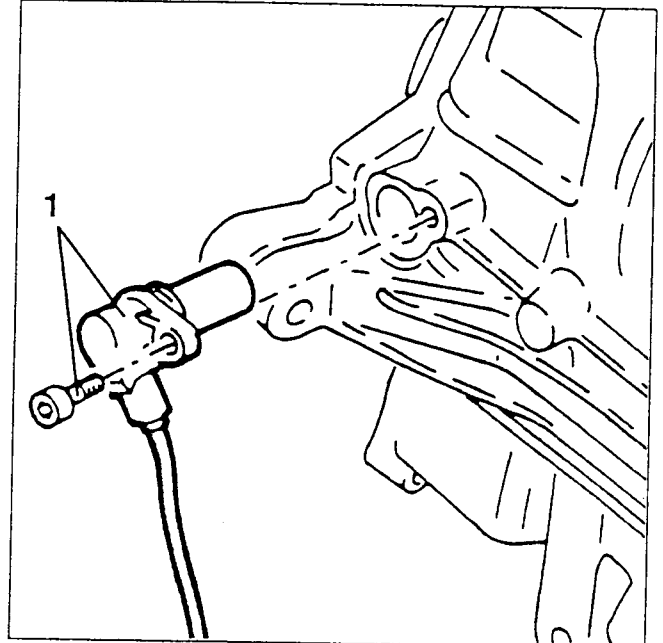
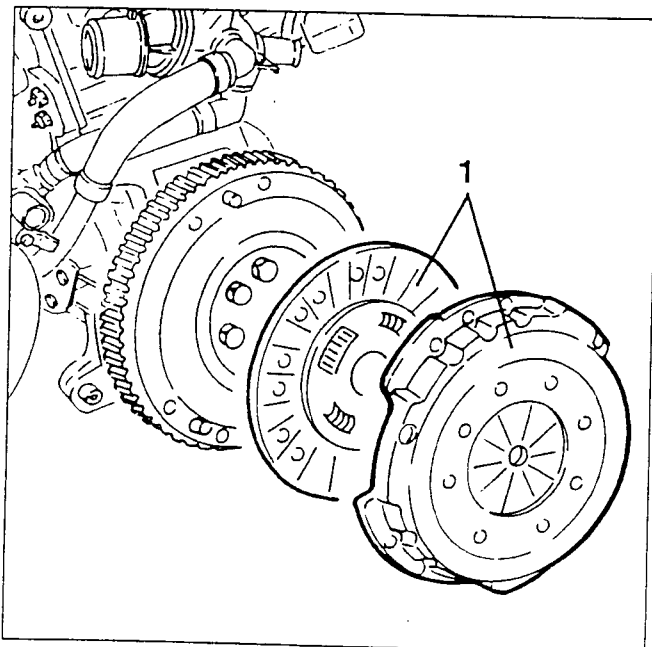
1. Retrieve the rear flywheel guard.



1. Slacken the fastening screw and remove the rpm and timing sensor.

- Release the engine wiring from the cable clamps, disconnect the electrical connections still connected, then remove the wiring.

1. Slacken the fastening screws and remove the thrust plate and clutch plate.



## REFITTING

Repeat the operations of the removal procedure reversing their sequence and following the instructions given below:

- Prepare the engine compartment for refitting the power unit, placing all the electrical cables, pipes, etc. so that they do not interfere.



**WARNING:** Make sure that the power unit support points have been fastened correctly.


1. Slacken the fastening screw and remove the ping sensor from the crankcase.  
2. Remove the engine oil minimum pressure sensor.

- After assembly, fill the systems as specified (see GROUP 00).  
- Carry out all the checks and operations necessary (see GROUP 00).

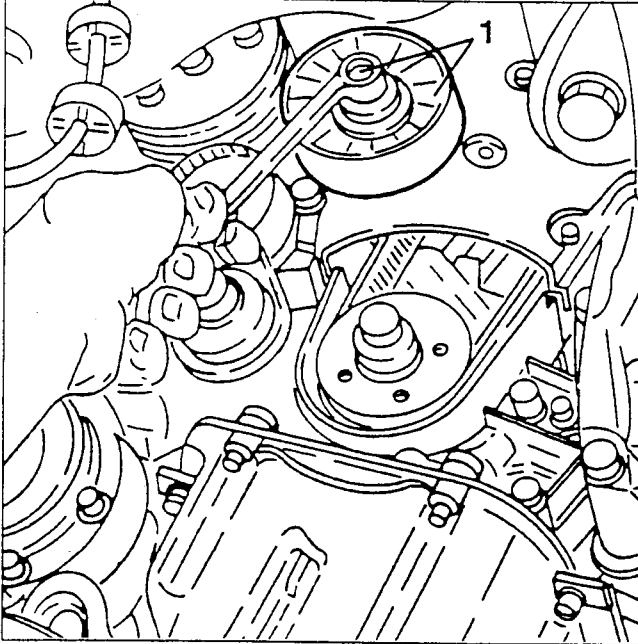


## CYLINDER HEAD

### REMOVING/REFITTING

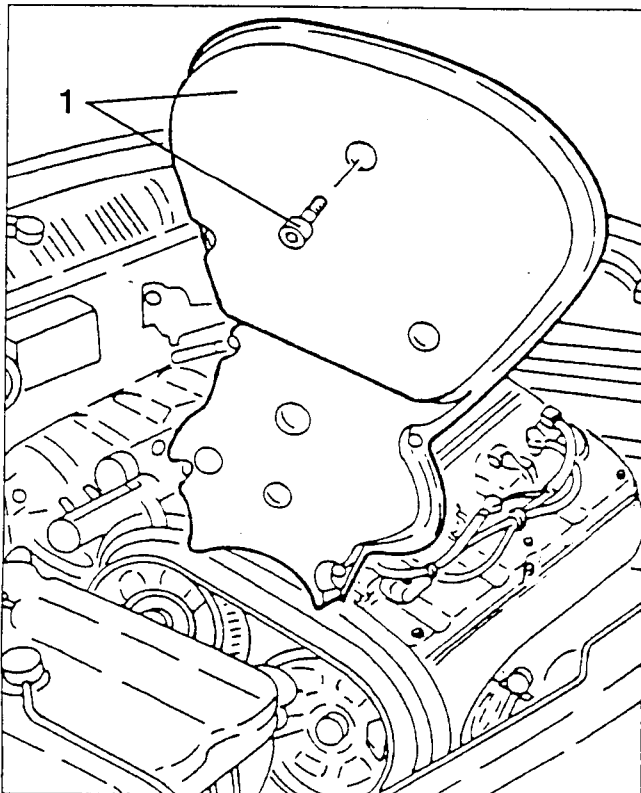
Proceed as described for  T. SPARK 16V engine up to removing the auxiliary components drive pulley included.

1. Slacken the fastening screw and remove the auxiliary components drive pulley guide.

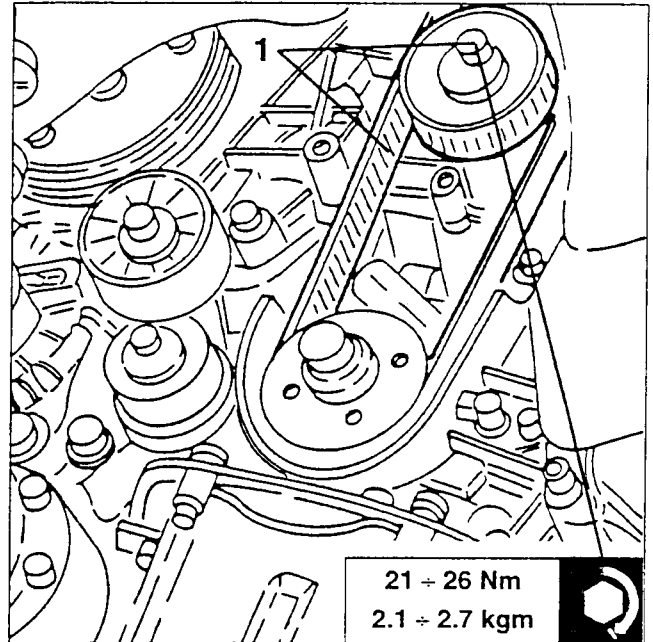



- Slacken the lower screws fastening the timing gear belt guard.

1. Lower the car, slacken the remaining fastening screws and remove the timing gear drive belt guard.



1. Working on the timing gear belt tensioner, loosen the tension of the belt, then remove it from the camshaft drive pulleys.




Complete the cylinder head removing/refitting procedure proceeding as described for  T. SPARK 16V engine.

T. SPARK  
16VT. SPARK  
16VT. SPARK  
16V

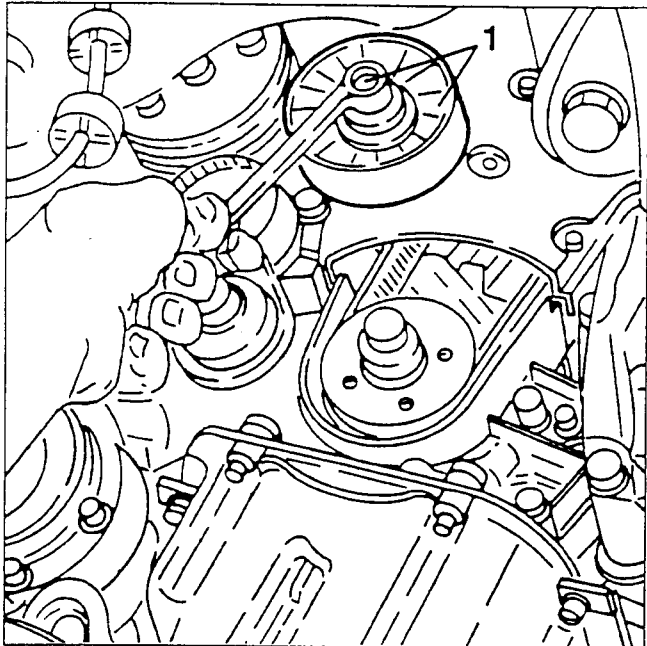
## OIL SUMP

T. SPARK  
16VT. SPARK  
16V

## REMOVING/REFITTING

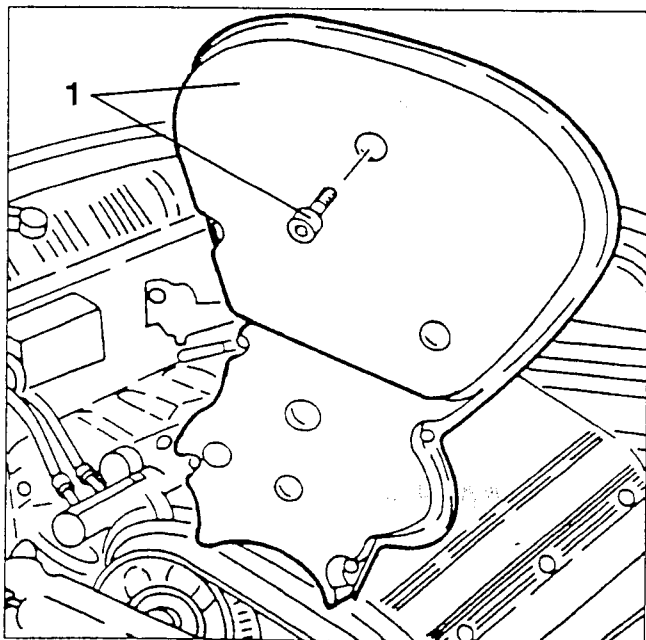
Proceed as described for  T. SPARK 16V engine up to removing the auxiliary components drive pulley included.

1. Slacken the fastening screw and remove the auxiliary components drive belt pulley guide.



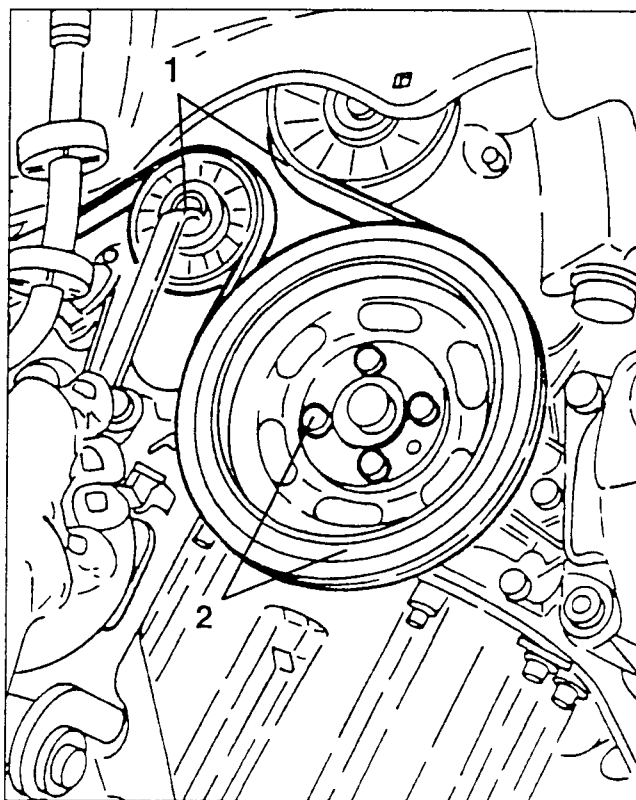
- Slacken the lower screws fastening the timing gear guard.


1. Lower the car, slacken the remaining fastening screws and remove the timing gear drive belt guard.



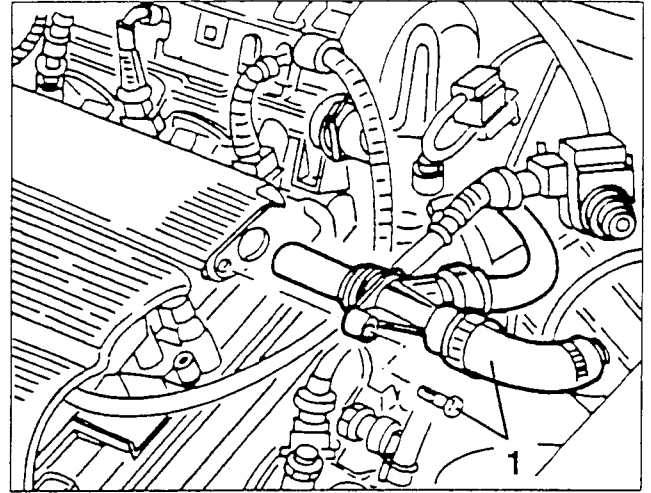
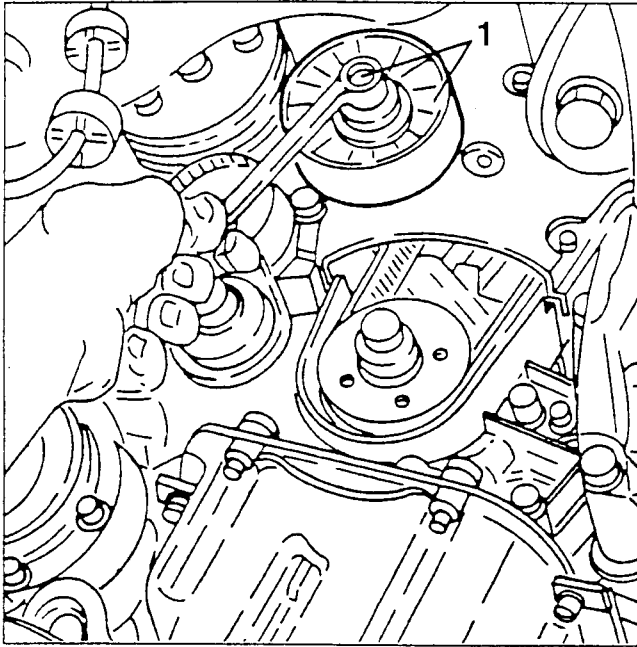
## CHANGING THE FRONT CRANKSHAFT OIL SEAL

- Set the car on a lift.
  - Disconnect the battery (-) terminal.
  - Remove the right front wheel and mud flaps.
1. Raise the car and working on the belt tensioner as illustrated, slacken the tension of the auxiliary components drive belt and remove it.
  2. Slacken the four fastening screws and remove the auxiliary components drive pulley.



Complete the procedure for removing/refitting the head oil sump proceeding as described for  T. SPARK 16V engine.

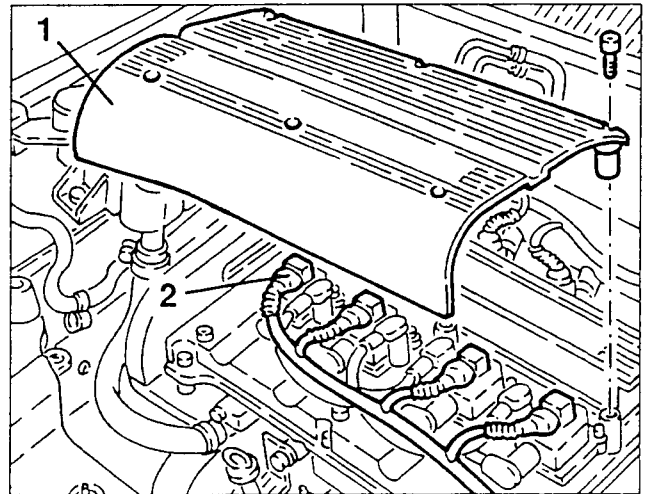
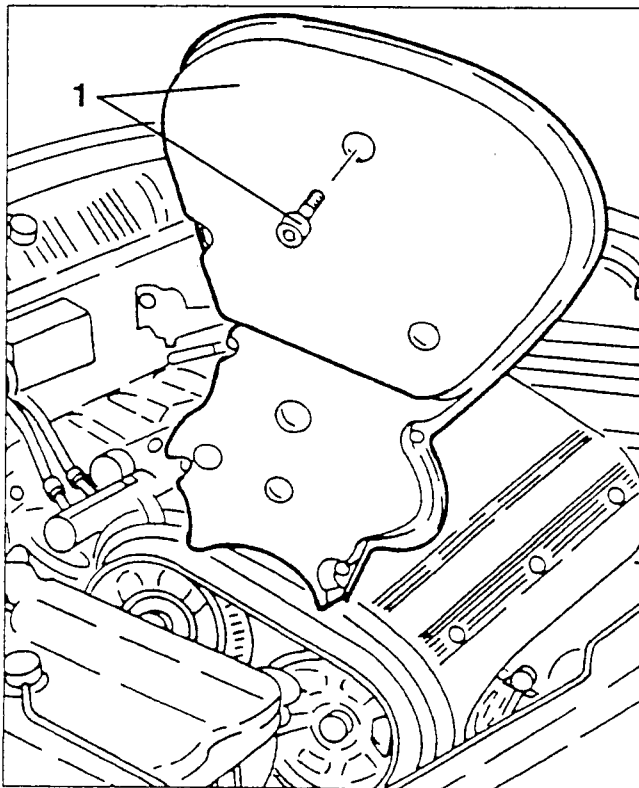
1. Slacken the fastening screw and remove the auxiliary components drive belt pulley guide.



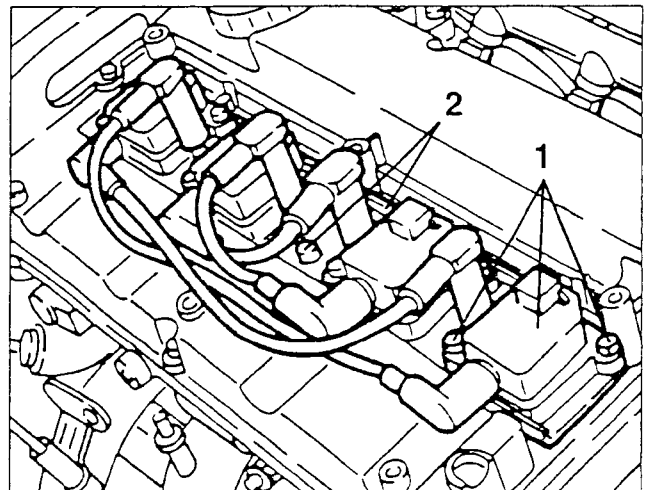
1. Slacken the fastening screws and remove ignition coils cover.  
2. Disconnect the electrical connections from the ignition coils.

- Slacken the lower screws fastening the timing gear drive belt guard.

1. Lower the car, slacken the remaining fastening screws and remove the timing gear drive belt guard.



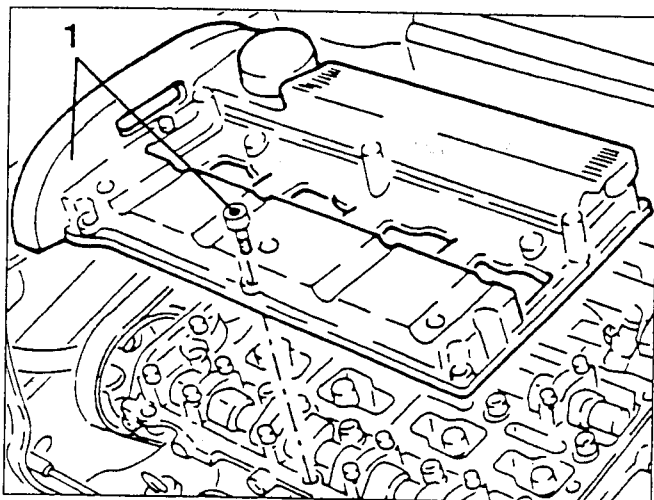
1. Slacken the fastening screws and remove the ignition coils.  
2. Slacken the fastening screws and remove the ignition coils support bracket.



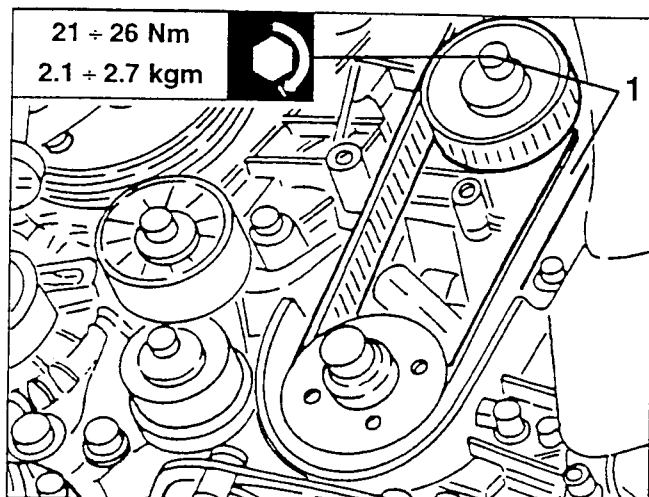
1. Slacken the fastening screw and withdraw the oil vapour recovery pipe socket.



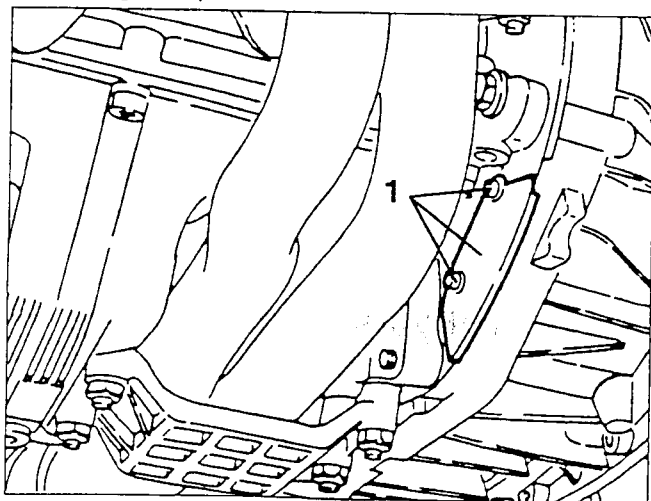
1. Slacken the fastening screws and remove the cylinder head cover complete with seal.



1. Working on the timing gear belt tensioner, slacken the tension of the belt, then remove it.

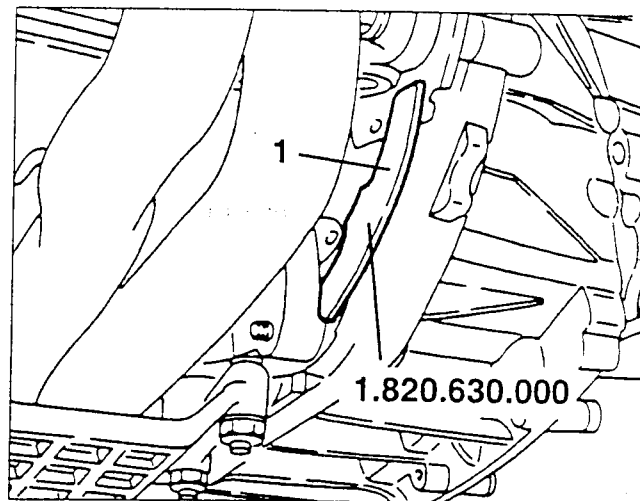


1. Slacken the two fastening screws and remove the flywheel guard plate.

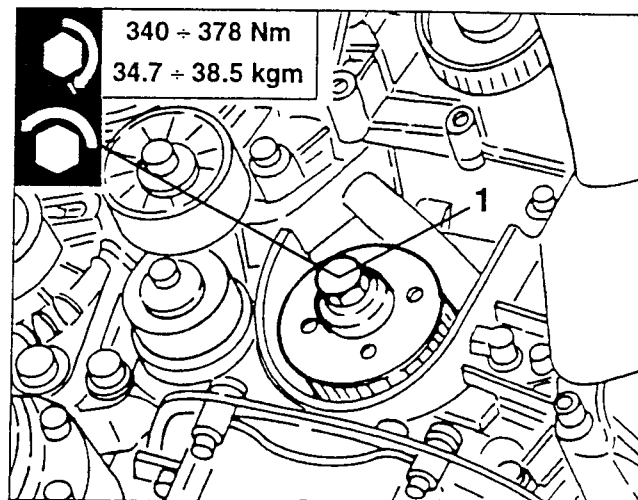


1. Install flywheel stopper tool no. 1.820.630.000, as illustrated.

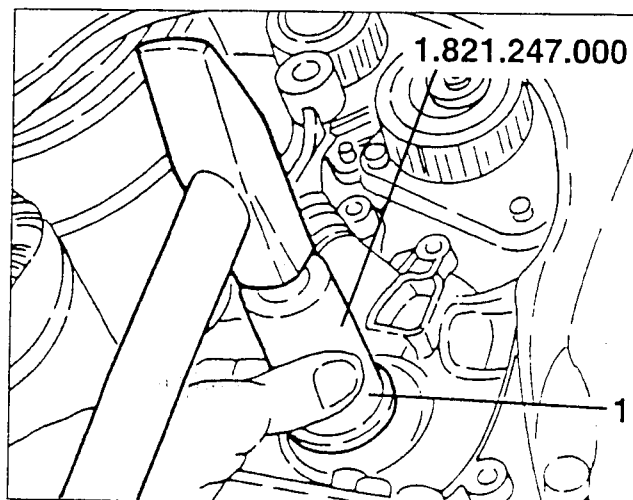
PA49300000007



1. Slacken the fastening screw (lefthand) of the timing gear drive belt pulley, then remove it.



1. Remove the oil seal and install a new one using tool no. 1.821.247.000.



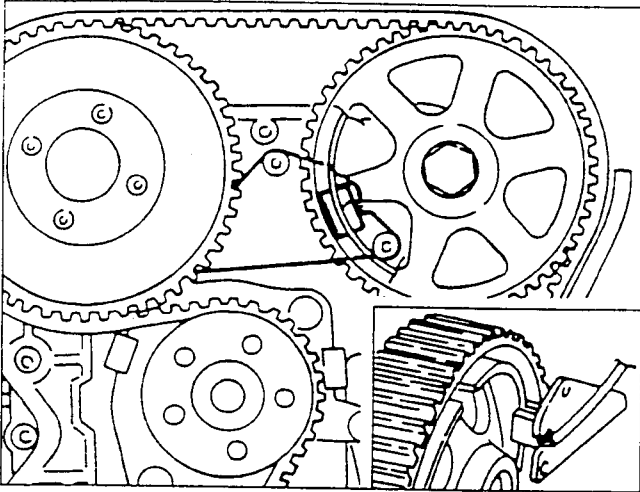
- Refit reversing the sequence described for removal.

Refer to GROUP 00 for refitting the timing gear drive belt and timing operations.

## TIMING SENSOR

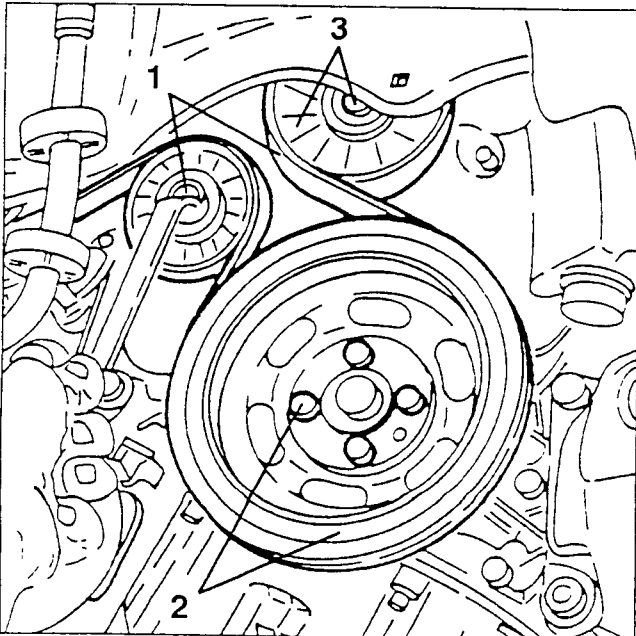
The timing sensor (cam angle sensor) is formed of a Hall effect device.

The voltage signal lowers abruptly when the tooth on the camshaft drive pulley facing the sensor passes in front of the sensor itself.



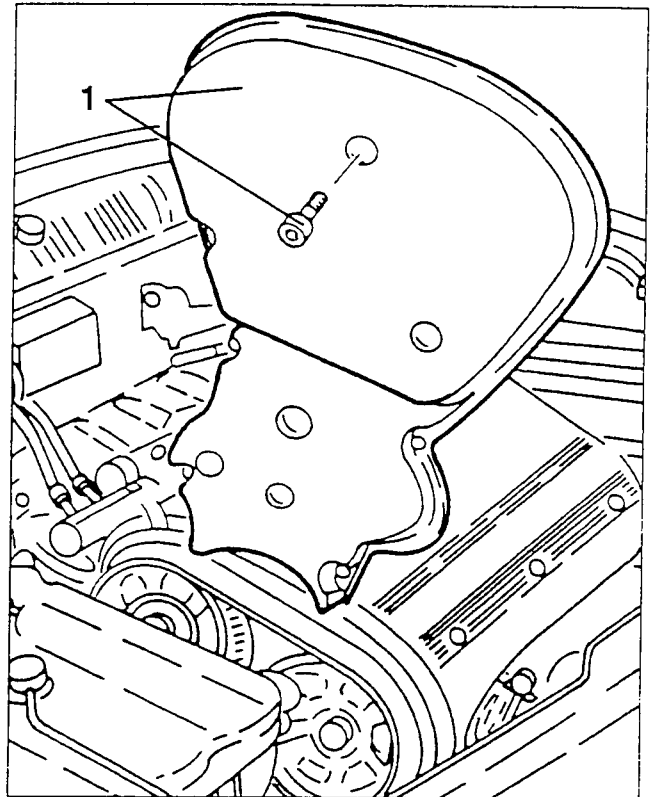
## REMOVING/REFITTING (For engines without counter-rotating shafts)

- Set the car on a lift.
- Disconnect the battery (-) terminal.
- Remove the right front wheel and mud flap.
- 1. Raise the car and proceeding as illustrated on the belt tensioner, slacken the tension of the auxiliary components drive belt and remove it.
- 2. Slacken the four fastening screws and remove the auxiliary components drive pulley.
- 3. Slacken the fastening screw and remove the auxiliary components drive belt pulley guide.

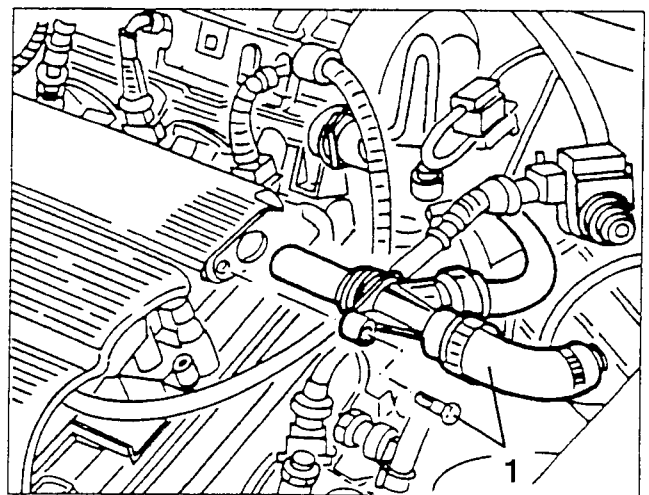


- Slacken the lower screws fastening the timing gear drive belt guard.

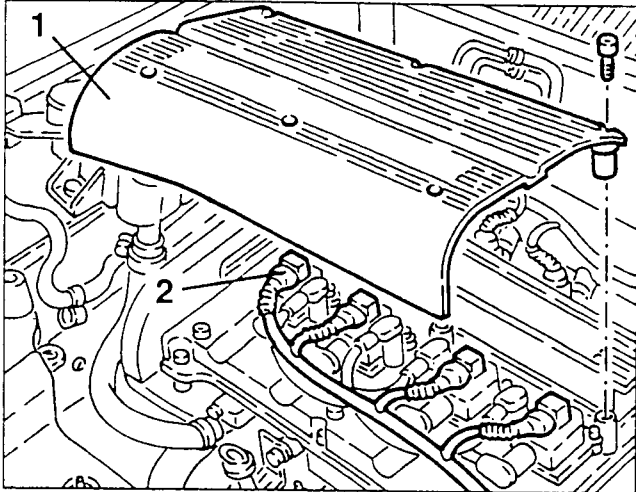
1. Lower the car, slacken the remaining screws and remove the timing gear drive belt guard.



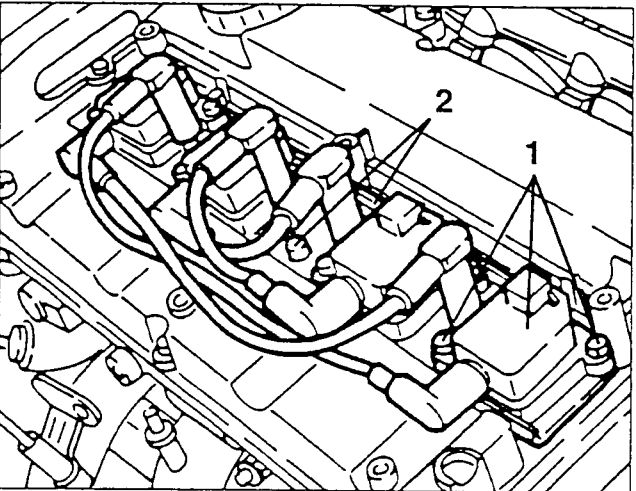
1. Slacken the fastening screw and clamp and remove the oil vapour recovery pipes.



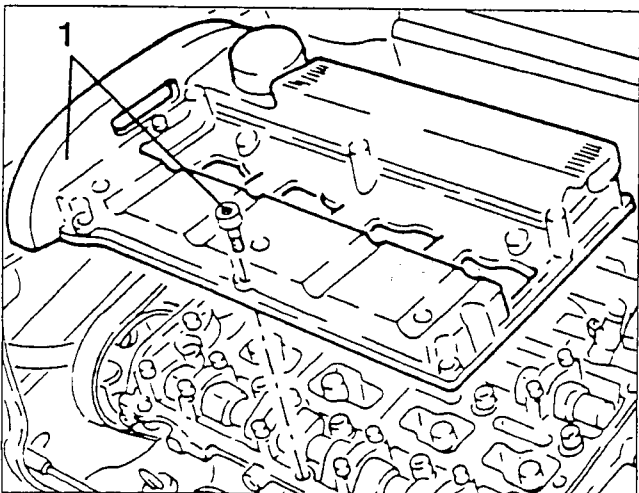
1. Slacken the fastening screws and remove the ignition coils cover.
2. Disconnect the electrical connections from the ignition coils.



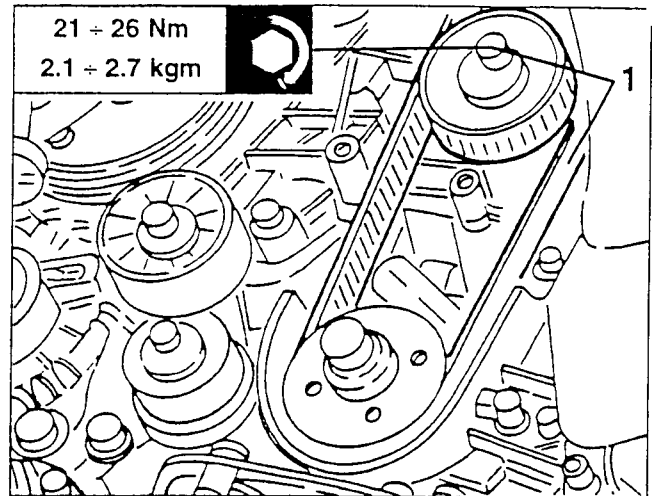
1. Slacken the fastening screws and remove the ignition coils.
2. Slacken the fastening screws and remove the ignition coils support bracket.



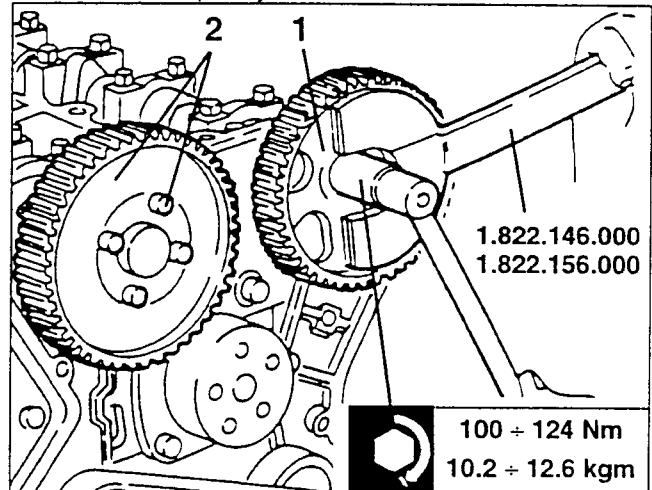
1. Slacken the fastening screws and remove the cylinder head cover complete with seal.



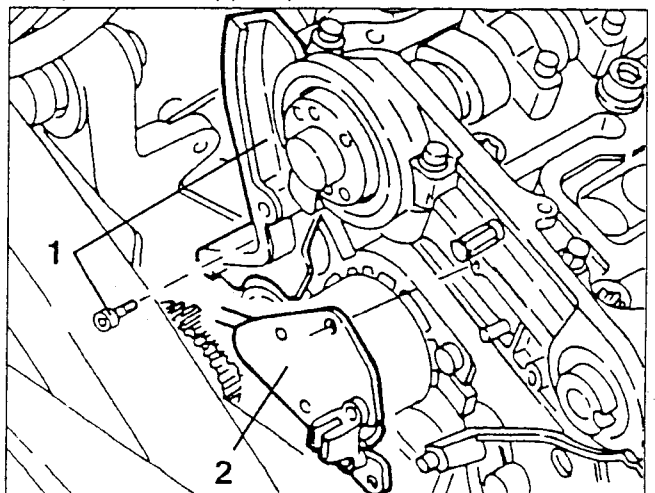
1. Working on the belt tensioner, slacken the tension of the belt, then remove it from the timing gear pulleys.



1. Using tools no. 1.822.146.000 and no. 1.822.156.000 slacken the screw fastening the timing gear drive pulley on the exhaust side and remove it.
2. Slacken the four fastening screws and remove the camshaft drive pulley intake side end remove it.

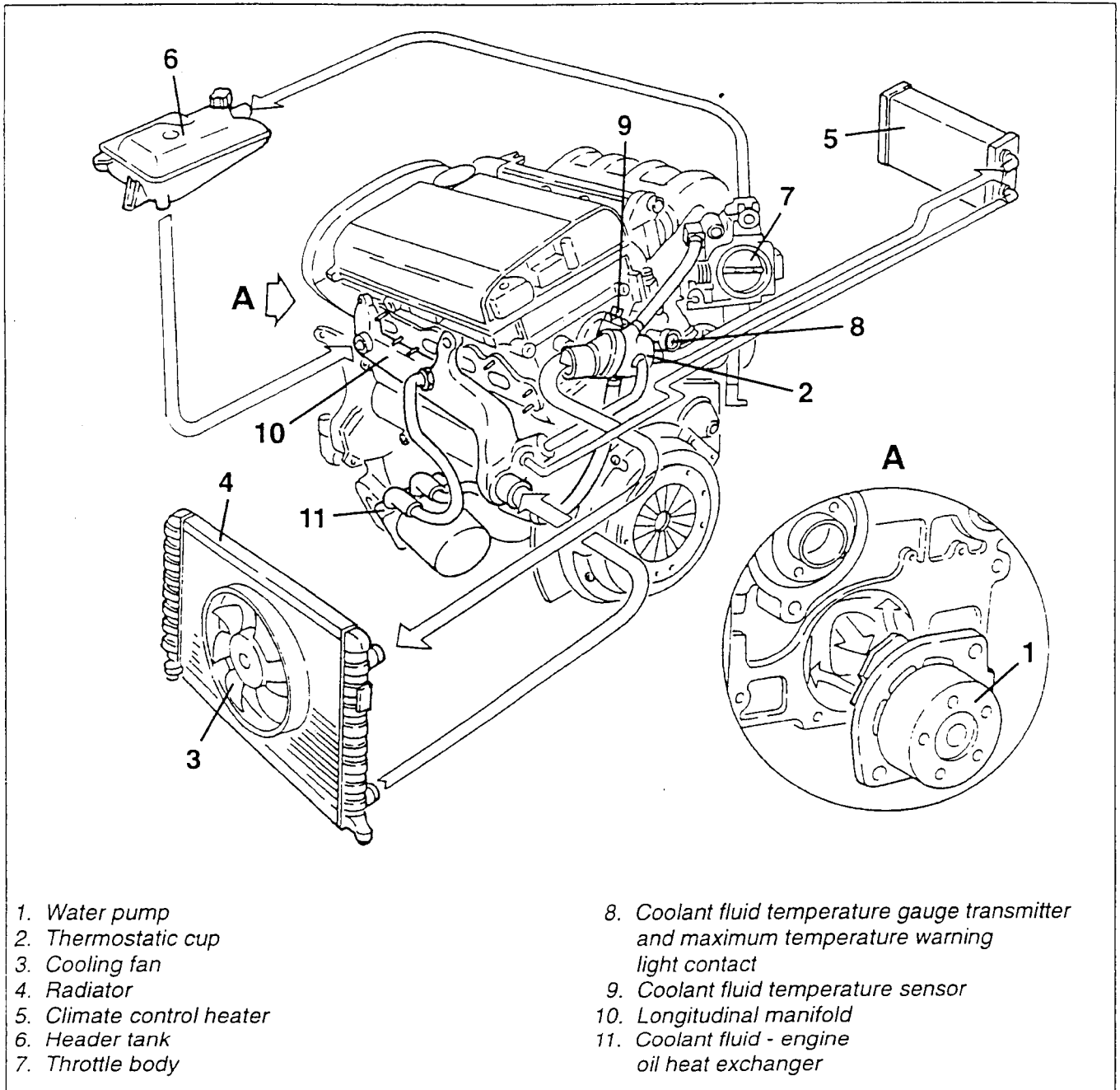


1. Slacken the fastening screws and remove the side guard on the intake side.
2. Disconnect the electrical connection, slacken the two fastening screws and remove the timing sensor complete with support plate.



Refer to GROUP 00 for refitting the timing gear drive belt and timing operations.

## DESCRIPTION OF ENGINE COOLING SYSTEM



The cooling system is of the sealed type with forced circulation by centrifugal pump (1) located on the cylinder head and controlled by the timing gear belt. A thermostatic valve (2), on the rear of the cylinder head, keeps the engine at optimum temperatures; it opens when the coolant fluid reaches a temperature of 83 °C.

In addition to the flow of dynamic air the radiator (4) cools the engine fluid also through a two-speed fan (3) controlled directly by the MOTRONIC control unit, depending on the signal received from the engine coolant temperature sensor (NTC).

(For further details on how the fan works see ELECTRIC- ELECTRONIC DIAGNOSIS - Sect. 26 for versions with air conditioner and Sect. 27 for versions with heater).

The header tank (7) supplies the circuit if the level falls and acts as a lung absorbing the changes in volume of the fluid as the temperature changes; it also vents air from the circuit.

The circuit is fitted with a coolant fluid temperature transmitter for the gauge and a maximum temperature thermal contact (9) for the warning light.

## OPERATION OF THE CIRCUIT

After cooling the engine, the fluid passes through the cylinder head to the thermostatising unit.

From here, if its temperature is below 83 °C, it is withdrawn by the pump (1) via a longitudinal coolant fluid return manifold (11) on the lefthand side of the cylinder head.

Conversely if the temperature exceeds this value, it is ducted by the opening of the thermostat towards the radiator (4).

After cooling in the radiator, the fluid returns, again through the longitudinal manifold, to the pump which channels it into the engine.

From the thermostatic cup the coolant fluid is also sent:

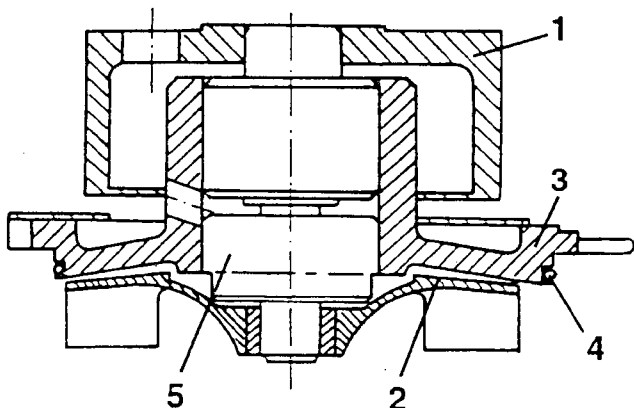
- to warm the throttle body (8) from which it flows to the header tank (7) also relieving air from the system;
- to the heater (6) of the climate control system and then return to the longitudinal manifold;
- to the heat exchanger (12) for cooling the engine oil from which it is ducted directly into the longitudinal manifold for coolant fluid return to the pump.

The header tank supplies the engine cooling system via a special connection hose to the longitudinal manifold.

## WATER PUMP

The water pump is of the centrifugal type with blades. It is fastened to the cylinder head and operated through the timing gear belt, by the crankshaft.

An O-Ring ensures tightness between the cylinder head and pump. The water pump operates constantly thereby ensuring the continuous circulation of the coolant fluid.

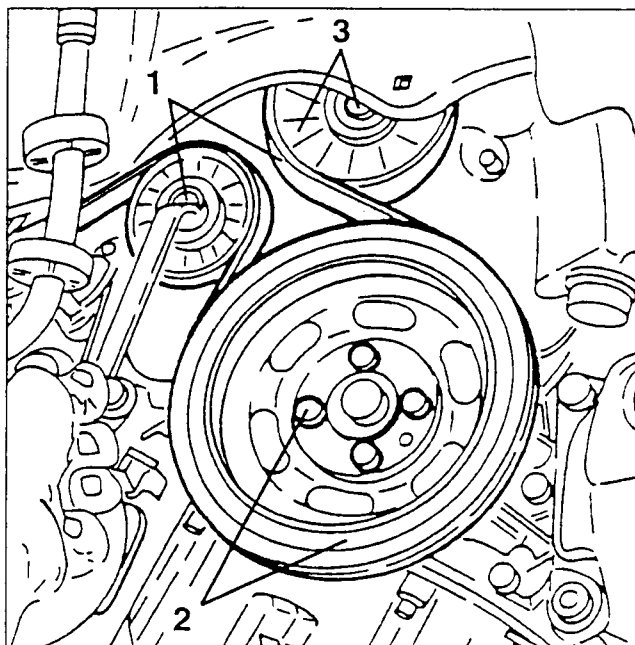


1. Pulley  
2. Impeller  
3. Pump casing

4. O-Ring  
5. Bearing

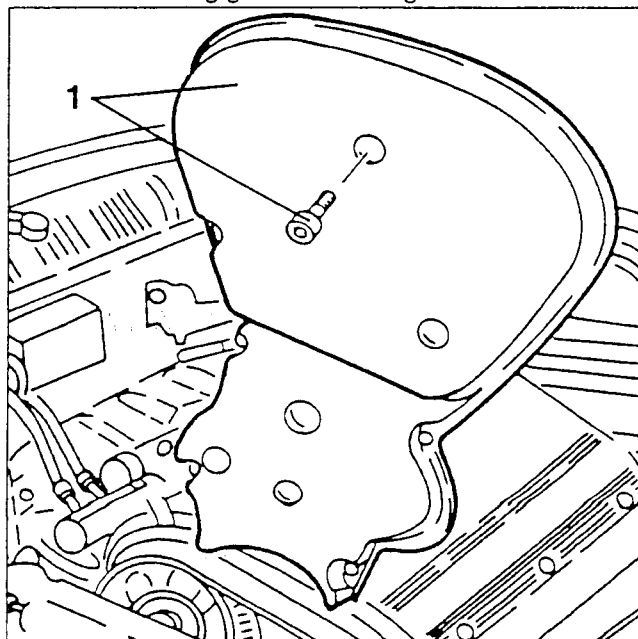
## REMOVING/REFITTING (For engines without counter-rotating shafts)

- Set the car on a lift.
  - Disconnect the battery (-) terminal.
  - Drain the engine coolant fluid (see specific paragraph).
  - Slacken the screws and move aside the header tank without disconnecting the hoses.
1. Raise the car and working as illustrated on the belt tensioner, loosen the tension of the auxiliary components drive belt and remove it.
  2. Slacken the four fastening screws and remove the auxiliary components drive pulley.
  3. Slacken the fastening screw and remove the auxiliary components drive belt guide.

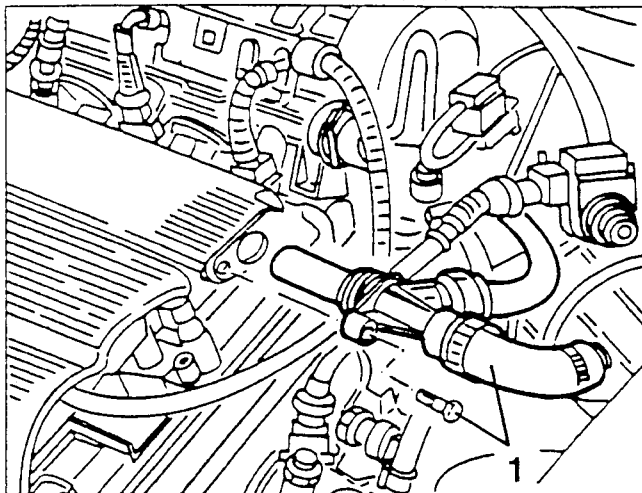


- Slacken the lower screws fastening the timing gear drive belt guard.

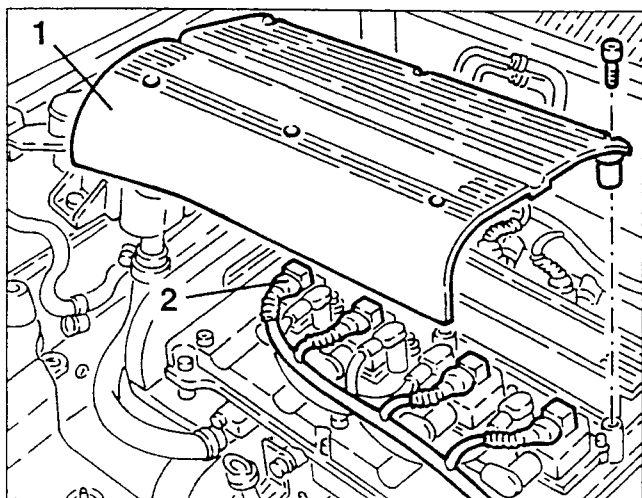
1. Lower the car, slacken the remaining screws and remove the timing gear drive belt guard.



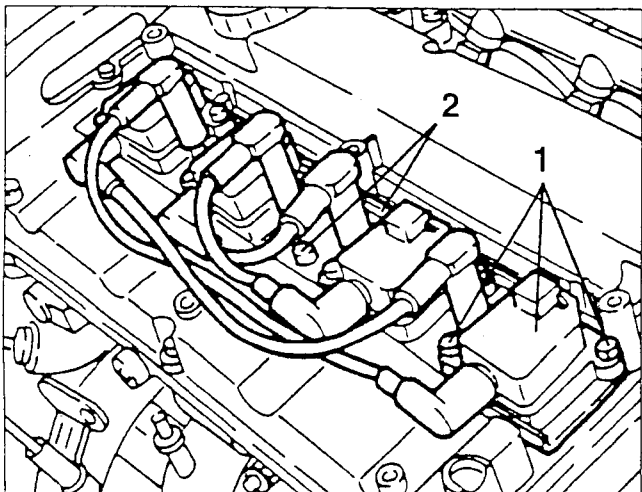
1. Slacken the fastening screw and withdraw the socket for the oil vapour recovery pipes.



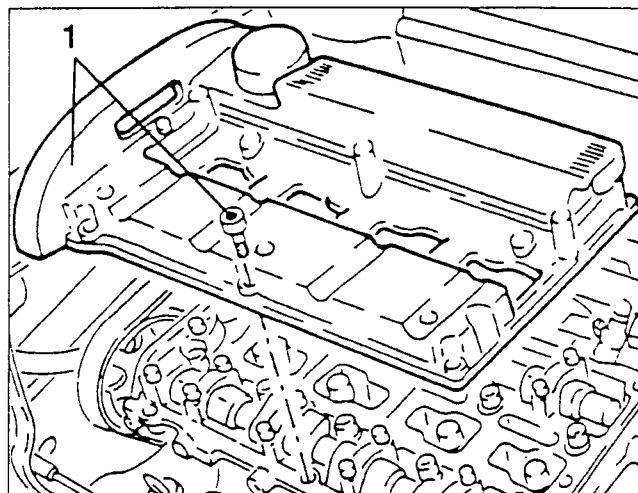
1. Slacken the fastening screws and remove the ignition coil cover.  
2. Disconnect the electrical connections from the ignition coils.



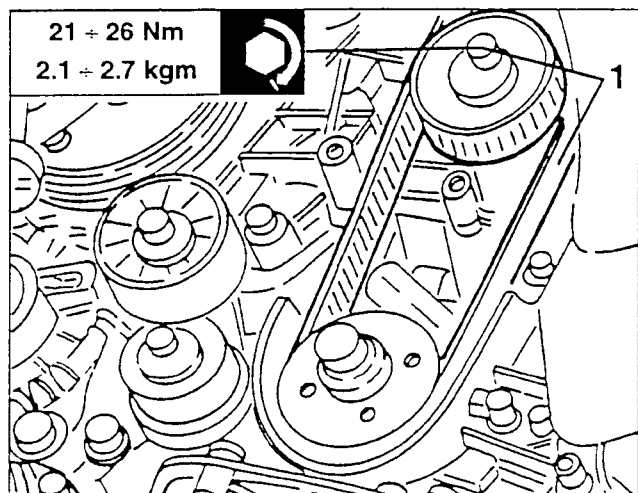
1. Slacken the fastening screws and remove the ignition coils.  
2. Slacken the fastening screws and remove the ignition coil support bracket.



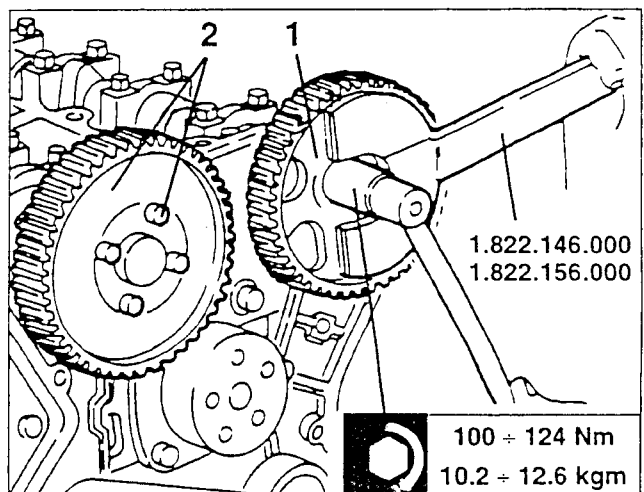
1. Slacken the fastening screws and remove the cylinder head cover complete with seal.



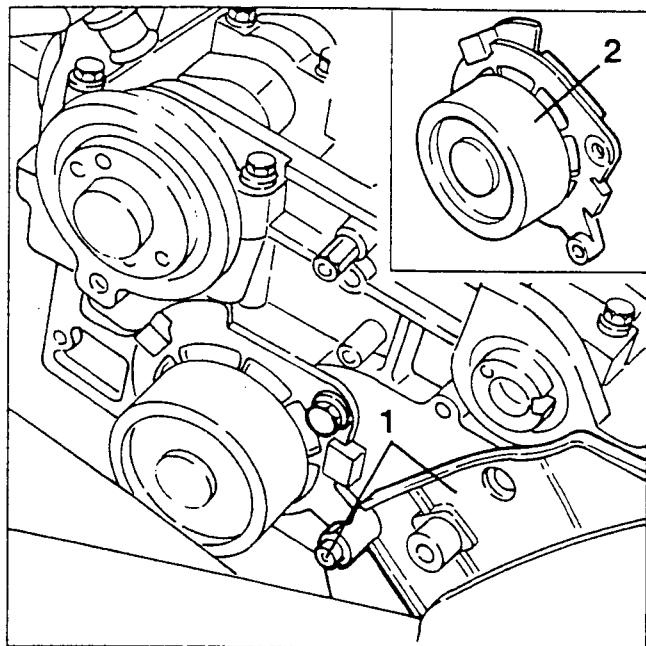
1. Working on the timing gear belt tensioner, loosen the tension of the belt, then remove it from the timing gear drive pulleys.



1. Using tools no. 1.822.146.000 and no. 1.822.156.000, slacken the screw fastening the camshaft drive pulley on the exhaust side and remove it.  
2. Slacken the four screws and remove the intake side camshaft drive pulley.



1. Slacken the fastening screws and remove the exhaust side protection.
2. Slacken the two fastening screws and remove the water pump complete with O-Ring.



- Refit reversing the sequence followed for removal.

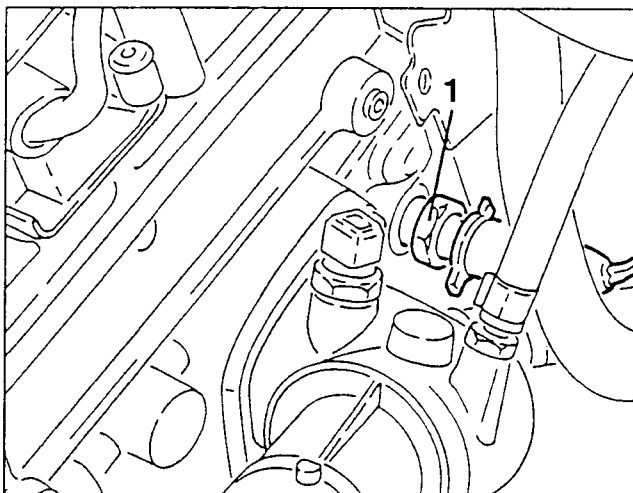
For reassembly of the camshaft drive belt and timing see GROUP 00.

## COOLANT TEMPERATURE GAUGE TRANSMITTER AND MAXIMUM TEMPERATURE WARNING LIGHT CONTACT

### REMOVING/REFITTING

- Disconnect the battery (-) terminal.
- Disconnect the electrical connection from the coolant fluid temperature sensor (NTC).

1. Disconnect the electrical connection from the coolant fluid temperature gauge transmitter and maximum temperature warning light contact, then remove it and collect the coolant fluid that comes out.



### CHECKS AND INSPECTIONS

Check the transmitter setting referring to the wiring diagram (see "Electric System Diagnosis").

| Temperature (°C)              | Resistance (Ω) |
|-------------------------------|----------------|
| 60<br>(test fluid water)      | 470 ÷ 600      |
| 90<br>(test fluid water)      | 160 ÷ 230      |
| 120<br>(test fluid glycerine) | 73 ÷ 93        |

|                              |            |
|------------------------------|------------|
| Contacts closing temperature | 120 ± 2 °C |
| Contacts opening temperature | 108 ± 2 °C |

## GENERAL DESCRIPTION

Refer to the instructions given for the 1747 T.S. 16V and 1970 T.S. 16V engines but bearing in mind that the system is not fitted with the variable geometry intake box and the associated components.

Therefore, the operating logic for "Timing variator and modular intake manifold control" is as described below.

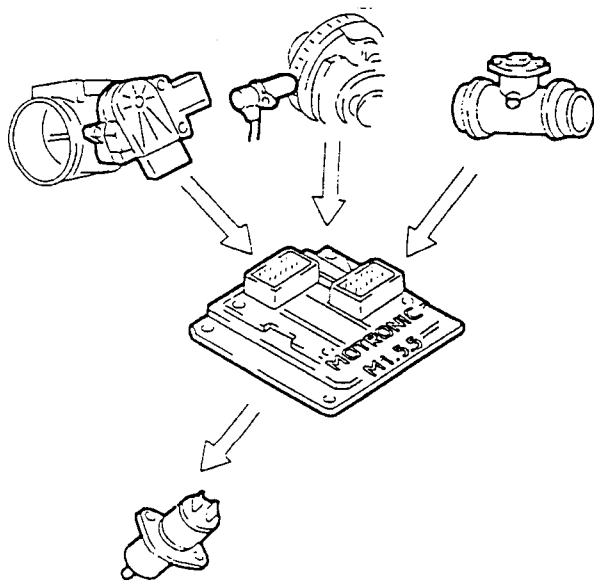
### Timing variator control

In order to optimise the amount of air taken in by the engine the control unit controls intake timing on two angular positions.

At maximum torque the control unit sets the "open" phase with the cam advance by 25° of the engine.

At full power and at idle speed, the control unit sets the "closed" phase with the cam in the normal position.

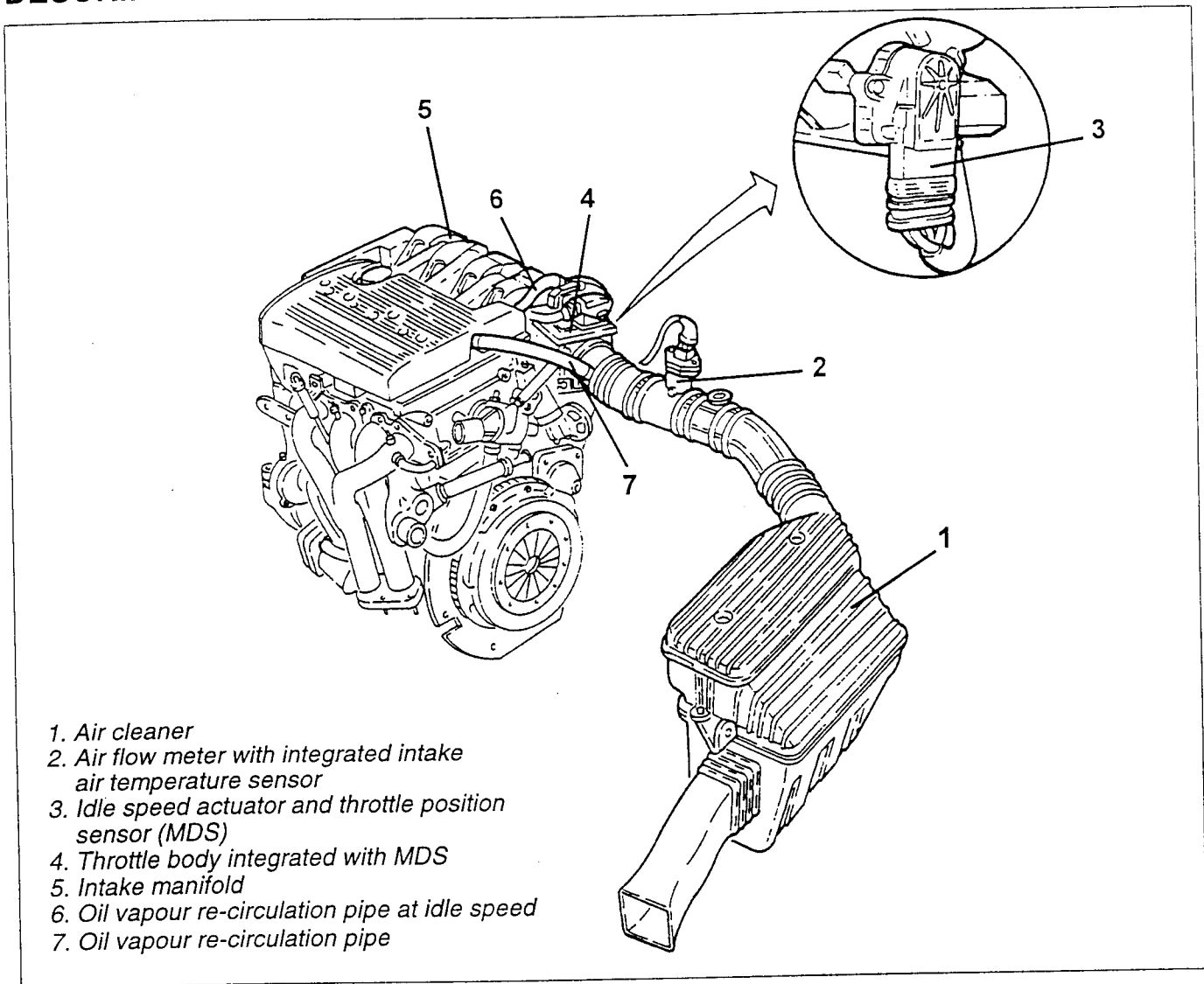
In the other engine operating conditions, the control unit chooses the most suitable configuration to optimise performance, consumption and emission rates.



For all the other operating logics, refer to the instructions for the 1747 T.S. 16V and 1970 T.S. 16V engines.



## DESCRIPTION OF AIR SUPPLY AND OIL VAPOUR RECOVERY SYSTEM



1. Air cleaner
2. Air flow meter with integrated intake air temperature sensor
3. Idle speed actuator and throttle position sensor (MDS)
4. Throttle body integrated with MDS
5. Intake manifold
6. Oil vapour re-circulation pipe at idle speed
7. Oil vapour re-circulation pipe

The air, taken in through a dynamic inlet and filtered by a cartridge element (1), through the corrugated sleeve on which the hot film air flow meter (2) with integrated intake air temperature sensor is fitted, reaches the throttle body integrated with MDS. The latter, controlled by the accelerator cable, adjusts the amount of air in the intake manifold.

The throttle body integrates the idle speed actuator and throttle position sensor which are controlled directly by the injection control unit.

The fuel vapours (see specific paragraph) and oil vapours flow to the air supply system.

The oil vapours are developed when the engine is running and gather in the cylinder head from where the condensed oil falls back into the crankcase, while the remaining vapours are sent to the intake through two pipes.

When the engine is running at idle speed, the oil vapours are ducted to the throttle body through the special pipe (8). At higher loads, the vapours are sent upstream of the throttle valve through a connection pipe (9) to the corrugated sleeve and are then burnt in the engine.

**INTAKE MANIFOLD**

The intake manifold is made of plastic and differs from the one fitted on the 1747 T.S. 16V and 1970 T.S. 16V engines only in the fact that it does not have the control of the manifolds with variable geometry.

**REMOVAL/REFITTING**

Refer to the instructions given for the 1747 T.S. 16V and 1970 T.S. 16V engines, with the following differences:

- do not disconnect the electrical connection of the modular intake manifold control actuator (not present)
- do not remove the front section of the exhaust pipe and manifold support bracket (not present)
- free the cables from the clamp under the intake manifold during removal.

## GENERAL DESCRIPTION

Bosch Motronic M1.5.5 is an electronic system with the following integrated functions:

- induced discharge digital electronic ignition
- static distribution
- timed sequenced electronic injection (1 - 3 - 4 - 2).

When the engine is idling, the unit controls:

- the instant of ignition
- the air intake

thus ensuring the engine is running regularly regardless of the environment conditions or applied loads.

The control unit handles injection ensuring that the stoichiometric ratio (i.e. air/fuel ratio) is constantly optimal.

The system functions are, essentially, the following:

- injection timing
- spark advance control
- cold start control
- acceleration enrichment control
- release phase fuel cut-off
- idling control and handling
- maximum rev limitation
- exhaust control - lambda sensor
- cylinder position acknowledgement
- fuel fume re-circulation
- air conditioner connection (where fitted)
- Alfa Romeo CODE (Immobilizer) ECU connection
- system self-adjustment
- self-test
- cooler fan control.

## INJECTION SYSTEM

The essential air-fuel mixing conditions for the correct operation of controlled ignition engines are:

- the air/fuel ratio must be appropriately "dosed" and kept as close as possible to the stoichiometric value to ensure fast combustion and avoid unnecessary fuel consumption
- the mix must be "homogenous" i.e. must consist of petrol fumes spread as finely and evenly as possible in the air.

For optimal dosing, the ECU processes electric signals transmitted from:

- the intake air flow meter with integrated temperature sensor, signalling the exact amount of intake air
- the rev sensor, which generates an alternating single phase signal indicating the engine revolution frequency
- the throttle position potentiometer (integrated in the constant idle actuator), indicating minimum, partial and full loads
- the lambda sensor, defining the amount of oxygen contained in the exhaust gas.

## IGNITION SYSTEM

This is a static inductive discharge ignition system (i.e. without high voltage distributor) with power modules located inside the injection ECU.

The system consists of a signal coil for each for each spark plug (MONO-COIL). The advantages of this solution are:

- lower electric overload;
- constant discharge on each spark plug.

A map, containing the sequence of optimal spark advance values (for cylinder in explosion stroke) that the engine can adopt according to the required ratio or load, is stored in the ECU memory.

The ECU corrects the spark advance mainly on the basis of the following information:

- engine coolant temperature
- inlet air temperature
- knock
- throttle position.

The ECU processes the electric signals from the following devices and pilots the mono-coil:

- the intake air flow meter with integrated temperature sensor, signalling the exact amount of intake air
- the rev sensor, which generates an alternating single phase signal indicating the engine revolution frequency
- knock sensor (on the rear part of the crankcase between cylinders 2° and 3°) to acknowledge which cylinder is exploding and consequently correct spark advance
- the throttle position potentiometer (integrated in the constant idle actuator), indicating minimum, partial and full loads.

## INJECTION SYSTEM OPERATING LOGIC

### System self-adjustment

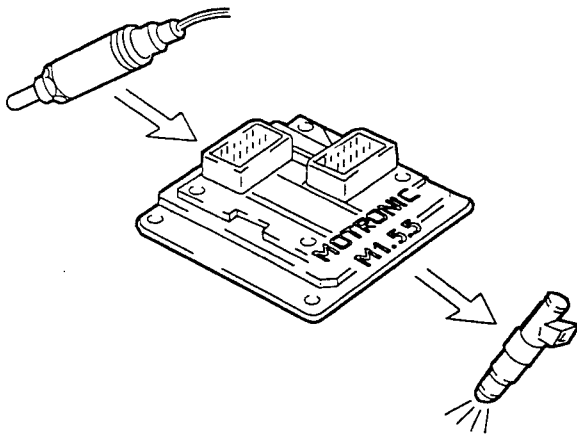
The ECU is equipped with a self-adjusting function with the purpose of acknowledging changes due to time and ageing in the engine and in its components. These changes are saved in the ECU memory as modifications to the basic map.

The purpose is to adjust the system operation to the progressive alterations of the engine and the engine components with respect to new units.

The self-adjustment function also compensates for the inevitable diversity between spare parts (due to manufacturing tolerance rates) which may be changed in time.

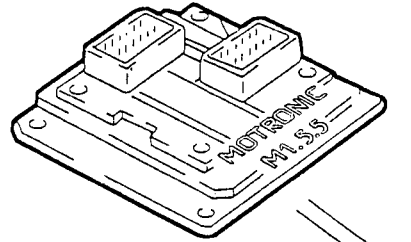
The exhaust gas analysis ECU changes the basic map with respect to new engines.

The self-adapting parameters are not deleted when the battery is disconnected.



- recovery

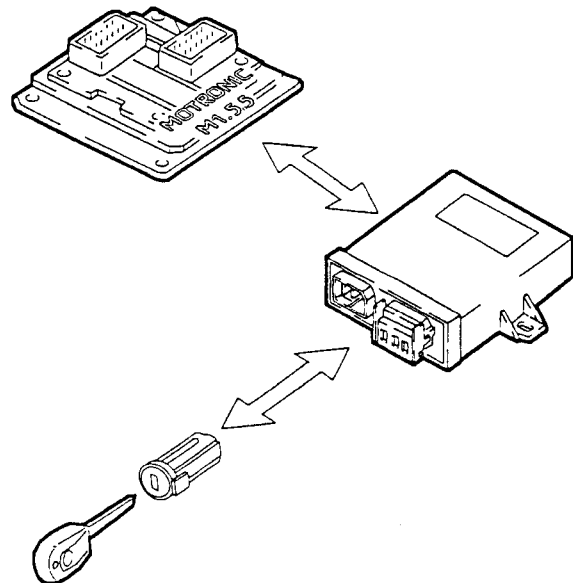
- the ECU defines the type of recovery according to the faulty component
- recovery parameters are not handled by faulty components.



### Alfa Romeo CODE acknowledgement

When the ECU receives a signal indicating the ignition key is turned to "MAR", it dialogues with the Alfa Romeo CODE ECU and enables engine ignition.

The communication is performed along a two-way dedicated diagnostic serial line connecting the two ECU's.



### Self-test

The ECU self-test function checks the signals from each sensor and compares them to the thresholds:

- faults signalled during ignition

- warning light on for 4 seconds indicates the test is being run
- warning light off after 4 seconds indicates there are no faulty components which could alter pollution parameters
- warning light on after 4 seconds indicates there is a fault.

- faults signalled during operation

- warning light on indicates a fault
- warning light off indicates there are no faulty components which could alter pollution parameters.

### Cold starting control

Under cold starting conditions the following occur:

- natural impoverishment of the mixture (due to poor swirl of the fuel particles at low temperature)
- low fuel evaporation
- condensation of the fuel on the inner walls of the intake manifold
- higher viscosity of the lubricating oil.

The control unit detects this condition and corrects the injection time on the basis of the:

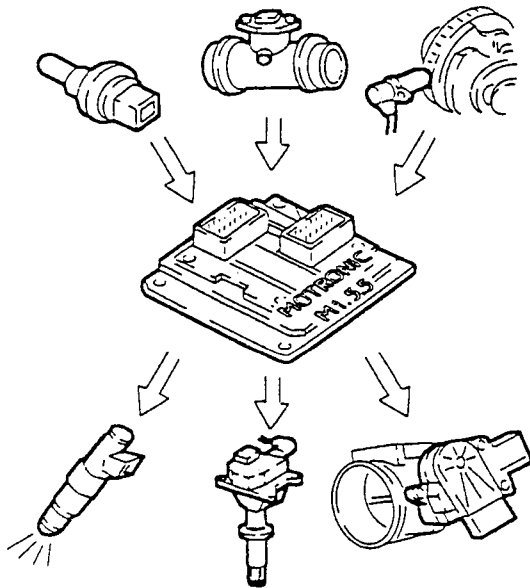
- coolant fluid temperature
- intake air temperature
- battery voltage
- engine rpm.

The spark advance depends only on the rpm and on the engine coolant fluid temperature.

During starting the control unit commands a first, simultaneous injection for all the injectors (full-group injection) and, after detecting the stroke of the cylinders, it starts normal, timed, sequential operation.

During the engine warming phase, the control unit governs the idle speed actuator to adjust the amount of air needed to ensure the engine self-supporting speed.

The rotation speed is decreased proportionately with the increasing engine temperature until obtaining the nominal rating when the engine reaches normal operating temperature.

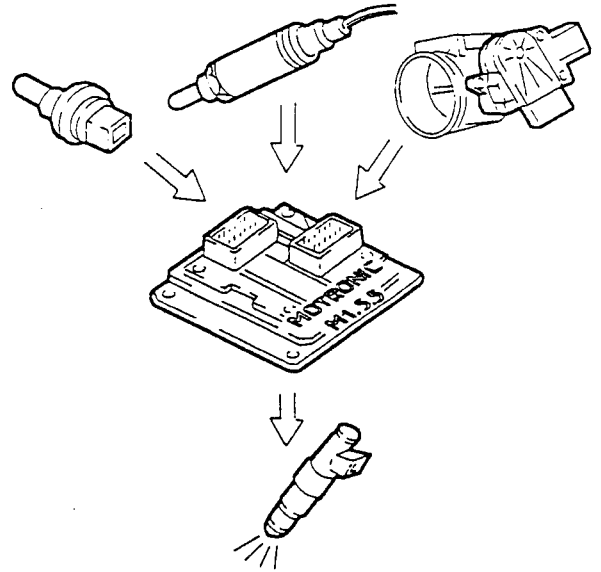


### Combustion control - lambda sensor

With the engine in the following conditions:

- idle speed
- medium load
- temperature > 30°C

with a special integrator, the control unit processes the lambda sensor signal and determines the injector opening time.



### Timing variator control and modular intake manifold

To optimise the amount of air taken in by the engine, the control unit controls:

- intake timing on two angular positions
- the geometry of the intake manifolds on two lengths.

At maximum torque the control unit sets the "open" phase:

- cam advanced by 25° of the engine
- intake box long manifolds.

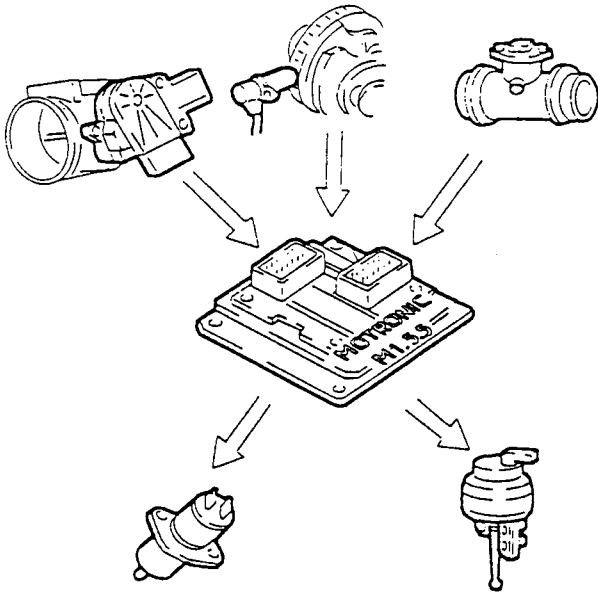
At full power the control unit sets the "closed" phase:

- cam in normal position
- intake box short manifolds.

At idle speed the control unit sets the "closed" phase:

- cam in normal position
- intake box short manifolds.

In the other engine operating conditions, the control unit chooses the most suitable configuration to optimise performance - consumption - emissions. During deceleration the box intake ducts are always "short".



### Pinging control

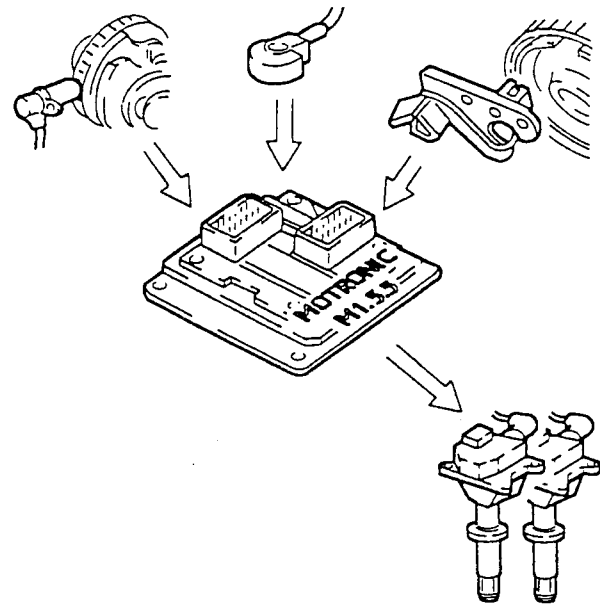
The control unit detects the presence of pinging by processing the signal leading from the corresponding sensor. The control unit continuously compares the signals from the sensor with a threshold value, which is in turn continuously updated, to take account of the engine background noise and engine ageing.

This way the control unit is able to detect the presence of pinging, (or incipient pinging) and reduces the spark advance (in steps of  $3^\circ$  up to a maximum of  $6^\circ$ ) until pinging ceases.

The advance is then gradually restored to the base value (in  $0.8^\circ$  steps).

During acceleration, a higher threshold is used to take account of the higher engine noise in this condition.

The pinging control logic also has a self-adapting function which any continuously repeated advance reductions in order to adapt the map to the different engine conditions.

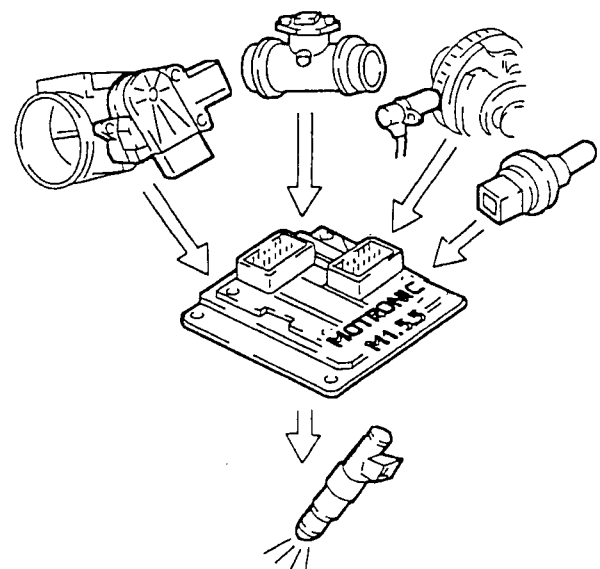


### Enrichment control during acceleration

If during the request for acceleration the change in the air flow meter signal exceeds a pre-defined threshold, the control unit increases injection (injection time) to rapidly reach the required engine speed.

Recovery:

- the control unit replaces the signal leading from the faulty air flow meter with the throttle potentiometer signal.



### Fuel cut-off during release

When the accelerator pedal is released and the engine rating exceeds a specific pre-set value, the ECU:

- cuts off injector power
- returns power to the injectors at 1300 ± 1500 rpm.

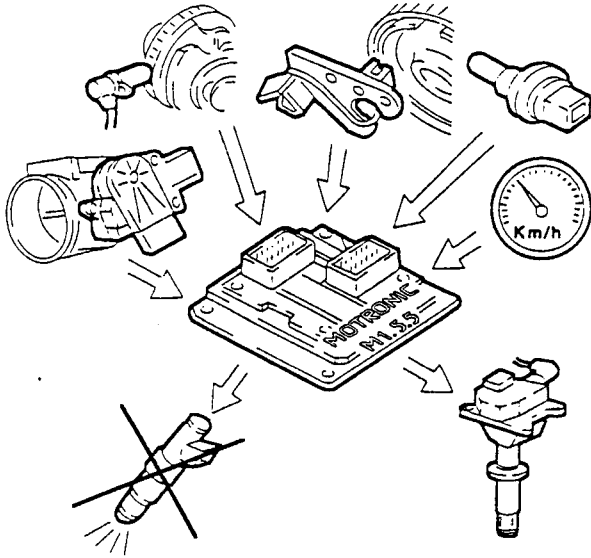
When the throttle is closed and the engine rating is 1700 rpm, the ECU inhibits injector opening.

Without fuel supply, the rating decreases more or less rapidly according to the vehicle running conditions. Before idle rating is reached, the revolution decrease is checked.

If rating is higher than a pre-set value, fuel supply is partially reactivated to take the engine to idle rating "smoothly".

The fuel supply and fuel cut-off thresholds vary according to the following:

- engine coolant temperature
- vehicle speed
- rpm.

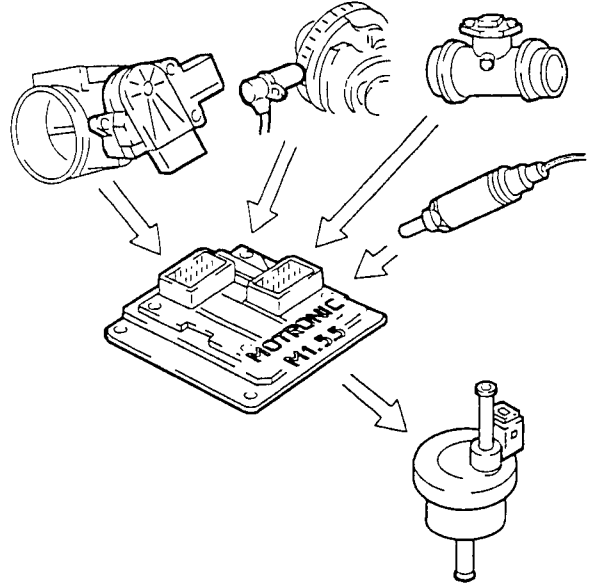


### Fuel fume re-circulation

Fuel fumes (pollutants) are collected in an active carbon filter (canister) and sent through the intake manifolds to be burnt.

This is controlled by means of a solenoid valve controlled by the ECU only when engine running conditions allow.

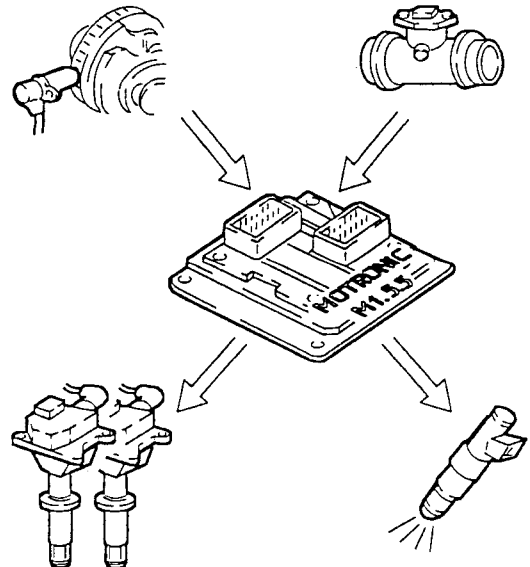
The ECU, in fact, compensates the amount of supplementary fuel by reducing feed to the injectors.



### Maximum revolution limiter

According to the following engine ratings:

- over 6800 rpm the ECU reduces injection time
- over 7000 rpm the ECU cuts injector feeding
- under 6800 rpm the ECU pilots the injectors again.



### Fuel pump supply control

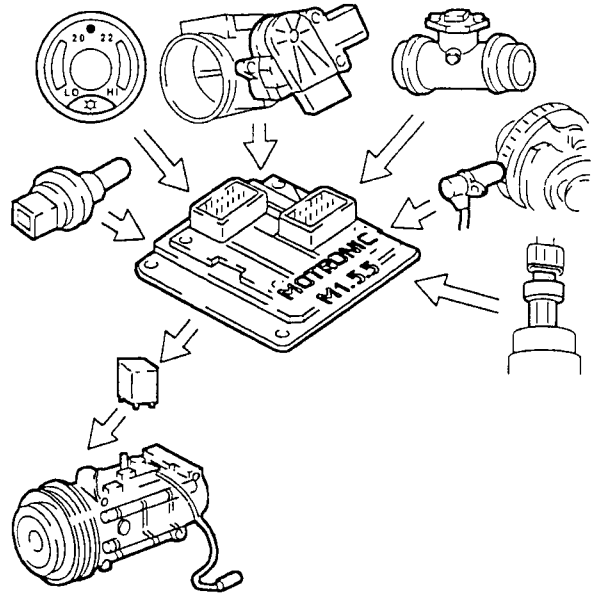
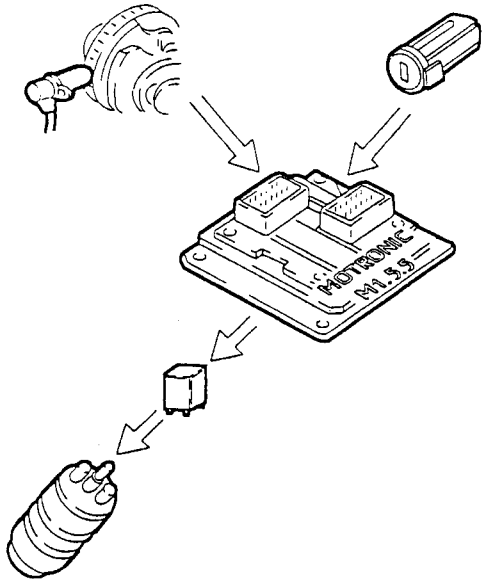
The ECU operates the fuel pump:

- for 0.8 seconds when the key turned to MAR
- when the key turned to AVV and engine rating is > 22.8 rpm.

The ECU cuts power to the pump:

- when the key turned to STOP
- when the engine rating is < 22.8 rpm.

The "no return" fuel supply system has a constant petrol pressure of 3.5 bars.



### Cylinder position acknowledgement

During each engine cycle, the ECU acknowledges the cylinder in explosion stroke:

- it controls the injection and ignition sequence to the correct cylinder.

With no timing sensor signal, the ECU:

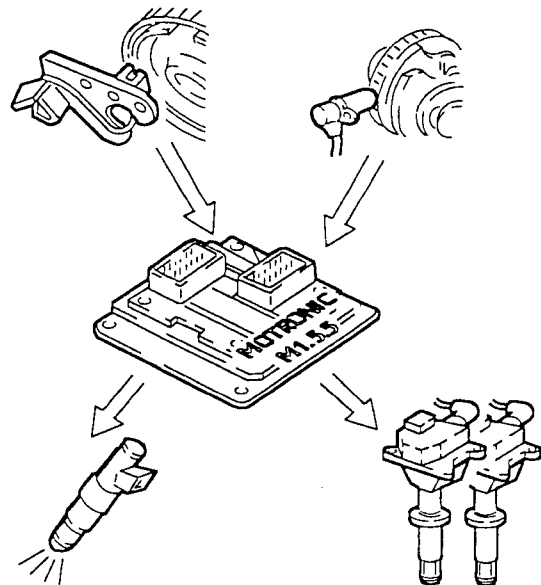
- deactivates the knock sensor
- if the vehicle is moving, it keeps timed injection
- if the vehicle is standing, it controls a simultaneous operation of cylinders 1-4 and 2-3.

### Climate control system connection

When the compressor is started and power demand is increased, the ECU pilots the idling actuator to increase air intake.

When the demand for power is high, the ECU temporarily cuts off power supply to the compressor as follows:

- over 6500 rpm, power to the compressor is cut off
- engine temperature > 112°C power to the compressor is cut off.

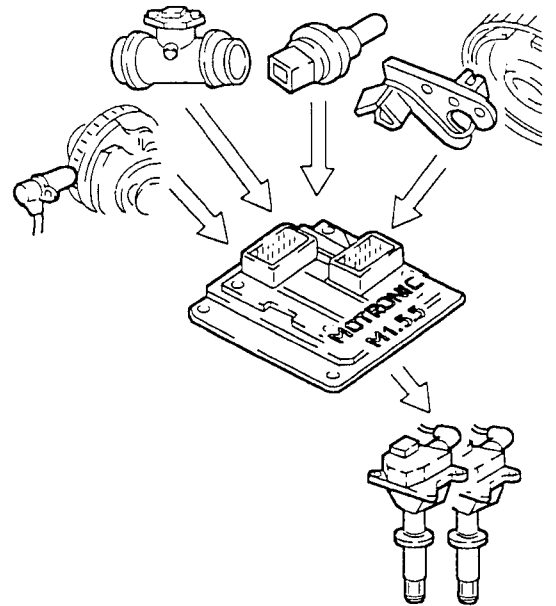
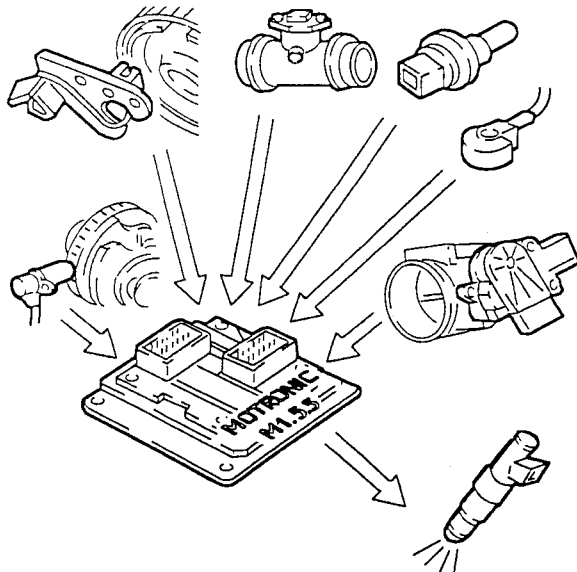


### Injection time control

The ECU controls the injection opening time with extreme speed and accuracy according to the following:

- engine load (rpm and air intake)
- battery voltage
- engine coolant temperature.

Injection is sequential and timed for each cylinder. "Injection start" is optimised. "Injection end" is constant.



### Idle control/handling

Idle status is acknowledged by the ECU via the potentiometer integrated in the idle actuator located on the throttle (valve axis).

The ECU controls idling ratio ( $850 \pm 30$  rpm) according to the devices in use by:

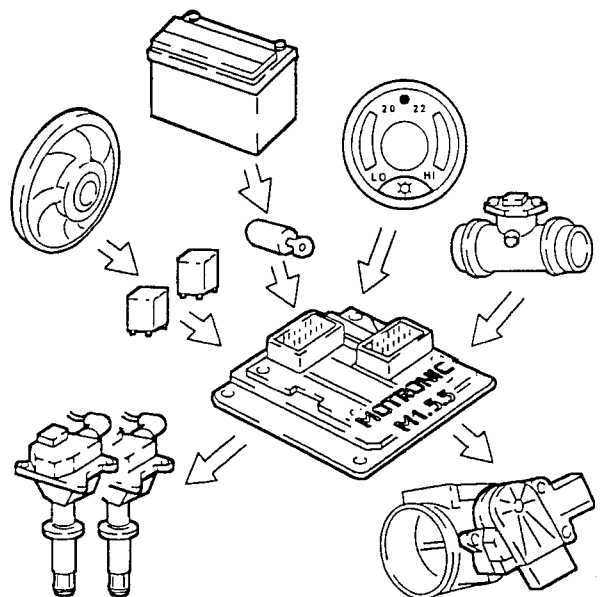
- changing spark advance
- piloting the throttle position ( $0^\circ \div 15^\circ$ ), by means of the idling actuator, to control air intake.

### Spark advance

The ECU can compute, thanks to a map saved in its memory, spark advance on the basis of the following:

- engine load (minimum, partial, full, according to rpm and air intake)
- inlet air temperature
- engine coolant temperature.

Spark can be postponed only on the cylinder requiring it which is recognised by means of the values registered by the rev and timing sensors.





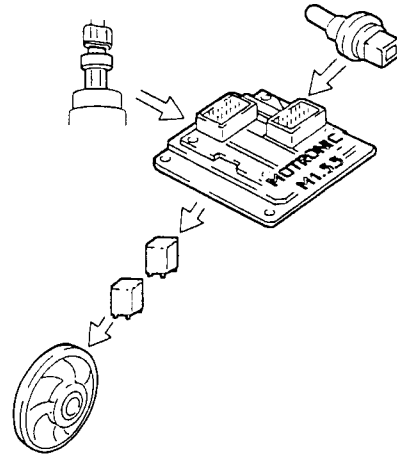
### Radiator cooling fan

According to the coolant temperature, the ECU controls the fan:

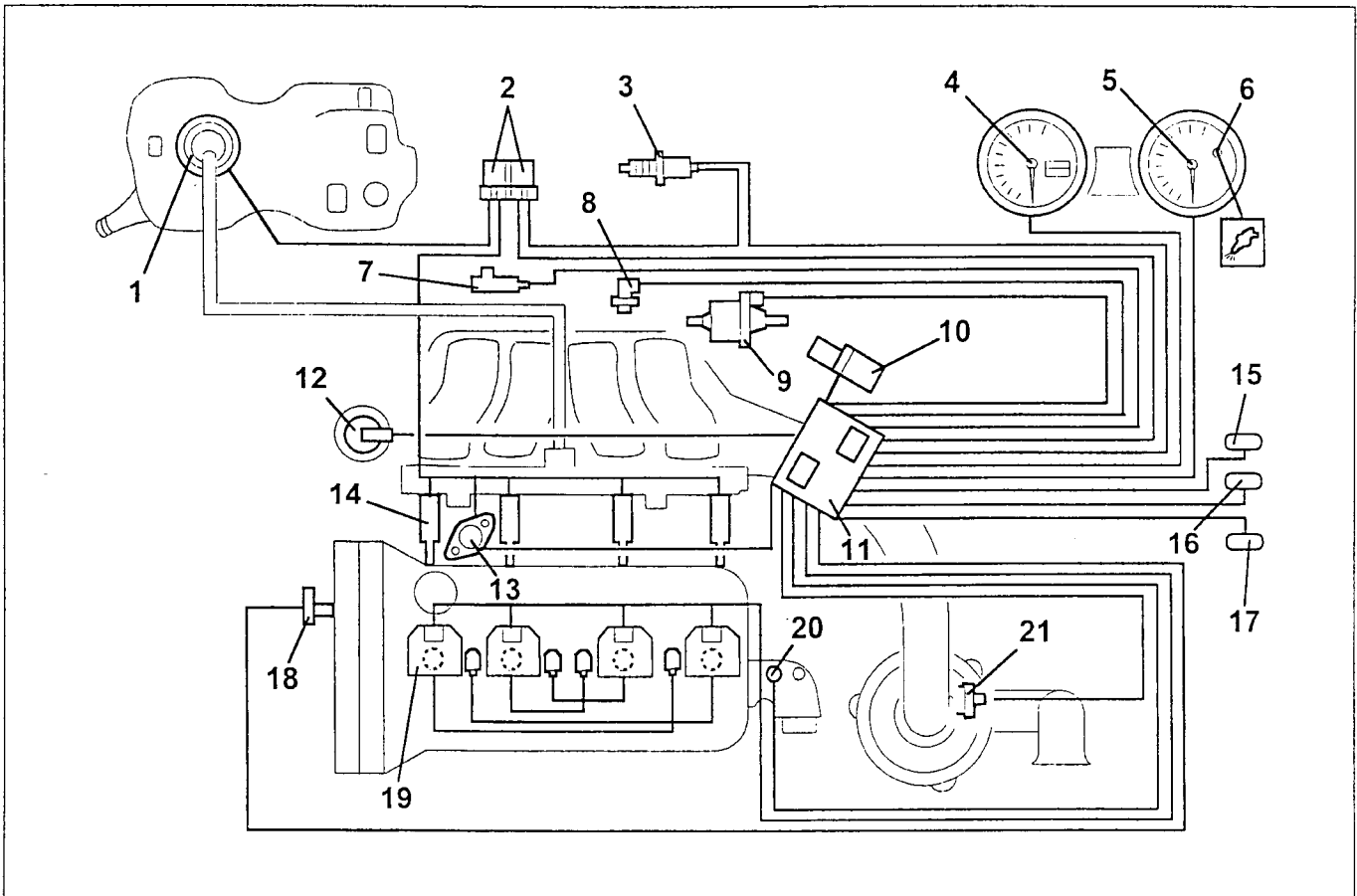
- 1st speed at 98°C
- 2nd speed at 101°C

An additional check (quadrinary signal), starts the fan at the 1st or 2nd speed according to the cooling gas pressure when the climate control system is on.

If no coolant temperature signal is received, the ECU runs a recovery function and operates the fan at 2nd speed until the error is solved.

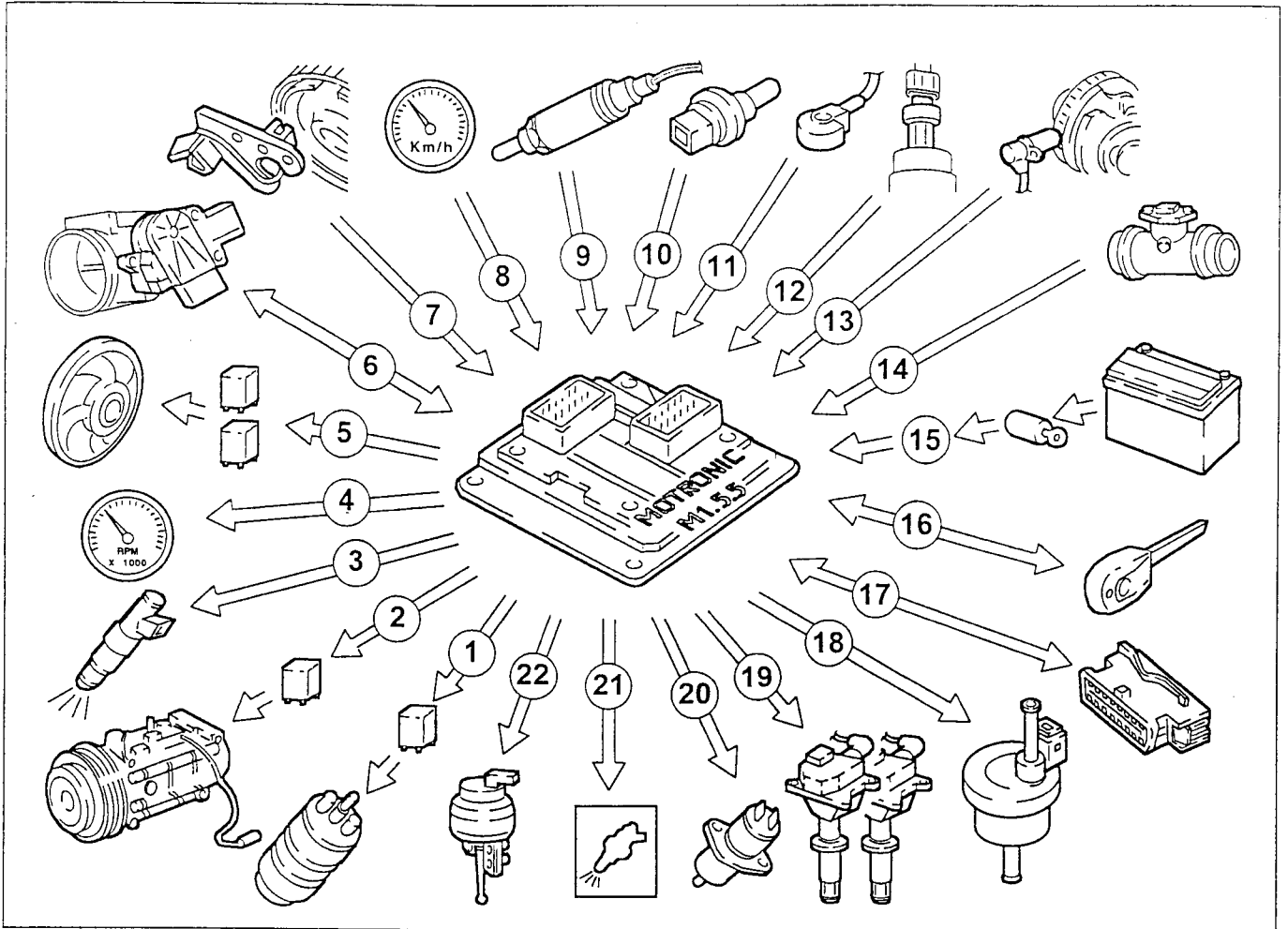


### M1.5.5 IGNITION - INJECTION SYSTEM COMPONENTS



- |                                                        |                                                           |
|--------------------------------------------------------|-----------------------------------------------------------|
| 1. Fuel pump                                           | 12. Modular intake manifold solenoid valve                |
| 2. Relays                                              | 13. Timing variator                                       |
| 3. Lambda sensor                                       | 14. Injectors                                             |
| 4. Speedometer                                         | 15. Climate control connector                             |
| 5. Rev counter                                         | 16. Diagnostic connector                                  |
| 6. Check Engine warning light                          | 17. Alfa Romeo CODE connector                             |
| 7. Knock sensor                                        | 18. Timing sensor                                         |
| 8. Rev sensor                                          | 19. Ignition coils                                        |
| 9. Fuel fume re-circulation solenoid valve             | 20. Engine coolant temperature sensor                     |
| 10. Throttle position sensor (MDS) and idling actuator | 21. Air flow meter with integrated air temperature sensor |
| 11. Injection-ignition ECU                             |                                                           |

M1.5.5 IGNITION - INJECTION SYSTEM COMPONENTS



- |                                                       |                                                           |
|-------------------------------------------------------|-----------------------------------------------------------|
| 1. Fuel pump                                          | 13. Rev sensor                                            |
| 2. Air conditioner compressor                         | 14. Air flow meter with integrated air temperature sensor |
| 3. Injectors                                          | 15. Battery                                               |
| 4. Rev counter                                        | 16. Alfa Romeo CODE                                       |
| 5. Fan                                                | 17. Diagnostic socket                                     |
| 6. Throttle position sensor (MDS) and idling actuator | 18. Fuel fume re-circulation solenoid valve               |
| 7. Timing sensor                                      | 19. Ignition coils                                        |
| 8. Speedometer                                        | 20. Timing variator                                       |
| 9. Lambda sensor                                      | 21. Check Engine warning light                            |
| 10. Engine coolant temperature sensor                 | 22. Modular intake manifold solenoid valve                |
| 11. Knock sensor                                      |                                                           |
| 12. Quadrinary                                        |                                                           |

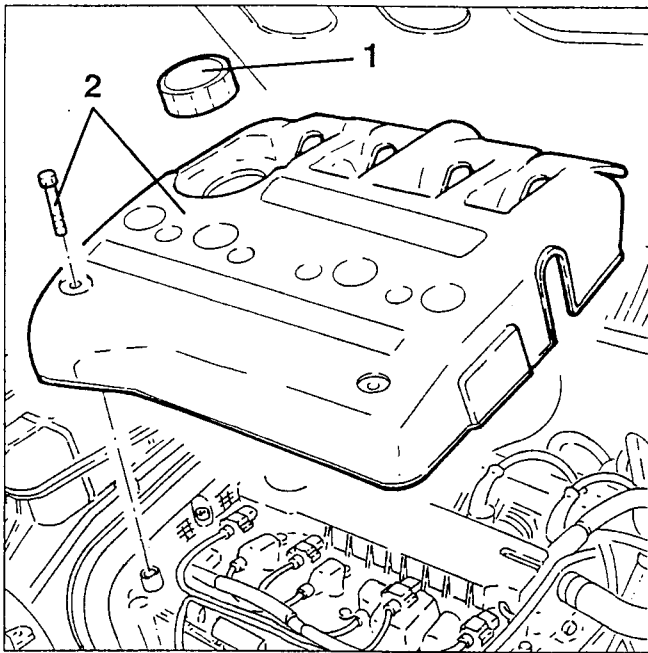
## TIMING VARIATOR ELECTROMAGNET

### REMOVAL/REFITTING

- Disconnect the (-) battery terminal.

1. Remove the engine oil filler cap.

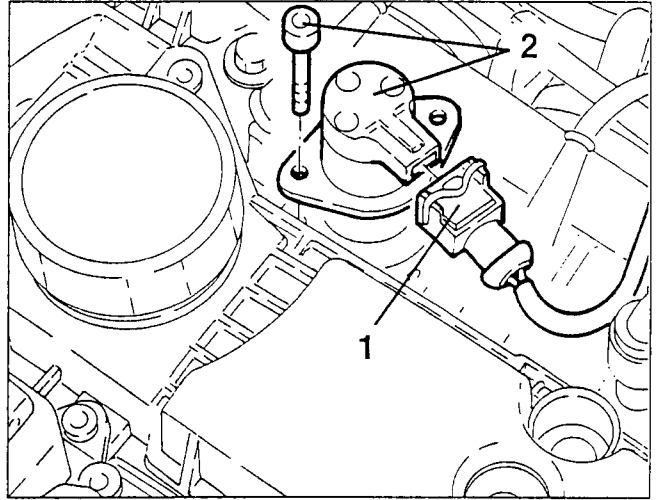
2. Remove the fastening screws and remove the ignition coil cover.



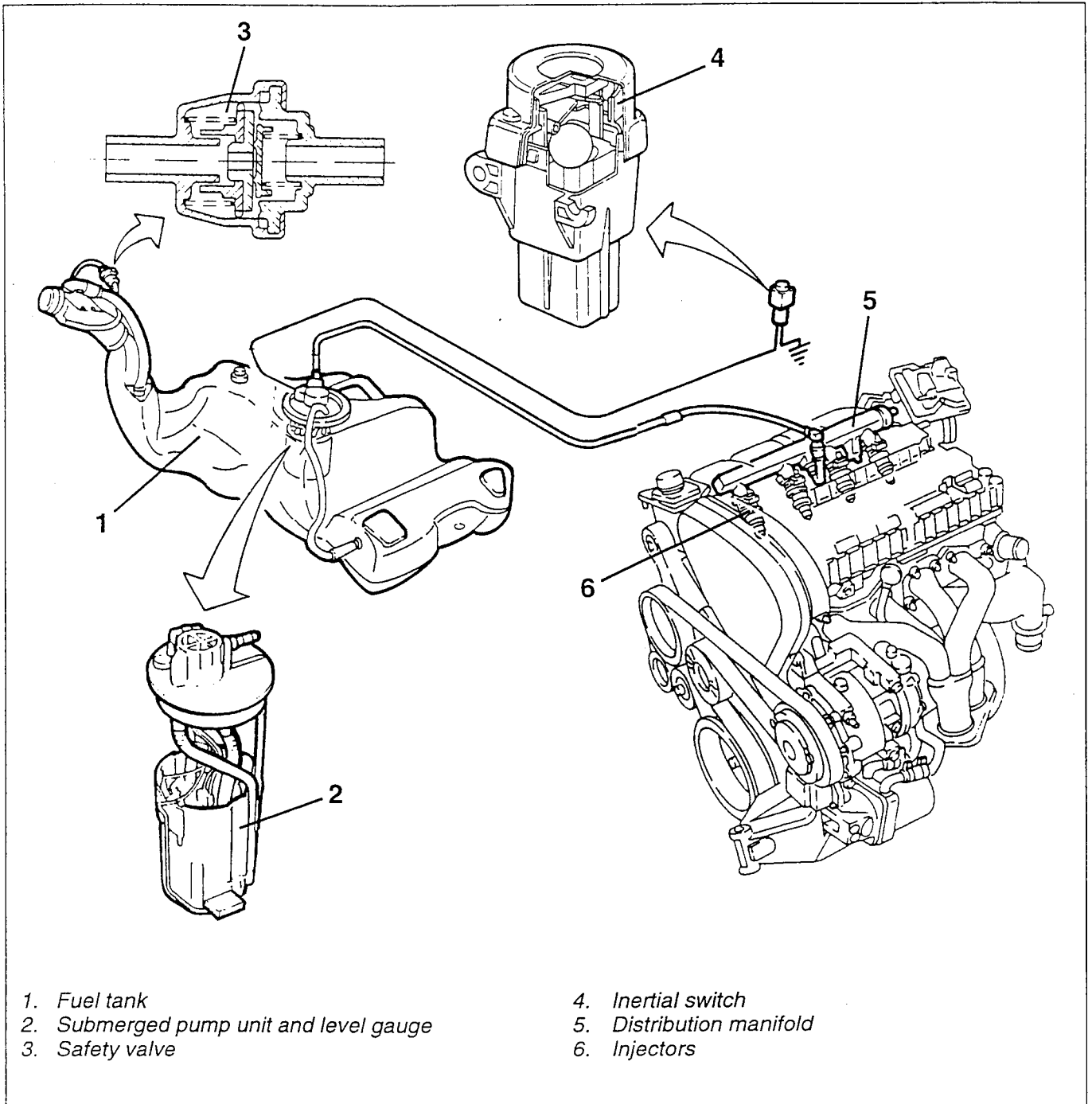
- Refit the engine oil filler cap.

1. Reconnect the electric connection from the timing variator electromagnet.

2. Remove the electromagnet fastening screws and remove the electromagnet.



FUEL FEEDING SYSTEM DESCRIPTION



- 1. Fuel tank
- 2. Submerged pump unit and level gauge
- 3. Safety valve

- 4. Inertial switch
- 5. Distribution manifold
- 6. Injectors

This is a return-less fuel feeding system, i.e. with a single pipe connecting the fuel pump and the engine. This allows:

- to reduce the risk of fire in the event of an accident
- to reduce fuel fume emission in the atmosphere.

The fuel tank located under the body (boot) is made of high mechanical resistance plastic.

The pump is included in a rack which also contains:

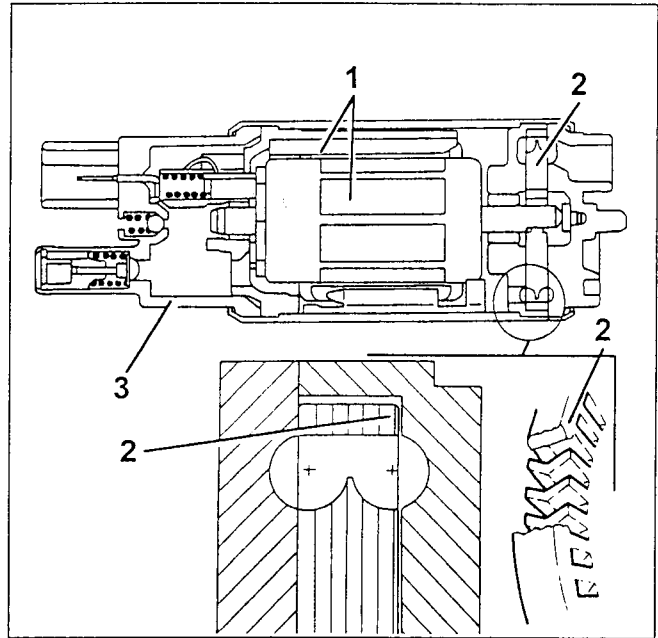
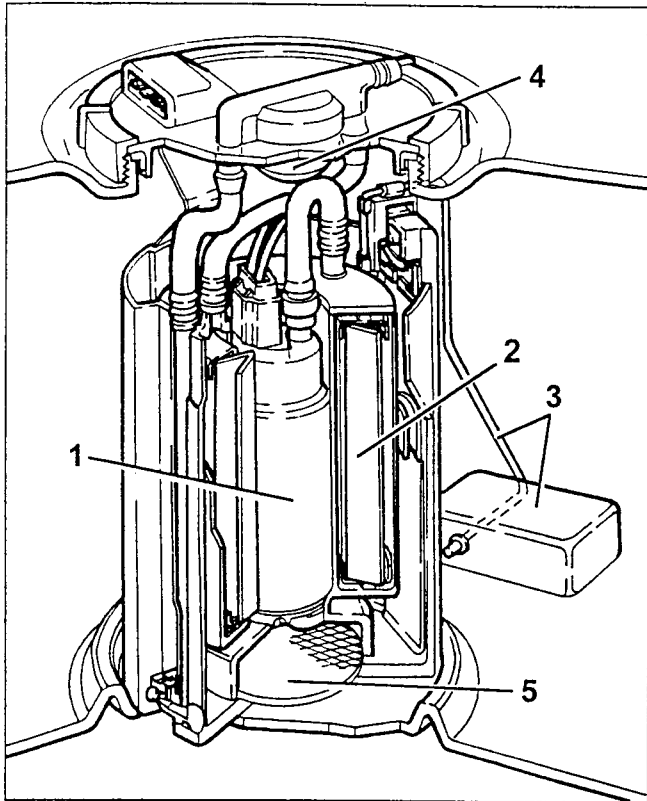
- the fuel pressure regulator
- the fuel level gauge
- the fuel filter.

The system is equipped with an inertia switch which cuts off the fuel pump in the event of an accident.

## SUBMERGED PUMP UNIT AND LEVEL GAUGE

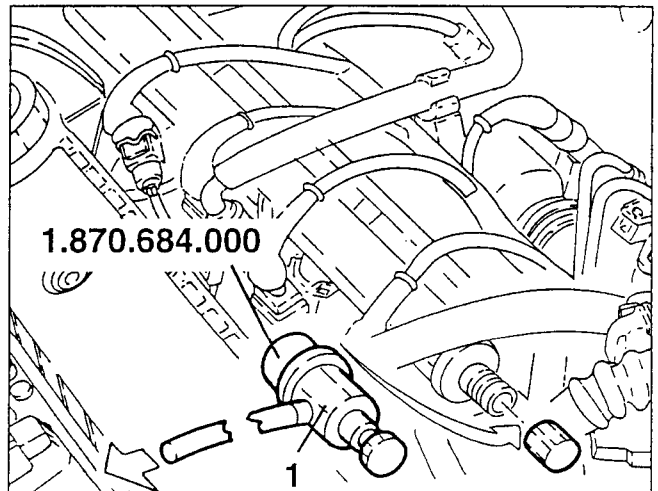
This unit essentially consists of:

- a fuel pump (1)
- a fuel filter (2)
- a floating level gauge (3)
- a membrane pressure regulator (4)
- a net pre-filter (5).



## REMOVAL/REFITTING

- Disconnect the (-) battery terminal.
- 1. Connect tool No. 1.870.684.000 to the distribution manifold bleeder valve and discharge the fuel pressure.



### Fuel pump EKP 13.5

The fuel pump is equipped with a permanent magnet electric motor (1) which controls the pump impeller (2) and a terminal support cover (3) containing the electric and hydraulic connections.

This is a single stage, peripheral flow pump suited to operate in conditions of low voltage and temperature. The advantages of this type of pump with respect to volumetric pumps are:

- reduced weight
- reduced size.

- Tilt the rear seat back forward.
- Lift the boot carpeting.
- 1. Remove the fastening screws and remove the pump cover.
- 2. Disconnect the pump electric connections.

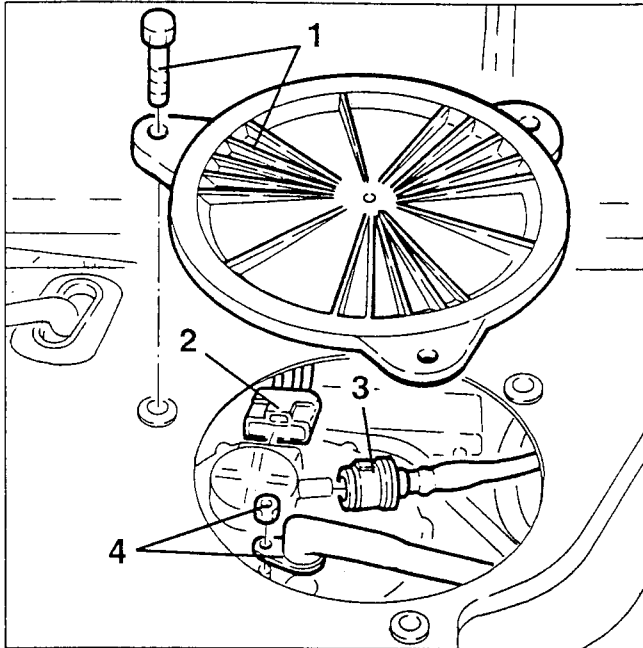


T. S.  
16V

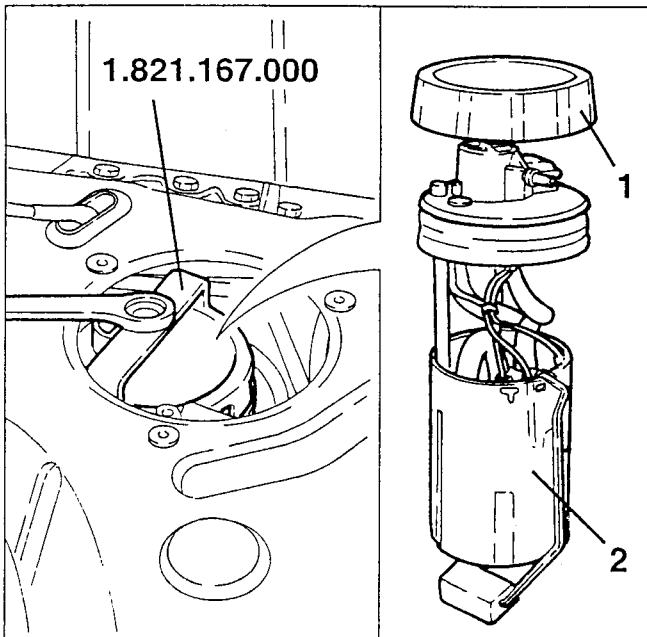


T. S.  
16V

3. Disconnect the fuel delivery manifold to the pump.
4. Remove the fastening nut and disconnect the breather pipe between the upper and lower part of the tank from the pump.



1. Remove the fuel pump nut screw with tool No. 1.821.167.000.
2. Remove the submerged pump – gauge unit and seal.



## INJECTORS

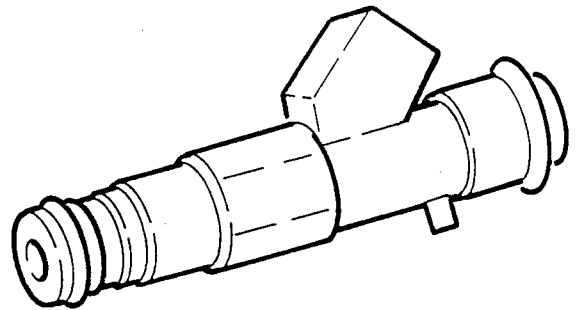
These double jet injectors are installed on the distribution manifold.

They are secured to the distribution manifold by means of safety clips and sealed with O-rings.

The injectors output the appropriate quantity of fuel to the engine.

They are "all or nothing" type devices, i.e. they present two stable stages, either completely open or completely closed.

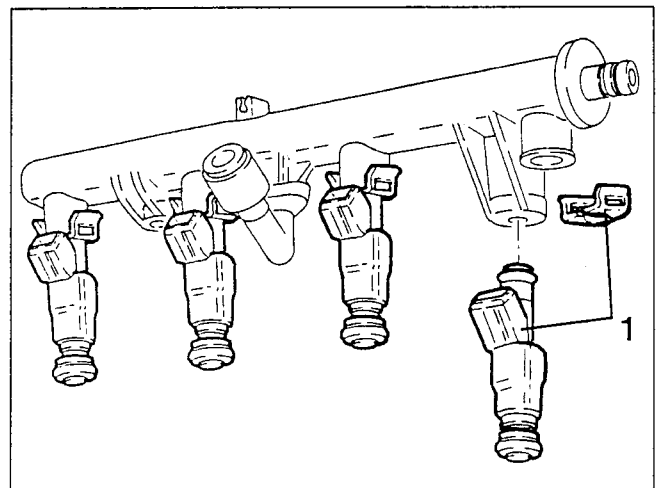
They let fuel flow through when they are open and stop the fuel flow when they are closed.



## REMOVAL/REFITTING

- Remove the fuel distribution manifold (see specific paragraph).

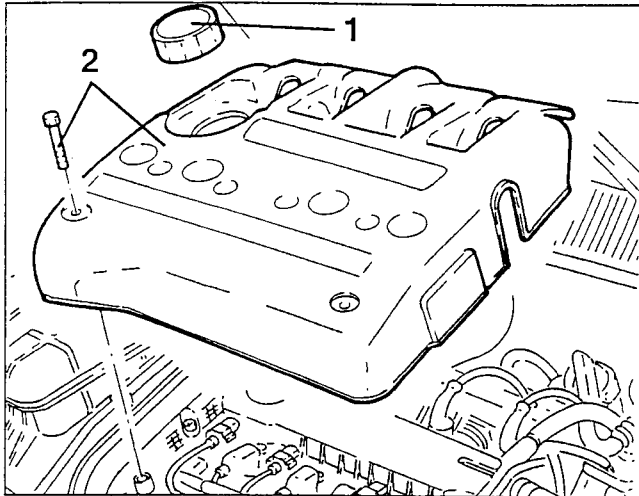
1. On a work bench, remove the safety clips. Remove the injectors from the distribution manifold.



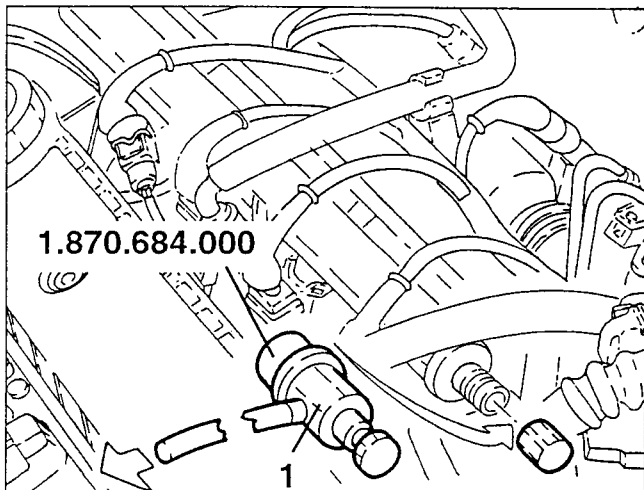
## FUEL DISTRIBUTION MANIFOLD

### REMOVAL/REFITTING

- Disconnect the (-) battery terminal.
- 1. Remove the engine oil filler cap.
- 2. Remove the ignition coil screws and cover.
- Refit the engine oil filler cap.



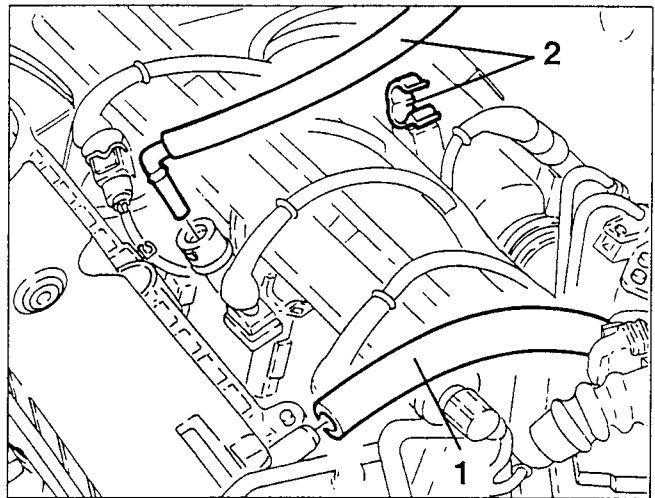
1. Connect tool No. 1.870.684.000 to the distribution manifold bleeder valve and discharge the fuel pressure.



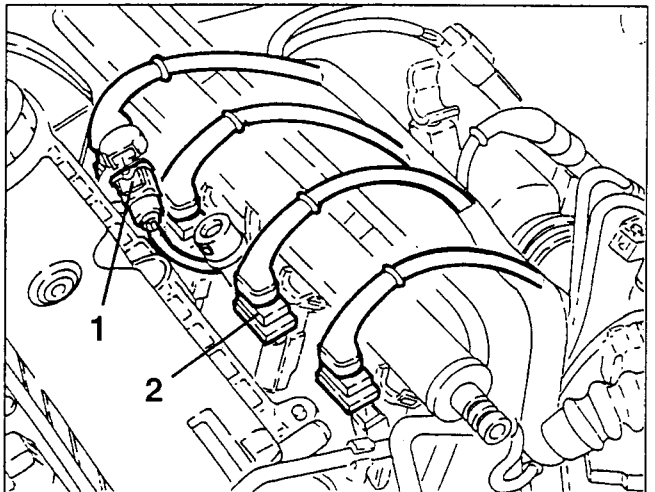
1. Disconnect the oil fume re-circulation pipe from the tappet cover.

**NOTE:** Collect the fuel in a suitable container.

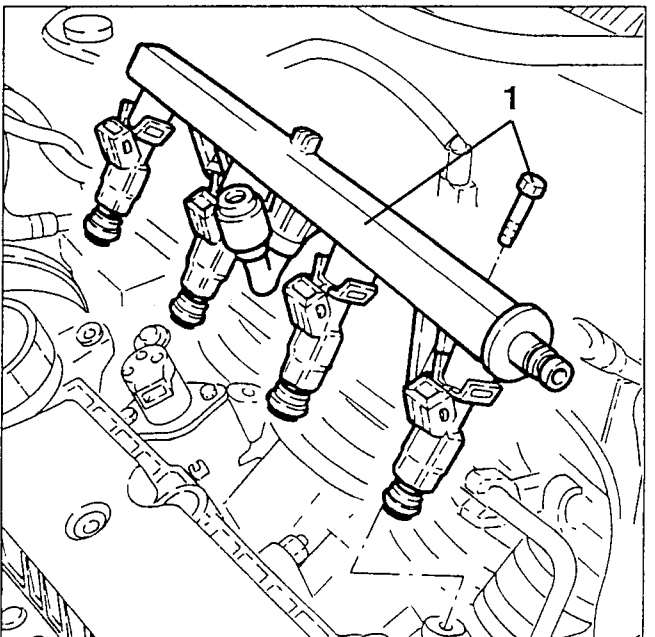
2. Disconnect the delivery pipe from the fuel distribution manifold. Release it from the clip on the modular intake manifold. Shift it to a side.



1. Disconnect the electric connection from the timing variator electromagnet.
2. Disconnect the electric connections from the injectors.



1. Remove the fastening screws and remove the distribution manifold and the injectors.
- If required, remove the safety clips and remove the injectors from the manifold.





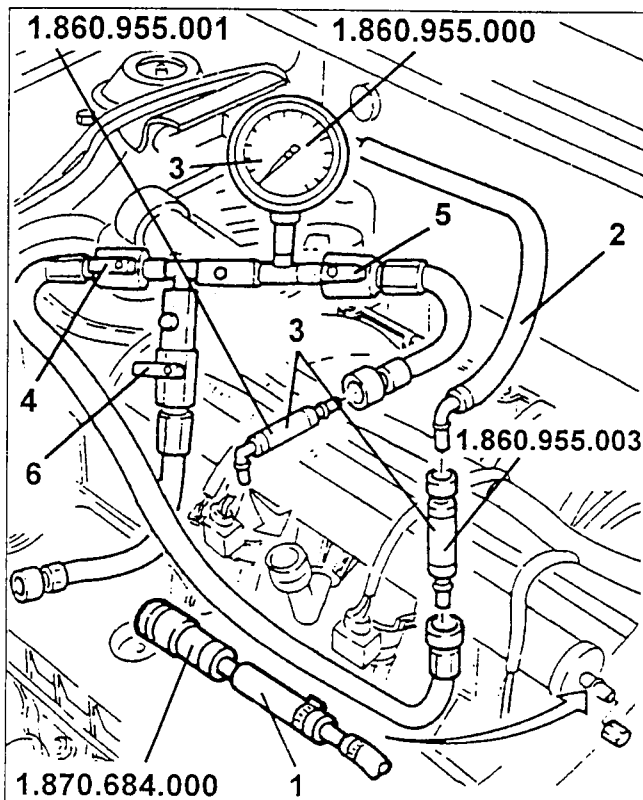
## CHECKING THE PRESSURE AND TIGHTNESS OF THE FUEL CIRCUIT

1. Connect tool no. 1.870.684.000 to the distributor manifold relief valve and relieve the fuel pressure.
2. Disconnect the fuel delivery pipe from the distributor manifold.
3. Assemble couplings no. 1.860.955.003 and no. 1.860.955.001 on pressure gauge no. 1.860.955.000.
- Connect the tool made in this way to the fuel delivery pipe and to the distributor manifold.
4. Open the ball valve.
5. Open the ball valve.
6. Close the engine and at idle speed, check that the fuel pressure is within the specified limits.



Fuel pressure at idle speed

3.3 ÷ 3.7 bar





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T. S.  
16V



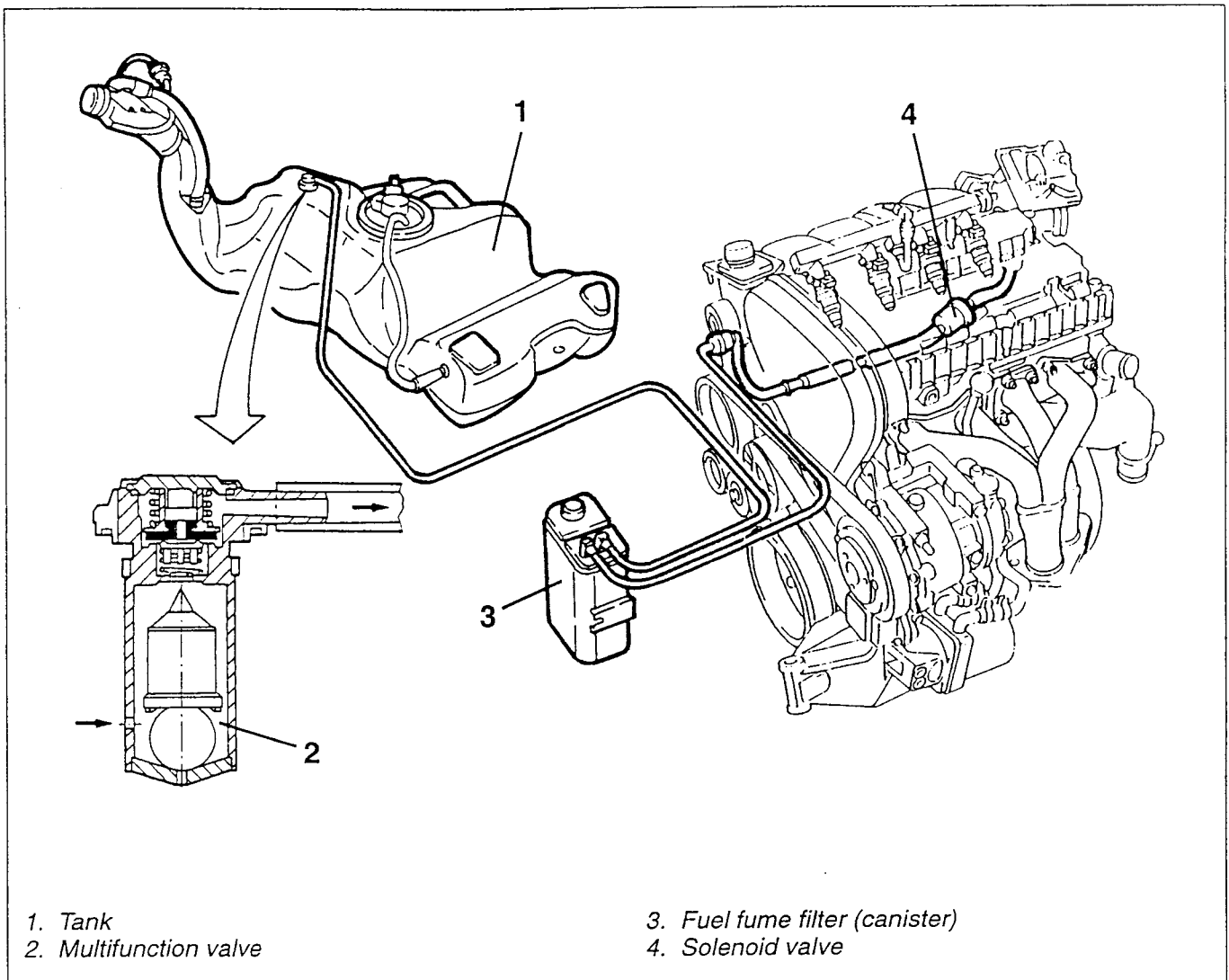
T. S.  
16V

ENGINE  
Fuel supply system **10**

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## FUEL FUME RE-CIRCULATION SYSTEM DESCRIPTION



The fuel in the tank (1) contains a considerable amount of fumes which would pollute the atmosphere if released. The re-circulation system collects these fumes and conveys them to the engine to be burnt. When the fume pressure in the reservoir reaches  $0.038 \pm 0.053$  bar, the multifunctional valve opens (2) and the fumes are conveyed to the fuel fume "canister" (3) via a specific pipe.

The canister absorbs and stores the fumes in an active carbon filter.

A solenoid valve (4) is located between the fuel fume filter and the intake unit. When the valve is not energised, the connection with the intake unit is closed and the fuel fumes are stored in the canister.

In certain load conditions, the Motronic ECU controls the opening of the solenoid valve allowing the intake of the fumes from the canister.

This condition persists also when the lambda sensor detects the decrease of oxygen in exhaust due to excessive presence of fuel in combustion chamber. This fact is signalled to the ECU which reduces the fuel feed to the injectors so that the engine is always fuelled appropriately.

If there are no fuel fumes in the canister and consequently only air is taken in, the lambda sensor detects the condition and signals in increase in oxygen to the ECU.

The ECU closes the solenoid thus closing the connection to the canister and eliminating the air in excess.

## FUEL FUME INTERCEPTOR VALVE

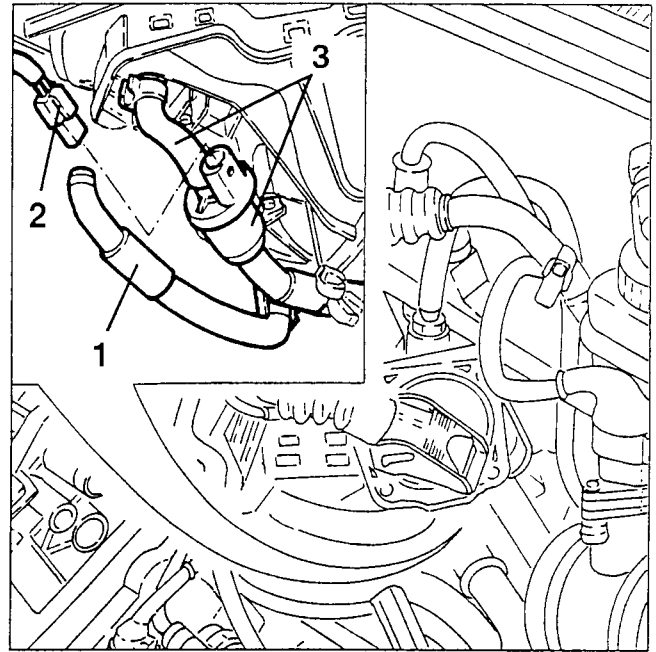
### REMOVAL/REFITTING

- Remove the throttle (see specific paragraph).

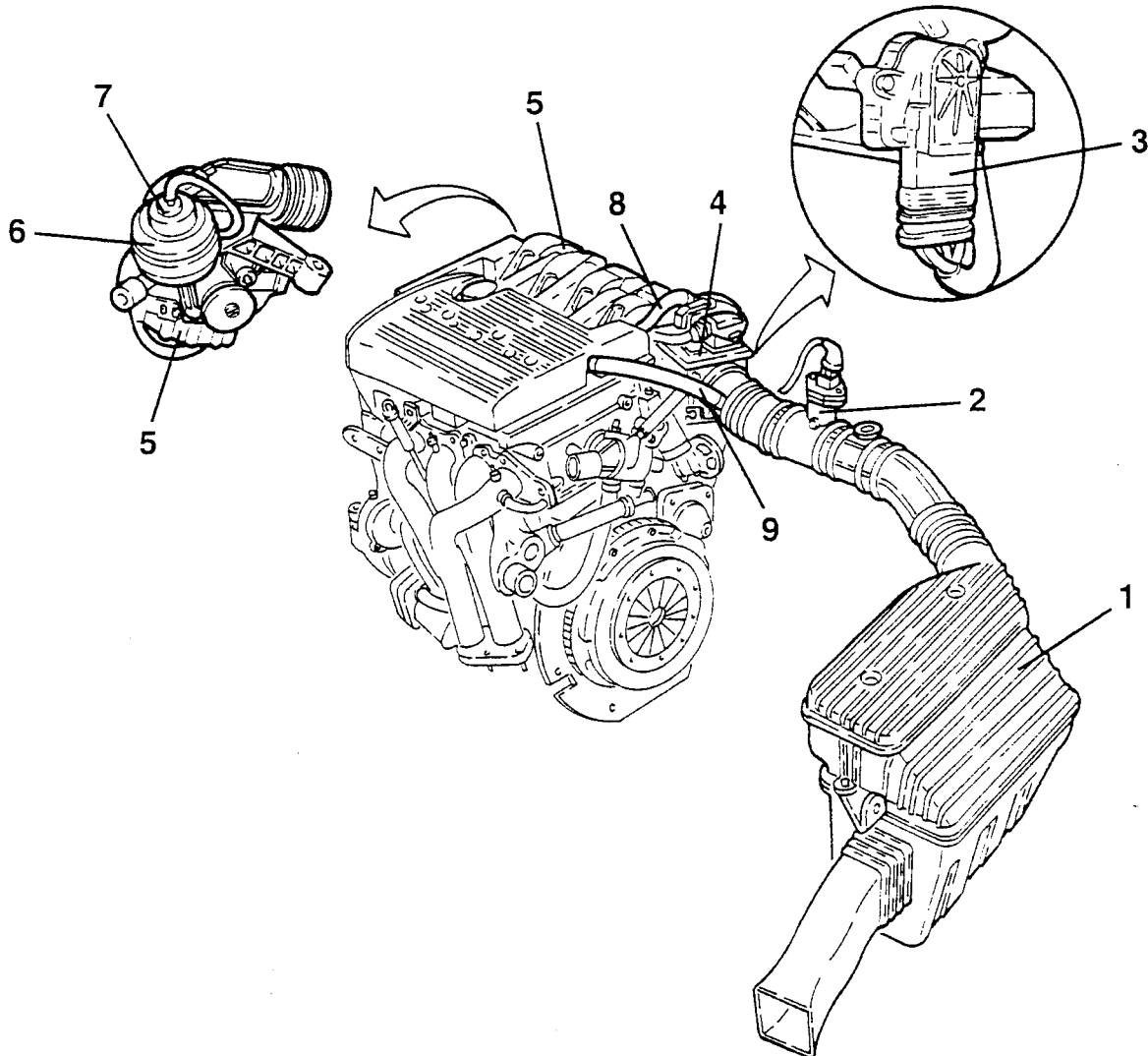
1. Disconnect the pipe from the distribution manifold, as shown in the illustration, to access the fuel fume interceptor valve.

2. Disconnect the electric connections of the fuel fume interceptor valve.

3. Disconnect the pipes and remove the fuel fume interceptor valve removing it from the support rod.



## AIR INTAKE SYSTEM AND OIL FUME RE-CIRCULATION SYSTEM DESCRIPTION



1. Air filter
2. Intake air flow meter with integrated air temperature sensor
3. Idling actuator and throttle position sensor (MDS)
4. Throttle
5. Modular intake manifold

6. Modular intake manifold pneumatic control actuator
7. Modular intake manifold control solenoid valve
8. Idling oil fume re-circulation pipe
9. Oil fume re-circulation pipe

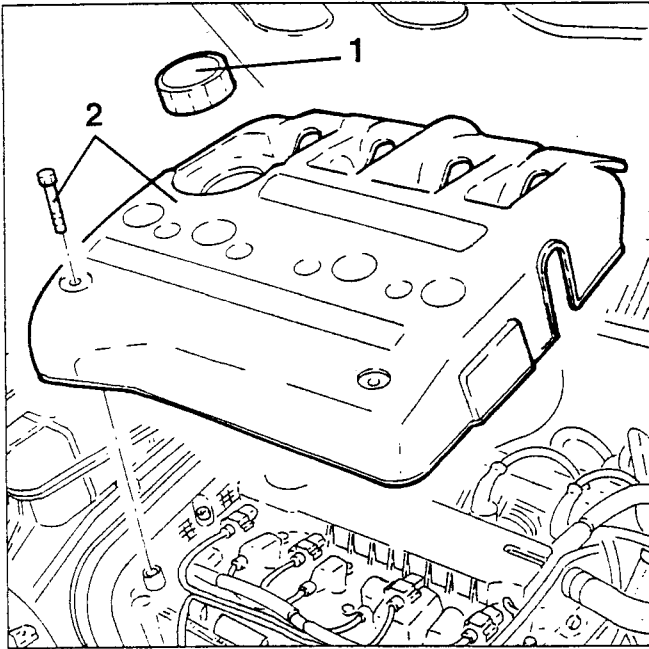
The intake air crosses a dynamic inlet and is filtered by a cartridge (1). It reaches the throttle (4) via a corrugated sleeve on which a hot film flow meter with integrated air intake temperature sensor is located. The throttle is controlled by the accelerator wire and adjusts the amount of intake air in the unit. The idling actuator is located on a side of the throttle. The throttle position sensor (MDS) (3) controlled by the injector ECU and is also located on the throttle. The fuel fumes (see specific paragraph) and the oil fumes are conveyed to the fuel feed system.

Oil fumes develop during engine operation. They are collected in the cylinder head. The condensed oil drips back to the crankcase while the fumes are conveyed to the intake unit via two pipes. When idling, the oil fumes are conveyed to the throttle via the specific pipe (8). At higher loads, the fumes are conveyed upstream with respect to the throttle via a connection pipe (9) to the corrugated sleeve to be burnt in the engine.

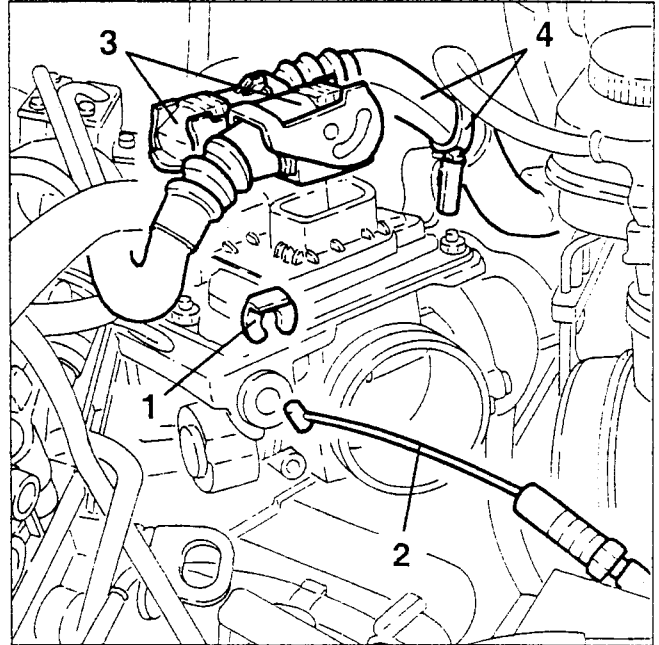
**THROTTLE****REMOVAL/REFITTING**

- Disconnect the (-) battery terminal.

1. Remove the engine oil filler cap.
2. Remove the fastening screws and remove the ignition coil cover.

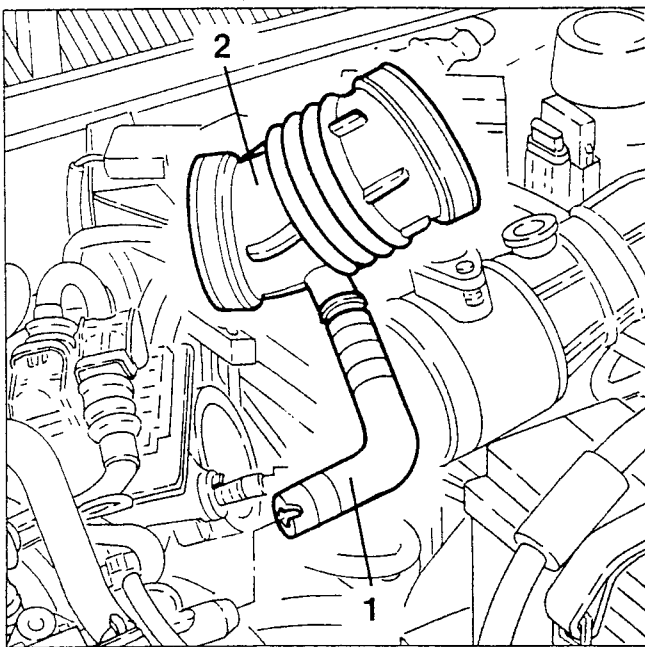


1. Remove the fastener from the accelerator wire from the rod.
2. Release the accelerator wire from the cam on the throttle and shift it.
3. Disconnect the engine ECU electric connections.
4. Release the wiring from the clip on the ECU.

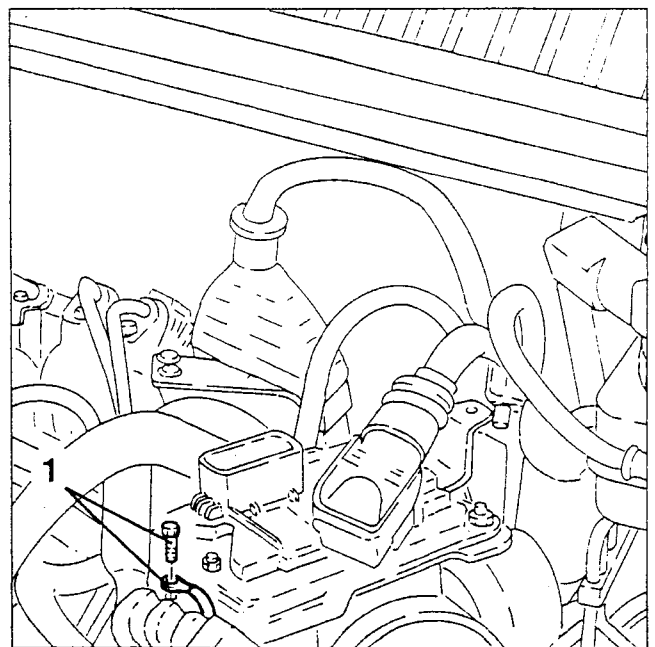


- Refit the engine oil filler cap.

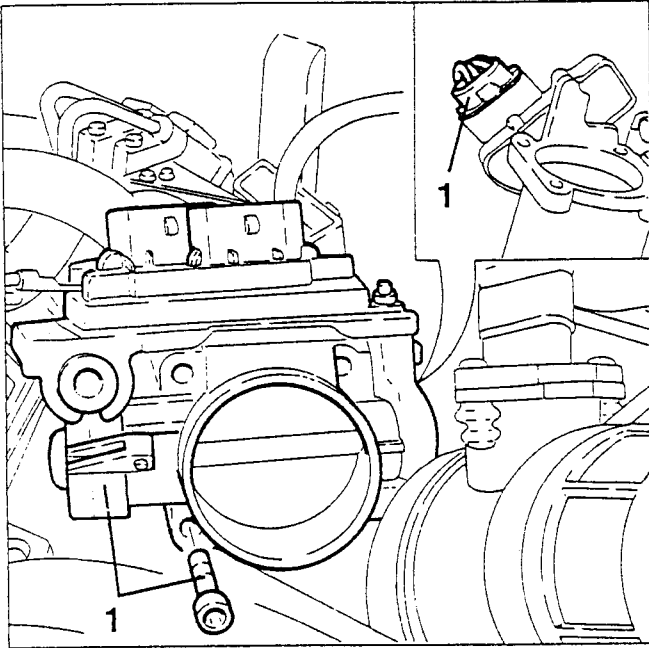
1. Disconnect the oil fume re-circulation pipe from the tappet cover.
2. Disconnect the air flow meter sleeve from the throttle and remove it.



1. Disconnect the earth from the engine ECU support.



1. Remove the fastening screws and remove the throttle, disconnecting the idling actuator electric connection.



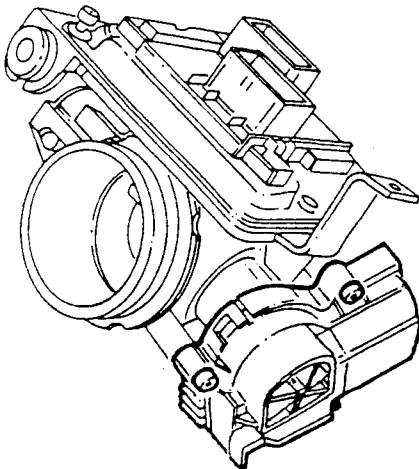
## IDLING ACTUATOR AND THROTTLE POSITION SENSOR (MDS)

The actuator is located on the throttle and is controlled by the injection ECU.

It consists of a DC motor which adjusts the throttle opening from 0° to 15°.

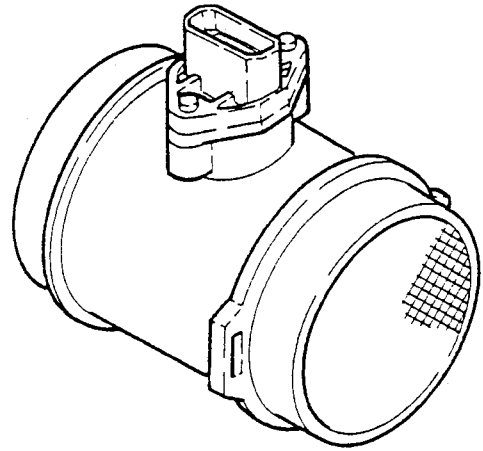
Two potentiometers integrated in the actuator transmit the angle to the ECU, respectively:

- 0° ÷ 15° for idling
- 0° ÷ 83° for other engine ratios.

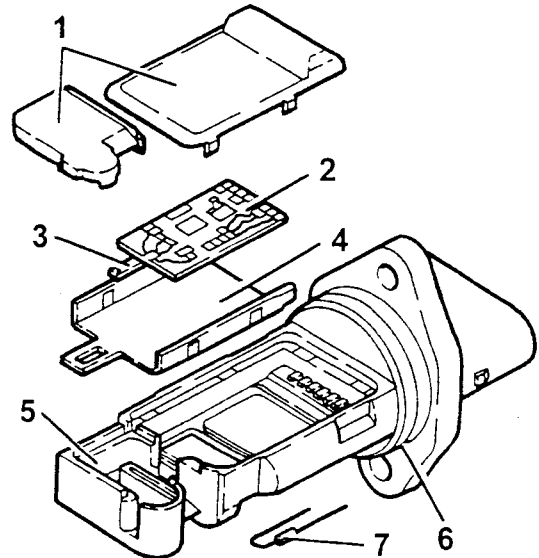


## INTAKE AIR FLOW METER WITH INTEGRATED AIR TEMPERATURE SENSOR

This "heated film" flow meter is located on the intake manifold.



An intake air temperature sensor is integrated in the sensor.

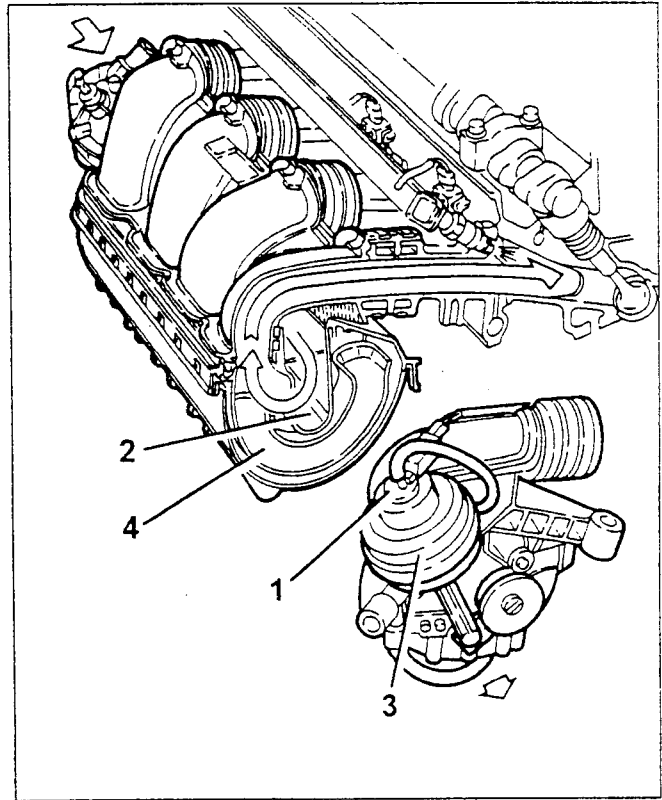


1. Covers
2. Electronic board
3. Sensors
4. Support plate
5. Support
6. O-ring
7. Temperature sensor

The operation principle is based on a heated film interposed in the measuring channel the intake air directed to the engine flows through.

The membrane film is kept at constant temperature (approximately 120°C higher than the intake air temperature) by a resistance. The intake air crossing the channel tends to take heat from the membrane. To keep temperature constant, therefore, a certain current must cross the element. This current is measured by means of a specific Wheatstone bridge and is proportional to the air flow. **A flow meter directly measures the amount of air (not the volume) thus eliminating problems due to temperature, altitude, pressure, etc.**

- short power manifolds for engine ratio over 4900 rpm.



## MODULAR INTAKE MANIFOLD

This modular length intake manifold is controlled by the injection ECU.

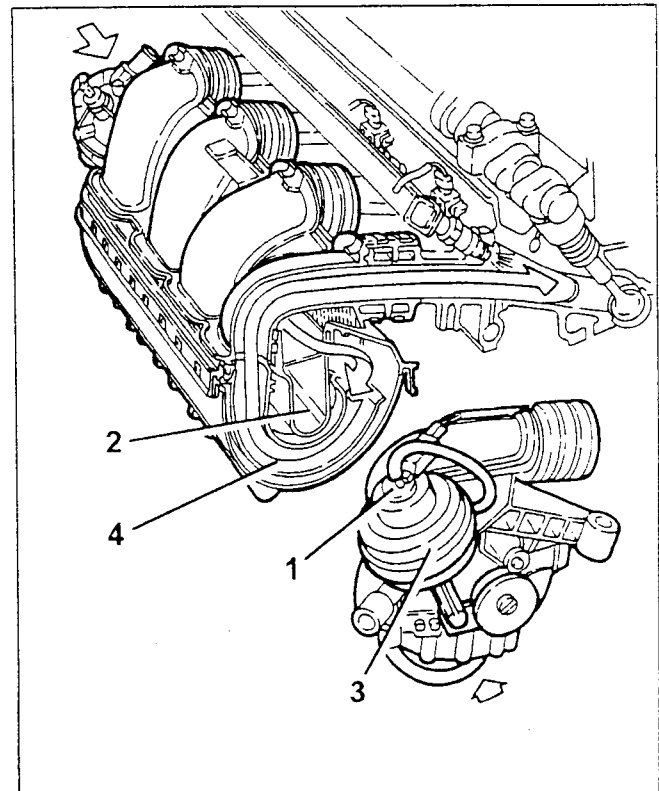
It increases volumetric performance and consequently:

- optimises torque output at low/medium ratios
- increases power at high ratios.

The manifold consists of:

- two half cases made in nylon
- an internal rocking manifold
- a vacuum accumulator inside the manifold
- a modular intake manifold actuator with an integrated three-way control solenoid valve.

- long torque manifolds for engine ratio from 800 to 4900 rpm.



## OPERATION

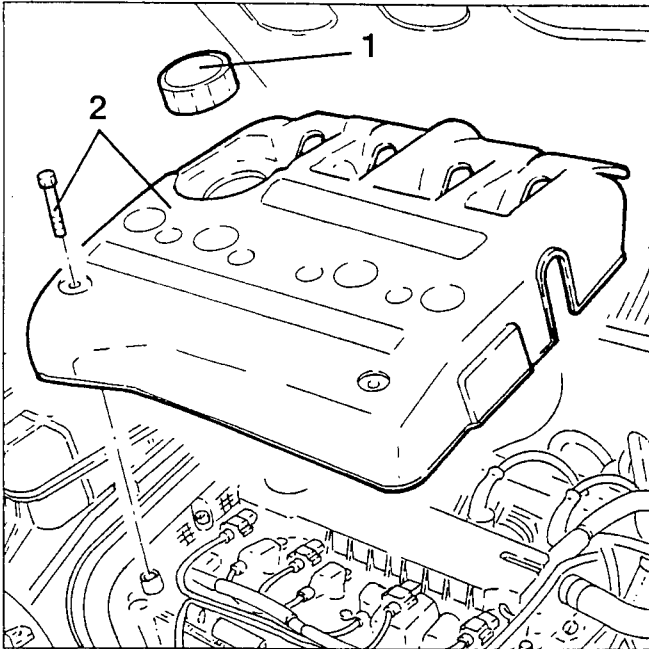
The injection ECU controls the three-way solenoid valve (1) thus connecting the vacuum accumulator (2) and the pneumatic actuator (3) which, by means of specific linkages, controls the movement of the rocking manifold (4).

The rocking manifold rotation configures the manifolds as follows:

## REMOVAL/REFITTING

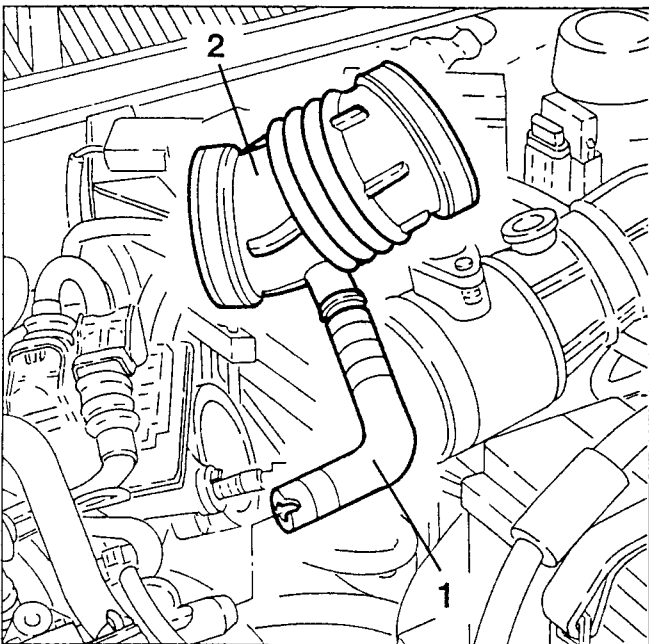
- Position the vehicle on a shop jack.
- Disconnect the (-) battery terminal.

1. Remove the engine oil filler cap.
2. Remove the fastening screws and remove the ignition coil cover.

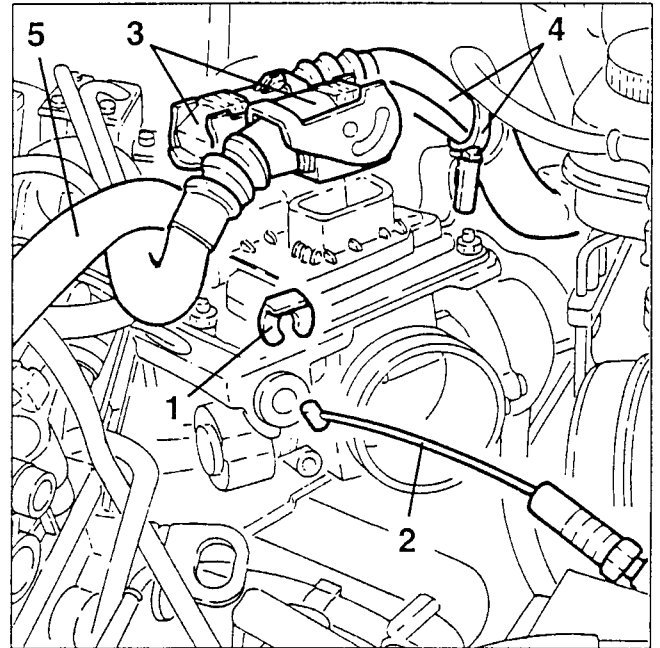


- Refit the engine oil filler cap.

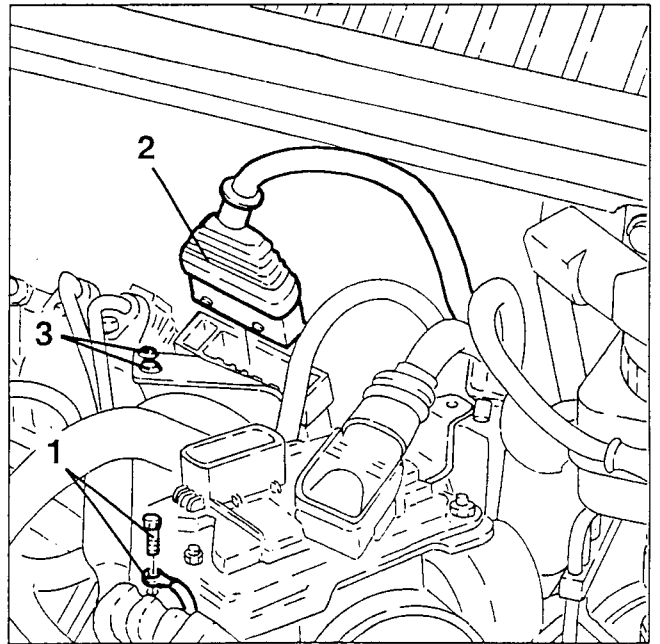
1. Disconnect the oil fume re-circulation pipe from the tappet cover.
2. Disconnect the air flow meter sleeve from the throttle and remove it.



3. Disconnect the engine ECU electric connections.
4. Release the wiring from the clip on the ECU.
5. Disconnect the oil fume intake pipe from the throttle.



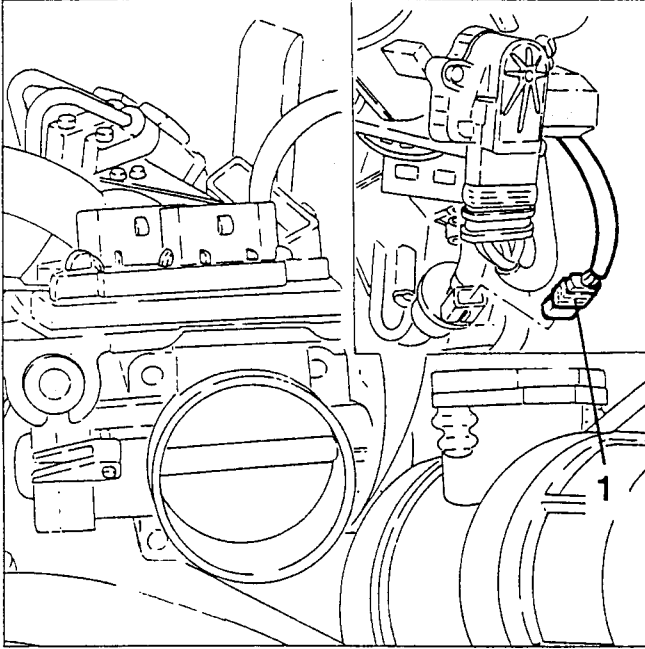
1. Disconnect the earth from the engine ECU support.
2. Disconnect the electric connection from the front/engine connection wiring.
3. Remove the screws fastening the front/engine connection wiring to the modular intake manifold.



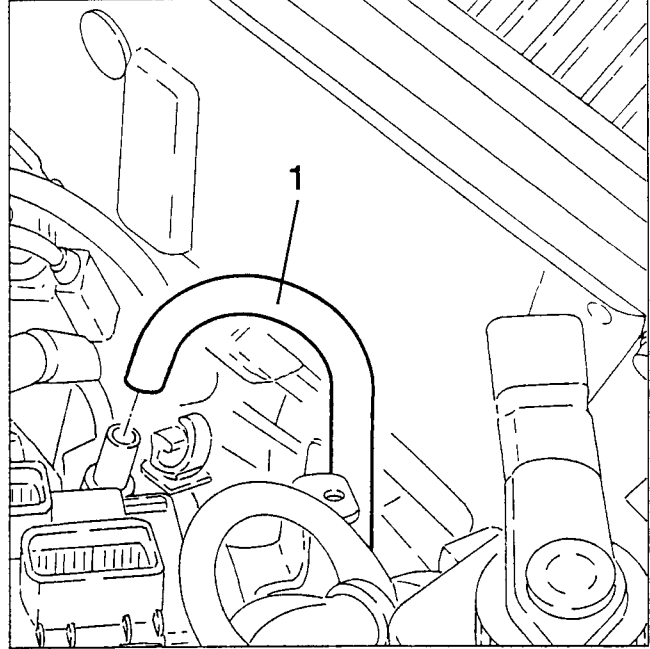
1. Remove the accelerator wire fastener from the rod.
2. Release the accelerator wire from the cam on the throttle and shift it.



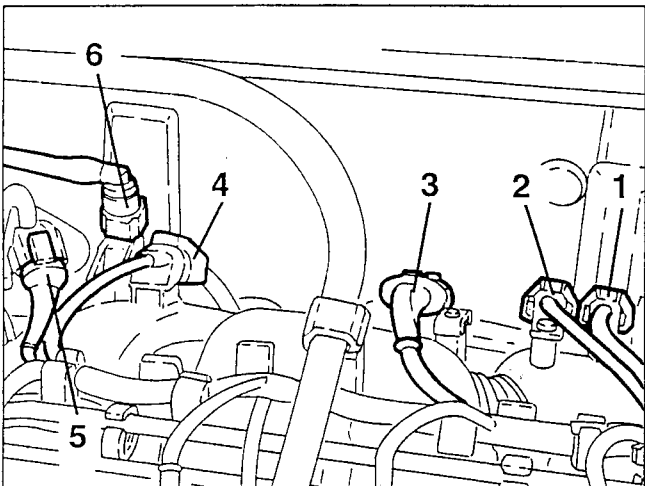
1. Disconnect the fuel fume interceptor valve electric connection.



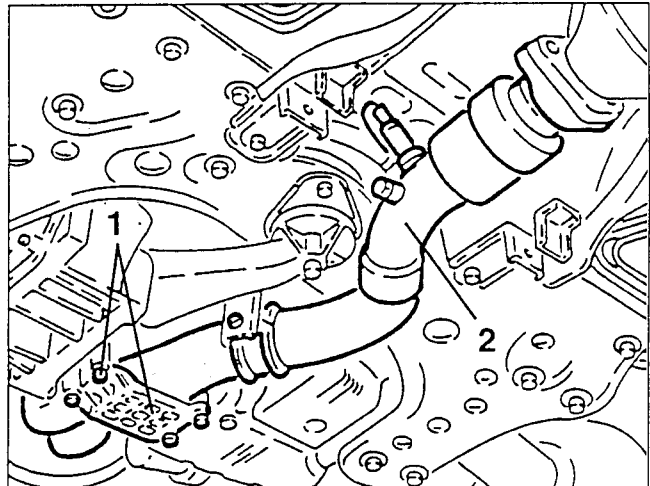
1. Disconnect the brake booster vacuum pipe.



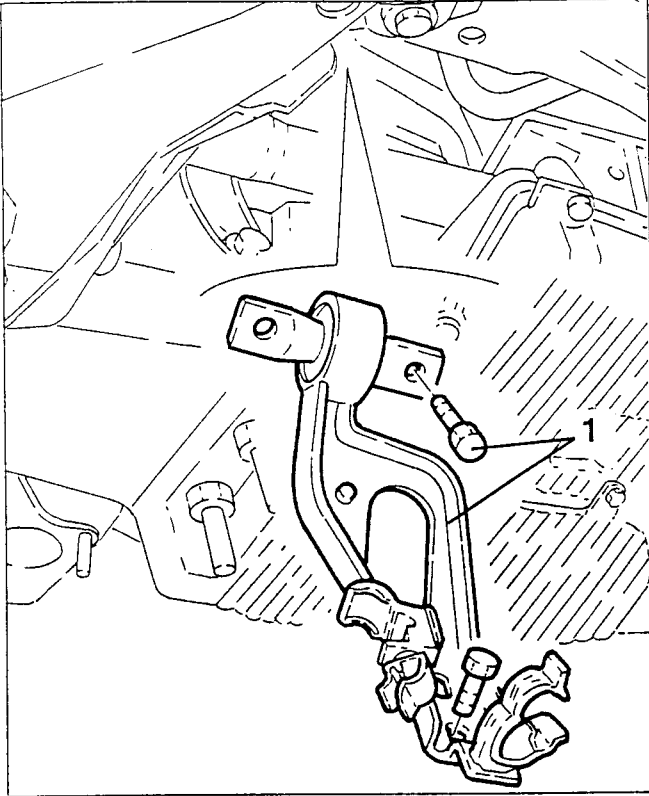
1. Disconnect the rev and timing sensor electric connection.  
 2. Disconnect the knock sensor electric connection.  
 3. Disconnect the lambda sensor electric connection.  
 4. Disconnect the timing sensor electric connection.  
 5. Disconnect the electric connection from the modular intake manifold actuator.  
 6. Disconnect the fuel fume hose.  
 - Release the electric wiring and pipes from the clips on the modular intake manifold.



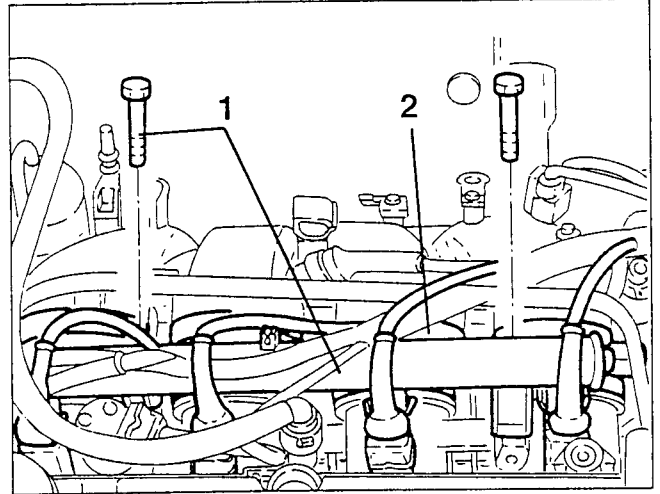
- Release the injector wiring from the fastening clips on the modular intake manifold.  
 - Release the coolant return pipe to reservoir from the clips on the modular intake manifold.  
 - Lift the vehicle.  
 - Remove the guard under the motor.  
 1. Remove the fastening nuts and the front exhaust pipe reinforcement.  
 2. Remove the fasteners and the front section of the exhaust pipe with lambda sensor and seals.



1. Remove the fastening screws and the modular intake manifold support rod.
- Remove the screw fastening the right-hand side of the modular intake manifold.

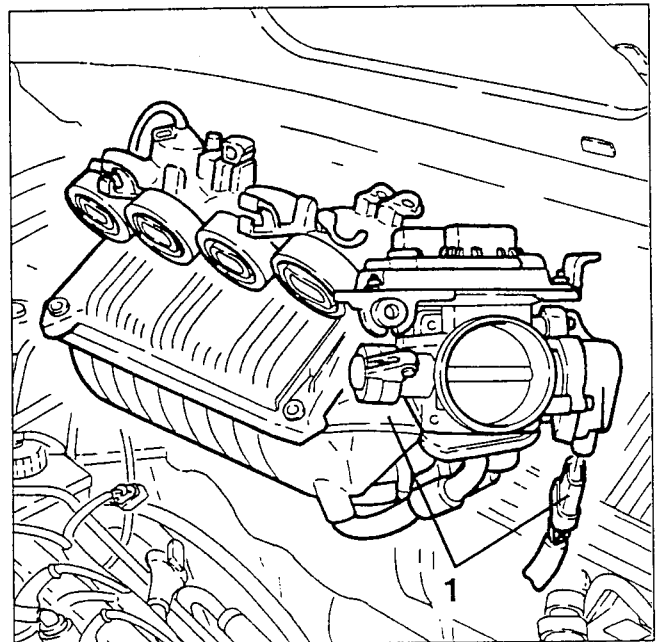
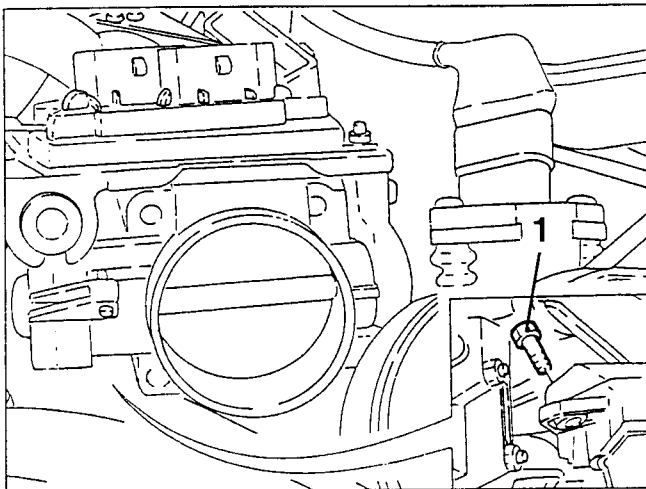


1. Remove the fuel distribution manifold fastening screw and shift it to access the rubber sleeves.
2. Disconnect the rubber sleeve fastening clips. Shift the modular intake manifold and remove the sleeves.



1. Remove the modular intake manifold, after disconnecting the constant idling actuator.

- Lower the vehicle.
1. Remove the screw fastening the left-hand side of the modular intake manifold.

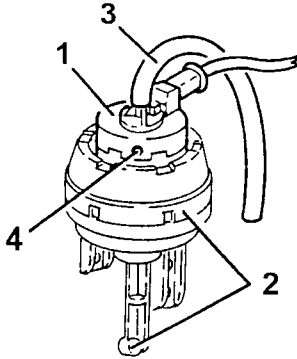


## INTAKE MANIFOLD SOLENOID VALVE

This is a three-way solenoid valve integrates in the pneumatic actuator controlling the variable geometry unit.

It is controlled by the injection ECU.

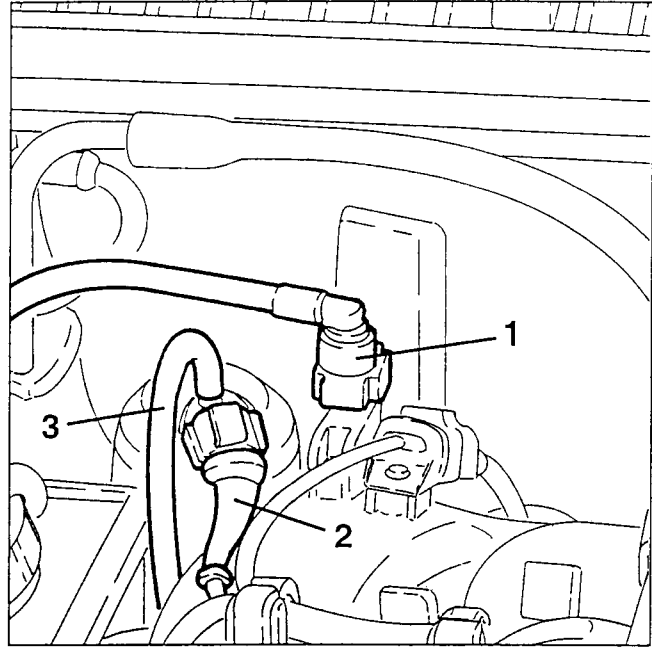
It enables the vacuum in the vacuum reservoir (inside the intake unit) to act on the rocking manifold control pneumatic actuator.



1. Modular intake manifold solenoid valve
2. Modular intake device control actuator
3. Vacuum pipe
4. Atmospheric pressure air inlet

- Refit the engine oil filler cap.

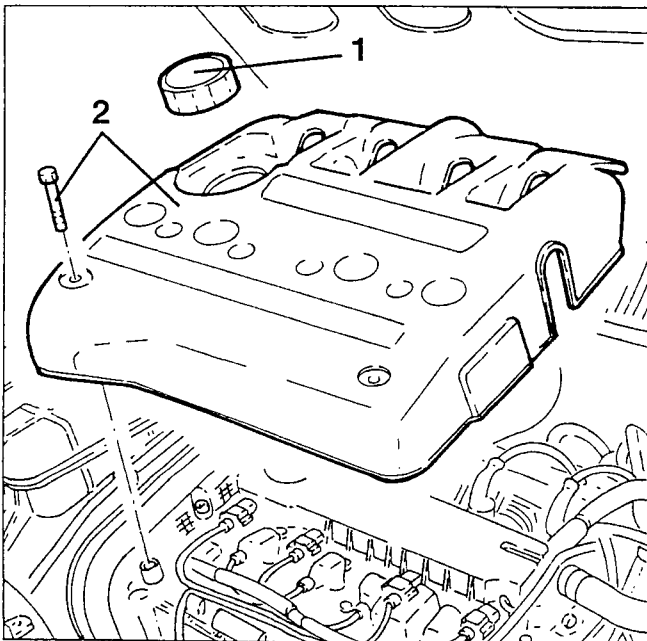
1. Disconnect the fuel fume quick coupling pipe and release it from the clip on the power steering reservoir.
2. Disconnect the modular intake manifold actuator electric connection.
3. Disconnect modular intake manifold actuator vacuum pipe.



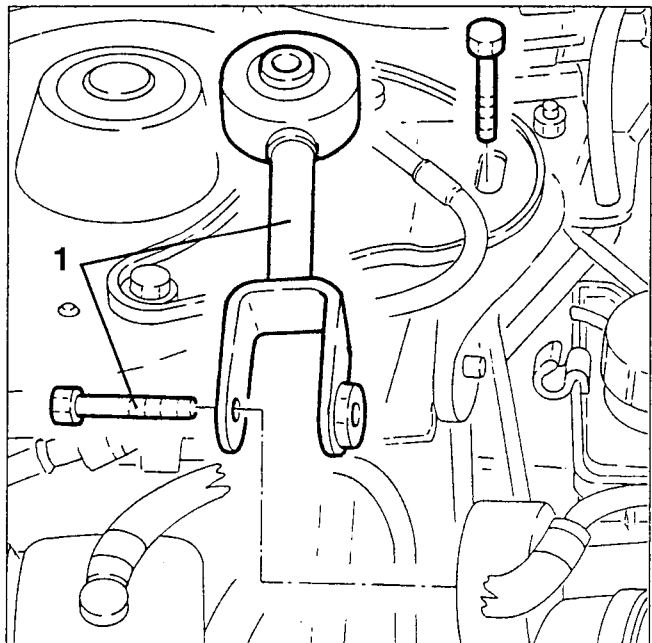
## REMOVAL/REFITTING

- Disconnect the (-) battery terminal.

1. Remove the engine oil filler cap.
2. Remove the fastening screws and remove the ignition coil cover.

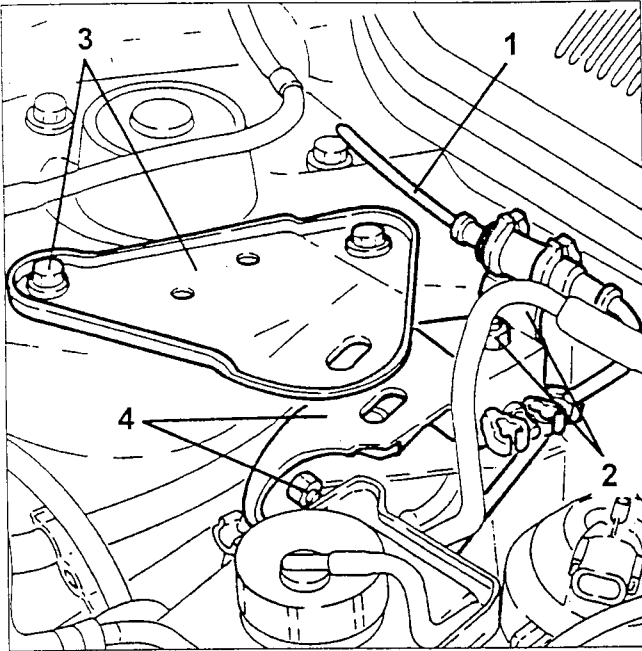


1. Remove the fastening screw and remove the engine reaction tie-rod.

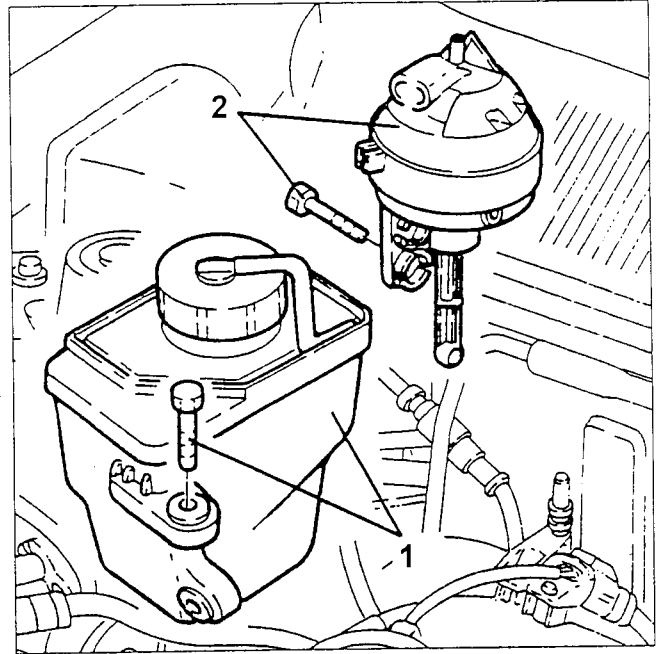


1. Disconnect the right-hand ABS sensor electric connection from the support rod.
2. Remove the fastening nut and remove the ABS sensor electric connection support rod.

3. Slacken the fastening screws and remove the upper support bracket of the power unit reaction rod.
4. Slacken the nut and fastening screw, then remove the power unit reaction rod support bracket.



1. Slacken the fastening screws and move aside the power steering tank.
2. Slacken the fastening screws, disconnect the rod from the joint and remove the modular box control actuator.



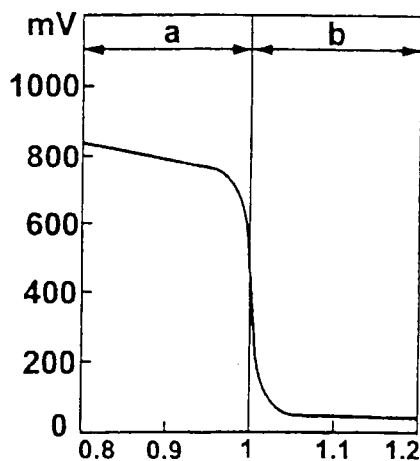
## LAMBDA SENSOR

This is of the "planar" type and is fitted on the front section of the exhaust pipe. It informs the injection - ignition control unit about combustion (stoichiometric ratio).

The electronic control unit identifies the composition of the mixture (lean or fat) from the lambda sensor output voltage.

It adapts the amount of fuel injected to ensure an optimum composition of the mixture ( $\lambda = 1$ ), to create the ideal conditions for treating the exhaust gases in the catalytic converter.

If the mixture is too fat ( $\lambda < 1$ ), the amount of fuel must be reduced and if the mixture is too lean ( $\lambda > 1$ ), the amount of fuel must be increased.



- a. Fat mixture (lack of air)  
b. Lean mixture (excess air)

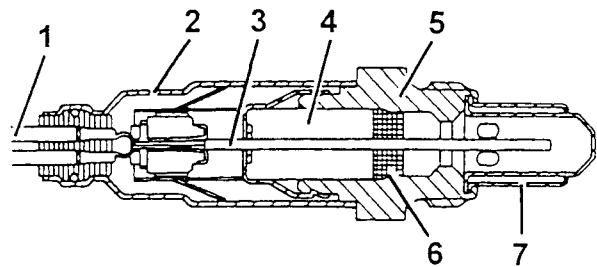
The lambda sensor, placed in contact with the exhaust gas, generates an electric signal, the voltage of which depends on the concentration of oxygen in the gas.

This voltage is characterised by an abrupt change when the composition of the mixture departs from  $\lambda = 1$ .

Lambda sensor heating is controlled by the injection control unit proportionately with the temperature of the exhaust gas.

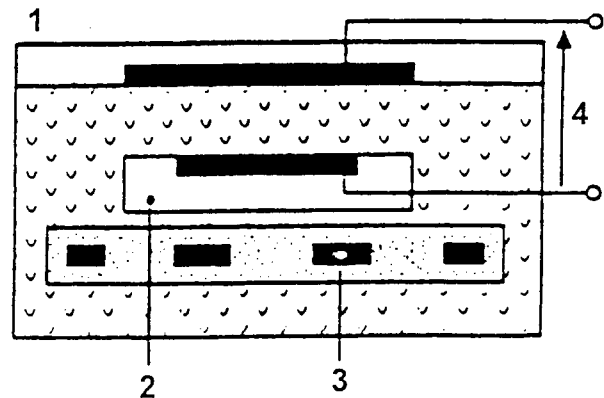
This prevents thermal shocks to the ceramic body due to contact with the condensed water contained in the exhaust gas when the engine is cold

The measurement cell and the heater are integrated in the "planar" (stratified) ceramic element with the advantage of obtaining quick heating of the cell, so that closed loop control ( $\lambda = 1$ ) is enabled within 10 seconds from starting the engine.



1. Connection cable
2. Protective sleeve
3. Planar sensor element
4. Ceramic support pipe
5. Sensor housing
6. Ceramic seal
7. Protection pipe

The lambda sensor works on the principle of an oxygen concentration cell with solid electrolyte. The measuring cell surfaces are coated with microporous layers of precious material.

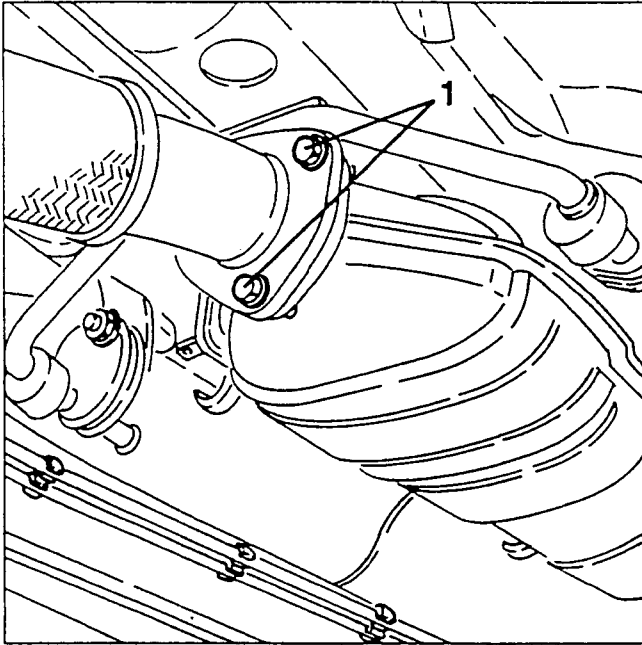


1. Exhaust gas
2. Reference air passage
3. Heater
4. Lambda sensor voltage

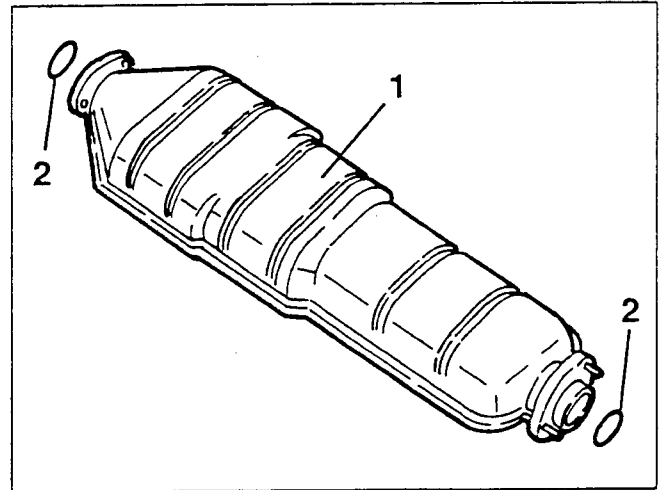
## REMOVING/REFITTING

- Set the car on a lift and raise it.


1. Slacken the three bolts fastening the front section of the exhaust piping to the catalytic converter releasing the support bracket.



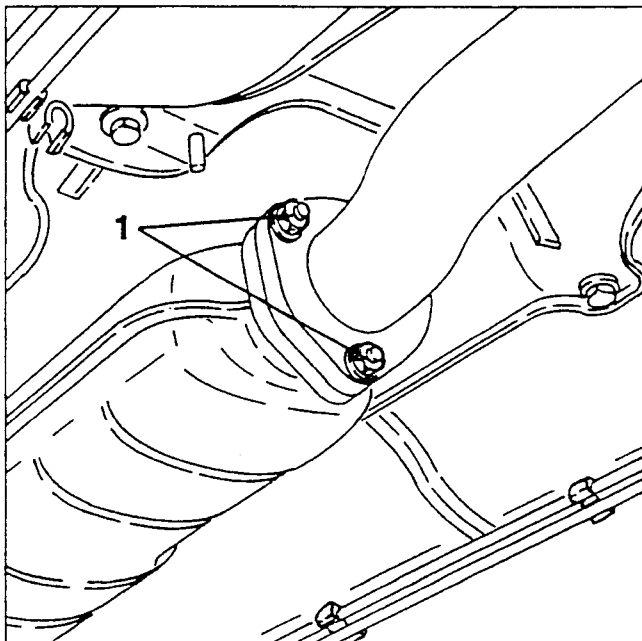
1. Remove the catalytic converter.
2. Retrieve the seal rings.



### NOTE:

FOR REMOVING/REFITTING THE FRONT AND REAR SECTIONS OF THE EXHAUST PIPING REFER TO THE PROCEDURES GIVEN FOR VERSION  TD BEARING IN MIND THAT THEIR CONNECTION TO THE CATALYTIC CONVERTER IS MADE BY FLANGES WITH SEALS RATHER THAN BY CLAMPS.

1. Slacken the three bolts fastening the catalytic converter to the rear section of the exhaust piping.

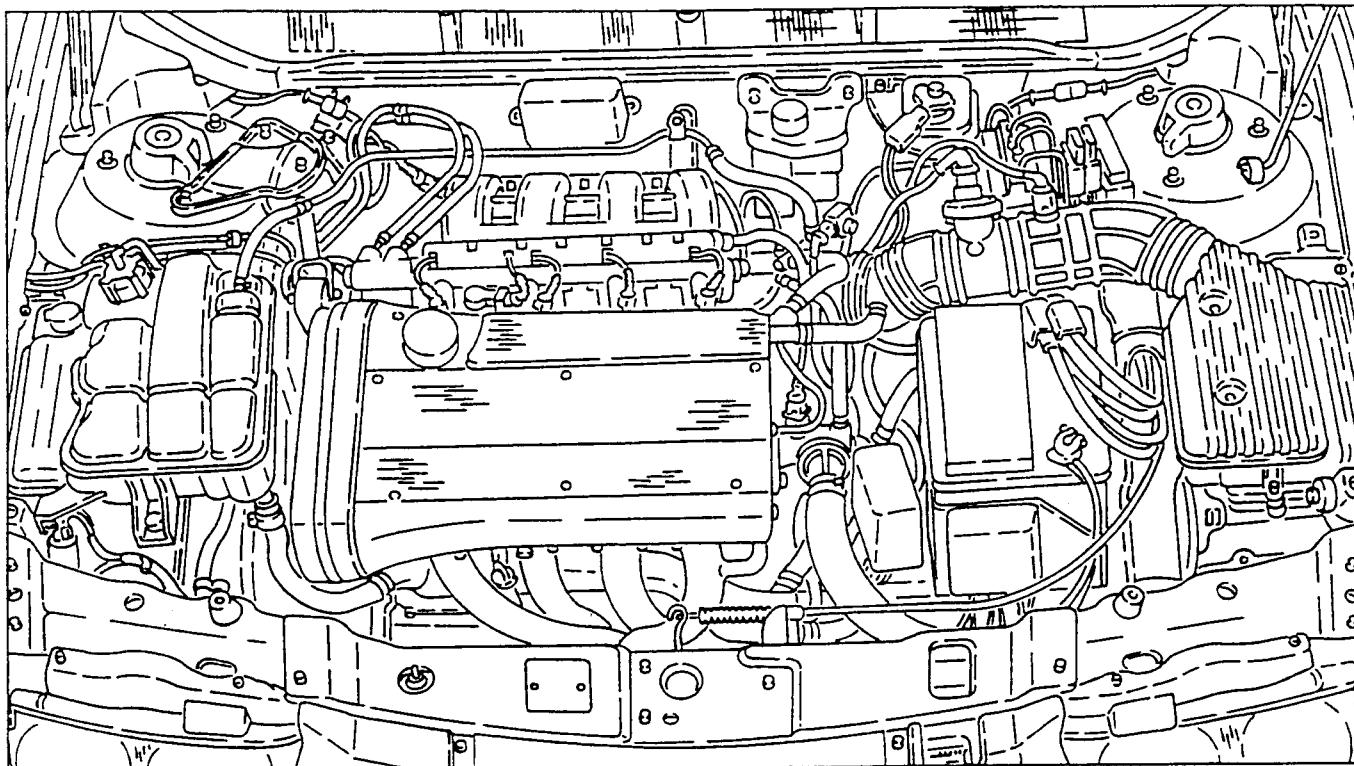


## GENERAL DESCRIPTION

The information and illustrations given below enable the rapid removal of the engine assembly from its housing in the engine compartment and its subsequent refitting. Dis-assembly of the single components on the bench is described in the volume "ENGINE OVERHAULING".

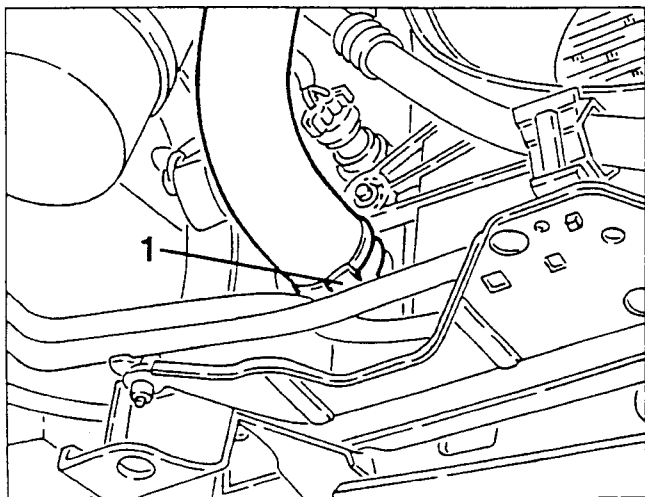
This is to be considered a single, complete procedure with the possibility of adopting only parts of it according to necessity.

For further information and details, see the chapters referring to the specific components or groups.



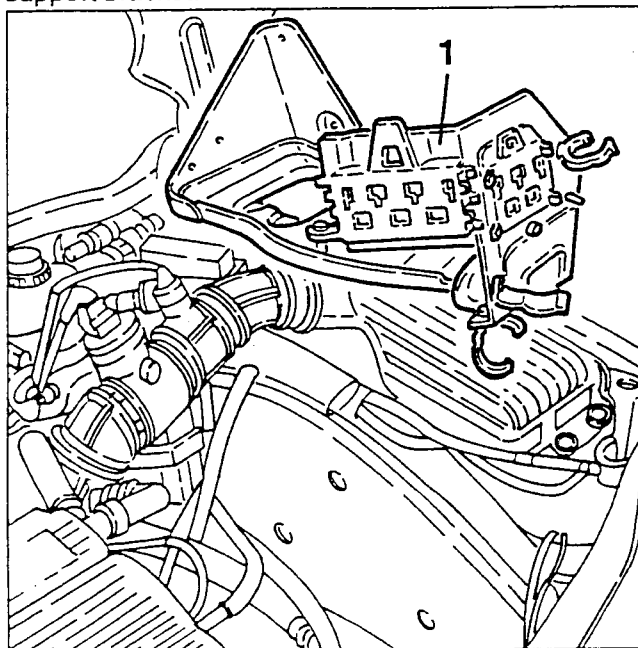
## REMOVAL

- Set the car on a 2 column lift.
  - Remove the battery.
  - Remove the front wheels and mud flaps.
1. Raise the car and drain the engine coolant fluid disconnecting the radiator outlet sleeve.



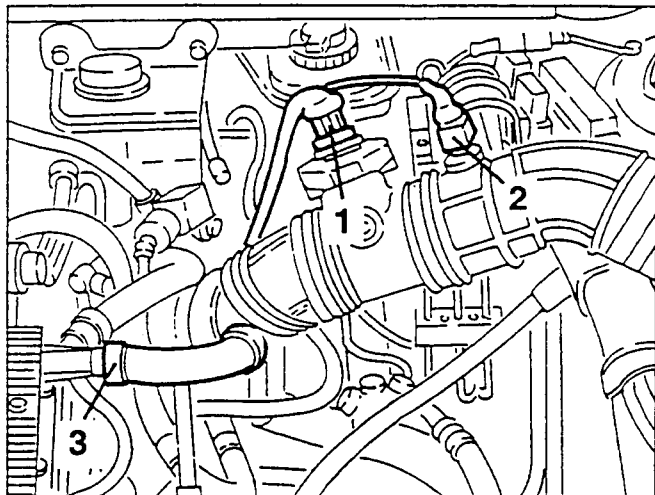
- Remove the relays from the battery support and set them to one side together with their wirings so that they do not hinder the following operations.

1. Slacken the fastening screws, then remove the battery support after removing it from the rear cable support bracket.

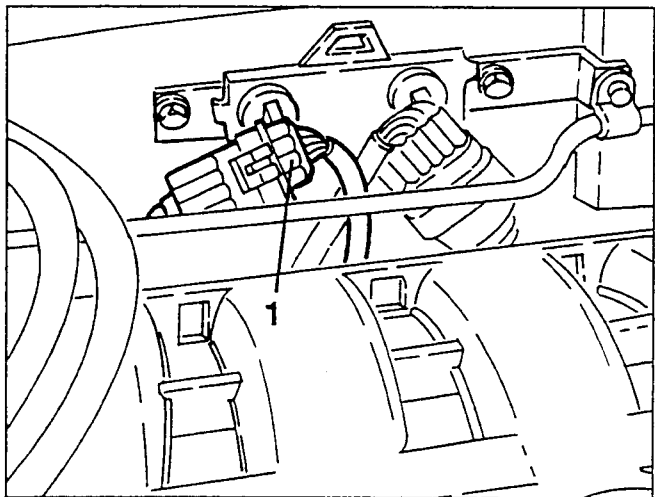




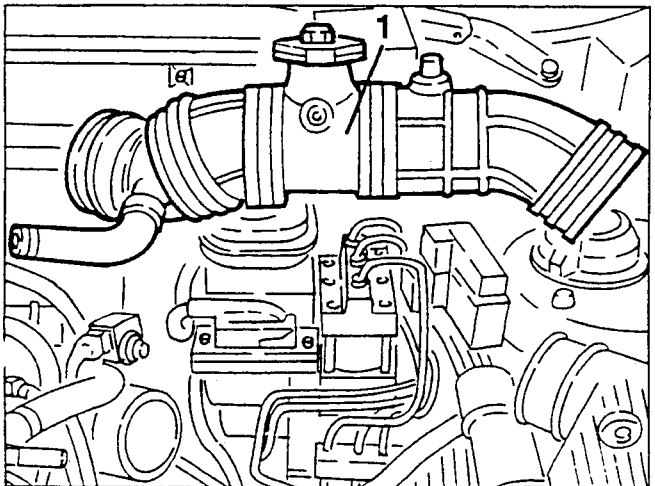
1. Disconnect the electrical connection from the air-flow meter.
2. Disconnect the electrical connection from the intake air temperature sensor (NTC).
3. Slacken the fastening clamp and disconnect the oil recirculation pipe from the cylinder head.



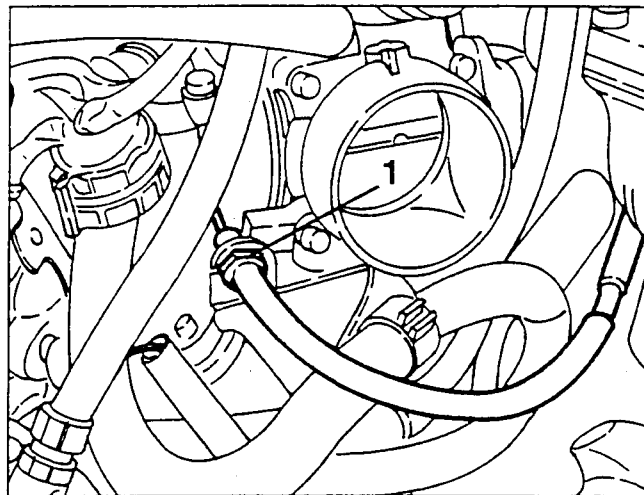
1. Disconnect the electrical connection of the lambda probe.



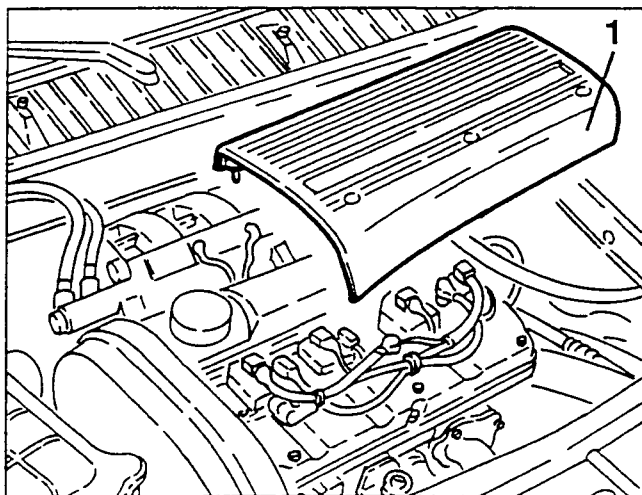
1. Slacken the fastening clamps and remove the corrugated sleeve complete.



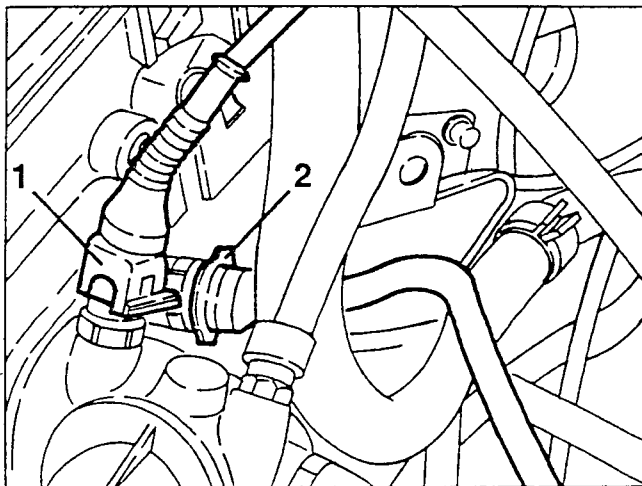
1. Disconnect the accelerator cable from the throttle body.



1. Slacken the fastening screws and remove the ignition coils cover.



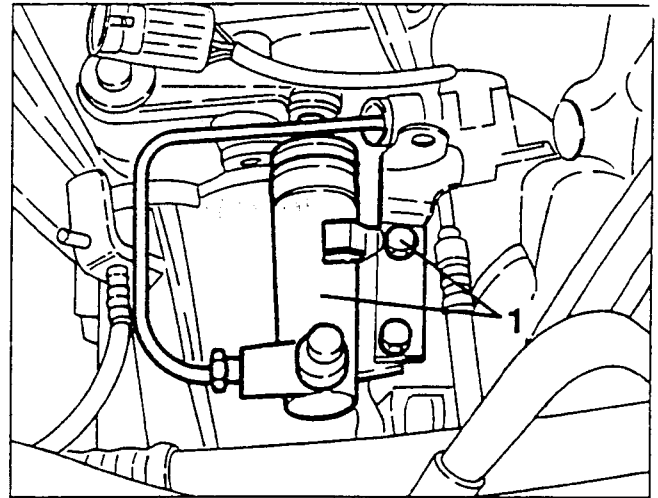
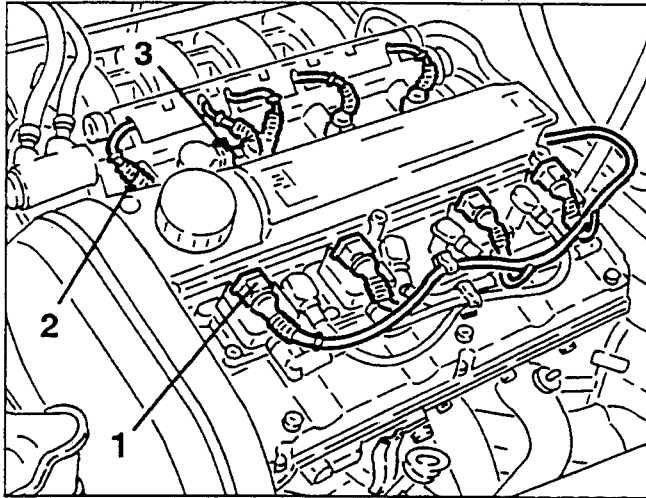
1. Disconnect the electrical connection from the engine coolant fluid temperature sensor (NTC).
2. Disconnect the electrical connection from the engine coolant temperature warning light transmitter, then move aside the wiring.





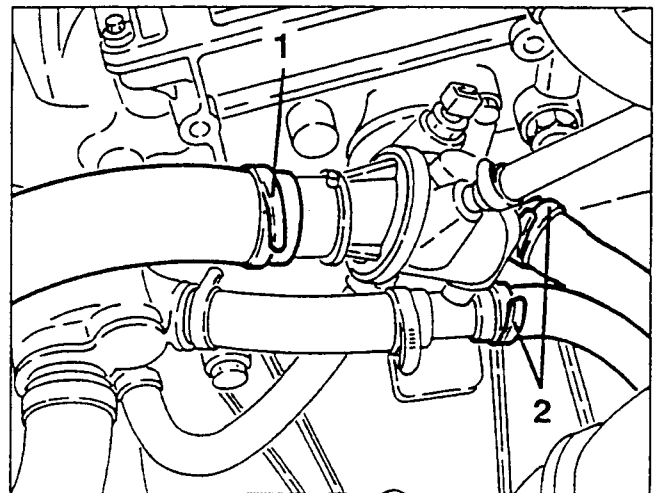
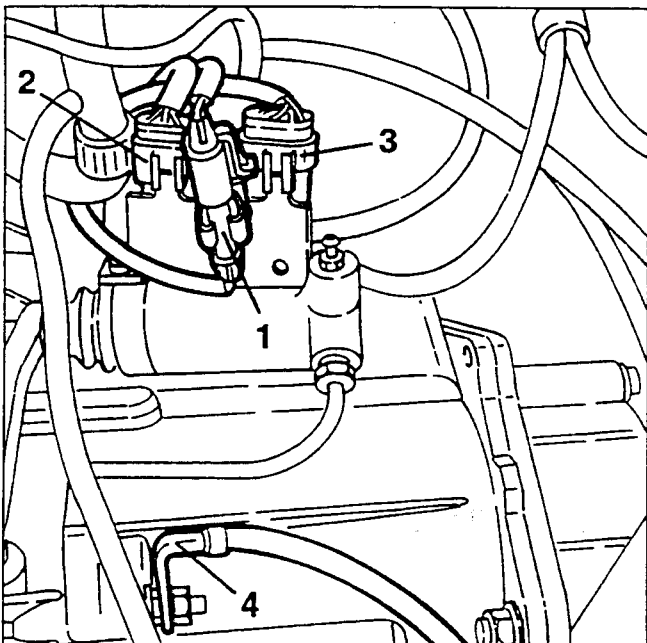


1. Disconnect the electrical connections ignition coils.
  2. Disconnect the electrical connections from the electroinjectors.
  3. Disconnect the electrical connection from the timing variator solenoid.
- Disconnect the earth cable from the cylinder head.

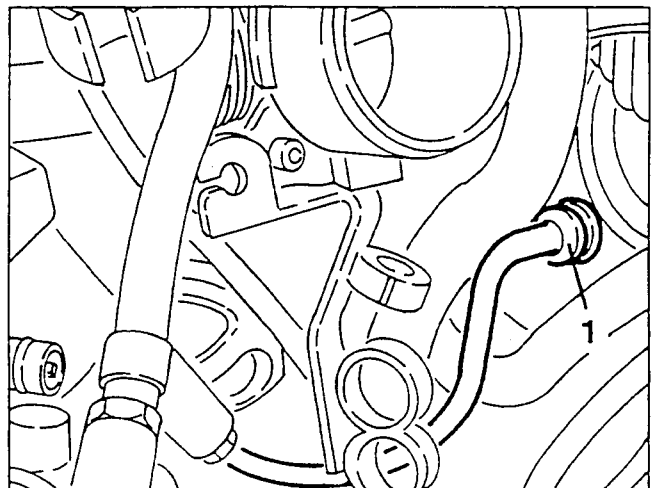


1. Disconnect the coolant fluid delivery and return pipes from the thermostatic cup to the climate control system heater and release them from the bracket.
2. Disconnect the coolant fluid delivery pipe to the radiator from the thermostatic cup.

1. Disconnect the electrical connection of the starter motor.
2. Disconnect the electrical connection of the tachometric sensor.
3. Disconnect the electrical connection of the injection system.
4. Disconnect the earth cable from the gearbox cover.



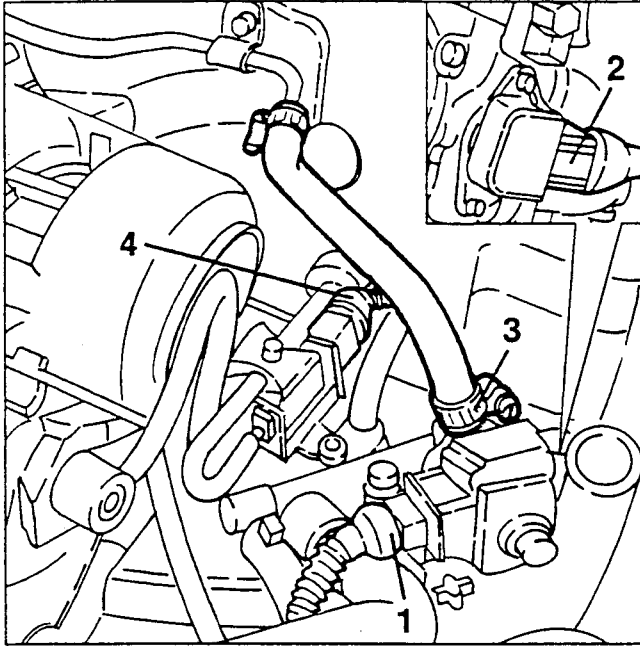
1. Disconnect the vacuum takeoff pipe from the servo brake.



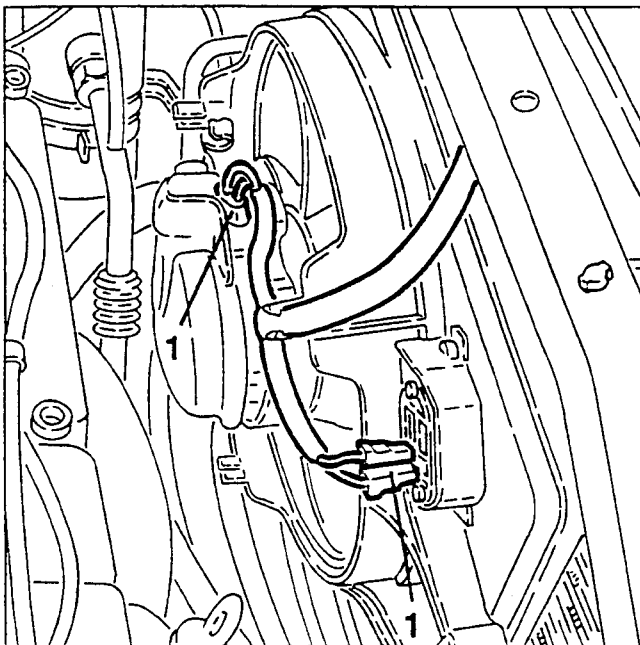
1. Slacken the fastening screws, then move the clutch control cylinder without disconnecting the pipes.



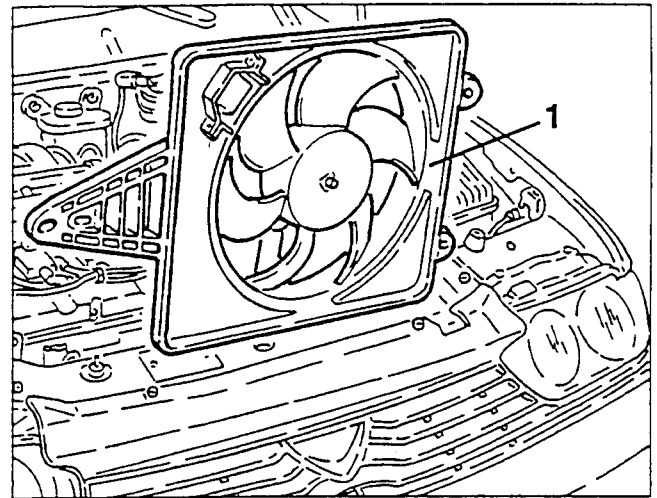
1. Disconnect the electrical connection from the constant idle speed actuator.
2. Disconnect the electrical connection from the throttle potentiometer.
3. Disconnect the coolant delivery pipe to the header tank from the throttle body.
4. Disconnect the electrical connection from the E.G.R. modulation solenoid valve.



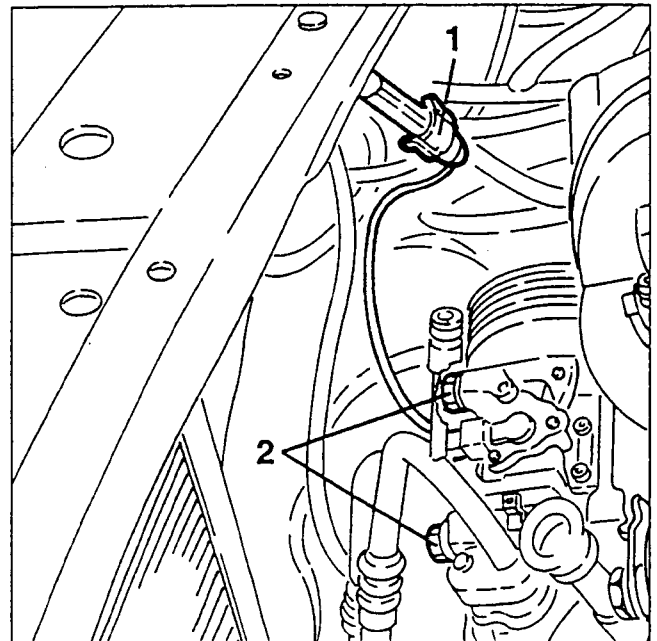
1. Disconnect the electrical connections from the cooling fan.



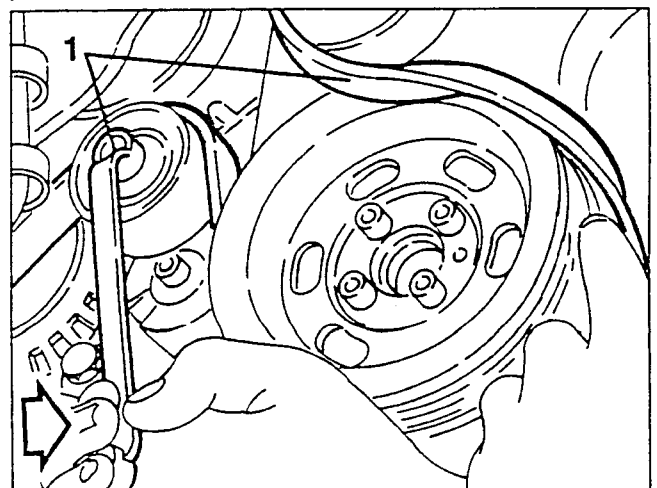
1. Slacken the fastening screws and remove the cooling fan.



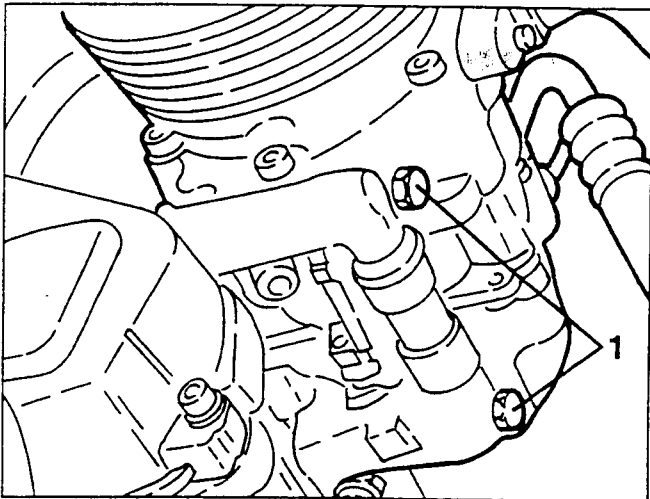
1. Disconnect the electrical connection supplying the conditioner compressor.
2. Slacken the two upper screws fastening the conditioner compressor.



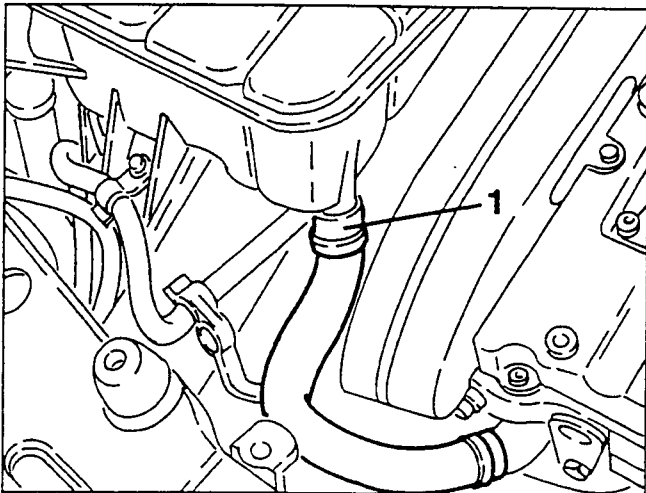
1. Raise the car and working as illustrated on the guide pulley, loosen the tension of the auxiliary components drive belt and remove it.



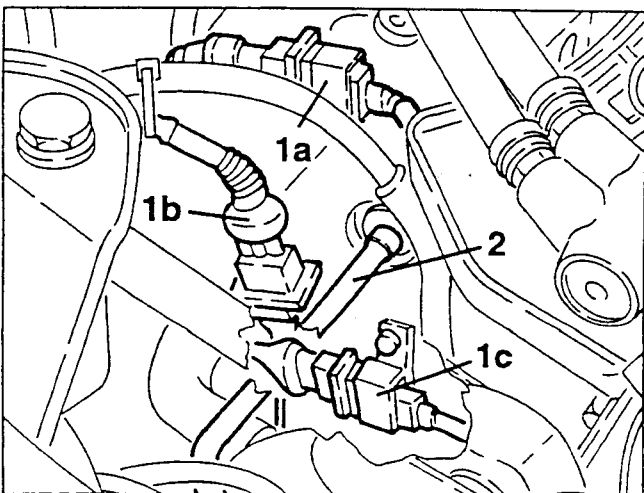
1. Slacken the two lower screws fastening the conditioner compressor, then, without disconnecting the piping, fasten it to one side to prevent hindrance in the following operations.



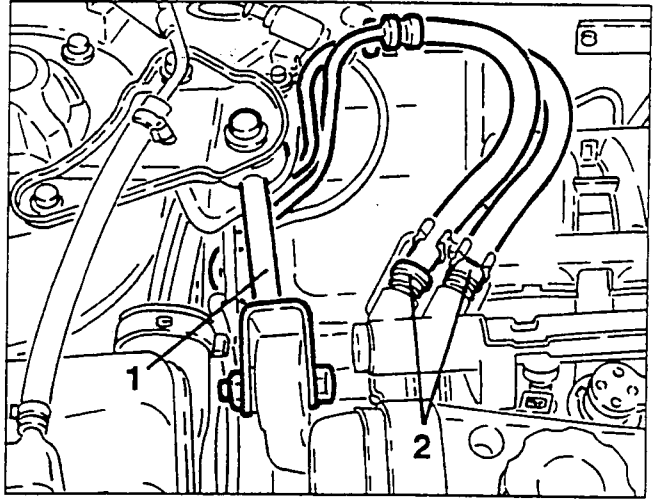
1. Lower the car and disconnect the system supply pipe from the header tank.



1. Disconnect the electrical connections of the timing sensor (1a), pinging sensor (1b) and rpm and timing sensor (1c).  
2. Disconnect the fuel vapour recirculation pipe from the intake box.

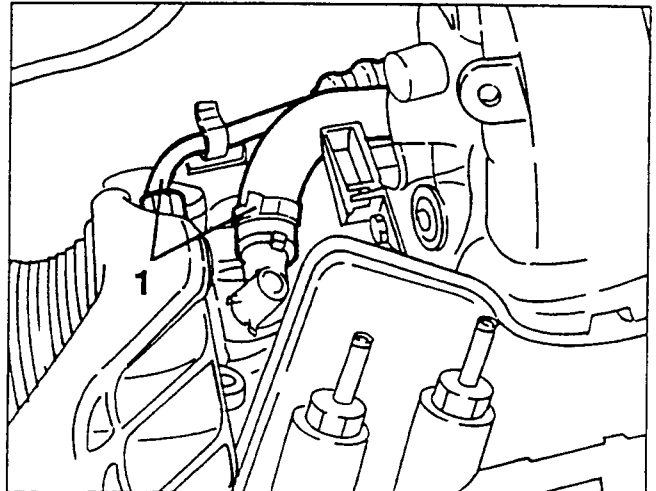


1. Slacken the fastening screws and remove the engine stay connecting rod.  
2. Disconnect the fuel inlet and outlet pipes from the distributor manifold.



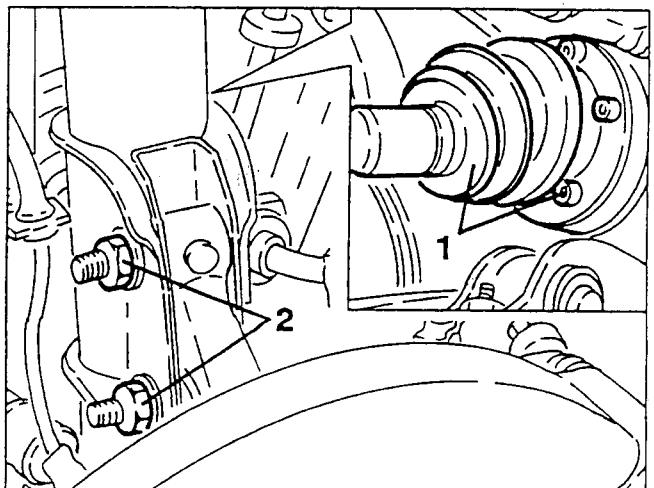
- Using a suitable syringe, drain the oil from the power steering tank.

1. Disconnect the oil inlet and delivery pipes from the power steering pump.



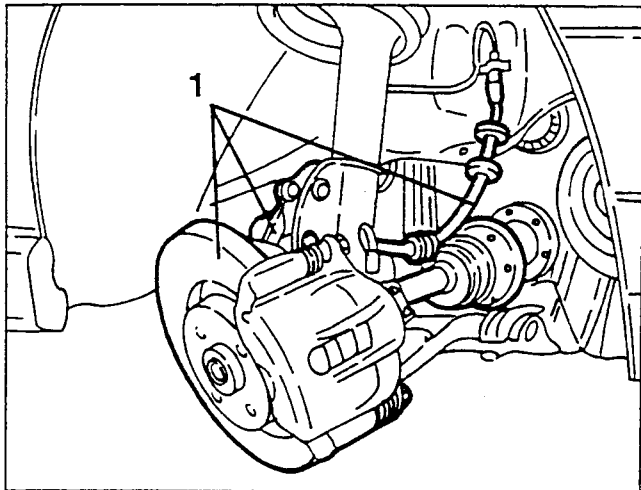
1. Raise the car, slacken the fastening bolts and disconnect the axle shafts.

2. Slacken the two bolts fastening the uprights to the shock absorbers, then remove only the upper bolt.

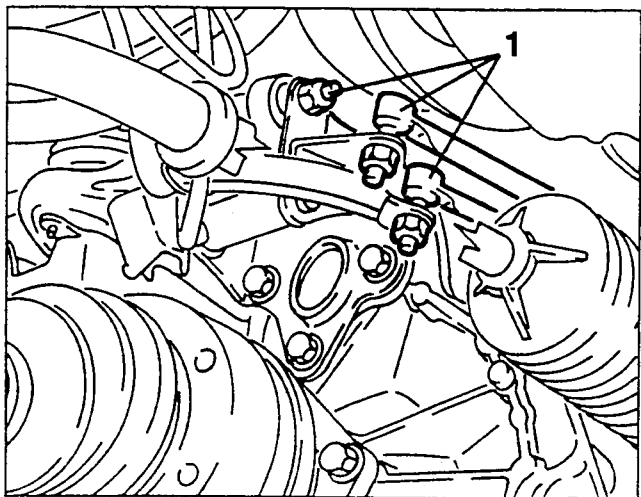




1. Release the brake pipes and A.B.S. sensor cables from their clamps, then turn the wheel hubs forwards as far as possible to move the axle shafts forwards.

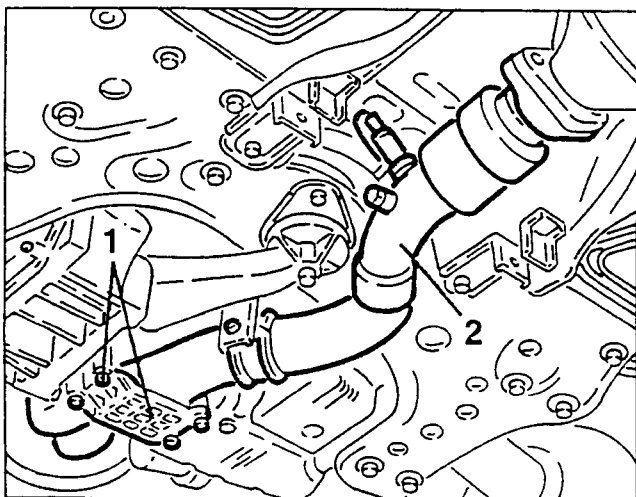


1. Working from the wheelhouse, slacken the fastening nuts and disconnect the gearshift control rods.

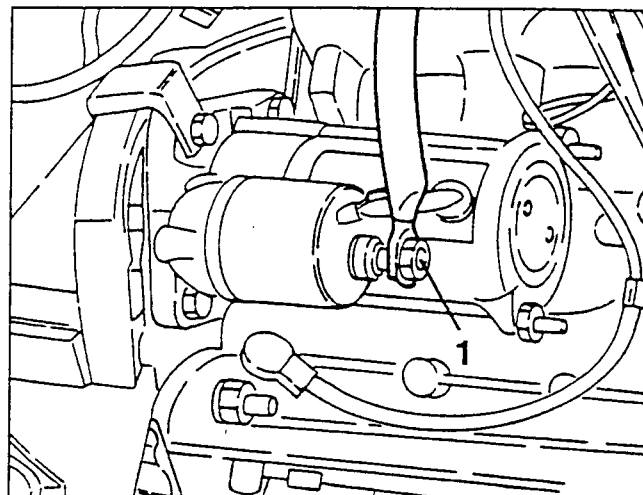


1. Slacken the fastening screws and remove the reinforcement bracket.

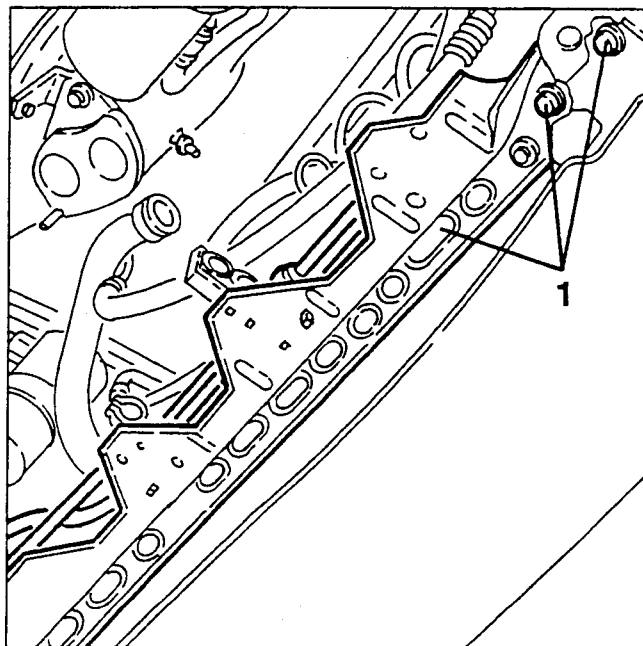
2. Remove the front section of the exhaust pipe complete with lambda probe after slackening their fastenings.



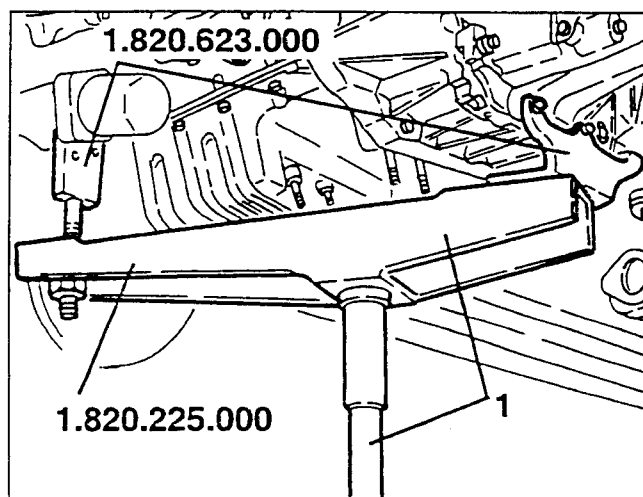
1. Disconnect the electrical connections from the starter motor.



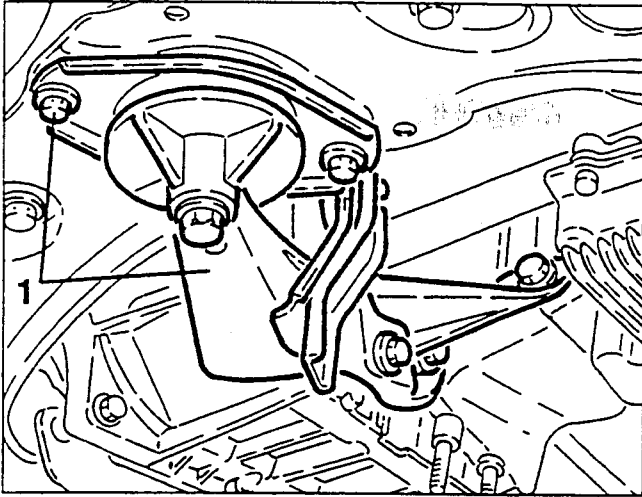
1. From the lower crossmember prise the power steering pipes, then slacken the fastening screws and remove them.



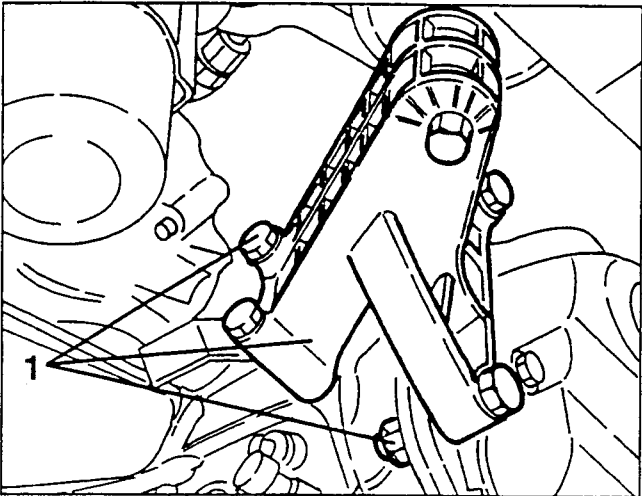
1. Position a hydraulic jack complete with tools no. 1.820.225.000 and no. 1.820.623.000 as illustrated.



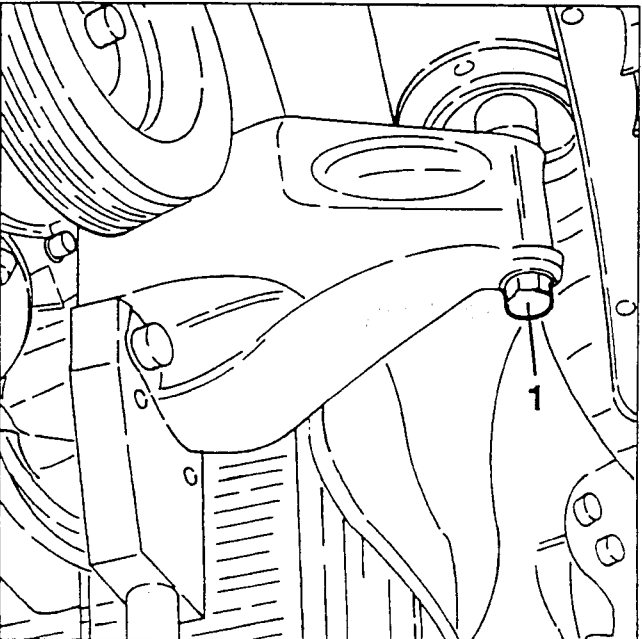
1. Slacken the fastening screws and remove the rear power unit support.



1. Slacken the fastening screws and bolts and remove the gearbox side power unit support.

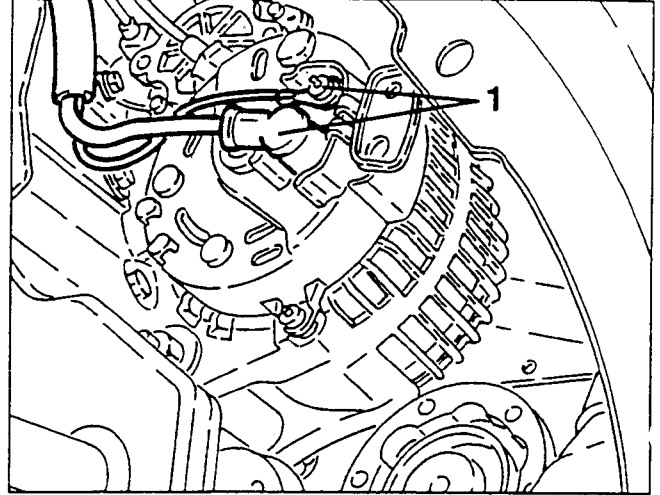


1. Slacken the screw fastening the camshaft side power unit support.

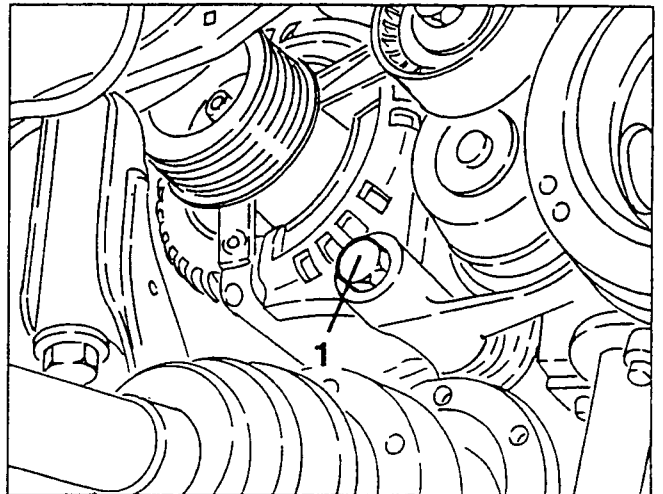


- Lower the power unit just enough with a hydraulic jack to be able to remove the alternator, proceeding as described below:

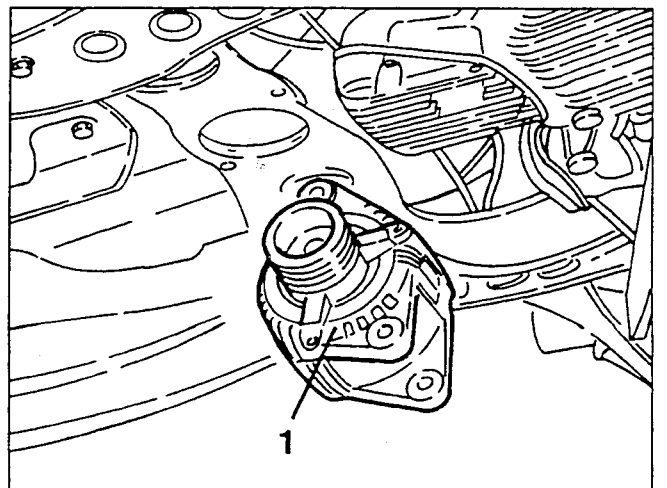
1. Disconnect the electrical connections of the alternator.



1. Slacken the two bolts fastening the alternator to the support bracket.



1. Remove the alternator withdrawing it from under the car as illustrated.





- Lower the hydraulic jack and remove the power unit from the engine compartment.



**WARNING:**  
The hydraulic jack must have a capacity of at least 1000 kg.

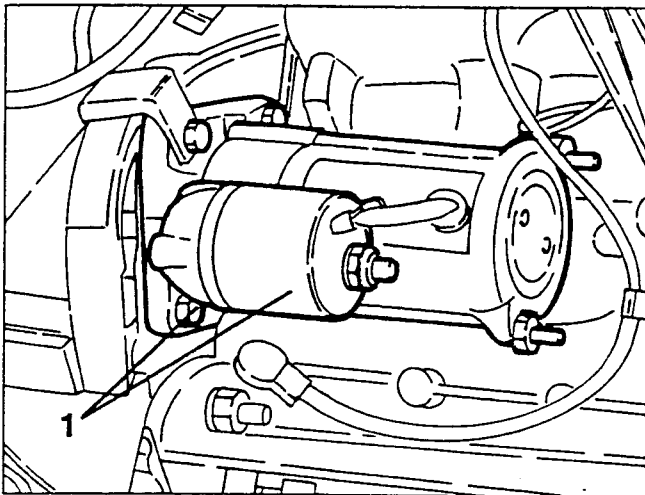
- Support the power unit with a hydraulic hoist besides the hydraulic jack used for removal.



**WARNING:**  
For moving the power unit, use a hydraulic hoist after freeing it from the hydraulic jack.

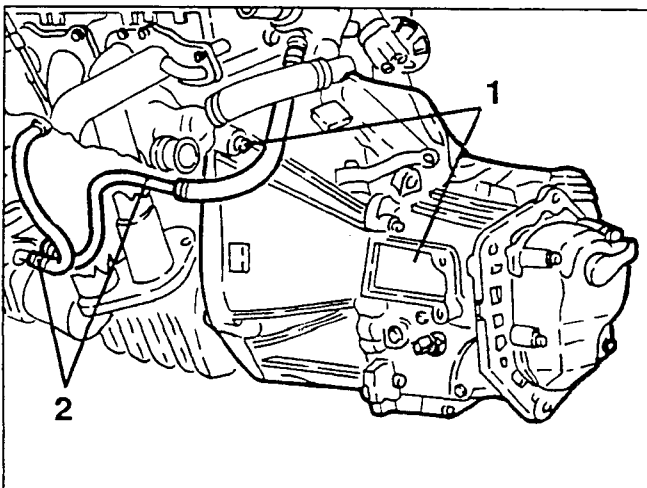
- Release the power unit from the support tools then position it on a suitable workbench.

1. Slacken the fastening screws and remove the starter motor.



1. Slacken the fastening screws and nuts and remove the gearbox and differential unit.

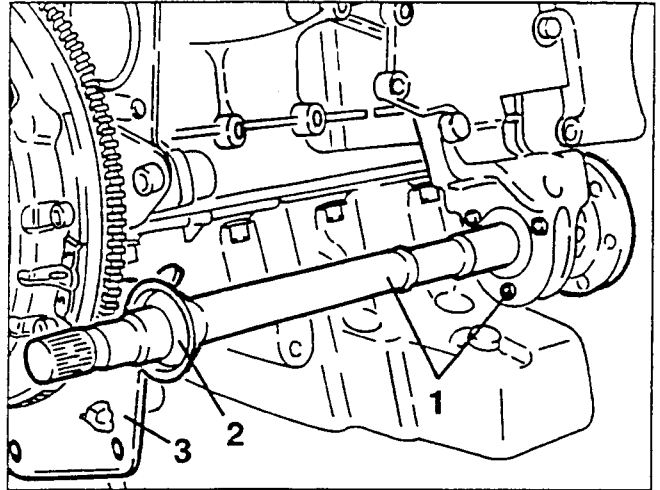
2. Remove the two heat exchanger coolant delivery and return pipes.



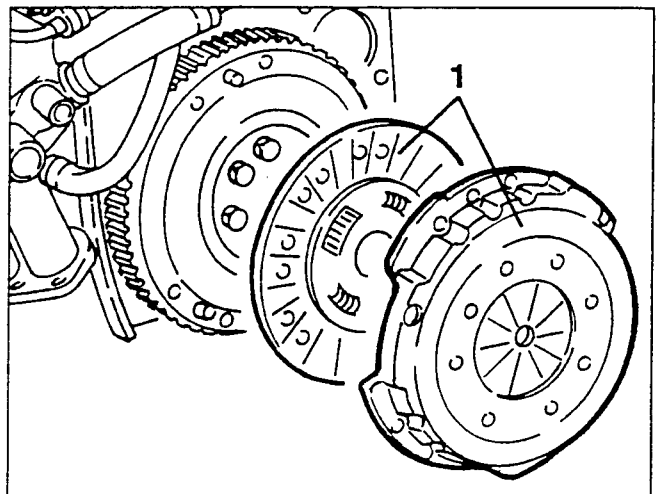
1. Slacken the three fastening screws and remove the lay shaft.

2. Remove the dust guard ring.

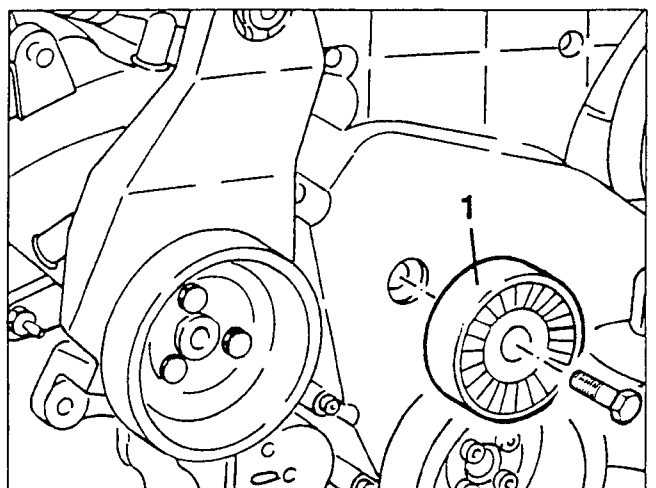
3. Remove the lower flywheel cover.



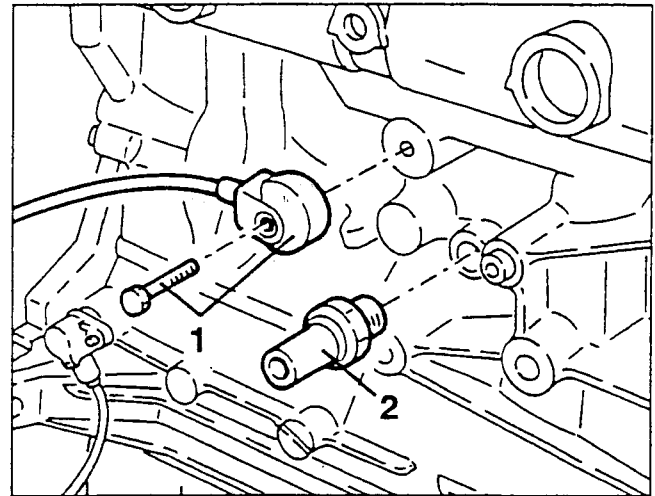
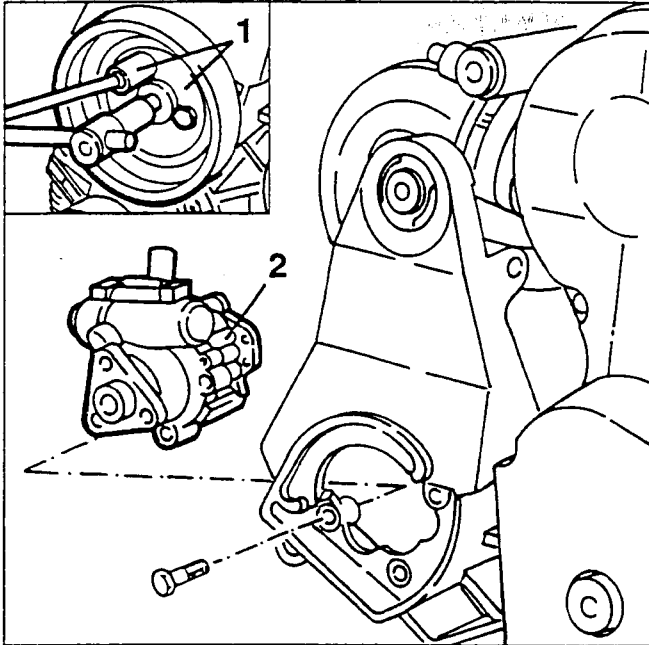
1. Slacken the fastening screws and remove the pressure plate body and clutch plate.



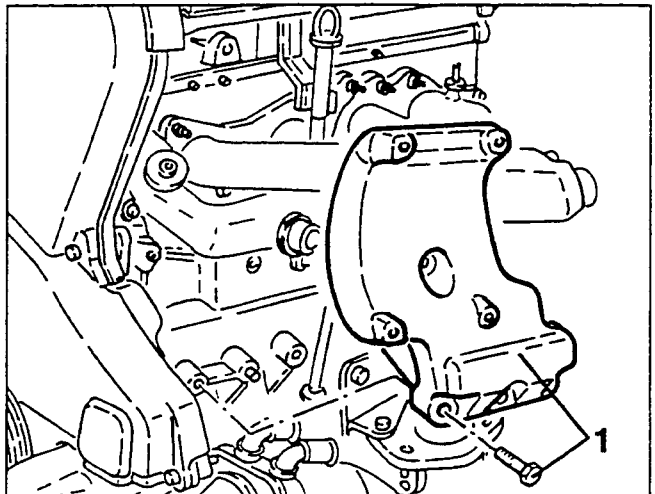
1. Slacken the fastening screw and remove the auxiliary components drive belt guide pulley.



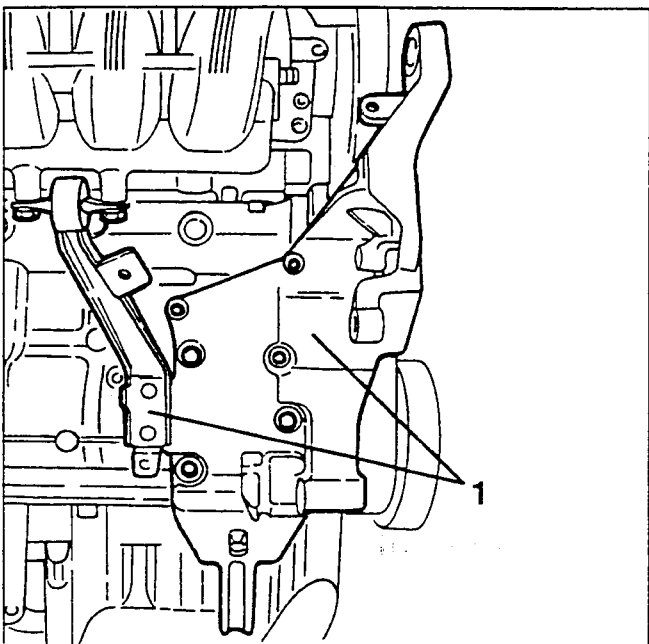
1. Using a 3/8" Allen wrench as counter torque, slacken the three fastening screws and remove the power steering pump pulley.
2. Slacken the three fastening screws and remove the power steering pump.



1. Slacken the four fastening screws and remove the air conditioning compressor support.



1. Slacken the fastening screws and remove the power steering pump support and alternator complete with intake box support.



1. Slacken the fastening screw and remove the ping sensor from the crankcase.
2. Slacken and remove the engine oil pressure meter.

## REFITTING

Reverse the sequence of the operations followed for removal, observing the following instructions:

- Prepare the engine compartment to accommodate the power unit, arranging all the electric cables, pipes, etc. so that they do not interfere with refitting operations.



### WARNING:

Make sure that the power unit supporting points have been fastened correctly.

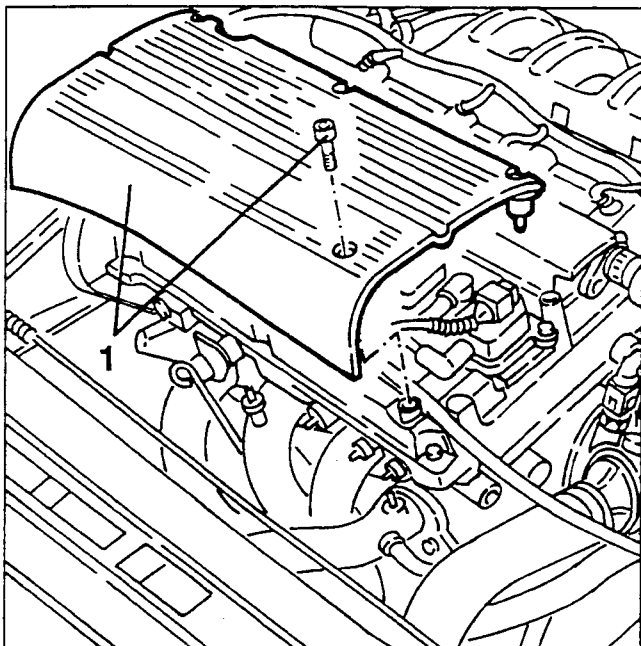
- After assembly, check the correct tensioning of the belts, fill the various systems as specified (see GROUP 00).
- Carry out all the necessary checks and operations (see GROUP 00).

## CYLINDER HEAD

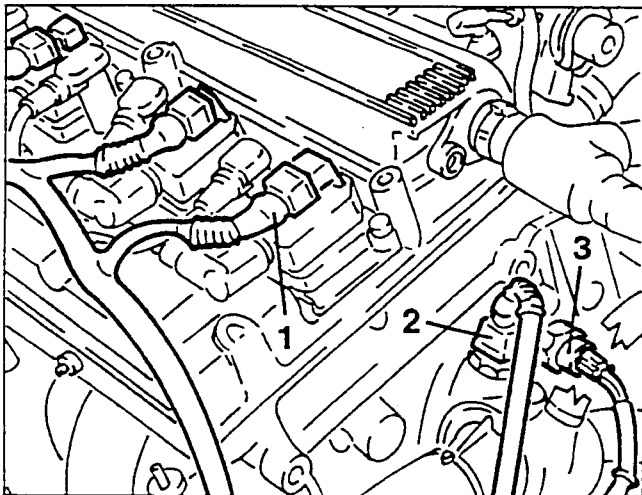
## REMOVING/REFITTING

- Follow the first steps of the procedure "REMOVING/REFITTING ENGINE" up to removal of the corrugated sleeve.

1. Slacken the fastening screws and remove the ignition coils cover.



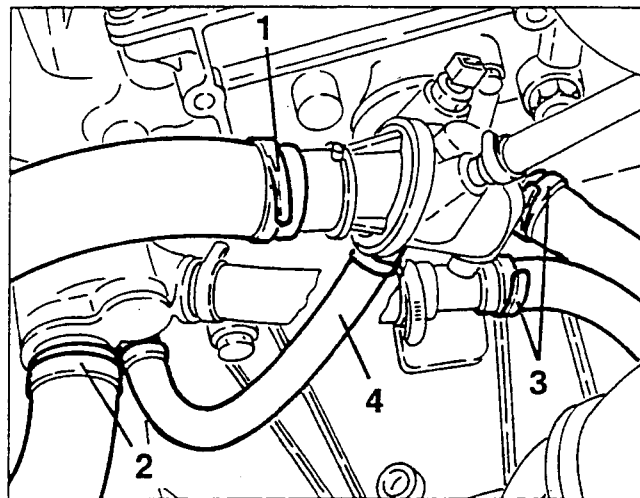
1. Disconnect the electrical connections from the ignition coils.
2. Disconnect the electrical connection from the coolant temperature sensor.
3. Disconnect the electrical connection from the engine coolant temperature gauge transmitter and maximum temperature warning light contact.



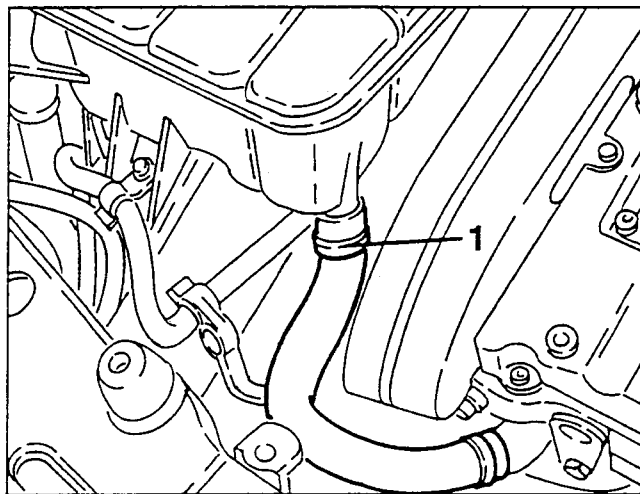
1. Disconnect the coolant delivery sleeve to the radiator from the thermostatic cup.
2. Disconnect the return sleeve from the radiator from the coolant return manifold to the pump.

3. Disconnect the coolant delivery and return pipe for the climate control unit heater from the thermostatic cup.

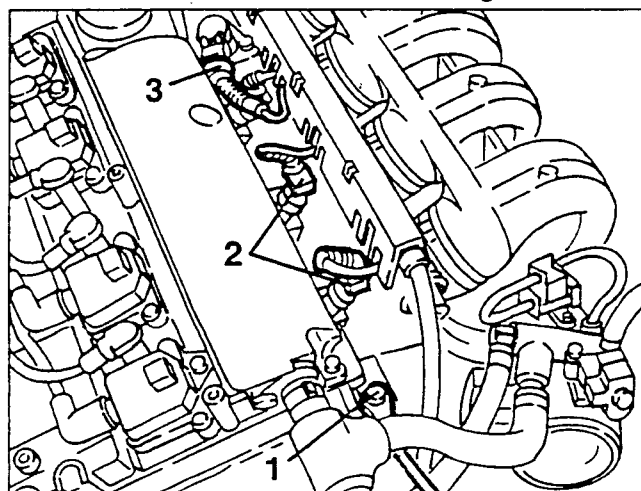
4. Disconnect the coolant delivery pipe to the heat exchanger for the engine lubrication circuit from the thermostatic cup.



1. Disconnect the system supply pipe from the header tank.

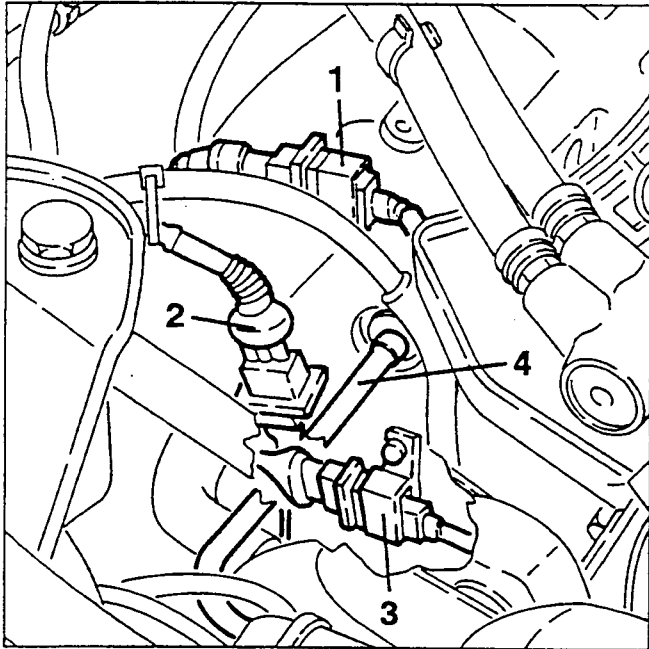


1. Disconnect the earth cable from the cylinder head.
2. Disconnect the electrical connections from the injectors.
3. Disconnect the electrical connection from the timing variator and move the associated wiring to one side.

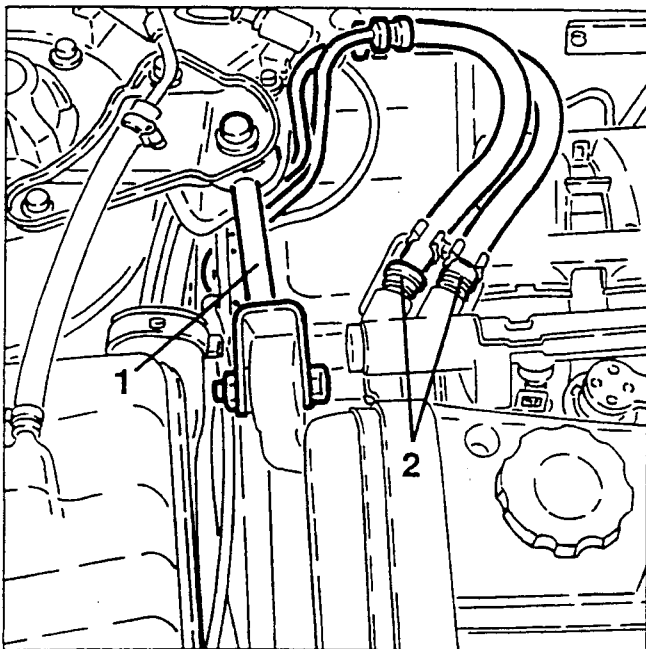




1. Disconnect the electrical connection of the timing sensor.
2. Disconnect the electrical connection pinging sensor.
3. Disconnect the electrical connection timing and rpm sensor.
4. Disconnect the fuel vapour recirculation pipes from the air intake box.

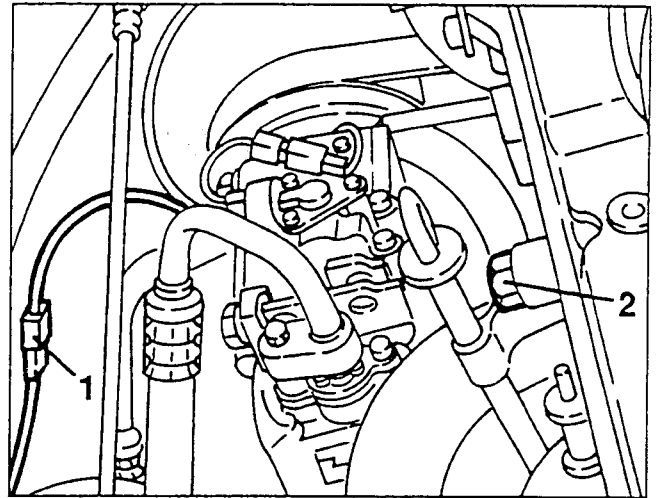


1. Slacken the fastening screws and remove the engine stay connecting rod.
2. Disconnect the fuel inlet and outlet pipes from the distributor manifold.

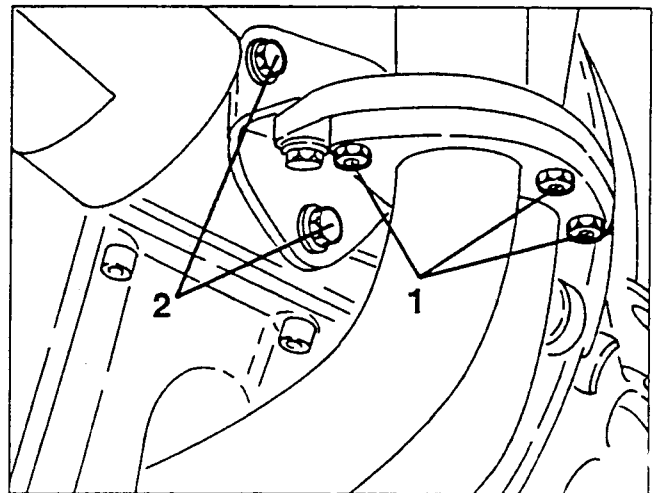


1. Disconnect the intermediate electrical connection from the air conditioning system compressor.

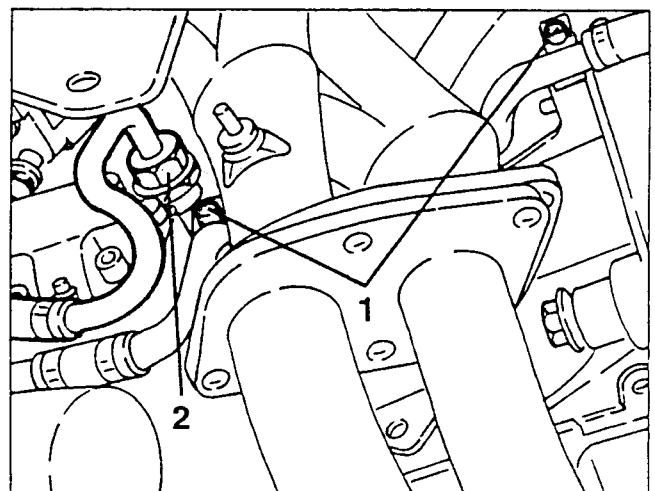
2. Slacken the engine oil dipstick fastening screw.



1. Raise the car and slacken the bolts fastening the front section of the exhaust pipe to the manifolds.
2. Slacken the screws fastening the exhaust manifold support bracket to the crankcase.

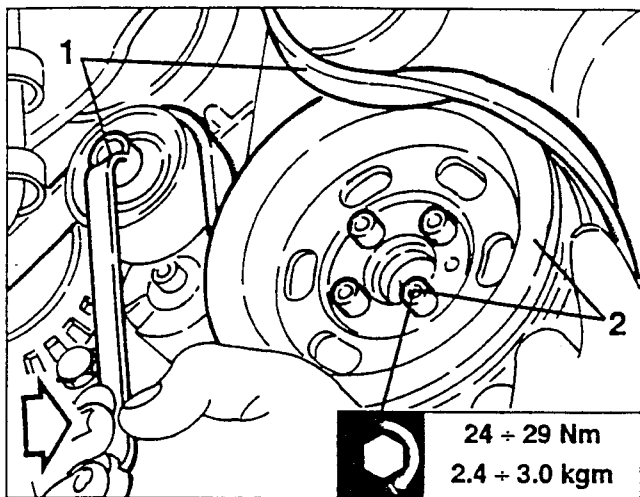


1. Slacken the two screws fastening the coolant delivery pipe to the heat exchanger.
2. Disconnect the coolant outlet pipe from the heat exchanger.

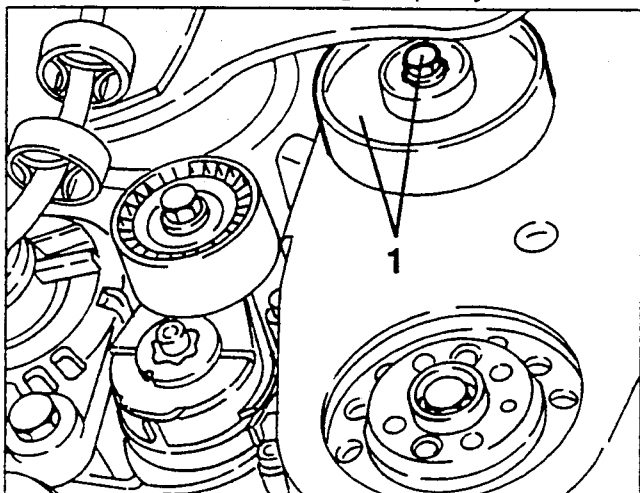




1. Working as illustrated on the guide pulley, loosen the tension of the auxiliary components drive belt and prise it off.
2. Slacken the four fastening screws and remove the auxiliary components drive pulley.

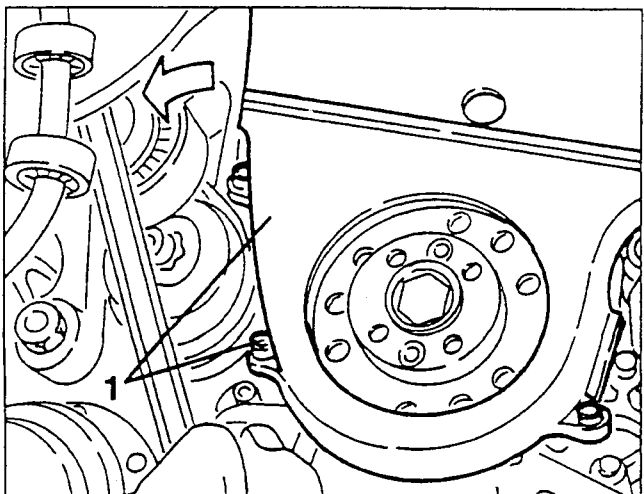


1. Slacken the fastening screw and remove the auxiliary components drive belt guide pulley.

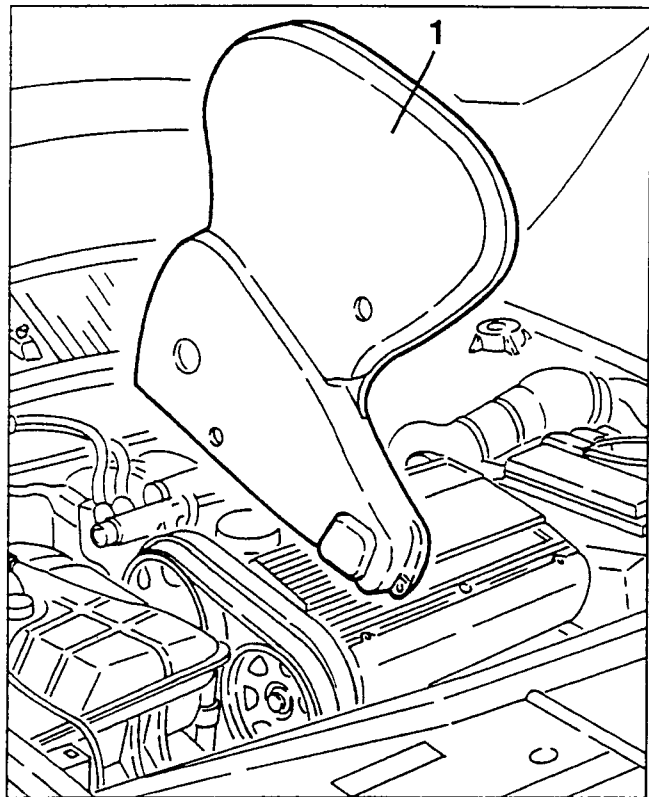


1. Slacken the fastening screws and remove the lower cover of the timing belts and counter-rotating shafts.

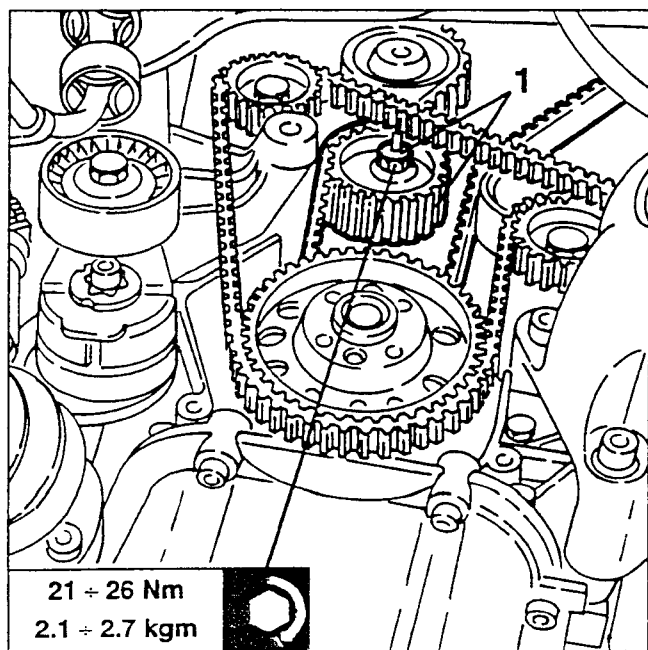
**NOTE:** To gain access to the rear screw, turn the belt tensioner as illustrated.



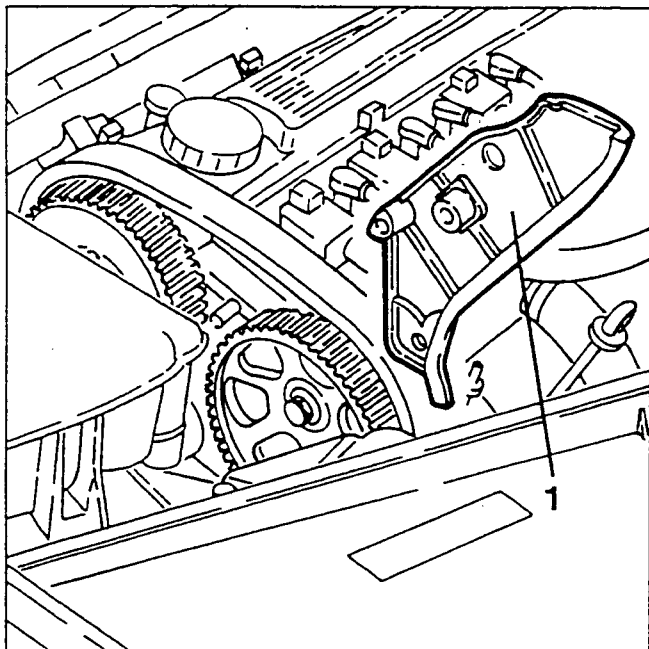
- Slacken the lower screws of the upper cover for the timing gear and counter-rotating shafts drive belts.
1. Lower the car, slacken the remaining fastening screws and remove the upper cover.



1. Working on the timing gear belt tensioner, loosen the tension of the belt, then prise it off the camshaft driving pulleys.

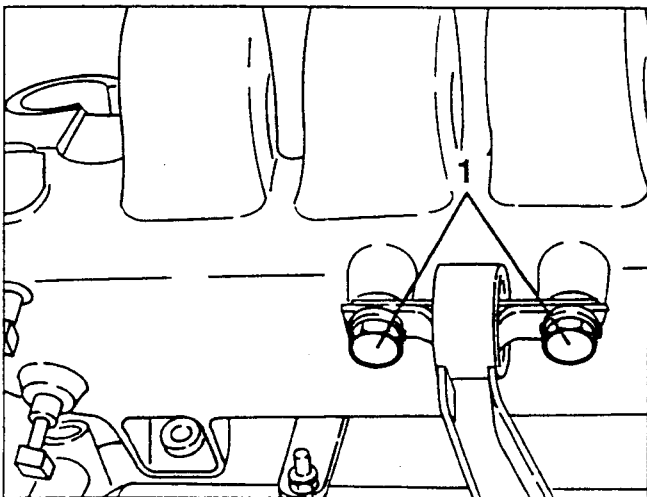


1. Slacken the fastening screws and remove the two timing gear belt side covers.



- Remove the bracket connecting the cylinder head to the engine stay rod support.

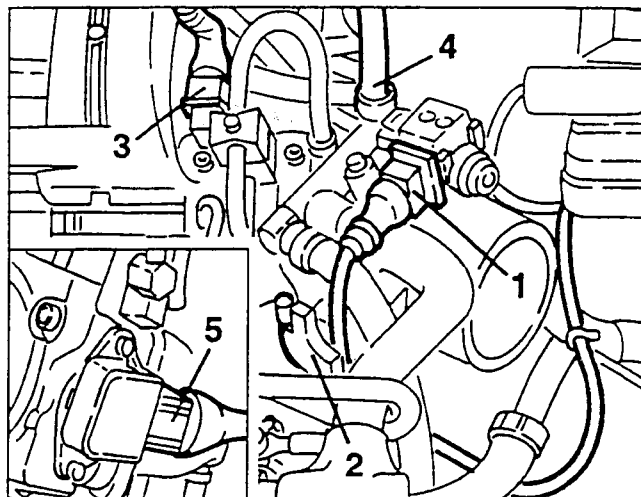
1. Raise the car and slacken the two screws fastening the support to the intake box.



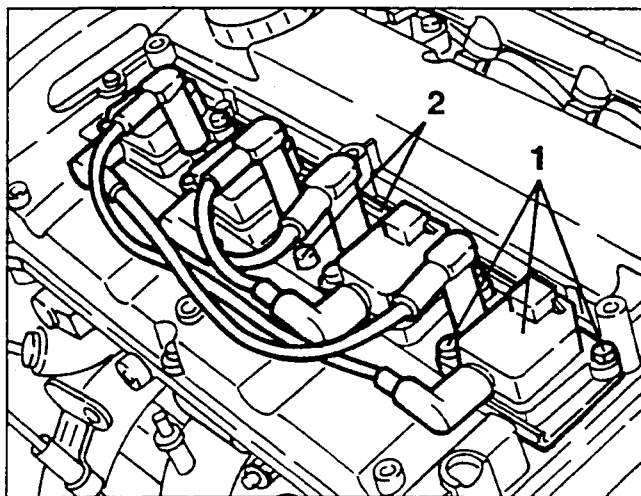
- Disconnect the vacuum takeoff pipe from the servo-brake.

1. Disconnect the electrical connection from the constant idle speed actuator.
2. Disconnect the accelerator cable from the throttle body.
3. Disconnect the electrical connection from the E.G.R. modulation solenoid valve.
4. Disconnect the coolant fluid delivery pipe to the header tank from the throttle body.

5. Disconnect the electrical connexion from the throttle potentiometer.

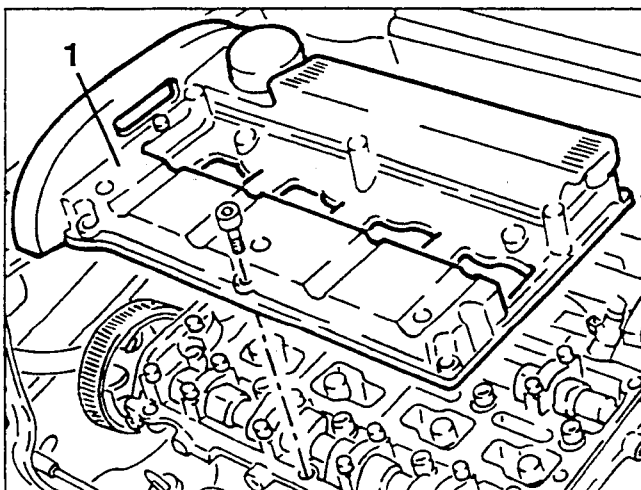


1. Slacken the fastening screws and remove the ignition coils.
2. Slacken the fastening screws and remove the ignition coils support bracket.



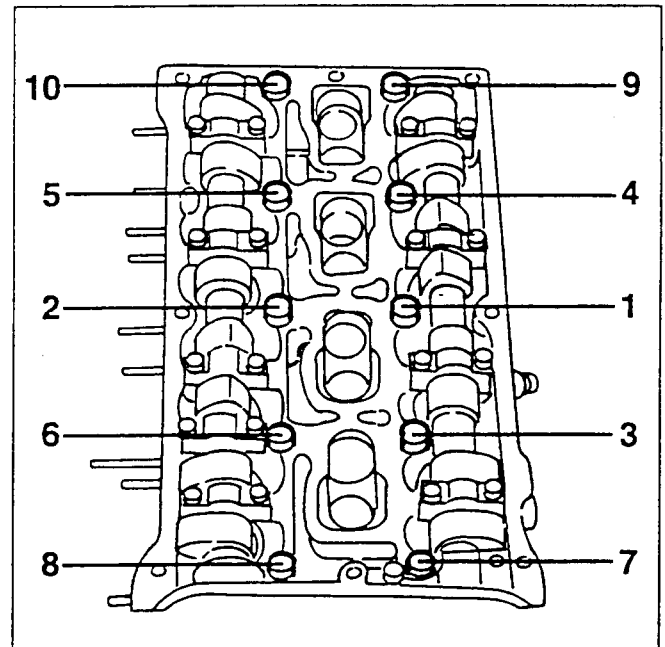
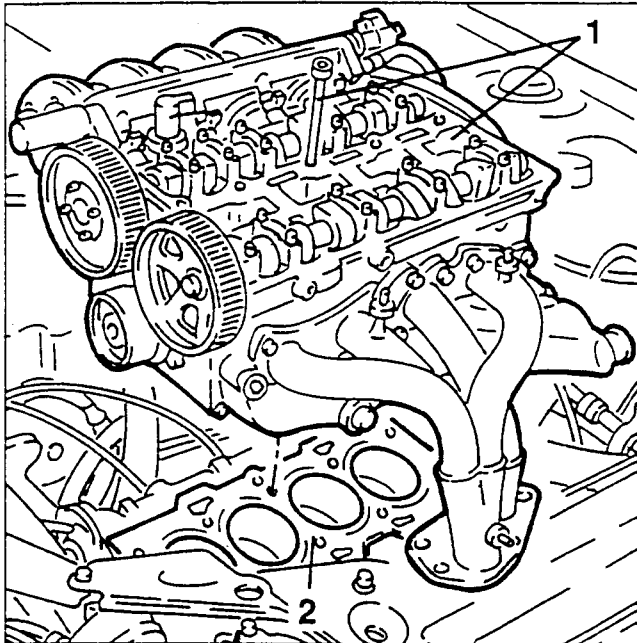
- Disconnect the oil vapour recovery pipe from the cylinder head.

1. Slacken the fastening screws and remove the cylinder head cover complete with gasket.





1. Slacken the cylinder head fastening screws and remove it.
2. Remove the gasket.



- Strip down the cylinder head and overhaul as described in the volume "OVERHAULING - ENGINES".

Re-assemble the cylinder head reversing the sequence described for removal and following the instructions given below.

- Turn the crankshaft to move the pistons of the 1st and 4th cylinder to the T.D.C.
- Position a new gasket on the cylinder head.

NOTE: The cylinder head gasket is in aramidic fibre and cylinder head retightening is unnecessary throughout the life of the engine.

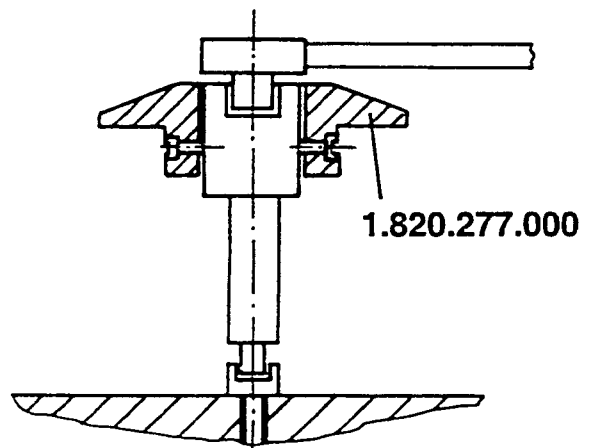


**WARNING:** Before assembly, accurately clean the cylinder head and crankcase surfaces.

- Assemble the complete cylinder head on the crankcase.
- Tighten the cylinder head fastening screws as described below and bearing in mind that, for each step, the tightening sequence is the one illustrated.

| Tightening procedure                             |                 |
|--------------------------------------------------|-----------------|
| Set in all the screws to a torque of:            | 20 Nm (2.0 kgm) |
| Tighten the screws to the preliminary torque of: | 40 Nm (4.1 kgm) |
| Turn all the screws with an angle of:            | 90° + 90° + 90° |

- For angle tightening use graduated disk no. 1.820.277.000 as illustrated.

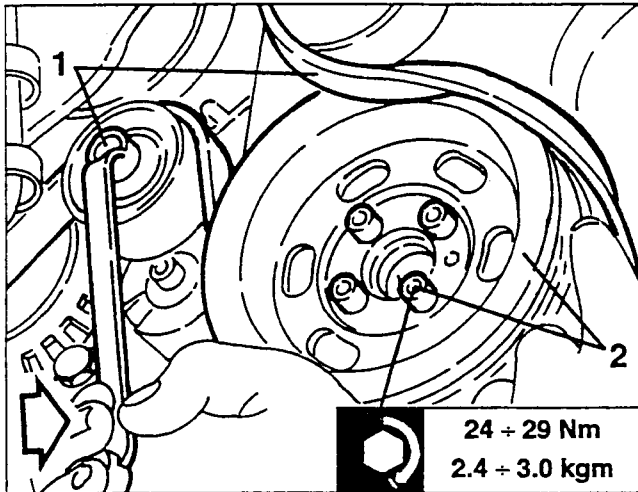


For re-assembly of the timing gear drive belt and timing and for assembly of the auxiliary components drive belt see GROUP 00.

## OIL SUMP

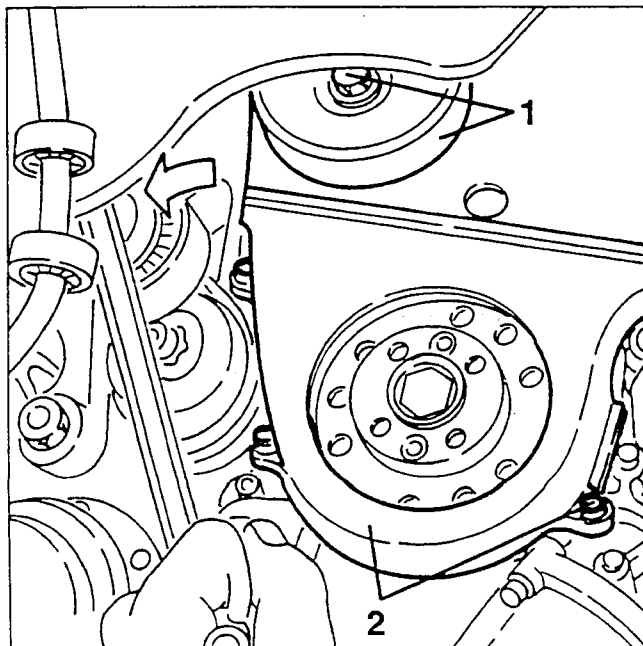
## REMOVAL/REFITTING

- Set the car on a lift.
  - Drain the engine oil (see GROUP 00).
  - Remove the right front wheel and mud flap.
1. Raise the car and working as illustrated on the belt tensioner, loosen the tension of the auxiliary components drive belt prise it off.
  2. Slacken the four fastening screws and remove the auxiliary components drive pulley.

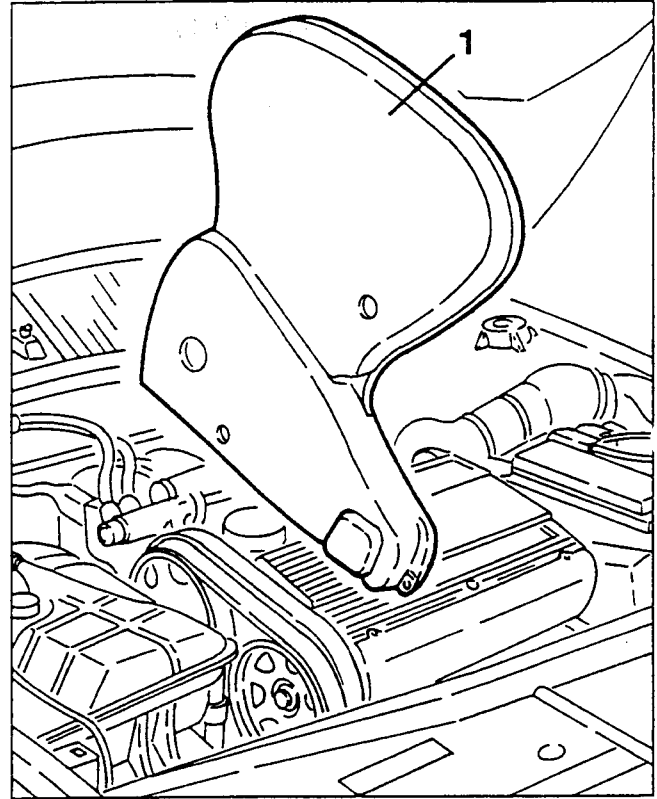


1. Slacken the fastening screw and remove the auxiliary components drive belt guide pulley.
2. Slacken the fastening screws and remove the lower cover of the timing gear and counter-rotating shaft belts.

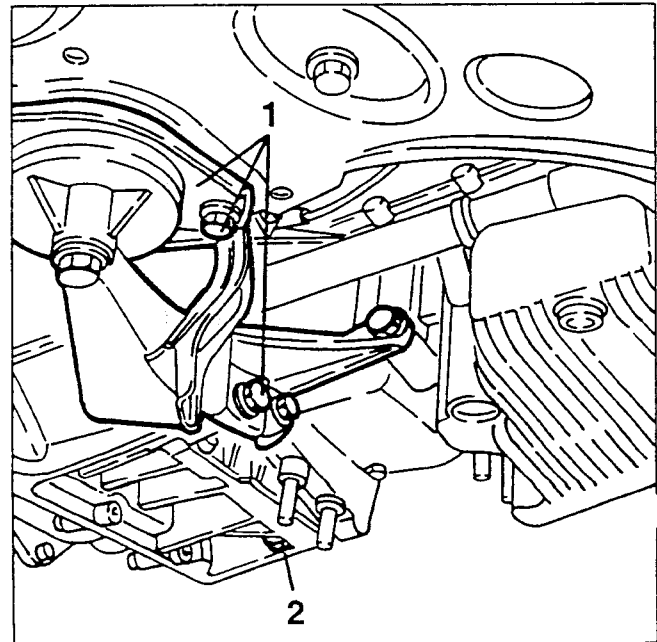
**NOTE:** To gain access to the rear screw, turn the belt tensioner as illustrated.



- Slacken the lower screws of the upper cover of the timing gear and counter-rotating shaft belts.
1. Lower the car, slacken the remaining fastening screws and remove the upper cover.

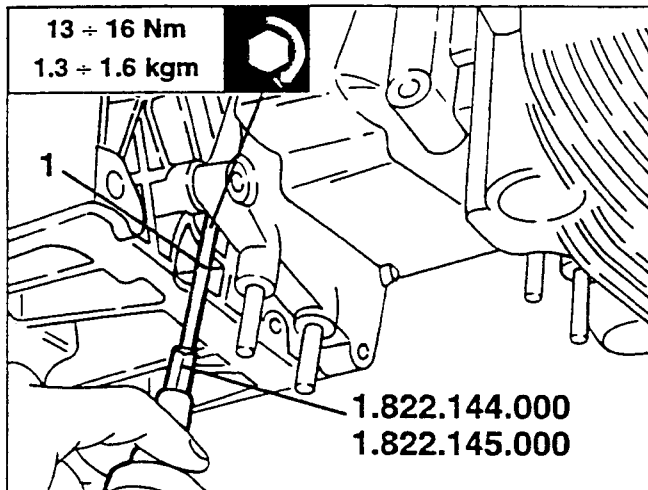


- Remove the front section of the exhaust pipe.
  - Position a hydraulic jack under the gearbox.
1. Slacken the fastening screws and remove the power unit rear support.
  2. Slacken the screws fastening the gearbox to the oil sump.

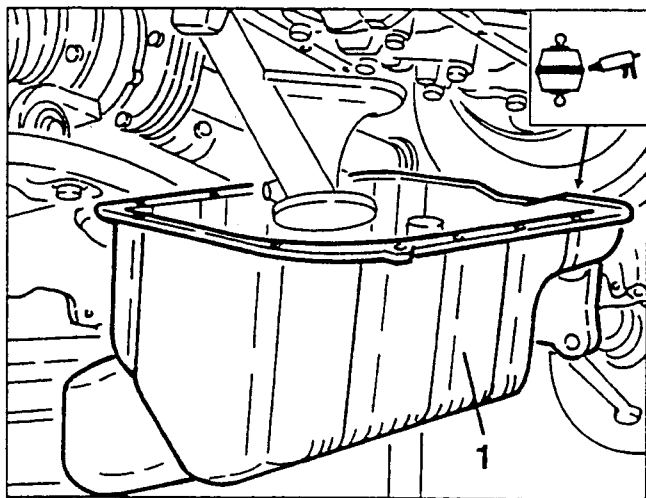




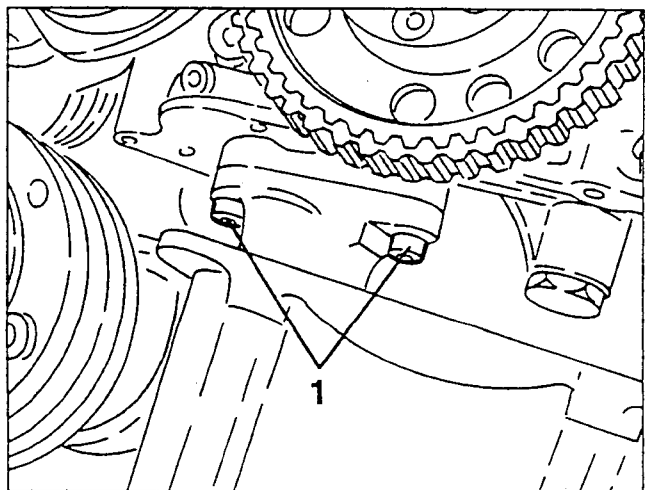
1. Slacken the oil sump fastening screws using tools no. 1.822.144.000 and no. 1.822.145.000 for those to which access is not possible.



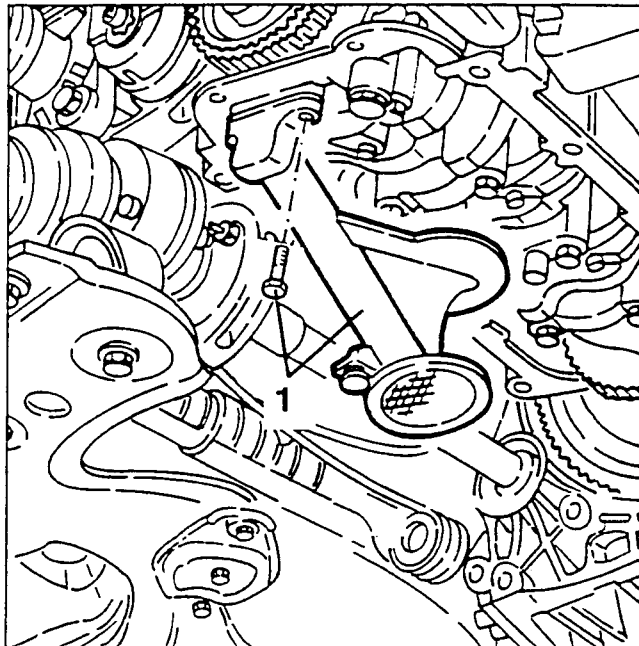
1. Lower the hydraulic jack as required and remove the oil sump.



**NOTE:** if difficulty is encountered in removing the oil sump, slacken the fastening screws (1) of the suction device.

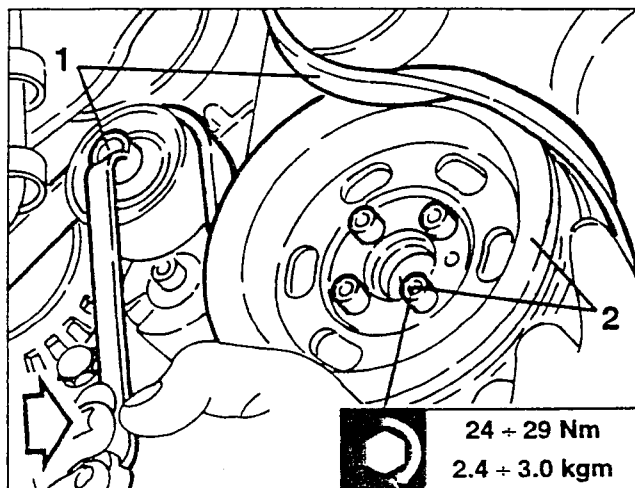


1. Slacken the fastening screws and remove the suction device.  
- Remove the seal.



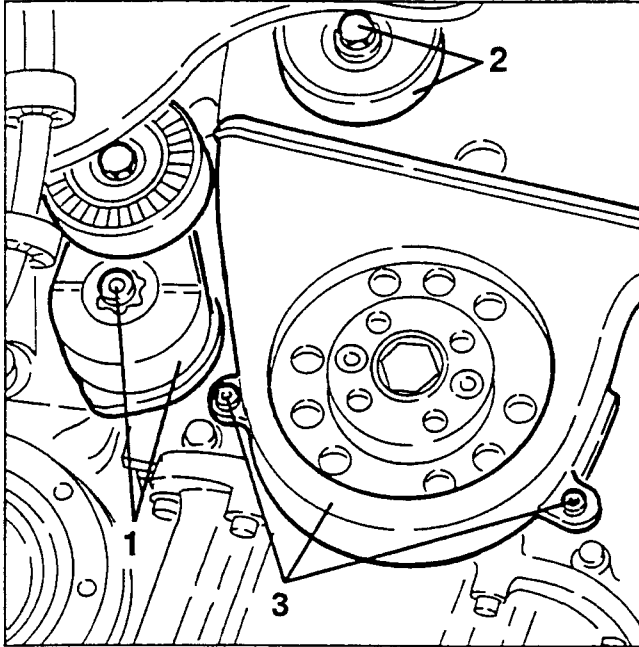
## CHANGING THE CRANKSHAFT FRONT OIL SEAL

- Set the car on a lift.
  - Disconnect the battery (-) terminal.
  - Remove the right front wheel and mud flap.
1. Raise the car and working as illustrated on the belt tensioner, loosen the tension of the auxiliary components drive belt prise it off.
  2. Slacken the four fastening screws and remove the auxiliary components drive pulley.

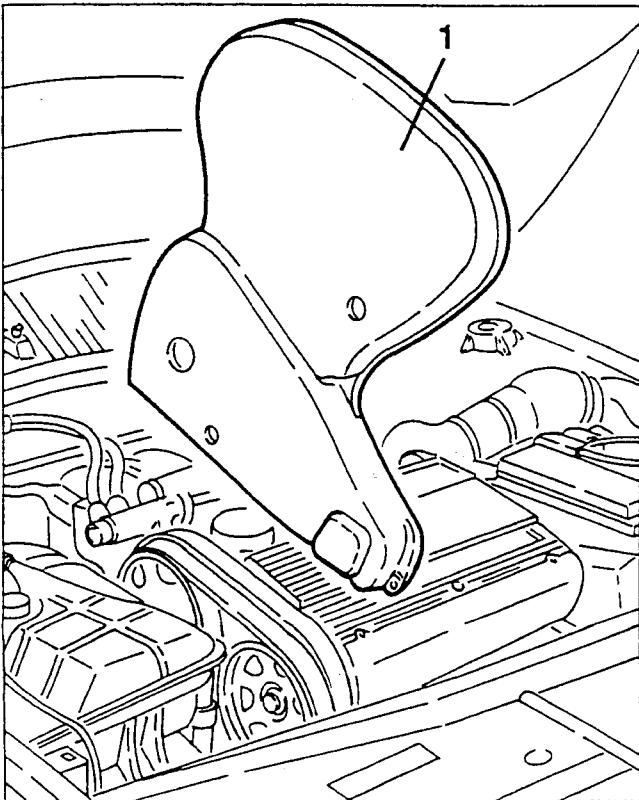




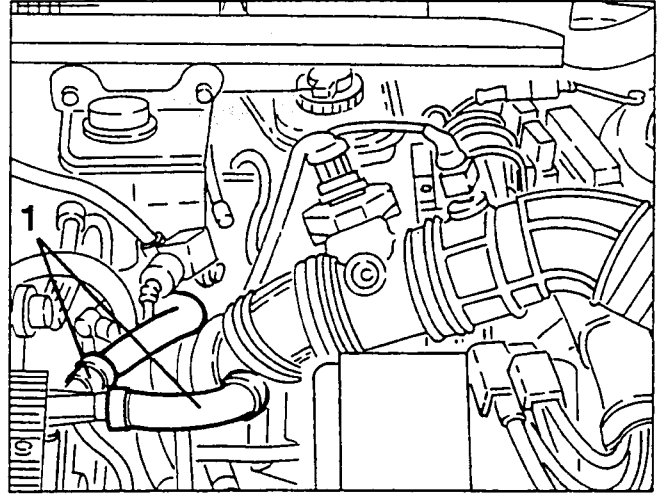
1. Slacken the fastening screw and remove the belt tensioner.
2. Slacken the fastening screw and remove the auxiliary components drive belt guide pulley.
3. Slacken the fastening screws and remove the lower cover of the timing gear and counter-rotating shaft drive belts.



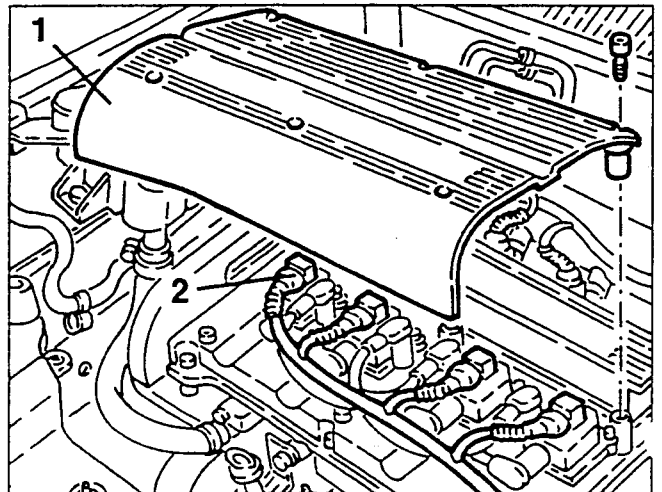
- Slacken the lower screws of the upper cover of the timing gear and counter-rotating shaft drive belts.
1. Lower the car, slacken the fastening screws and remove the upper cover.



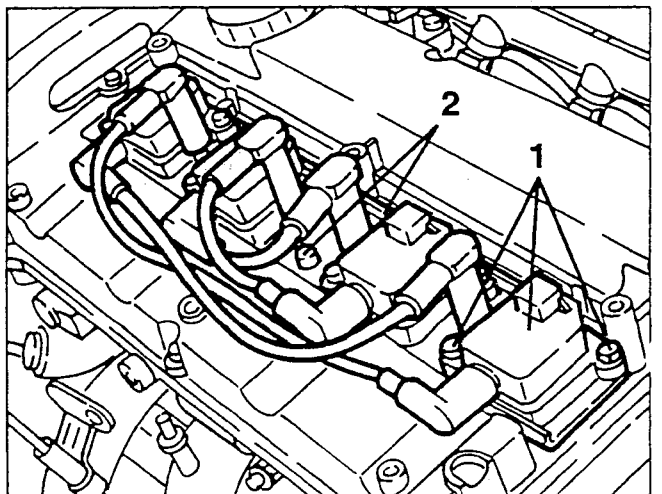
1. Disconnect and remove the oil vapour recovery pipes.



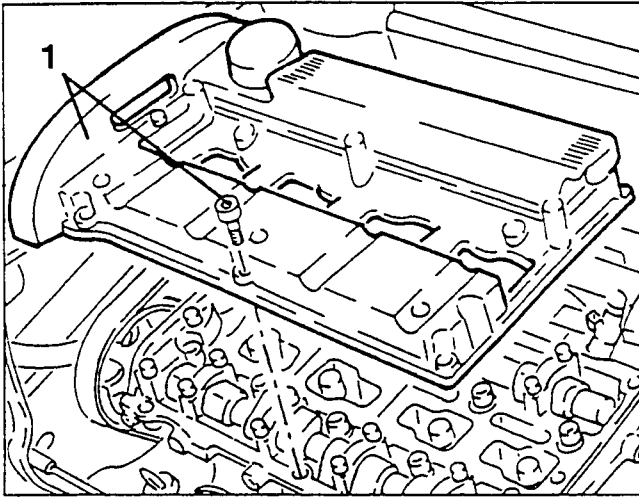
1. Slacken the fastening screws and remove the ignition coils cover.
2. Disconnect the electrical connections from the ignition coils.



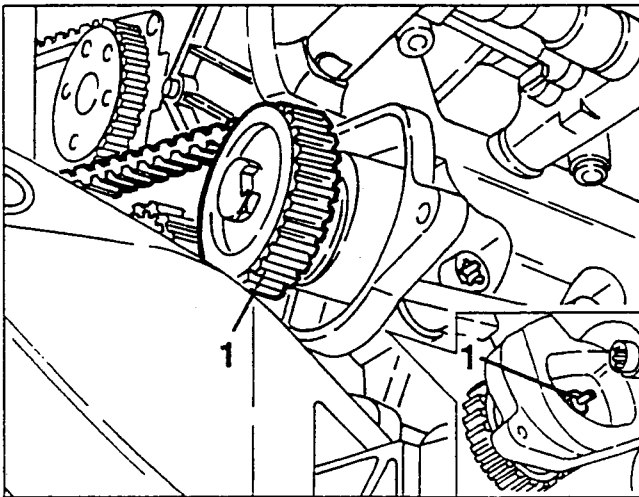
1. Slacken the fastening screws and remove the ignition coils.
2. Slacken the fastening screws and remove the ignition coils support bracket.



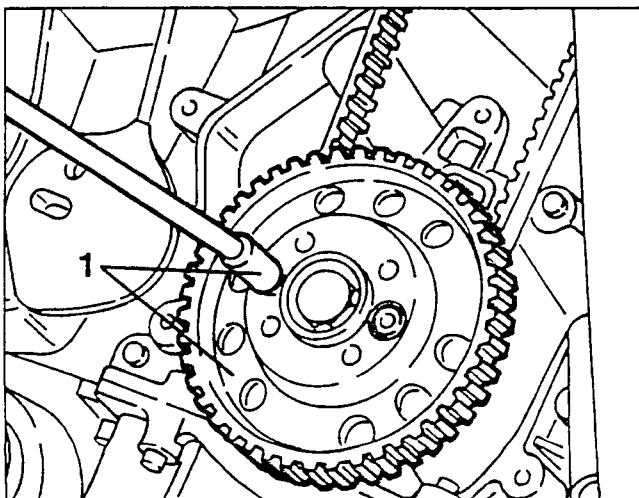
1. Slacken the fastening screws and remove the cylinder head cover complete with gasket.



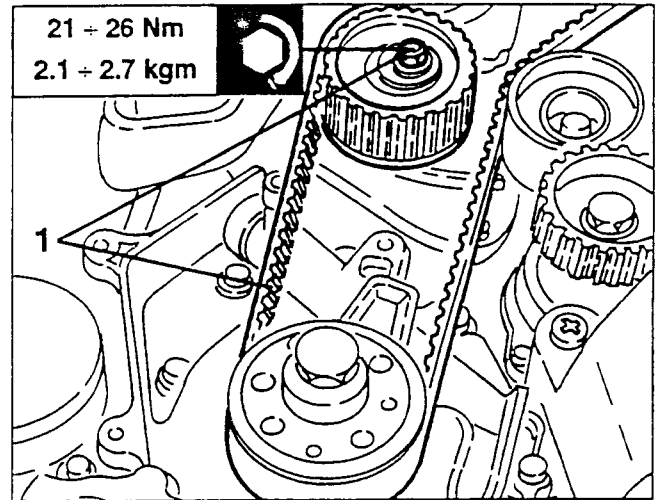
1. Loosen the tension of the counter-rotating shaft belt slackening the fastening nut of the corresponding belt tensioner, then prise and remove the belt.



1. Slacken the two fastening screws and remove the counter-rotating shaft belt driving pulley.

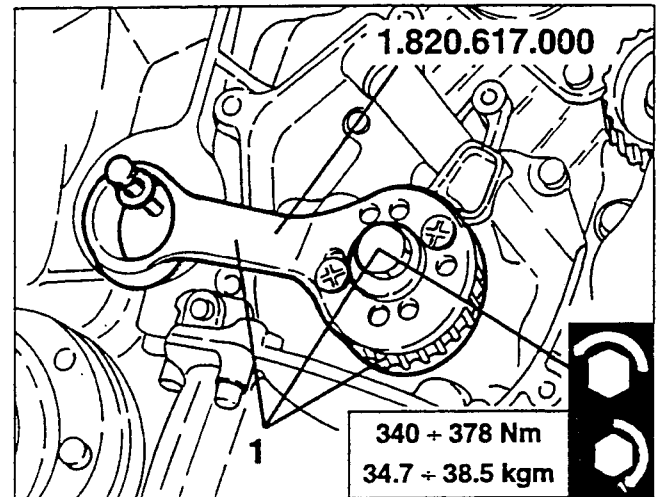


1. Working on the timing gear belt tensioner, loosen the tension of the belt, then prise it off.



### Solution for engines before change

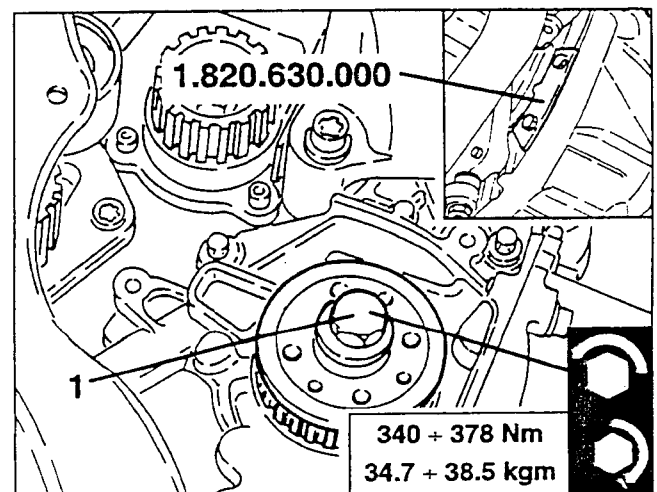
1. Using tool no. 1.820.617.000 as counter-torque slacken the screw (left-handed) fastening the timing gear drive belt pulley, then remove it.



### Solution for engines after change

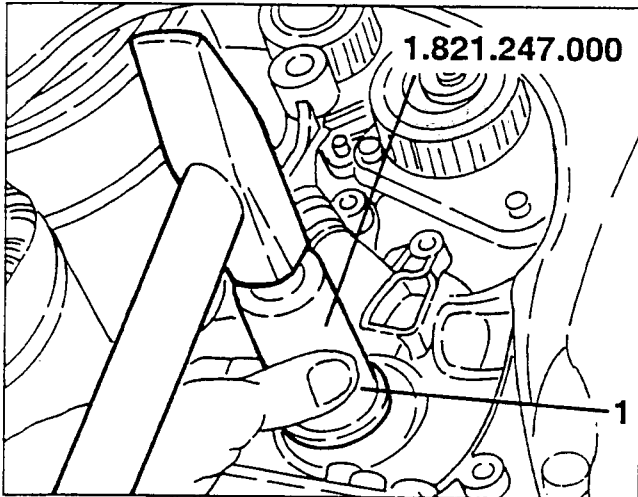
- Slacken the fastening screws and remove the lower flywheel cover.

1. Install flywheel stopper tool no. 1.820.630.000 as illustrated, slacken the fastening screw (left-handed), then remove the timing gear pulley.





1. Remove the oil seal and install a new one using tool no. 1.821.247.000.



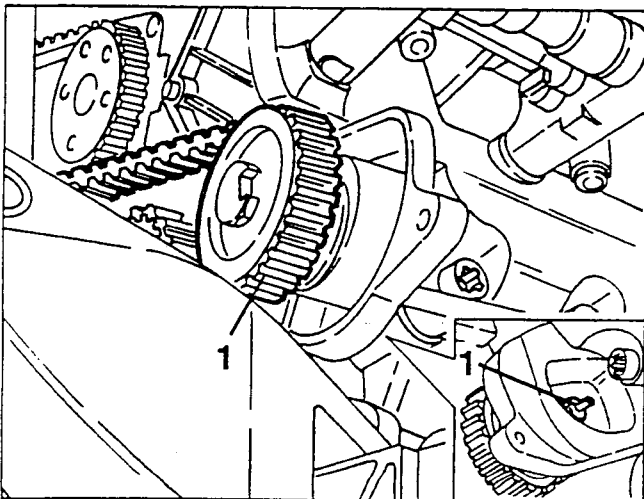
- Re-assemble reversing the sequence followed for removal.

Refer to GROUP 00 for re-assembly of the timing gear belts, counter-rotating shaft belts and their timing and for assembly of the auxiliary components drive belt.

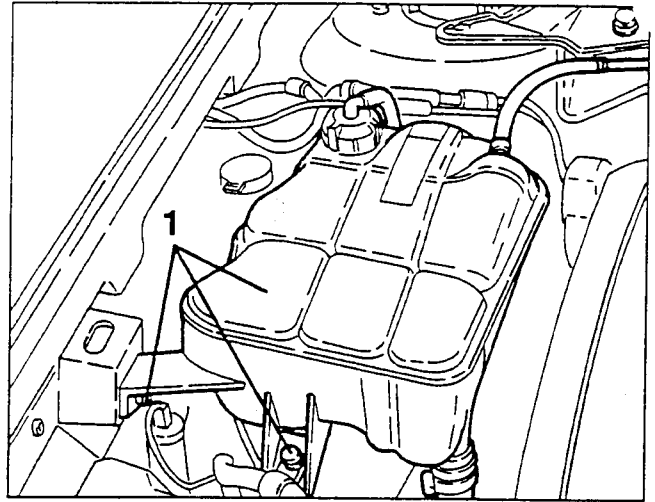
## CHANGING THE COUNTER-ROTATING SHAFT SEALS

- Proceed as described in the procedure for "Changing the crankshaft front oil seal" up to removal of the upper cover for the timing gear and counter-rotating shaft belts.

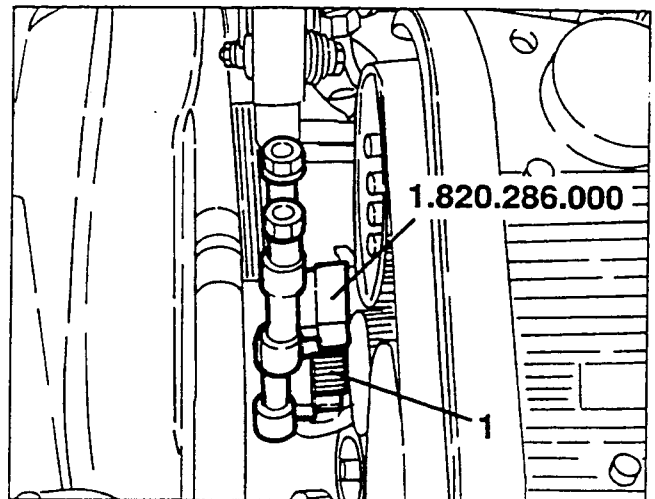
1. Loosen the tension of the counter-rotating shaft belt slackening the nut fastening the corresponding belt tensioner, then prise and remove the belt.



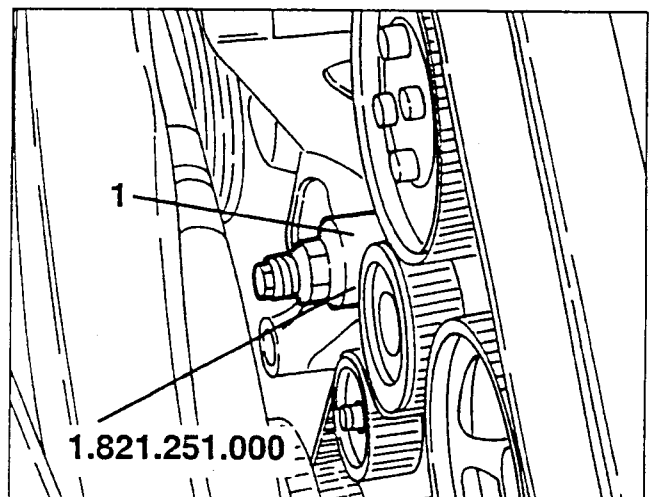
1. Slacken the screws and move the header tank to one side without disconnecting the piping.



1. Using tool no. 1.820.286.000 slacken the screw fastening the counter-rotating shaft pulley and remove it.



1. Remove the oil seal and install a new one using tool no. 1.821.251.000.

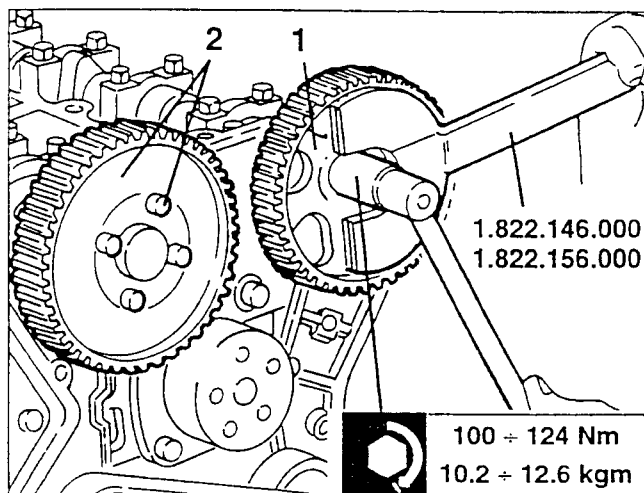


- Carry out re-assembly reversing the sequence described for removal referring to GROUP 00 for assembly of the counter-rotating shaft belt and for assembly of the auxiliary components drive belt.

## CHANGING THE CAMSHAFT OIL SEALS

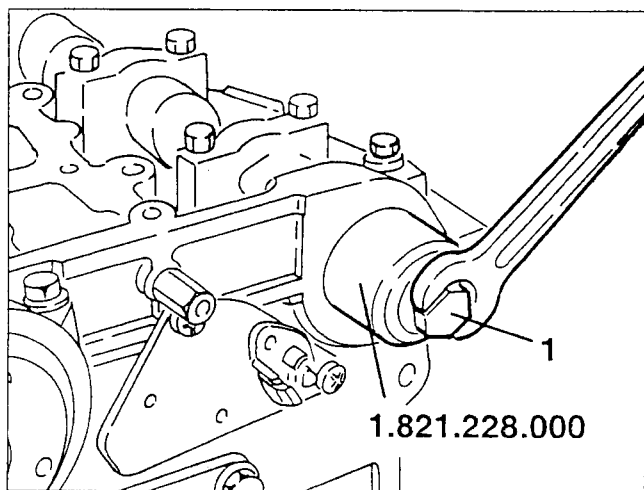
- Proceed as described in the procedure for "Changing the crankshaft front oil seal" up to removing the timing gear drive belt.

1. Using tool no. 1.822.146.000 complete with tool no. 1.822.156.000 slacken the screw fastening the camshaft pulley on the exhaust side and remove it.
2. Slacken the four screws and remove the camshaft drive pulley on the intake side.

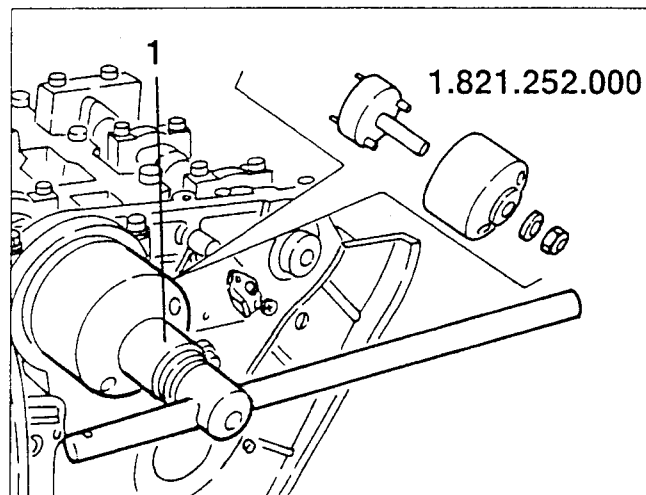


- Remove the camshaft oil seals.

1. Install a new camshaft front oil seal on the exhaust side using tool no. 1.821.228.000.



1. Install a new camshaft front oil seal on the intake side using tool no. 1.821.252.000.

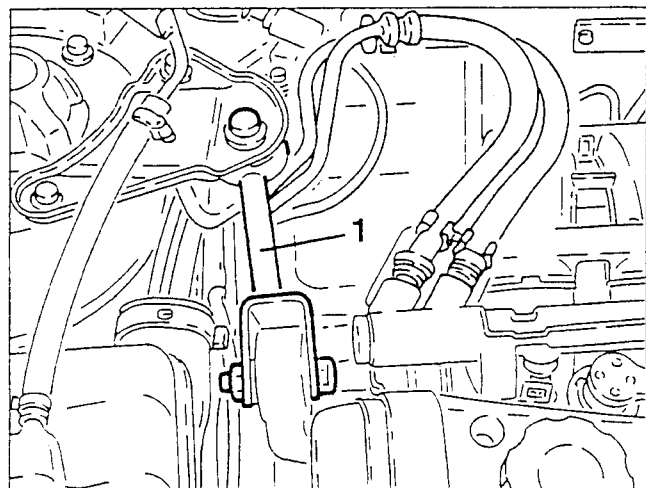


- Carry out re-assembly reversing the sequence described for removal

Refer to GROUP 00 for assembly of the timing gear and counter-rotating shaft belts and for assembly of the auxiliary components drive belt.

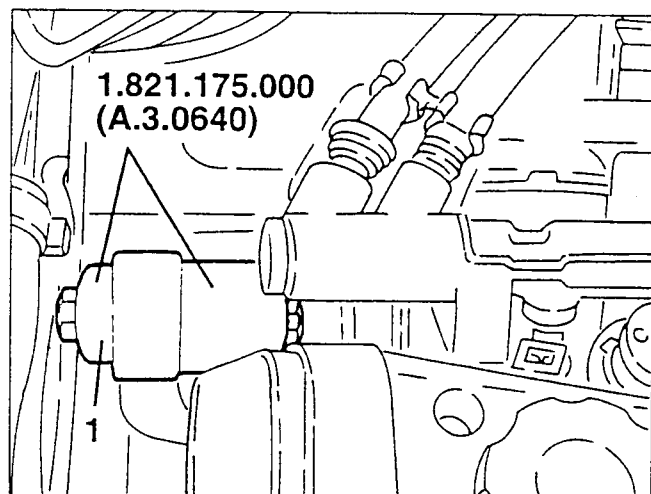
## CHANGING THE FLEXIBLE BUSHING OF THE ENGINE STAY ROD ANCHOR BRACKET

1. Slacken the fastening screws and remove the engine stay rod.

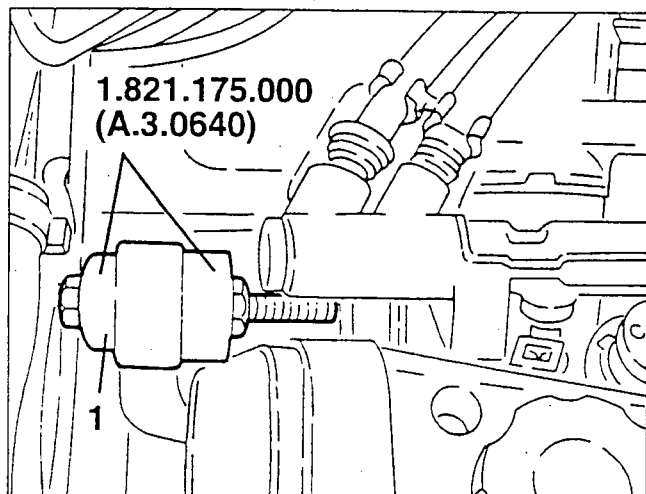


- Slacken the fastening screws and move the header tank to one side without disconnecting the piping.

1. Using tool no. 1.821.175.000 (A.3.0640) as illustrated remove the flexible bushing from the engine stay rod anchor bracket.



1. Refit a new flexible bushing still using tool no. 1.821.175.000 (A.3.0640) as illustrated.

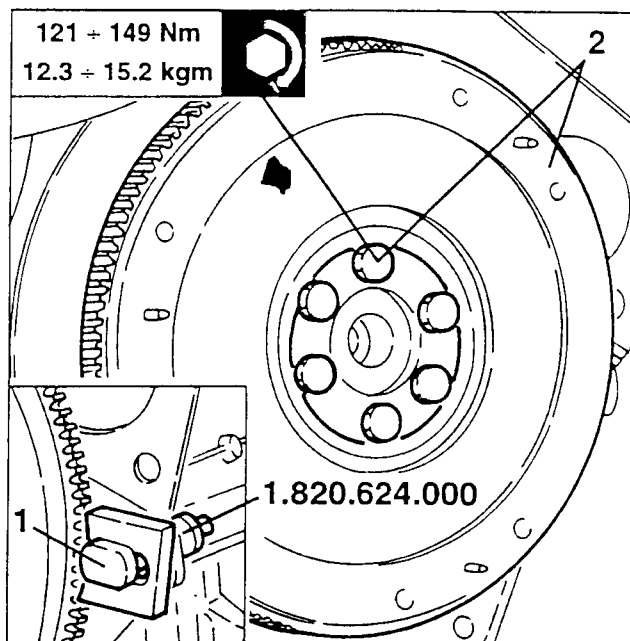


- Complete re-assembly reversing the sequence followed for removal.

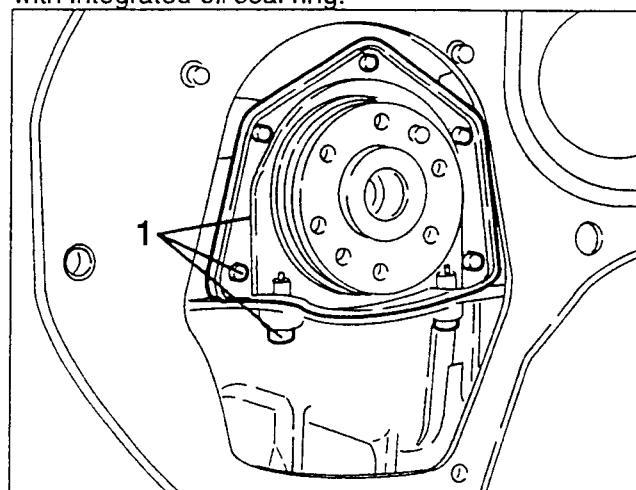
## CHANGING THE REAR CRANKCASE COVER (with oil seal)

- Remove the gearbox (see specific paragraph).  
- Remove the clutch (see specific paragraph).

1. Fit flywheel stopper tool no. 1.820.624.000.  
2. Slacken the fastening screws and remove the flywheel.

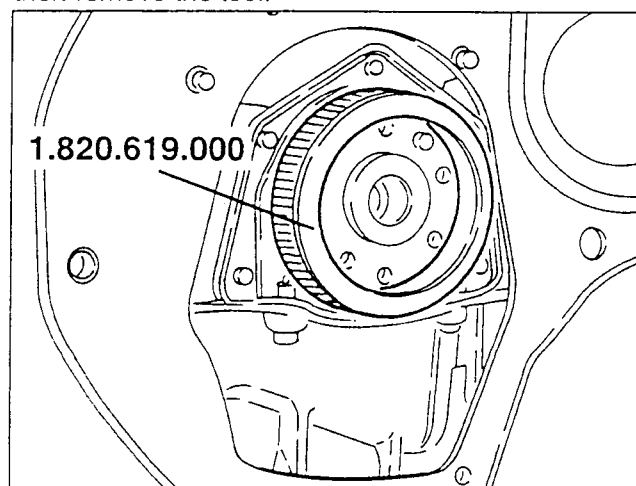


1. Slacken the screws fastening the oil sump to the crankcase, then remove the rear crankcase cover with integrated oil seal ring.



- Refit the rear cover proceeding as follows:

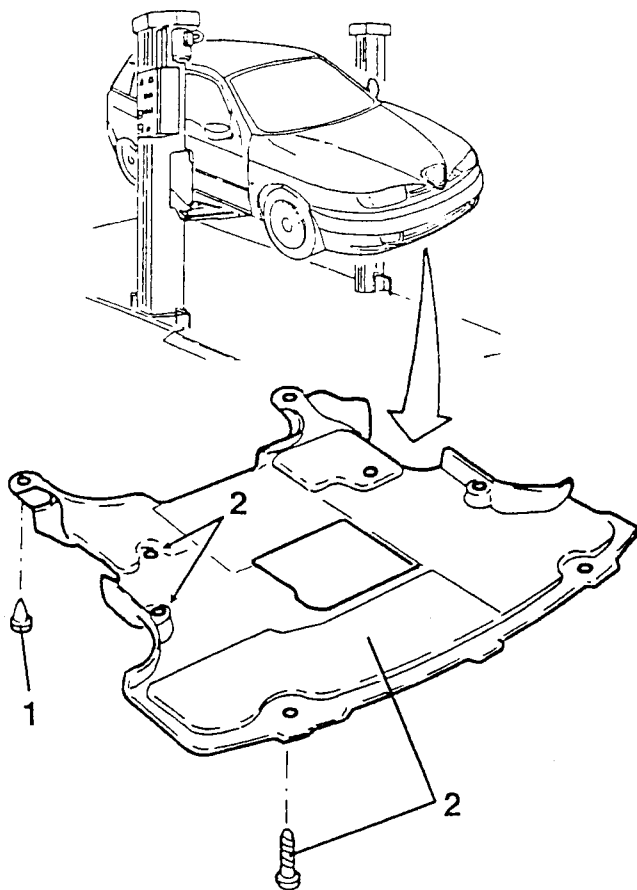
- Fit tool no. 1.820.619.000 on the oil seal of the rear crankcase cover.
- Assemble the tool - rear cover assembly and tighten the screws fastening the crankcase and the oil sump, then remove the tool.



## GUARD UNDER ENGINE

### REMOVING/REFITTING

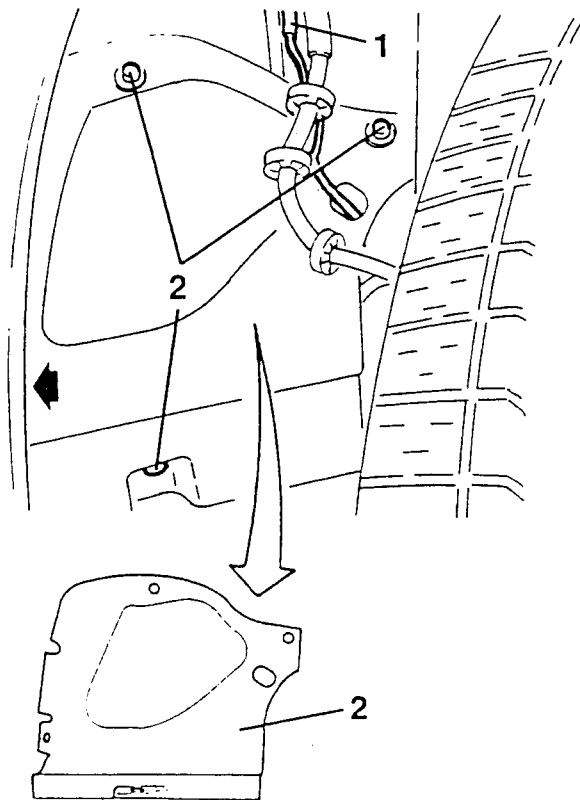
- Set the car on a lift and raise it.
- 1. Remove the two plastic buttons fastening the guard under the engine to the body.
- 2. Slacken the six fastening screws and remove the guard under the engine.



## WHEEL HOUSE GUARDS

### REMOVING/REFITTING

- Set the car on a lift and raise it.
- Turn the wheel just enough to gain access to the left guard.
- 1. Disconnect the electrical connection of the brake pad wear signalling cable and remove the latter from the hole on the left guard.
- 2. Slacken the fastenings and remove the left wheel house guard.
- Carry out the same procedure for removing/refitting the right wheel house guard.



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T. SPARK  
16V

ENGINE  
Operations in vehicle **10**

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**WHITE**



## GENERAL DESCRIPTION

An electronic control system supervises and regulates all the parameters of the engine, optimising performance and consumption levels through response in real time to the different operating conditions: this sophisticated latest generation system consists of a single control unit which controls both ignition (static with lost spark) and injection (timed).

This is the M 2.10.3 version of the proven and reliable BOSCH MOTRONIC system.

Compared with the previous versions this new M 2.10.3 system adopts a control unit - with 55 pins - with advanced design and production technology, it also possesses many possibilities for inserting auxiliary functions.

As a result of the use of new sensors and revision of the control programmes, the system makes it possible to achieve considerable improvements in terms of consumption and emission levels and vehicle handling.

Another feature of this system is self-adaptation, i.e. the capability to recognise the changes that take place in the engine and to compensate them, according to functions which mainly correct:

- the mixture titration
- the carburetion parameters according to the command of the evaporative solenoid valve
- an adaptive programme for idle speed control.

## FUNCTIONS OF THE SYSTEM

### Sequential and timed injection (S.E.F.I.)

With this control unit, fuel injection is sequential and timed for each cylinder: the injection instant (delivery of fuel into the intake manifolds by the opening of the injectors) is not simultaneous for all the cylinders, but takes place for each cylinder in correspondence with the optimal point of injection, calculated by the control unit according to special maps depending on the load, speed and temperature of the engine.

**NOTE:** the instant considered in the design of the maps is that of the start of injection (the cylinder is in the exhaust stroke - intake valve still closed).

### Static ignition

An electronic ignition system has been adopted with "static distribution" (with semi-conductors, without distributor). This solution makes it possible to eliminate rotary components; in addition, it does not produce external sparks thus reducing the risk of interferences; lastly it reduces the number of high voltage cables and connectors; as the power modules for controlling the primary windings of the coil are inside the control unit.

Static ignition takes place through four coils, according to the so-called "lost spark" logic: this solution exploits the different pressures and environments existing contemporaneously in a pair of cylinders: when one of the cylinders approaches the bursting stroke, with a mixture of air and fuel, the corresponding cylinder is at the end of the exhaust stroke in the presence of exhaust gas.

In a 4-cylinder in line engine, the paired cylinders are 1/4 and 2/3.

The solution adopted for this engine (T.SPARK - 16 valves) has required the adoption of a larger "central" spark plug and a smaller "side" spark plug. Each of the four coils supplies the small spark plug of the cylinder below and simultaneously the large one of the paired cylinder.

**NOTE:** This way it is impossible to invert the spark plug cables during servicing operations.

### Metering the air flow rate

The air flow meter adopted is of a more modern design known as the "hot film" type.

Outside, the air-flow meter looks like a part of duct between the intake manifold and the air cleaner. Inside the air-flow meter there is an electronic circuit and a plate that is crossed by the air which passes into the duct. The film plate is kept at a constant temperature (appr. 120°C over the temperature of the incoming air) by a heating resistance placed in contact with it. The mass of air flowing through the manifold tends to withdraw heat from the plate: therefore, to keep its temperature constant, a certain current needs to flow through the heating resistance: this current, suitably measured, is proportionate with the mass of flowing air.

**N.B.** This air flow meter measures directly the mass of air (and not the volume as in the previous versions with "floating port", thereby eliminating problems of temperature, altitude, pressure, etc.), enabling an optimum ratio between the weight of the air and the weight of the fuel.



### Cylinder detection

Following the sequential and timed injection system, a timing sensor has been introduced (cam angle sensor): this makes it possible to detect which cylinder is in the bursting stroke when the engine is started, in order to be able to start the correct injection sequence. The sensor is formed of a Hall-effect device by which the voltage signal sent to the control unit "lowers" suddenly when the tooth machined on the camshaft pulley passes in front of the actual sensor; therefore a signal is sent every two turns of the crankshaft.

Conversely, the rpm sensor sends a reference signal for each turn of the engine and each subsequent tooth of the phonic wheel informs the control unit of an increase of the angular position of the crankshaft, so that injection is sent correctly from the suitable cylinder and the spark to the corresponding pair of cylinders.

### Fuel pump

The control logic of the fuel pump carried out by the control unit (mainly based on the rpm signal) immediately cuts off the supply to the pump as soon as the engine stops.

Moreover, the pump will not operate with the key engaged and the engine not running.

In this car, this logic is integrated - in order to further higher the standards of safety - by the **inertial switch** device: this is an electromechanical switch which, in the event of heavy shocks, opens to cut off the circuit that takes the earth to the fuel pump, which stops instantaneously. This device is particularly important as an integration of the safety guaranteed by the logic of the control unit, especially if the car is hit from behind or in the case of other accidents in which the engine does not stop immediately.

### Timing variator

This T.SPARK - 16 valve engine is fitted with an electro-mechanical-hydraulic timing variator which is connected to the camshaft and controls and adjusts intake timing (advance) in such a way that a larger amount of air is taken in. This device is activated by the control unit only after exceeding a determinate rpm and engine load to avoid adversely affecting correct operation of the engine at low speeds.

### Percentage of exhaust gas recirculation

Nox (nitric oxide) is developed at high temperatures in the combustion chambers. To reduce these emissions an E.G.R. (Exhaust Gas Recirculation) system is adopted which by recirculating part of the exhaust gases, lowers the temperature, thus the Nox produced, in the combustion chambers.

In fact, part of the exhaust gas is withdrawn through the special EGR Valve and re-admitted to the intake box where it is mixed with the intaken air and burnt again in the engine. The EGR valve is modulated by a solenoid valve controlled by the injection control unit and, as a result of the type of control, in addition to reducing the amount of Nox, consumption levels are also optimised.

The percentage of exhaust gas to be returned to the engine is established by the control unit taking account of a specific characteristic curve which depends on the load, speed and temperature of the engine.



## OPERATING LOGIC

### – Identification of the "operating point":

the "point of operation of the engine" is located mainly through two sensors: the rpm sensor informs the control unit of the speed of rotation of the engine; the air flow meter supplies the value of the mass of air actually entering the cylinders, defining the instantaneous volumetric yield of the engine.

– **Adjustment of injection times (quantity of fuel):** the control unit controls the injectors very quickly and precisely, calculating the opening time on the basis of engine load (rpm and air flow), also taking into account the battery voltage and the temperature of the engine. Injection is "sequential", i.e. the injectors are opened in correspondence of the exhaust stroke of the corresponding cylinder.

### – Ignition adjustment (calculation of advances):

the control unit calculates the advance on the basis of the engine load (rpm and air flow); the value is also corrected according to the temperature of the intaken air and that of the engine: ignition is "static" as described previously.

### – Cold starting control:

during cold starts the control unit uses special advance values and injection times.

When a determinate temperature/rpm ratio is reached, the control unit resumes normal operating conditions.

### – Control of enrichment during acceleration:

upon the need for acceleration, the control unit increases injection in order to reach the required load as quickly as possible.

This function takes place through the potentiometer located on the throttle which instantaneously informs the control unit of the need to accelerate.

### – Fuel cut-off during deceleration:

with the throttle closed and an engine speed above a certain threshold, the control unit de-activates fuel injection; this way the rpms decrease rapidly towards idle speed reducing the speed and fuel consumption. The cut-off threshold value varies according to the temperature of the engine and the speed of the car.

### – Control of idle speed:

the adjustment of the engine idle speed is carried out through the special actuator fitted directly on the throttle body which acts on the throttle by-pass: in fact, when the throttle is closed, this valve adjusts the by-pass gap compensating the load required by the services in order to ensure that idle speed is as constant as possible.

### – Maximum Rpm limiting:

above a certain threshold the control unit automatically stops the injection of fuel preventing the engine from "over-revving".

### – Combustion control -lambda probe-:

the oxygen sensor (or "lambda" probe) informs the control unit of the amount of oxygen at the exhaust, and therefore the correct air-fuel metering.

The optimum mixture is obtained when the lambda coefficient = 1 (optimum stoichiometric mixture).

The electric signal sent by the probe to the control unit changes abruptly when the composition of the mixture departs from lambda = 1.

When the mixture is "lean" the control unit increases the amount of fuel, reducing it when the mixture is "rich": this way the engine operates as far as possible around the ideal lambda rating.

The signal from the lambda probe is processed inside the control unit by a special integrator which prevents sudden "oscillations".

The probe is heated by an electrical resistance so that it quickly reaches the correct operating temperature (appr. 300 °C).

Through this probe it is therefore possible to adjust engine carburetion precisely.

Among other items, this makes it possible to meet emission limit regulations.



– **Timing variator control:**

The electro-mechanical-hydraulic timing variator, connected to the camshaft, controls and adjusts the intake timing according to the load and rpm of the engine. This device is activated by the control unit at higher engine operating speeds (above 1,600 rpm and with load above 30%).

– **Knocking control:**

Through a knock sensor the control unit is informed if any pinging or "knocking" occurs and it corrects the spark advance "delaying" it accordingly; a further correction also takes account of the air temperature, in fact, when the temperature of the intake air is high, pinging is more accentuated.

**N.B.** The intaken air temperature sensor to be found just downstream of the air-flow meter, is not used to calculate the engine load but to control the knocking parameters.

– **Fuel vapour recovery:**

the fuel vapours collected from the various points of the supply circuit in a special active carbon canister are ducted to the engine where they are burnt: this takes place through a solenoid valve which is opened by the control unit only when the engine is in a condition that allows correct combustion without adversely affecting the operation of the engine: in fact the control unit compensates this amount of fuel by reducing delivery to the injectors.

– **E.G.R. valve control**

The percentage of exhaust gas to be returned to the engine is determined by the control unit taking account of a specific characteristic curve which depends on the engine load and speed: recirculation is only activated when the engine speed is between 2500 and 4000 rpm., also in relation to the temperature of the engine (higher recirculation percentage with high temperatures).

– **Connection with the air conditioner compressor:**

the control unit is connected with the air conditioner compressor and it cuts in the compressor in relation to operation of the engine. As this service absorbs a considerable amount of power, the control unit:

- adapts the engine idle speed each time the compressor cuts in; if the engine speed falls below 700 rpm, the compressor is turned off;
- when there is the need for high power - high speed - over 6000 rpm, it momentarily cuts out the compressor
- when the engine is being started the compressor is disabled until normal operating conditions have been reached.

– **Connection with ALFA ROMEO CODE system:**

on cars fitted with "electronic key" (ALFA ROMEO CODE), as soon as the Motronic control unit receives the signal that the key has been turned to MARCIA, it "asks" the Alfa Romeo CODE system for consent to start the engine: this consent is given only if the Alfa Romeo CODE control unit recognizes the code of the key engaged in the ignition switch as correct. This dialogue between the two control units takes place on diagnosis line K already used for the Alfa Romeo Tester (see specific paragraph).

**N.B.** Before working on the system you are advised to read the corresponding chapter.

– **Self-diagnosis:**

the control unit possesses a **self-diagnosis system**, which continuously monitors the plausibility of the signals from the various sensors and compares them with the limits allowed: if these limits are exceeded, the system detects a fault and turns on the corresponding warning light on the instrument cluster.

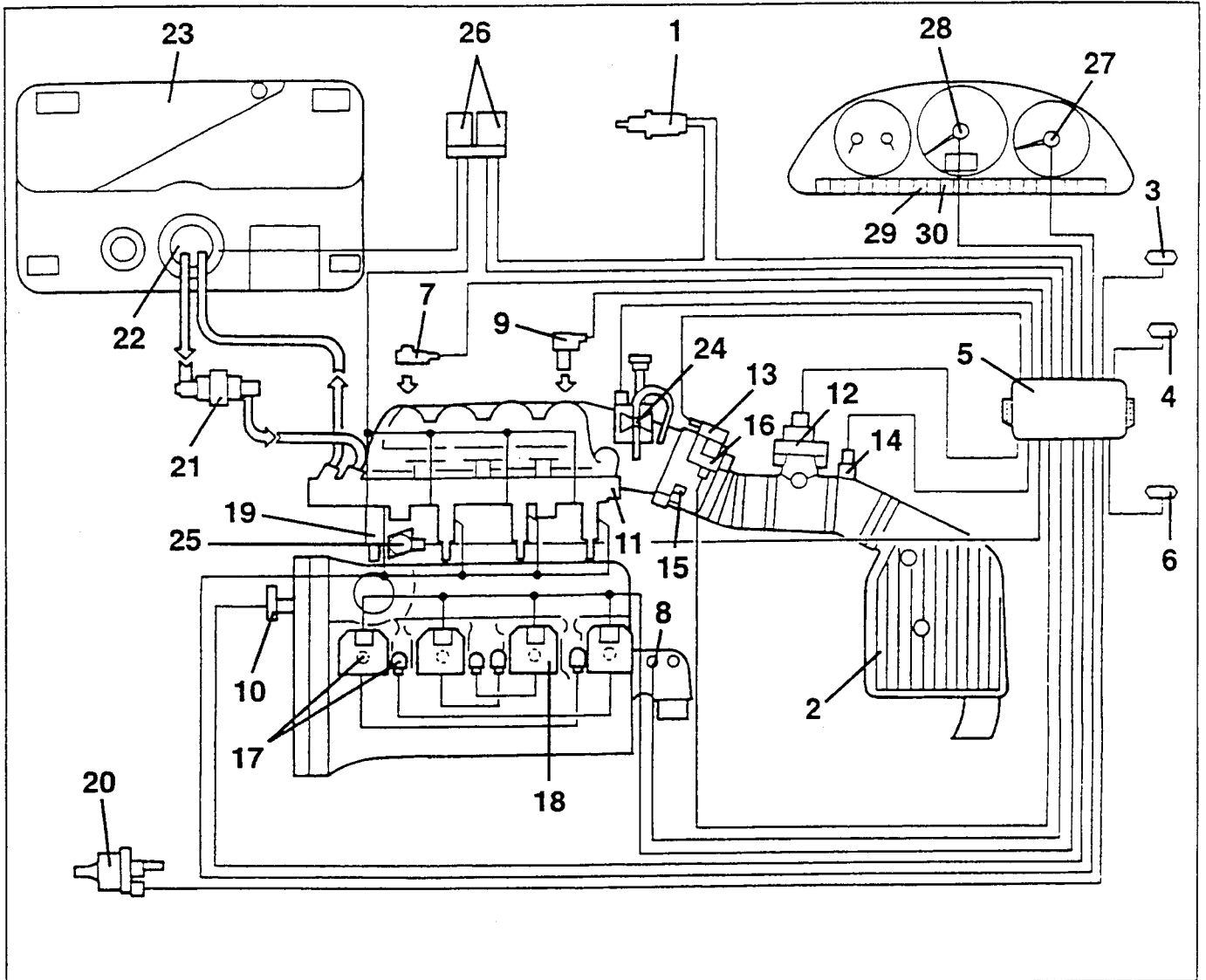
The warning light turns on when the engine is started to indicate the initial test of the entire system (appr. 4 seconds), it then turns off if no errors have been memorised: otherwise it stays on.

For certain parameters, the control unit replaces the abnormal values with suitable ones so that the car can "limp" to a point of the Service Network.

These "recovery" values depend on the other correct signals and they are defined individually by the control unit operating logic.

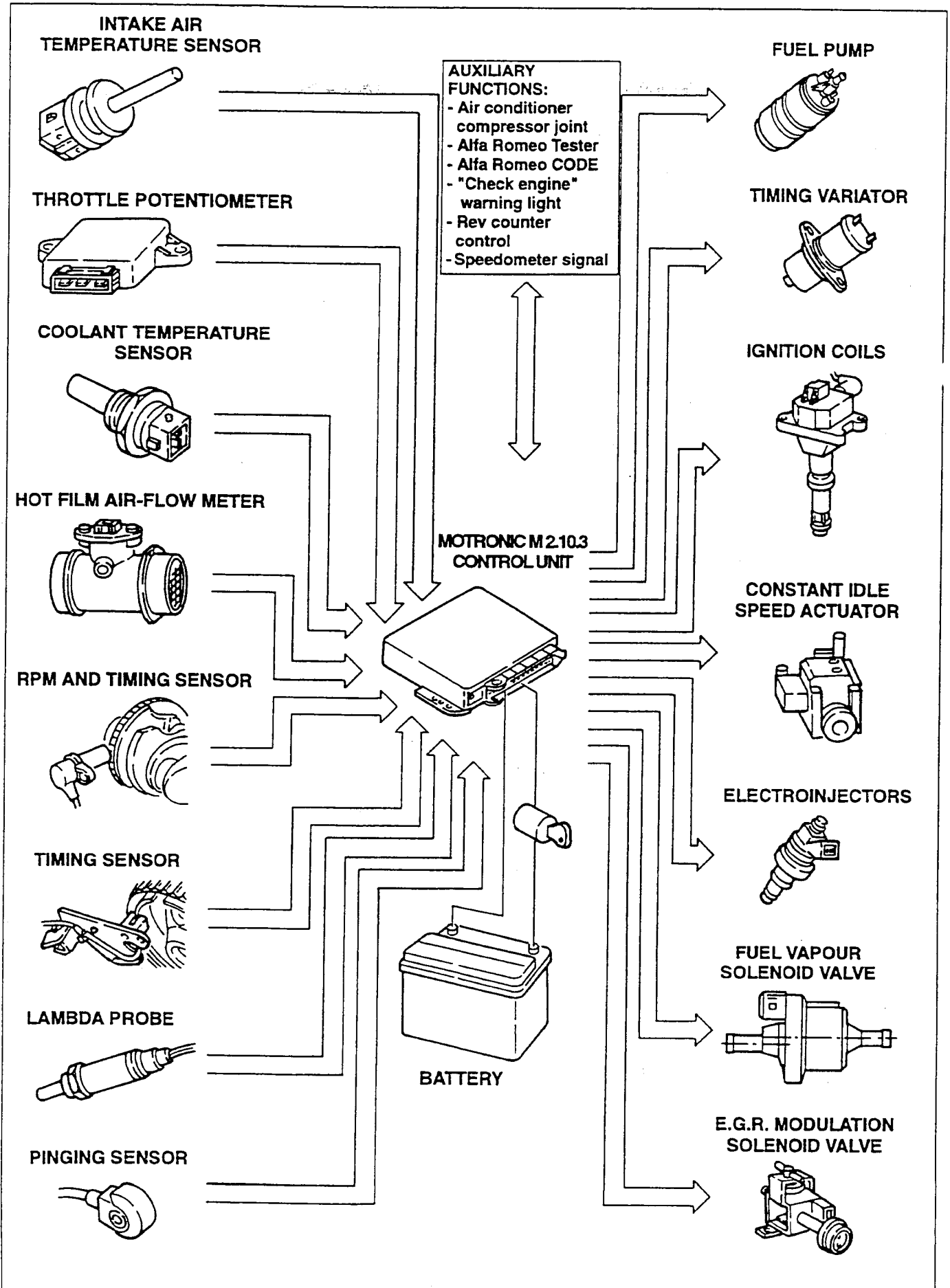
The self-diagnosis system also enables quick and effective location of faults connecting with the ALFA ROMEO Tester (see "Fault-finding"), through which all the errors memorised can be displayed. It is also possible to check the operating parameters recorded by the control unit and operate the single actuators to check whether they are working properly.

## COMPONENTS OF THE MOTRONIC M 2.10.3 ELECTRONIC INJECTION AND IGNITION SYSTEM



- |                                           |                                      |
|-------------------------------------------|--------------------------------------|
| 1. Lambda sensor                          | 16. Constant idle speed actuator     |
| 2. Air cleaner                            | 17. Spark plugs                      |
| 3. Climate control system connector       | 18. Ignition coils                   |
| 4. Diagnosis socket (Alfa Romeo Tester)   | 19. Electroinjectors                 |
| 5. Injection - ignition control unit      | 20. Fuel vapour solenoid valve       |
| 6. Alfa Romeo CODE control unit connector | 21. Fuel filter                      |
| 7. Pinging sensor                         | 22. Electric fuel pump               |
| 8. Coolant temperature sensor (NTC)       | 23. Fuel tank                        |
| 9. Rpm and timing sensor                  | 24. E.G.R. modulation solenoid valve |
| 10. Timing sensor                         | 25. Timing variator                  |
| 11. Fuel pressure regulator               | 26. Set of relays                    |
| 12. Air-flow meter                        | 27. Rev counter                      |
| 13. Throttle potentiometer                | 28. Speedometer                      |
| 14. Intake air temperature sensor (NTC)   | 29. "Check engine" warning light     |
| 15. Throttle body                         | 30. Alfa Romeo CODE warning light    |

FUNCTIONAL LAYOUT OF MOTRONIC M 2.10.3 INJECTION - IGNITION SYSTEM





## GENERAL DESCRIPTION

An electronic control system supervises and regulates all the parameters of the engine, optimising performance and consumption levels through response in real time to the different operating conditions.

This is the M 2.10.4 version of the proven and reliable BOSCH MOTRONIC system.

Compared with the previous versions this new M 2.10.4 system adopts a control unit - with 55 pins - with advanced design and production technology, it also possesses many possibilities for inserting auxiliary functions engine cooling fan).

Owing to the use of new sensors and updated programmes the system also makes it possible to achieve considerable improvements in terms of consumption, emission levels and vehicle handling.

Another feature of this system is self-adaptation, namely the capability of detecting the changes that take place in the engine and compensate them, according to functions which mainly correct:

- mixture titration;
- carburetion parameters according to the command of the evaporative solenoid valve;
- the adaptation plan for idle speed control.

## FUNCTIONS OF THE SYSTEM

### Sequential and timed injection (S.E.F.I.)

With this control unit injection is sequential and timed for each cylinder: the injection instant (delivery of fuel into the intake manifolds actuated through the opening of the injectors) is not simultaneous for all the cylinders, but takes place for each cylinder in correspondence with the optimum point of injection, calculated by the control unit according to special maps according to the load, speed and temperature of the engine.

### Static ignition

An ignition system has been adopted with "static distribution" (with semi-conductors, without distributor). This solution makes it possible to eliminate rotary components; in addition, it does not produce external sparks thus reducing the risk of interferences; lastly it reduces the number of high voltage cables and connectors.

Static ignition takes place through four coils, according to the logic known as "lost spark".

Each of the four coils supplies the spark plug of the cylinder below and simultaneously that of the cylinder paired cylinder but in the same position (central with central, side with side).

**NOTE:** this way it is impossible to invert the spark plug cables during servicing operations.

This solution exploits the different environment conditions existing contemporaneously in a pair of cylinders: when one of the cylinders approaches the bursting stroke, with a mixture of air and fuel, the spark is useful, whereas for the corresponding cylinder which is at the end of the exhaust stroke in the presence of exhaust gas, the spark is lost.

This T.SPARK - 16 valve engine requires the adoption of two spark plugs of different size: a "central" larger one and a smaller "side" one.

### Metering the air flow rate

The air flow metering system has been newly designed and it is of the "heated film" type.

Outside the air-flow meter looks like a part of duct between the intake manifold and the air cleaner. Inside the air-flow meter there is an electronic circuit and a plate that is crossed by air which passes into the duct. The film plate is kept at a constant temperature appr. 120°C above the temperature of the incoming air) by a heating resistance placed in contact with it.

The mass of air flowing through the duct tends to withdraw heat from the plate; therefore, to keep its temperature constant, a certain current needs to flow through the heating resistance: this current, suitably measured, is proportionate with the mass of flowing air.

**N.B.** This air flow meter measures directly the mass of air (and not the volume as in the previous versions with "floating port", thereby eliminating problems of temperature, altitude, pressure, etc.)

This air flow meter does not incorporate the intaken air temperature sensor which is separate, to be found just upstream of the air flow meter itself.



## Cylinder detection

Following the adoption of the sequential and timed injection system, a timing sensor has been introduced (cam angle sensor): this makes it possible to detect which cylinder is in the bursting stroke when the engine is started, in order to be able to start the correct injection sequence.

The sensor is formed of a Hall-effect device by which the voltage signal sent to the control unit "lowers" suddenly when the tooth machined on the camshaft pulley passes in front of the actual sensor; therefore a signal is sent every two turns of the crankshaft.

Conversely, the rpm sensor sends a reference signal each turn of the engine and each subsequent tooth of the phonic wheel informs the control unit of an increase in the angular position of the crankshaft, so that the correct injection and ignition are sent to the appropriate cylinder.

## Fuel pump

The complex control logic of the fuel pump carried out by the control unit (chiefly based on the rpm signal) immediately cuts off the supply to the engine as soon as the engine stops.

Moreover, the pump will not operate with the key engaged and the engine not running.

In this car, this logic is integrated - in order to further higher the standards of safety - by the **inertial switch** device: this is an electromechanical switch which, in the event of heavy shocks, opens to cut off the circuit that takes the earth to the fuel pump, which stops instantaneously.

This device is particularly important as an integration of the safety guaranteed by the logic of the control unit, especially if the car is hit from behind or in the case of other accidents which do not cause the engine to stop immediately.

## Timing variator

This T. SPARK 16 valve engine is fitted with an electromechanical-hydraulic timing variator which is connected to the camshaft and controls and adjusts the intake timing (advance) so that timing that offers the best performance levels is obtained.

This mechanism is activated by the control unit only after exceeding a determinate engine rpm and load so that correct operation of the engine at low speed is not adversely affected.

## OPERATING LOGIC

### - Identification of the "operating point":

the "point of operation of the engine" is located mainly through two sensors: the rpm sensor informs the control unit of the speed of rotation of the engine; the air flow meter supplies the value of the mass of air actually entering the cylinders, defining the instantaneous volumetric yield of the engine.

### - Adjustment of injection times (quantity of fuel):

the control unit controls the injectors very quickly and precisely, calculating the opening time on the basis of engine load (rpm and air flow), also taking into account the battery voltage and the temperature of the engine. Injection is "sequential and timed", i.e. the injectors are opened in correspondence of the exhaust stroke of the associated cylinder.

### - Ignition adjustment (calculation of advances):

the control unit calculates the advance on the basis of the engine load (rpm and air flow); the value is also corrected according to the temperature of the intaken air and that of the engine. Ignition is "static" as described previously.

### - Cold starting control:

during cold starts the control unit uses special advance values and injection times in order to reach the required load more rapidly.

**- Control of enrichment during acceleration:**

upon the need for acceleration, the control unit increases injection in order to reach the required load as quickly as possible. This function takes place through the potentiometer located on the throttle which instantaneously informs the control unit of the need to accelerate.

**- Fuel cut-off during deceleration:**

with the throttle closed and an engine speed above a certain threshold, the control unit de-activates fuel injection; this way the rpms decrease rapidly towards idle speed reducing the speed and fuel consumption. The cutoff threshold values varies according to the temperature of the engine and the speed of the car.

**- Control of idle speed:**

the adjustment of the engine idle speed is carried out through the special actuator, fitted directly on the throttle body, which acts on the throttle by-pass.

This device acts as a regulator for cutting in the various services (e.g. conditioner compressor): in fact, when the throttle is closed, this valve adjusts the by-pass gap compensating the load required by the services in order to ensure that idle speed is as constant as possible.

The system also controls the cutting in of the radiator cooling fan, if necessary, compensating the engine idling speed.

**- Maximum Rpm limiting:**

above a certain threshold the control unit automatically stops the injection of fuel preventing the engine from "over-revving".

**- Combustion control -lambda probe-:**

the oxygen sensor (or "lambda" probe) informs the control unit of the amount of oxygen at the exhaust, and therefore the correct air-fuel metering.

The optimum mixture is obtained when the lambda coefficient = 1 (optimum stoichiometric mixture).

The electric signal sent by the probe to the control unit changes abruptly when the composition of the mixture departs from lambda = 1. When the mixture is "lean" the control unit increases the amount of fuel, reducing it when the mixture is "rich": this way the engine operates as far as possible around the ideal lambda rating.

The probe is heated by an electrical resistance so that it quickly reaches the correct operating temperature (appr. 300°C).

Through this probe it is also possible to adjust engine carburetion precisely. Among other items, this makes it possible to meet emission limit regulations.

**- Timing variator control:**

the electromechanical-hydraulic timing variator, connected to the camshaft, controls and adjusts intake timing depending on the engine load and rpm. This device is activated by the control unit over idle speed (over 1,600 rpm and with load above 30%).

**- Pinging control:**

the control unit is informed about pinging or "knocking" through the pinging sensor and it corrects ignition advance delaying it accordingly.

**- Fuel vapour recovery:**

the fuel vapours collected from the various points of the supply circuit in a special active carbon canister are ducted to the engine where they are burnt: this takes place through a solenoid valve which is opened by the control unit only when the engine is in a condition that allows correct combustion without adversely affecting the operation of the engine: in fact the control unit compensates this amount of fuel by reducing delivery to the injectors.

**- Connection with the conditioner compressor:**

the control unit is connected with the air conditioning system and controls the cutting in of the compressor and fan according to the operating conditions of air conditioning system.

**- Connection with the radiator cooling fan:**

in this version the cooling fan control thermal contact on the radiator has been eliminated.

The fan command for the first and second speed is supplied by the injection control unit depending on the temperature measured by the coolant fluid temperature sensor of the MOTRONIC system.

**- Connection with the Alfa Romeo Code system:**

on cars fitted with "electronic key" (Alfa Romeo CODE), as soon as the Motronic control unit receives the "key at MARCIA" signal, it asks the Alfa Romeo CODE system for consent to start the engine: this consent only takes place if the Alfa Romeo CODE control unit recognises the code of the key engaged in the ignition switch as correct. This conversation between the two control units takes place on diagnosis line K already used by the Alfa Romeo Tester.

**- Self-diagnosis:**

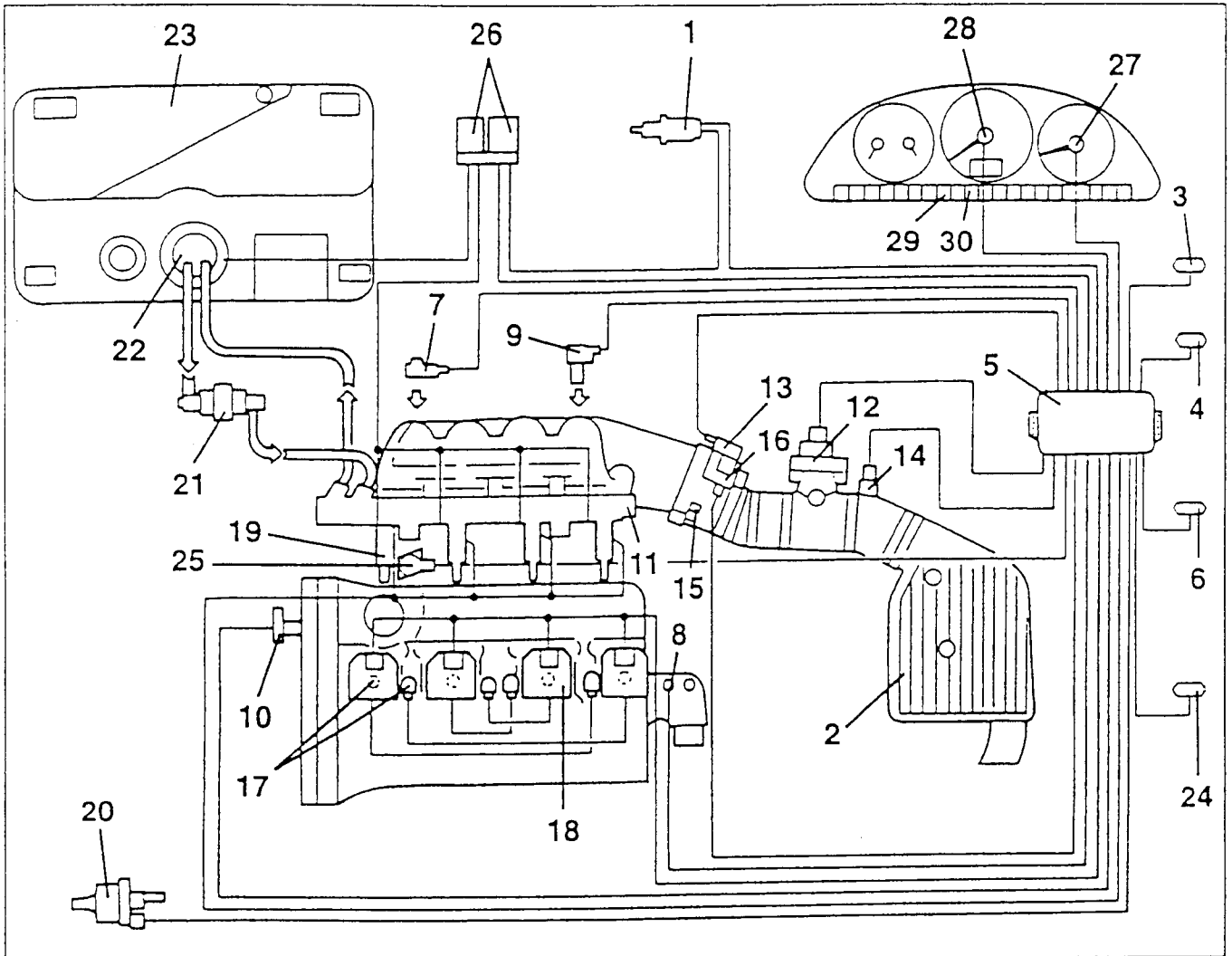
The control unit possesses a diagnosis system which continuously monitors the signals leading from the various sensors checking their plausibility and comparing them with the permissible limits: if these limits are exceeded, the system detects a fault and turns on the warning light on the instrument cluster.

The warning light turns on when the engine is started to indicate the initial test of the whole system (appr. 4 seconds), then it goes off if no errors are memorised: otherwise it stays on.

For certain parameters, the control unit replaces the abnormal values with suitable mean ones to enable the car to "limp" to a point of the Service Network. These are known as "recovery" values, they depend on the other correct signals and are defined individually by the control unit operating logic. The system also makes it possible to quickly locate faults by connecting with the Alfa Romeo Tester (see "Fault-finding"), through which all the errors memorised can be displayed.

It is also possible to check the operating parameters recorded by the control unit and command the turning on of the single actuators to check whether they are working properly.

### COMPONENTS OF THE MOTRONIC M2.10.4 ELECTRONIC INJECTION AND IGNITION SYSTEM

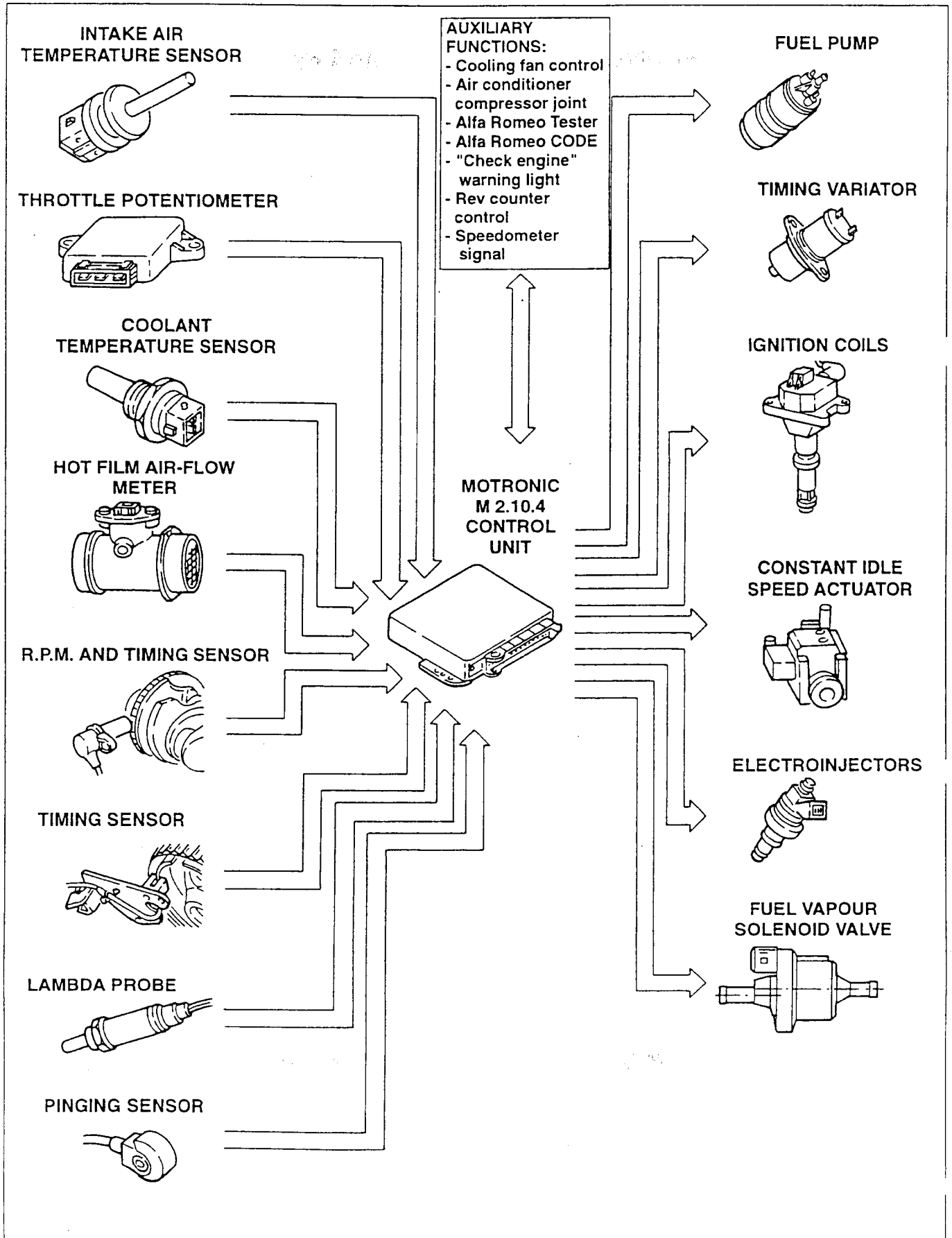


- |                                           |                                              |
|-------------------------------------------|----------------------------------------------|
| 1. Lambda sensor                          | 16. Constant idle speed actuator             |
| 2. Air cleaner                            | 17. Spark plugs                              |
| 3. Climate control system connector       | 18. Ignition coils                           |
| 4. Diagnosis socket (Alfa Romeo Tester)   | 19. Electroinjectors                         |
| 5. Injection - ignition control unit      | 20. Fuel vapour solenoid valve               |
| 6. Alfa Romeo CODE control unit connector | 21. Fuel filter                              |
| 7. Pinging sensor                         | 22. Electric fuel pump                       |
| 8. Coolant temperature sensor (NTC)       | 23. Fuel tank                                |
| 9. Rpm and timing sensor                  | 24. Connector coupling engine cooling system |
| 10. Timing sensor                         | 25. Timing variator                          |
| 11. Fuel pressure regulator               | 26. Set of relays                            |
| 12. Air-flow meter                        | 27. Rev counter                              |
| 13. Throttle potentiometer                | 28. Speedometer                              |
| 14. Intake air temperature sensor (NTC)   | 29. "Check engine" warning light             |
| 15. Throttle body                         | 30. Alfa Romeo CODE warning light            |





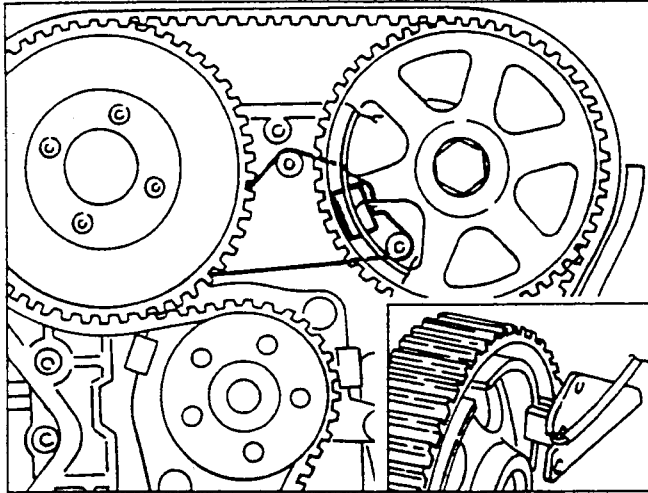
### FUNCTIONAL LAYOUT OF MOTRONIC M2.10.4 INJECTION - IGNITION SYSTEM



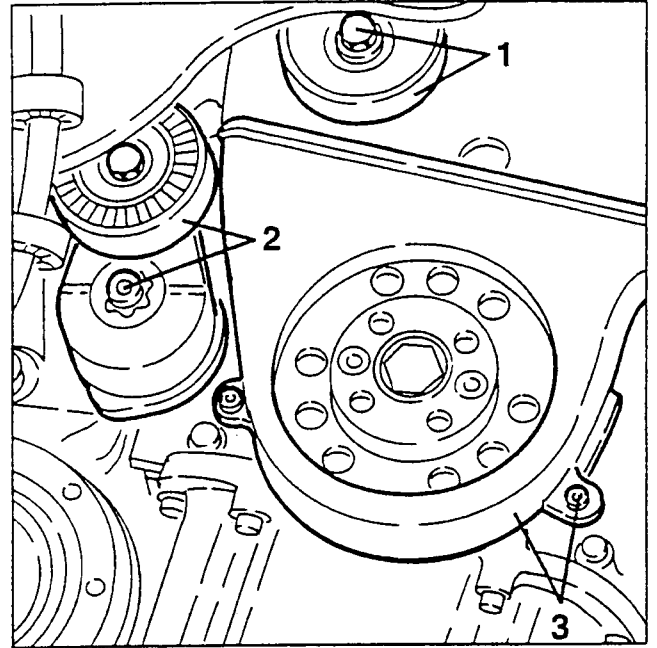
## TIMING SENSOR

The timing sensor (cam angle sensor) comprises a Hall effect device.

The voltage signal "lowers" sharply when the tooth machined on the camshaft drive pulley opposite the sensor passes in front of it.

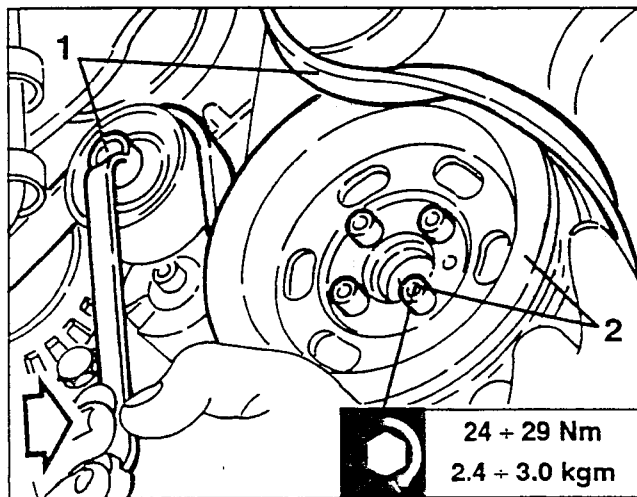


2. Slacken the fastening screw and remove the auxiliary components drive belt guide pulley.
3. Slacken the fastening screws and remove the lower cover of the timing gear and counter-rotating shaft drive belts.



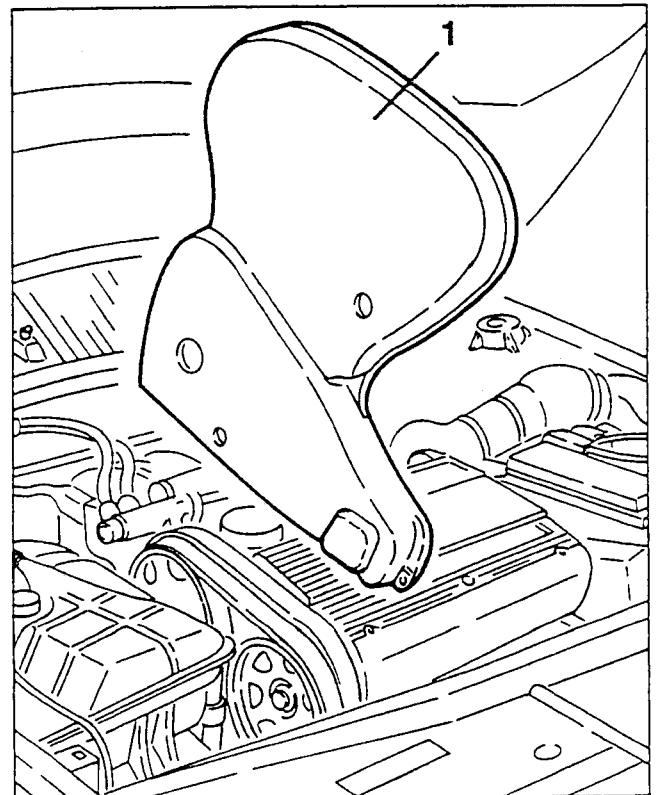
## REMOVAL/REFITTING

- Set the car on a lift.
  - Disconnect the battery (-) terminal.
  - Remove the right front wheel and mud flap.
1. Raise the car and working as illustrated on the belt tensioner loosen the tension of the auxiliary components drive belt and remove it.
  2. Slacken the four fastening screws and remove the auxiliary components drive pulley.

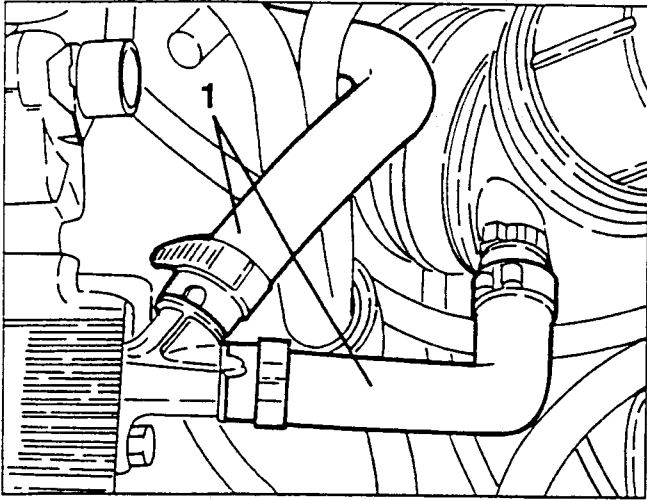


1. Slacken the fastening screw and remove the belt tensioner.

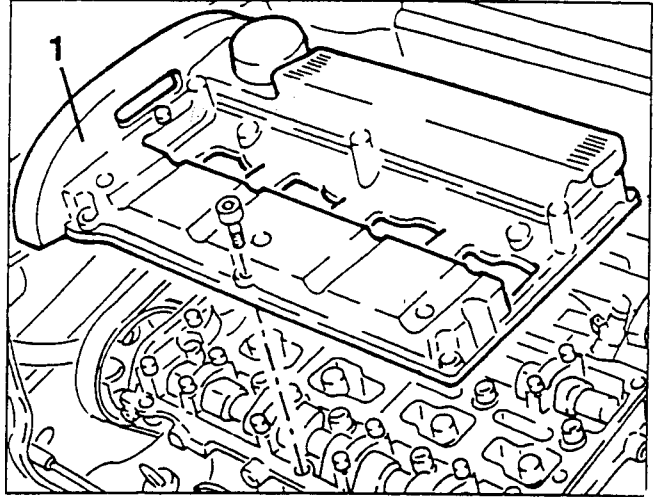
- Slacken the lower screws of the upper cover of the timing gear and counter-rotating shaft drive belts.
1. Lower the car, slacken the fastening screws and remove the upper cover.



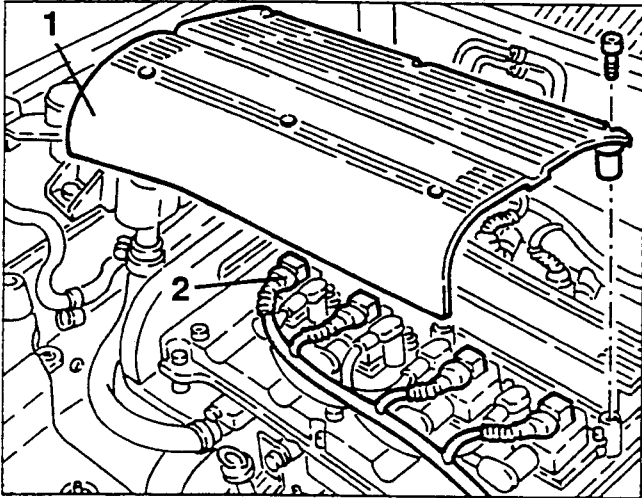
1. Disconnect and remove the oil vapour recovery pipes.



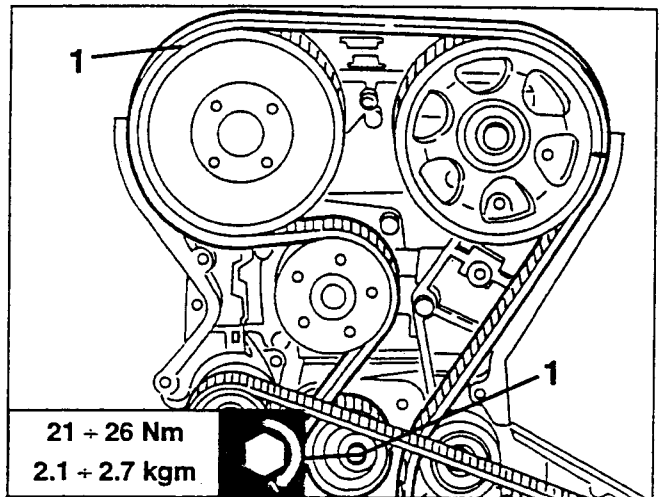
1. Slacken the fastening screws and remove the cylinder head cover complete with gasket.



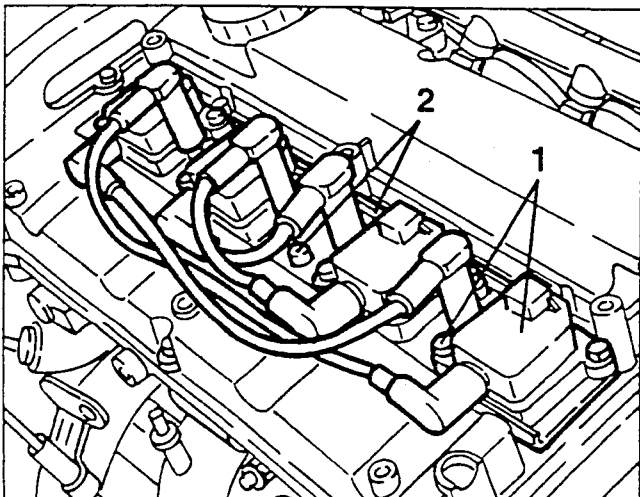
1. Slacken the fastening screws and remove the ignition coils cover.  
2. Disconnect the electrical connections from the ignition coils.



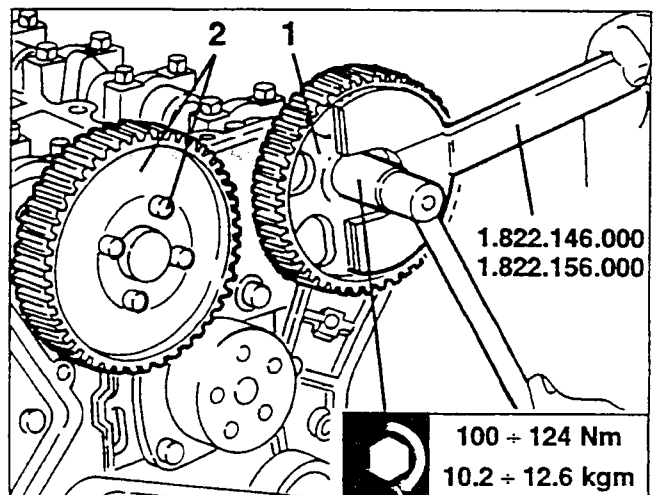
1. Working on the timing gear belt tensioner, loosen the tension on the belt, then take it off the timing gear drive pulleys.



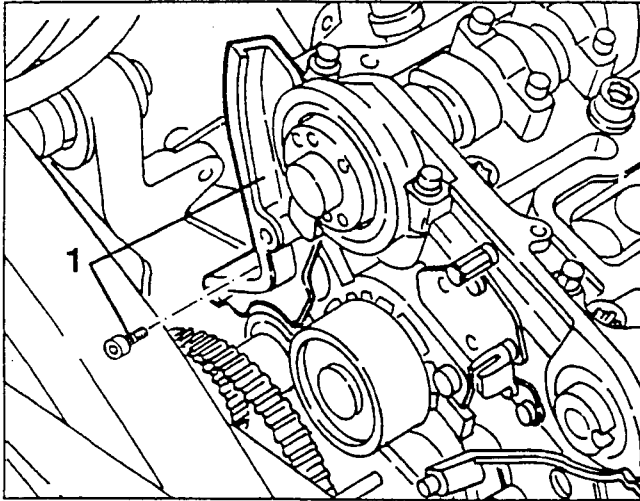
1. Slacken the fastening screws and remove the ignition coils.  
2. Slacken the fastening screws and remove the ignition coils support bracket.



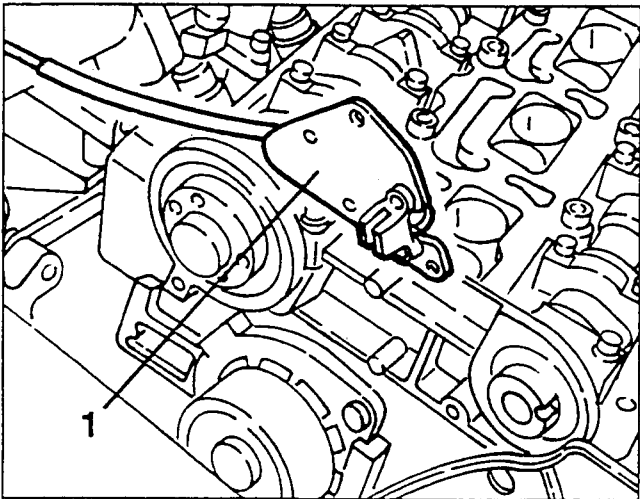
1. Using tools no. 1.822.146.000 and no. 1.822.156.000 slacken the screw fastening the timing gear exhaust side drive pulley and remove it.  
2. Slacken the four screws fastening the timing gear intake side drive pulley and remove it.



1. Slacken the fastening screws and remove the intake side cover.



1. Disconnect the electrical connection, slacken the two fastening screws and remove the timing sensor complete with support plate.



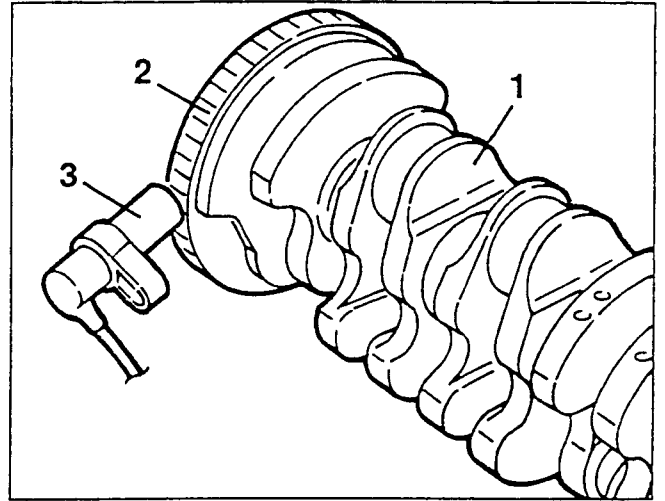
For re-assembly of the timing gear drive belt, valve gear timing and assembly and tensioning the auxiliary components drive belt see GROUP 00.

## RPM AND TIMING SENSOR

The sensor for detecting the rpm and engine timing is of the inductive type which operates through the change of a magnetic field generated by the passage of the teeth of a toothed pulley (phonic wheel) shrunk onto the crankshaft.

The teeth which pass in front of the magnetic field generator change the gap between the pulley and the sensor; therefore, the dispersed flux, which consequently varies, induces an alternate sinusoidal voltage in the coils of the sensor, the amplitude of which depends on the peripheral speed of the phonic wheel, the gap between the tooth and the sensor, the shape

of the teeth, the magnetic characteristics of the sensor and on the support system.



1. Crankshaft
2. Phonic wheel
3. Rpm and timing sensor

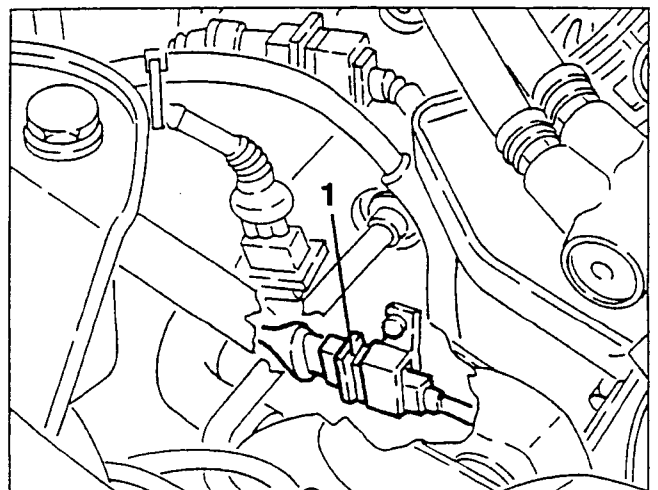
The output signal which varies in relation to the rpm is processed by the control unit to obtain a signal at each passage through zero and a constant rectangular oscillation of amplitude to enable the control of the digital circuits inside the control unit.

The interval between the start of one tooth and another is  $6^\circ$  with the exception of the reference mark which is made by eliminating two of the 60 teeth of the pulley.

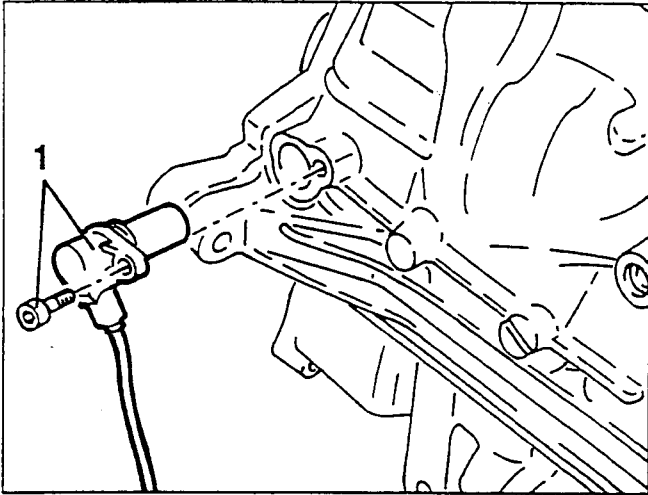
The hollow due to the lack of two teeth gives the control unit a reference point of the crankshaft and each subsequent tooth of the phonic wheel informs the control unit of an increase in its angular position.

## REMOVAL/REFITTING

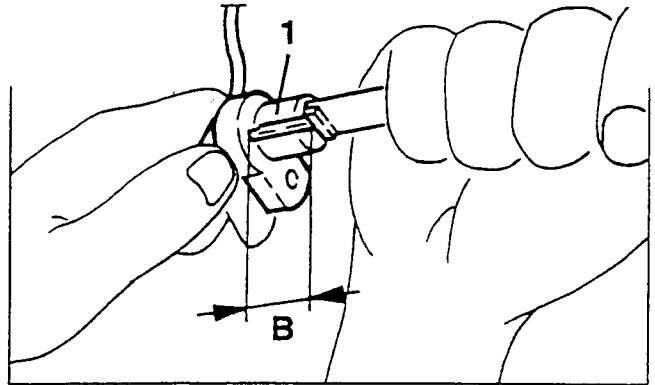
- Set the car on a lift.
  - Disconnect the battery (-) terminal.
1. Disconnect the timing sensor electrical connection.



1. Raise the car, slacken the fastening screw and remove the rpm and timing sensor.



1. Using a gauge measure dimension "B" on the sensor.



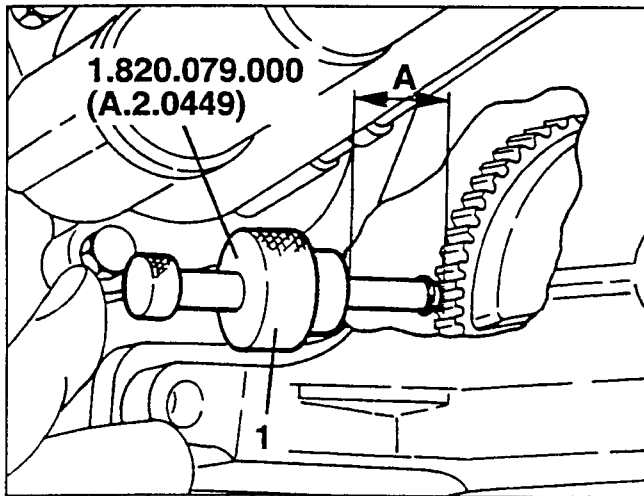
- Calculate the rpm and timing sensor gap and check that it is within the specified limits.

### CHECKING THE GAP

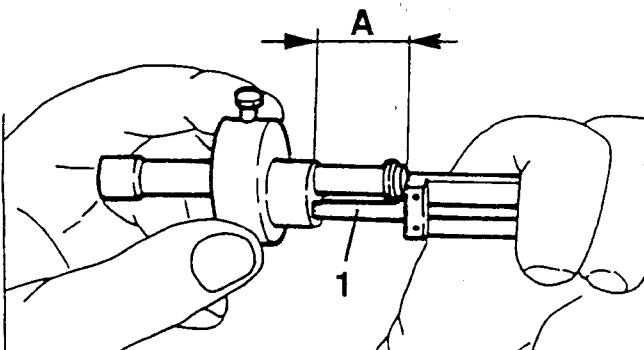
- Set the car on a lift and remove the front section of the exhaust pipe.

- Remove the rpm and timing sensor (see specific paragraph).

1. Using tool no. 1.820.079.000 (A.2.0449), find dimension "A".



1. Using a gauge measure dimension "A".

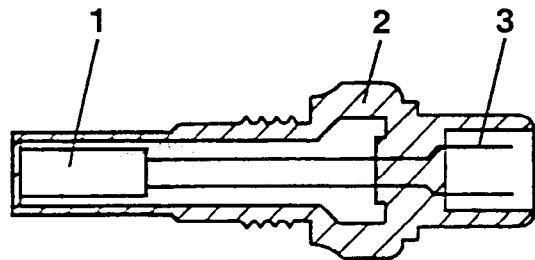


Rpm and timing sensor gap

$$A - B = 0.5 \div 1.5 \text{ mm}$$

### ENGINE COOLANT TEMPERATURE SENSOR (NTC)

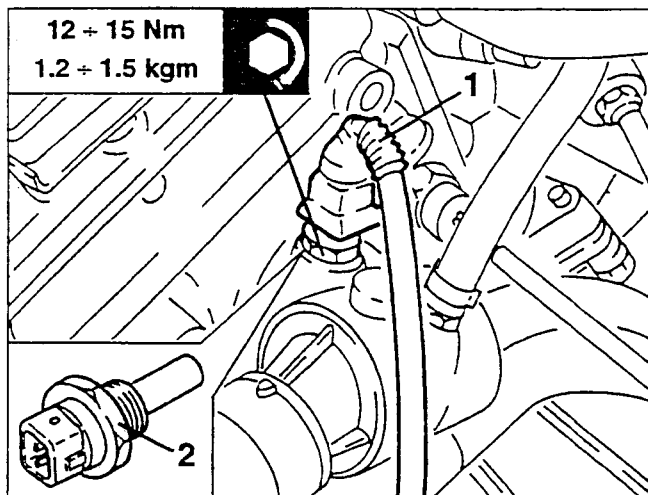
This sensor detects the engine coolant temperature on the thermostatic cup through a thermistor (NTC) with a negative resistance coefficient, i.e. capable of lowering its resistance as the temperature increases. The electric signal obtained reaches the electronic control unit where it is used to correct the air-fuel mixture.



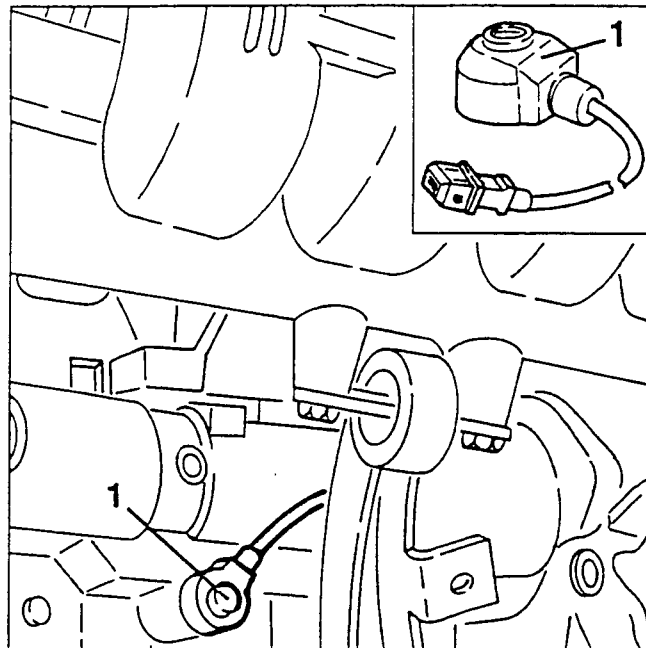
1. NTC resistance
2. Body
3. Connector

### REMOVAL/REFITTING

- Disconnect the battery (-) terminal.
- 1. Disconnect the electrical connection from the engine coolant temperature sensor (NTC).
- 2. Slacken and remove the engine coolant temperature sensor from the thermostatic cup.



- Remove the front section of the exhaust piping.
- 1. Slacken the fastening screw and remove the ping- ing sensor.



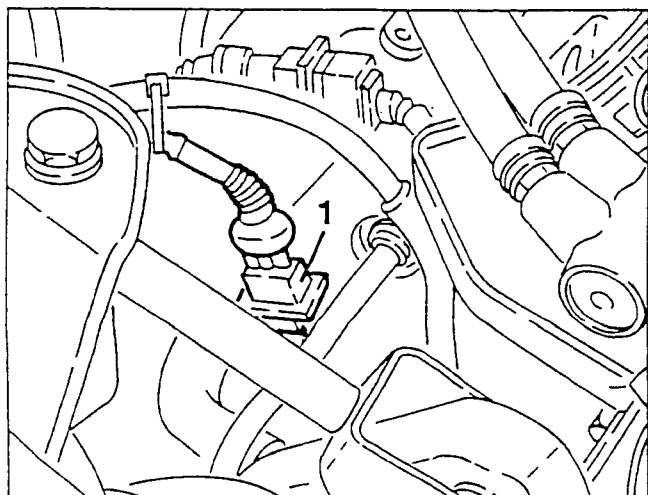
### KNOCKING SENSOR

The knocking sensor detects the intensity of the vibrations (pinging in the cylinder head) caused by knocking in the combustion chamber.

In this condition the control unit increases the amount of fuel and reduces the advance ratings calculated from the special map, in order to eliminate knocking as quickly as possible: in fact the advance curves are reduced by appr. 2°, then if necessary by another 2° etc., until pinging ceases, after which the normal advance corresponding to the original map is resumed.

### REMOVAL/REFITTING

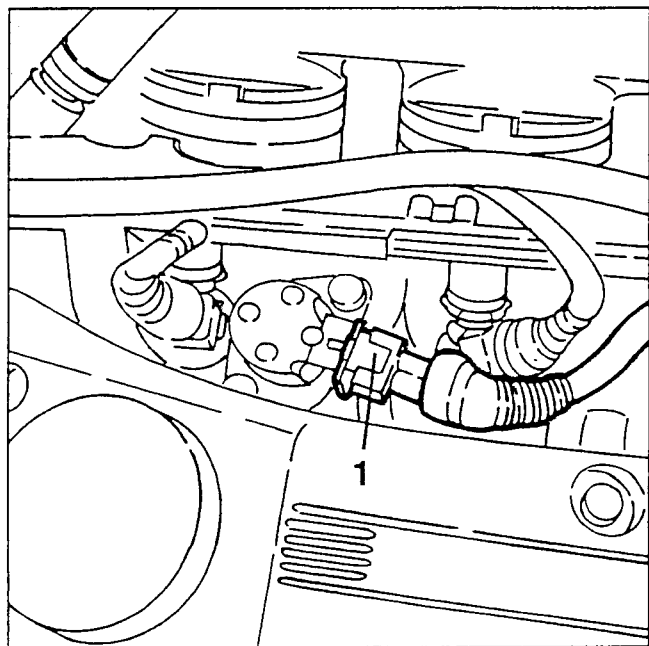
- Disconnect the battery (-) terminal.
- 1. Disconnect the electrical connection of the ping- ing sensor.



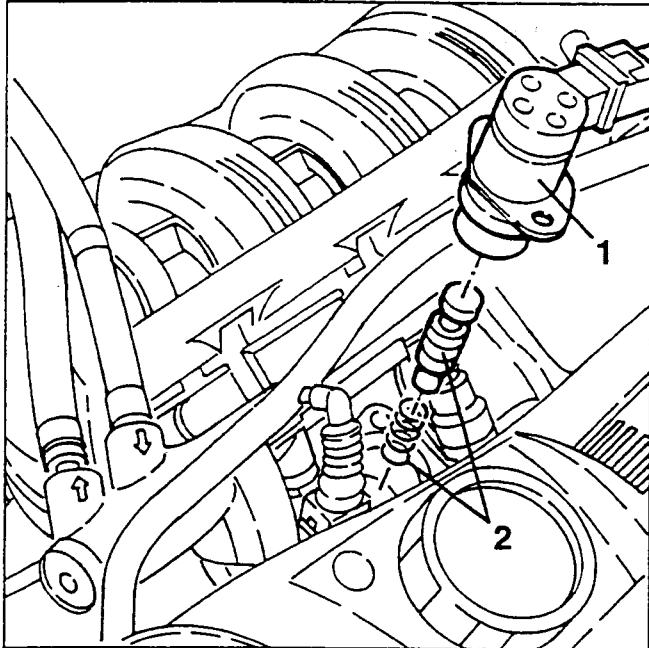
### TIMING VARIATOR SOLENOID

#### REMOVAL/REFITTING

- Disconnect the battery (-) terminal.
- 1. Disconnect the electrical connection from the timing variator solenoid.



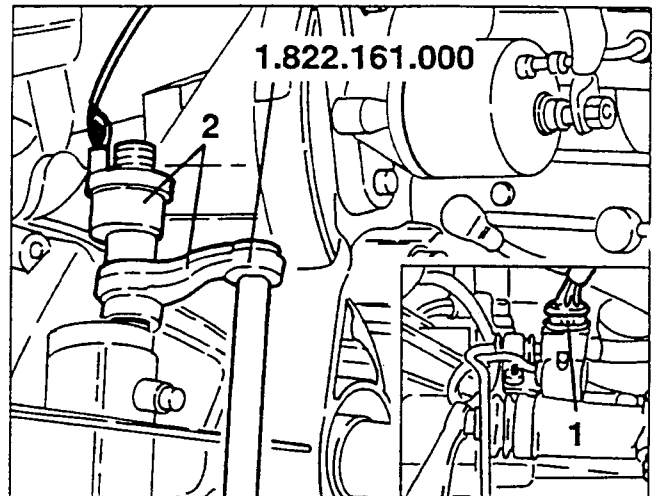
1. Slacken the two fastening screws and remove the timing variator solenoid.
2. Remove the valve complete with the timing variator spring.



## SPEEDOMETER SENSOR

### REMOVAL/REFITTING

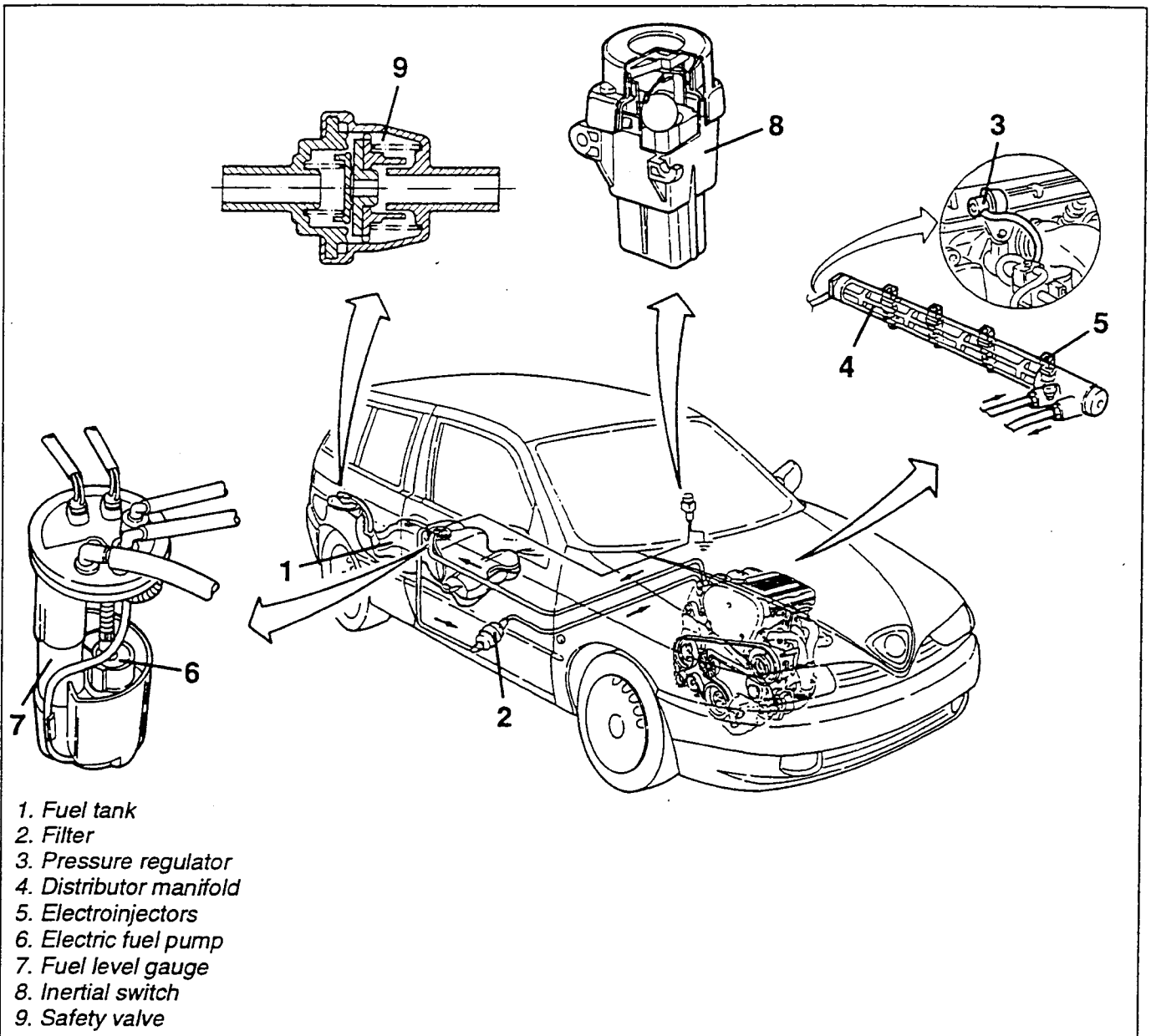
- Set the car on a lift.
  - Disconnect the battery (-) terminal.
1. Disconnect the electrical connection of the speedometer sensor.
  2. Raise the car and using wrench no. 1.822.161.000, slacken and remove the speedometer sensor.



## INERTIAL SWITCH

See  16V Boxer engine.

## DESCRIPTION OF FUEL SUPPLY SYSTEM



1. Fuel tank
2. Filter
3. Pressure regulator
4. Distributor manifold
5. Electroinjectors
6. Electric fuel pump
7. Fuel level gauge
8. Inertial switch
9. Safety valve


The fuel supply circuit comprises an electric fuel pump (6) located in the fuel tank (1) which sends the fuel under pressure through a special tube to the filter (2). From the filter the fuel is sent to the distributor manifold (4) and controlled by the vacuum withdrawn from the intake box it returns to the fuel tank through the distributor and a special pipe.

The amount of fuel injected depends solely on the injection time which is controlled by the control unit. The different sections of the fuel pipes are connected by special connectors (for their disconnection see specific paragraph).

The fuel supply system is fitted with an inertial switch (8) which is triggered in the event of a crash, cutting off the connection to earth of the fuel pump thereby also the injection system supply.

**Notes on serviceable fuels:**

correct operation of the engine requires the use of unleaded fuels (95 R.O.N.) as the presence of lead would quickly bring about consumption of the catalytic converter at the exhaust.

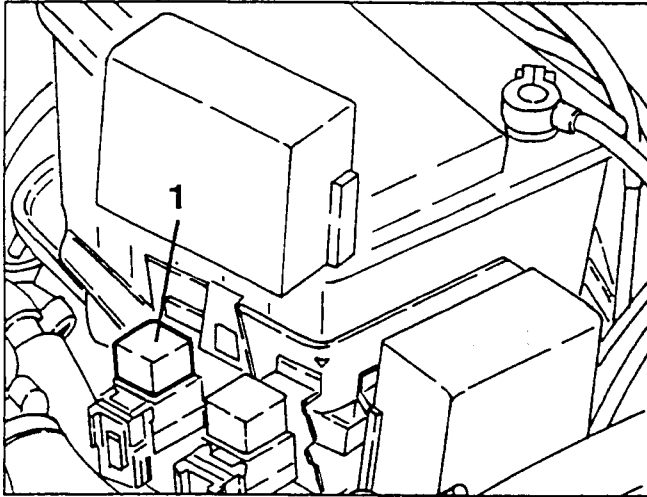
**NOTE:** For the description and removing/refitting of the components of the fuel supply system not described here, refer to the  16V Boxer engine.



**CAUTION**

Before doing any work on the components of the fuel supply system, proceed as follows to prevent dangerous leaks of fuel:

- Remove the protective cap and disconnect the fuel pump supply relay (1).



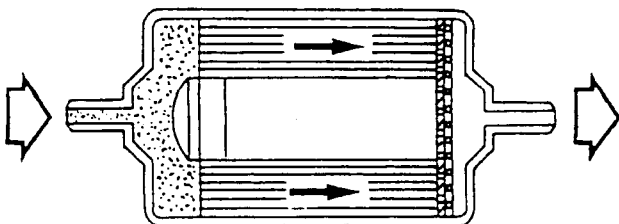
- Run the engine until it stops.

**FUEL FILTER**

The filter is inserted in the delivery pipe to the injectors, under the car floor next to the fuel tank.

It is formed of an outer aluminium casing and an inner polyurethane support which carries a paper element with high filtering power.

Filtering of the fuel is absolutely necessary to ensure correct functioning of the injectors as they are highly sensitive to foreign matter in the supply circuit.

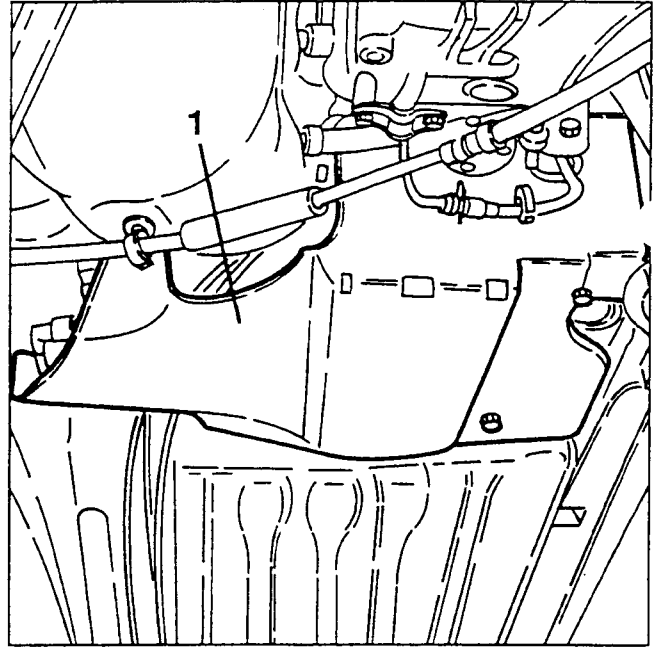


An arrow on the outer casing of the filter points in the direction of the flow of the fuel, therefore the correct assembly position.

**REPLACEMENT**

- Set the car on a lift and raise it.

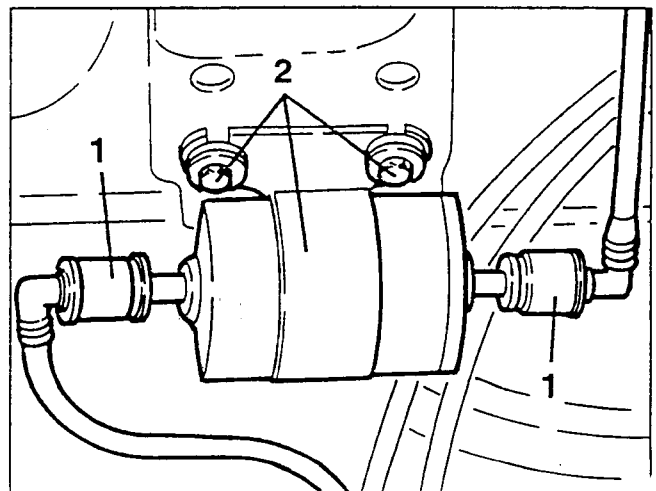
1. Slacken the fastening screws and remove the plastic cover to gain access to the fuel filter.



1. Disconnect the connections of the fuel inlet and outlet pipes from the filter (see "FUEL PIPE FITTINGS" - Boxer 18V engine).

2. Slacken the two screws fastening the support bracket, then remove it complete with fuel filter.

- Separate the fuel filter from the support bracket on the bench.

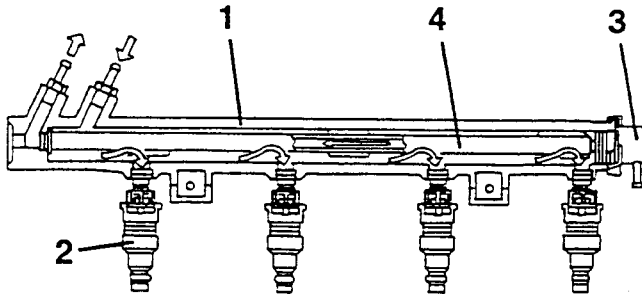


- Install the new filter so that the arrow stamped on it points in the direction of the flow of fuel.

## FUEL DISTRIBUTOR MANIFOLD

This device is die-cast and incorporates the pressure regulator and the injectors fastened on the manifold itself by special catches.

The fuel returns to the tank through a pipe contained inside the manifold connected to the fuel pressure regulator.

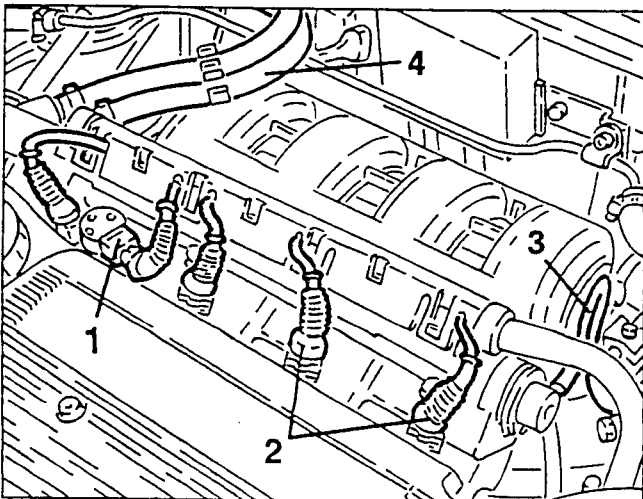


1. Fuel distributor manifold
2. Electroinjectors
3. Pressure regulator
4. Excess fuel return pipe

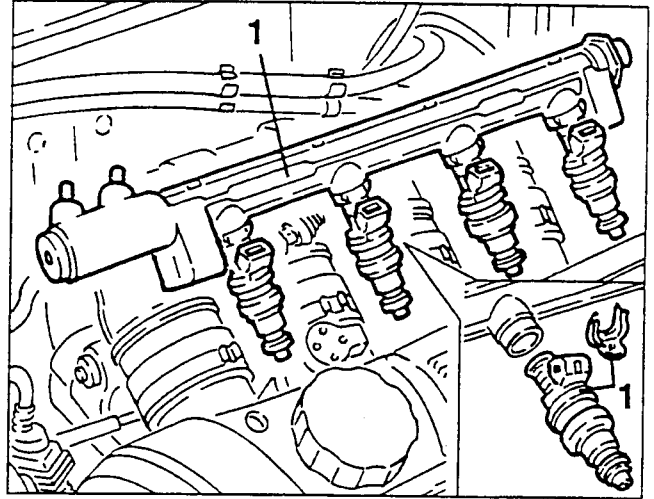
**NOTE:** Never wash the fuel distributor manifold with aggressive fluids, this operation may only be carried out on the outside using a brush. Otherwise, damage may occur to the seals (O-rings) and to the return circuit plastic piping.

## REMOVAL/REFITTING

- Disconnect the battery (-) terminal.
- 1. Disconnect the electrical connection from the timing variator electromagnet.
- 2. Disconnect the electrical connection from the injectors, then move aside the wiring after removing the cover.
- 3. Disconnect the vacuum takeoff pipe from the pressure regulator.
- 4. Disconnect the fuel return and delivery pipes from the distributor manifold.



1. Slacken the two fastening screws and remove the fuel distributor manifold complete with injectors and pressure regulator and, if necessary, separate them on the bench.



## ELECTROINJECTORS

The electroinjectors are installed on a new aluminium distributor manifold which on one side incorporates the pressure regulator.

The injector nozzle is formed so that the jet of fuel atomizes into a 30° cone.

The injectors are locked by the fuel distributor which presses them into their housings machined on the intake ducts.

The injectors are also anchored to the fuel distributor by "safety catches" and sealed by two O-Rings.

The electroinjectors have the task of metering the amount of fuel needed by the engine.

They are "ON-OFF" devices i.e. they only have two possible conditions, either open or closed.

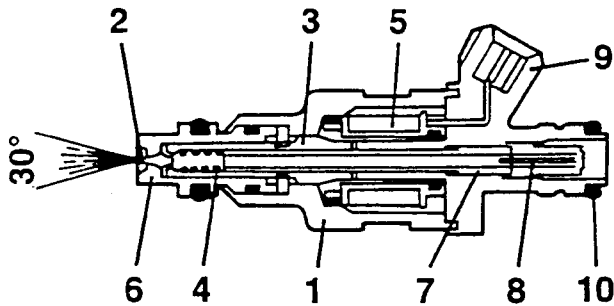
They will let the fuel pass when they are "open" and prevent it from being delivered when they are "closed".

They basically comprise a nozzle controlled by an electromagnet and by a return spring.

In the rest position, the needle, which forms one piece with the core, is pushed by the spring onto the electroinjector nose to close the hole and ensure that unwanted fuel is unable to come out.

As soon as the winding is energized, the core is attracted, it compresses the spring opening the nozzle hole, thereby allowing the fuel to flow out.

Considering the physical characteristics of the fuel (viscosity, density) and the pressure difference (pressure regulator) constant, the amount of fuel injected depends on the injector opening time only. The winding energizing time is normally called the "injection time".



- |                   |                              |
|-------------------|------------------------------|
| 1. Injector body  | 6. Injector nose             |
| 2. Needle         | 7. Adjustable pressure plate |
| 3. Magnetic core  | 8. Filter                    |
| 4. Helical spring | 9. Electrical connection     |
| 5. Winding        | 10. Seal rings               |

## CHECKING FOR CORRECT OPENING OF ELECTROINJECTORS

- Measure the quantity of CO at the exhaust.
- Disconnect the electroinjector connectors one by one; each time measure for a reduction of the CO quantity at the exhaust and check that this value remains constant at each check.
- If not, locate and replace the faulty electroinjector; in any case a visual index of the efficiency of the electroinjectors is given by the spark plug electrodes:
  - a mixture which is too rich corresponds to a black colour.
  - a mixture which is too lean corresponds to a light colour.

## CHECKING THE SEALING OF ELECTROINJECTORS

- Remove the electroinjectors complete with fuel distributor manifold, keeping the fuel supply circuit connected.
- Disconnect the electrical connections from the electroinjectors.
- Operate the starter motor and check that there are no leaks of fuel from the electroinjectors; if so replace the faulty injector.

## REMOVAL/REFITTING

Proceed as described in the procedure "Fuel distributor manifold - Removal/Refitting".

## FUEL PRESSURE REGULATOR

The purpose of the pressure regulator is to keep the difference between the pressure of the fuel and the pressure in the intake box constant.

This way it is possible to meter the amount of fuel solely on the basis of the injector opening time.

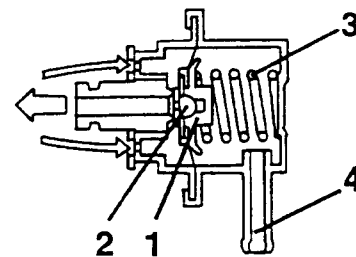
The pressure regulator is fitted directly on the fuel distributor manifold.

It is a limiting regulator a diaphragm which regulates the fuel pressure to appr. 3 bar.

When the fuel pressure exceeds the maximum rating, the diaphragm acts on a valve which opens the return pipe, through which the excess fuel is returned to the fuel tank.

A tube connects the regulator spring chamber to the air intake box.

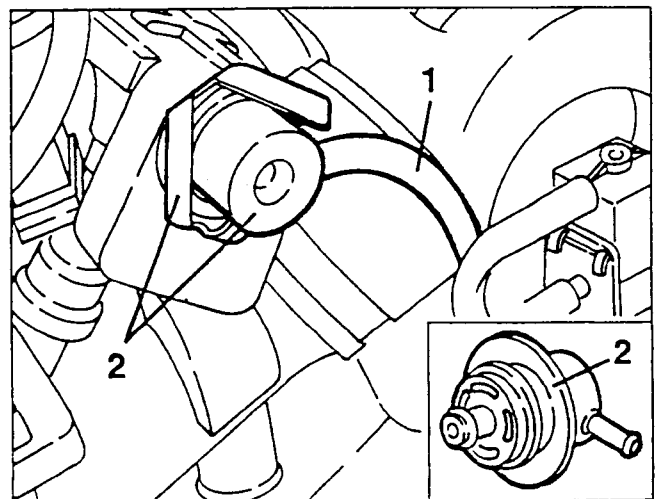
An interdependence is created by this connection between the pressure in the fuel circuit and the pressure in the intake manifold, so that the pressure between the inlet and outlet of the electroinjectors is always the same, when they are open.



- |               |                      |
|---------------|----------------------|
| 1. Diaphragm  | 3. Adjustment spring |
| 2. Flow valve | 4. Vacuum takeoff    |

## REMOVAL/REFITTING

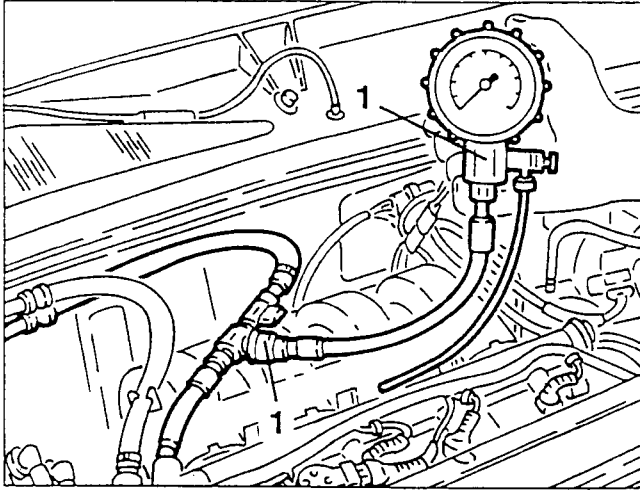
1. Disconnect the vacuum takeoff pipe from the fuel pressure regulator.
2. Remove the catch and withdraw the fuel pressure regulator complete with O-Ring from the fuel distributor manifold.





## CHECKING THE PRESSURE AND TIGHTNESS OF THE FUEL CIRCUIT

1. Disconnect the fuel delivery pipe from the distributor manifold, then connect a pressure gauge, using a "T" adapter, between the damper and the disconnected pipe.



- Disconnect the fuel pressure regulator vacuum takeoff pipe to avoid any irregularities in the rotation speed from causing abnormal readings.

- Start the engine and at idle speed check that the fuel pressure is within the specified limits.



**Fuel pressure at idle speed**

2.8 ÷ 3.2 bar

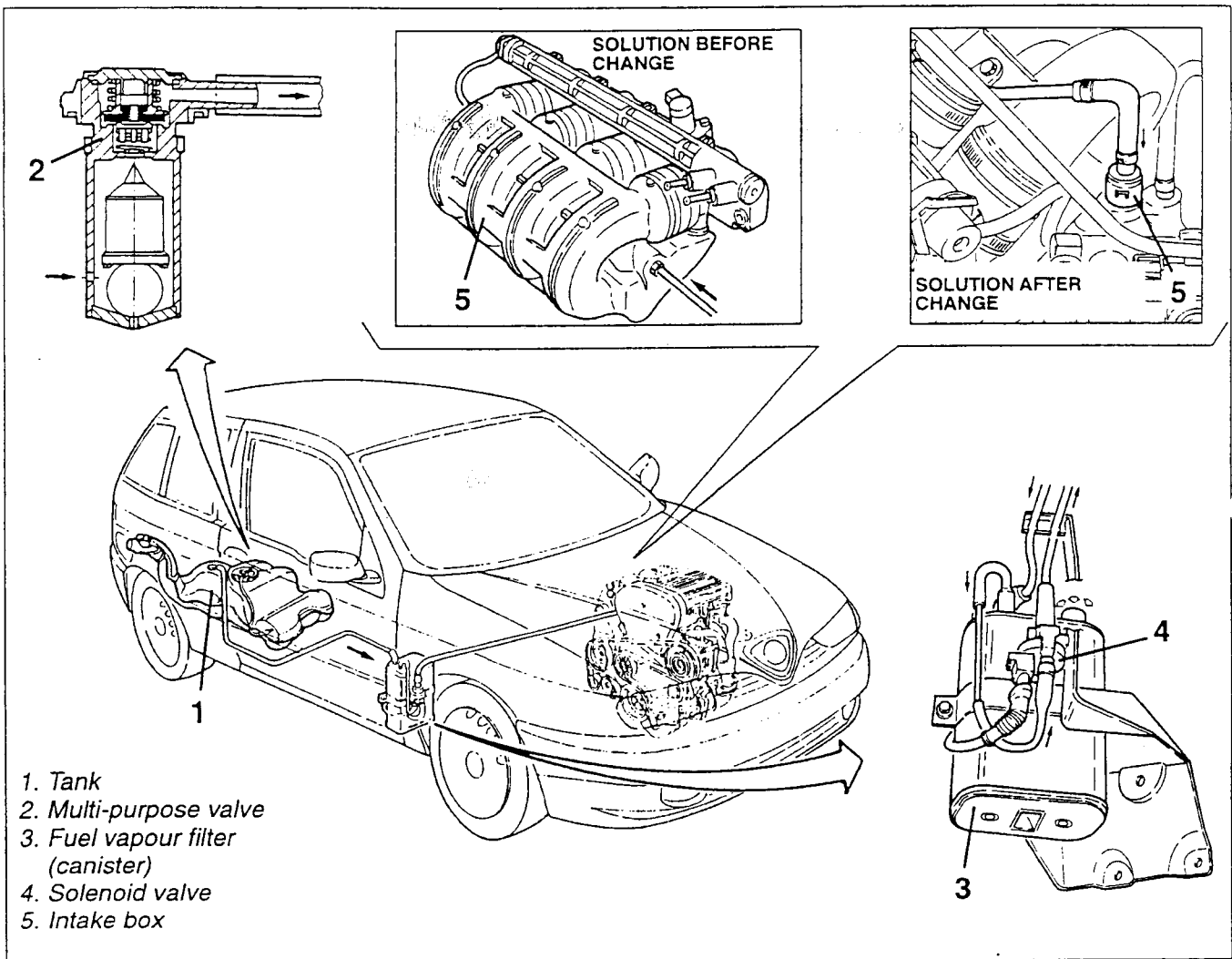
- Reconnect the vacuum takeoff pipe on the regulator and check that the fuel pressure falls by ~ 0.5 bar and then rises again when the throttle valve opens.

If this fails to occur, look for any leaks in the vacuum takeoff pipe.

- Keeping the vacuum takeoff pipe connected to the regulator and with the engine running at idle speed, choke the distributor manifold outlet pipe noting the increase in pressure up to ~ 4 bar (do not allow the pressure to exceed this rating).

- If the pressure does not reach this rating and no leaks are detected, check the fuel filter and/or that the pump is working properly.

## DESCRIPTION OF FUEL VAPOUR RECOVERY SYSTEM



The fuel contained in the tank (1) produces a considerable amount of vapours, which would pollute the environment if released.

The vapour control and recovery system gathers these vapours and burns them in the engine.

When the pressure inside the fuel tank reaches  $0.038 \pm 0.053$  bar, the multi-purpose valve (2) opens to send the vapours to the fuel vapour filter "canister" (3) via a special pipe. The canister absorbs and stores the vapours in the active carbon contained in the filter.


There is a solenoid valve (4) between the fuel vapour filter and the intake box (5): when the solenoid valve is not activated the connection with the intake is closed and the fuel vapours are collected in the canister.

Under certain load conditions the Motronic control unit controls the opening of the solenoid valve allowing any fuel vapours in the canister to be withdrawn.

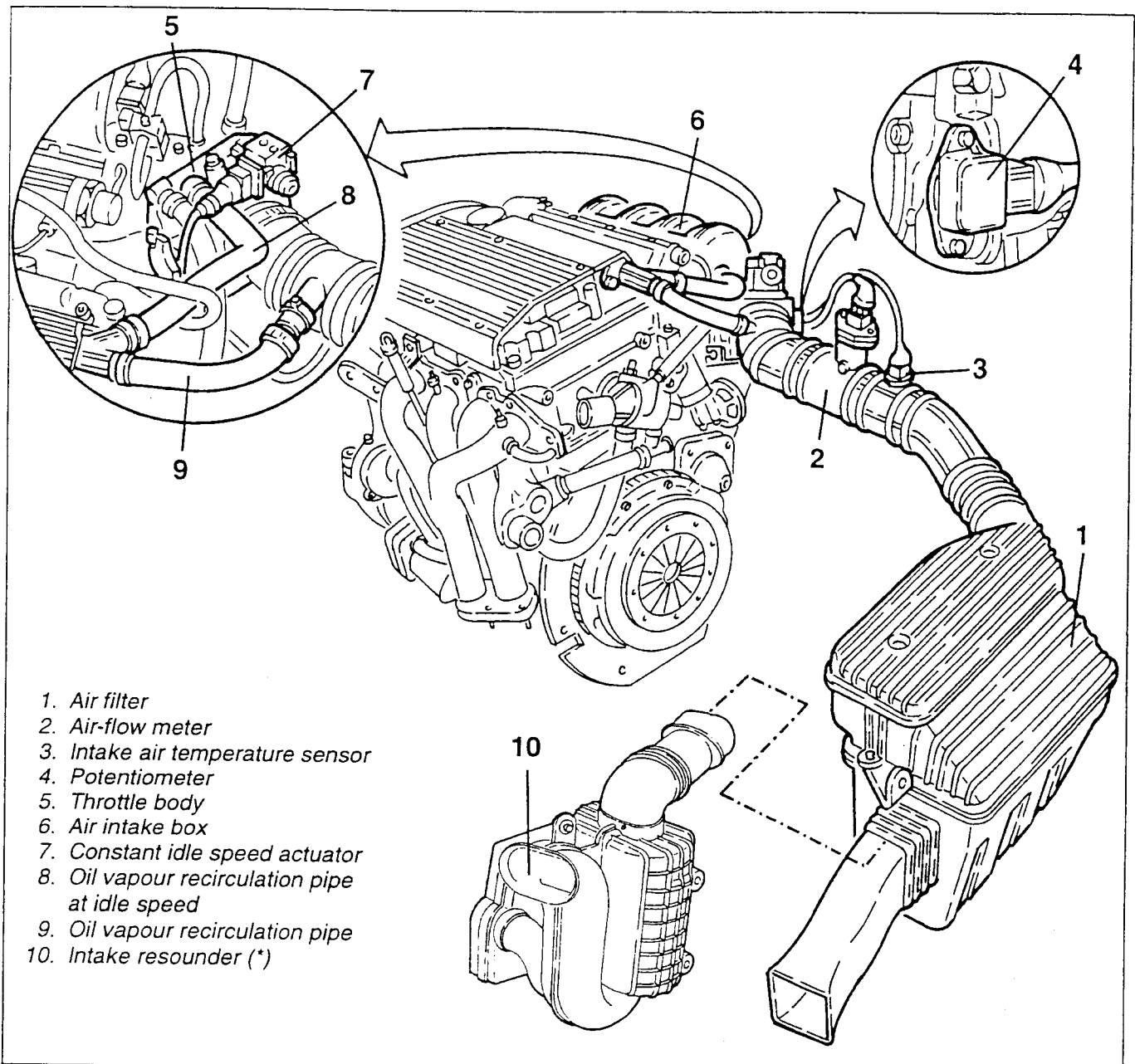
This condition remains even if at the exhaust the lambda sensor detects a reduction of oxygen which, due to the presence of too much fuel in the combustion chamber, is signalled to the control unit which delivers less fuel to the injectors so that the engine is always supplied under optimal conditions.

If there is a lack of fuel vapours in the canister, resulting in withdrawing only air, the lambda sensor detects this and signals the control unit of an increase in the oxygen.

In this case the control unit closes the solenoid valve thus preventing the connection of the canister with the intake box, thereby eliminating the excess air.

**NOTE:** For the description and removing/refitting of the components of the fuel vapour recovery system see the  16V BOXER engine

## DESCRIPTION OF AIR SUPPLY AND OIL VAPOUR RECOVERY SYSTEM



1. Air filter
2. Air-flow meter
3. Intake air temperature sensor
4. Potentiometer
5. Throttle body
6. Air intake box
7. Constant idle speed actuator
8. Oil vapour recirculation pipe at idle speed
9. Oil vapour recirculation pipe
10. Intake resounder (\*)

(\*): From chassis no. .... the air intake system is fitted with intake resounders (for removing refitting see specific paragraph).

The air, drawn in through a dynamic inlet and filtered by a cartridge element (1), reaches the throttle body (5) through the corrugated sleeve on which the hot film air-flow meter (2) and the intake air temperature sensor (3) are fitted.

The latter, controlled by the accelerator cable, adjusts the amount of air drawn into the box (6).

On one side of the throttle body there is the potentiometer (4) fastened to the pivot pin of the throttle itself which informs the control unit of the position of the throttle.

Still on the throttle body there is an additional air solenoid valve (7) which by-passes the throttle via a

special groove to keep engine idle rpm constant under particular operating conditions of the engine.

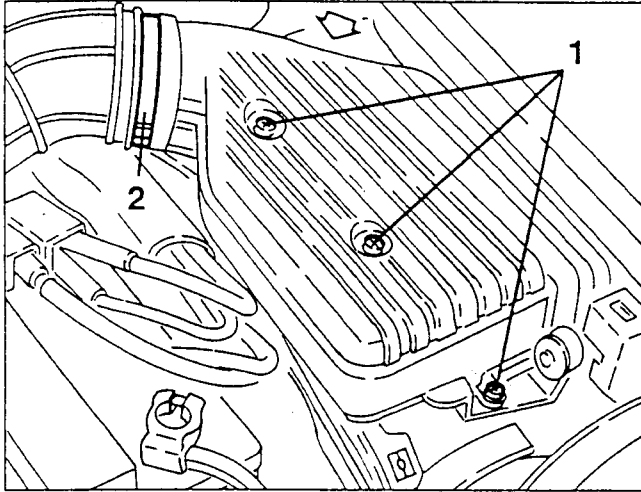
The fuel vapours (see specific paragraph) and the oil vapours flow to the air supply system.

The oil vapours are formed when the engine is running and they are collected in the cylinder head from which the condensed oil returns to the crankcase, while the remaining vapours are sent to the intake through two pipes. When the engine is running at idle speed the oil vapours are ducted to the throttle body through the special pipe (8).

At higher loads, the vapours are sent upstream of the throttle valve through a pipe (9) connected with the corrugated sleeve and then burnt in the engine.

## CHANGING THE AIR CLEANER CARTRIDGE

1. Slacken the four air cleaner cover fastening screws.
2. Slacken the clamp fastening the air cleaner cover to the corrugated sleeve.

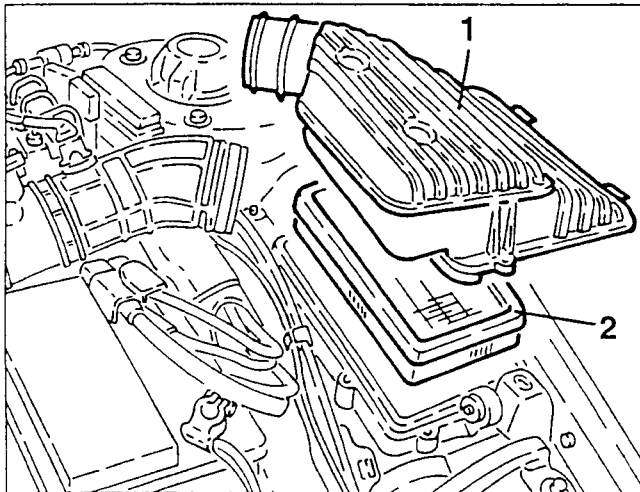


1. Remove the air cleaner cover.
2. Remove the air cleaner cartridge.



### WARNING:

Any filter cleaning operation might damage it, thereby adversely affecting the correct operation of the engine.



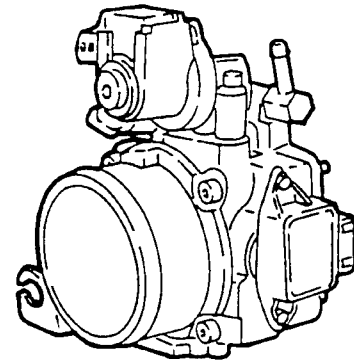
## THROTTLE BODY

The throttle body adjusts the amount of air sent to the intake box in relation to the position of the accelerator pedal.

In fact, the accelerator acts on a specific sector of pulley locked on the throttle valve pivot pin. A coil spring allows the throttle to return to the closed position.

To prevent the formation of ice on the throttle valve which would prevent it from closing, the throttle body is heated by the engine coolant fluid.

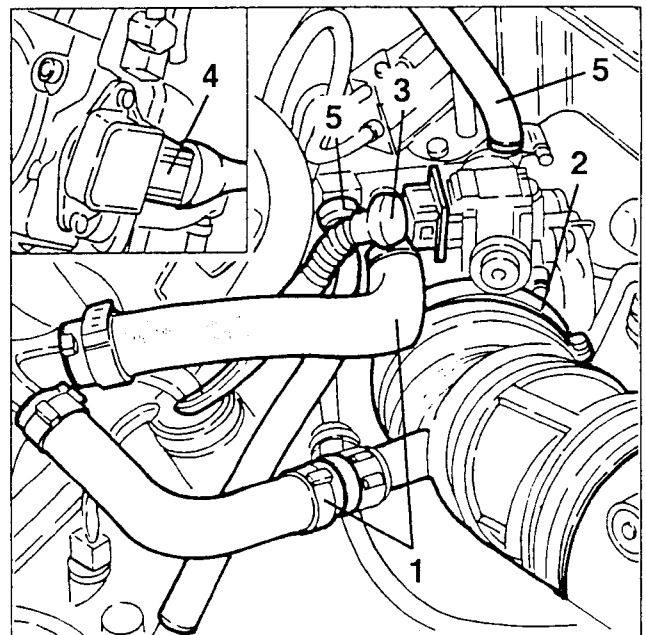
The constant idle speed actuator is installed directly on the throttle body.



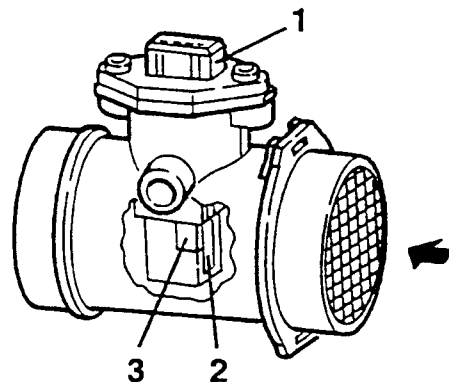
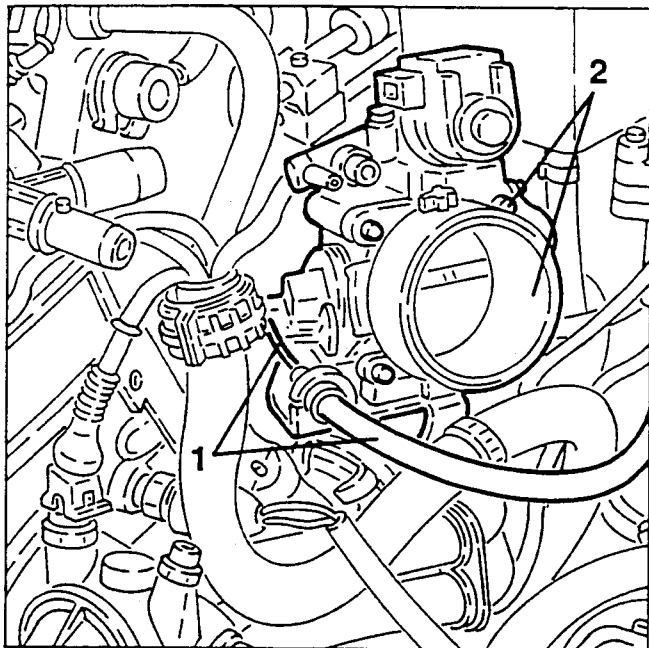
## REMOVAL/REFITTING

- Disconnect the battery (-) terminal.

1. Disconnect the oil vapour recirculation pipes from the throttle body and from the corrugated sleeve.
2. Slacken the fastening clamp and disconnect the corrugated sleeve from the throttle body.
3. Disconnect the electrical connection from the constant idle speed actuator.
4. Disconnect the electrical connection from the throttle potentiometer.
5. Disconnect the two engine coolant fluid inlet and outlet pipes from the throttle body.



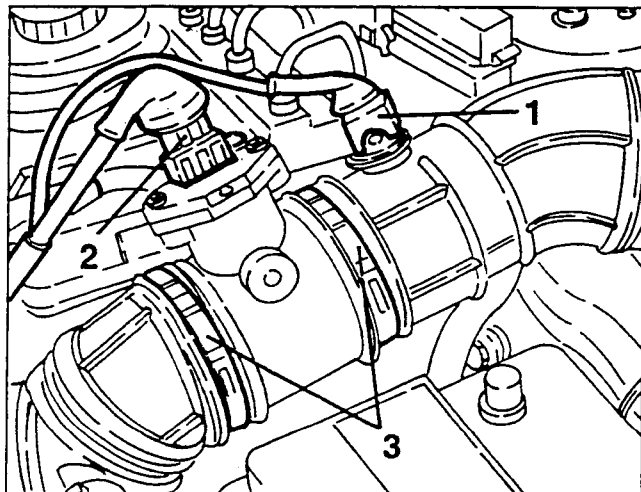
1. Disconnect the accelerator cable from the throttle.
  - Release the pipes from the fastenings on the bracket under the throttle body.
2. Slacken the four fastening screws and remove the throttle body complete with potentiometer and constant idle speed actuator and separate them on the bench.
  - Remove the throttle body seal.



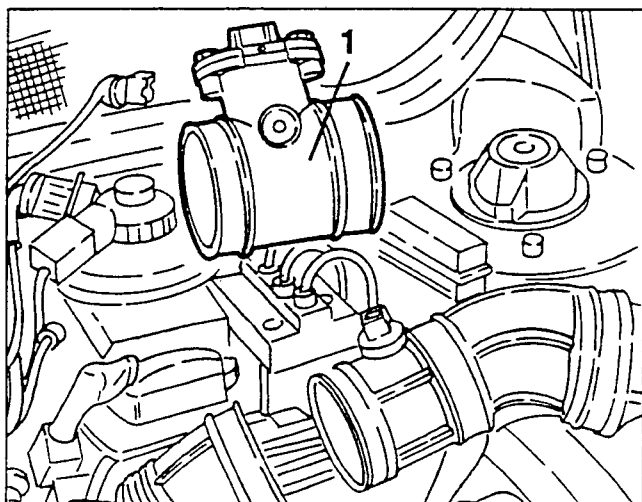
1. Connector
2. Measurement duct
3. Hot film sensor

## REMOVAL/REFITTING

- Disconnect the battery (-) terminal.
1. Disconnect the electrical connection of the intake air temperature sensor.
  2. Disconnect the electrical connection from the air-flow meter.
  3. Slacken the two clamps fastening the corrugated sleeve to the air-flow meter.



1. Withdraw and remove the air-flow meter from the corrugated sleeve.



## AIR-FLOW METER

The air flow meter is of the "heated film" type. Its operating principle is based on a heated diaphragm interposed in a measurement duct through which the air admitted to the engine flows.

The hot film diaphragm is kept at a constant temperature (~ 120°C above the temperature of the incoming air) by the heating resistance in contact with it.

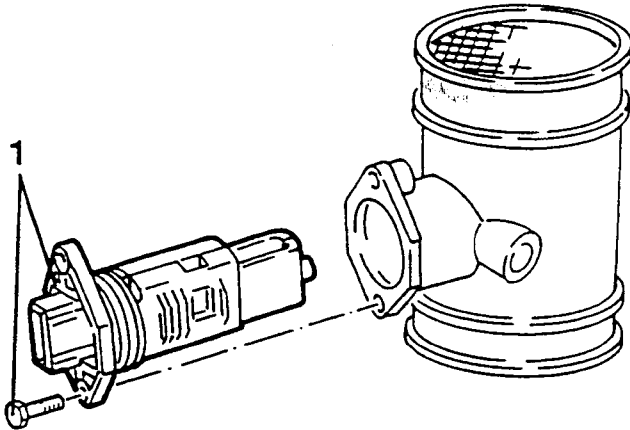
The mass of air crossing the measurement duct tends to withdraw heat from the diaphragm, therefore, in order to keep its temperature constant, a certain amount of current must flow through the resistance. This current is measured by a suitable Wheatstone bridge.

Thus, the current is proportionate with the mass of flowing air.

This air-flow meter measures directly the mass of air and not the volume) thereby eliminating problems of temperature, altitude, pressure, etc. The correct operation of the air flow meter depends on the condition of the air cleaner, which must therefore be checked often.



1. If necessary, slacken the two fastening screws and remove the air-flow meter from its support.

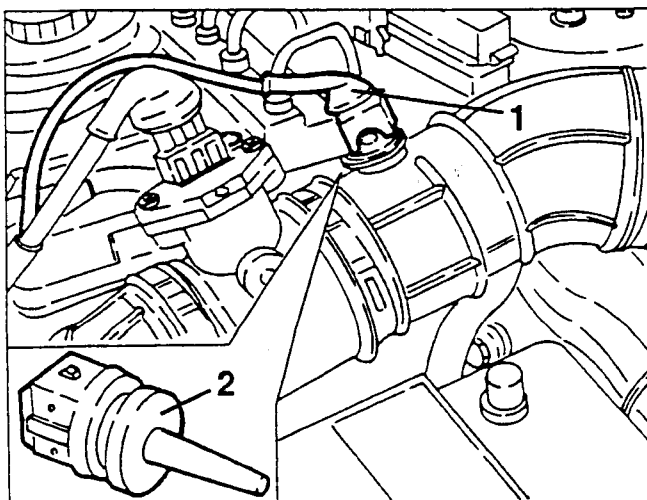


## INTAKE AIR TEMPERATURE SENSOR (NTC)

The intake air temperature sensor is located on the air intake corrugated sleeve and measures the temperature of the air through an NTC thermistor with a negative resistance coefficient, i.e. capable of lowering its resistance as the temperature increases. The electric signal obtained reaches the electronic control unit where it is used to calculate the density of the air.

### REMOVAL/REFITTING

- Disconnect the battery (-) terminal.
- 1. Disconnect the electrical connection from the intake air temperature sensor.
- 2. Withdraw and remove the intake air temperature sensor from the corrugated sleeve.

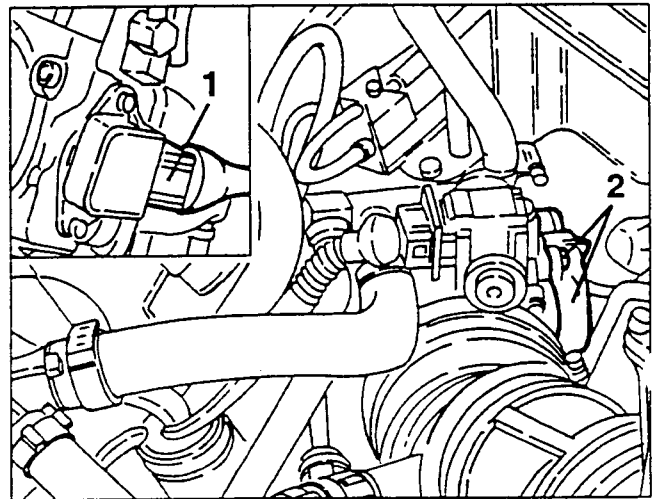


## THROTTLE POTENTIOMETER

This is a potentiometer the mobile part of which is controlled directly by the throttle valve shaft. The potentiometer signals the control unit instantaneously when there is the need for "full power", anticipating the signal from the air-flow meter which records a considerable increase of the flow of air, thereby obtaining a more immediate response. The potentiometer automatically detects the throttle closed position through a "self-adapting" function. This eliminates the need for potentiometer adjustment operations and makes it possible to follow in time any wear occurring on the throttle closing position.

### REMOVAL/REFITTING

- Disconnect the battery (-) terminal.
- 1. Disconnect the electrical connection from the throttle potentiometer.
- 2. Slacken the two fastening screws and remove the throttle potentiometer.



## CONSTANT IDLE SPEED ACTUATOR

Idle speed rpm is controlled by an actuator fitted directly on the throttle body, but since it is more compact and can be operated individually, it is on the whole more cost-effective and reliable. The actuator adjusts the amount of air taken in by the engine when the throttle valve is closed. This makes it possible to compensate the power required by the various services (conditioner compressor, power steering, alternator) so that the engine speed remains unaffected.

The opening and closing controls are independent due to a double electromagnetic circuit with considerable advantages in terms of prompt adjustment.

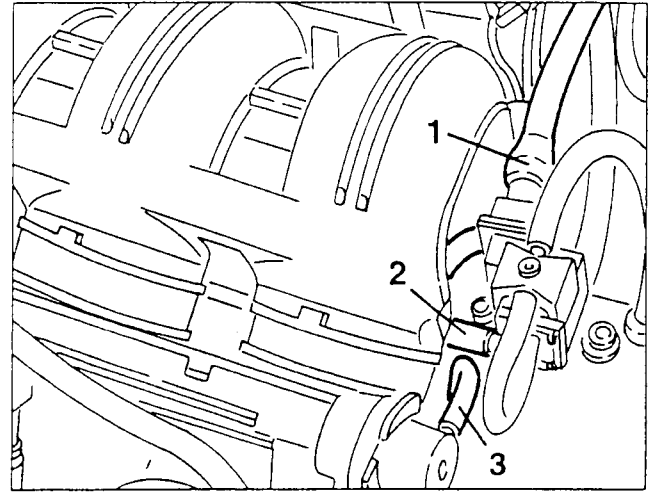
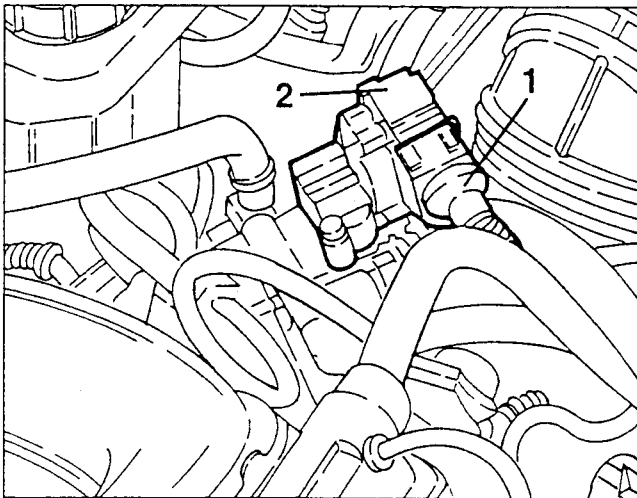
In fact, as the control unit is "self-adaptive", it is necessary to follow and "detect" the changes that occur in the engine (different internal frictions at different temperatures, settling of the engine over the course of time etc.) so that idle speed remains constant under all conditions.

Lastly, in the event of a fault, a spring moves the actuator to an intermediate degree of opening to enable the car to reach an authorised service centre.

## REMOVAL/REFITTING

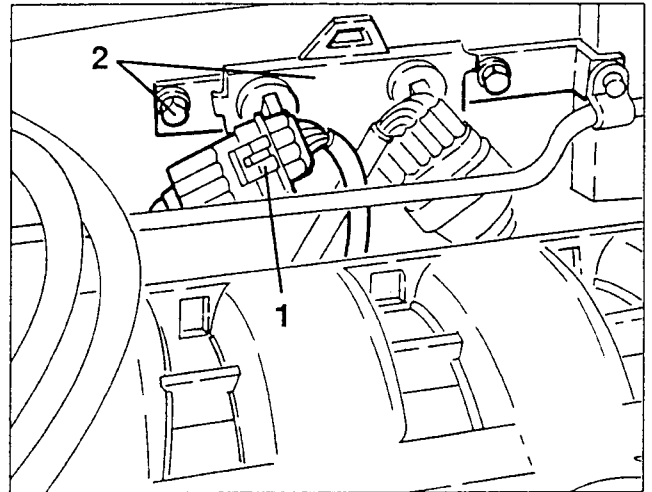
- Disconnect the battery (-) terminal.

1. Disconnect the electrical connection from the constant idle speed actuator.
  2. Slacken the two fastening screws and remove the constant idle speed actuator from the throttle body.
- Remove the seal.



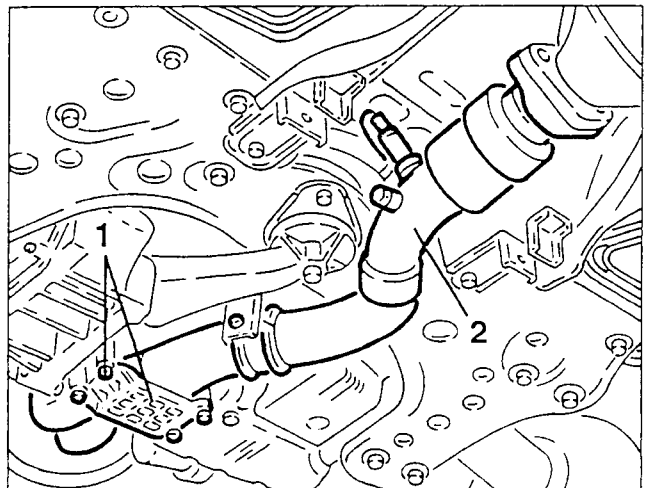
- Disconnect the vacuum takeoff pipe from the servo-brake.

1. Disconnect the lambda probe connector.
2. Slacken the fastening screws and remove the electrical connection support bracket.



1. Raise the car, slacken the fastening screws and remove the reinforcement bracket.

2. Remove the front section of the exhaust pipe complete with lambda probe after slackening the fastenings.



## AIR INTAKE BOX

### REMOVAL/REFITTING

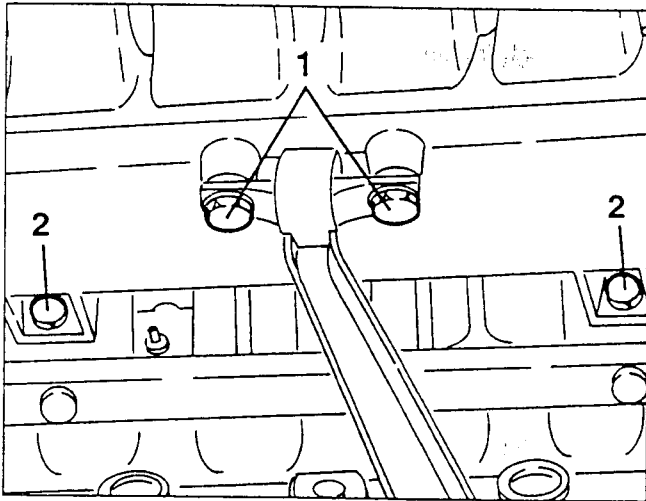
- Set the car on a lift.

- Disconnect the battery (-) terminal.

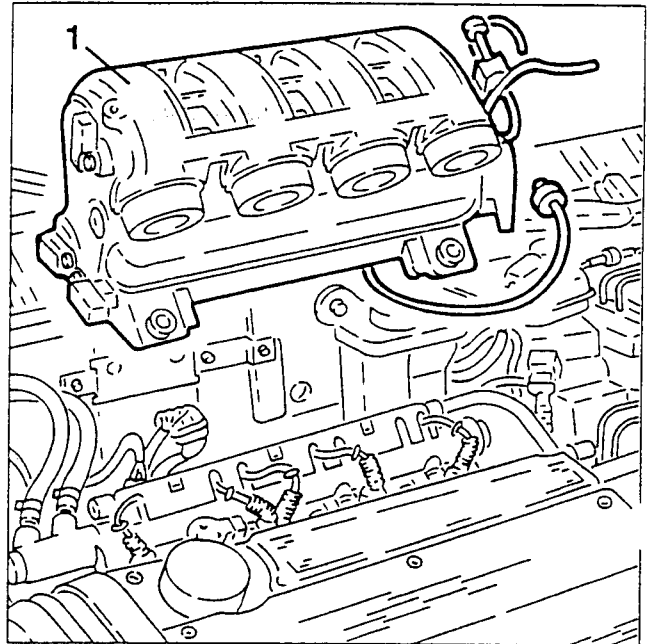
- Remove the throttle body (see specific paragraph).

1. Disconnect the electrical connection from the E.G.R. modulation solenoid valve.
2. Disconnect the E.G.R. valve connection pipe from the modulation solenoid valve.
3. Disconnect the vacuum takeoff pipe for the fuel pressure regulator.

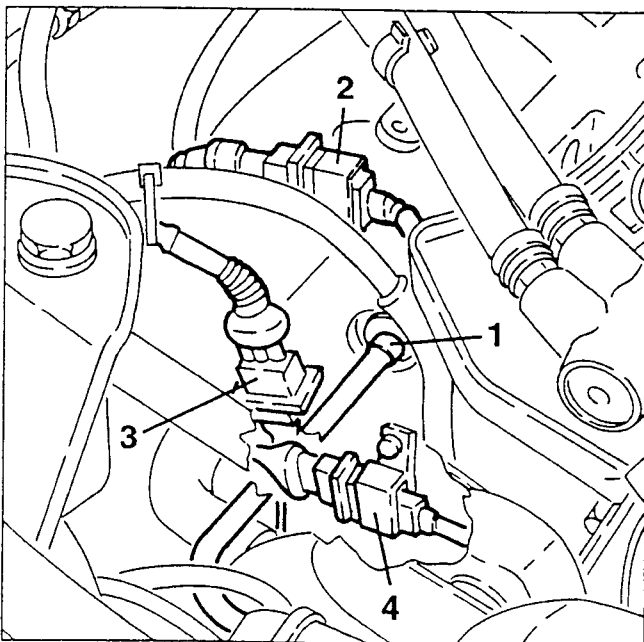
1. Slacken the two screws fastening the support to the intake box.
2. Slacken the two screws fastening the intake box to the cylinder head.



1. Slacken the fastening clamps and remove the intake box pulling it upwards.



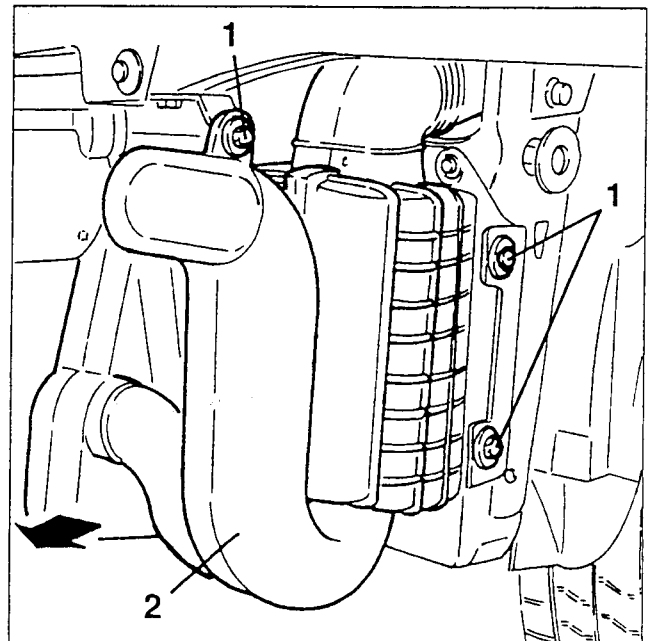
1. Lower the car and disconnect the fuel vapour recirculation pipe from the intake box.
2. Disconnect the electrical connection of the timing sensor.
3. Disconnect the electrical connection of the ping sensor.
4. Disconnect the electrical connection of the rpm and timing sensor.



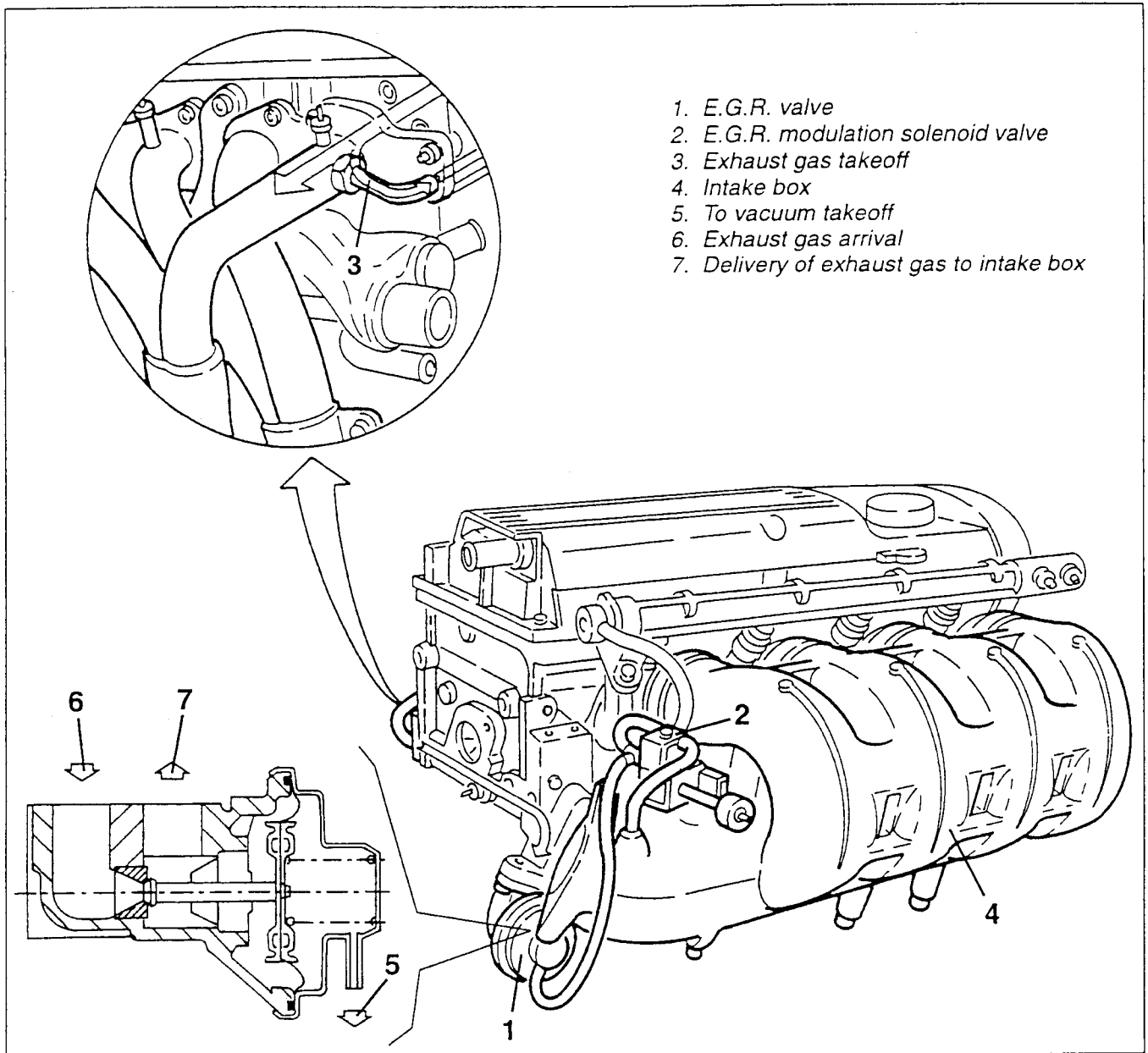
## AIR INTAKE RESOUNDER

### REMOVING/REFITTING

- Set the car on a lift and raise it.
  - Remove the front bumper.
1. Slacken the three screws fastening the air intake resounder.
  2. Remove the air intake resounder withdrawing it forwards.



## DESCRIPTION OF EXHAUST GAS RECIRCULATION SYSTEM (Specific for versions with M2.10.3 injection - ignition system)



1. E.G.R. valve
2. E.G.R. modulation solenoid valve
3. Exhaust gas takeoff
4. Intake box
5. To vacuum takeoff
6. Exhaust gas arrival
7. Delivery of exhaust gas to intake box

To further reduce emissions of NOx (nitric oxides) the supply system is fitted with an E.G.R. valve (1).

The E.G.R. valve (Exhaust Gas Recirculation) withdraws part of the exhaust gas and returns it to the intake box (4), where it is mixed with the intake air and burnt in the engine.

The E.G.R. valve is operated by the vacuum modulated by the solenoid valve (2) controlled by the MOTRONIC control unit.

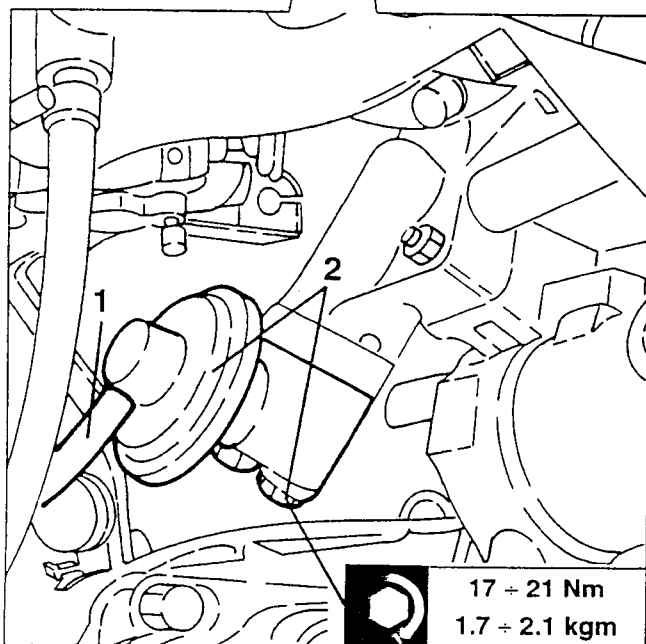
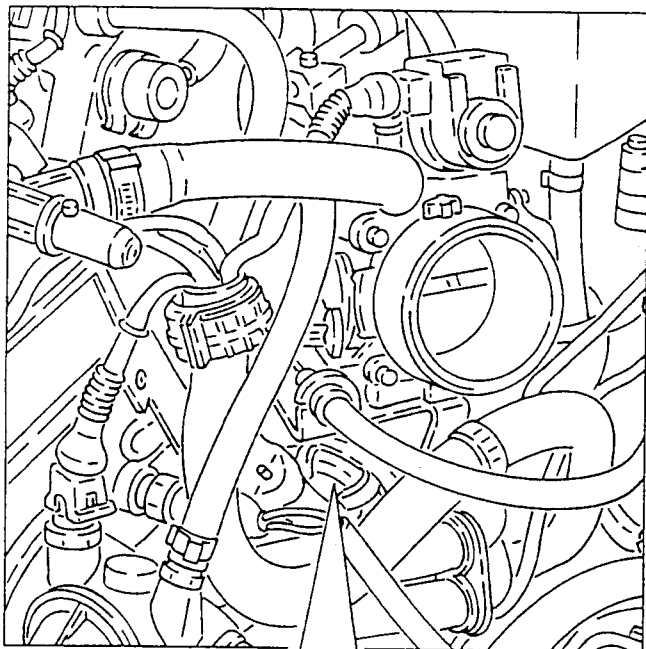
The amount of exhaust gas sent to the engine is determined by the MOTRONIC control unit, taking account of the characteristic curve of the E.G.R. control depending on the engine load and speed and on the temperature of the coolant fluid.

Through the MOTRONIC control unit the solenoid valve modulates the vacuum to be sent to the E.G.R. valve for opening.

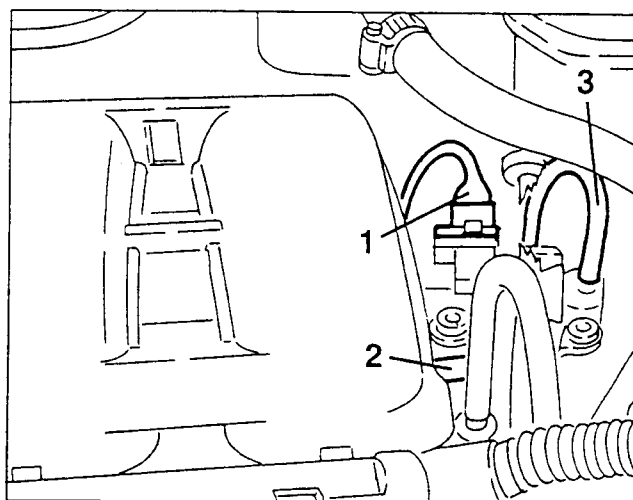
The E.G.R. valve is not activated at idle speed, in neutral gear and for engine speeds below 2000 rpm. When the engine coolant fluid temperature exceeds 60°C the E.G.R. valve is operational and it is completely closed at engine speeds in excess of 4600 rpm.

**E.G.R. VALVE****REMOVAL/REFITTING**

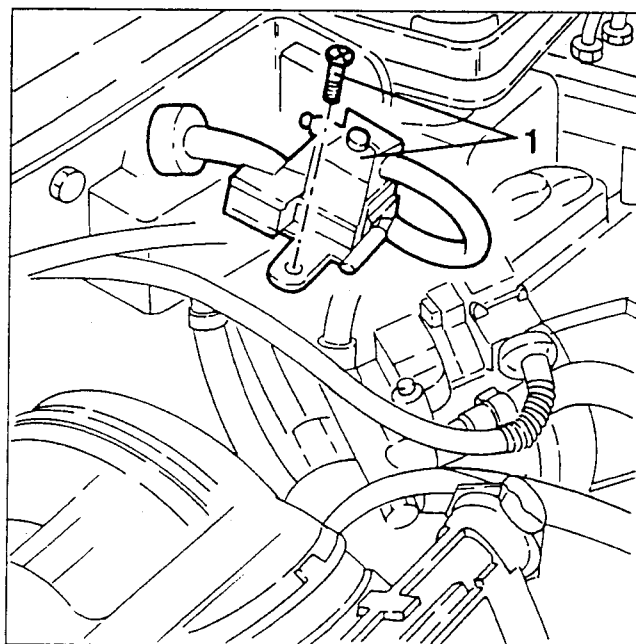
- Remove the battery.
- Loosen the fastening clamp and disconnect the corrugated sleeve from the throttle body.
- 1. Disconnect the connection pipe with the modulation solenoid valve from the E.G.R. valve.
- 2. Slacken the two fastening screws and remove the E.G.R. valve from the intake box.

**E.G.R. MODULATING SOLENOID VALVE****REMOVAL/REFITTING**

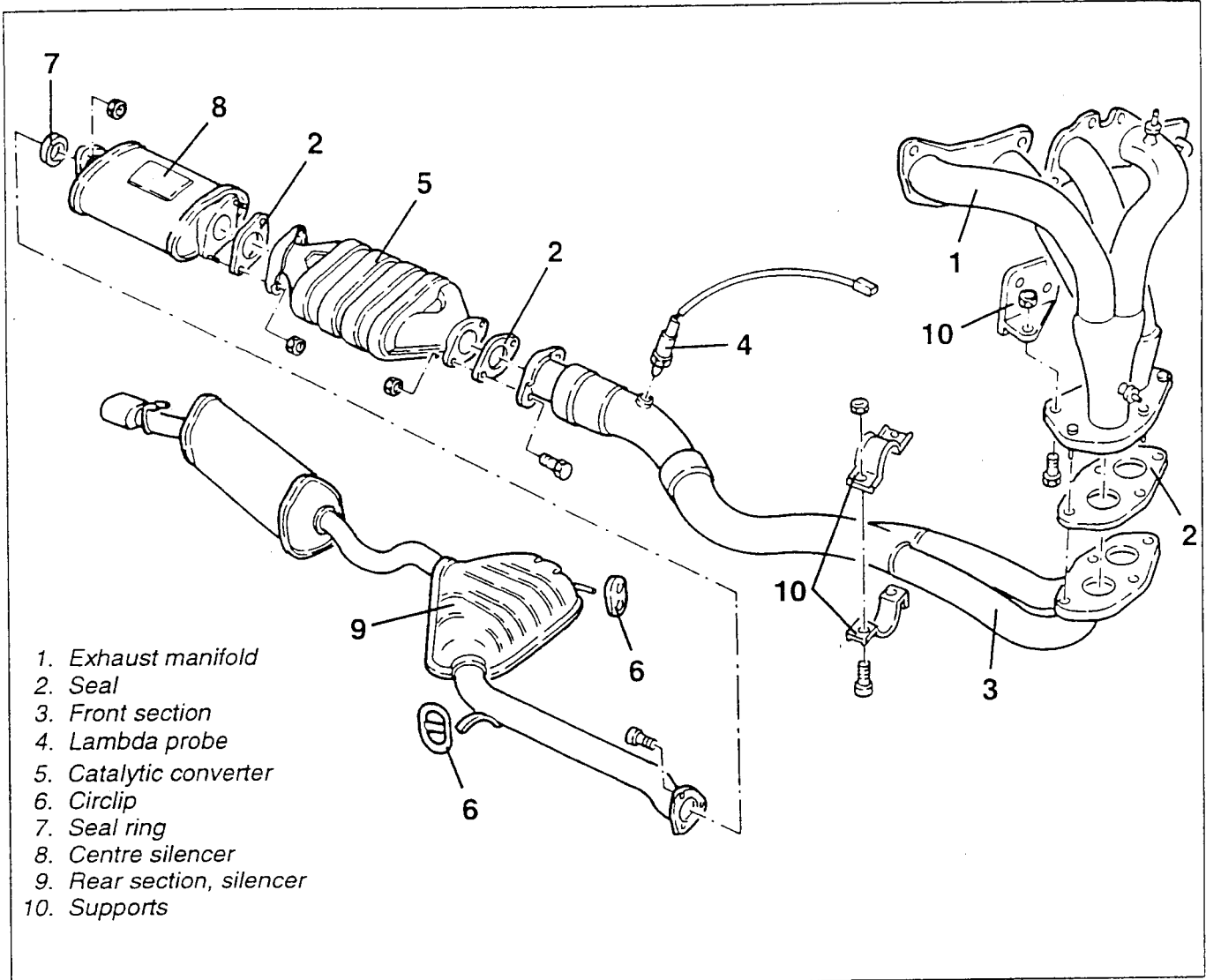
- Disconnect the battery (-) terminal.
- 1. Disconnect the electrical connection from the E.G.R. modulating solenoid valve.
- 2. Disconnect the connection pipe with the E.G.R. valve from the modulation solenoid valve.
- 3. Disconnect the vacuum takeoff pipe from the E.G.R. modulation solenoid valve.



1. Slacken the two fastening screws and remove the E.G.R. modulation solenoid valve.



## DESCRIPTION OF EXHAUST SYSTEM (Specific for versions before change)



The exhaust gases from the cylinder head converge in two double manifolds (1) connected below by a single flange.

From here, through the front section of the exhaust pipe (3), they reach the three-way catalytic converter (5) where most of the pollutants are transformed.

On the front section of the exhaust pipe, there is a flexible piece which makes it possible to limit the transmission of vibrations and the exhaust gas takeoff socket downstream of the catalytic converter.

The lambda sensor (4) is fitted on the front section of the exhaust pipe at the inlet of the catalytic converter and it informs the control unit about the oxygen content in the exhaust gas, making it possible to adapt injection times to keep the stoichiometric ratio (air - fuel) at an optimum level.

The exhaust gas leaves the catalytic converter and crosses the three special silencers (8 - 9).

The connection between the different pieces of the exhaust pipe is made by flanges with seals. Restraint to the body is by brackets with flexible supports.

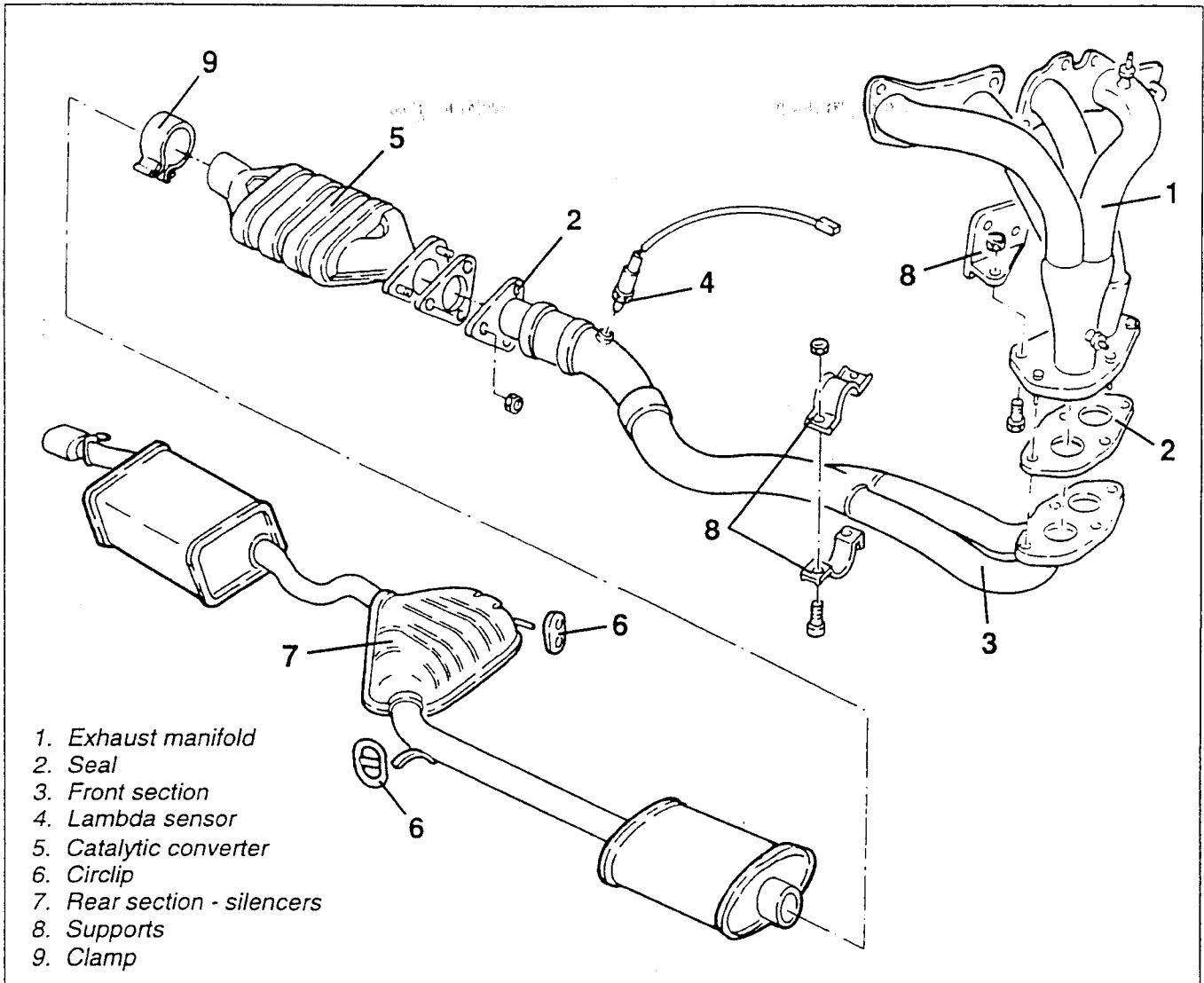
Heat radiation towards the body which is very high owing to the presence of the catalytic converter, is limited by a set of heat guards between the exhaust pipe and the body itself.

**When the car is running, all the exhaust pipes and the catalytic converter in particular, heat up considerably.**

**Before doing any work it is therefore necessary to wait for a suitable length of time with the engine off.**

**Never touch the catalytic converter without adequate protection such as gloves, etc. Do not put easily inflammable materials near the catalytic converter.**

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The exhaust gases from the cylinder head converge in two double manifolds (1) connected below by a single flange.

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The exhaust gas leaves the catalytic converter and crosses the three special silencers joined in a single section of pipe.

The connection between the different pieces of the exhaust pipe is made by flanges with seals, except for

the one between the catalytic converter and the silencers which is by a "spy glass" coupling with special clamp. Restraint to the body is by brackets with flexible supports.

Heat radiation towards the body which is very high owing to the presence of the catalytic converter, is limited by a set of heat guards between the exhaust pipe and the body itself.

**When the car is running, all the exhaust pipes and the catalytic converter in particular, heat up considerably.**

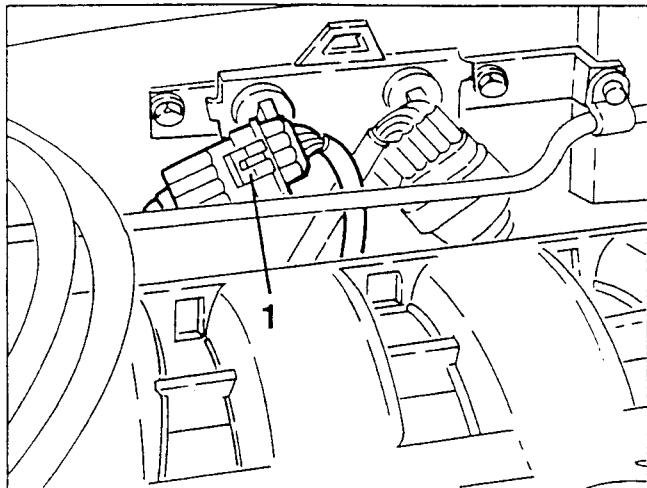
**Before doing any work it is therefore necessary to wait for a suitable length of time with the engine off.**

**Never touch the catalytic converter without adequate protection such as gloves, etc.**

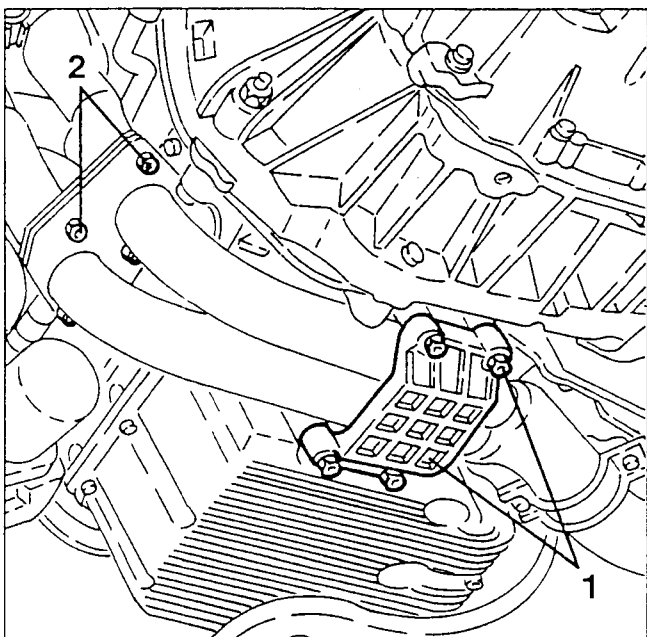
**Do not put easily inflammable materials near the catalytic converter.**

**EXHAUST, FRONT SECTION****REMOVING/REFITTING**

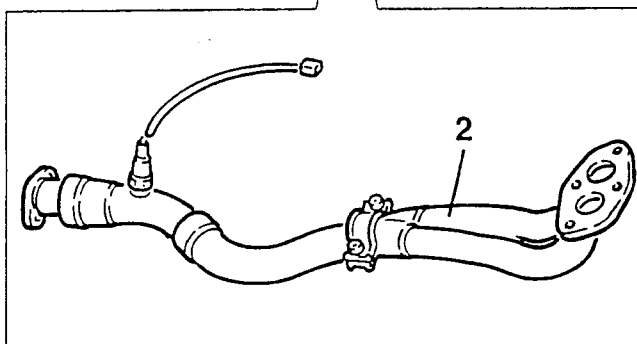
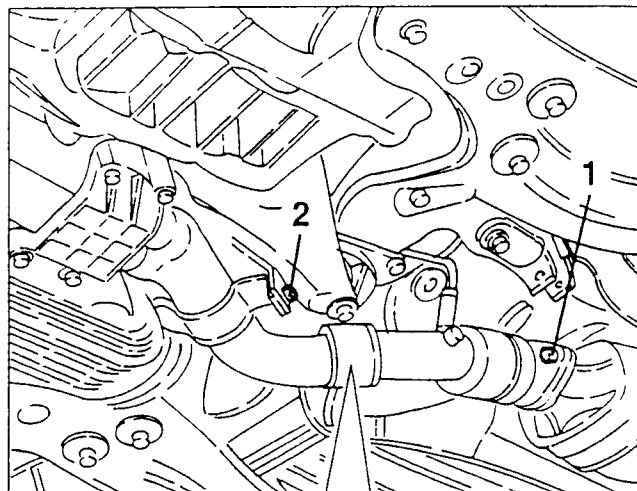
- Set the car on a lift.
- Disconnect the battery (-) terminal.
- 1. Disconnect the lambda sensor electrical connection.




- 1. Raise the car, slacken the fastening nuts and remove the bracket.
- 2. Slacken the nuts fastening the exhaust pipe front section to the manifold.



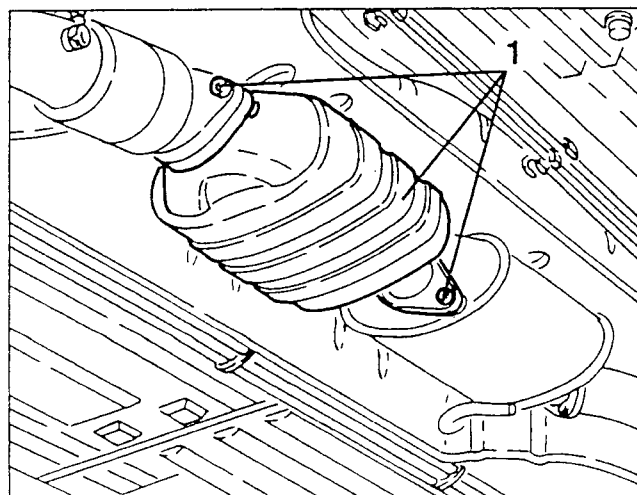
- 1. Slacken the bolts fastening the exhaust pipe front section to the catalytic converter.
- 2. Slacken the support bracket bolt, then remove the exhaust pipe front section with the lambda sensor.
- Remove the seals.

**CATALYTIC CONVERTER**

**NOTE:** For the description of the catalytic converter see Boxer  16V engine.

**REMOVING/REFITTING**  
(Specific for versions before change)

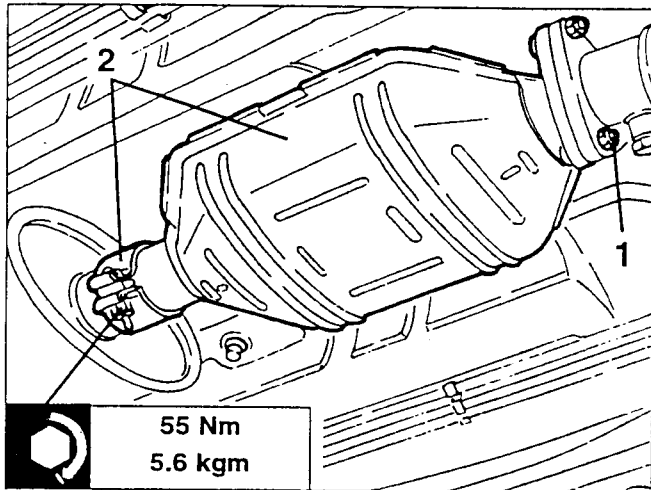
- Set the car on a lift and raise it.
- 1. Slacken the bolts fastening the catalytic converter to the front section and to the exhaust pipe centre silencer, then remove it.
- Remove the seals.





## REMOVING/REFITTING (Specific for versions after change)

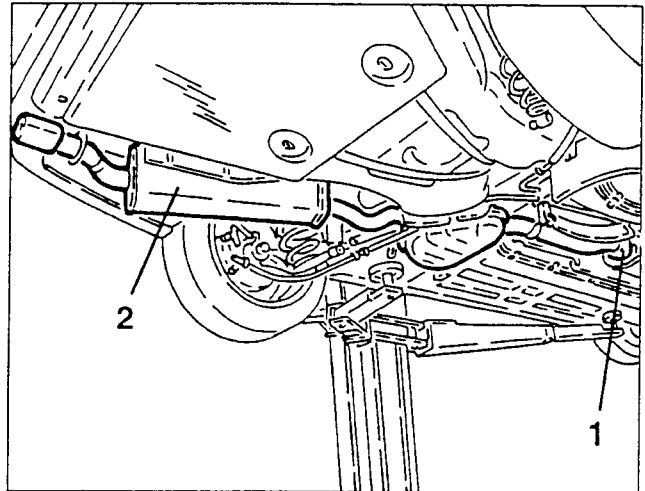
- Set the car on a lift and raise it.
- 1. Slacken the three nuts fastening the catalytic converter to the front section.
- 2. Slacken the clamp fastening the catalytic converter to the rear section, then remove it.
- Remove the seal.



## EXHAUST, REAR SECTION

### REMOVING/REFITTING (Specific for versions before change)

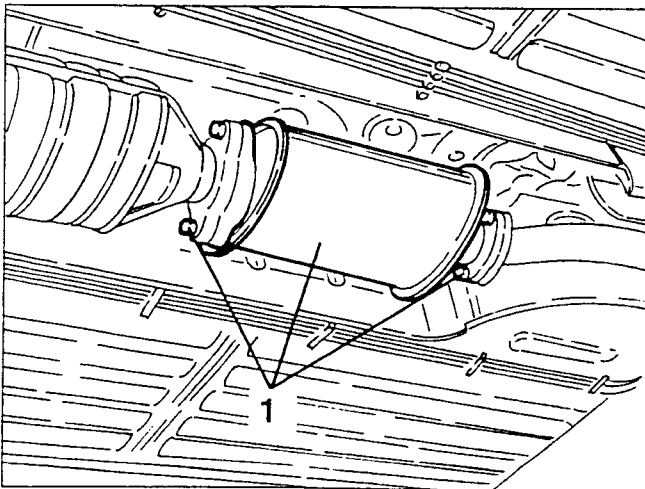
- Set the car on a lift and raise it.
- 1. Slacken the bolts fastening the exhaust pipe rear section from the centre silencer.
- 2. Remove the exhaust pipe rear section freeing it from the supporting circlips and withdrawing from the handbrake control cable.



## CENTRE SILENCER (Specific for versions before change)

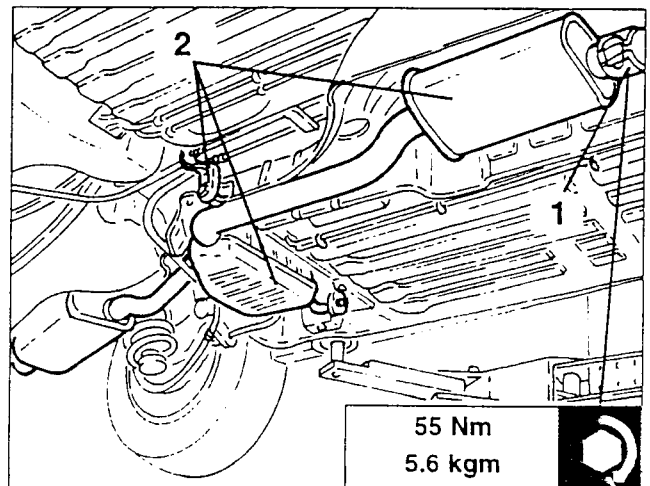
### REMOVING/REFITTING

- Set the car on a lift and raise it.
- 1. Slacken the bolts fastening the centre silencer to the catalytic converter and the exhaust pipe rear section, then remove it.
- Remove the seals.




### REMOVING/REFITTING (Specific for versions after change)

- Set the car on a lift and raise it.
- 1. Slacken the clamp fastening the exhaust pipe rear section of the catalytic converter.
- 2. Remove the exhaust pipe rear section freeing it from the supporting circlips and withdrawing it from the handbrake control cable.



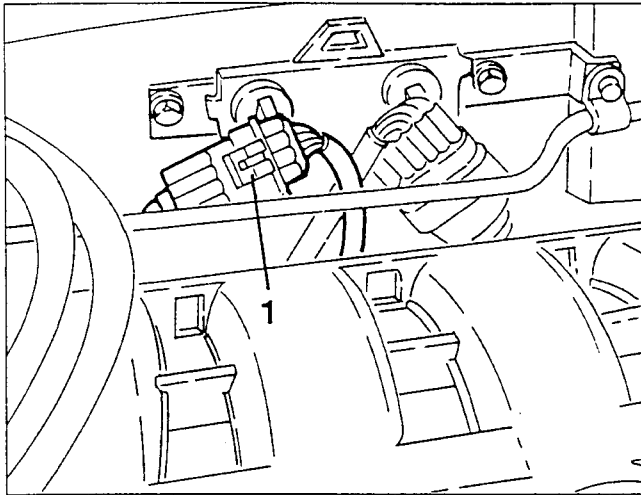
## LAMBDA SENSOR

### NOTE:

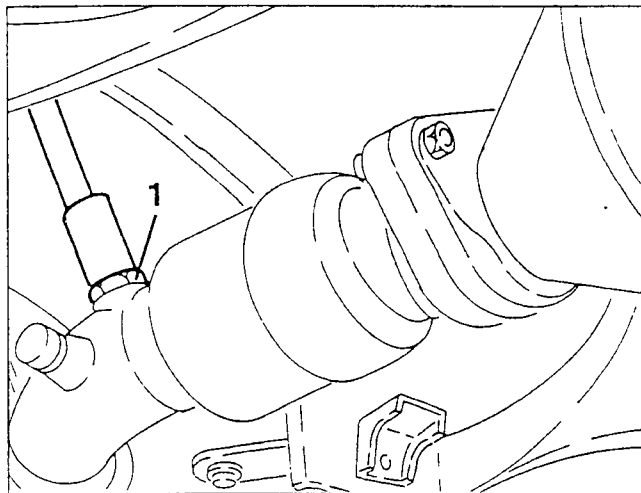
For the description of the lambda sensor see Boxer  16V engine.

## REMOVING/REFITTING

- Set the car on a lift.
- Disconnect the battery (-) terminal.
- 1. Disconnect the lambda sensor electrical connection.



1. Raise the car, then slacken and remove the lambda sensor complete with electric wiring.



## CHECKING EMISSIONS AT EXHAUST

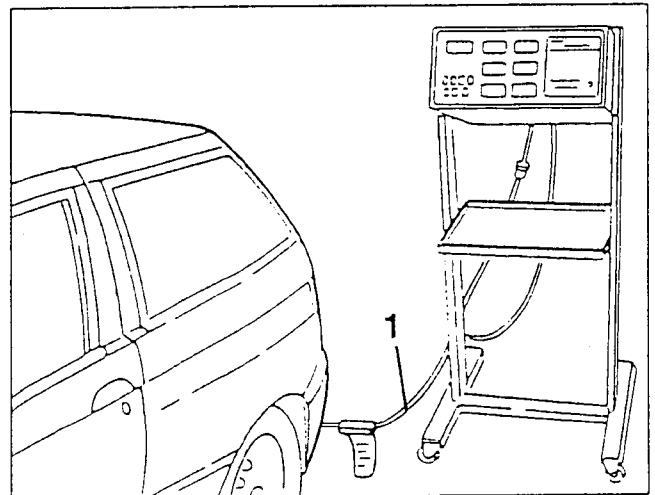
Exhaust emission should be checked outdoors or at least in a suitable place according to current regulations.

The engine should be at normal operating temperature (i.e. when the fan has come on and turned off) and at idle speed (see GROUP 00 - "TECHNICAL SPECIFICATIONS OF THE ENGINE").

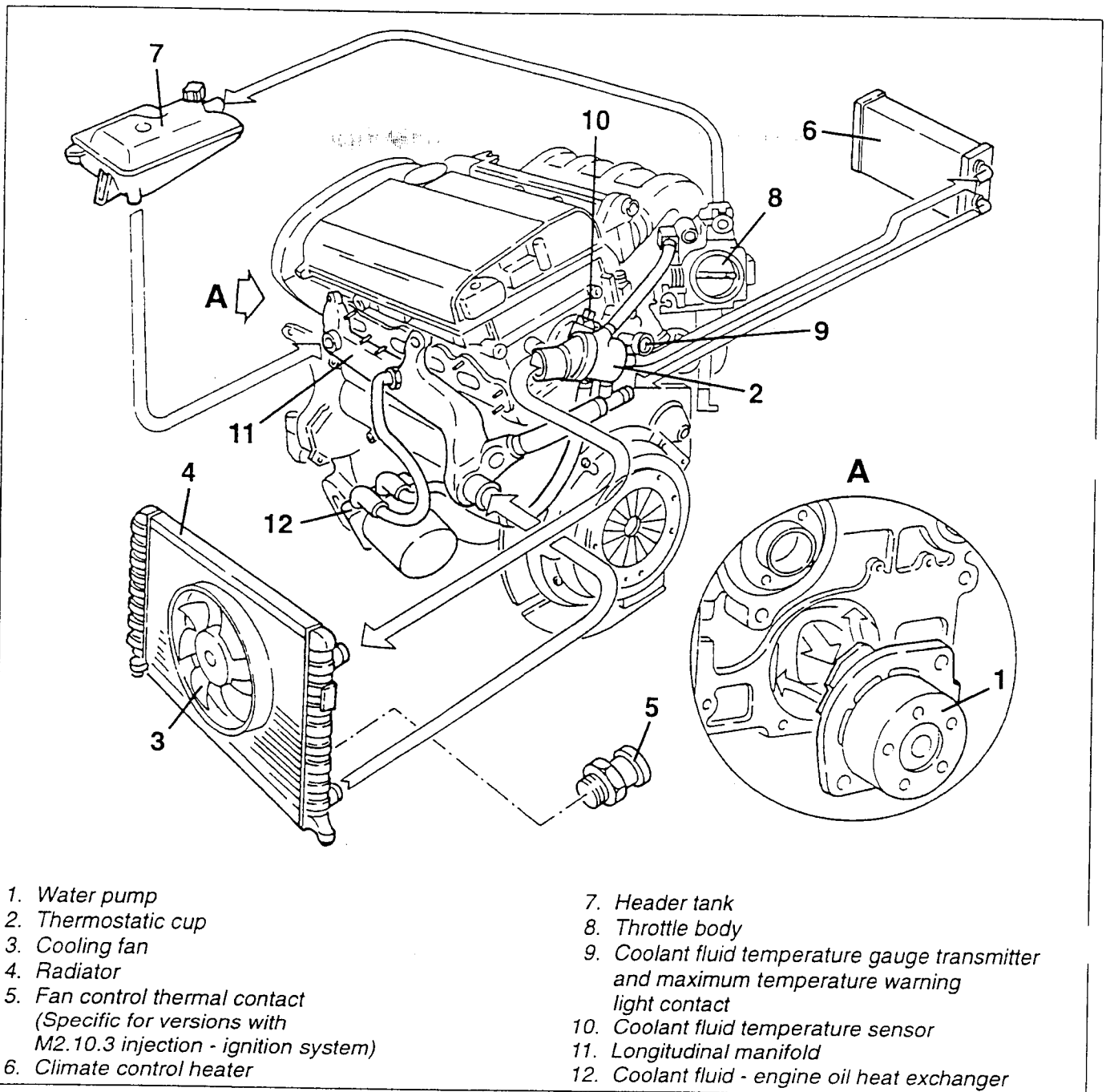
If idle speed is not within the specified limits check that the constant idle speed actuator is working properly.

- Check that the engine oil level is correct and that the air cleaner cartridge is clean.
- Start the engine and keep it at idle speed.
- 1. Insert the feeler of the analyser in the end of the exhaust pipe and check that the amount of CO and HC are within the specified limits.

|                         |                                       |
|-------------------------|---------------------------------------|
| CO at the exhaust       | $\leq 2.2 \text{ g} \times \text{km}$ |
| HC + NOx at the exhaust | $0.5 \text{ g} \times \text{km}$      |



## DESCRIPTION OF ENGINE COOLING SYSTEM



The cooling system is of the sealed type with forced circulation by centrifugal pump (1) located on the cylinder head and controlled by the timing gear belt. A thermostatic valve (2), on the rear of the cylinder head, keeps the engine at optimum temperatures; it opens when the coolant fluid reaches a temperature of 83 °C.

In addition to dynamic air, the radiator (4) cools the engine fluid also by a two-speed fan (3) which is engaged by:

- for versions with M2.10.3 injection-ignition system, by a thermal contact (5) on the radiator;
- for versions with M2.10.4 injection-ignition system, directly by the MOTRONIC control unit, depending on

the signal received by the engine coolant fluid temperature sensor (NTC).

(For further details about the fan see ELECTRIC-ELECTRONIC DIAGNOSIS - Sect. 26 for versions with air conditioner and Sect. 27 for versions with heater).

The purpose of the header tank (7) is to supply the circuit if the level falls and it acts as a lung absorbing the changes in volume of the fluid as the temperature changes; it also vents air from the circuit.

The circuit is fitted with coolant fluid temperature transmitter for the gauge and a maximum temperature thermal contact (9) for the warning light.

## OPERATION OF THE CIRCUIT

After the fluid has cooled the engine, it leaves the cylinder head and reaches the thermostatic unit (92). From here, if the temperature is below 83 °C, it is drawn into the pump (1) through a longitudinal coolant return manifold located on the left-hand side of the cylinder head.

Conversely, if the temperature exceeds this value, the fluid is directed to the radiator (4) through the opening of the thermostat.

After being cooled in the radiator, the fluid returns, still through the longitudinal manifold, to the pump which directs it to the engine.

From the thermostatic cup the fluid is also sent to:

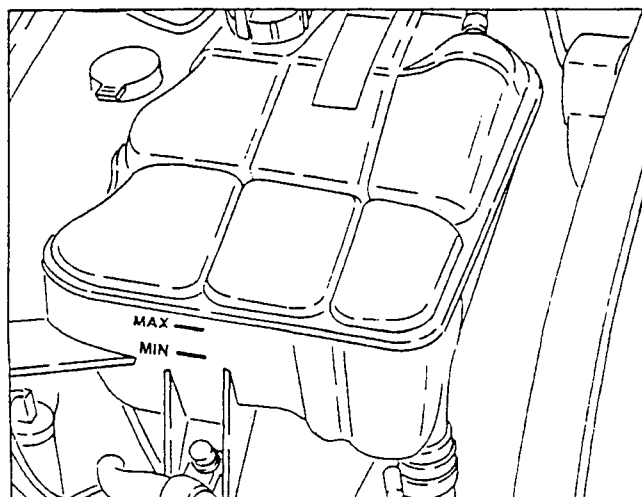
- heat the throttle body (8) from which it flows to the expansion tank (7) also venting air from the system;
- the climate control system heater (6) from which it returns to the longitudinal manifold;
- the heat exchanger (12) for cooling the engine oil before being ducted directly into the longitudinal manifold through which it returns to the pump.

The expansion tank supplies the engine cooling system via a special pipe connected with the longitudinal manifold.

## CHECKING THE LEVEL AND CHANGING THE ENGINE COOLANT FLUID

### Checking

- Check that when the engine is cold the level of the coolant fluid in the header tank is between the MIN and MAX marks.



## Draining and replenishing

- Set the car on a lift.
- Slacken and remove the header tank plug.



### WARNING:

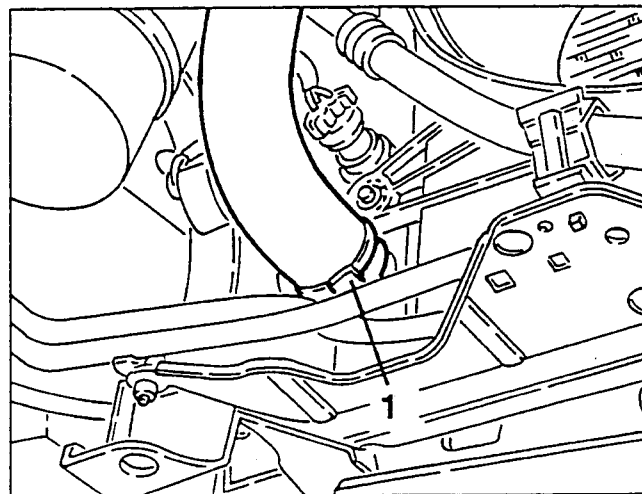
**Absolutely never remove the header tank plug when the engine is hot!**

- Raise the car.
- 1. Slacken the radiator outlet hose and drain the coolant into a suitable recipient.



### WARNING:

**The anti-freeze mixture used as coolant can harm the paintwork: therefore avoid any contact with painted components.**



- Reconnect the sleeve to the radiator and any disconnected pipes, checking that all the clamps are firmly tightened.
- Fill with fluid of the specified type and quantity until reaching the MAX mark on the header tank.
- Start the engine and bring it to normal operating temperature so that the thermostat opens to release the amount of residual air in the circuit.
- With the engine cold, top up until reaching the MAX mark on the header tank.
- Retighten the pressurised cap on the header tank.



### WARNING:

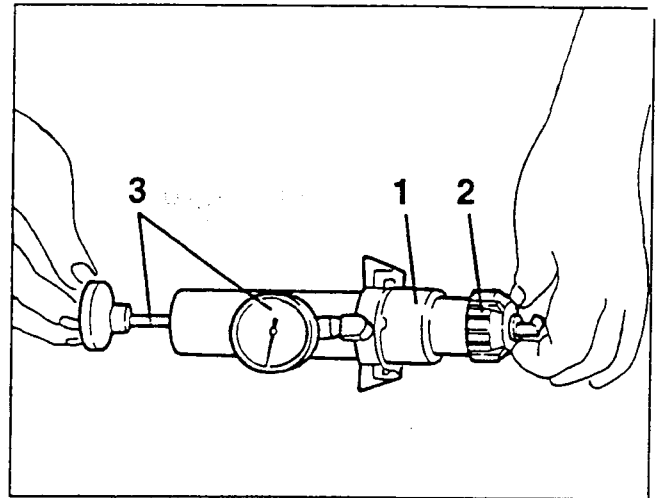
**It is unwise to mix anti-freeze fluids of different types or brands!  
Never use antirust additives: they might not be compatible with the anti-freeze in use!**

## EXPANSION TANK

The expansion tank supplies the circuit and absorbs the variations in coolant volume due to the changes in engine temperature.

In addition, a special calibrated valve contained in the pressurised cap and a pipe connected to it relieve air from the circuit from the pipe leading from the throttle body.

This valve also acts as a washing function enabling outside air to enter the system to compensate for the vacuum created as the system cools.

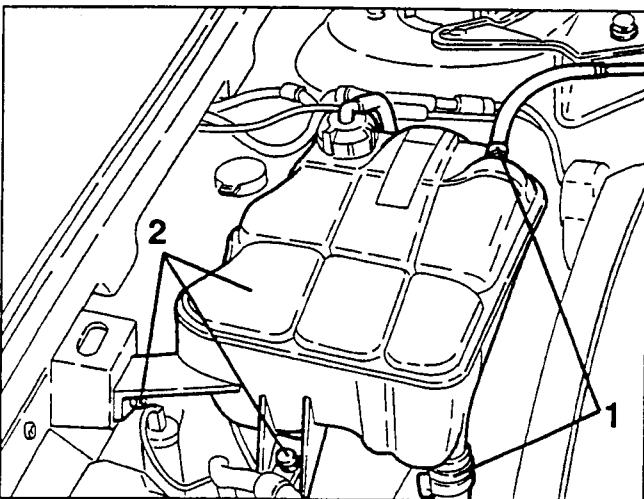


## REMOVAL/REFITTING

- Drain the engine cooling system (see relative paragraph).

1. Loosen the two clamps and disconnect the coolant delivery and return hoses from the expansion tank.

2. Unscrew the three screws and remove the expansion tank.



## ENGINE COOLING SYSTEM LEAK TEST

- Slacken and remove the pressurised cap from the header tank.

1. Screw the instrument for the hydraulic circuit leak test with the special fitting on the header tank filler.

2. Manually pressurise the circuit and check on the instrument that the pressure stays within the specified limit. If not, check for leaks from the sleeves or radiator.



Hydraulic circuit control pressure

1.08 bar



### WARNING:

During these checks with the tester, for safety reasons, never allow the pressure to exceed 1.38 bar.

## PRESSURIZED CAP SEALING TEST

- Perform the test using a seal test tool.

1. Screw the fitting to the lower end of the test tool.

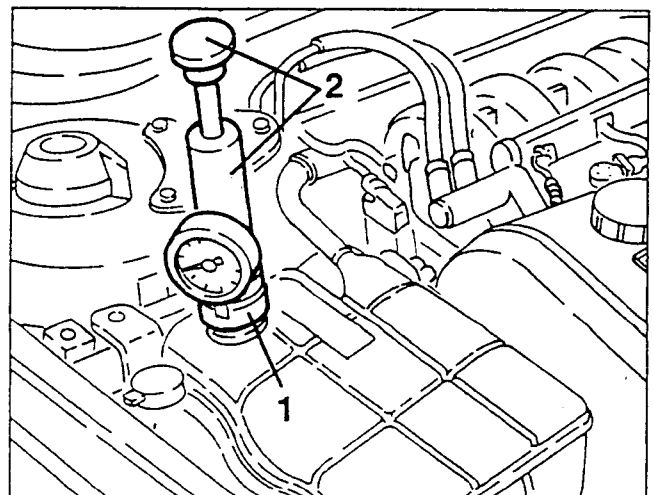
2. Install the expansion tank pressurized cap onto the fitting of the test tool.

3. Manually operate the piston of the test tool and pressurize the cap. Check that the valve opens at the specified pressure read from the manometer.



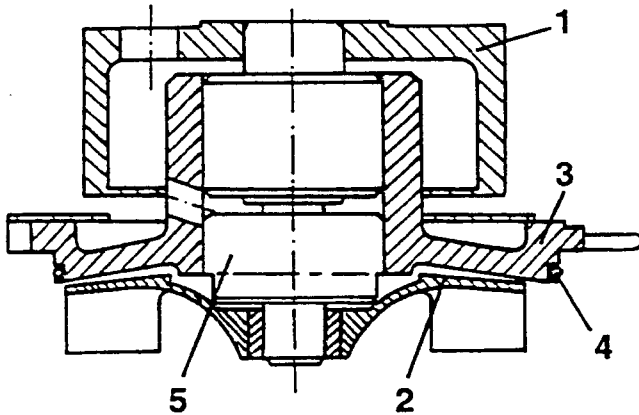
Pressurized cap setting

$0.98 \pm 0.1$  bar



## WATER PUMP

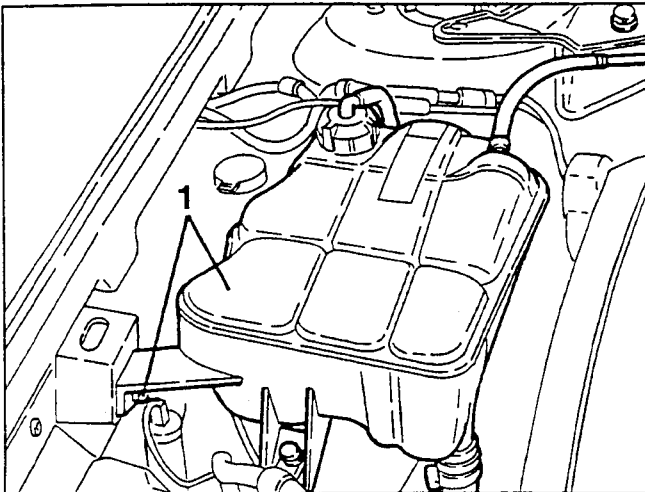
The water pump is of the centrifugal type with blades. It is fastened to the cylinder head and operated by the crankshaft via the timing gear belt. An O-Ring ensures tightness between the cylinder head and the pump. The water pump is kept running constantly to ensure that the coolant fluid circulates continuously.



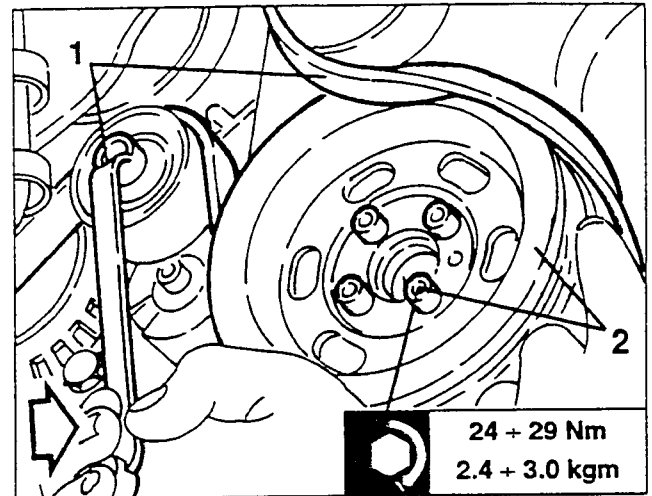
- |                |            |
|----------------|------------|
| 1. Pulley      | 4. O-Ring  |
| 2. Impeller    | 5. Bearing |
| 3. Pump casing |            |

## REMOVAL/REFITTING

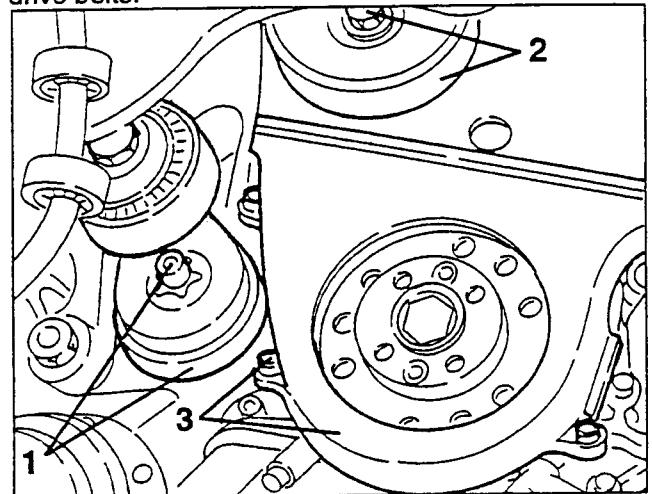
- Set the car on a lift.
  - Disconnect the battery (-) terminal.
  - Drain the engine cooling system (see relative paragraph).
1. Slacken the screws and move the header tank to one side without disconnecting the piping.



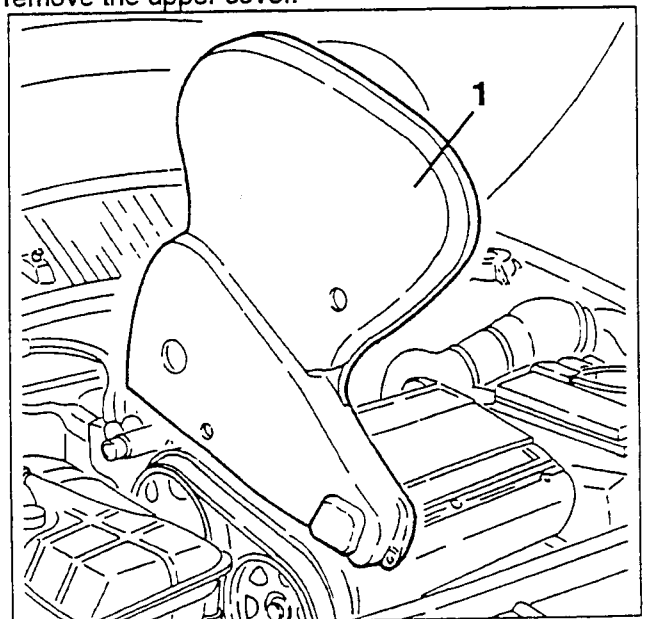
1. Raise the car and working as illustrated on the belt tensioner loosen the tension of the auxiliary components drive belt and remove it.
2. Slacken the four fastening screws and remove the auxiliary components drive pulley.



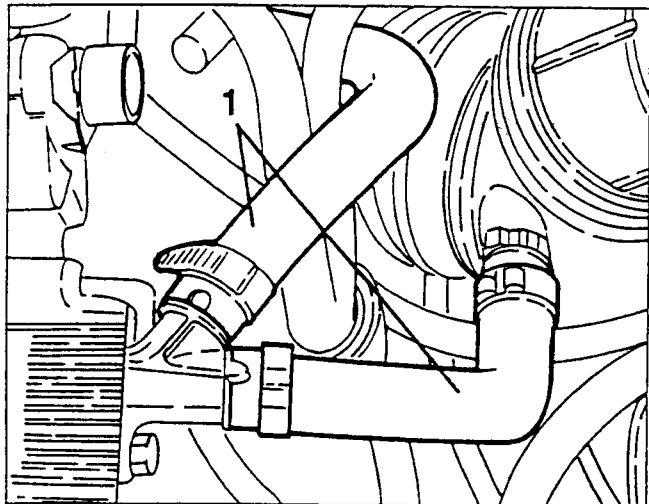
1. Slacken the fastening screw and remove the belt tensioner.
2. Slacken the fastening screw and remove the auxiliary components drive belt guide pulley.
3. Slacken the fastening screws and remove the lower cover of the timing gear and counter-rotating shaft drive belts.



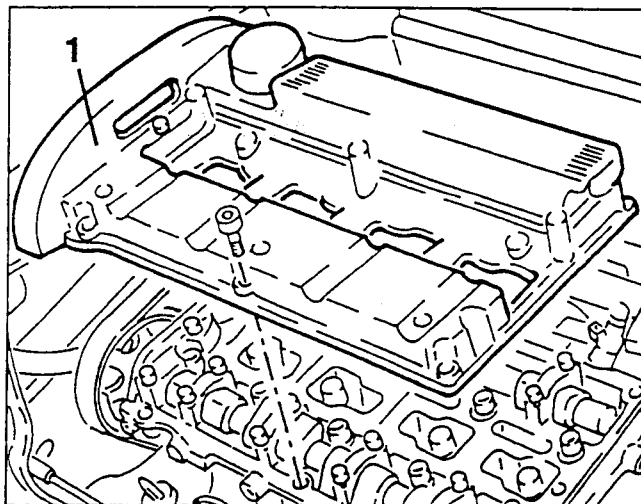
- Slacken the lower screws of the upper cover of the timing gear and counter-rotating shaft drive belts.
1. Lower the car, slacken the fastening screws and remove the upper cover.



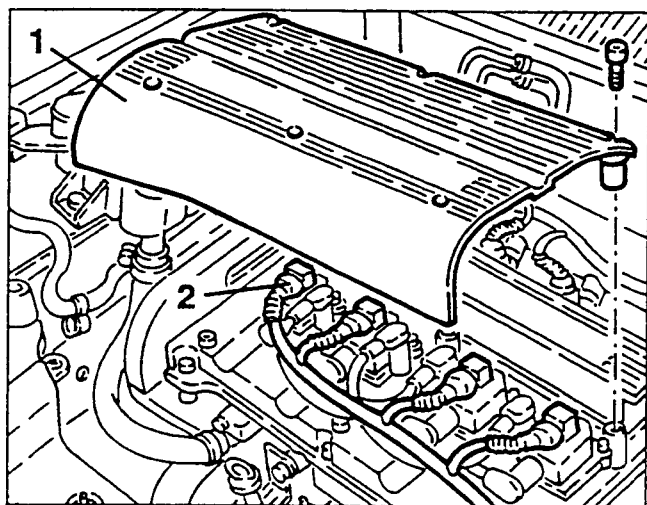
1. Disconnect and remove the oil vapour recovery pipes.



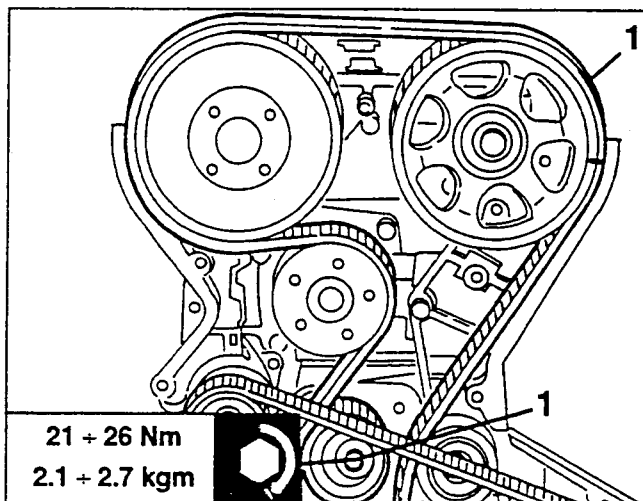
1. Slacken the fastening screws and remove the cylinder head cover complete with gasket.



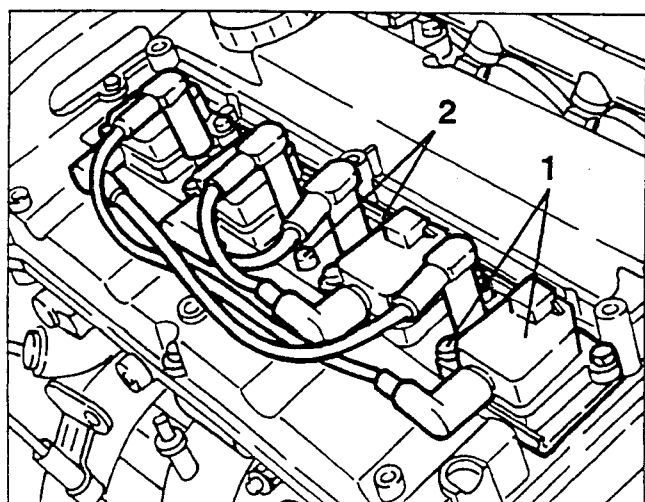
1. Slacken the fastening screws and remove the ignition coils cover.  
2. Disconnect the electrical connections from the ignition coils.



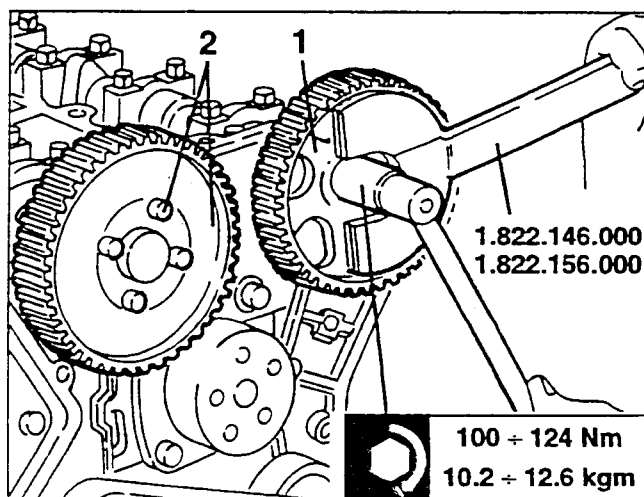
1. Working on the timing gear belt tensioner, loosen the tension on the belt, then take it off the timing gear drive pulleys.



1. Slacken the fastening screws and remove the ignition coils.  
2. Slacken the fastening screws and remove the ignition coils support bracket.

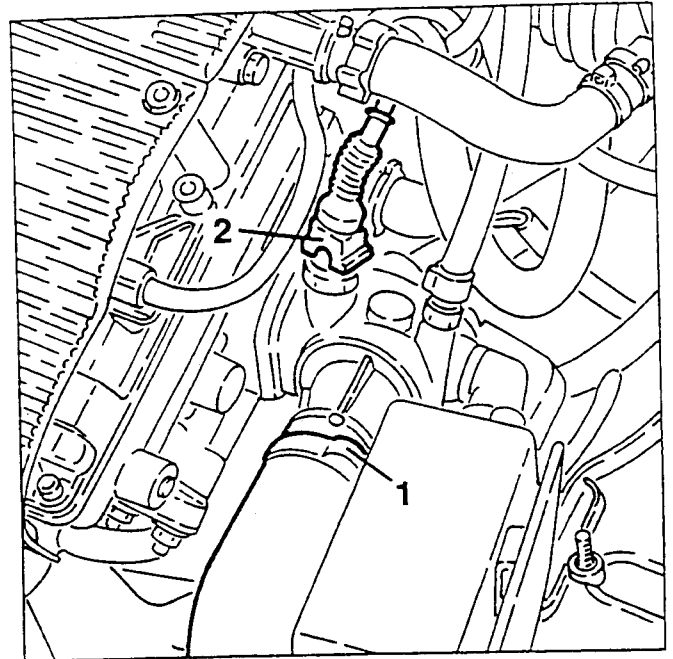
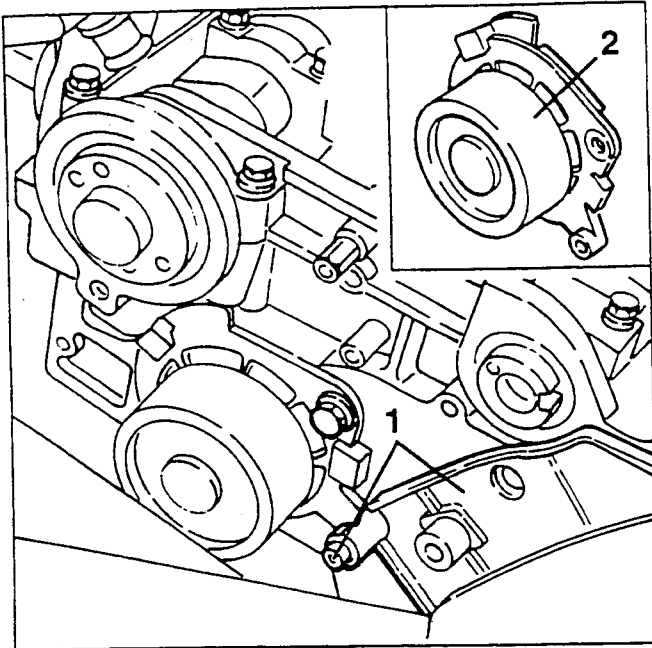


1. Using tools no. 1.822.146.000 and no. 1.822.156.000 slacken the screw fastening the timing gear exhaust side drive pulley and remove it.  
2. Slacken the four screws fastening the timing gear intake side drive pulley and remove it.





1. Slacken the fastening screws and remove the side protection on the exhaust side.
2. Remove the two fastening screws and remove the water pump complete with O-Ring.



1. Disconnect all the pipes connected to the thermostat unit.
2. Slacken the fastening screws and remove the thermostat unit.

- Refit reversing the sequence followed for removal.

For refitting the timing gear drive belt and timing and for assembly of the auxiliary components drive belt see GROUP 00.

## THERMOSTAT UNIT

The thermostat unit is fitted on the rear end of the cylinder head.

Its purpose is to prevent the engine from exceeding the optimum temperature: until the coolant temperature reaches 83 °C, the thermostatic valve diverts the coolant fluid towards the pump; at higher temperatures, the opening of the thermostatic valve enables the passage of the fluid towards the radiator.

On the thermostat unit there is a sensor (NTC) for detecting the coolant temperature to be sent to the control unit.



## REMOVING/REFITTING

- Remove the battery.

  1. Drain the engine coolant fluid disconnecting the radiator delivery sleeve from the thermostatic cup.
  2. Disconnect the electrical connection from the engine coolant temperature sensor (NTC).

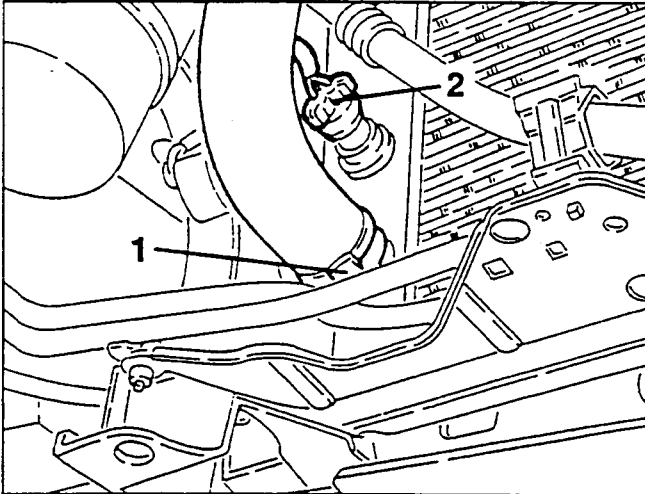
## RADIATOR

The radiator is sized to meet the heat dispersal requirements when the engine is running. It comprises a radiant mass and two side reservoirs fitted with inlet and outlet unions for the coolant fluid; the pipes and radiant mass fins are in aluminium, the reservoirs are in plastic.



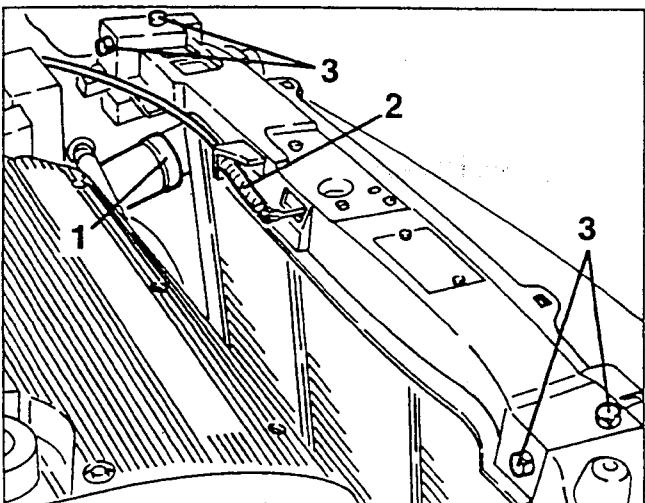
**REMOVING/REFITTING**  
(for versions without air conditioner)

- Set the car on a lift.
  - Disconnect the battery (-) terminal
  - Remove the cooling fan (see specific paragraph)
1. Raise the car and drain the coolant fluid disconnecting the radiator outlet sleeve.
  2. Disconnect the electrical connection from the fan drive thermal contact.

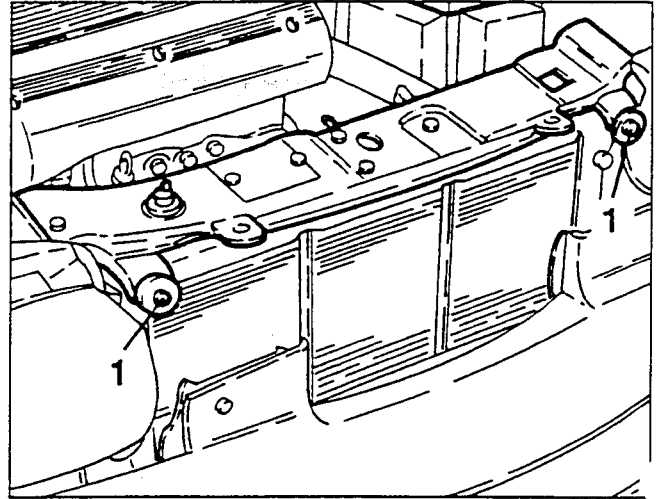


- Lower the car and remove the radiator grille (see GROUP 70).

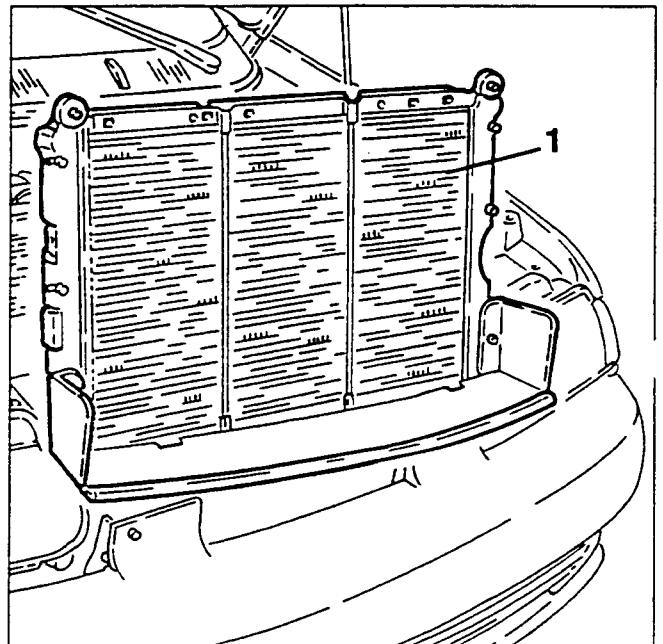
1. Disconnect the coolant inlet sleeve from the radiator.
  2. Disconnect the bonnet opening cable from the lock.
- Disconnect the electrical connection from the anti-theft button on the radiator upper crossmember.
3. Slacken the four screws fastening the upper radiator crossmember to the body.



1. Slacken the two screws fastening the radiator to the upper crossmember, then remove the crossmember after releasing it from the electric wiring.

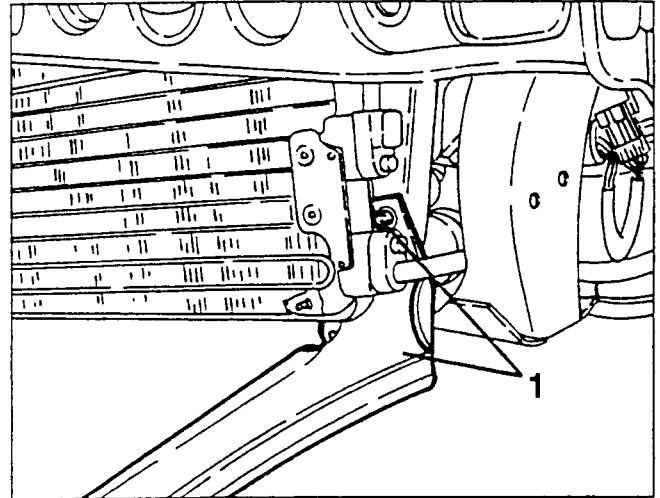
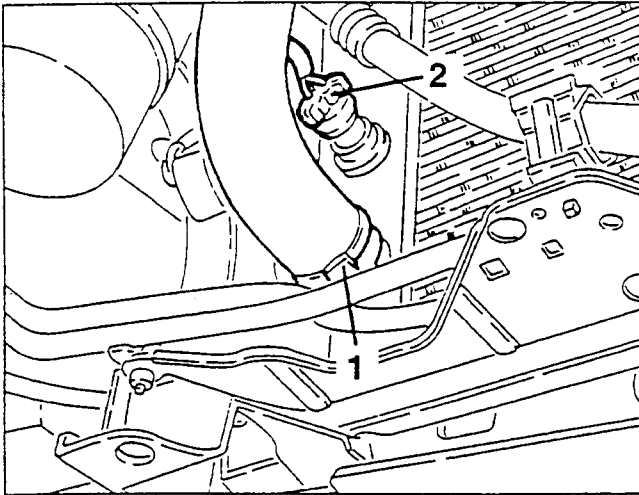


1. Remove the radiator complete with duct and fan drive thermal contact, pulling it upwards.

**REMOVING/REFITTING**  
(for air-conditioned versions)

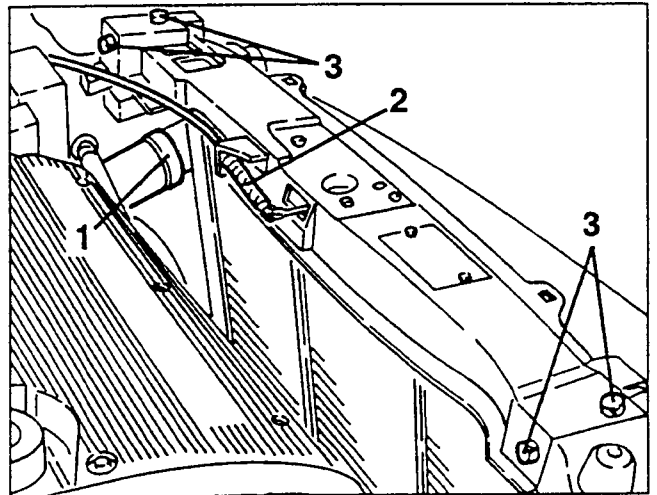
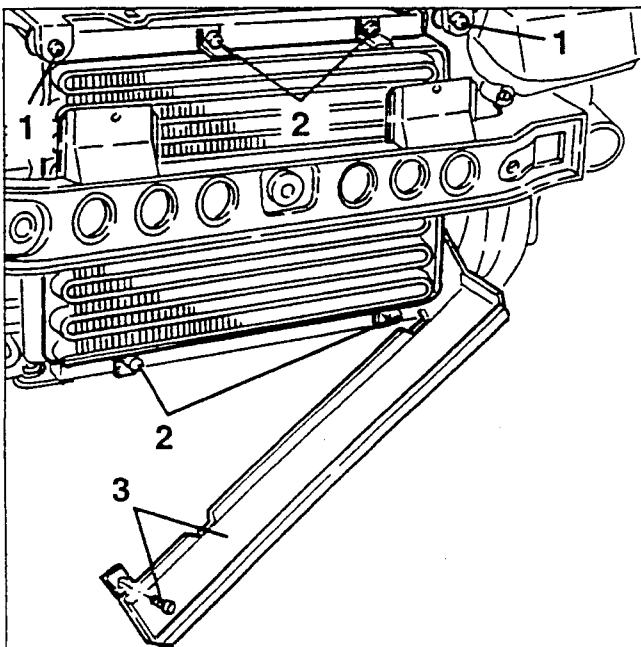
- Set the car on a lift.
- Disconnect the battery (-) terminal
- Remove the radiator grille and front bumper (see GROUP 70)
- Remove the cooling fan (see specific paragraph).

1. Raise the car and drain the coolant fluid disconnecting the radiator outlet sleeve.
2. Disconnect the electrical connection from the fan drive thermal contact.

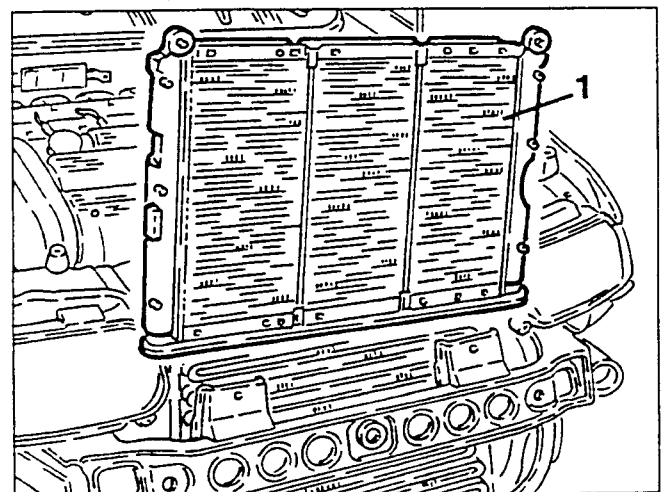


1. Disconnect the coolant inlet sleeve from the radiator.
2. Disconnect the bonnet opening cable from the lock. - Disconnect the electrical connection from the anti-theft button on the radiator upper crossmember.
3. Slacken the four screws fastening the upper radiator crossmember to the body, then remove the crossmember after releasing it from the electric wiring.

1. Lower the car, slacken the two screws fastening the radiator to the upper crossmember and retrieve the spacers.
2. Slacken the four screws fastening the conditioner condenser to the radiator, then support it suitably keeping it connected to the piping.
3. Slacken the screw on the right-hand side fastening the air duct to the radiator, then lower it as illustrated to gain access to the left-hand screw.



1. Remove the radiator complete with fan drive thermal contact, pulling it upwards.



1. Slacken the left-hand screw fastening the air duct to the radiator, then remove it.

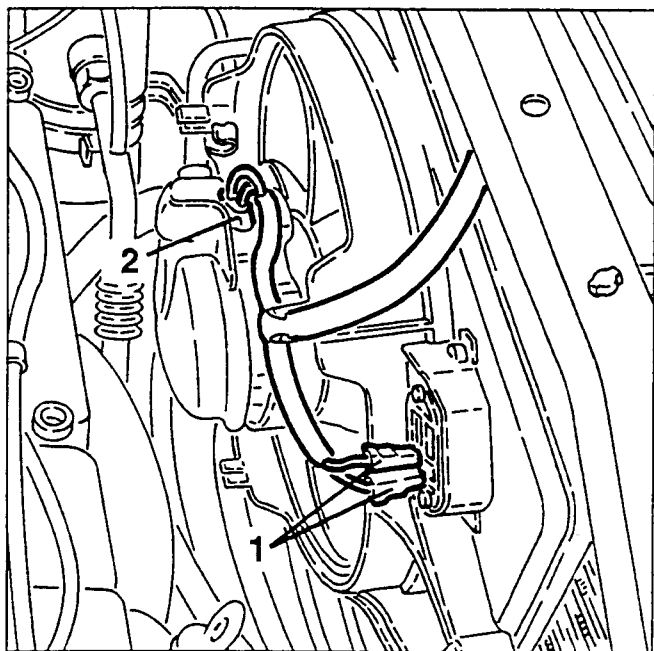
## COOLING FAN

The two-speed cooling fan makes it possible to increase the heat dispersal capacity of the radiator. A thermal contact with double threshold where the first contact takes place at 92 °C and the second, through an additional resistance, at 97 °C activates the fan at two different speeds.

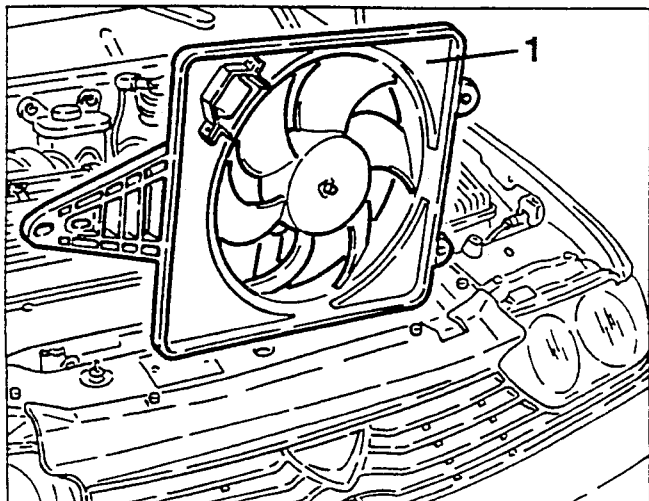
## REMOVAL/REFITTING

- Disconnect the battery (-) terminal.

1. Disconnect the electrical connections of the fan additional coil.
2. Disconnect the cooling fan electrical supply connection.

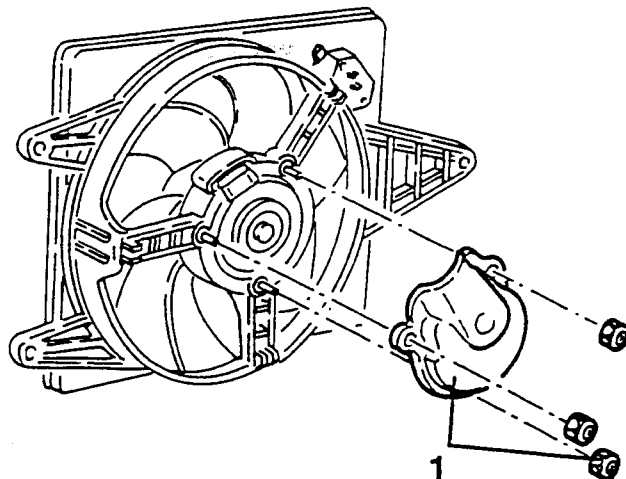


1. Slacken the fastening screws and remove the cooling fan.

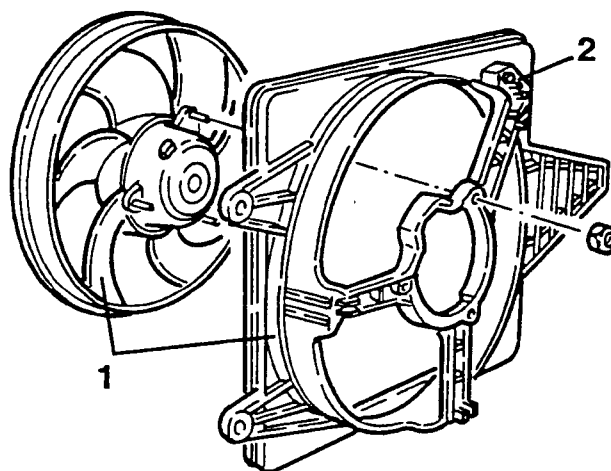


## DIS-ASSEMBLY

1. Slacken the three fastening nuts and remove the heat shield.



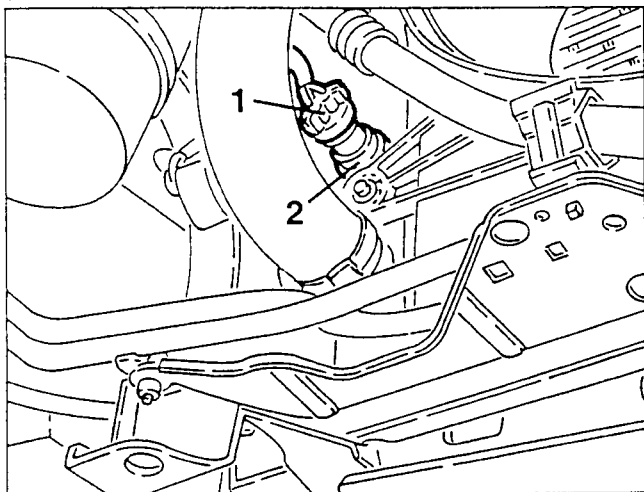
1. Slacken the three fastening nuts, then separate the fan from the duct.
2. Remove the additional resistance slackening the two fastening screws.



## FAN CONTROL THERMAL CONTACT (Specific for versions with M2.10.3 injection - ignition system)

### REMOVING/REFITTING

- Set the car on a lift.
  - Disconnect the battery (-) terminal.
1. Raise the car and disconnect the electrical connection from the fan control thermal contact.
  2. Slacken and remove the fan control thermal contact and recover the coolant that comes out.



### CHECKS AND INSPECTIONS

Check the setting of the thermal contact referring to the wiring diagram of the specific manual.

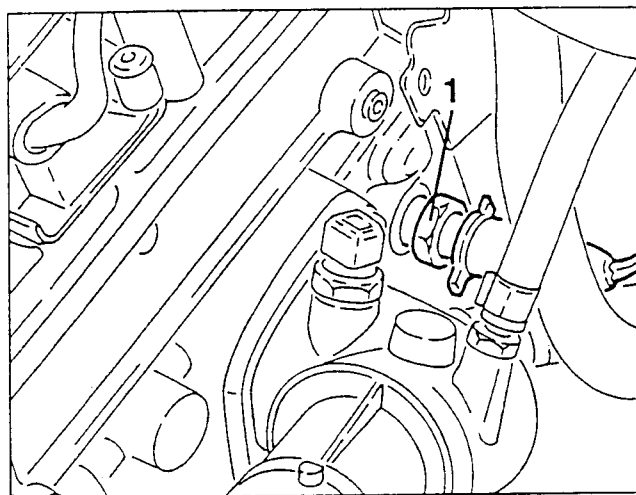
| Cooling fan cut-in/cut-out temperature |                         |                            |
|----------------------------------------|-------------------------|----------------------------|
| 1st speed                              | Cut in (contacts close) | $92 \pm 2^{\circ}\text{C}$ |
|                                        | Cut out (contacts open) | $87 \pm 2^{\circ}\text{C}$ |
| 2nd speed                              | Cut in (contacts close) | $97 \pm 2^{\circ}\text{C}$ |
|                                        | Cut out (contacts open) | $92 \pm 2^{\circ}\text{C}$ |

- If the values are not as specified, change the thermal contact.

## COOLANT TEMPERATURE GAUGE TRANSMITTER AND MAXIMUM TEMPERATURE WARNING LIGHT CONTACT

### REMOVING/REFITTING

- Disconnect the battery (-) terminal.
  - Disconnect the electrical connection from the coolant temperature sensor (NTC).
1. Disconnect the electrical connection from the coolant temperature gauge transmitter and maximum temperature warning light contact, then remove it recovering the coolant that comes out.



### CHECKS AND INSPECTIONS

Check the setting of the transmitter referring to the wiring diagram of the specific manual.

| Temperature ( $^{\circ}\text{C}$ ) | Resistance ( $\Omega$ ) |
|------------------------------------|-------------------------|
| 60<br>(Water test liquid)          | $525 \div 605$          |
| 90<br>(Water test liquid)          | $195 \div 245$          |
| 120<br>(Glycerine test liquid)     | $82 \div 94$            |

|                             |                             |
|-----------------------------|-----------------------------|
| Contact closing temperature | $122 \pm 2^{\circ}\text{C}$ |
| Contact opening temperature | $112 \pm 3^{\circ}\text{C}$ |



T. SPARK  
16V



T. SPARK  
16V



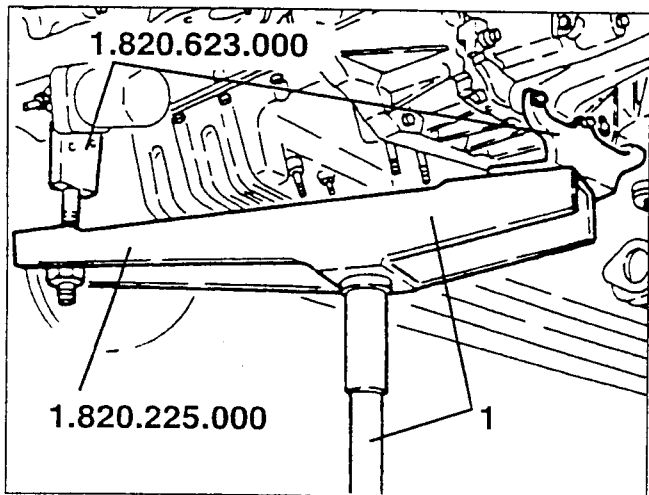
T. SPARK  
16V

THE FOLLOWING PROCEDURE IS VALID FOR ALL ENGINES AND WHILE FOR ENGINE IT IS VALID ONLY FOR VERSIONS WITH GEARBOX C.510.5 (UP TO CHASSIS NO. ....)

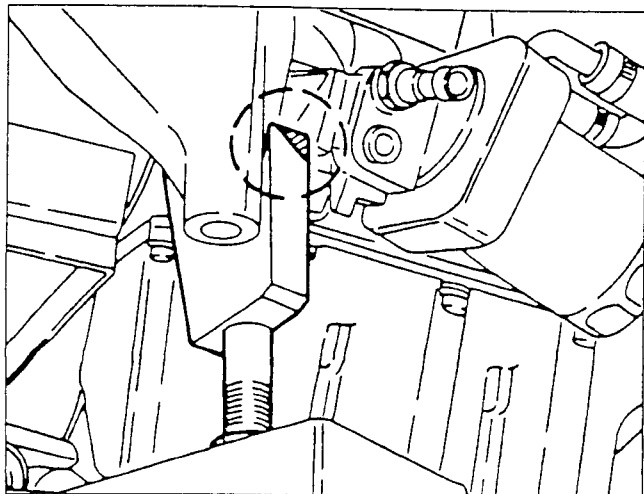
## REMOVAL

Proceed as described for engine removal with the exception of the following steps.

1. Set a hydraulic jack complete with tools no. 1.820.225.000 and no. 1.820.623.000 as illustrated.



**NOTE:** The camshaft side engine support part of tool no. 1.820.623.000, is to be relieved in the area illustrated to avoid interference with the oil filter support.

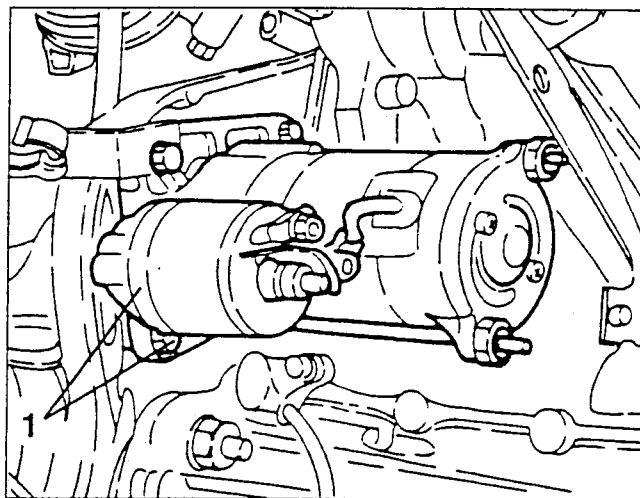


Complete removal of the engine from the car working as described for engine.

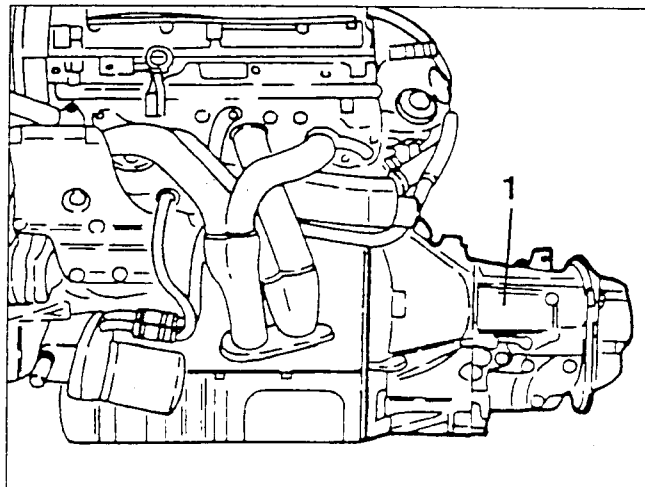
Once on the bench, remove the components as described below to make it possible to set the engine on the overhauling stand.

- Free the power unit from the support tools, then position it on a special work bench.

1. Slacken the fastening screws and remove the starter motor.



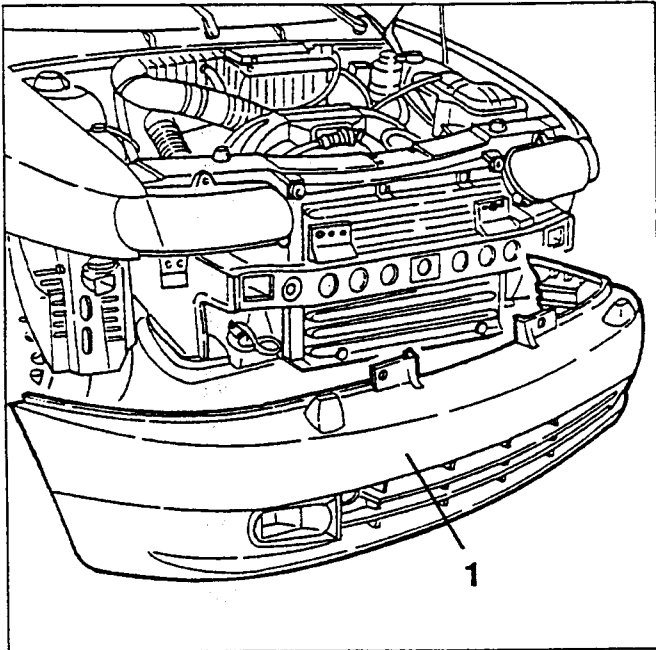
1. Slacken the fastening nuts and remove the gearbox and differential unit.



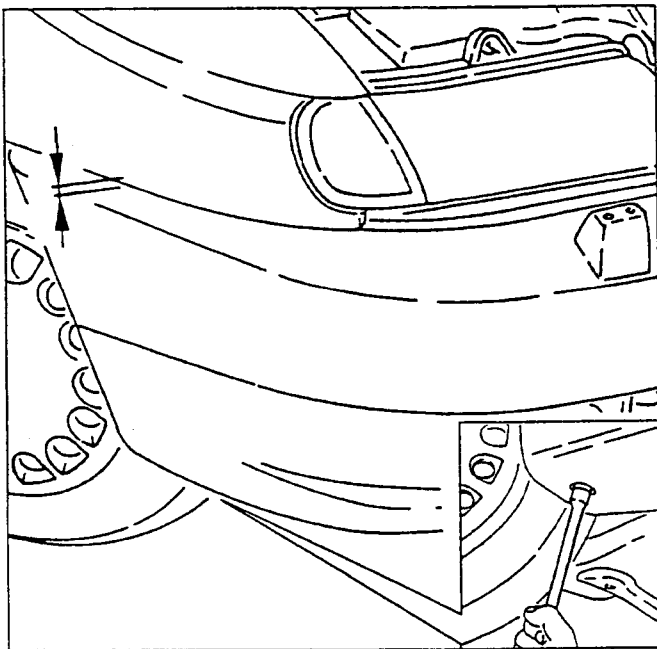
1. Remove the front bumper.



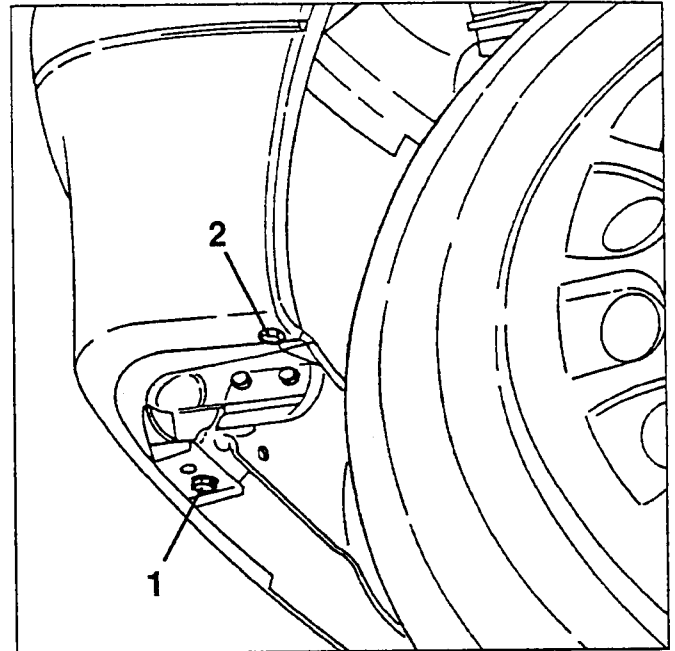
When refitting check that the two upper gaskets are present on the bumper.



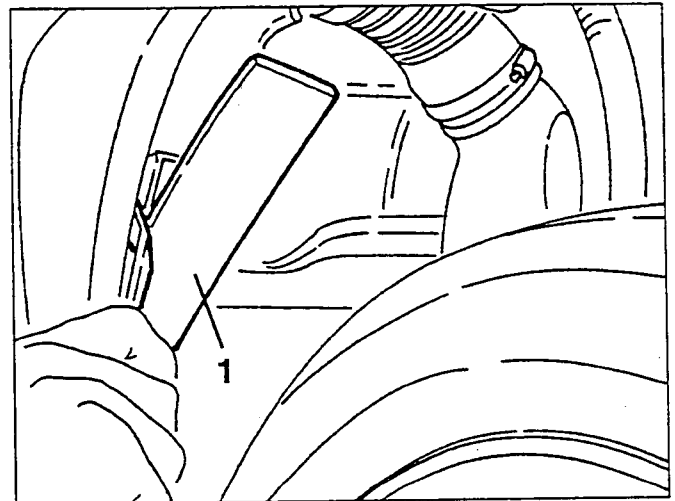
Refit by reversing the procedure followed for removal adjusting the position of the bumper using the screws shown in the diagram.



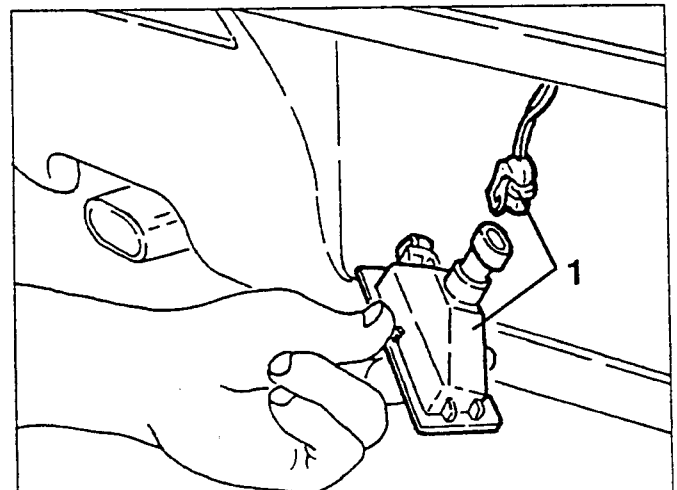
2. Loosen the two screws securing the rear wheel housing to the bumper.



1. Pull the wheel housing from the bumper.



1. Pull off the numberplate light and remove them after disconnecting the relative electrical connections.

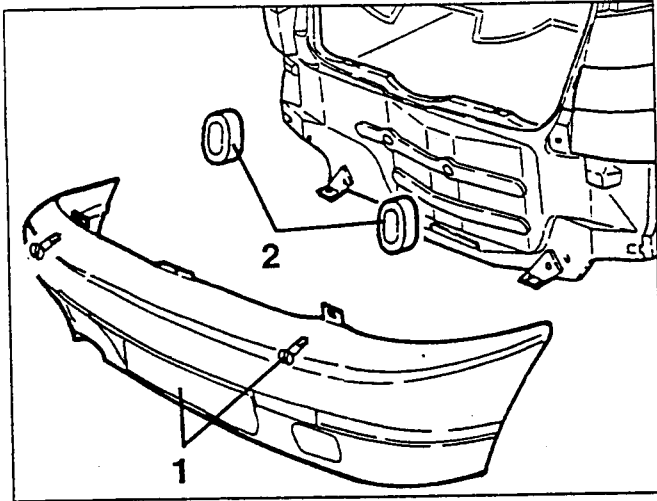


## REAR BUMPER

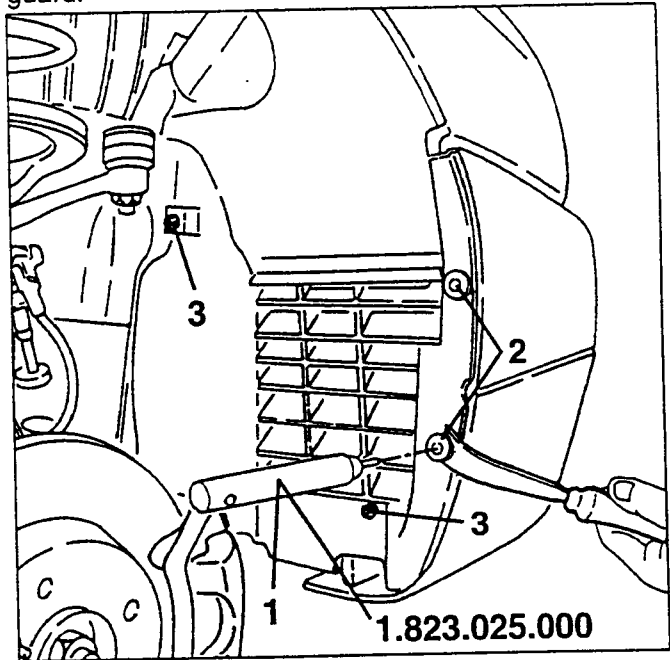
### REMOVAL/REFITTING

1. Loosen the two lower screws securing the bumper.

1. Working with the boot lid raised, loosen the two upper screws and remove the bumper.
2. Remove the two rubber energy absorbing buffers.



3. Loosen the four screws securing the front gravel guard.

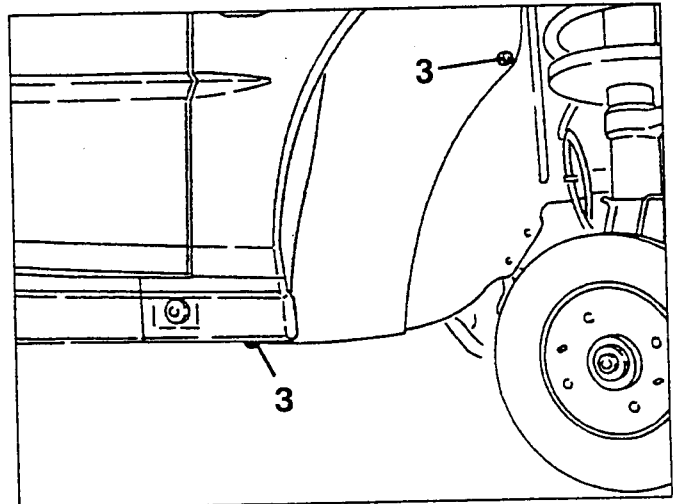
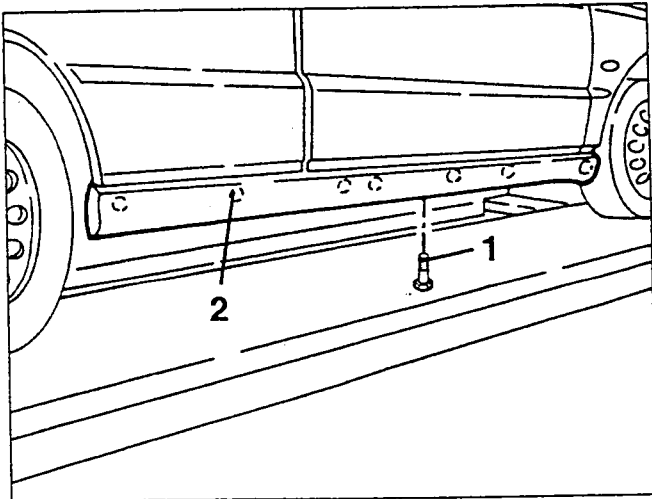


## DOOR SILL COVERING

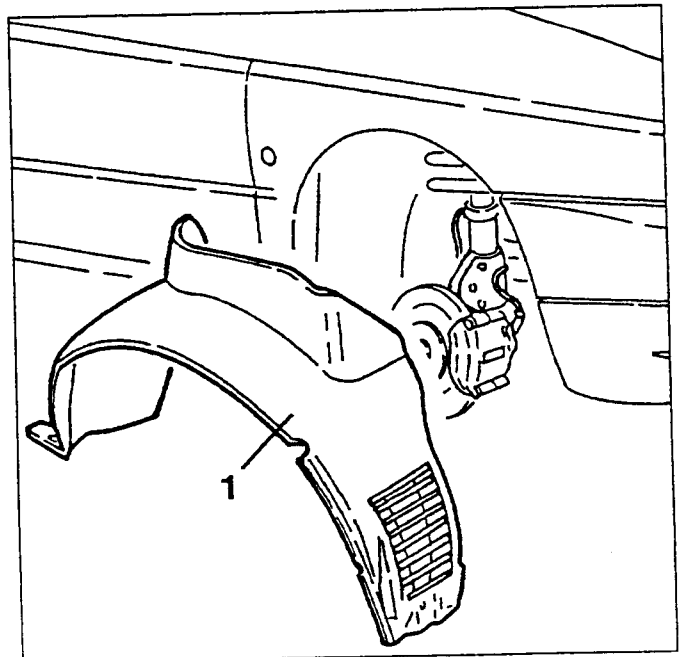
### REMOVAL\REFITTING

- Position the vehicle on a four-column bridge.

  1. Loosen the screws securing the door sill covering.
  2. Pull off the plastic buttons located in the positions shown in the diagram and remove the door sill covering.



1. Remove the front gravel guard.

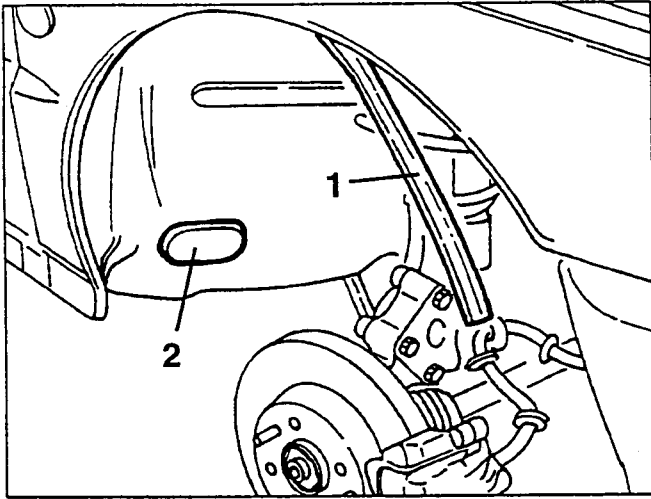


## FRONT GRAVEL GUARD

### REMOVAL/REFITTING

1. Using tool No. 1.823.025.000 release the clips of the centre part of the plastic nails fastening the side bumpers to the gravel guard.
2. Remove the above-mentioned nails using the special tool.

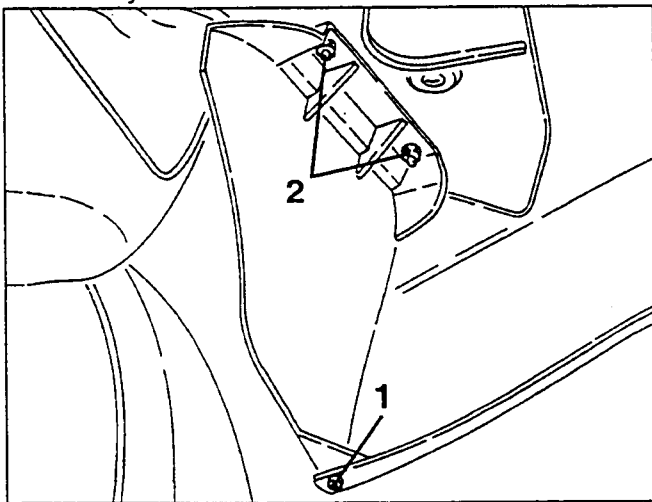
1. Remove the seal from the front wheel housing.
2. Check for presence and damage of the cap on the wing.



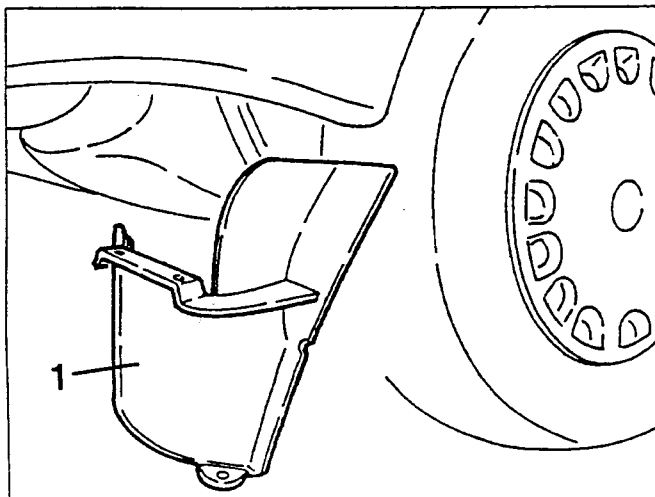
## REAR RIGHT-HAND GRAVEL GUARD

### REMOVAL/REFITTING

1. Loosen the screw securing the rear gravel guard to the bumper.
2. Loosen the two nuts securing the rear gravel guard to the body.



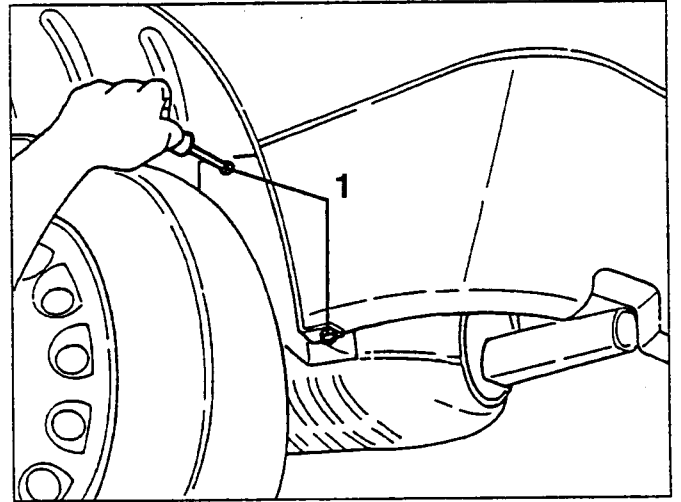
1. Remove the rear right-hand gravel guard.



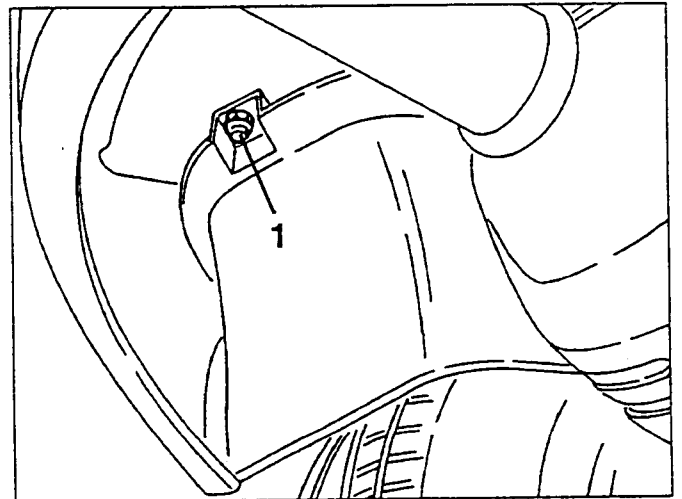
## REAR LEFT-HAND GRAVEL GUARD

### REMOVAL/REFITTING

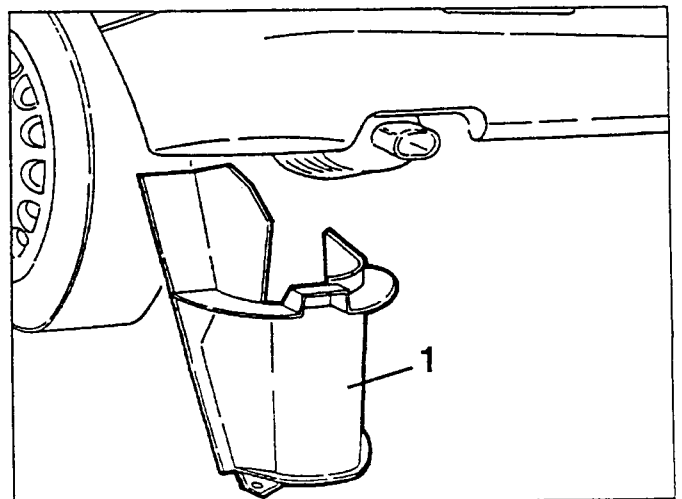
1. Loosen the two screws securing the rear gravel guard as shown in the diagram.



1. Loosen the nut securing the rear gravel guard to the body.



1. Remove the rear left-hand gravel guard.

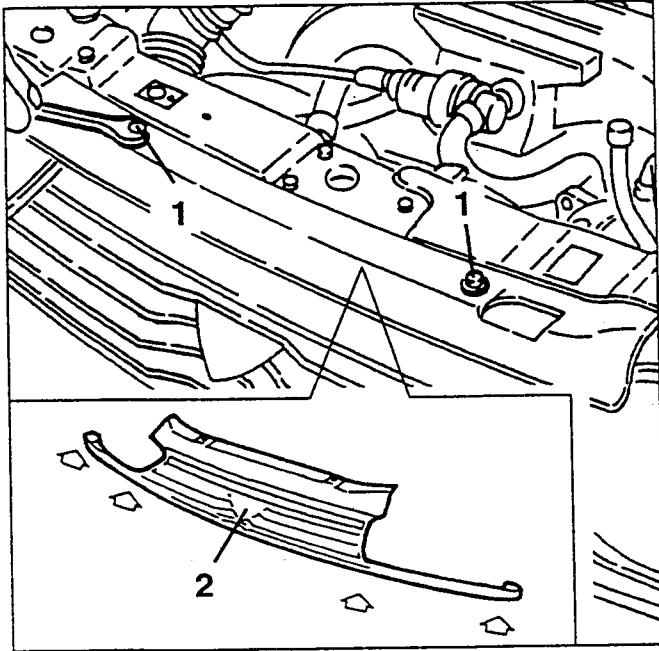




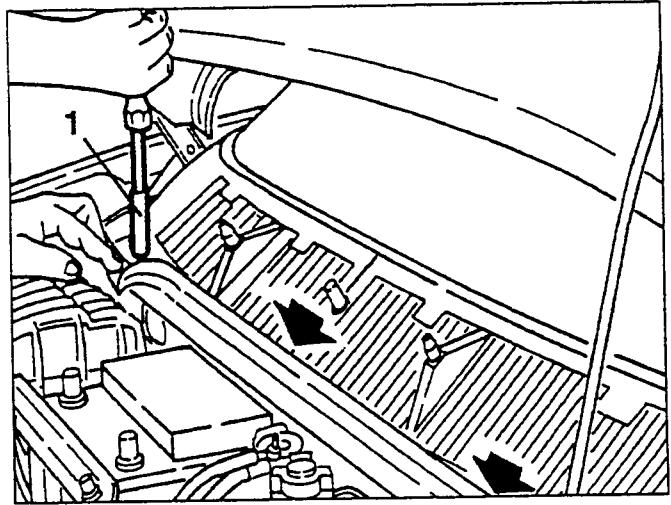
## RADIATOR GRILLE

### REMOVAL/REFITTING

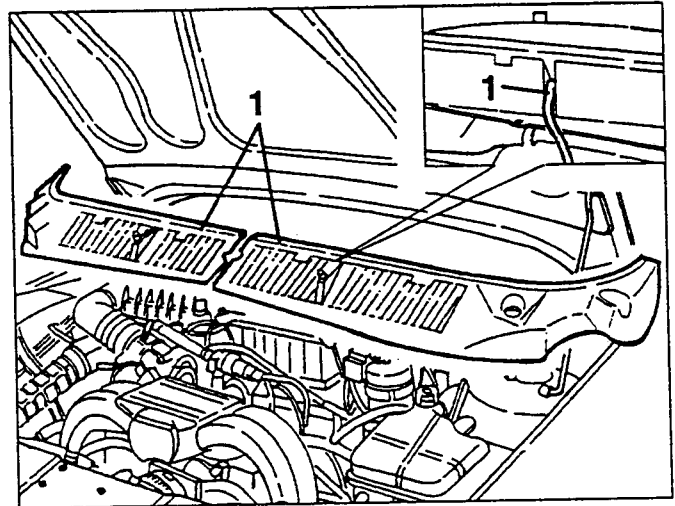
1. Working with the bonnet raised, loosen the two screws securing the radiator grille.
2. Pull the radiator grille away from the clips positioned as shown in the diagram and remove the grille.



grille.



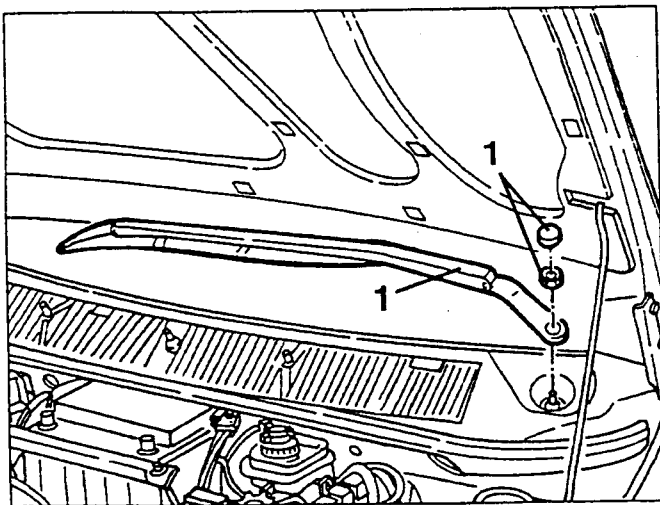
1. Pull off the two parts of the air intake grille and remove them after disconnecting the spray hoses.



## AIR INTAKE GRILLE

### REMOVAL/REFITTING

1. Working with the bonnet open, pull off the protective caps and loosen the nuts securing the windscreen wiper arms and then remove the windscreen wiper arms.

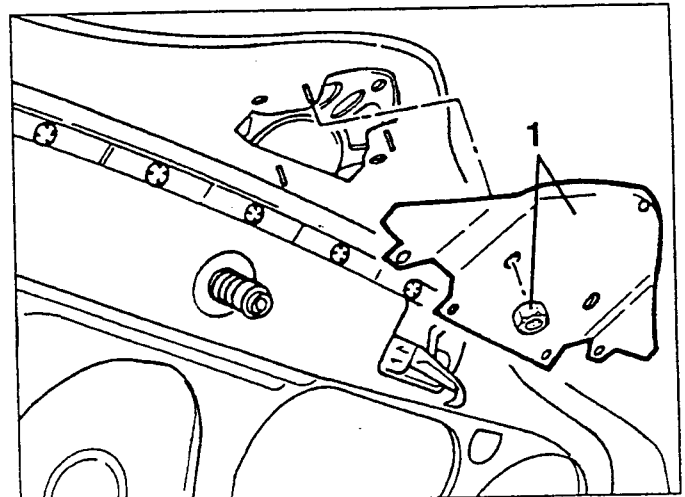


1. Loosen the three screws securing the air intake

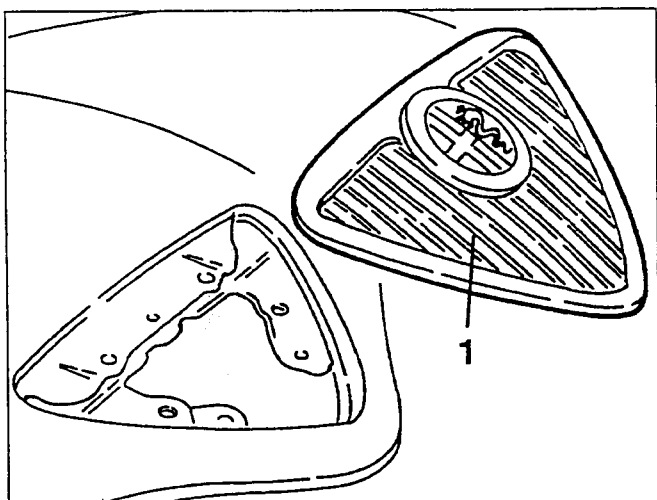
## BONNET GRILLE

### REMOVAL/REFITTING

1. Working with the bonnet in the upright position loosen the three nuts securing the grille and pull off the internal plastic covering.



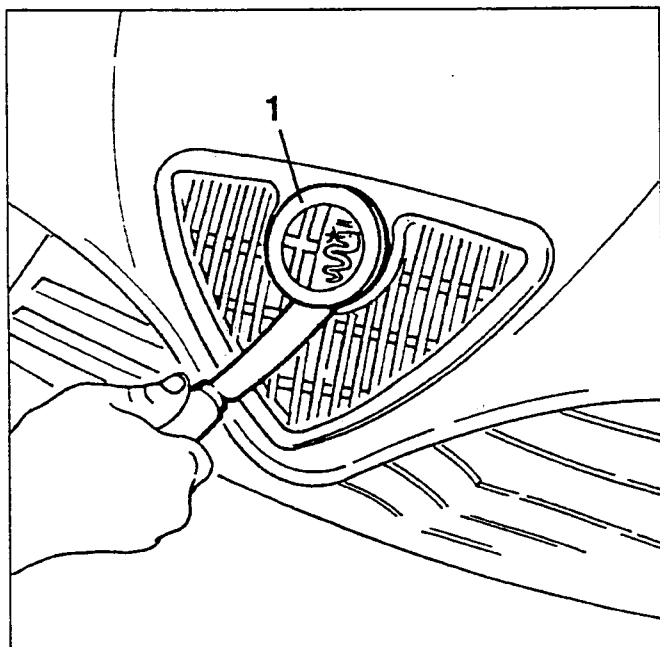
1. Remove the bonnet grille by pulling it away from the two glips.



## BONNET GRILLE LOGO

### REMOVAL/REFITTING

1. Pull off and remove the logo from the grille on the bonnet.

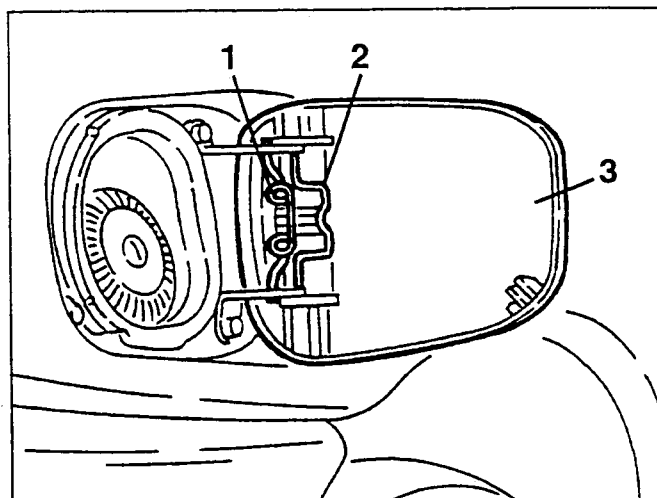


## FUEL CAP COVER

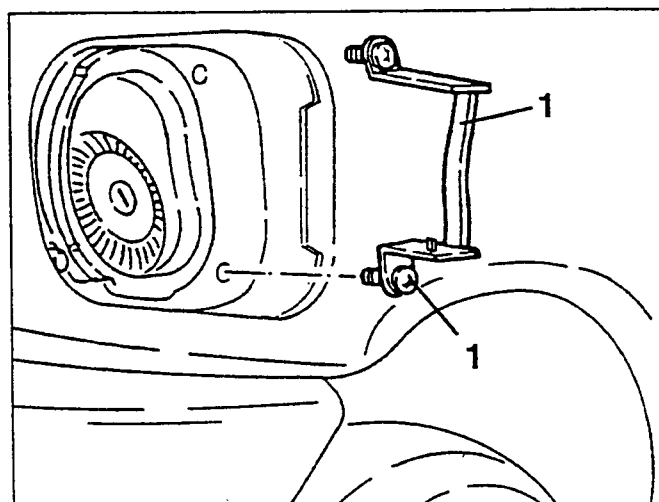
### REMOVAL/REFITTING

1. Open the flap and free the return spring.  
2. Unhook and remove the flap attachment device.

3. Remove the fuel flap.

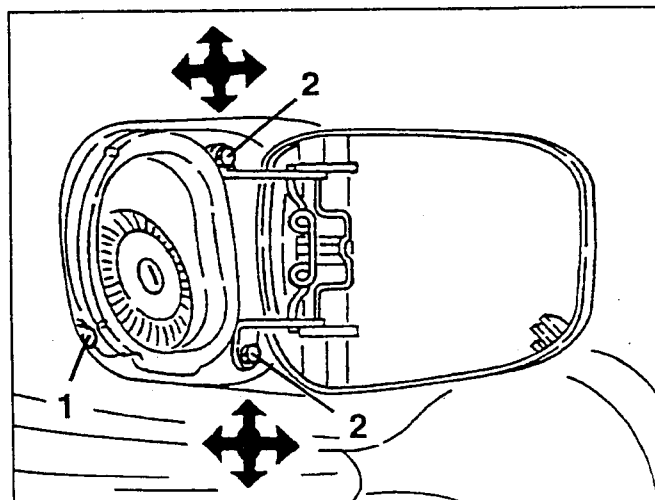


1. Working through the wheel housing loosen the two nuts and remove the fuel flap support bracket.



Refit by reversing the procedure followed for removal and note the following:

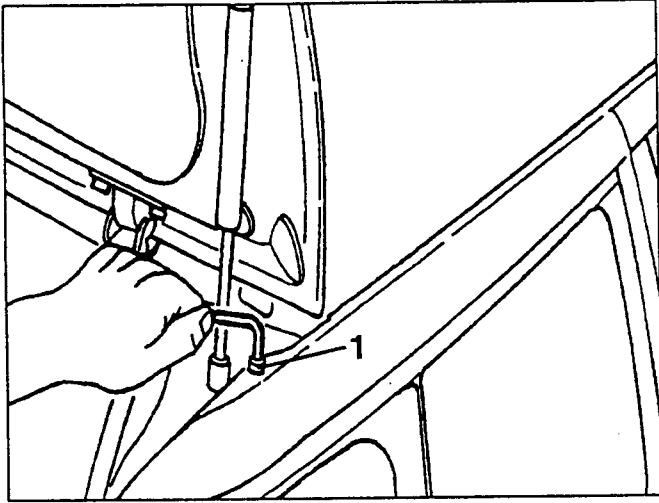
1. Ensure that the flap is fitted with its gasket.  
2. Adjust the position of the flap by turning the nuts securing the support bracket.



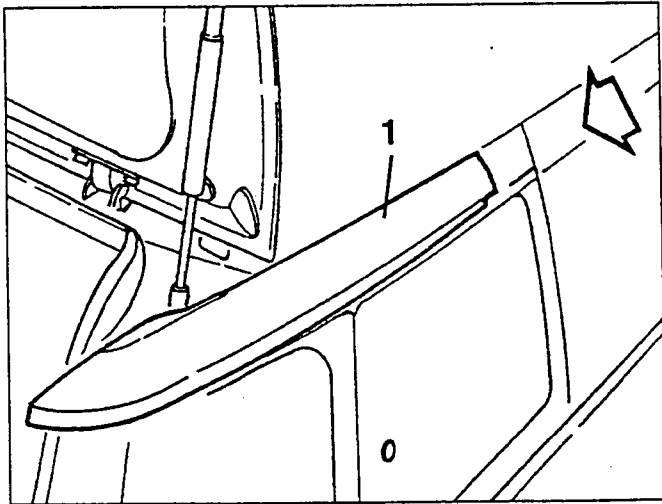
## UPPER WINDOW TRIM

### REMOVAL/REFITTING

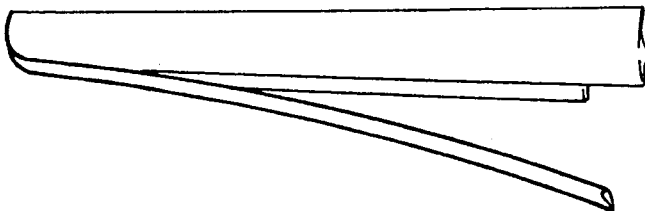
1. Working with the boot lid open loosen the screw securing the upper window trim.



1. Remove the upper window trim by pushing the rear part of the vehicle.



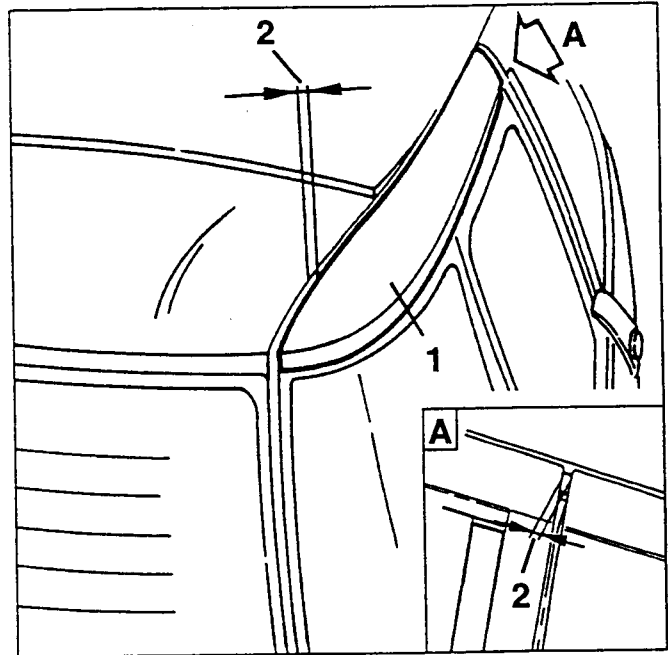
- Working on a bench remove the seal from the upper window trim.



**Refit by reversing the procedure followed for removal and note the following.**

1. Refit the upper window trim by pressing it onto the clips.

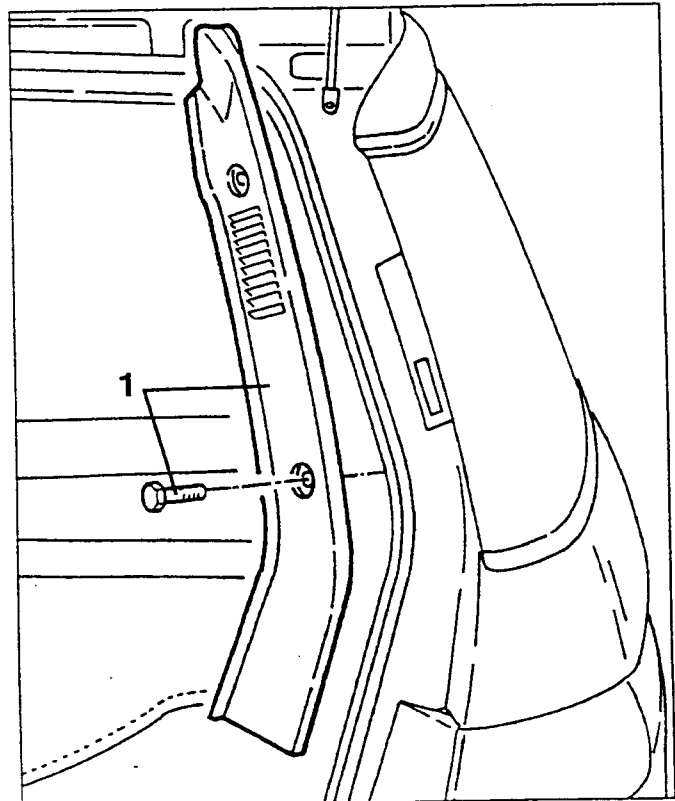
2. Adjust the trim longitudinally using the screw and check the gaps with the boot and door.



## AIR OUTLET GRILLE FROM PASSENGER COMPARTMENT

### REMOVAL/REFITTING

1. Working with the boot lid raised loosen the two screws and remove the passenger compartment air outlet grille.

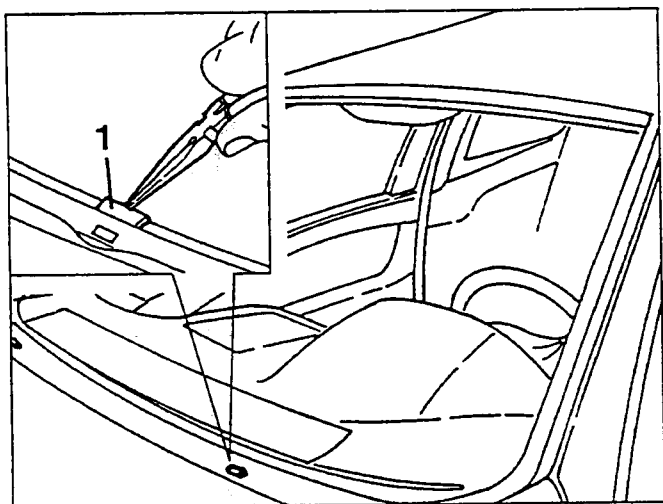


## WINDSCREEN

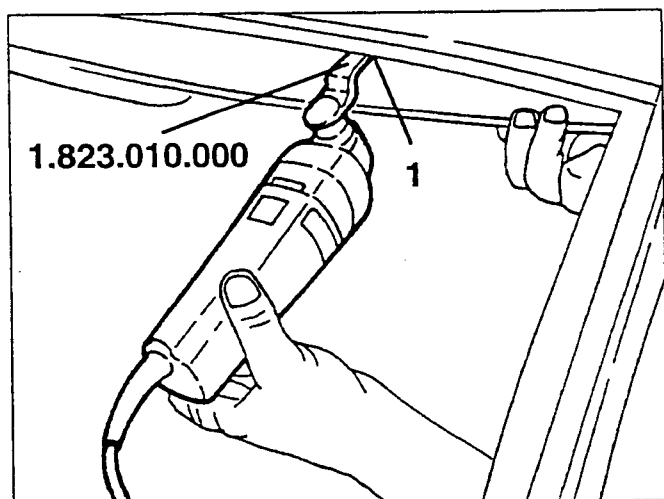
### REMOVAL

- Remove the air intake grille (see specific paragraph).
- Remove the trim from the front pillars (see specific procedure).
- Remove the front roof light (see GROUP 55).
- Remove the sun visors (see specific procedure).
- Remove the passenger compartment rear-view mirror (see specific procedure).
- Loosen the two screws securing the front of the roof panel and lower this in order to avoid hindering the successive operations.

1. Remove the two lower windscreen shims.



1. Working in the passenger compartment, using a pair of electric shears with blade N° 1.823.010.000, cut the sealant on the upper and side edges.

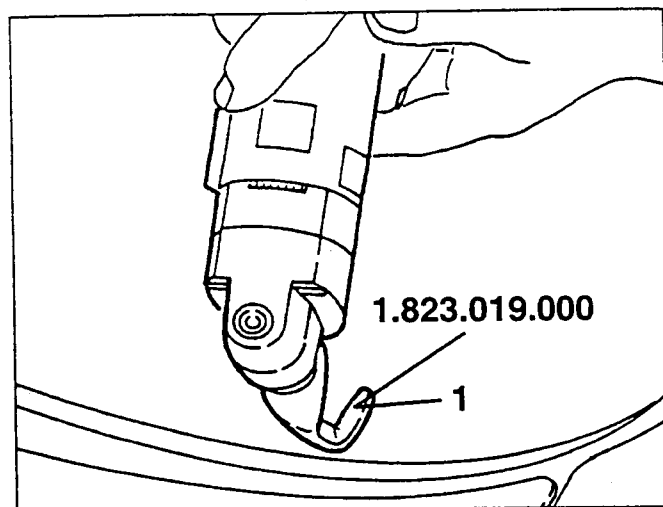


#### NOTE:

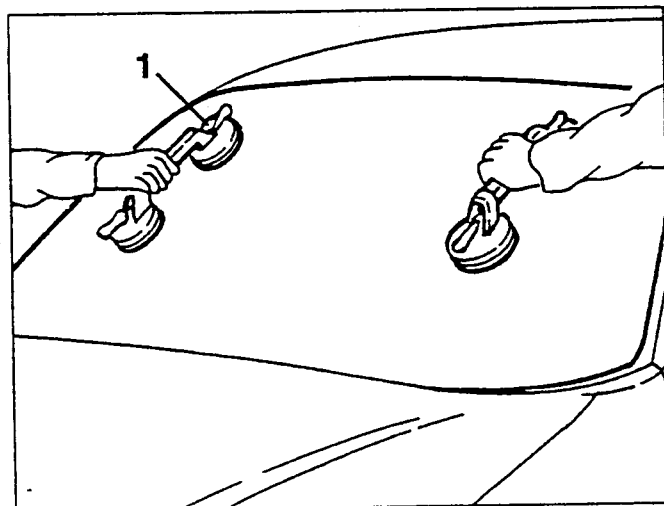
Adjust the cutting depth of the blade to avoid damaging the bodywork.

1. Working from outside the vehicle, using a pair of electric shears with blade N° 1.823.019.000, cut the

sealant on the lower edge.

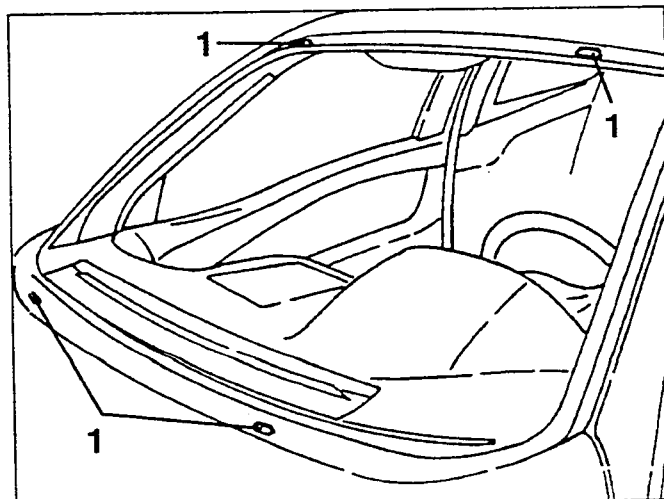


1. Using the appropriate sucker remove the windscreen and remove the upper windscreen shims.

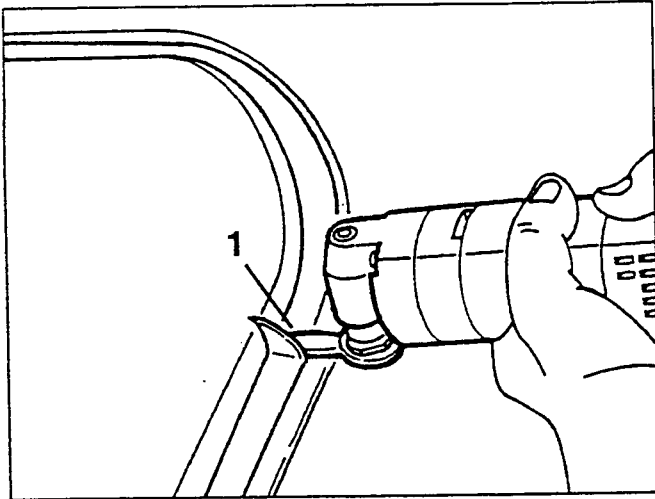


### REFITTING

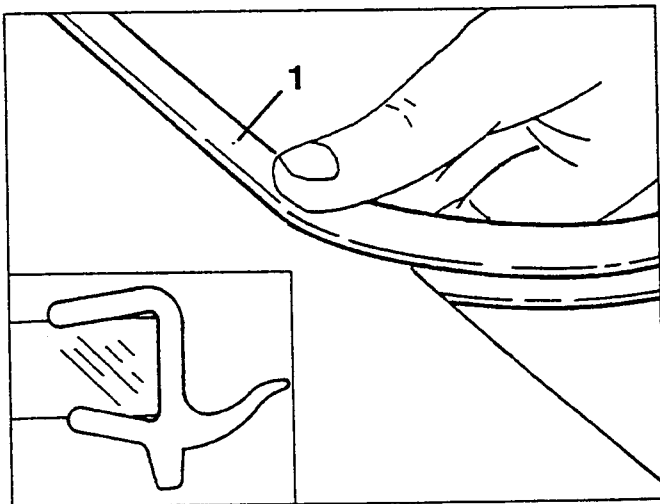
- Clean residues of sealant from the edge of the windscreen mating surfaces.
  - Restore any damaged paintwork caused when cutting the sealant with the shears.
1. Position the supports/spacers on the windscreen.



1. If the removed windscreen is to be re-used, remove the profile and the residual sealant from the edge of the windscreen.

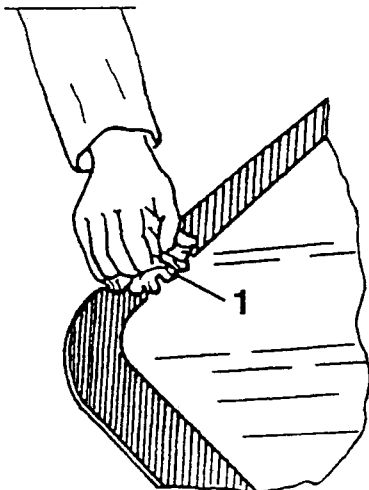


1. Fit the new profile on the windscreen.



Proceed with the glueing cycle using the special KIT supplied by Spares checking the date of expiry.

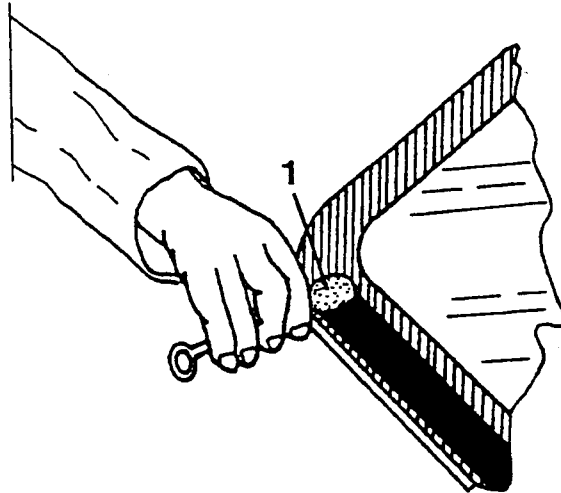
1. Carefully clean the edge of the windscreen with the special cloth moistened with degreasing agent.



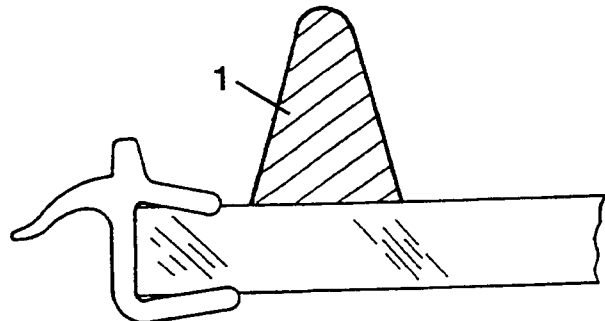
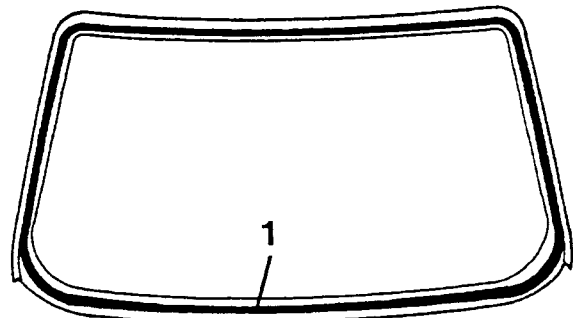
1. Apply the primer evenly and without interruption on the black printing using the applicator as shown in the diagram.

**NOTE:**

After applying the primer allow to dry for at least 10 minutes ensuring that the surfaces are kept clean.



1. Apply sealant along the line shown in the diagram using the nozzle (from which the guide must be removed) contained in the kit.



**NOTE:**

Using the short or long sealant cartridge (or both if necessary) depending on the edge of the windscreen in question.

- Using the appropriate suction cups install the windscreen positioning it on the lower spacers and centering it in its frame.
- Exert a light, uniform pressure around the edges of the windscreen.



- Before installing the windscreen ensure that when its is cleaned that there are no signs of chipping around the edges.
- Ensure that the windscreen housing frame is not bent.



Complete with refitting operations by reversing the procedure followed for removal ensuring that the rear-view mirror is not installed when the sealant is still fresh.

**NOTE:**

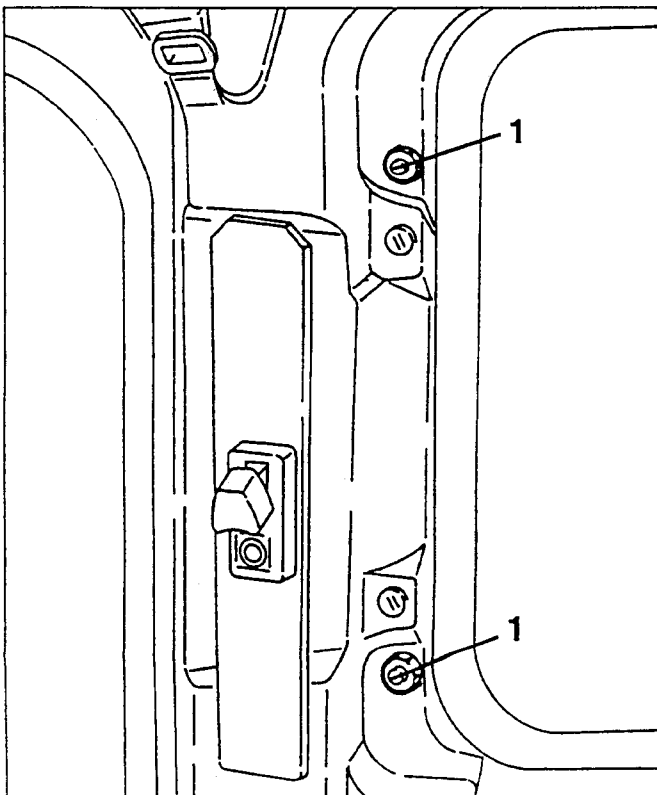
Do not use the vehicle until the sealant is completely dry.

## QUARTERLIGHT WINDOW

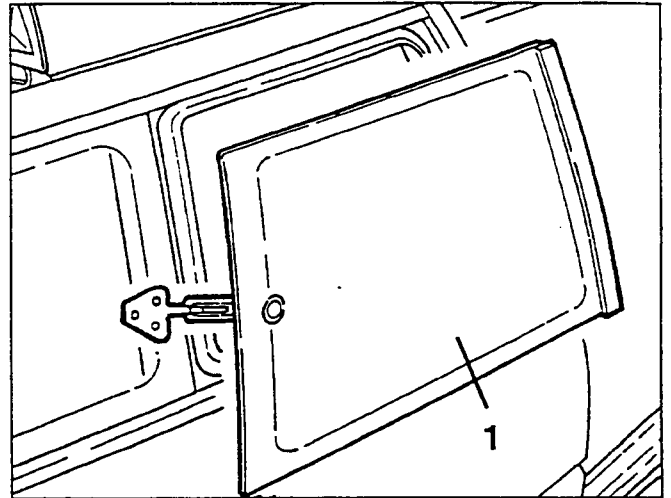
### REMOVAL/REFITTING

- Remove the window surround (see specific paragraph).

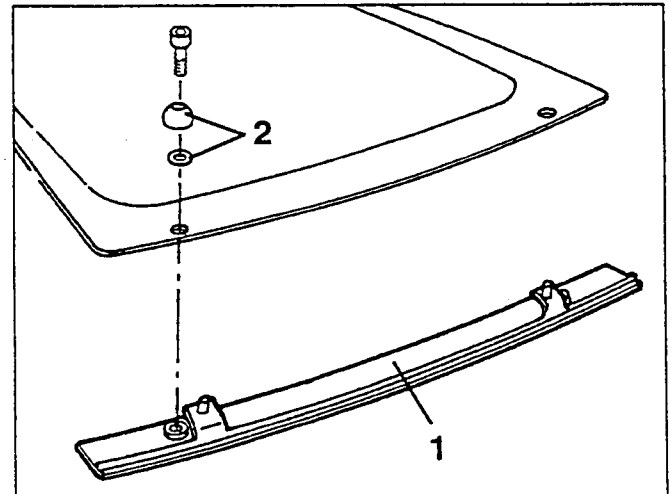
1. Loosen the two nuts securing the glass.



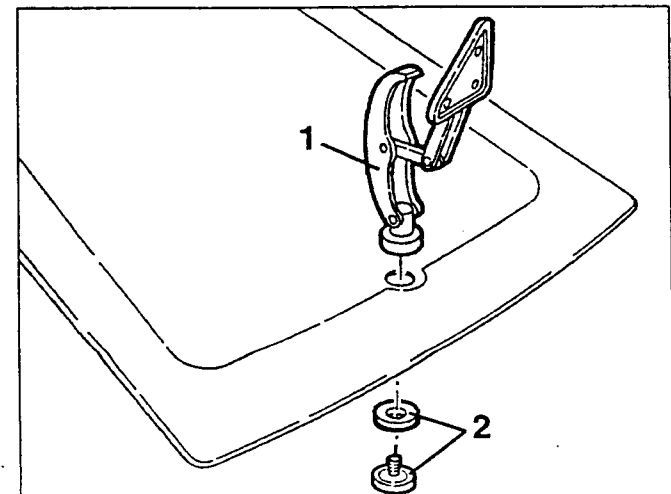
1. Remove the complete window.



1. Working on a bench loosen the two retaining screws and remove the glass from the front part of the frame.
2. Remove the spacers and seal strips.



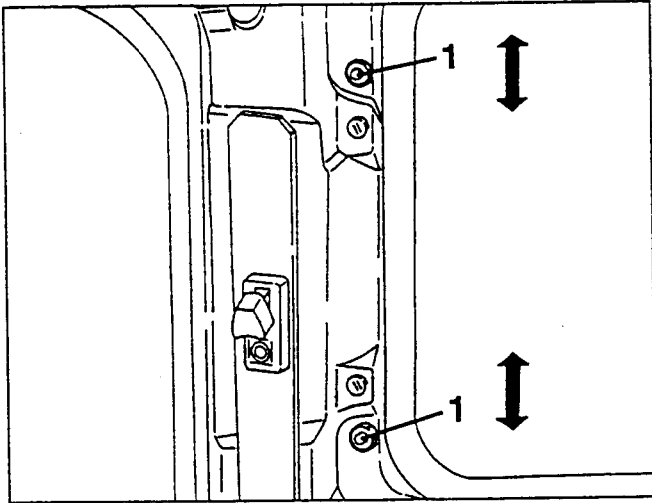
1. Loosen and remove the opening device from the window.
2. Remove the pin and the seal.



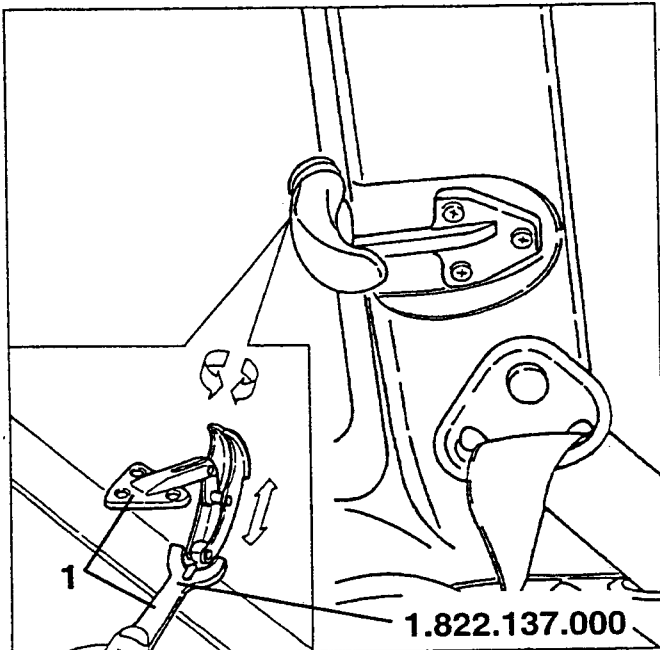


Refit by reversing the procedure followed for removal and adjust the position of the quarterlight as described below.

1. Adjust the height of the quarterlight by altering the two front attachment nuts.



1. Adjust the closing device by loosening the ring nut with tool N° 1.822.137.000 and turning the handle of the opening device.



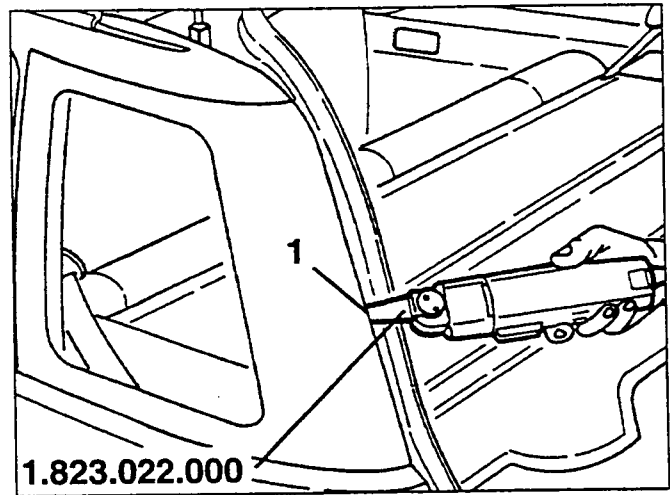
## REAR FIXED WINDOW

### REMOVAL

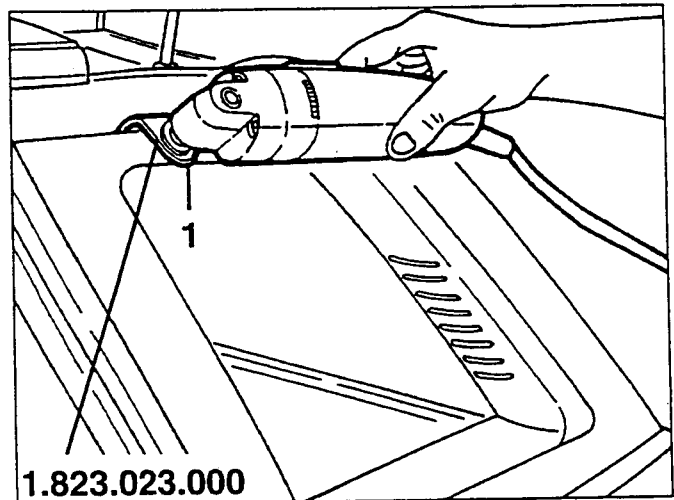
- Remove the upper window strip (see specific paragraph).
- Remove the quarterlight (see specific paragraph).
- Remove the lower window strip (see specific procedure).

- Remove the passenger compartment air outlet grille (see specific paragraph).

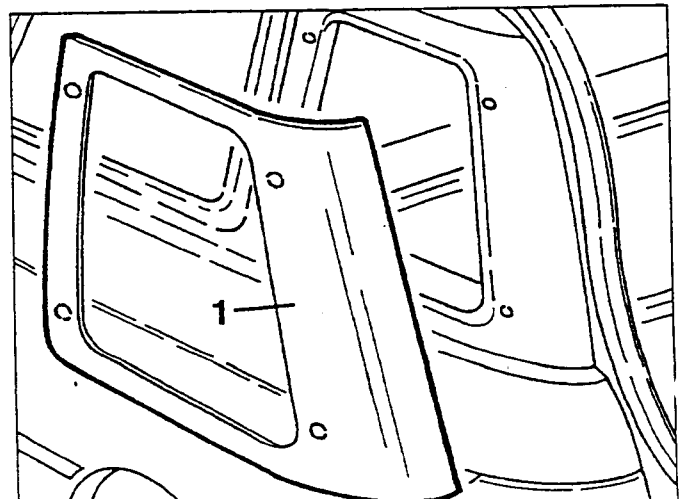
1. Using a pair of electric shears with blade N° 1.823.023.000, cut the sealant on the rear edge.



1. Using a pair of electric shears with blade N° 1.823.023.000, cut the remaining stretches of sealant.



1. Remove the window pulling it away from the plastic positioning nails.

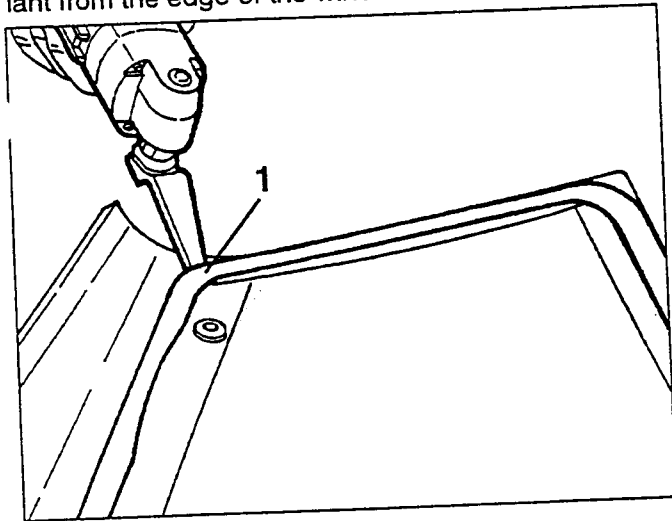


**NOTE:**

It is therefore possible to re-use the windscreen even if one or more supports of the centering pins are broken or cut.

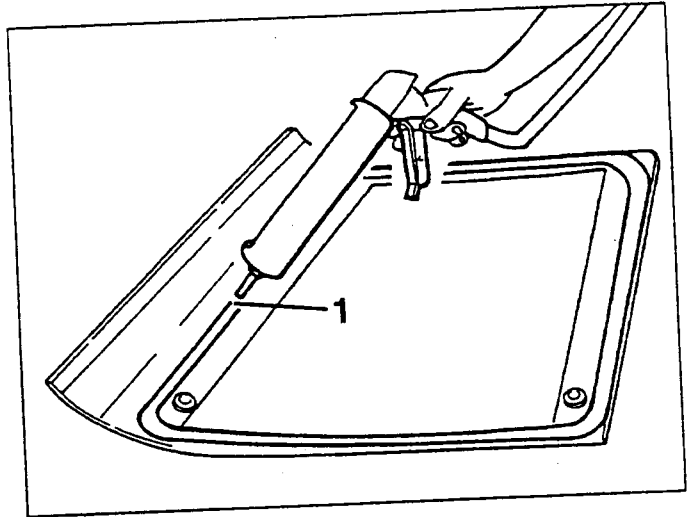
**REFITTING**

- Clean residues of sealant from the edge of the windscreen mating surfaces then clean with a dry cloth and blow-off with compressed air.
  - Restore any damaged paintwork caused when cutting the sealant with the shears.
1. If re-using the old windscreen remove the three lateral and upper strips and remove the residual sealant from the edge of the windscreen.



**NOTE:**

Use the short or long sealant cartridge depending on the edge of the window in question.



- Install the lower rear window seal strip.
- Install the rear fixed window centering the plastic nails and then pressing so that they are fixed in position.

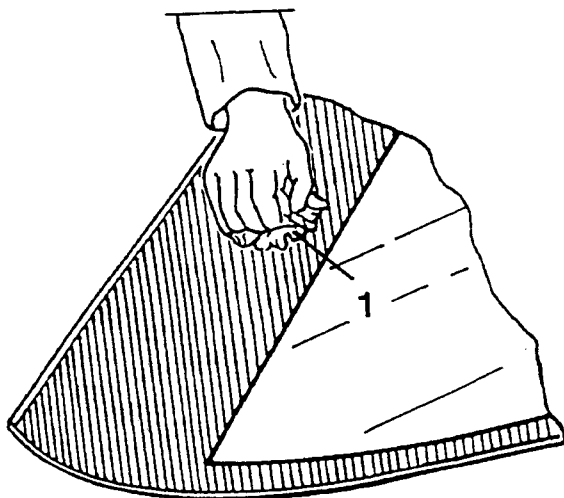


- Before installing the window ensure that when its is cleaned that there are no signs of chipping around the edges.
- Ensure that the window housing frame is not bent.



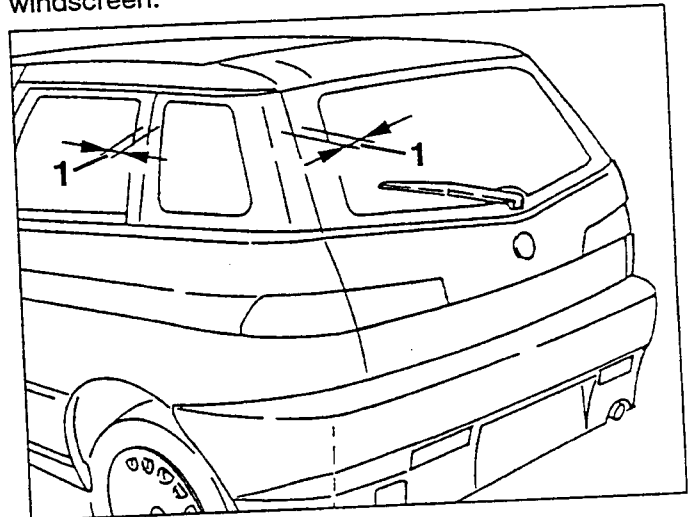
Proceed with the glueing cycle using the special KIT supplied by Spares checking the date of expiry.

1. Carefully clean the edge of the windscreen with the special cloth moistened with degreasing agent.



1. Apply sealant along the seal strip on the window using the nozzle from which the guide has been removed.

1. Check alignment with the quarterlight and the rear windscreen.



- Complete the refitting operations by reversing the procedures followed for removal.

**NOTE:**

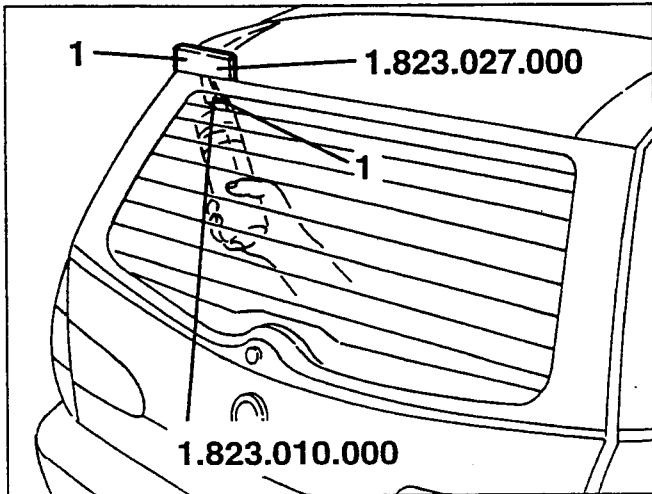
Do not use the vehicle until the sealant is completely dry.



**REAR WINDSCREEN****REMOVAL**

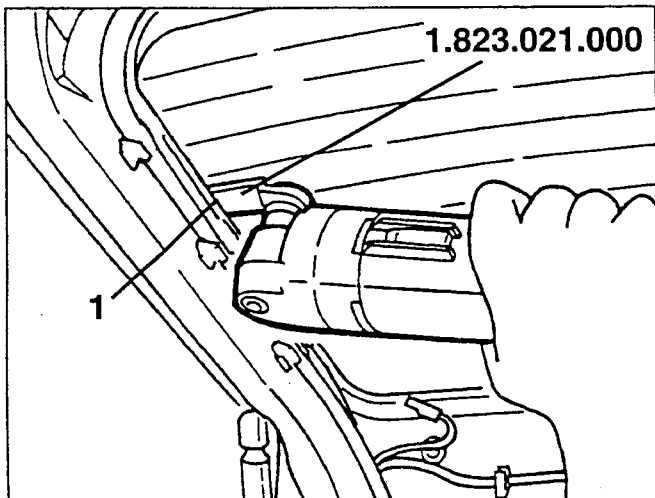
- Remove the internal finishing trim and the wiper arm from the rear windscreen (see specific paragraph).
- Disconnect the electrical connections from the heating element in the rear windscreen.

1. Using a pair of electric shears with blade N° 1.823.010.000 and tool N° 1.823.027.000, cut the sealant from the upper and lower edges.

**NOTE:**

Adjust the cutting depth of the shears to avoid damaging the bodywork.

1. Using a pair of electric shears with blade N° 1.823.021.000, cut the sealant on the side edges.

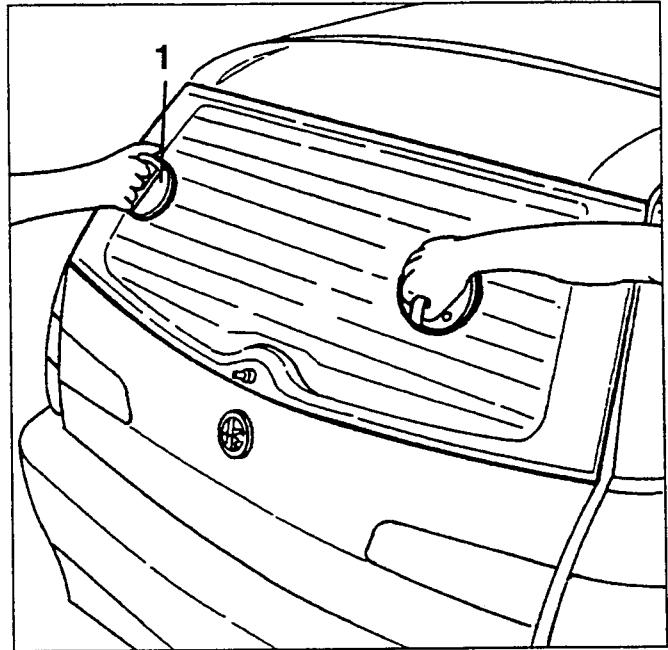
**NOTE:**

The correct use of the specified tools facilitates the removal of the heated rear windscreen without damaging the window seal strip.

1. Using the appropriate suction cups, remove the rear windscreen.

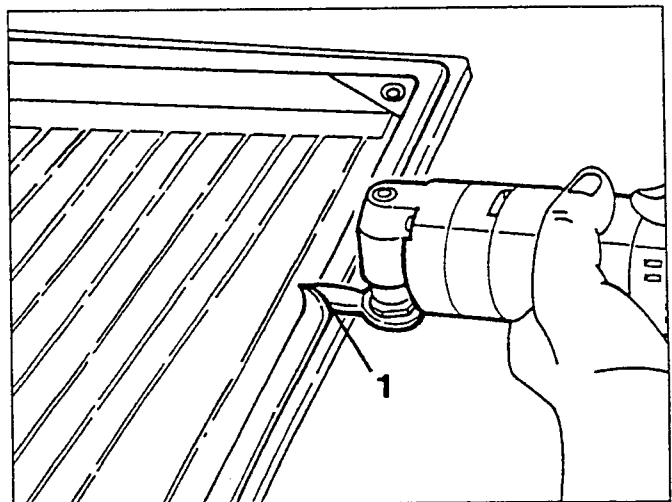
**NOTE:**

It is therefore possible to re-use the windscreen even if one or more supports of the centering pins are broken or cut.

**REFITTING**

- Clean the edges of the mating surfaces of residues of sealant using a clean cloth or compressed air.
- Restore any damaged to the paintwork caused by the sealant cutting operations.

1. When re-using the original rear windscreen remove the residual sealant from the edges.

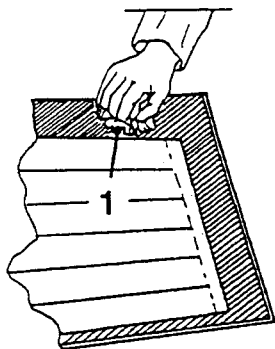


- When using a new windscreen install the four plastic centering pins.



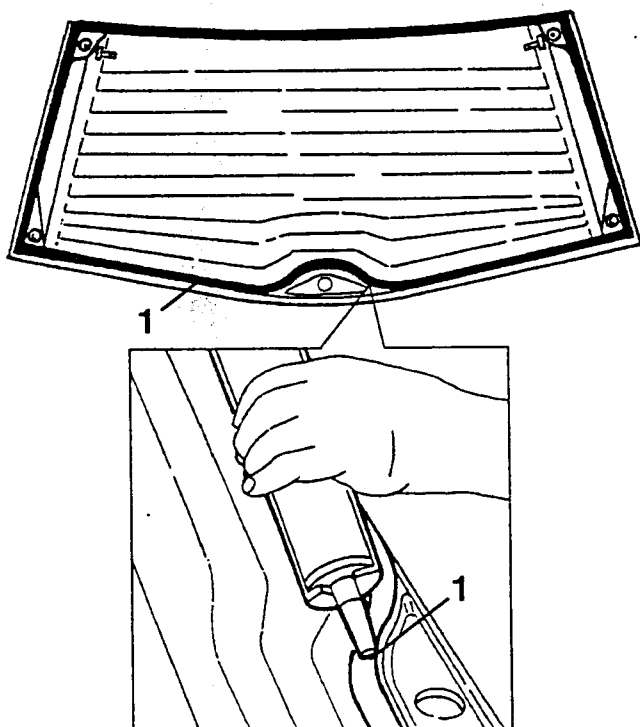
Proceed with the glueing cycle using the special KIT supplied by Spares checking the date of expiry.

RICAMBI ORIGINALI



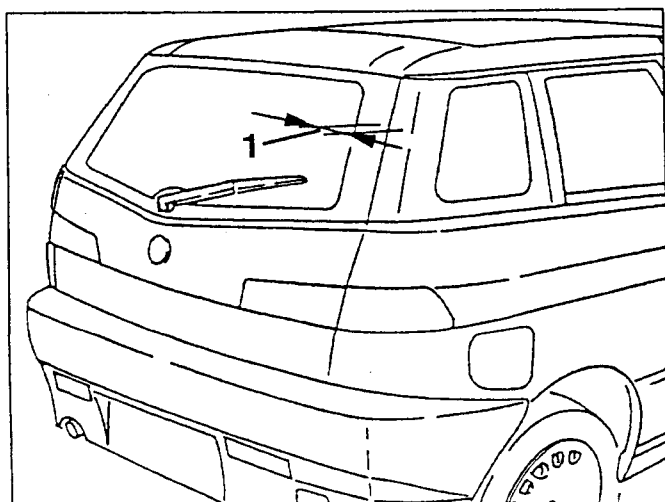
1. Carefully clean the edge of the windscreen with a special cloth moistened with degreasing agent.

1. Apply the sealant along the lines shown in the diagram using the nozzle (from which the guide has been removed) contained in the kit.



- Using the suction cups install the rear windscreen centering it in its housing frame.
- Exert a light, even pressure around the edges of the rear windscreen.

1. Check the gaps and alignment of the rear windscreen with the fixed windows.



- Complete the refitting operations by reversing the procedure followed for removal.

**NOTE:**

**Do not use the vehicle until the sealant is completely dry.**

## SUNROOF

### GENERAL DESCRIPTION

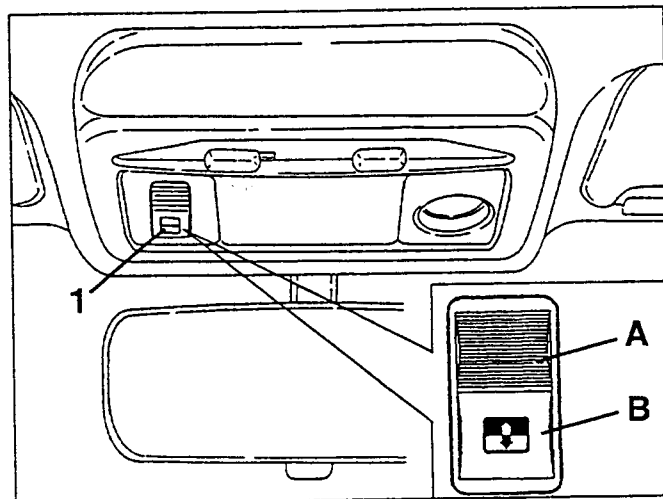
The sunroof is of the glass type with sunshade blind. The sunroof is operated by an electric motor.

The sliding mechanisms permit two different types of positioning:

- a "hidden" position which allows the roof to be opened partially or fully. The glass panel slides backwards into the space between the inner and outer roof panels.

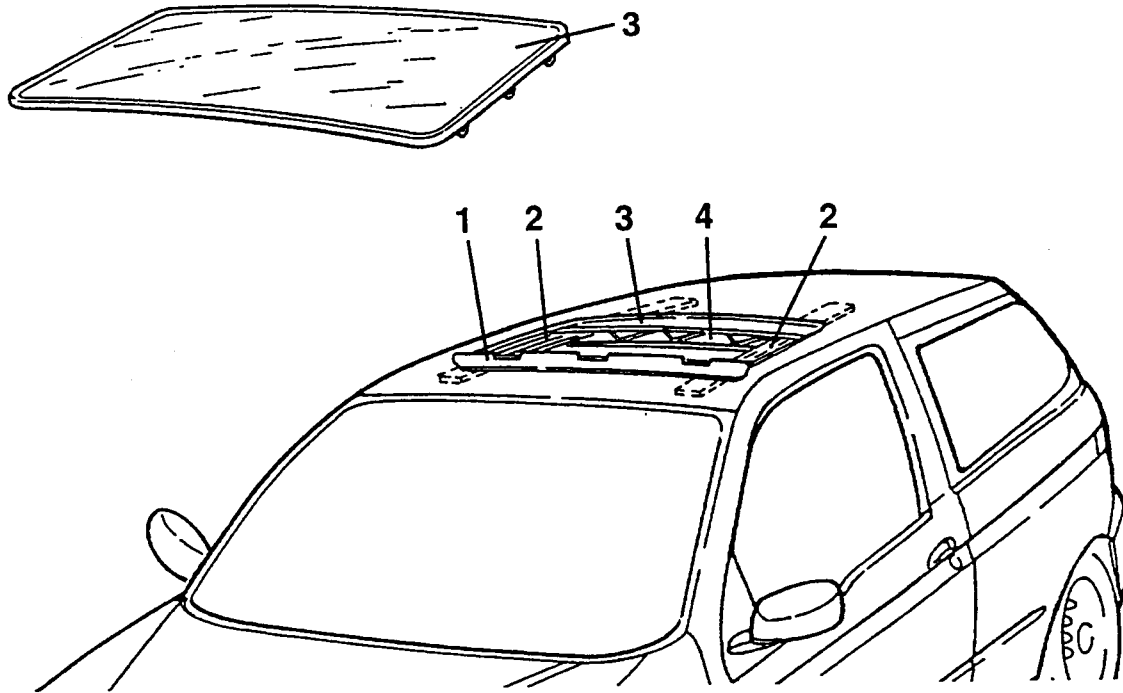
- the sunroof can also adopt a quarterlight position which makes it possible to raise the rear part of the roof so that a limited air flow enters the passenger compartment.

The blind is also housed in the space between the inner and outer roof panels when the sunroof is open. The sunroof is controlled using the button (1) located on the front roof light. The type of movement (closing/opening to the hidden or quarterlight positions) results from the shape of the control used to operated the sunroof cams on the runners and from the sliding of the runners on the rails.



| Initial position              | Operation | Resulting position            |
|-------------------------------|-----------|-------------------------------|
| Open to hidden position       | Press "B" | Closed                        |
| Closed                        | Press "B" | Open to quarterlight position |
| Open to quarterlight position | Press "A" | Closed                        |
| Closed                        | Press "A" | Open to hidden position       |

The sunroof is composed of an external glass panel (3) which slides on rails (2), by an internal blind (4), by an external spoiler (1) and by the device used to move the glass panel.

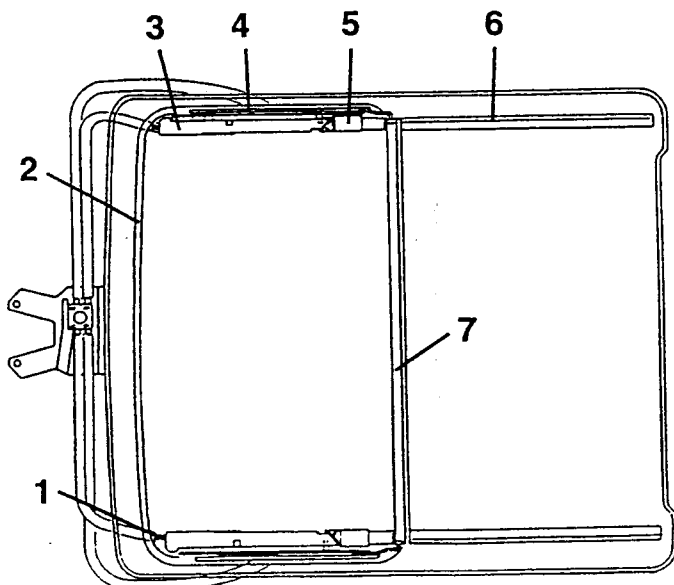


- 1. Spoiler
- 2. Rail
- 3. Glass panel
- 4. Blind

The frame holding the glass panel (2) is fixed to the positioning brackets (4) commanded by the movement of the runners (5) along the rails (3 e 6). The flexible racks (1), commanded by the electric motor form a single unit with the runners (5) and establish the movement. The coupling between the runners (5) and the brackets (4) permits both opening and closing actions through the sliding of the glass panel and the opening to the quarterlight position.

The bracket (4) is also connected to the mobile water run-off channel (7) which follows the movement of the roof when opening or closing.

The sunroof is fitted with an inner blind which can be moved manually to screen the occupants of the vehicle from direct sunlight.



- 1. Flexible rack
- 2. Frame for glass panel
- 3. Front rail
- 4. Sliding brackets
- 5. Runner
- 6. Rear rail
- 7. Water collection channel

## Structure of the sunroof

All the components of the sunroof are housed on a frame (13) secured to the body of the vehicle between the outer and inner roof panels.

The electric motor (1) is fixed frontally to this frame together with the controlling relay (4).

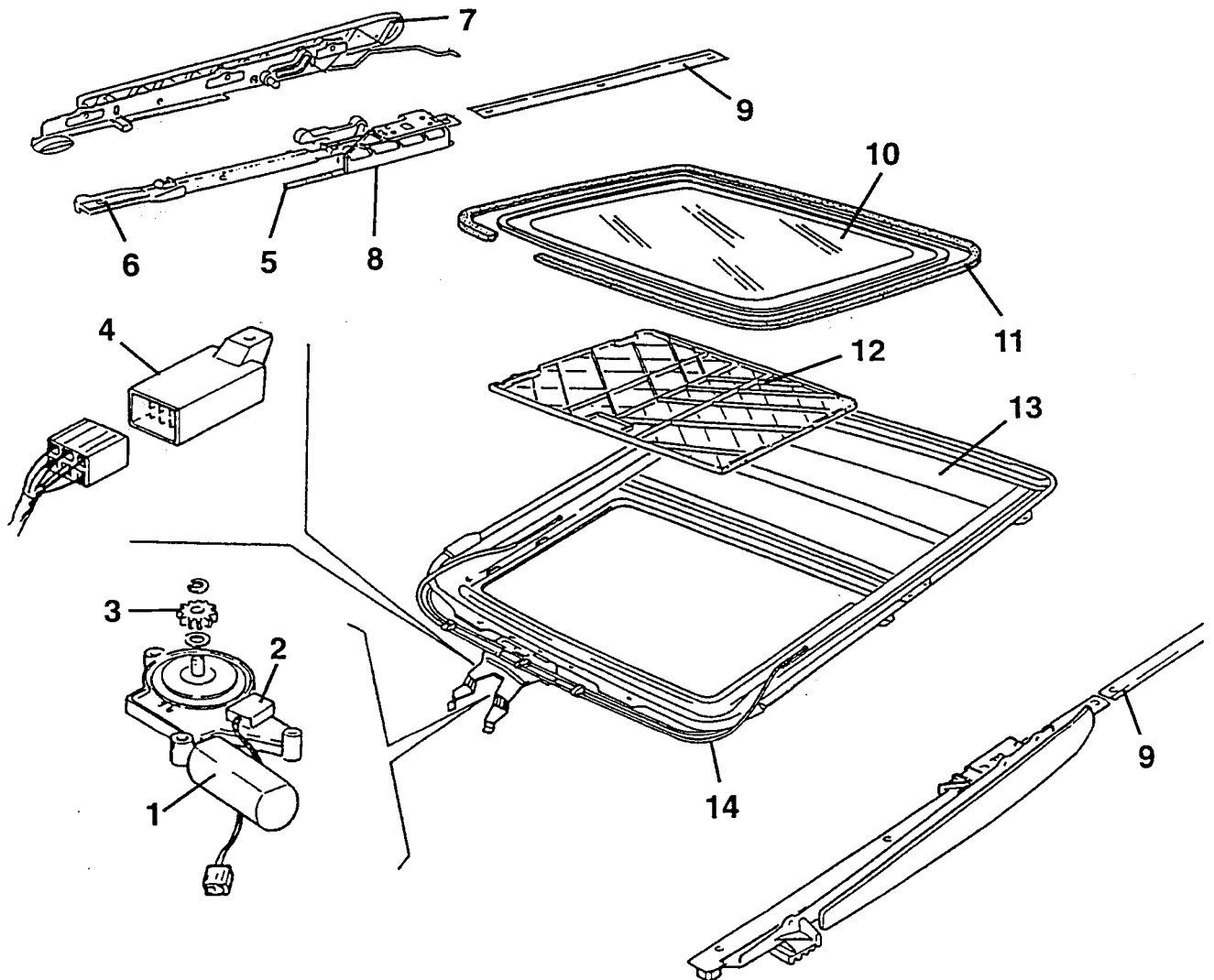
A microswitch (2) is fixed to the motor and this determines the position of the sunroof by the position of the runners through a cam on the spindle.

A toothed wheel (3) is positioned on the end of the spindle coming out of the electric motor and this engages with the flexible racks (5) controlling the sliding action along the inside of the guides (14).

The runner (8) which slides along the rails (6 and 9) is fixed to the frame at the end of each rack and this determines the various positions of the sunroof.

The coupling between the pins and cams and the longitudinal movement of the runners determines the type of movement of the brackets (7) to which the glass panel is fixed (10). The position of the runner determines the opening/closing sliding action and that of the opening to the quarterlight position.

The metal frame housing the glass panel is fixed to the brackets (7) with six screws. The holes which are occupied by these screws are slotted to allow the horizontal and vertical position of the roof to be adjusted.



1. Electric motor
2. Microswitch
3. Toothed wheel
4. Relay
5. Flexible rack
6. Front rail
7. Sliding bracket

8. Runner
9. Rear rail
10. Glass panel
11. Seal
12. Sliding blind
13. Sunroof frame
14. Guiding channel

## Opening/closing mechanism

The runner (16) slides along the guide rail (4) and is moved by the flexible rack (1).

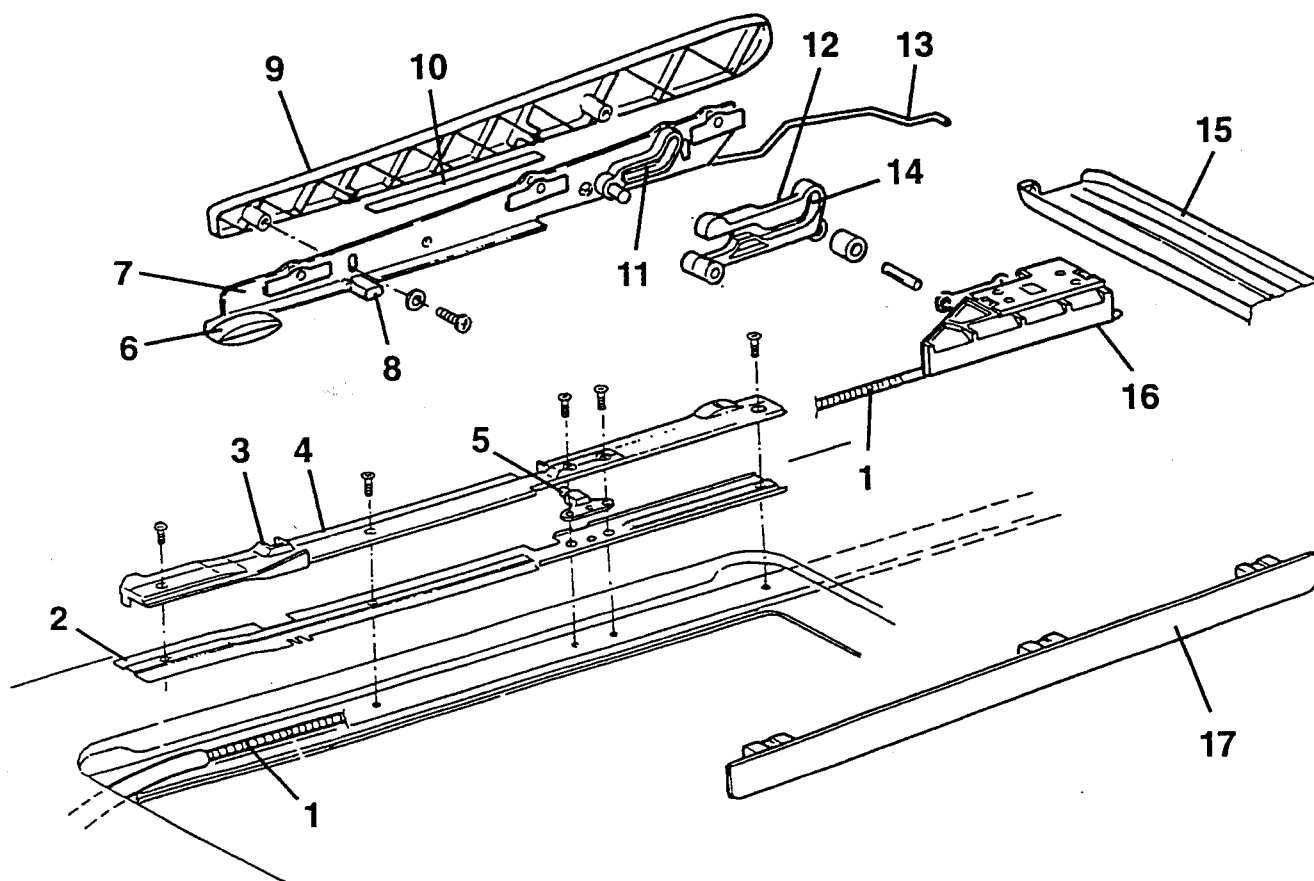
The pantograph device (12) is hinged to the runner and the coupling with the pins and relative cams ensures the sliding of the bracket (7) when opening or closing and the raising of the rear part to open it to the quarterlight position. The raising to the quarterlight position is caused by the pin (5), fixed to the guide, engaging in the cam groove (14) while the groove (11) makes it possible to lower the inner part of the frame when the horizontal opening movement begins.

The hook (13) is hinged to the bracket which moves the channel (15) so that it always shadows the movements of the glass panel.

The rail (6) guides the horizontal movements of the roof and, when it touches the opposite surface of the guide acts as a fulcrum to open to the quarterlight position.

The pin (8) engaging the slot (3) in the guide makes it possible to slightly back-off the roof during the opening to the quarterlight position so that it does not get in the way of the front edge of the sunroof housing frame.

The external finishing trim (9) is loosely fixed to the bracket (7) so that it remains in contact with the roof.



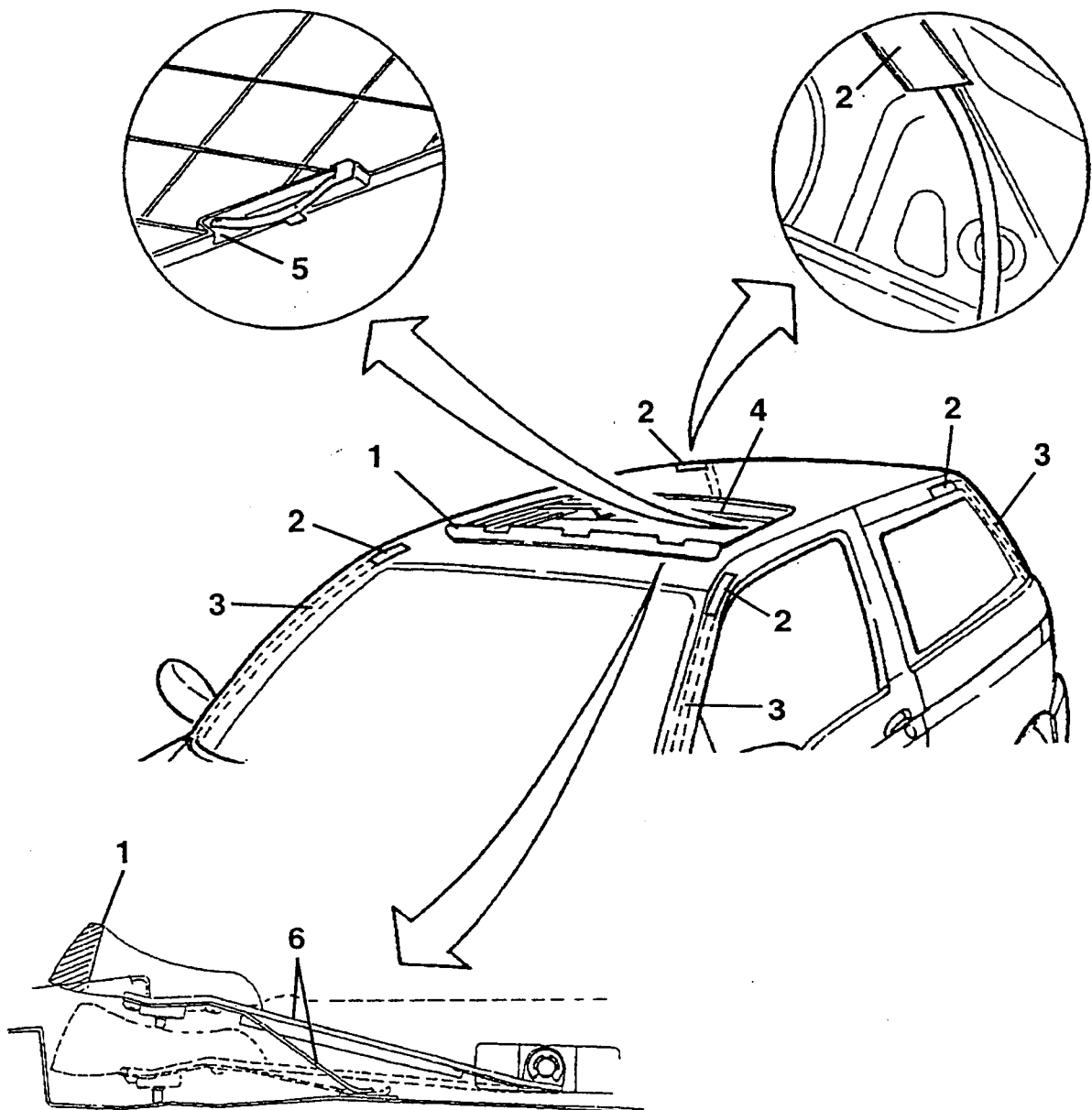
1. Flexible rack
2. Lower rail
3. Slot
4. Upper rail
5. Fixed pin
6. Runner
7. Sliding bracket
8. Pin
9. Outer moulding

10. Clip
11. Cam groove
12. Pantograph device
13. Channel two hook
14. Cam groove
15. Channel
16. Runner
17. Outer moulding

## Spoiler, Sliding blind, Draining

The opening of the panel to the hidden position allows the spoiler to lift up (1) thus deviating the flow of air. The spoiler is attached to the body by two brackets fitted with flexible arms (6). When the panel is closed or open in the quarterlight position it presses on the flexible arms holding the spoiler in the lowered position. When the roof panel is opened to the hidden position the roof panel frees the two flexible arms which thus raise the spoiler. Water which infiltrates between the seal of the glass is drained off by a channel in three fixed sides of the frame and on the mobile hoop. The channels are connected by a hose (3) and suitable connections (2) located in the four corners of the frame. The hoses drain the water off through outlets in the engine compartment and in the luggage compartment.

The inner sun blind (4) is connected to the frame by four spring attachments (5). These attachments also act as runners sliding in the guides on the frame. When the roof panel is closed the blind can be operated manually. When the sunroof is opened in the hidden position the blind is towed by the panel until, when the roof is fully open, it is completely hidden inside the space between the inner and outer roof panels. When the sunroof is closed the blind partially protrudes from the space between the two roof panels so that it can then be moved manually.



- 1. Spoiler
- 2. Connection
- 3. Hose

- 4. Blind
- 5. Blind attachment
- 6. Flexible arms

**OPERATION**

This paragraph describes the movements of the sunroof command mechanism in detail for opening/closing to both the hidden and quarterlight positions.

The flexible racks, moved by the electric motor, command the sliding of the runners **S** one on each side along the longitudinal rails **G**.

The pantograph element **E** is hinged to each runner and by the pin connected to the cam grooves, determines the movements of the bracket **M** to which the sunroof is fixed.

The front of the bracket is fitted with a runner **P** which runs in a groove.

**Opening the roof**

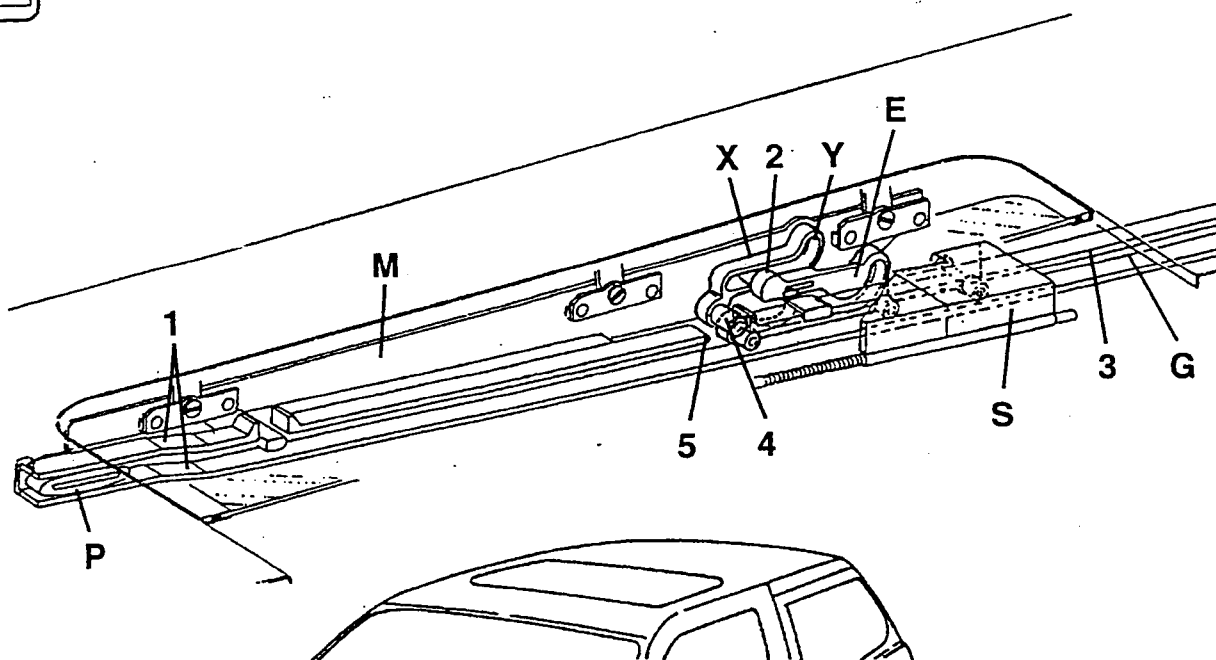
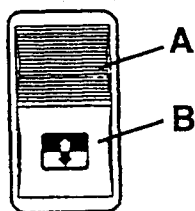
If, when the sunroof is closed, and side **A** of the control switch is pressed, the roof will begin to open.

From the closed position (position a) the runner **S** is pushed backwards by the flexible rack. The pin (2) of the pantograph **E** is moved from the "X" position to the "Y" position along the groove in the bracket **M** thus causing the rear part of the panel to be lowered so that it can slide into the compartment between the inner and outer roof panels.

At the same time pin (4) enters space (5) of guide **G** and is engaged under the groove (3).

After the glass panel has begun to back off the runner **P** follows the curve (1) of the guiding groove and cause the front part of the panel to be lowered (position b).

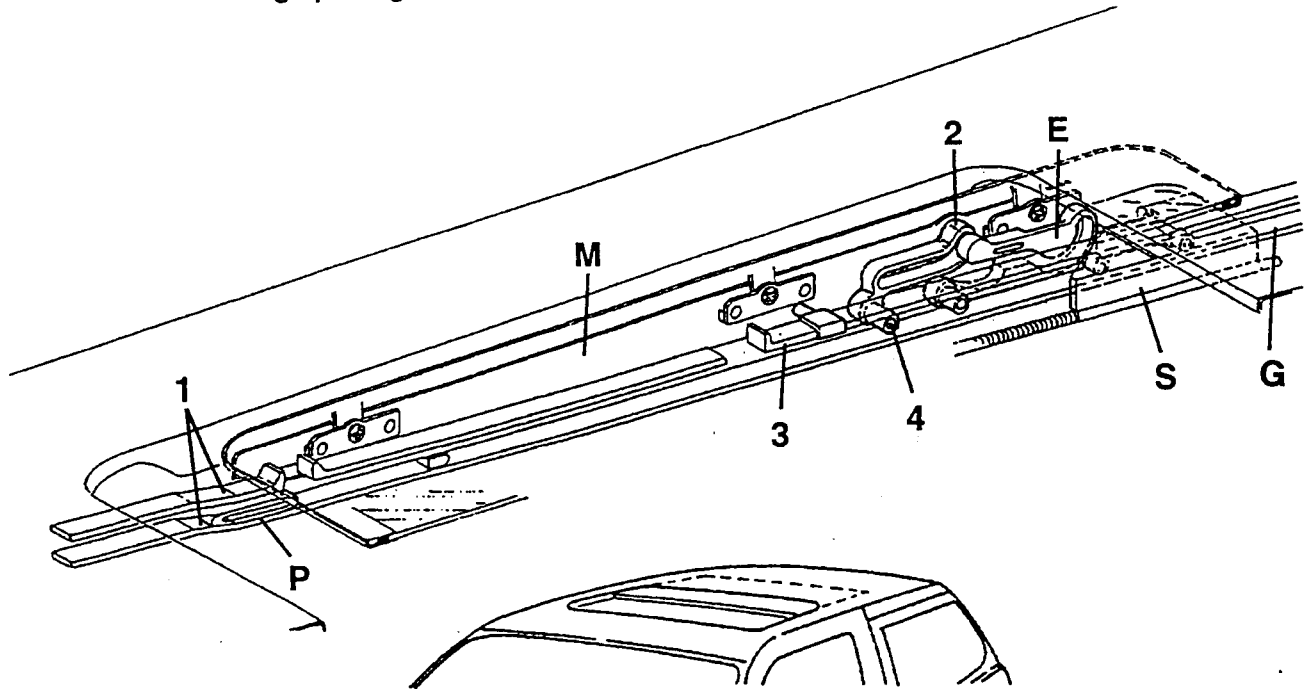
The opening action is continued in this configuration until the runner **S** reaches the stop limit (6) in the guide **G** and the motor is deactivated (position c).

**Position "a" - Roof closed**

P. Runner  
M. Sliding bracket  
E. Pantograph element  
G. Rail  
S. Runner

1. Bend in guiding groove  
2. Pantograph pin  
3. Guiding groove  
4. Pin  
5. Guide space

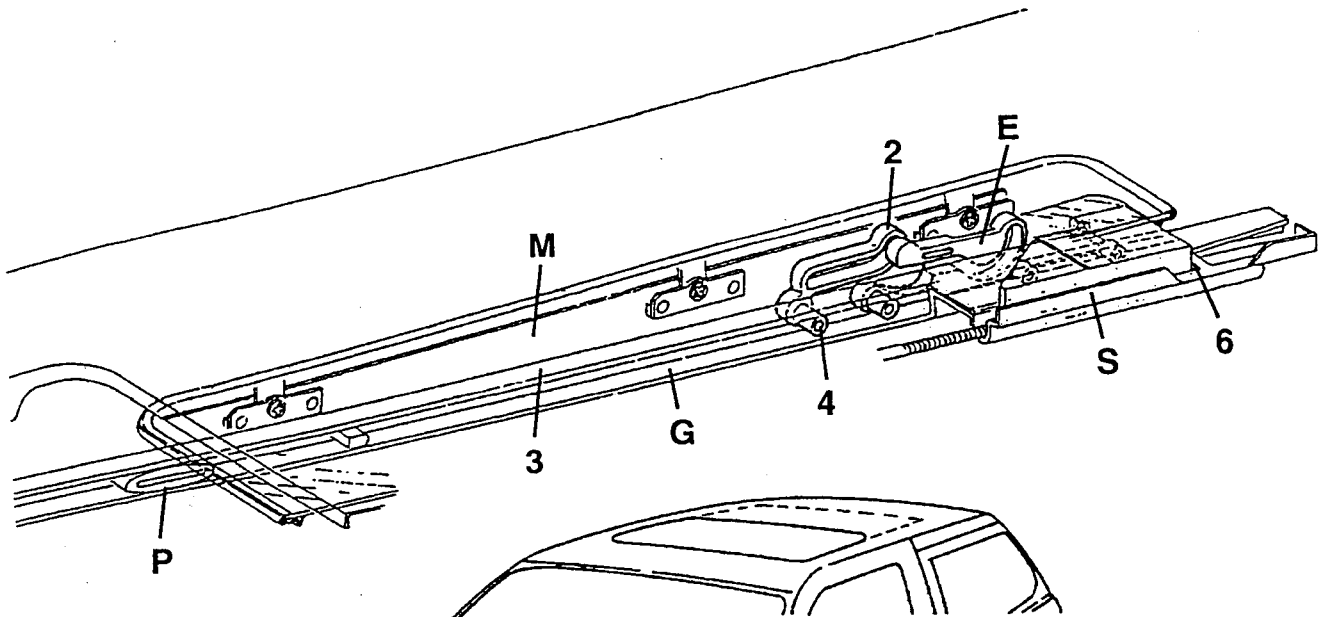
## Position "b" - Roof during opening



- P. Runner
- M. Sliding bracket
- E. Pantograph element
- G. Rail
- S. Runner

- 1. Bend in the guiding groove
- 2. Pantograph pin
- 3. Guiding groove
- 4. Pin

## Position "c" - Roof completely open



- P. Runner
- M. Sliding bracket
- E. Pantograph element
- G. Rail
- S. Runner

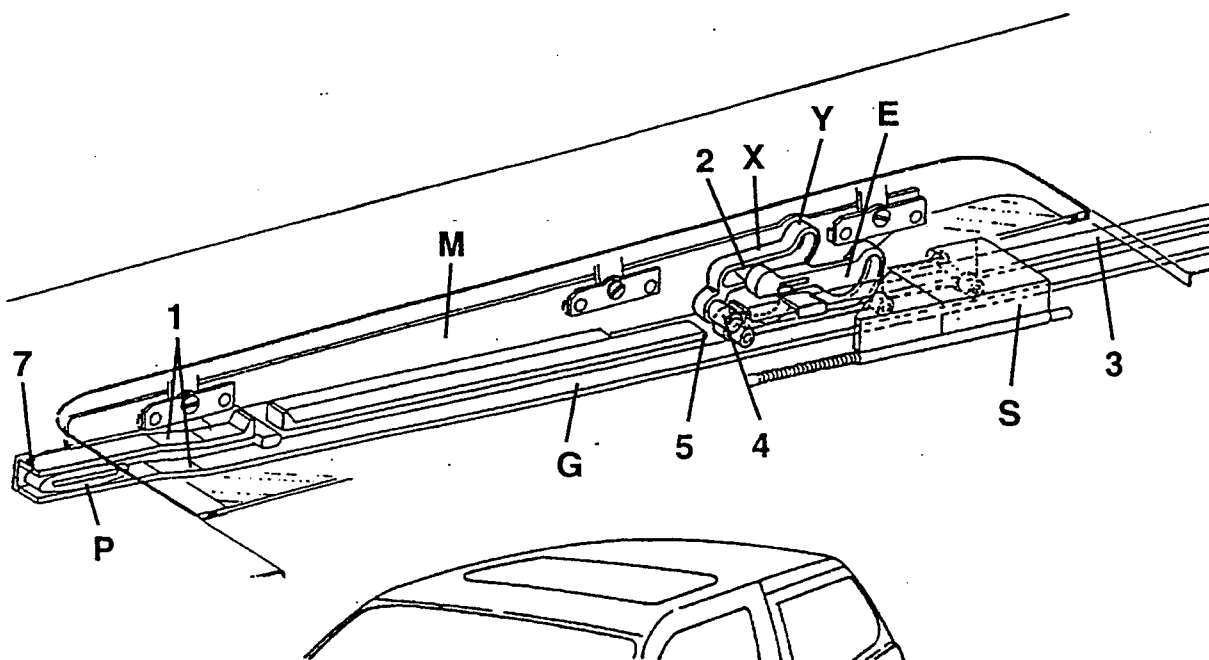
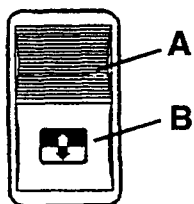
- 2. Pantograph pin
- 3. Guiding groove
- 4. Pin
- 6. Stop limit



## Closing the roof

The roof is closed by the forward motion of the runner **S** maintaining the position illustrated in positions c and b until the runner support **P** reaches the stop limit **(7)** in the guide **G**. At this point the front part of the bracket **M** is locked but the runner **S** continues its movement allowing the pin **(4)** to come out of the groove **(3)** through space **(5)**. Pin **(2)** is forced to move along the groove in the bracket **M** from position "Y" to position "X" thus raising the glass panel so that it is flush with the outer roof panel. At this point the microswitch disengages the electric motor as the closed position has now been reached (position d).

## Position "d" - Roof closed



- P. Runner
- M. Sliding bracket
- E. Pantograph element
- G. Rail
- S. Runner
- 1. Bend in guiding groove
- 2. Pantograph pin
- 3. Guiding groove
- 4. Pin
- 5. Guiding space
- 7. Stop limit

## Opening to quarterlight position

If the control button is pressed again (press side **B**) runner **S** moves forwards.

The pin (**2**) passes from position "X" to the end "Z" of the groove in the bracket **M** (position a).

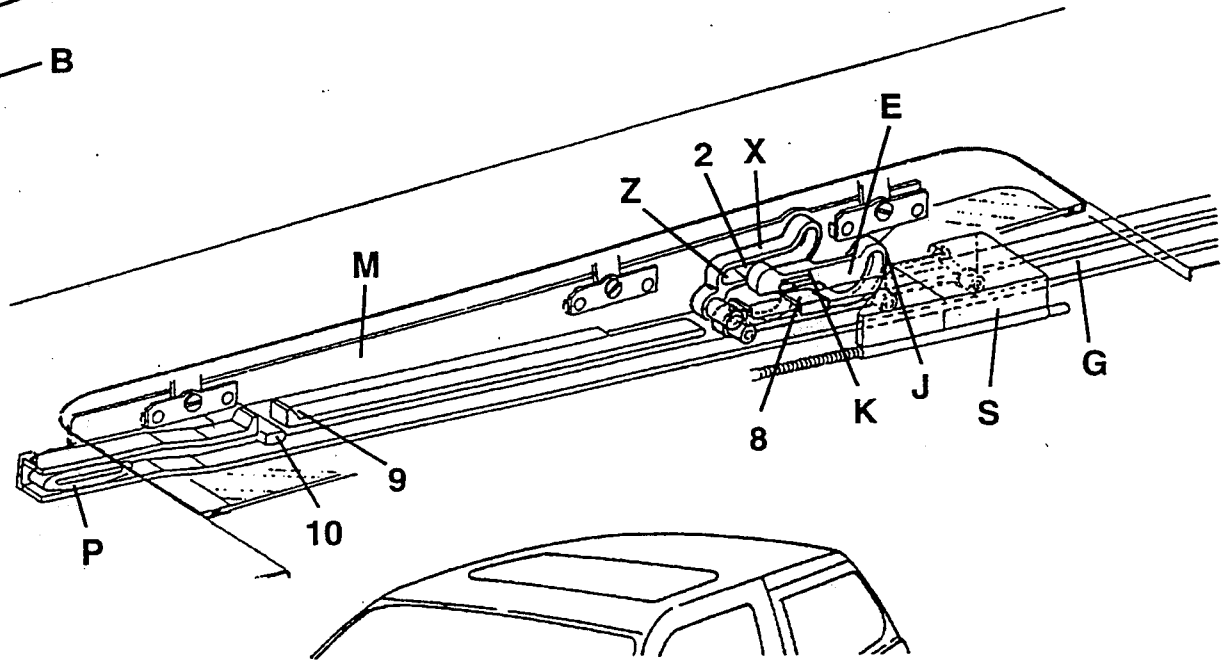
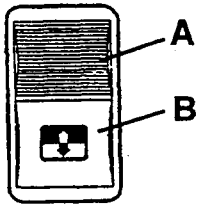
Pin (**8**), fixed to the guide, slots into the groove in the pantograph **E** passing from position "K" to position "J" (positions a and b).

The forward movement of the runner thus causes the pantograph device to lift up in turn causing the rear part of the roof to also lift up.

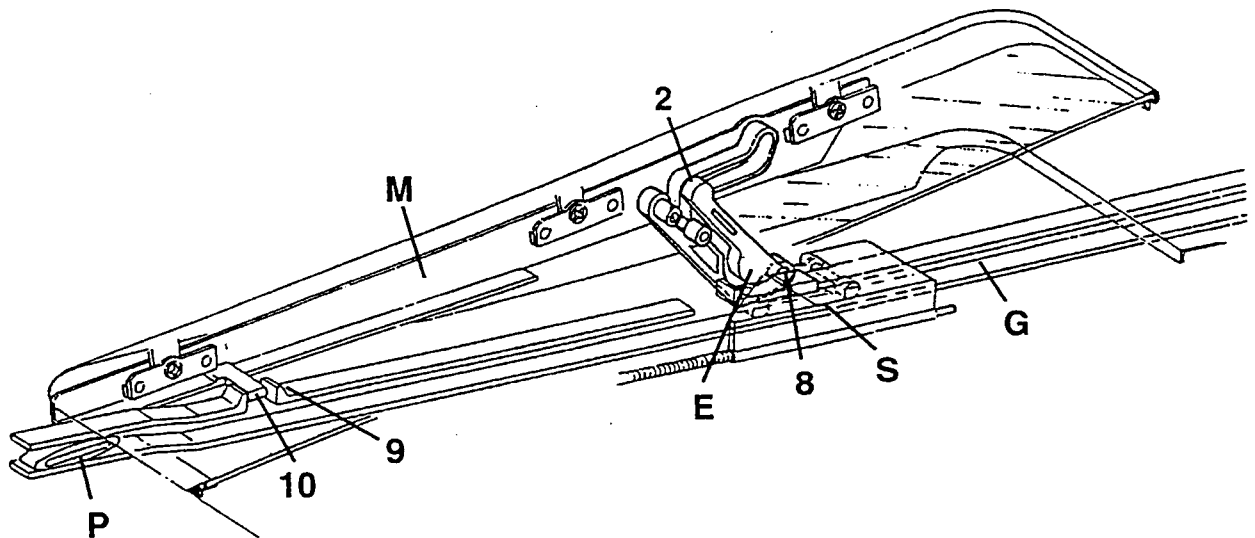
Towards the front the pin (**10**) is forced to enter the slot (**9**) causing the front end of the panel to back off a few millimeters so that it does not get in the way of the front edge of the sunroof housing frame.

The sunroof is closed (position a) by pressing side **A** of the button again.

### Position "a" - Roof closed



### Position "b" - Roof opened to the quarterlight position



- P. Runner
- M. Sliding bracket
- E. Pantograph element
- G. Rail
- S. Runner

- 2. Pantograph pin
- 8. Guide pin
- 9. Guiding slot
- 10. Pin

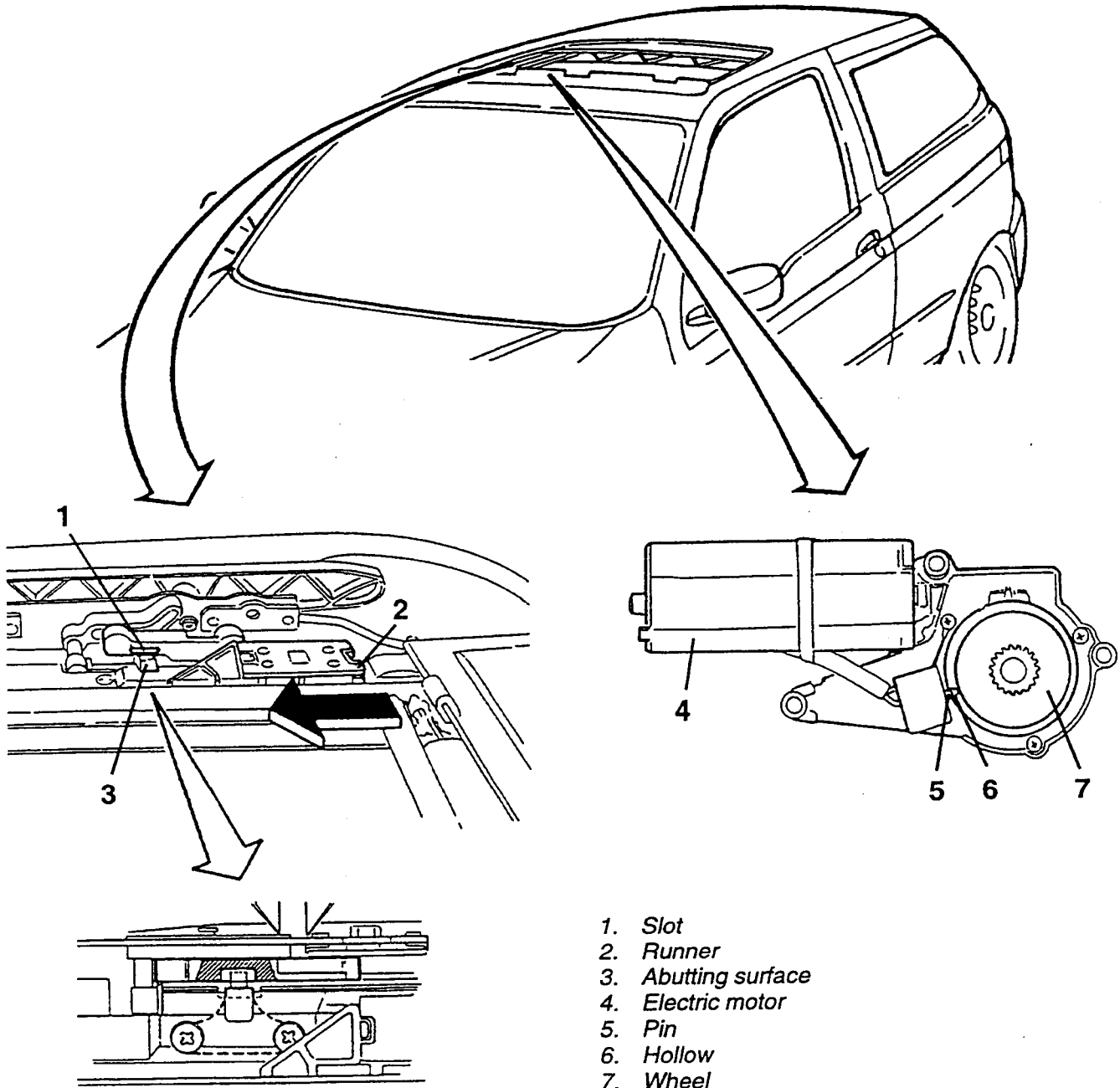
## Alignment of Runners and Motor

If, following maintenance interventions, the coupling must be restored between the rack and the motor the system must be first set in a certain position.

After disconnecting the glass roof and the motor, though maintaining the electrical connection, the runners (2) must be manually moved to the rear part and then returned to the front part until the slot (1) and the abutting surface (3) of the guide pin are perfectly aligned.

Activate the electric motor (4) until the pin (5) of the microswitch is engaged in the hollow (6) of the plastic wheel (7).

Starting from this position the electric motor and sunroof can be refitted.

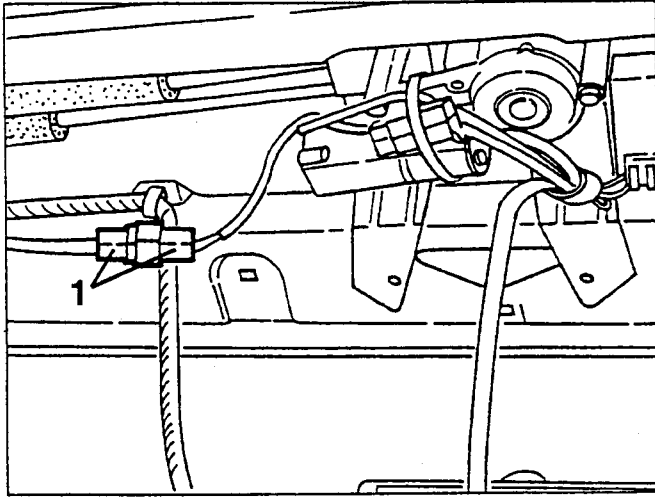


1. Slot
2. Runner
3. Abutting surface
4. Electric motor
5. Pin
6. Hollow
7. Wheel

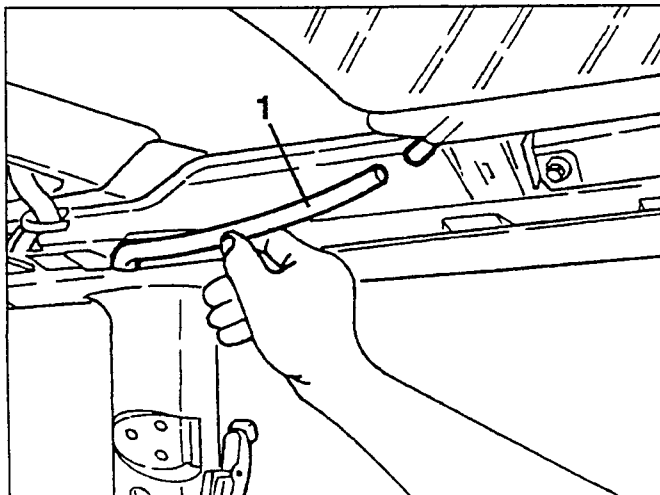
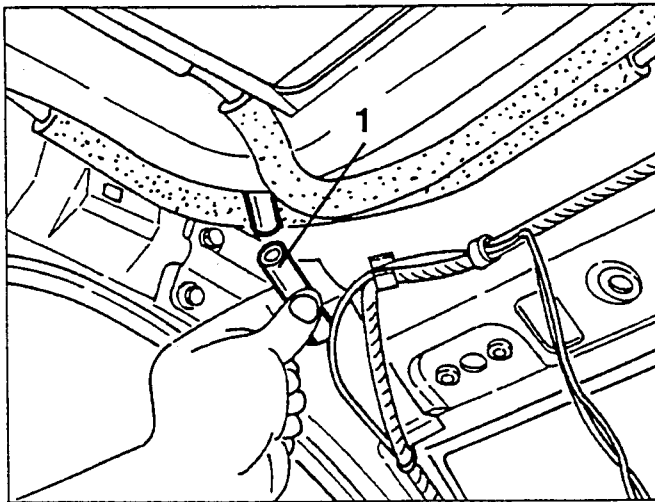
## REMOVAL/REFITTING

- Remove the roof panel (see specific paragraph).

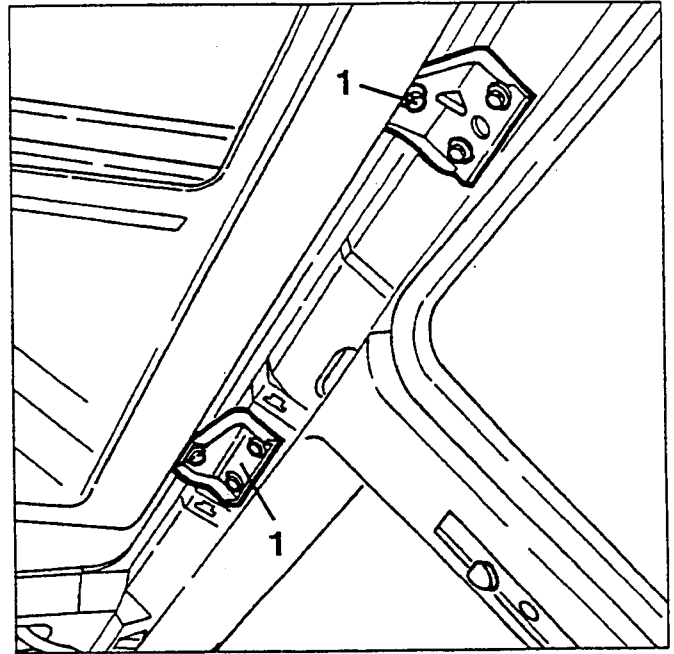
1. Disconnect the electrical connection from the sunroof motor.



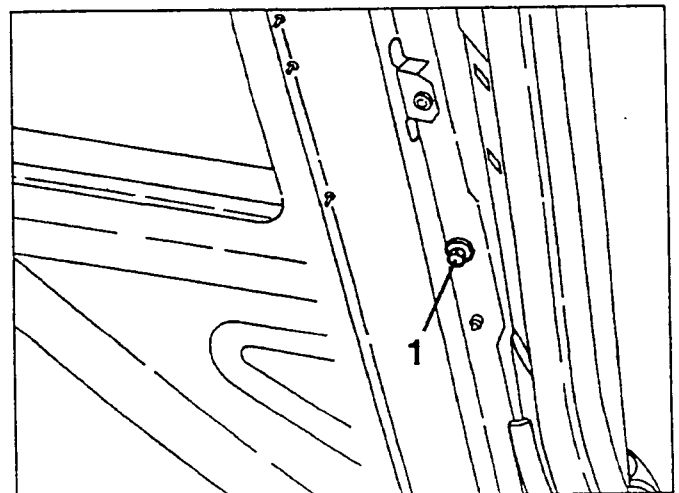
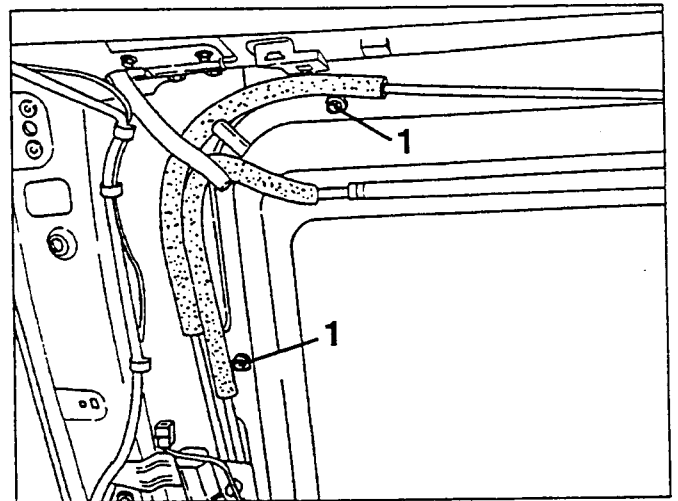
1. Disconnect the front and rear drainage hoses.



1. Loosen the screws securing the side brackets supporting the sunroof and remove the screws.

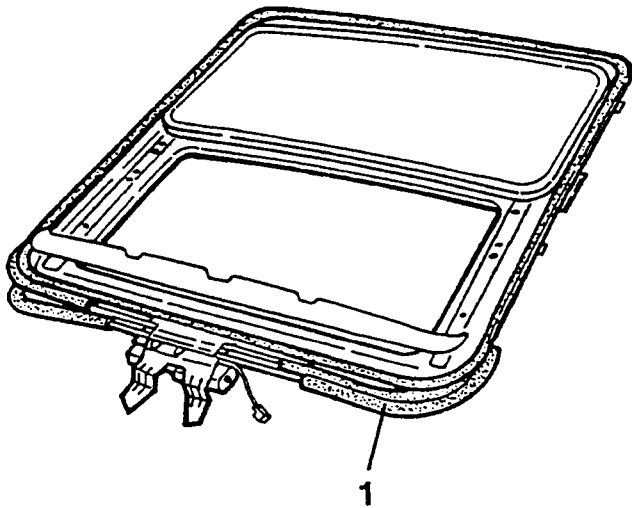


1. Loosen the four side screws and the two front screws securing the sunroof.

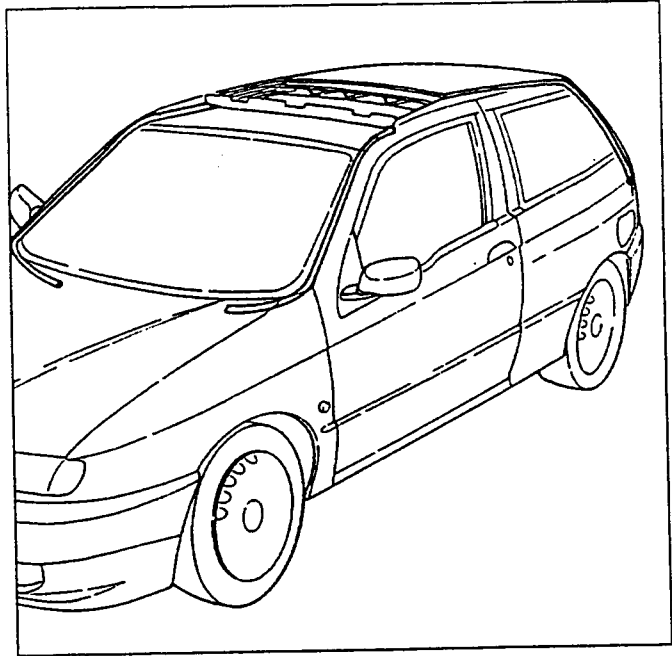


1. Remove the sunroof through the right-hand door.

**NOTE:**  
When refitting the sunroof check that the seals are present around the edge, that the tubular seals are present on the rack guides and the vibration buffers are on the centering pins.



## WATER DRAINAGE HOSES

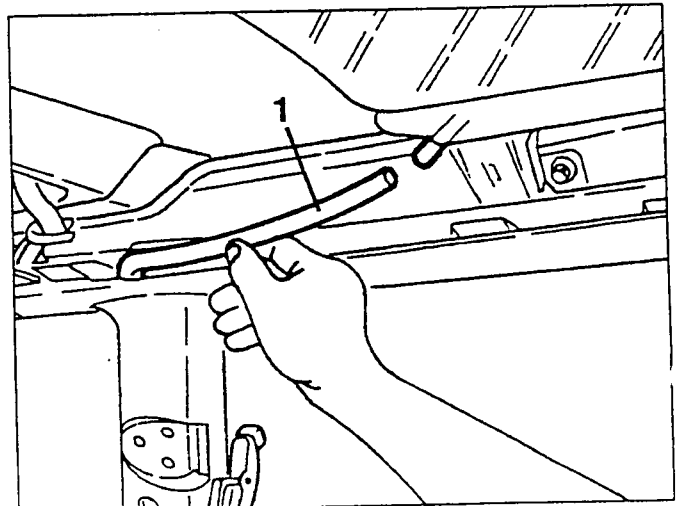
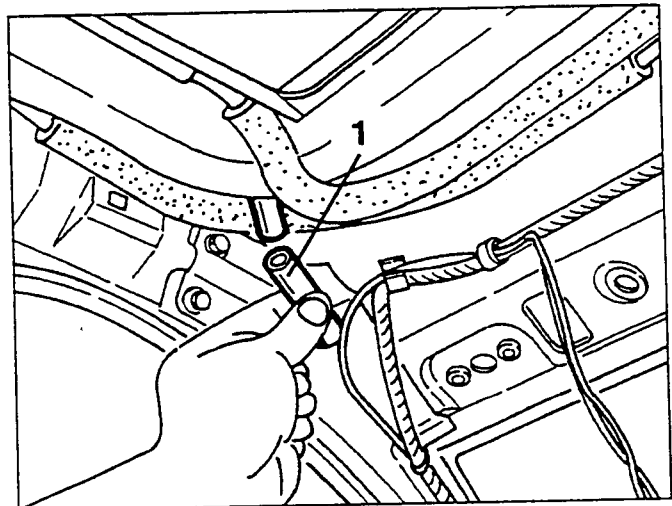
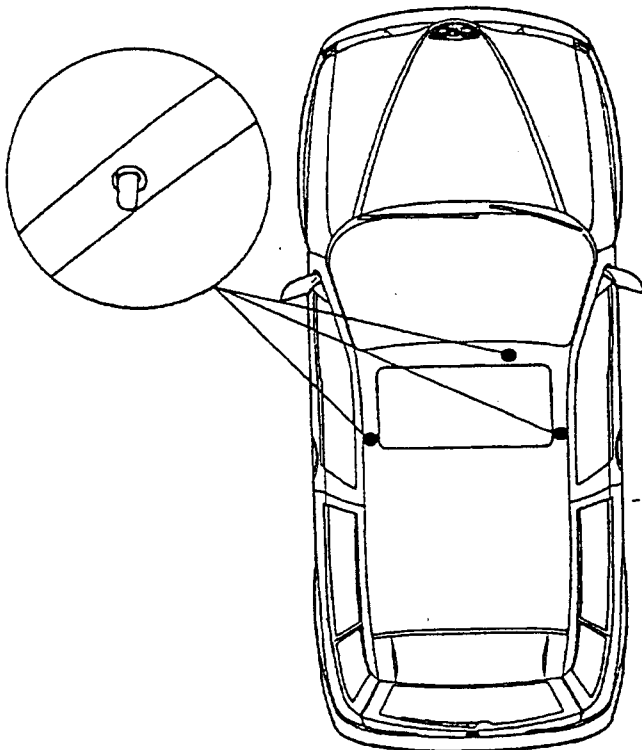


### Removal/Refitting

- Remove the roof panel (see specific paragraph).  
1. Disconnect the front and rear drainage hoses from the sunroof and withdraw them.

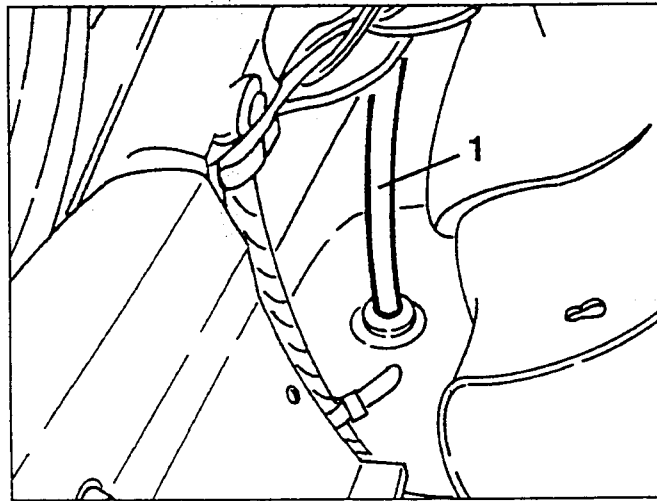
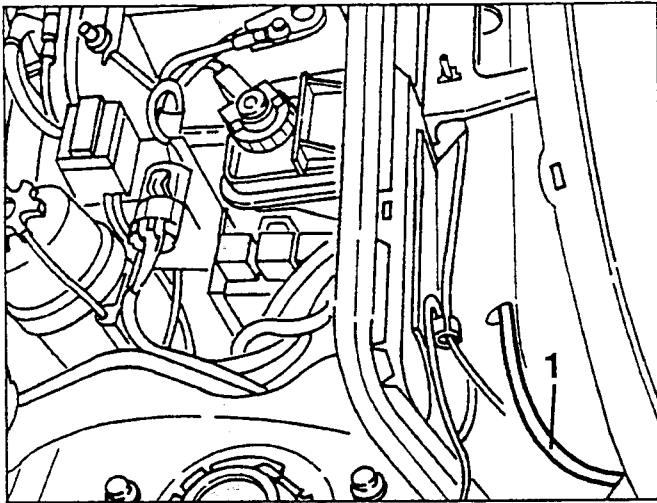


When refitting position the sunroof in the vehicle using the three centering pins as reference marks.



- After refitting check the alignment of the sunroof and that it works correctly.

1. Refit the front and the rear drainage hoses as shown in the diagram.



- If necessary replace the sunroof seal (the joint in the seal is towards the front).

**NOTE:**

After refitting adjust the position of the sunroof glass as described in the following paragraph.

### ADJUSTING THE POSITION OF THE SUNROOF GLASS

**NOTE:**

To adjust the position of the sunroof glass two operators are needed, one working from the inside and one from the outside.

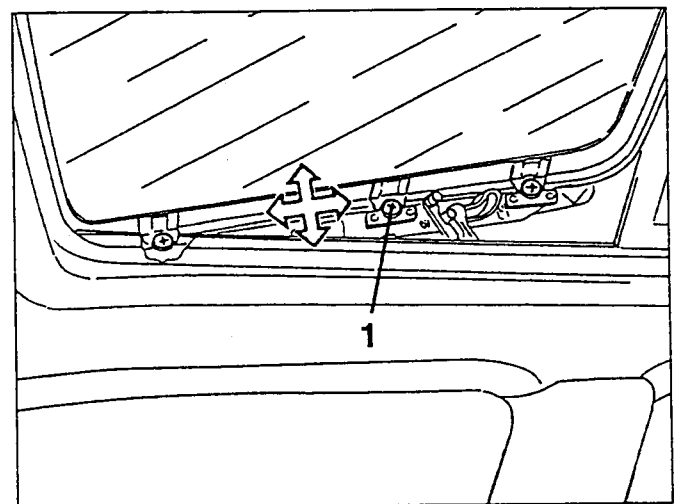
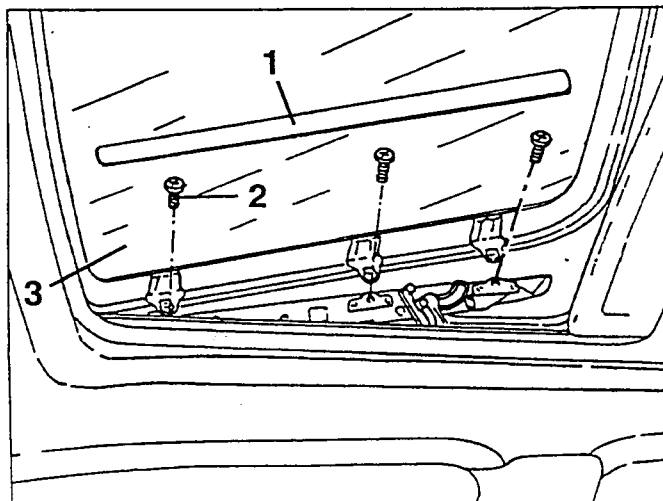
The operator working outside the vehicle centres the glass in its seating in the roof of the vehicle and level with the surface of the roof. The operator working on the inside tightens the adjustment screws.

- Open the sunroof the quarterlight position.
- Remove the internal protective strips from the sliding mechanisms.
- Close the roof.
- 1. Loosen the six adjustment screws (three screws on each side).
- Correctly position the glass longitudinally and vertically.
- Tighten the six screws.

### SUNROOF GLASS PANEL

#### Removal/Refitting

- Open the sunroof to the quarterlight position.
- 1. Open the sliding blind and remove the two protective strips.
- 2. Loosen the three screws securing each side of the glass to the sliding mechanisms.
- 3. Lift up the glass and remove it from the outside.

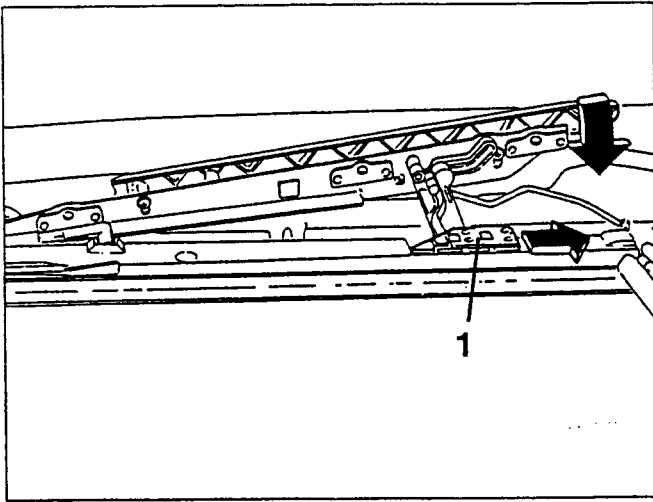


### ALIGNING THE RUNNERS

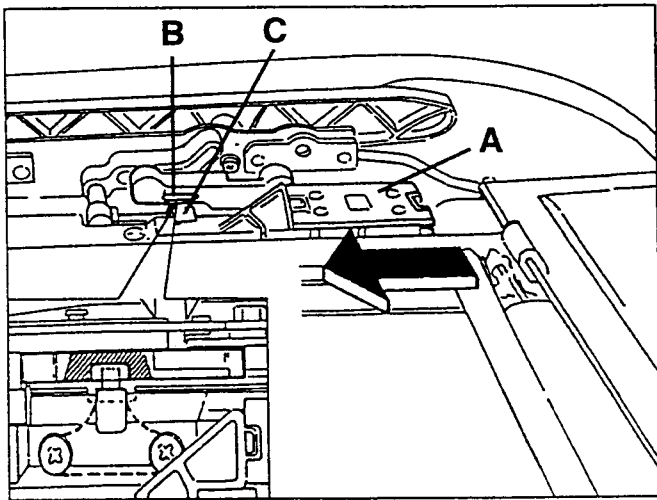
If the parts of the sunroof command system are malfunctioning and/or being replaced it is also necessary to realign the runners which carry the roof and the relative coupling with the motor, as follows:

- Remove the glass from the sunroof (see specific paragraph)
- Disconnect the electric motor without however disconnecting the electrical connections (see specific paragraph).

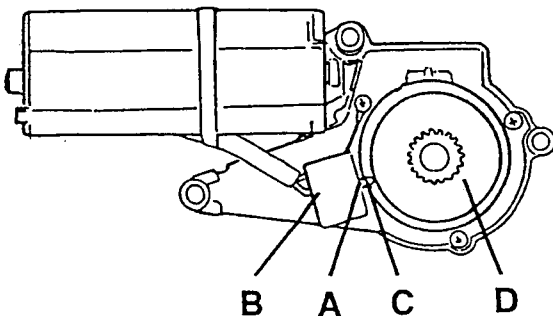
1. Manually push the runners to the rear part of the roof compartment.



- Manually return the runners (A) to the front area until the slot (B) and the abutting face (C) of the guide pin are perfectly aligned.



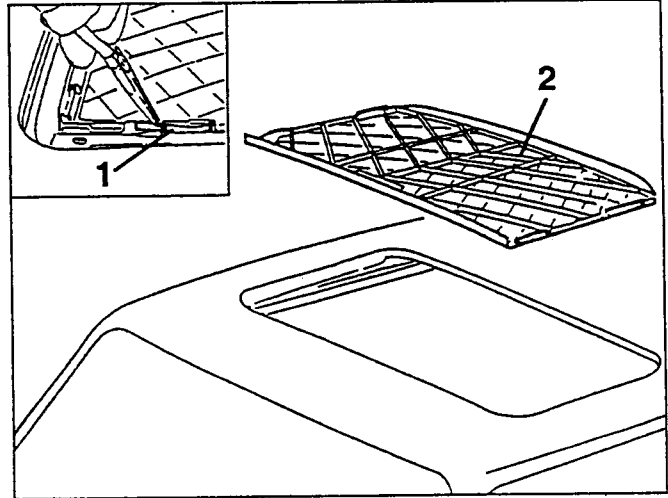
- Insert the sunroof command switch into its connector.
- Work the electric motor until pin (A) of microswitch (B) is engaged in the hollow (C) in the plastic wheel (D).
- Without adjusting the position of the runners refit the motor and tighten the three screws.
- Refit the glass panel and the front roof light operating as shown in the relative paragraphs.



## SLIDING BLIND

### Removal/Refitting

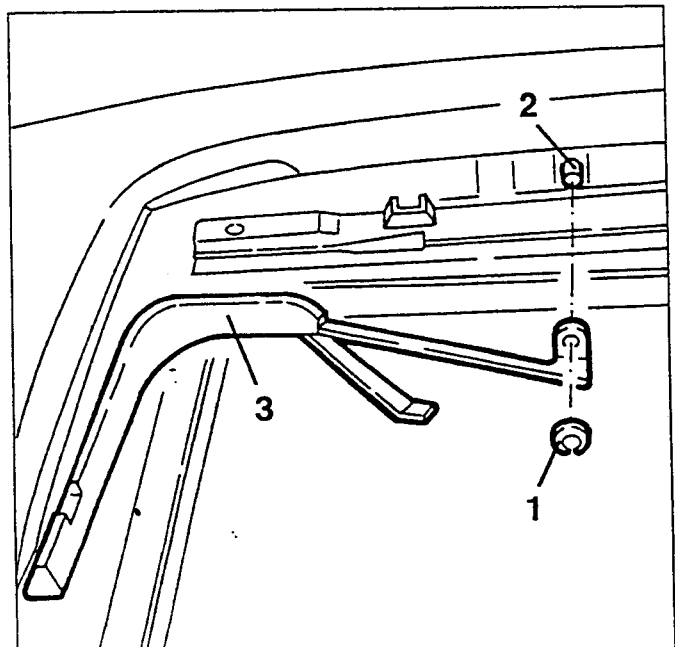
- Remove the glass panel (see specific paragraph).
- Move the blind to the closed position.
- 1. Using a suitable tool release the springs on one side of the blind from the guide.
- 2. Free the sliding blind and remove it from the front end.



## MOBILE SPOILER

### Removal/Refitting

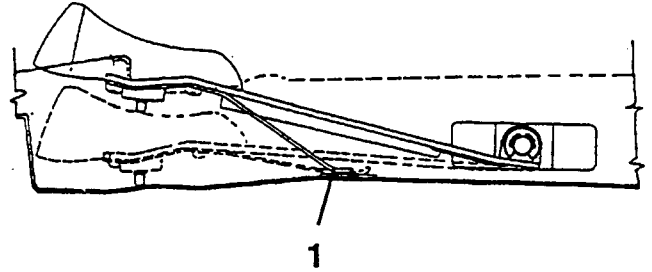
- Open the sunroof .
- 1. Remove the seeger from each side.
- 2. Remove the bracket from the pin.
- 3. Remove the deflector.





When refitting reverse the procedure followed for removal and note the following:

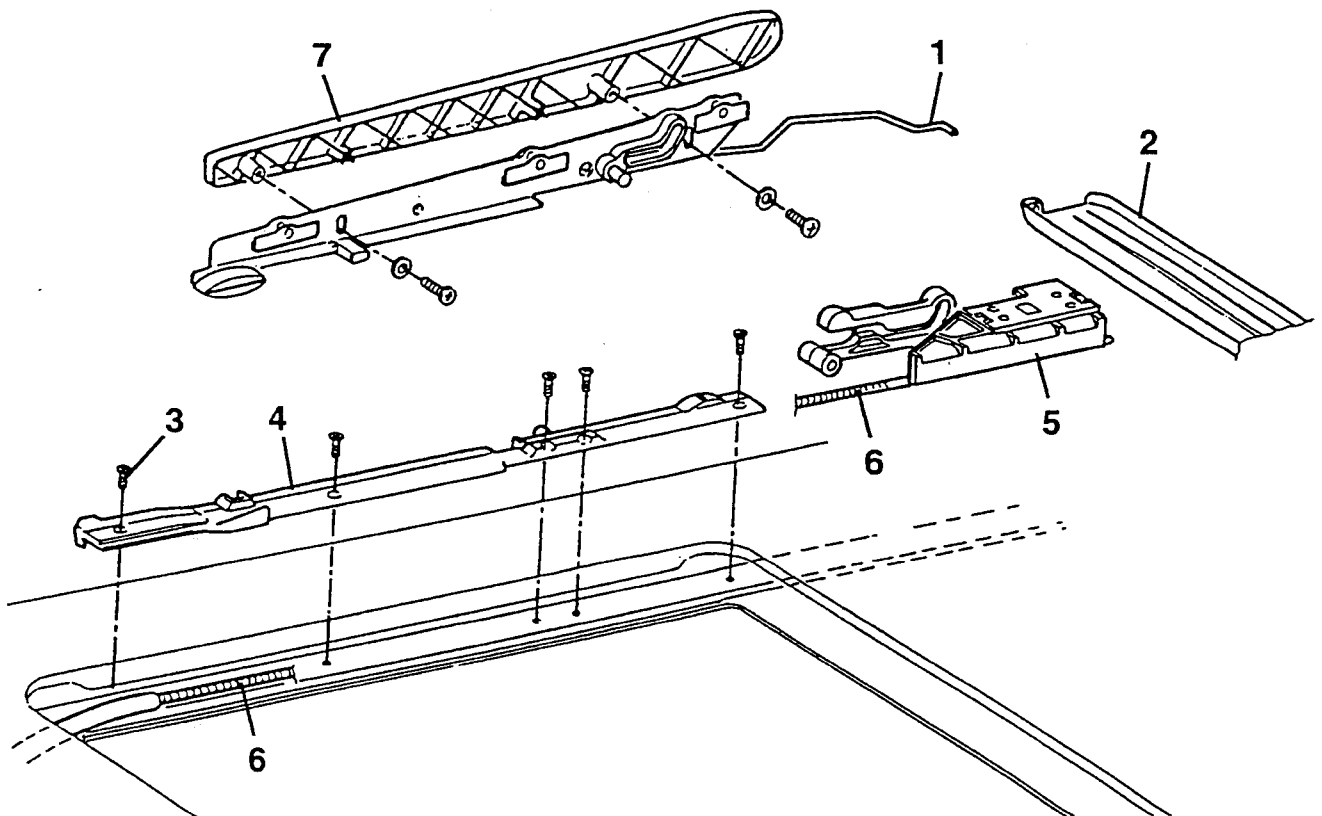
1. Grease the mating surfaces between the flexible spring and frame.



## RUNNERS AND RACKS

### Removal/Refitting

- Remove the glass panel (see specific paragraph).
  - Remove the sliding blind (see specific paragraph).
  - Remove the electric motor (see specific paragraph).
1. Free the water connection channel from the two connecting pins holding it to the runners.
  2. Back-off the channel.
  3. Loosen the five screws moving the runners bit by bit to enable them to be removed.
  4. Remove the guides.
  5. Remove the entire runner.
  6. Withdraw the flexible rack from the guide track.
  7. If necessary loosen the two screws and separate the external moulding.







When refitting reverse the procedure followed for removal and note the following:

- When inserting the flexible rack in the guiding tracks check that the second section of track slides correctly in the gear seating.
- Align the runners (see specific paragraph) and refit the electric motor.
- Refit the various parts by following the procedures given in the relative paragraphs.

## MOBILE WATER CHANNEL

### Removal/Refitting

#### NOTE:

The procedure for disassembling the channel is similar to that for dismantling the runners (see specific paragraph).

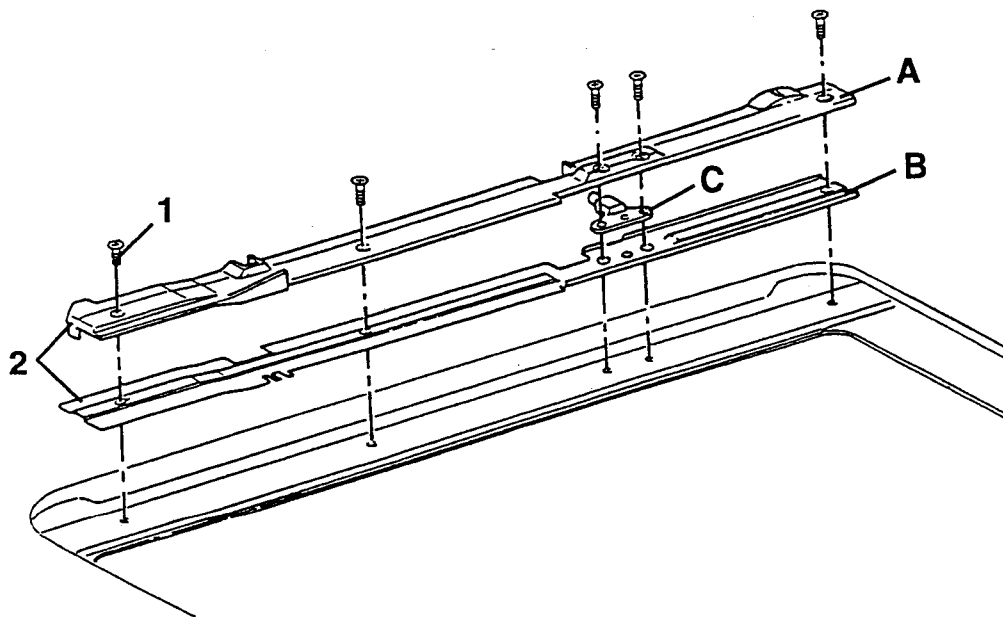
It is only necessary to remove one runner to free and remove the channel.

## GUIDES

### Disassembly and Reassembly.

- Fully open the sunroof.
- 1. Loosen the five screws securing each guide.
- 2. Remove the complete guide.

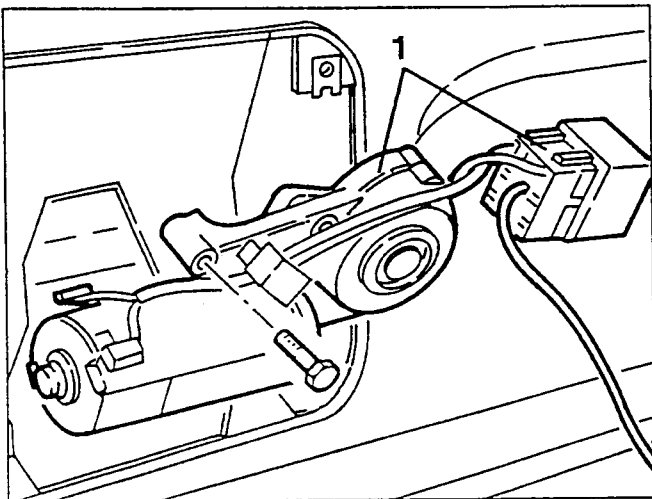
- 3. Separate the plastic upper part (A) from the lower part (B) and remove the guide pin (C).



**SUNROOF ELECTRIC MOTOR/RELAY****Removal/Refitting**

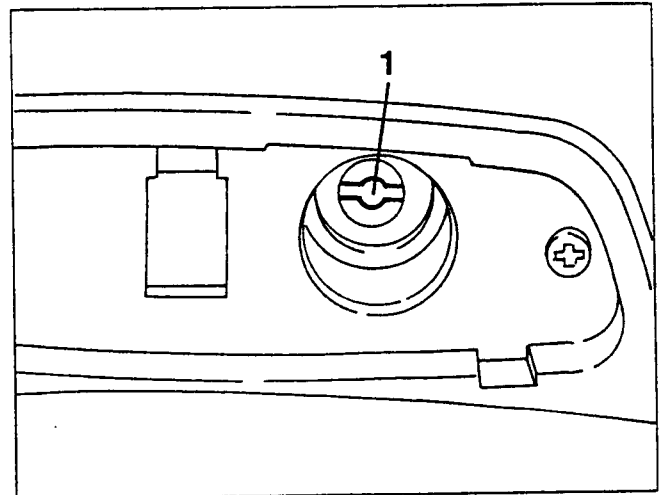
**NOTE:** In the event of a failure of the electric motor, it is possible to move the roof to the required position operating the motor manually (see "EMERGENCY MANUAL OPERATION OF THE SUNROOF").

- Move the sunroof to the closed position flush with the roof.
- Remove the front passenger compartment ceiling light (see GROUP 55).
- 1. Slacken the three fastening screws and withdraw the motor-control relay assembly just enough to disconnect the electrical connection, then remove it.
- On the bench, remove the relay from its base.



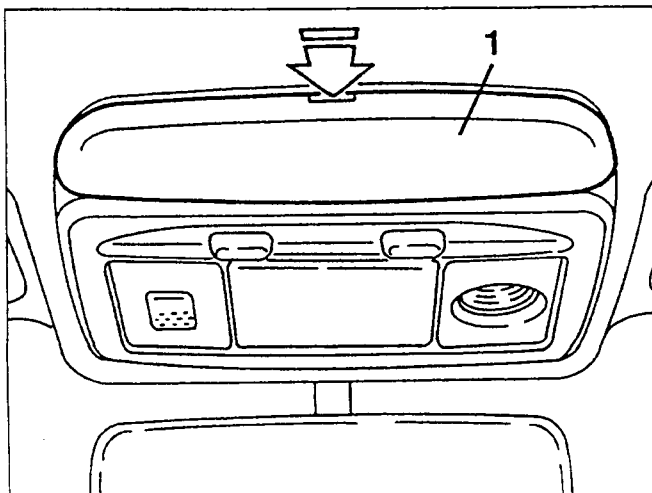
1. Using the special wrench provided in the car tool bag, turn the bush of the sunroof gear motor until the roof is brought to the required position.

**NOTE:** When this operation has been completed, before removing the wrench, it must be turned half a turn in the opposite direction to before until a click is heard.

**EMERGENCY MANUAL OPERATION OF THE SUNROOF**

If the electric control device fails to work, the sunroof can be operated manually as follows:

1. Levering in the point shown by the arrow, remove the cover.



## SUNROOF

### GENERAL DESCRIPTION

The sunroof (INALFA) is of the glass type with sunshade curtain and it can be distinguished from the previous one (WEBASTO) by the completely smooth outer deflector (rather than having three grooves).

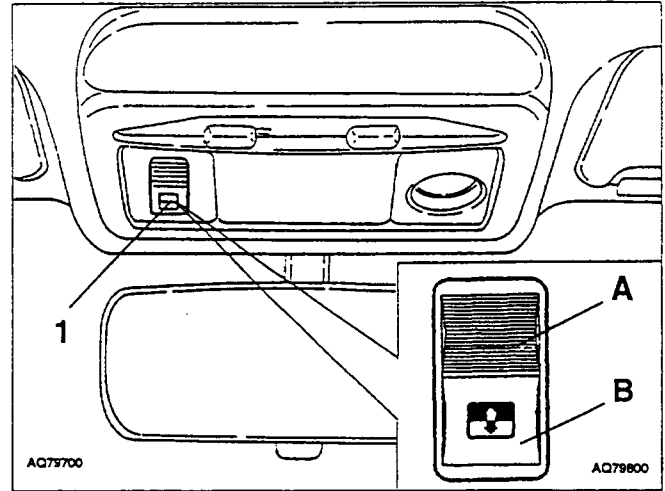
The sliding mechanisms of the sunroof enable two different types of positioning:

a "concealed" position, by which it can be partially or completely opened, making it slide completely into the gap between the roof panel trim and the roof panel.

a "quarter-light" position, by which the roof is raised to allow air to escape from the passenger compartment but limits ventilation.

The sunshade is also housed, in the opening position, in the space between the roof panel trim and the roof panel.

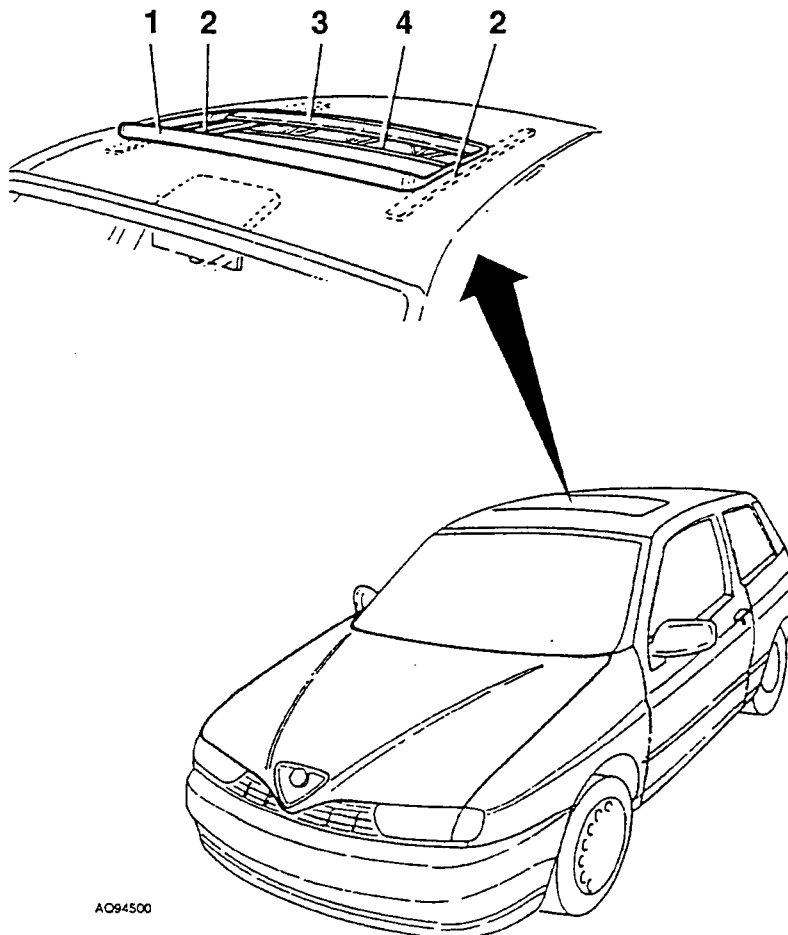
The sunroof is operated by a pushbutton (1) located on the front roof light; the type of resulting movement (closing/"quarter-light" opening or "concealed" opening) is caused by the profile of the cams machined on the runners and by the sliding of the runners inside the guides.



The sunroof operating sequence is described in the following table:

| Initial position | Operation | Position obtained |
|------------------|-----------|-------------------|
| Completely open  | Press «A» | Closed            |
| Closed           | Press «A» | Quarter-light     |
| Quarter light    | Press «B» | Closed            |
| Closed           | Press «B» | Completely open   |

The sunroof (see Figure) consists of an external glass (3), sliding on guides (2), an outside deflector (1) and the glass moving device.



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(\*): See engine  TD

(▲): See engine  T. SPARK  
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## DESCRIPTION

With the constant velocity joints the axleshafts form the set of devices which transmit motion from the gearbox to the driving wheels.

The assembly of these devices, commonly called "transmission" when in conjunction with the gearbox, comprises the following:

- right and left axle shafts;
  - constant velocity joints on wheel and gearbox side.
- The high-resistance steel axle shafts (11) have grooved ends to enable coupling with the constant velocity joints (12) and (13).

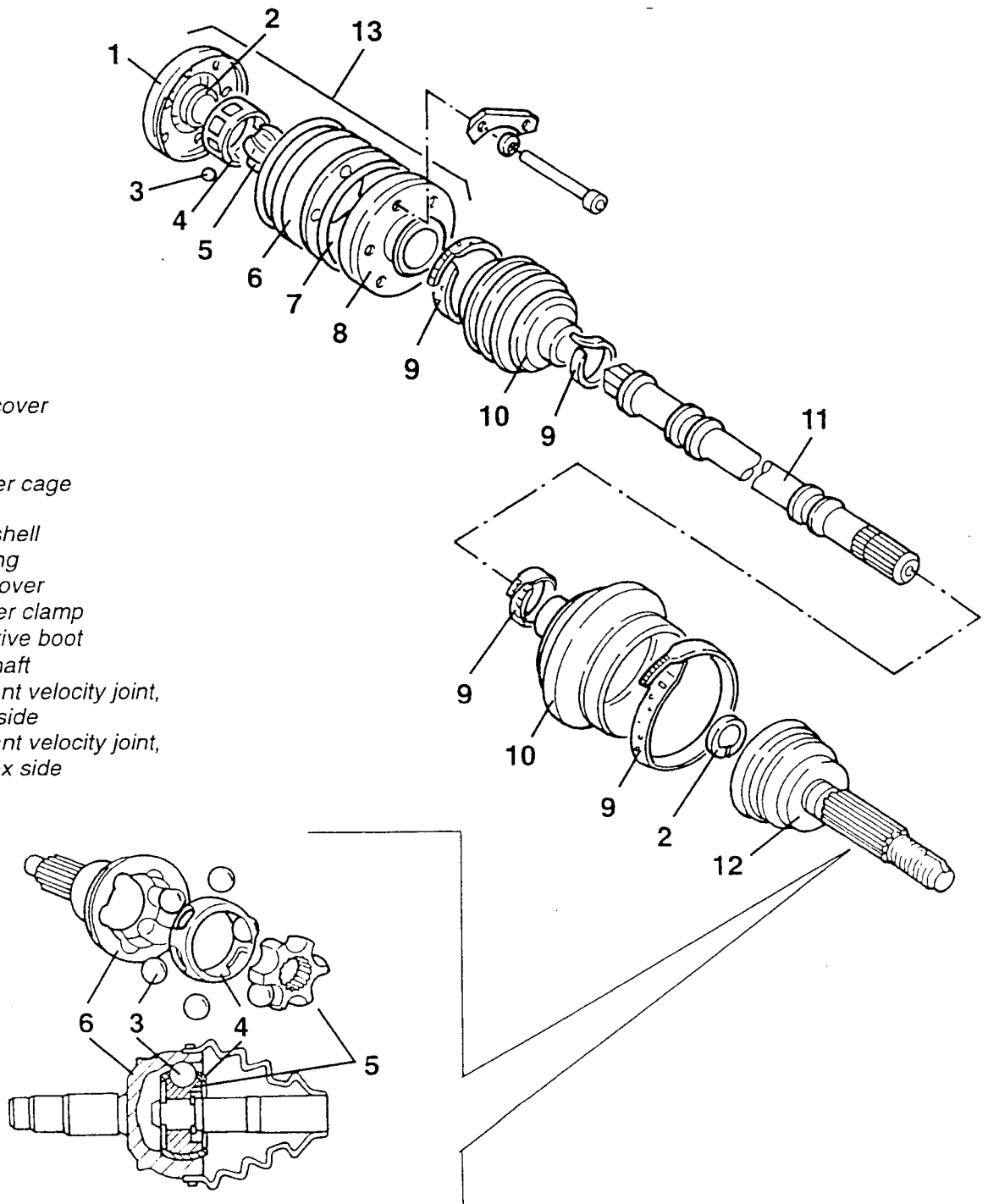
The housing for the flexible retainer rings (2) is made on these grooves.

The constant velocity joints are formed of an inner core (5) known as "drive", keyed onto the input shaft and an outer shell (6) called "driven", which forms the output element of the joint.

The inner core has six spherical grooves on its outer surface containing six balls (3), held in place by a cage (4).

These balls are the parts which actually transmit the motion and are also located in other grooves machined on the inner surface of the shell.

1. Outer cover
2. Circlip
3. Ball
4. Retainer cage
5. Core
6. Outer shell
7. Seal ring
8. Inner cover
9. Retainer clamp
10. Protective boot
11. Axle shaft
12. Constant velocity joint, wheel side
13. Constant velocity joint, gearbox side



## REMOVAL/REFITTING

The following procedure refers to removal/refitting of the lefthand axle shaft.

However, it is possible to wholly follow this procedure also for removing the righthand axle shaft.

- Set the car on a lift.

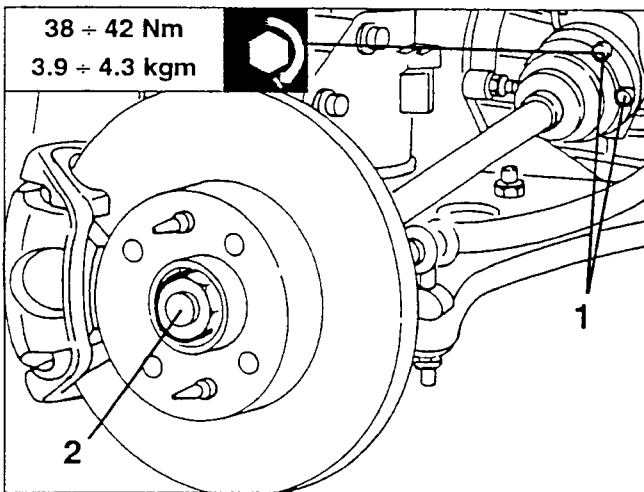
- Remove the left front wheel.

1. Slacken the screws fastening the left axle shaft to the differential support and disconnect it retrieving the safety plates.

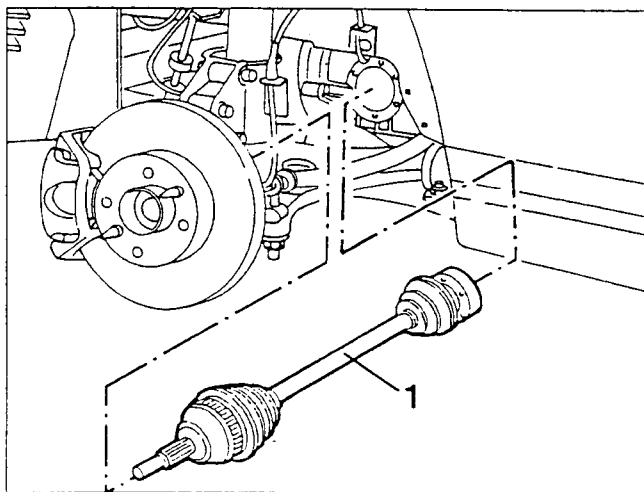
2. Remove the caulking and slacken the nut fastening the axle shaft constant velocity joint to the wheel hub.

When refitting, tighten the nut fastening the axle shaft to the wheel hub as described in GROUP 44

- Wheels and hubs - "Front wheel upright (Boxer versions)".



1. Pull out the axle shaft and remove it.



## DIS-ASSEMBLY OF JOINT ON GEARBOX SIDE

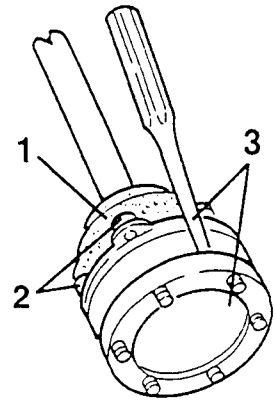
- Fasten the axle shaft in a vice fitted with protective jaws.

- Remove the clamps of the gearbox side boot.

1. Back off the boot on the axle shaft.

2. Remove the safety plates located on the inner cover after removing the corresponding screws.

3. Remove the outer cover using a punch.

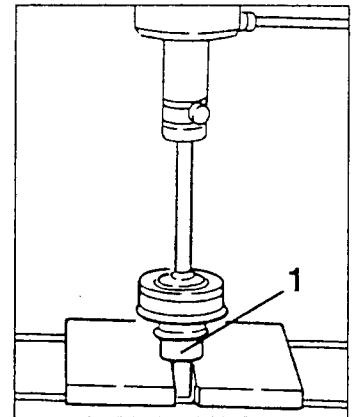


**Change the boot and clamps when re-assembling.**

- Make a reference mark on the outer ring, on the cage and on the core of the joint to reposition correctly when re-assembling.

- Remove the flexible retainer ring.

1. Working under the press with two half plates and a punch, remove the constant velocity joint from the axle shaft.

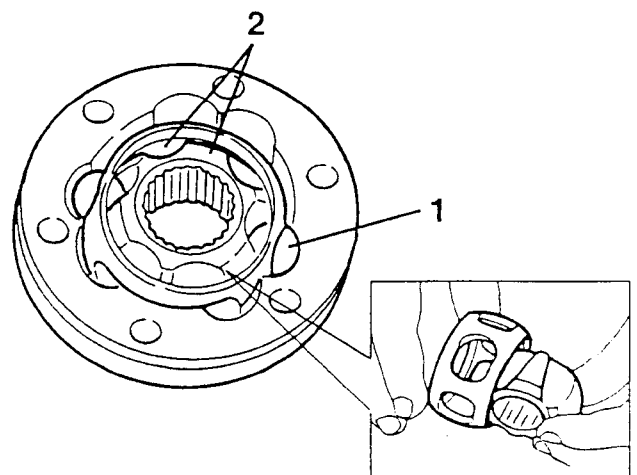


- Slide the protective boot off the axle shaft and remove the inner cover from the constant velocity joint.

- Remove the two seal rings from the joint outer ring.

1. Remove the balls from the joint.

2. Remove the core and cage turning them suitably in the outer ring and separate them.



## CHECKS

Degrease the joint components with fuel oil and check the balls and their housings for traces of wear and cracks.

Check the shaft for distortion, cracks and signs of wear.

## REFITTING THE JOINT ON THE GEARBOX SIDE

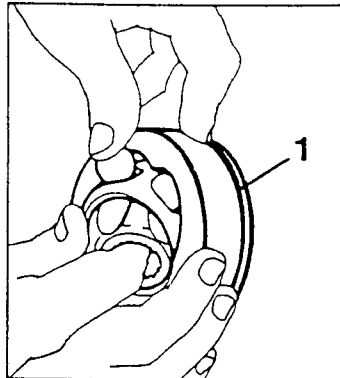
- Carefully grease the cage, core and balls with the specified grease and fill the inner chamber of the joint with 40 g of the specified grease.

- Fit the bellow on the axle shaft taking care not to scratch it on the teeth.

For this purpose it is wise to tape the toothing.

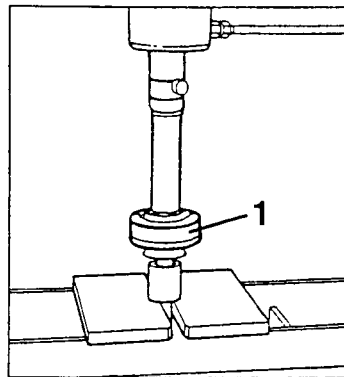
- Assemble the core and cage reversing the sequence followed for their removal.

1. Insert the balls working as illustrated and check that the joint works properly.



**Do not mix the balls of this joint with the balls of the joint on the wheel side as their diameter is different.**

1. Working under the press and using two half plates and a punch, insert the joint complete with inner cover on the axle shaft.

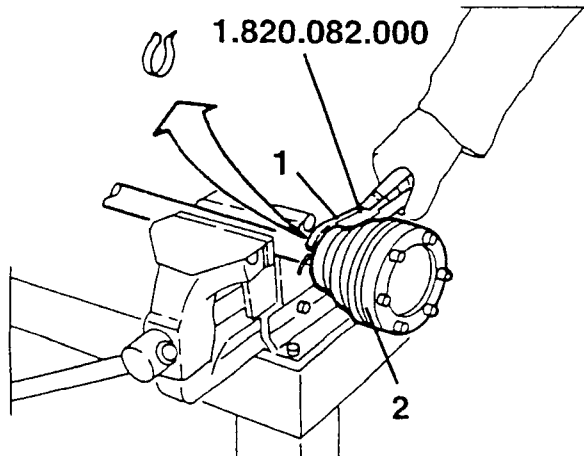


- Fill the joint with another 40 g of the specified grease.

- Fit the two seal rings on the outer ring of the joint.

1. Fit the bellow and using tool N° 1.820.082.000 install the inner clamp.

2. Using tool N° 1.820.084.000 install the outer clamp for fastening the boot.

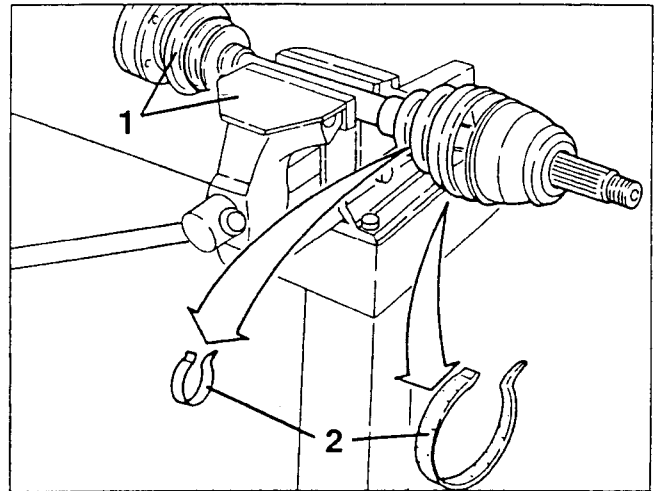


- Fit the safety plates on the inner cover using the corresponding screws, then fit the outer cover on the screws.

## DIS-ASSEMBLY OF THE JOINT ON THE WHEEL SIDE

1. Fasten the axle shaft in a vice complete with protective jaws.

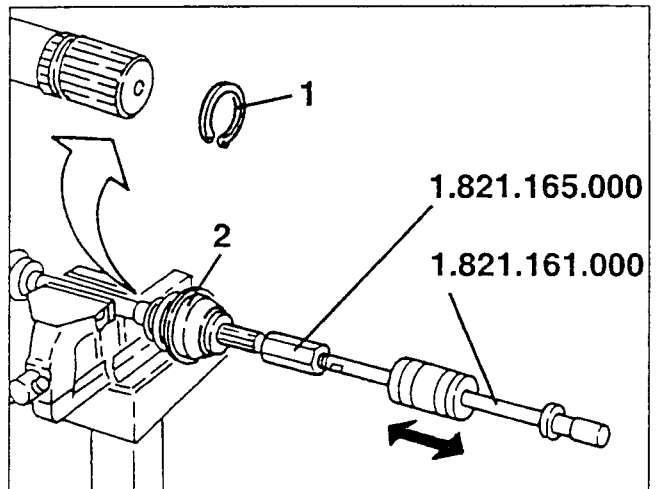
2. Remove the fastener clamps of the protective boot on the wheel side.



**When refitting change the boot and clamps.**

1. Remove the snap ring.

2. Using tools n° 1.821.165.000 and N° 1.821.161.000, remove the constant velocity joint from the axle shaft.



## CHECKS

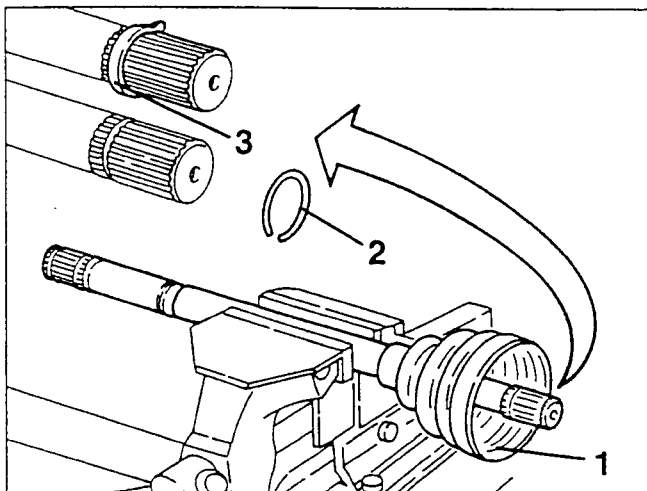
Degrease the joint components with fuel oil and check the balls and their housings for traces of wear and cracks.

Check the shaft for distortion, cracks and signs of wear.



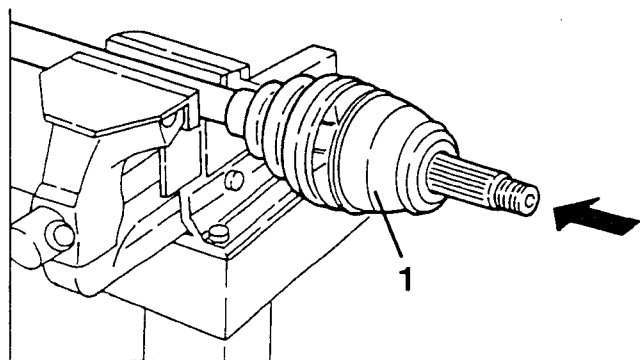
### REFITTING THE JOINT ON THE WHEEL SIDE

1. Fit a new protective boot on the axle shaft.
2. Position the snap ring in its housing.
3. Compress the snap ring with the fastener clamp.

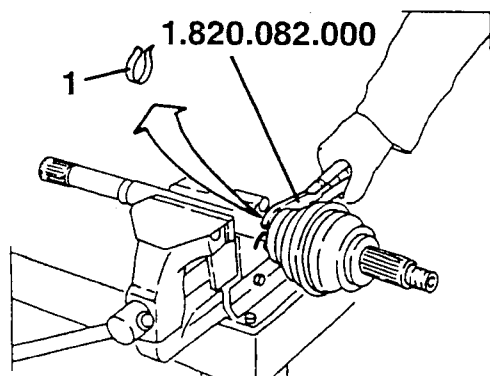


1. Position the joint on the axle shaft and push it into its housing using a soft hammer.

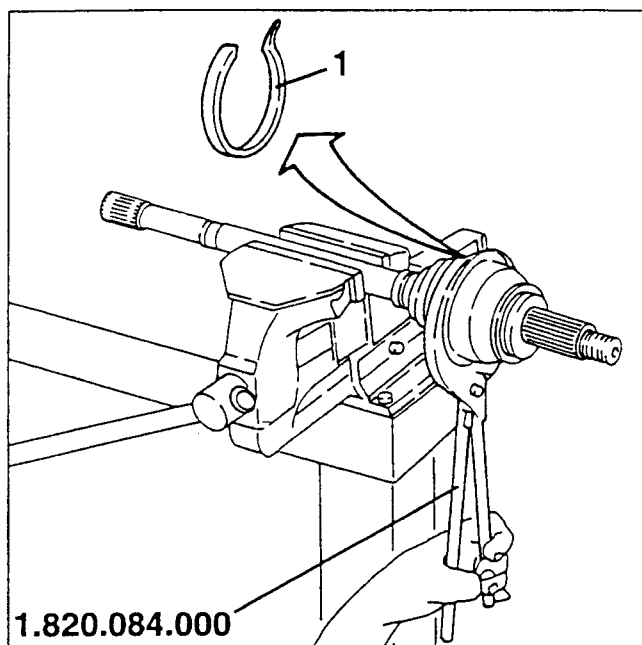
Fill the boot and grease the joint with appr. 120 g of the specified grease.



1. Using tool N° 1.820.082.000 fit the inner boot clamp.



1. Using tool N° 1.820.084.000 fit the outer boot clamp.



## DESCRIPTION

With the constant velocity joints the axle shafts form the set of devices which transmit motion from the gearbox to the driving wheels.

The assembly of these devices, commonly called "transmission" when in conjunction with the gearbox, comprises the following:

- right and left axle shafts;
- constant velocity joints on wheel and gearbox side.
- intermediate shaft.

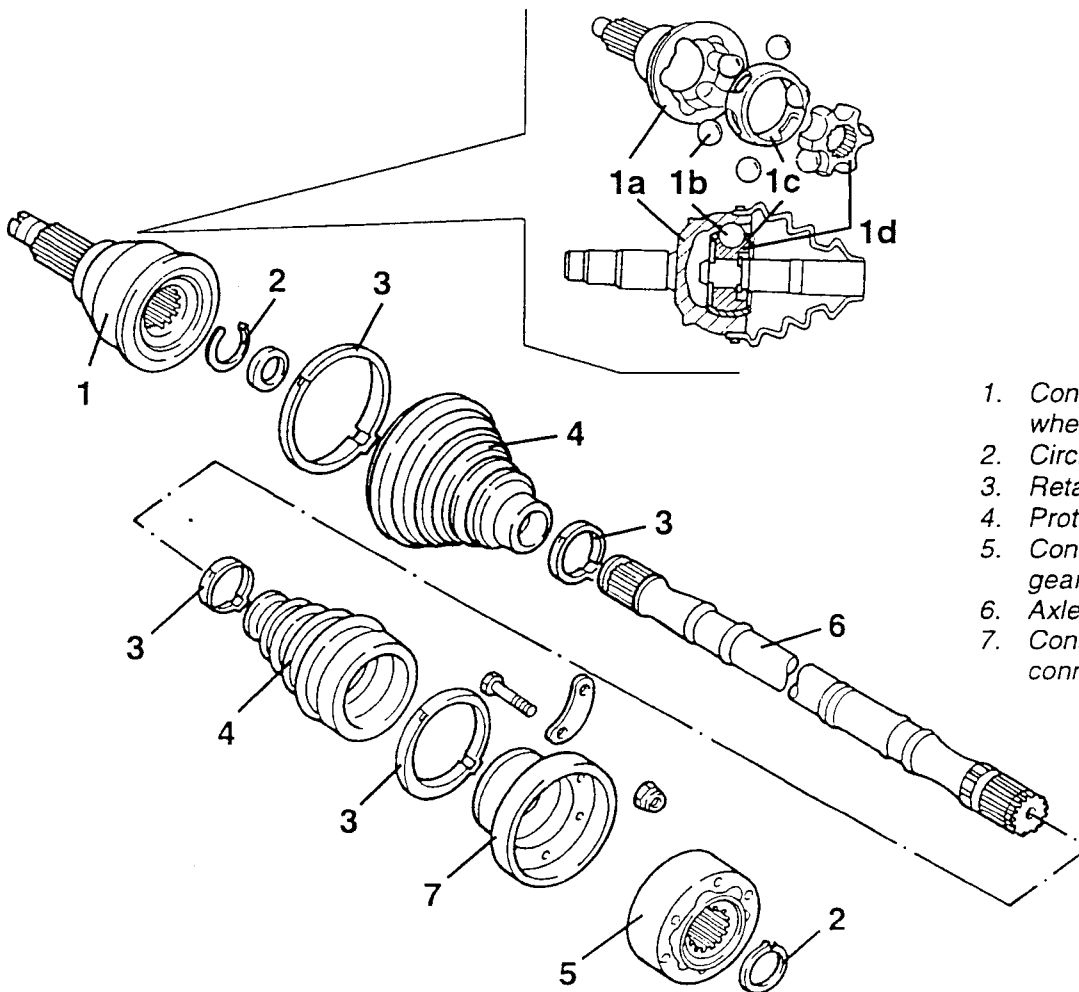
The high-resistance steel axle shafts (6) have grooved ends to enable coupling with the constant velocity joints (1) and (5).

The housing for the flexible retainer rings (2) is made on these grooves.

The constant velocity joints are formed of an inner core (1d) known as "drive", keyed onto the input shaft and an outer shell (1a) called "driven", which forms the output element of the joint.

The inner core has six spherical grooves on its outer surface containing six balls (1b), held in place by a cage (1c).

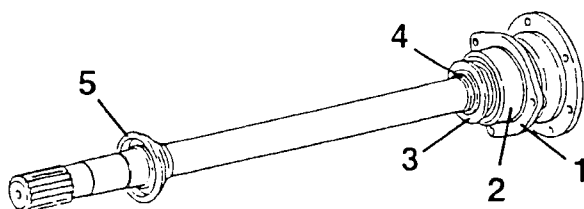
These balls are the parts which actually transmit the motion and are also located in other grooves machined on the inner surface of the shell.



1. Constant velocity joint, wheel side
2. Circlip
3. Retainer clamp
4. Protective boot
5. Constant velocity joint, gearbox side
6. Axle shaft
7. Constant velocity joint connection flange

The intermediate shaft, also with grooved ends and, like the axle shafts, made from high-resistance steel, has the purpose of connecting the differential output with the right axle shaft to which it is connected by a flange.

For this purpose, to limit the projection between the connection points, the intermediate shaft is supported by a housing machined especially on the gearbox.



1. Bearing retainer plate
2. Ball bearing
3. Flexible washer
4. Bearing retainer ring
5. Cup for bearing

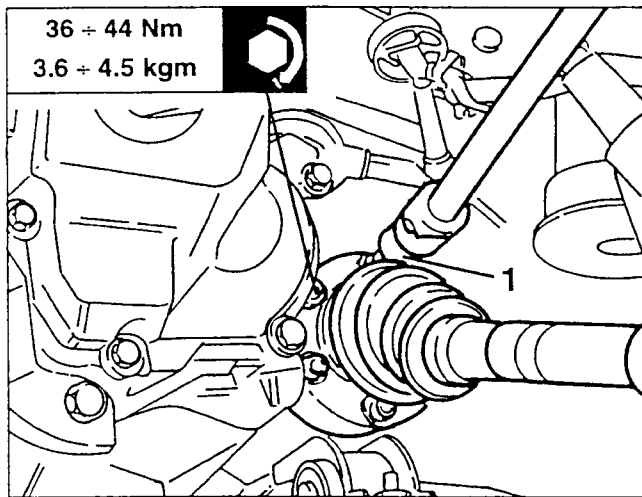
## REMOVAL/REFITTING

The following procedure refers to removal/refitting of the lefthand axle shaft.

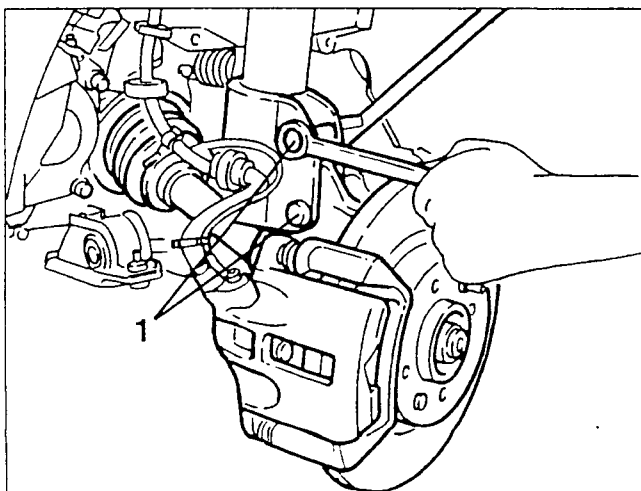
However, it is possible to wholly follow this procedure also for removing the righthand axle shaft.

- Set the car on a lift.
- Disconnect the battery (-) terminal.
- Raise the car.
- Remove the wheel and mudflap from the left front wheel house.
- Working from the left wheelhouse, disconnect the electrical connection of the brake pad wear sensor.
- Slacken the screw fastening the ABS inductive sensor support bracket.

1. Slacken the bolts fastening the left constant velocity joint from the differential flange retrieving the safety plates.



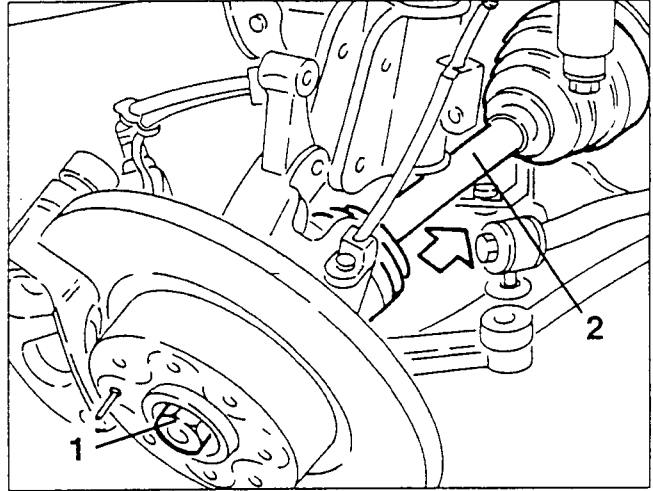
1. Slacken the two bolts fastening the left upright to the shock absorber, then remove the upper bolt only. This operation makes it possible to pull back the axle shaft just enough to disconnect the joint.



1. Remove the caulking and the nut fastening the joint to the wheel hub.

2. Pull the axle shaft and remove it.

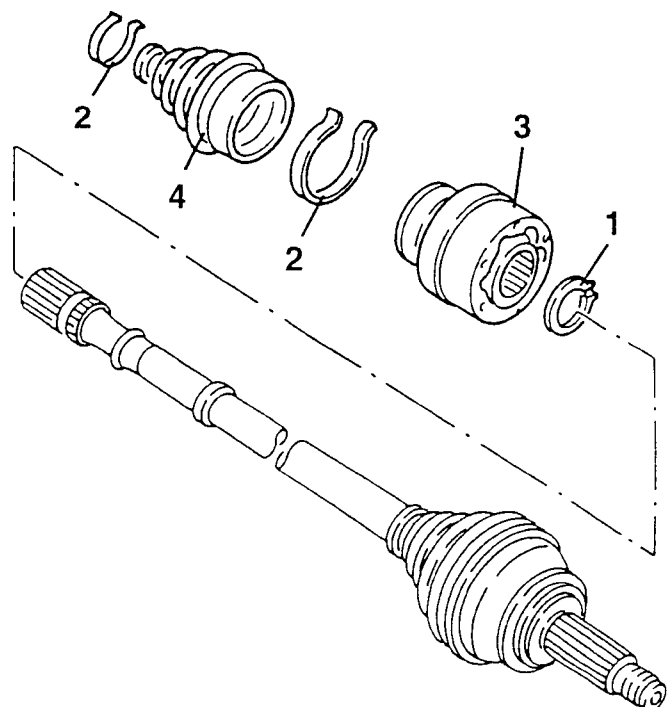
When refitting, tighten the nut fastening the axle shaft to the wheel hub as described in GROUP 44 - Wheels and hubs - "Front wheel upright (Boxer versions)".

DIS-ASSEMBLY OF JOINT  
ON GEARBOX SIDE

1. Remove the retainer ring.
2. Remove the gearbox side boot fastening clamps.
3. Pull the joint on the gearbox side off the axle shaft.
4. Separate the protective boot from the C.V. joint.

## CAUTION:

When refitting, change the boot and clamps.



**CHECKS**

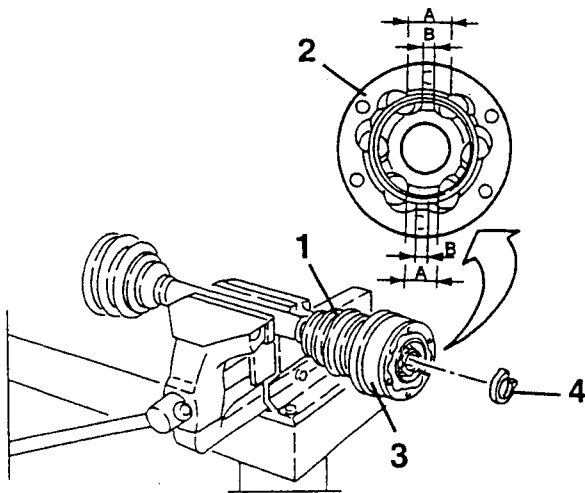
Degrease the joint components with fuel oil and check the balls and their housings for traces of wear and cracks.  
Check the shaft for distortion, cracks and signs of wear.

**REFITTING THE JOINT ON THE GEARBOX SIDE**

1. Fit a new boot on the axle shaft.
2. If previously dis-assembled, re-assemble the joint components as illustrated.

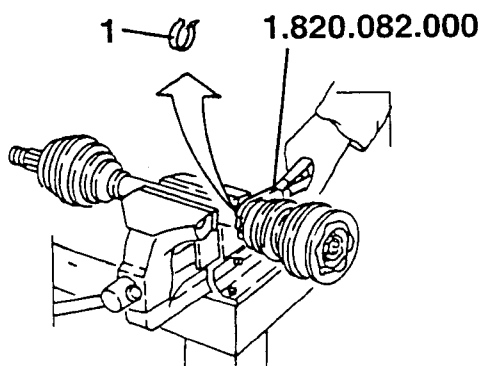
Fill the boot and grease the joint with 120 g of the specified grease.

3. Fit the joint on the gearbox side.
4. Fit the flexible retainer ring.

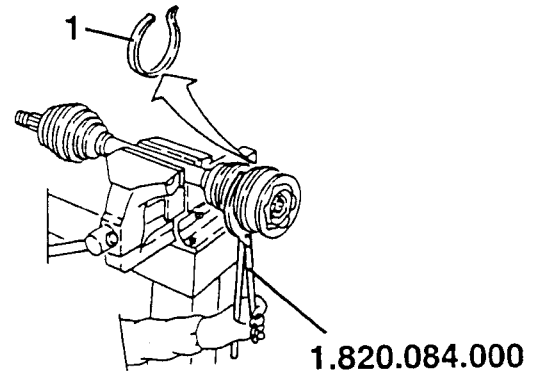


A = highest distance between ball housings  
B = smallest distance between ball housings

1. Using tool n° 1.820.082.000 fit the inner boot clamp.



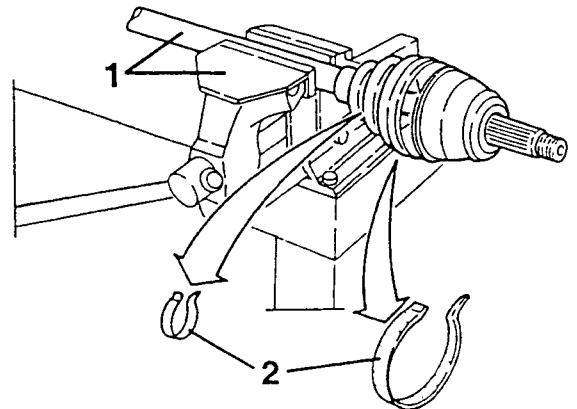
1. Using tool N° 1.820.084.000 fit the outer boot clamp.



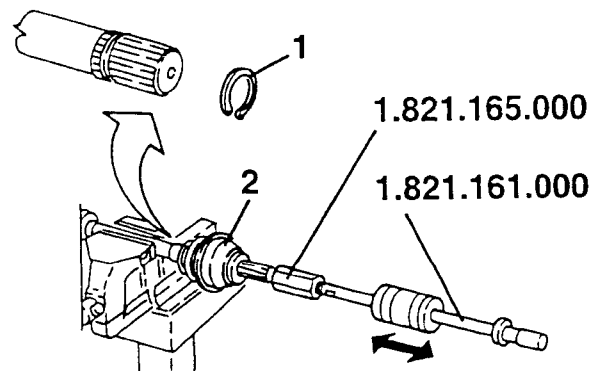
**DIS-ASSEMBLY OF THE JOINT ON THE WHEEL SIDE**

1. Fasten the axle shaft in a vice complete with protective jaws.
2. Remove the boot clamps on the wheel side.

When refitting, change the boot and clamps.



1. Remove the flexible retainer ring.
2. Using tools N° 1.821.165.000 and N° 1.821.161.000, remove the joint from the axle shaft.

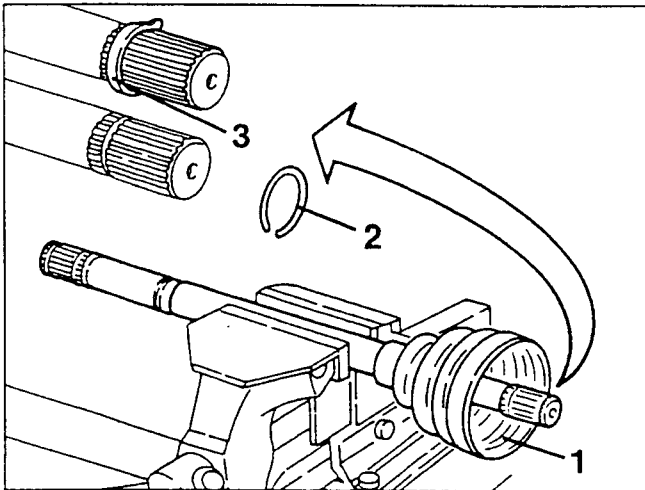


**CHECKS**

Degrease the joint components with fuel oil and check the balls and their housings for traces of wear and cracks.  
Check the shaft for distorsion, cracks and signs of wear.

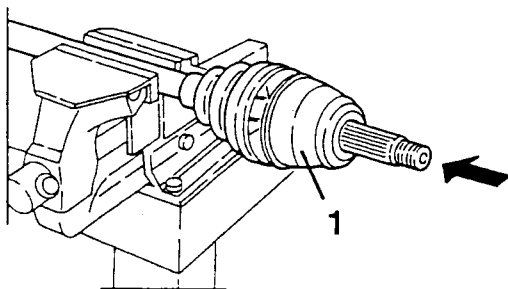
**REFITTING THE JOINT ON THE WHEEL SIDE**

1. Fit a new protective boot.
2. Position the flexible retainer ring.
3. Compress the flexible ring with the fastener clamp.

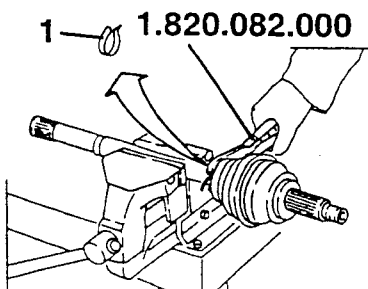


1. Position the C.V. joint on the axle shaft and push it into its housing using a soft mallet.

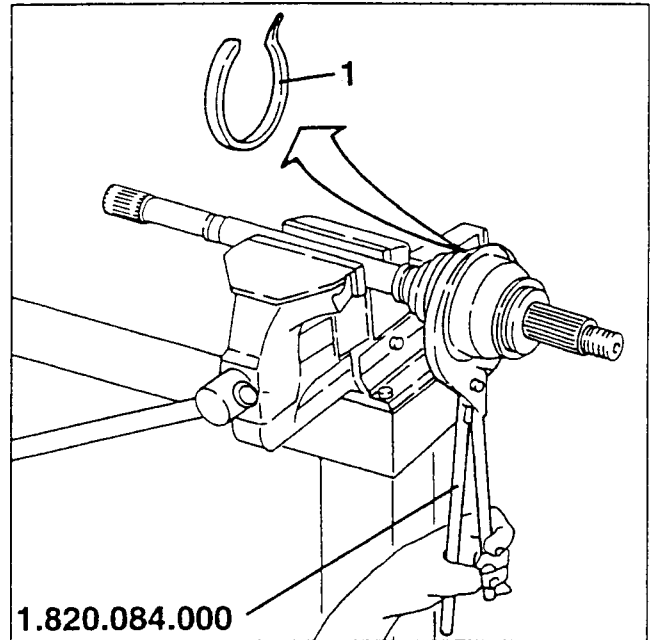
Fill the boot and grease the joint with appr. 120 g of the specified grease.



1. Using tool N° 1.820.082.000 fit the boot inner clamp.



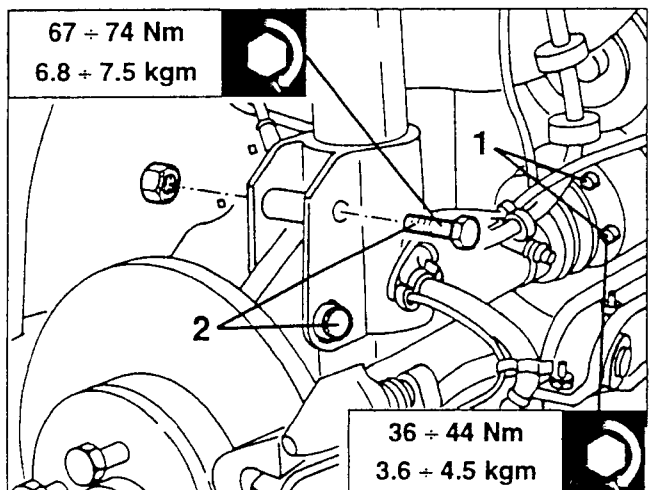
1. Using tool N° 1.820.084.000 fit the boot outer clamp.



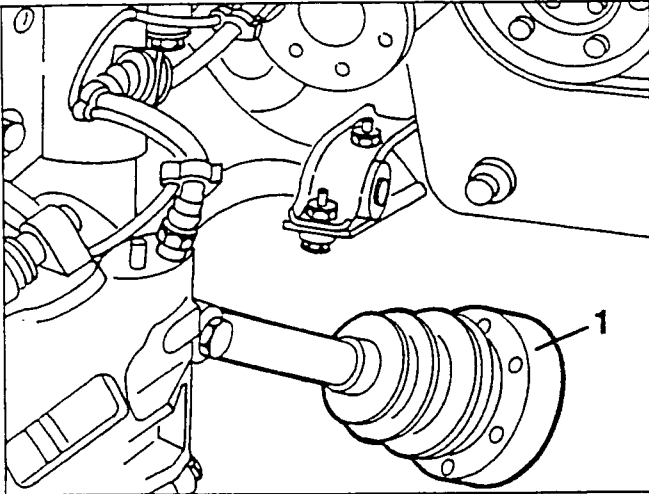
**REMOVAL/REFITTING OF INTERMEDIATE SHAFT**

- Set the car on a lift.
- Disconnect the battery (-) terminal.
- Raise the car.
- Remove the wheel and mudflap from the right front wheel house.
- Working from the right wheelhouse, disconnect the electrical connection of the brake pad wear sensor.
- Slacken the screw fastening the ABS inductive sensor support bracket.

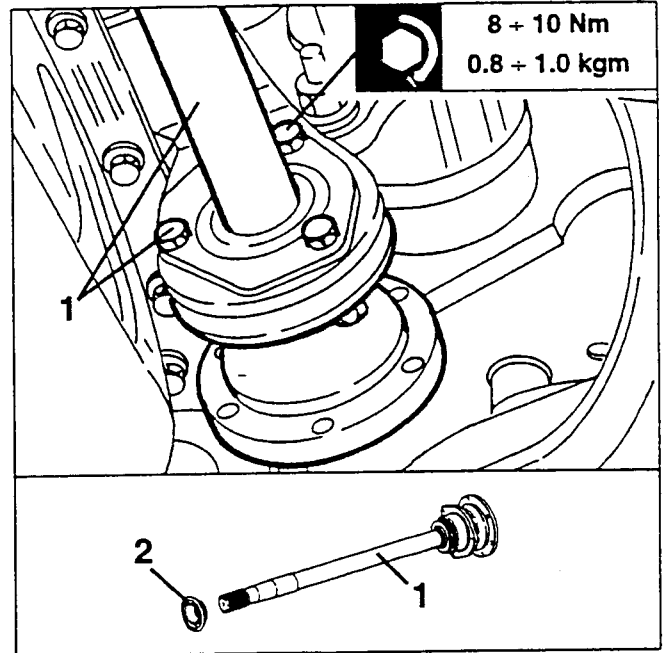
1. Slacken the two bolts fastening the left constant velocity joint from the intermediate shaft.
2. Slacken the two bolts fastening the right upright to the shock absorber, then remove the upper bolt only.



1. Pull back the axle shaft just enough to disconnect it from the intermediate shaft as illustrated.



1. Slacken the three fastening bolts and remove the intermediate shaft.  
2. Retrieve the dust guard cup.



**DESCRIPTION**

With the constant velocity joints the axle shafts form the set of devices which transmit motion from the gearbox to the driving wheels.

The assembly of these devices, commonly called "transmission" when in conjunction with the gearbox, comprises the following:

- right and left axle shafts;
- constant velocity joints on wheel and gearbox side.
- intermediate shaft.

The high-resistance steel axle shafts (6) have grooved ends to enable coupling with the constant velocity joints (1) and (5).

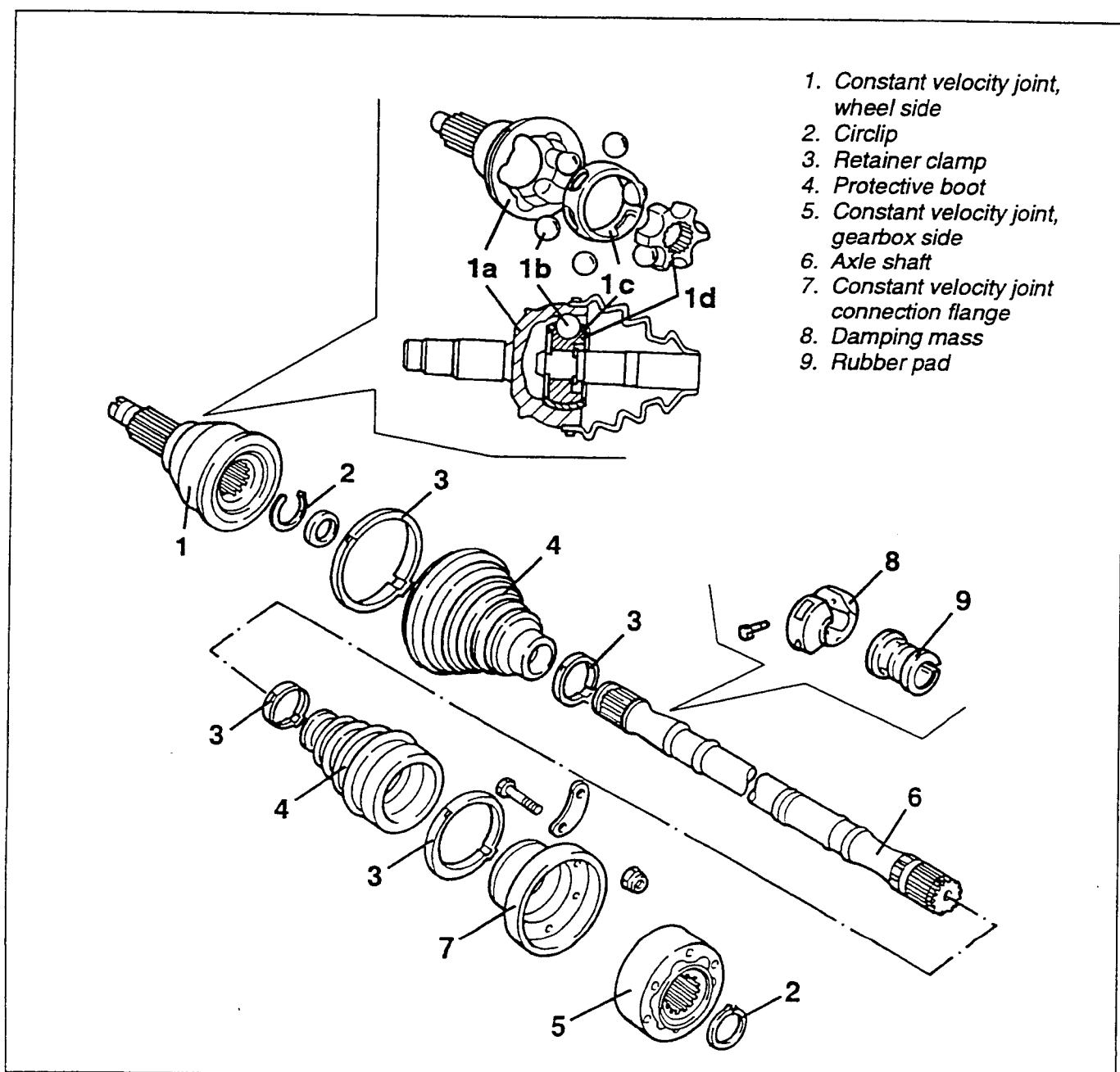
The housings for the joint retainer circlips (2) are on the ends.

The constant velocity joints are formed of an inner core (1d) known as "drive", keyed onto the input shaft and an outer shell (1a) called "driven", which forms the output element of the joint.

The inner core has six spherical grooves on its outer surface containing six balls (1b), held in place by a cage (1c).

These balls are the parts which actually transmit the motion and are also located in other grooves machined on the inner surface of the shell.

The left-hand axle shaft is fitted with a vibration damping mass (8) formed of two half shells and a rubber pad (9) for positioning.

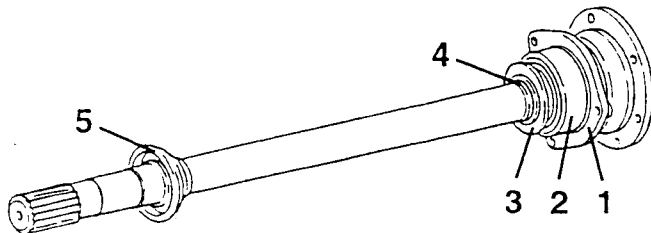


1. Constant velocity joint, wheel side
2. Circlip
3. Retainer clamp
4. Protective boot
5. Constant velocity joint, gearbox side
6. Axle shaft
7. Constant velocity joint connection flange
8. Damping mass
9. Rubber pad



The intermediate shaft, also with grooved ends and, like the axle shafts, made from high-resistance steel, has the purpose of connecting the differential output with the right axle shaft to which it is connected by a flange.

For this purpose, to limit the projection between the connection points, the intermediate shaft is supported by a housing machined especially on the gearbox.



1. Bearing retainer plate
2. Ball bearing
3. Flexible washer
4. Bearing retainer ring
5. Cup for bearing

## REMOVAL/REFITTING

Refer to the instructions for the TD engine.

## DIS-ASSEMBLY OF JOINT ON GEARBOX SIDE

Refer to the instructions for the TD engine.

## REFITTING THE JOINT ON THE GEARBOX SIDE

Refer to the instructions for the TD engine.

## DIS-ASSEMBLY OF THE JOINT ON THE WHEEL SIDE

Refer to the instructions for the TD engine.

## REFITTING THE JOINT ON THE WHEEL SIDE

Refer to the instructions for the TD engine.

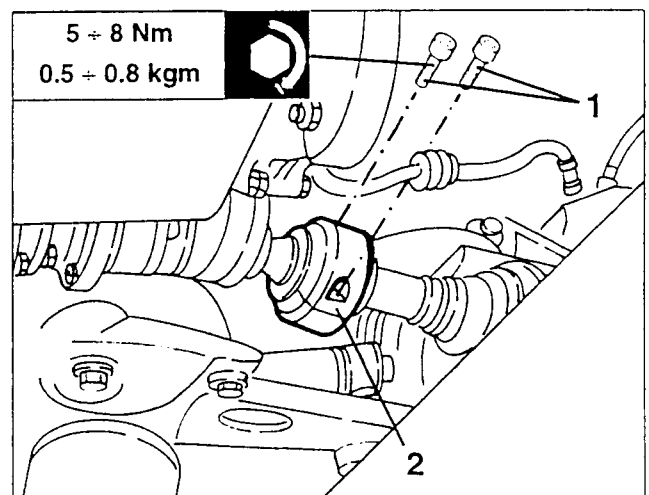
## REMOVAL/REFITTING OF INTERMEDIATE SHAFT

Refer to the instructions for the TD engine.

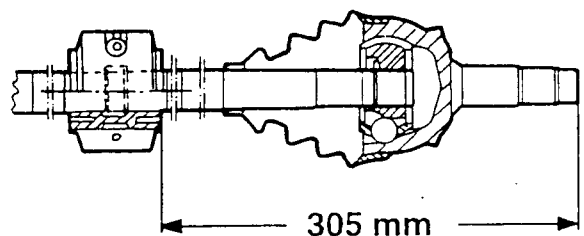
## LEFT-HAND AXLE SHAFT DAMPING MASS

### REMOVING/REFITTING

- On the left-hand-side of the car, proceed as follows:
- 1. Slacken the screws fastening the two half shells forming the damping mass.
- 2. Remove the mass together with the rubber pad below.



Refit reversing the sequence followed for removal taking care to position the damping mass observing the dimension on the diagram.





**DESCRIPTION**

The axle shafts, together with the constant velocity joints and the tripod joints, form the set of device which transmit motion from the gearbox to the driving wheels.

The assembly of these devices, in conjunction with the gearbox is commonly known as the "transmission" and it comprises the following:

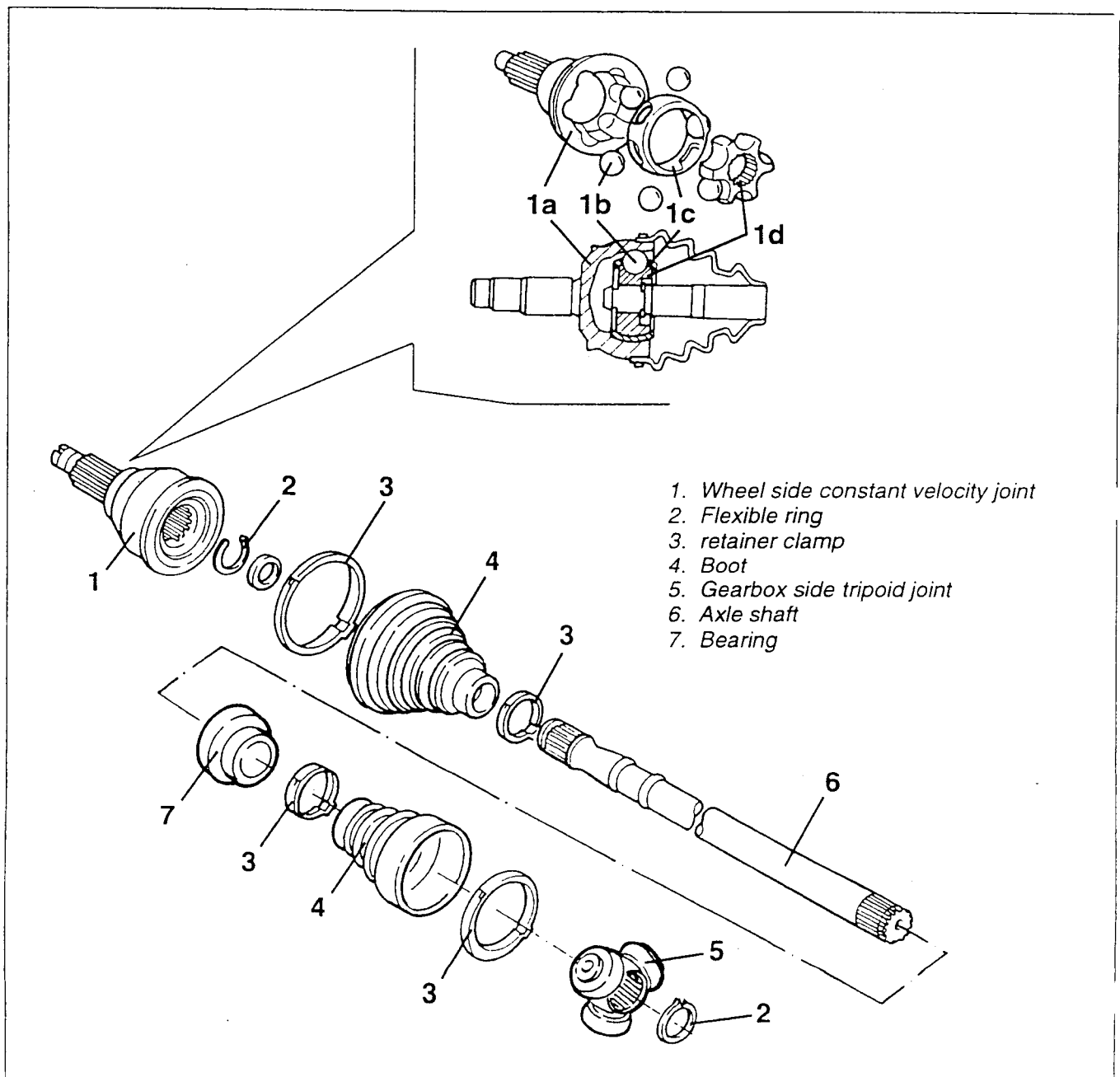
- right and left axle shafts;
- wheel side constant velocity joints;
- gearbox side tripod joints.

The axle shafts (6), made from very tough steel, have with grooved ends to enable coupling with the constant velocity joint (1) and tripod joint (5). On the ends there are the housings for the retainer circlips (2) of the joints themselves.

The constant velocity joints are formed of an inner core (1d) called "drive", shrunk onto the input shaft, and an outer shell (1a) called "driven", which forms the output of the joint.

The inner core has six spherical grooves on the outside containing the same number of balls (1b), held in place by a container cage (1c).

These balls, are the actual motion transmitting element, at the same time they are housed in the same number of grooves on the inner surface of the shell. The right axle shaft is fitted with a vibration damping mass (8) formed of two halves and a rubber plug (9) for positioning.





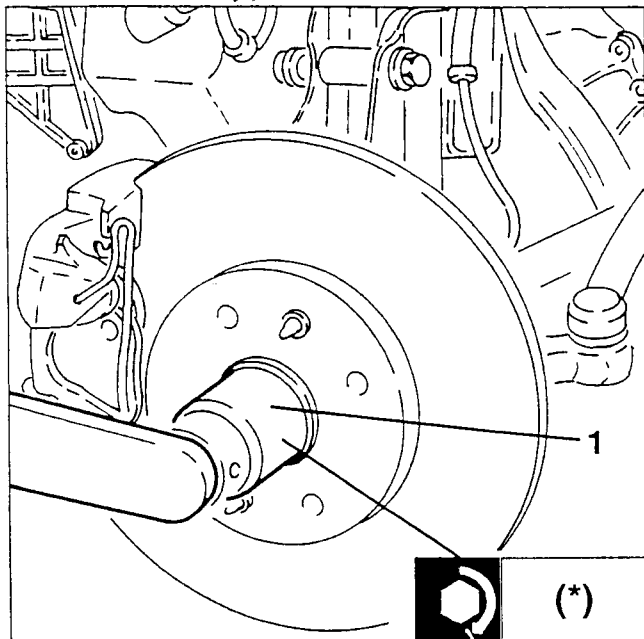
## REMOVING/REFITTING

The following procedure refers to removing/refitting the left axle shaft.

E' it is however possible to use the whole procedure also for removing the right axle shaft.

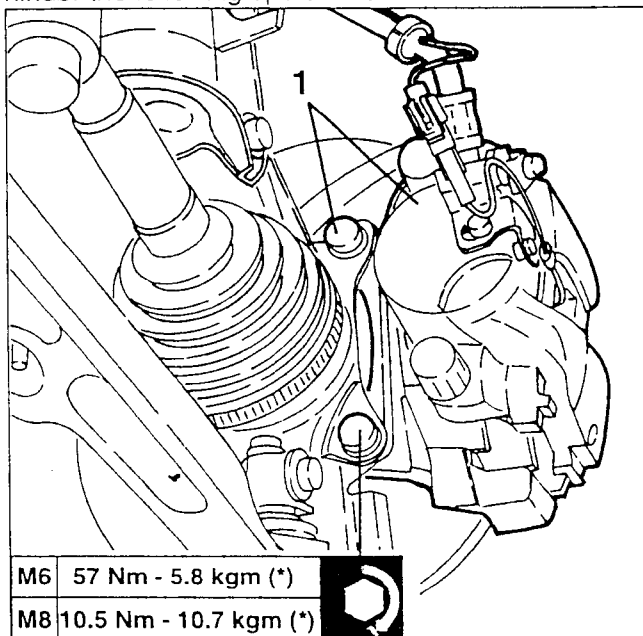
- Set the car on a lift.
- Remove the left front wheel.

1. Remove the caulking and slacken the nut fastening the constant velocity joint to the wheel hub.



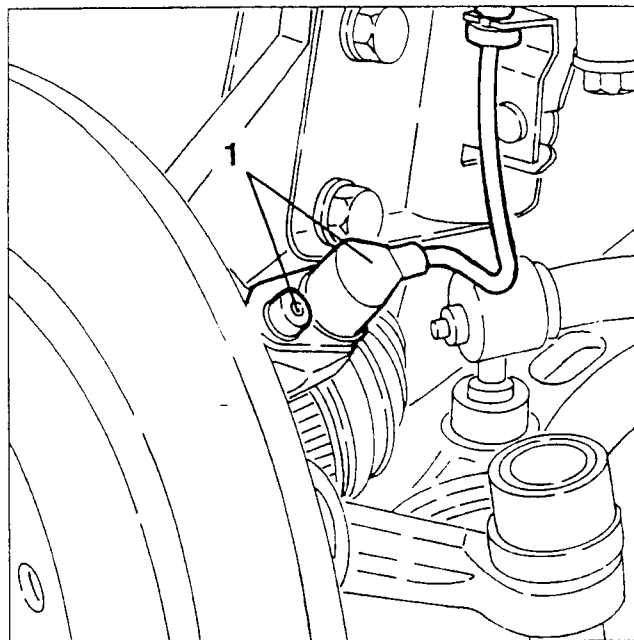
(\*): When refitting tighten the fastening nut working as described in GROUP 44.

1. Slacken the two fastening screws and remove the brake caliper complete without disconnecting the hoses and fasten it on one side so that it does not hinder the following operations.

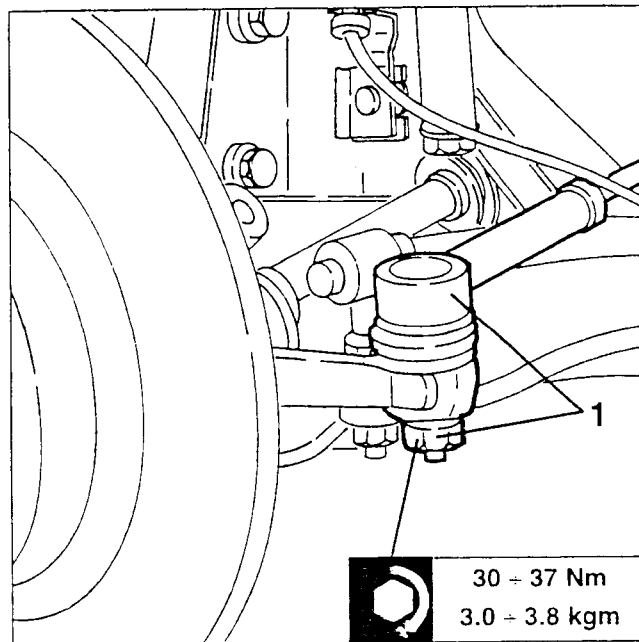


(\*): Screws with "Drilloc"; must be changed every time they are tightened or loosened.

1. Slacken the fastening screw and remove the A.B.S. inductive sensor from the wheel upright.



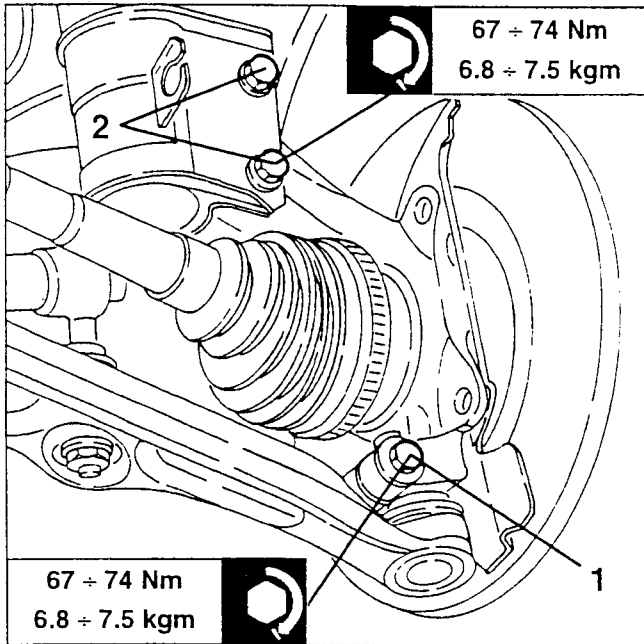
1. Slacken the fastening nut and disconnect the track rod from the wheel upright.



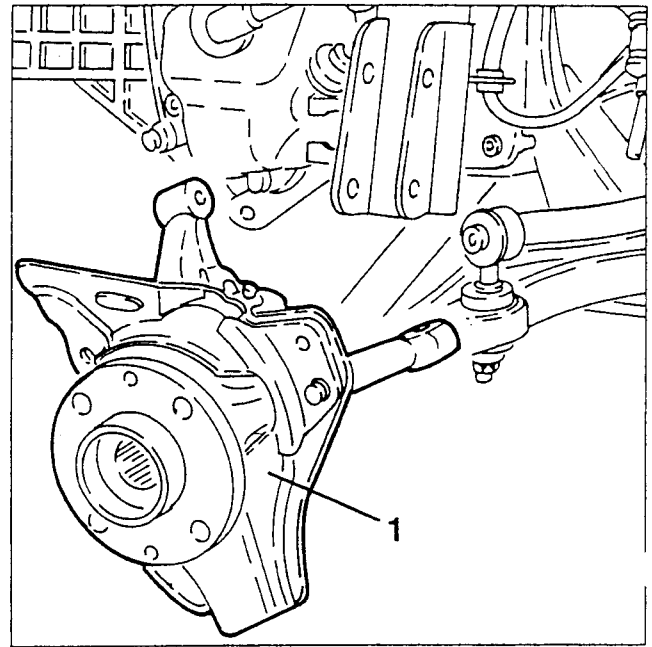
30 - 37 Nm  
3.0 - 3.8 kgm



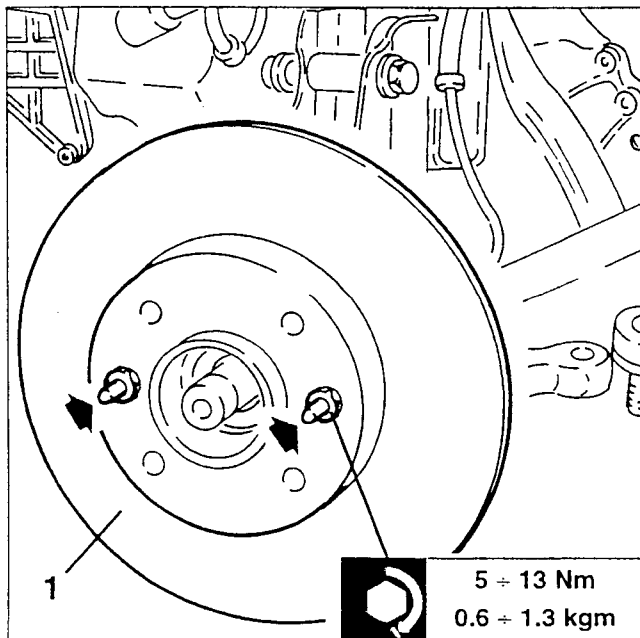
1. Slacken the bolt fastening the wishbone to the wheel upright.
2. Slacken the two bolts fastening the upright to the shock absorber.



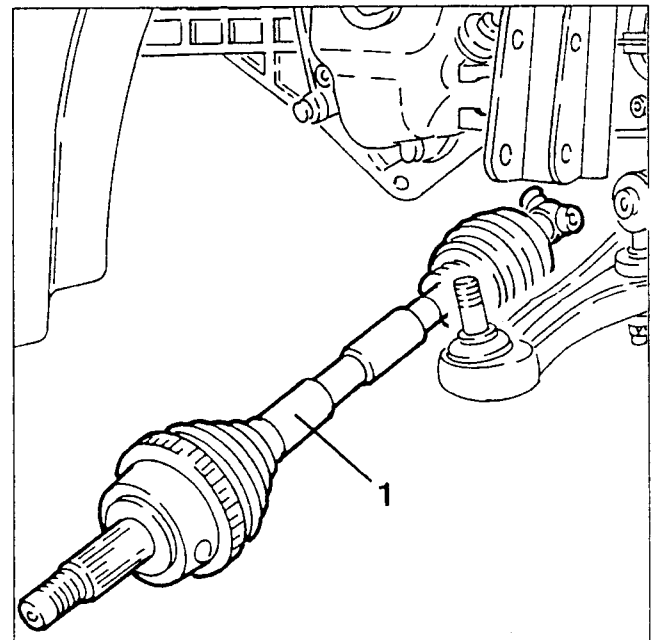
1. Withdraw and remove the wheel upright complete



1. Slacken the two fasteners and remove the brake disk.



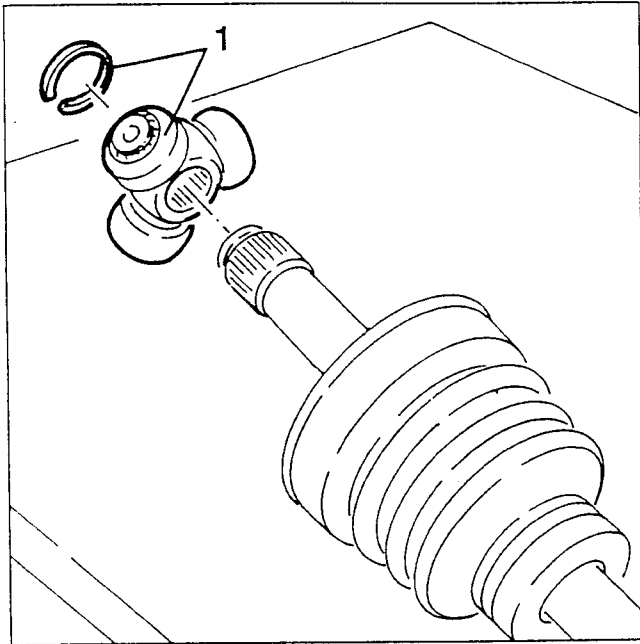
1. Slacken the clamp fastening the boot to the differential tripod joint, then withdraw and remove the axle shaft complete.



### DISASSEMBLING THE GEARBOX SIDE CONSTANT VELOCITY JOINT

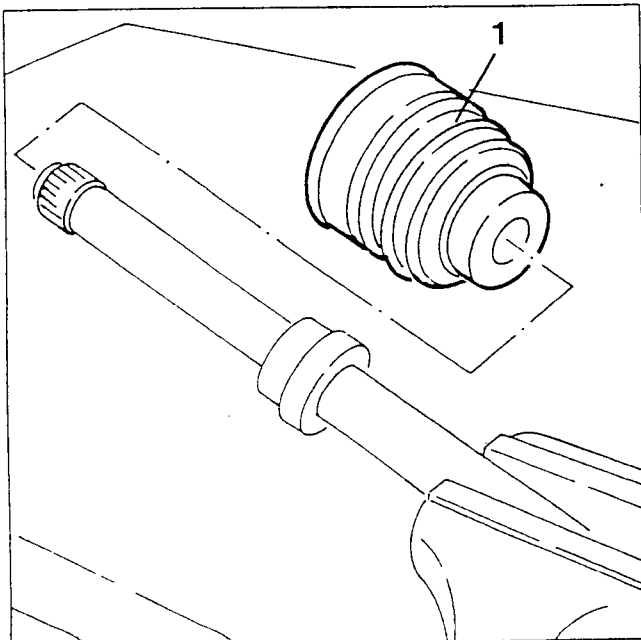
1. Remove the retainer circlip, then withdraw and remove the tripod joint.

**WARNING:** If any faults are found in the tripod joint it must be changed.

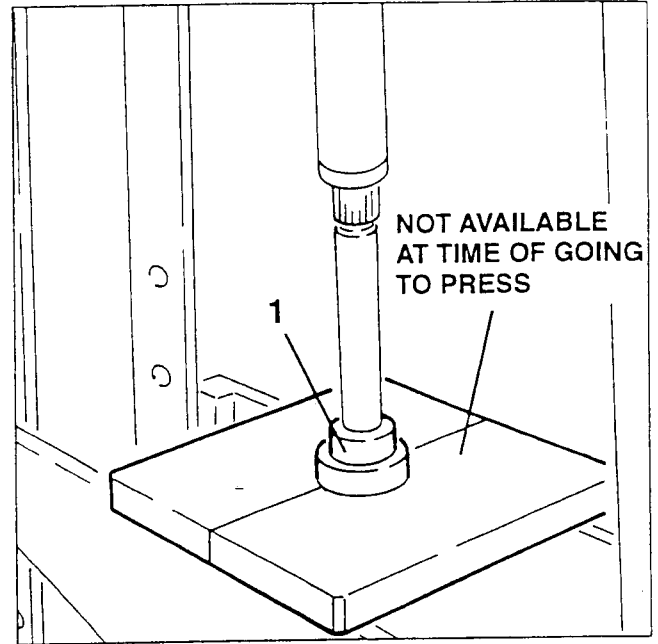


1. Slacken the fastening clamp and remove the boot.

**WARNING:** When reassembling replace the boot and its fastening clamps.

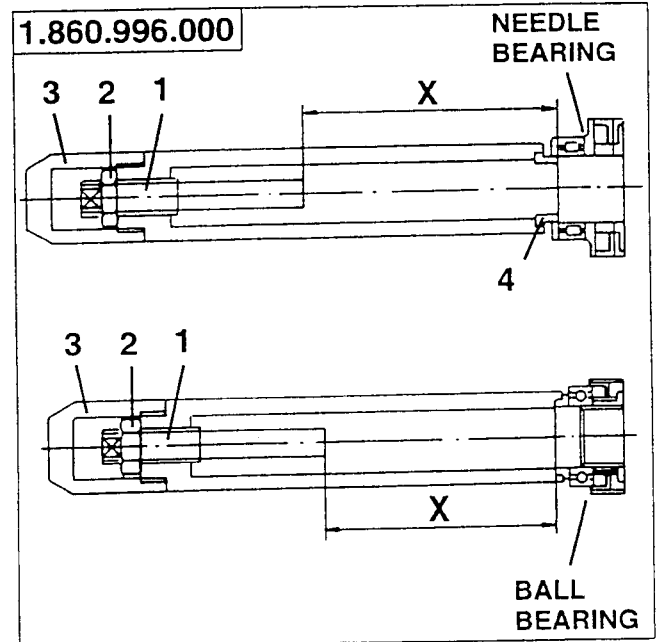


1. Working under the press and using half plates no. ...., prise and remove the bearing from the axle shaft.



### REFITTING THE GEARBOX SIDE CONSTANT VELOCITY JOINT

For assembling the bearing on the axle shaft use drift no. 1.860.996.000.



1. Screw for adjusting bearing force-fitting dimension
2. Screw locknut
3. Drift to be inserted when force the bearing
4. Adapter for force-fitting needle bearings

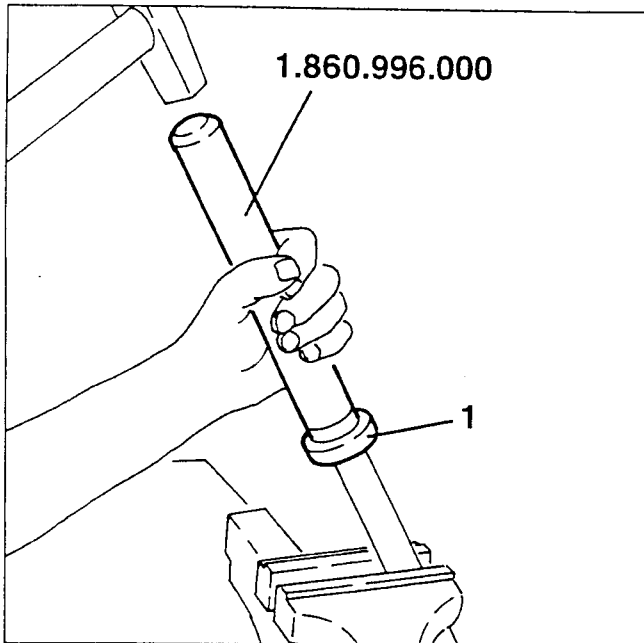
Adjust the above-mentioned tool so that dimension X for positioning the bearing is as specified.

| Dimension "X" for positioning bearing (mm) |           |           |
|--------------------------------------------|-----------|-----------|
| Right axle shaft                           | 108.8 (1) | 107.7 (2) |
| Left axle shaft                            | 143.8 (1) | 142.7 (2) |

(1): needle bearing

(2): ball bearing

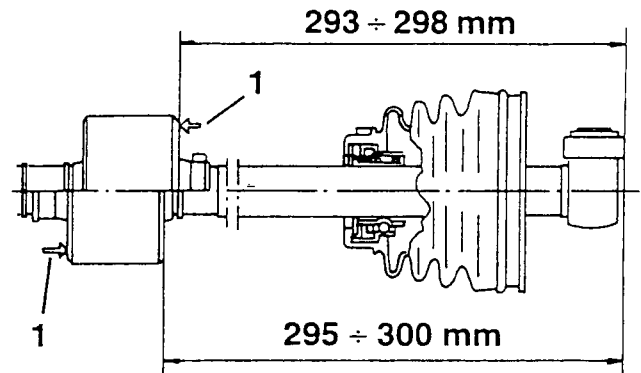
1. Using tool no. 1.860.996.000 adjusted as described previously, force fit the bearing on the shaft until the end contact screw of the tool contacts the axle shaft. This way correct positioning of the bearing is guaranteed.



## RIGHT AXLE SHAFT DAMPING MASS

On the right axle shaft a vibration damping mass is installed.

When disassembling from the axle shaft it must be re-assembled at the specified position.




(1): Direction of assembly

- Fit the boot on the bearing and fasten it with its clamp.  
Fit the tripod joint on the axle shaft and fasten it with the retainer circlip.

## DISASSEMBLING THE WHEEL SIDE CONSTANT VELOCITY JOINT

See the instructions for  TD

## REMOVING THE WHEEL SIDE CONSTANT VELOCITY JOINT





















See the instructions for  TD

# 145

## GEARBOX

21

### LIST OF CONTENTS

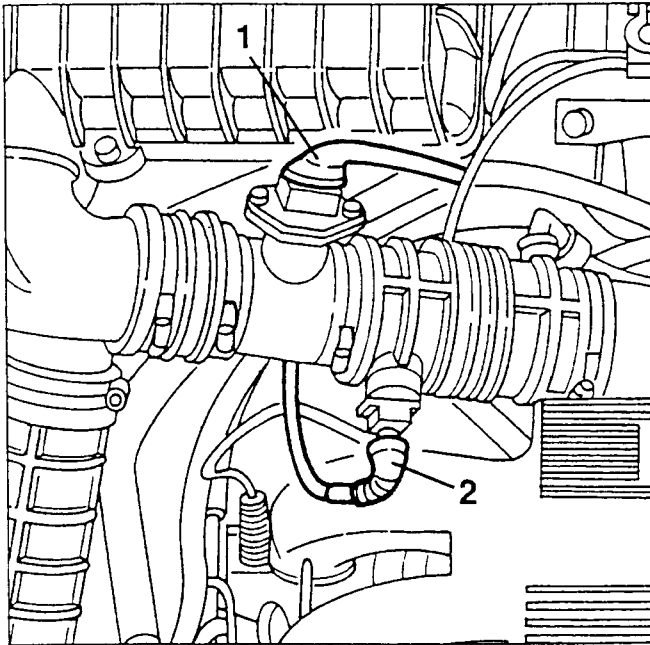
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(\*): See instructions given for  T. SPARK  
16V

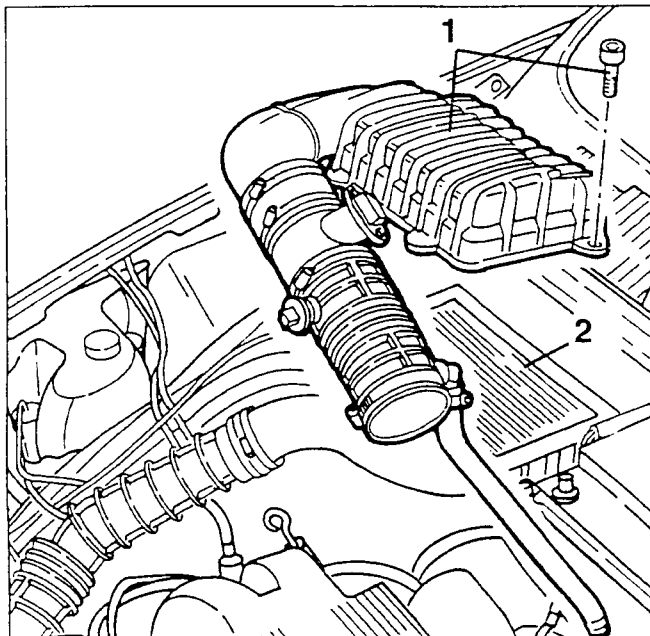


**REMOVAL/REFITTING**

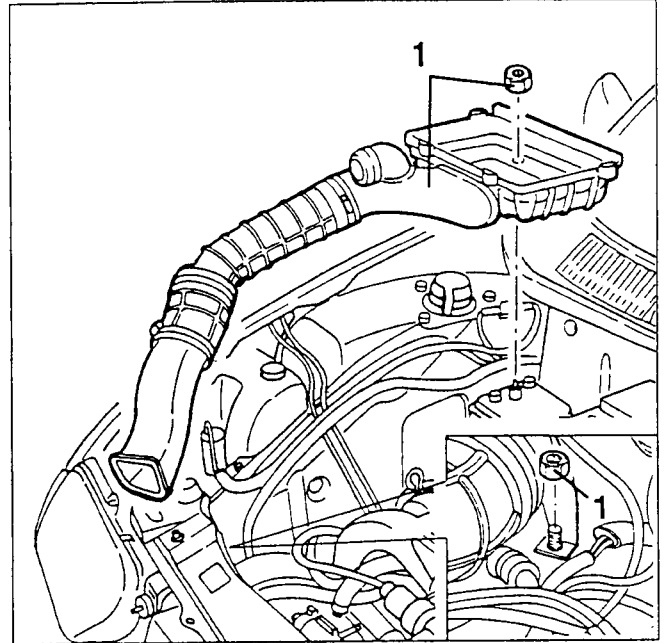
- Set the car on a lift.
  - Remove the battery (see GROUP 55).
  - Remove the gearbox cover (see GROUP 70).
  - Remove the radiator grille and the front bumper (see GROUP 70).
  - Remove the resonator
1. Disconnect the electrical connection from the air flow meter.
  2. Disconnect the electrical connection from the intake air temperature sensor.



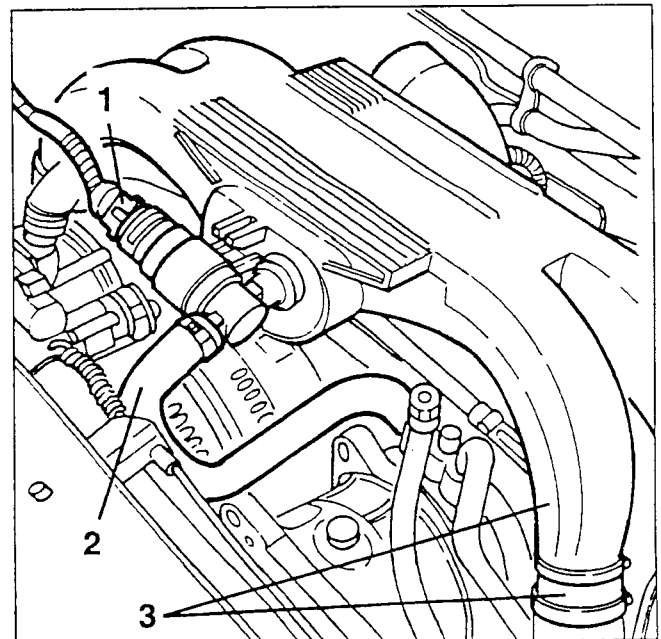
- Disconnect the oil vapour recovery pipe from the engine oil filler.
  - Disconnect the corrugated sleeve from the intake box.
1. Slacken the four fastening screws and remove the air cleaner cover complete with sleeves.
  2. Remove the filtering element.



1. Slacken the three nuts fastening the air cleaner box and the front bolt fastening the air inlet sleeve and remove it.



1. Disconnect the electrical connection from the idle speed actuator.
2. Disconnect the air intake pipe.
3. Slacken the clamps fastening the bodies, then remove the intake box releasing it from the cables and from the pipes fastened to the brackets below.



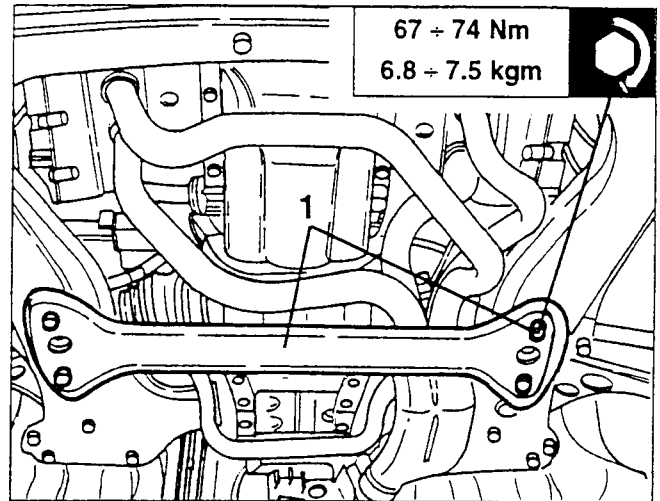
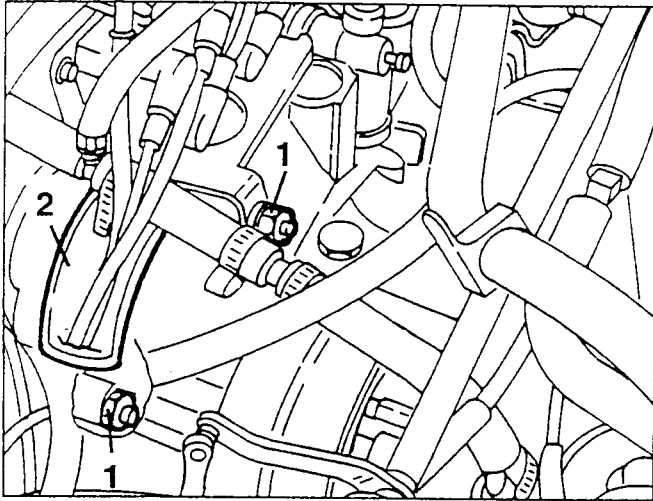
**NOTE:** Suitably plug the intake ducts to prevent foreign matter from getting into them.





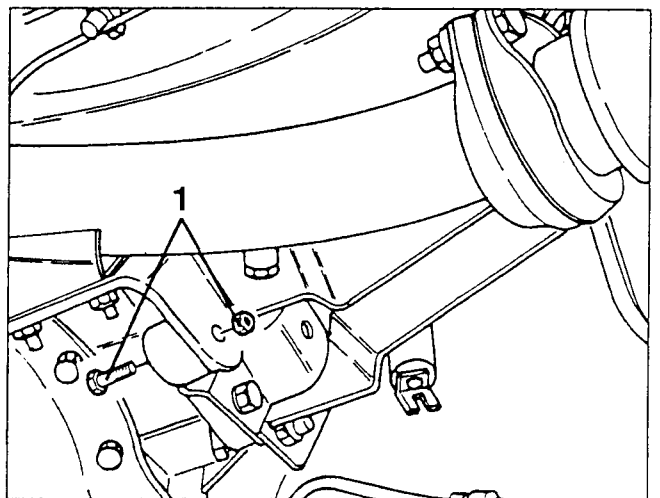
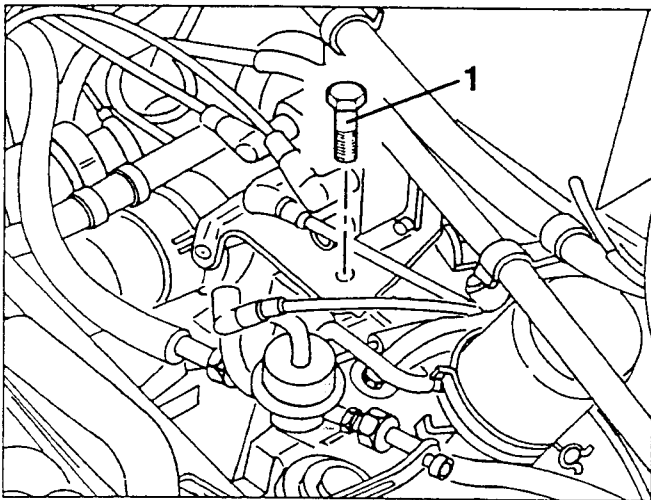
1. Slacken the two bolts fastening the starter motor.
2. Retrieve the protective cover.

- Raise the car.
1. Slacken the fastening screws and remove the engine mount frame crossmember.



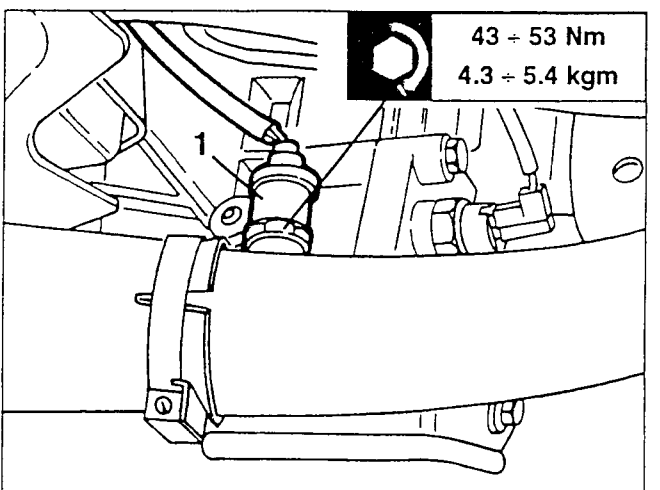
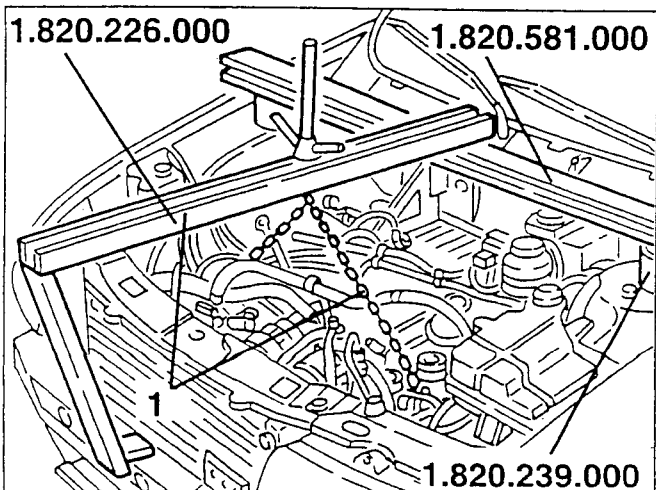
1. Slacken the screw fastening the ignition coils support bracket.

1. Slacken the bolt fastening the exhaust manifold support bracket.

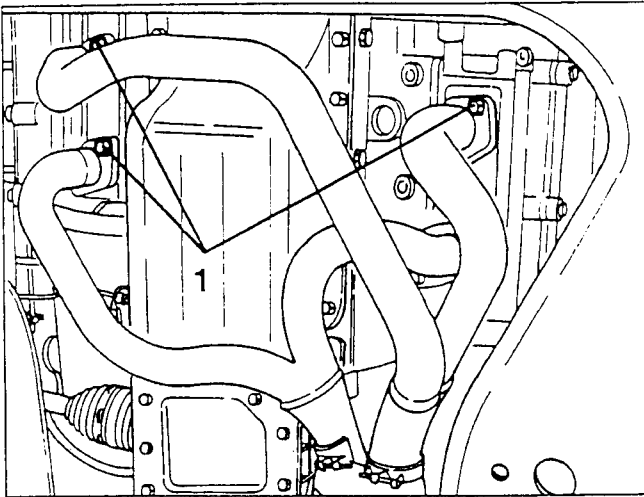


1. Using tools N° 1.820.239.000, N° 1.820.581.000 and N° 1.820.226.000 suitably support the engine.

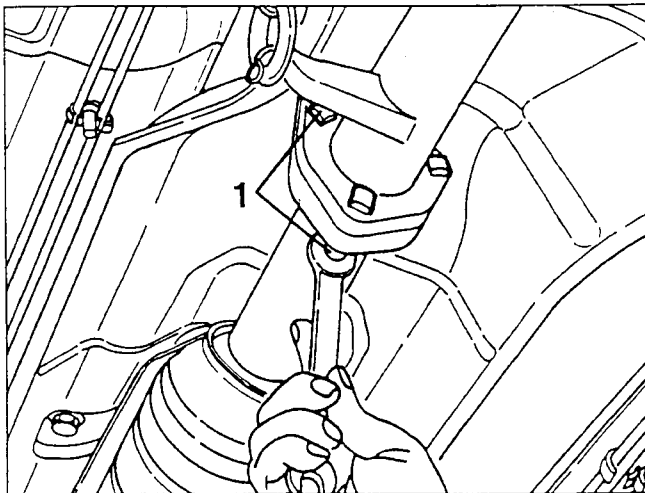
1. Remove the lambda sensor from the exhaust pipe.



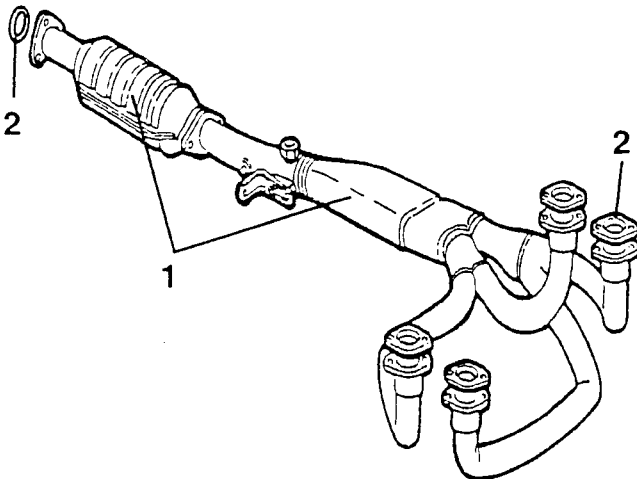
1. Slacken the nuts fastening the exhaust manifolds to the cylinder heads.



1. Slacken the three bolts fastening the catalytic converter to the exhaust silencers.

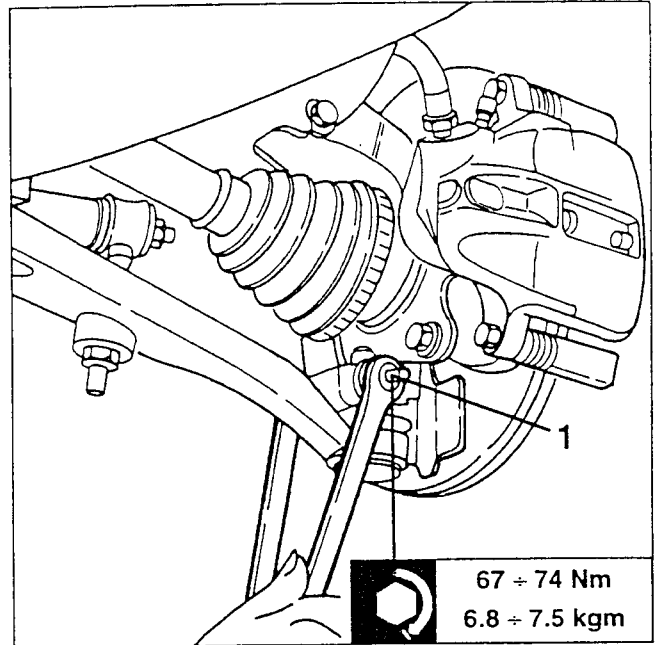


1. Remove the exhaust manifolds complete with the catalytic converter.  
2. Retrieve the seals.  
- Remove the catalyst heat guard.

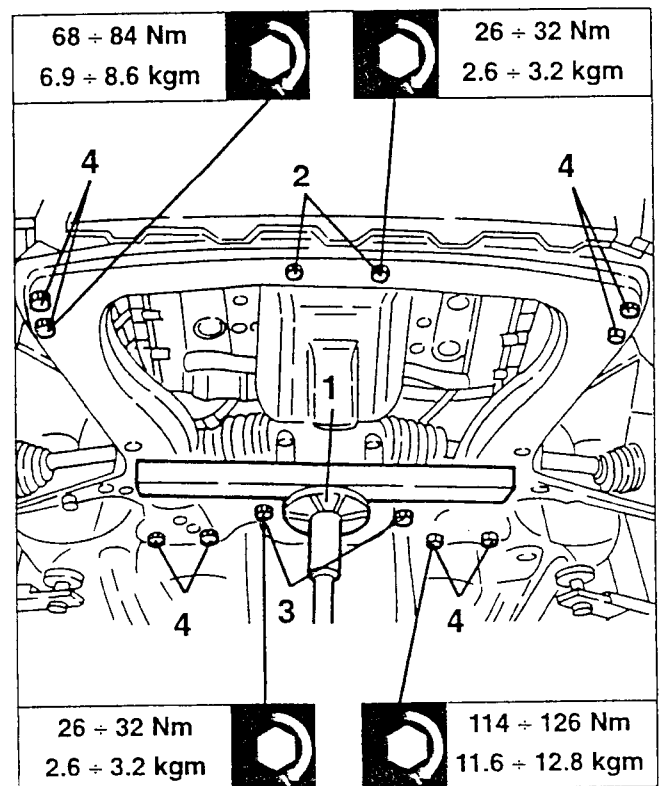


- Remove the front wheels.

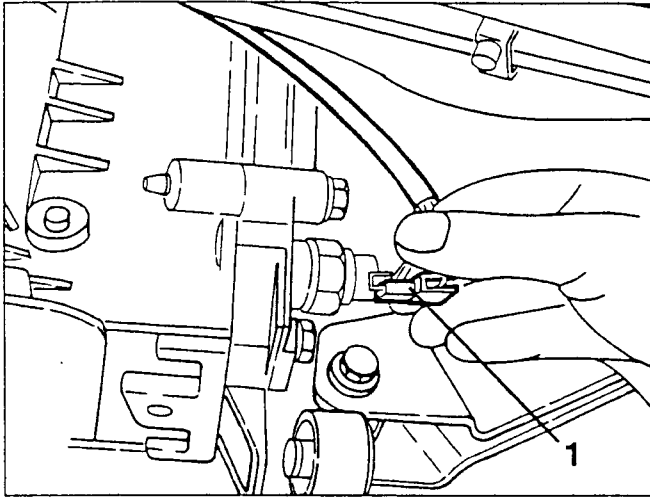
1. Slacken the bolts fastening the wishbones to the wheel hubs.



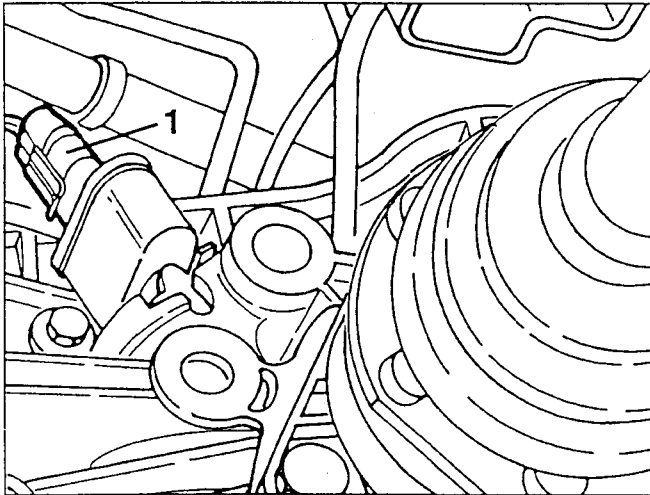
1. Suitably support the engine mount frame with a jack.  
2. Slacken the two screws fastening the frame to the engine flexible mount.  
3. Slacken the two screws fastening the frame to the gearbox flexible mounts.  
4. Slacken the screws fastening the frame to the body and remove it complete with wishbones and stabilizer bar.



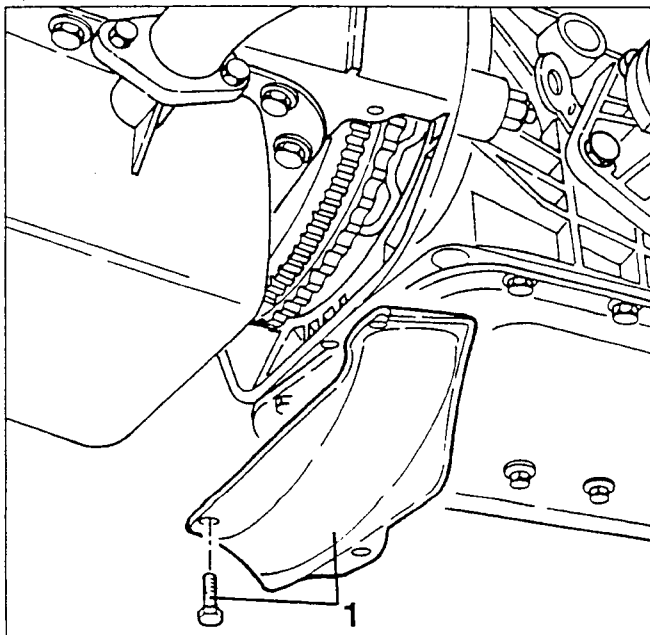
1. Disconnect the electrical connection from the reversing switch.



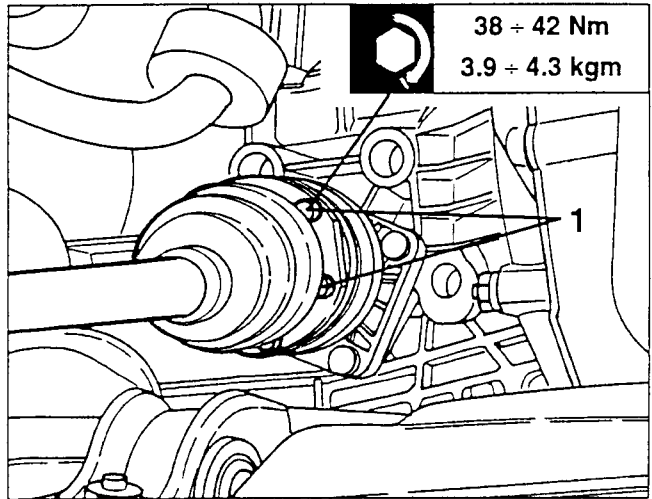
1. Disconnect the electrical connection from the speedometer sensor.



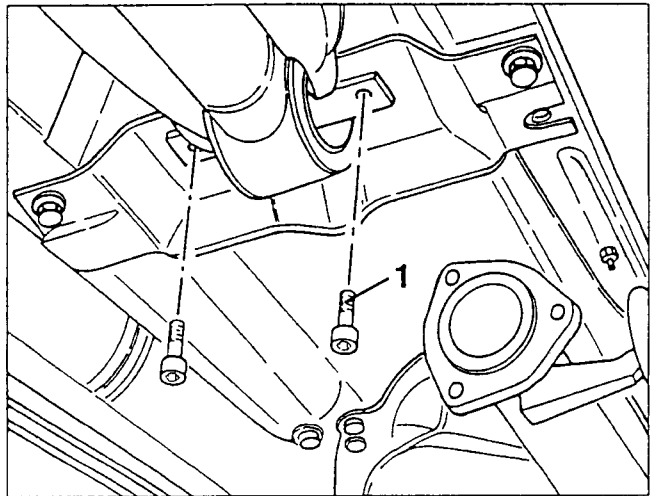
1. Slacken the three fastening screws and remove the flywheel guard.



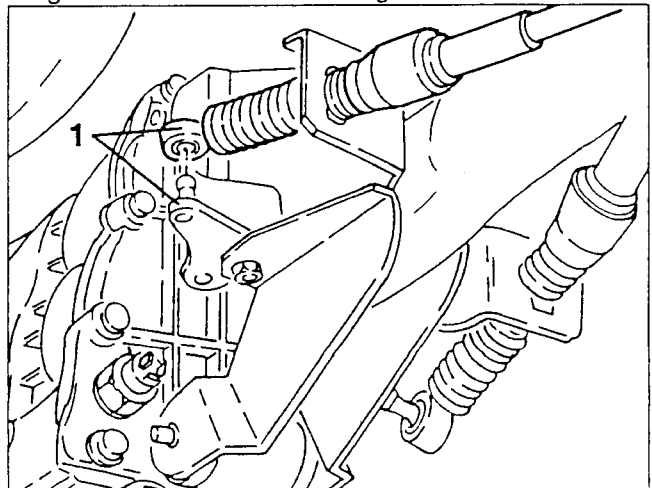
1. Slacken the fastening screws and disconnect the axle shafts.



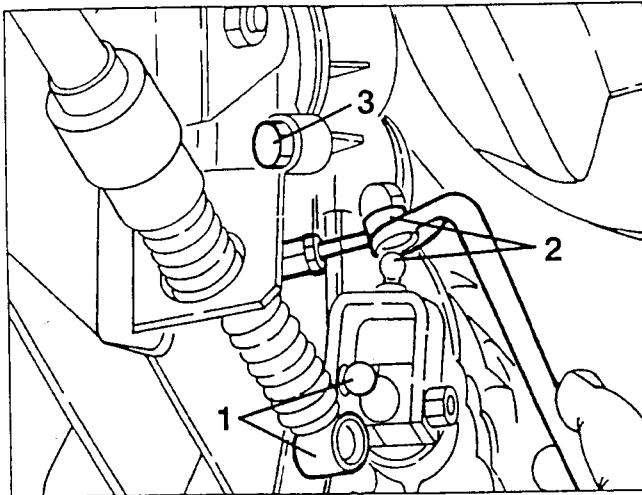
1. Slacken the two screws fastening the power unit rear support to the body and lower the power unit rearwards using the support tools.



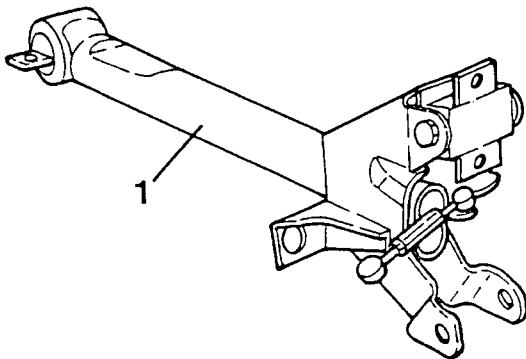
1. Disconnect the gear selector cable from the fastening on the transmission linkage.



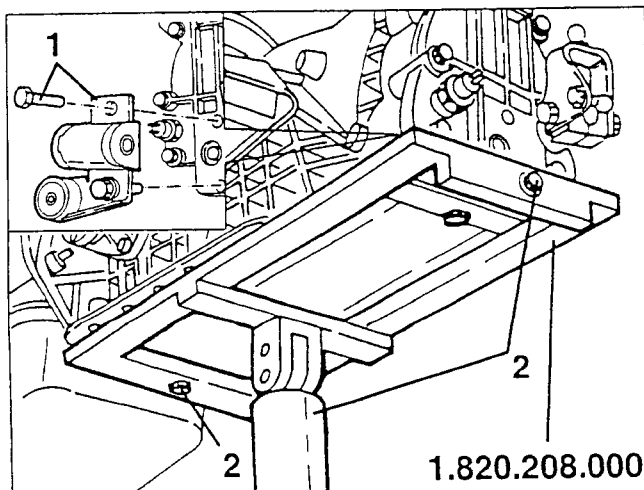
1. Disconnect the gear engagement cable from its fastening.
2. Disconnect the transmission rod of the gear selector cable from its fastening.
3. Slacken the bolt and the two upper screws fastening the rear power unit support to the gearbox cover.



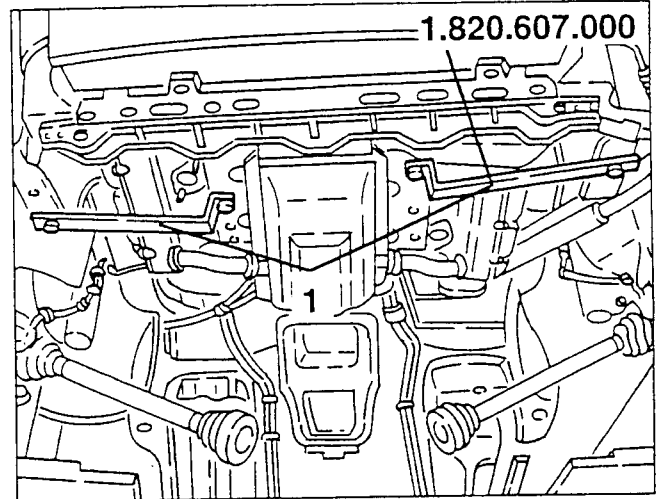
1. Remove the rear power unit support taking care to take the gearshift control cables off it.



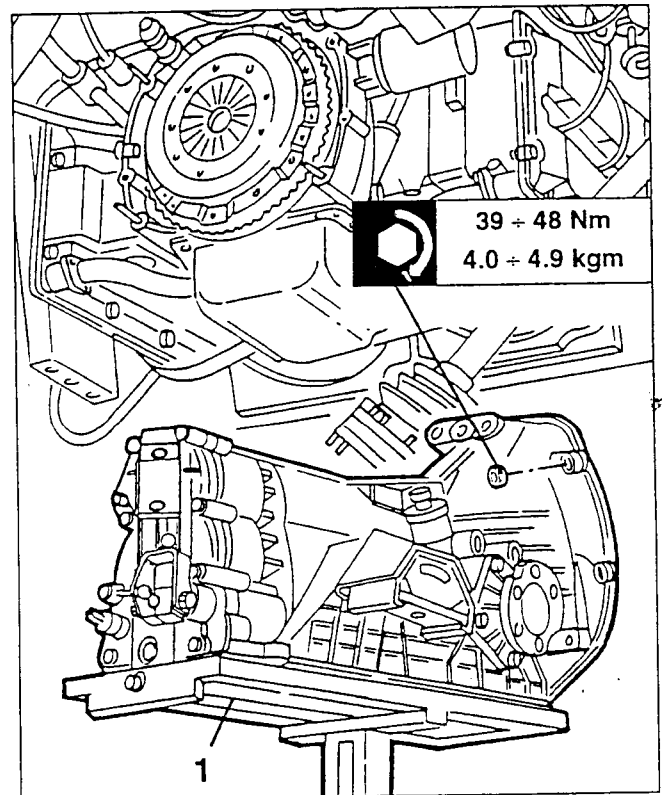
1. Slacken the two fastening screws and remove the lower flexible mount.
2. Install stand N° 1.820.208.000 fitted with a hydraulic jack as illustrated under the gearbox sump.



1. Fit two safety brackets N° 1.820.607.000 to support the engine.



1. Slacken the fastening nuts, suitably move the gearbox-differential unit to free it from the dowels on the engine and to release the clutch shaft from the driven plate. Then lower the hydraulic jack and remove the gearbox-differential unit.

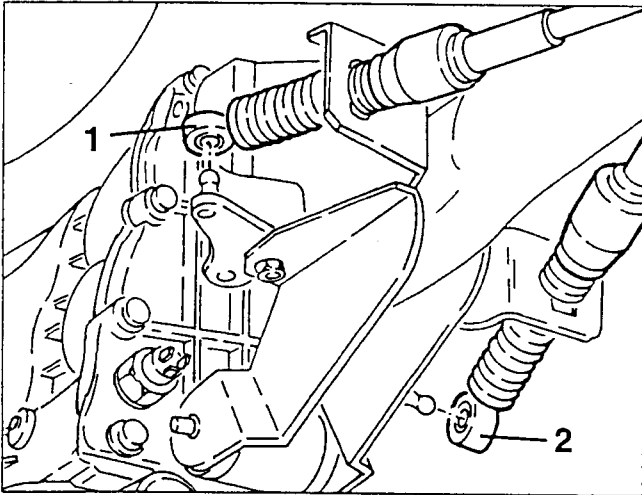


## GEARBOX CONTROL CABLES

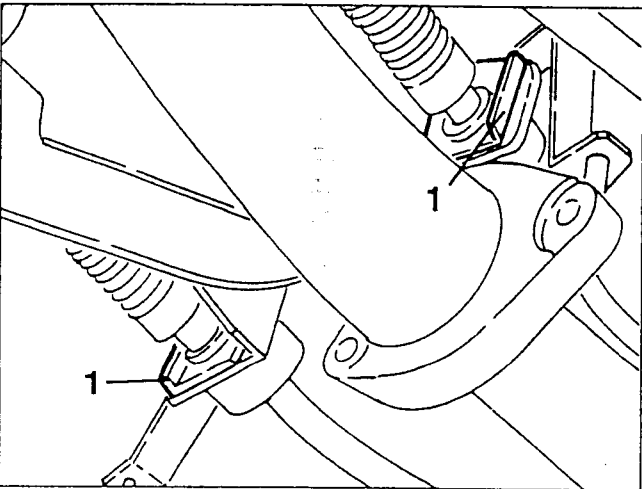
### REMOVAL/REFITTING

- Remove the catalytic converter and the corresponding heat guard (see GROUP 10).

1. Disconnect the gear selector cable from the fastening on the transmission linkage.
2. Disconnect the gear engagement cable from its fastening.

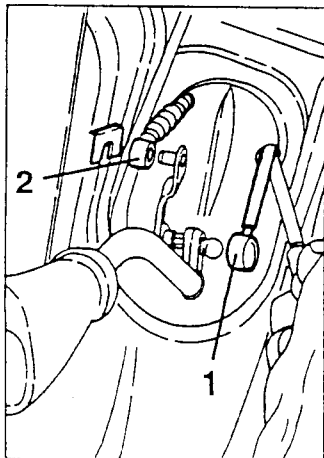


1. Remove the two gearshift control cable fastening clips from the power unit rear support.



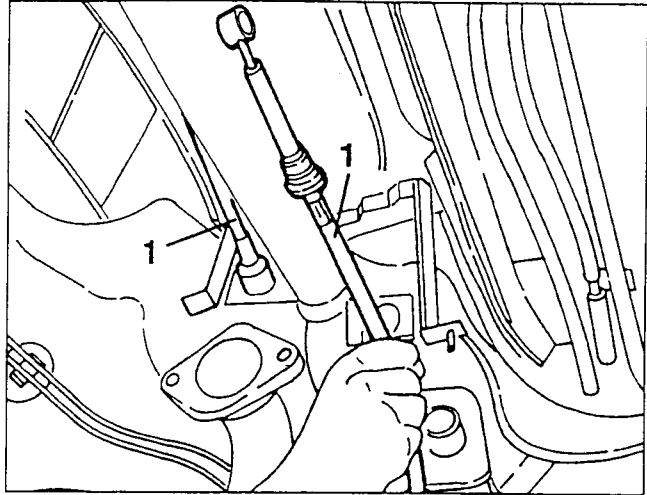
- Remove the gearbox centre console (see GROUP 70).

1. Disconnect the gear selector cable from the fastening on the control lever.
2. Remove the catch and disconnect the gear selector cable from the control lever.



- Raise the car.

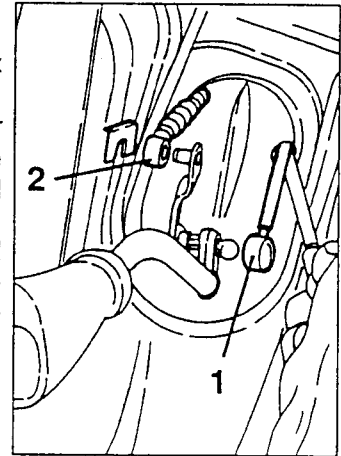
1. Withdraw and remove the two gearshift control cables.



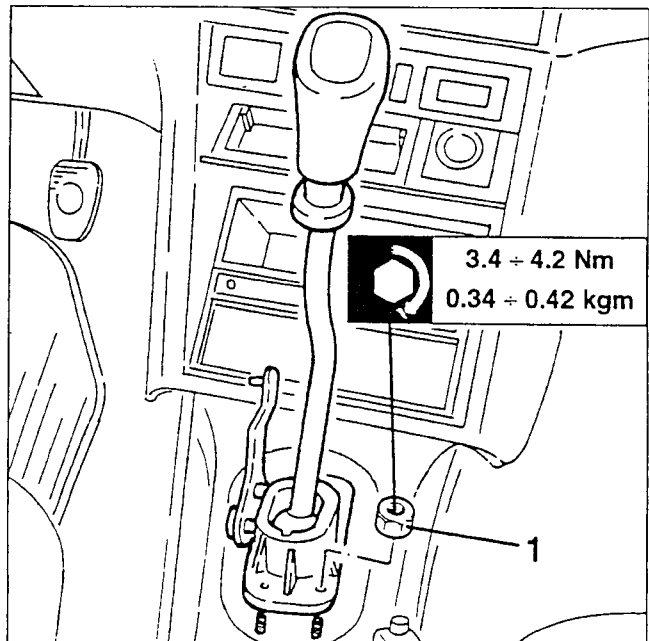
## GEARSHIFT CONTROL LEVER

- Remove the gearbox centre console.

1. Disconnect the gear selector cable from the fastening on the control lever.
2. Remove the catch and disconnect the gear selector cable from the control lever.

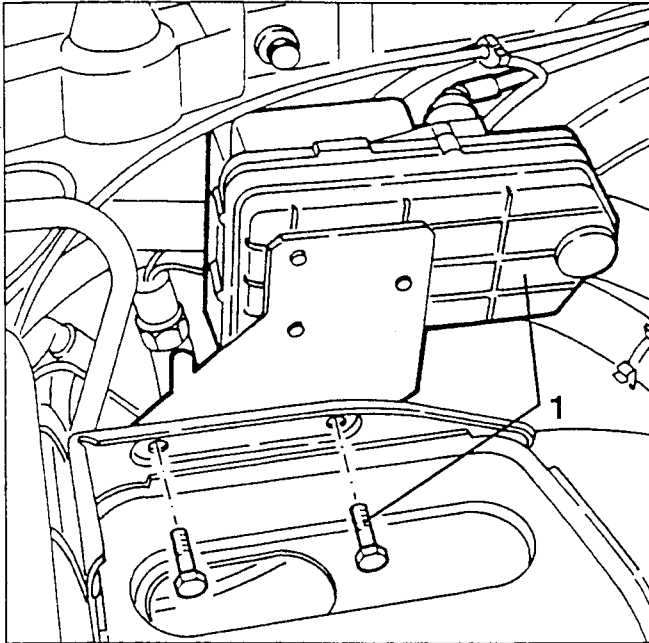


1. Slacken the three fastening nuts and remove the gearshift lever.

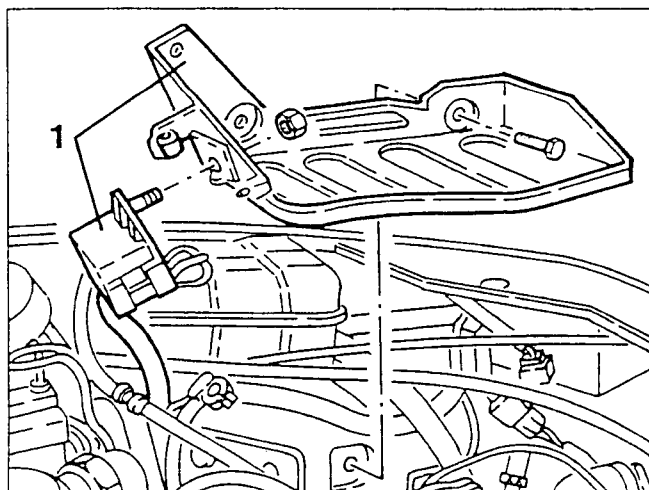


## REMOVAL/REFITTING

- Set the car on a lift.
  - Remove the front wheels.
  - Remove the radiator grille and the front bumper (see GROUP 70).
  - Remove the battery (see GROUP 55).
1. Slacken the two fastening screws and move the air conditioner control unit to one side.

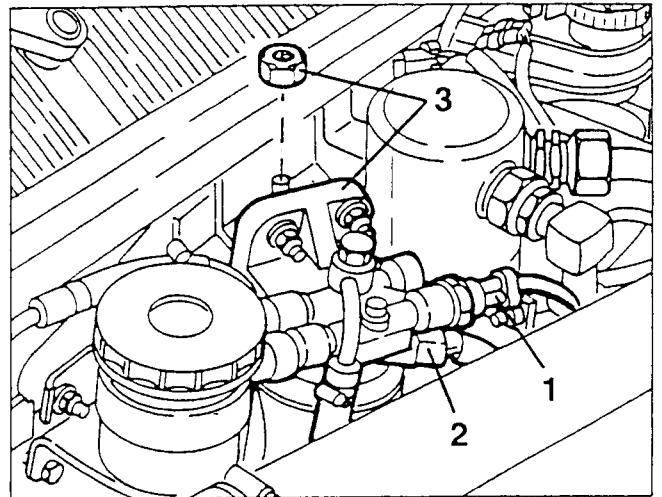


- Remove the battery acid drain duct.
1. Slacken the battery support bracket fastening screws, then remove it after disconnecting the glow plug warming control unit.

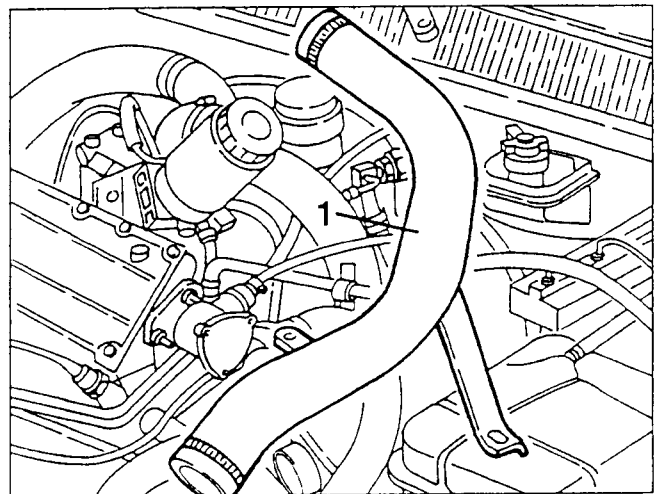


1. Disconnect the electrical connection from the fuel warming device sensor.  
2. Disconnect the electrical connection supplying the fuel warming device.

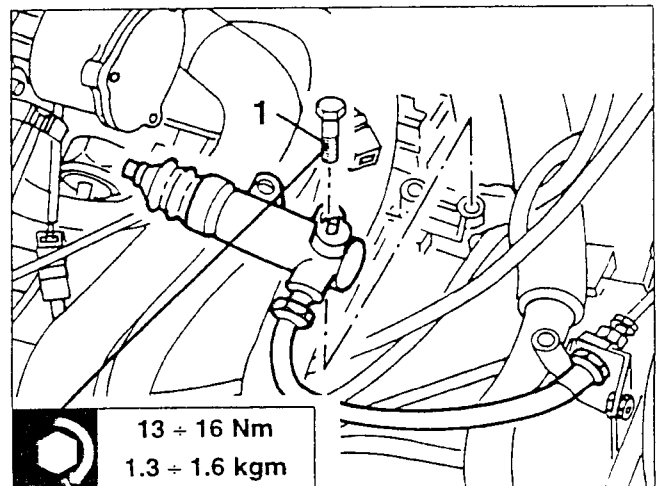
3. Slacken the nut fastening the fuel filter, then move it without disconnecting the hoses.




1. Slacken the clamps and screw of the intermediate bracket, then remove the stiff air delivery pipe from the turbocharger.

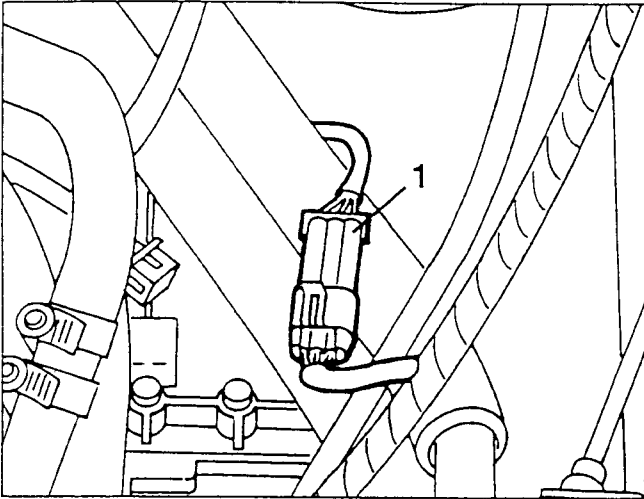


1. Slacken the two clutch control cylinder fastening screws and move it to one side without disconnecting the control hose.

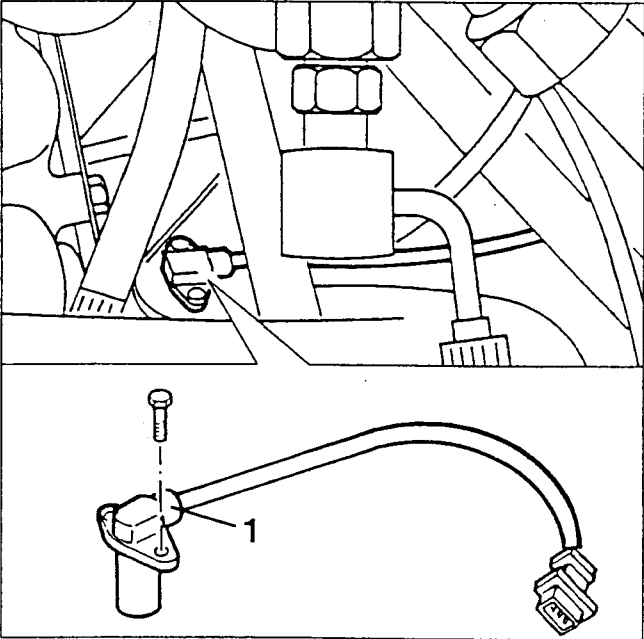


 **13 + 16 Nm**  
**1.3 + 1.6 kgm**

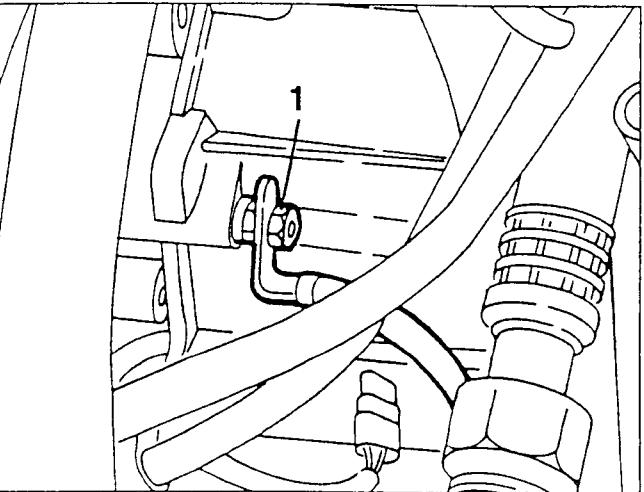
1. Disconnect the electrical connection of the speedometer sensor.



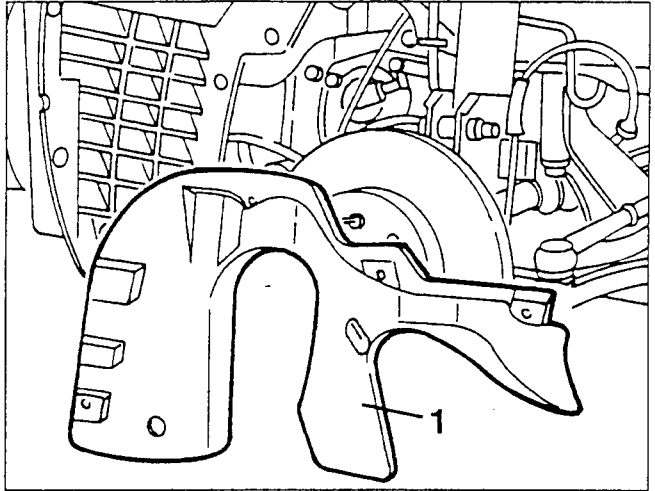
1. Disconnect the electrical connection, slacken the two fastening screws and remove the rpm sensor.



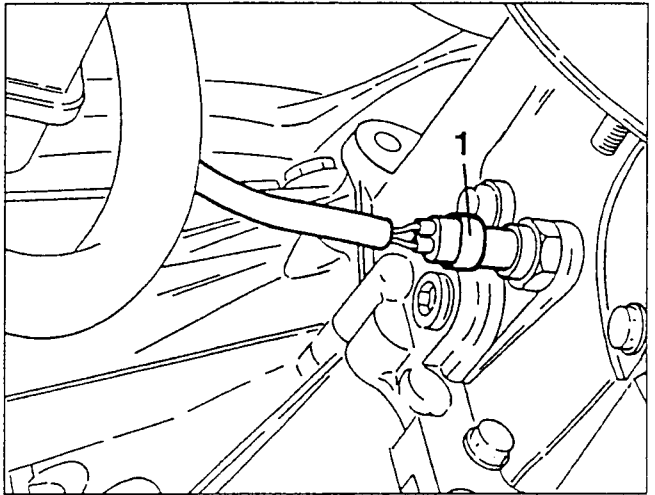
1. Disconnect the earth point of the battery (-) terminal.



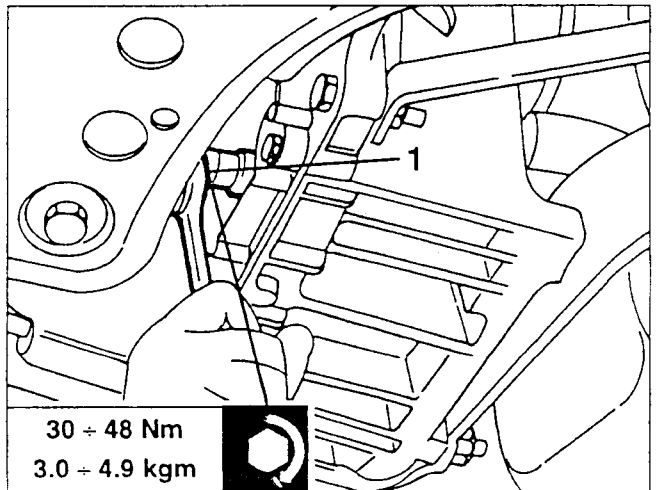
- Raise the car.
  - Working from the lefthand wheel arch disconnect the electrical connection of the brake pad wear sensor.
  - Slacken the screw fastening the ABS inductive sensor support bracket.
1. Remove the mud flaps from the wheel arches.



1. Disconnect the electrical connection from the reversing switch.



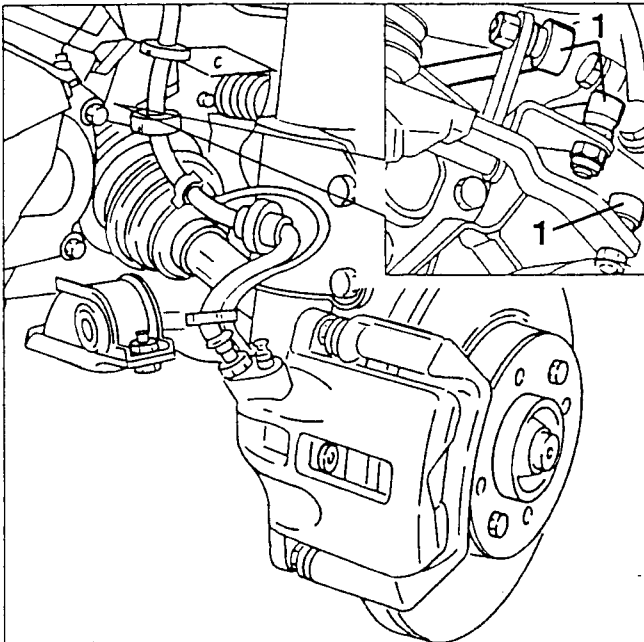
1. Remove the plug and drain the gearbox-differential oil into a suitable recipient.



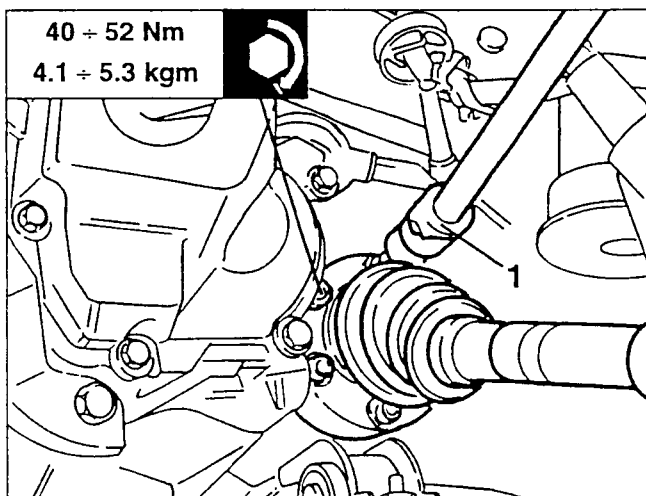
30 ÷ 48 Nm  
3.0 ÷ 4.9 kgm



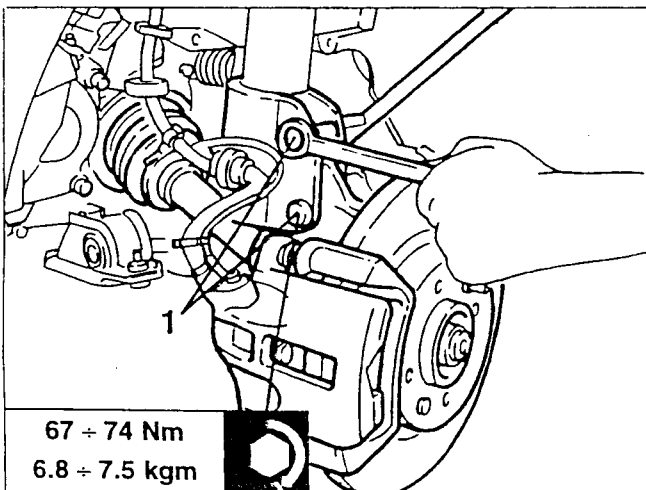
1. Working from the lefthand wheel arch, disconnect the gearshift control rods.



1. Slacken the axle shaft fastening screws.

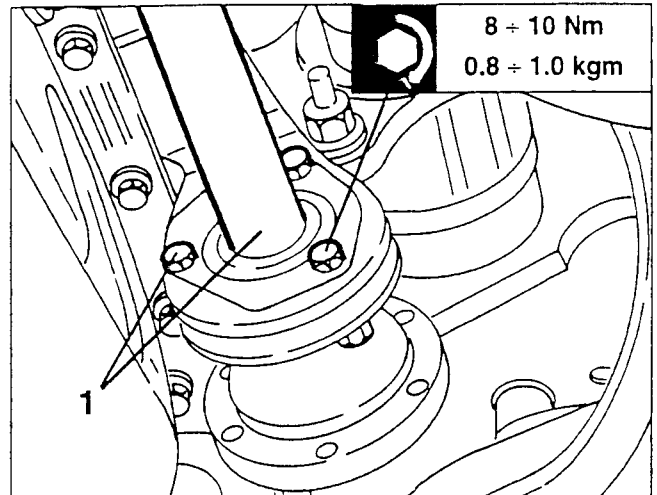


1. Slacken the two bolts fastening the right and left uprights to the corresponding shock absorbers, then withdraw the upper bolts only.



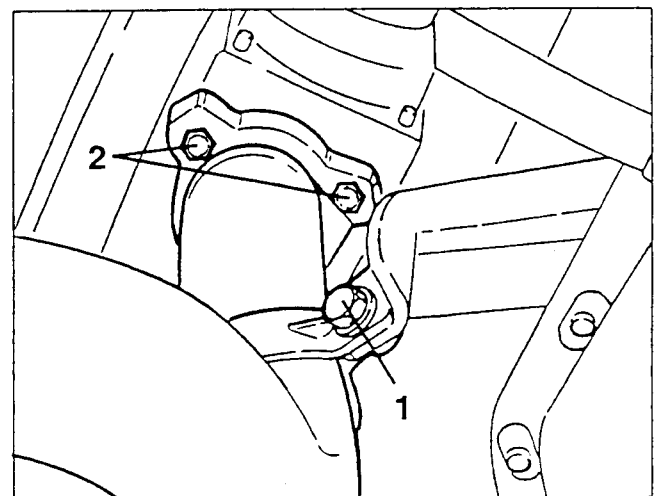
This operation makes it possible to move the axle shafts rearwards enough to disconnect them.

1. Slacken the three fastening bolts and remove the intermediate shaft from the differential.

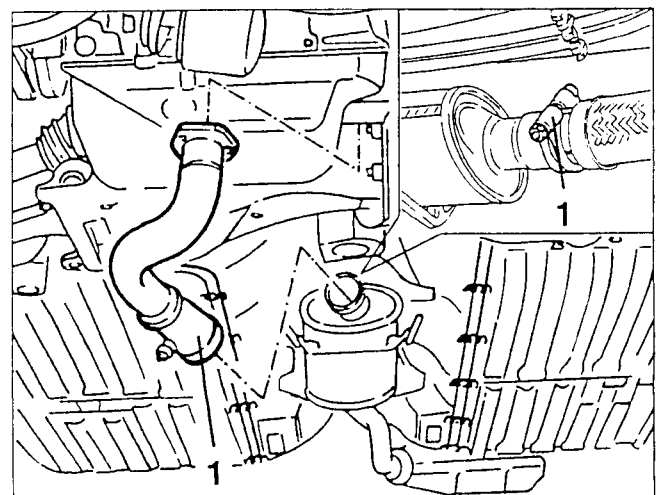


1. Remove the support clamp from the first section of the exhaust pipe.

2. Slacken the screws fastening the flanges connecting the exhaust pipe to the turbocharger.

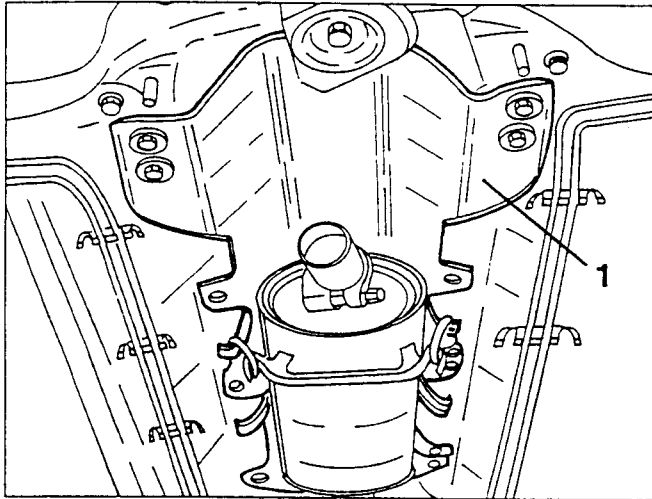


1. Slacken the clamp fastening the front section of the exhaust pipe and remove it.

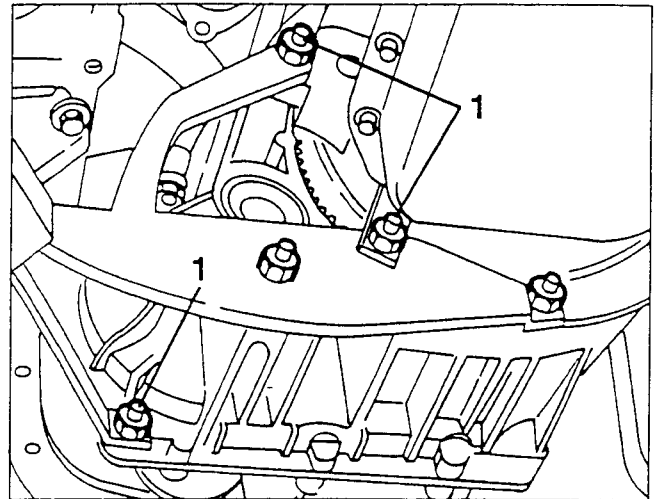




1. Slacken the screws and nuts fastening the "crocodile" to the body and lower it just enough to be able to remove the crossmember.

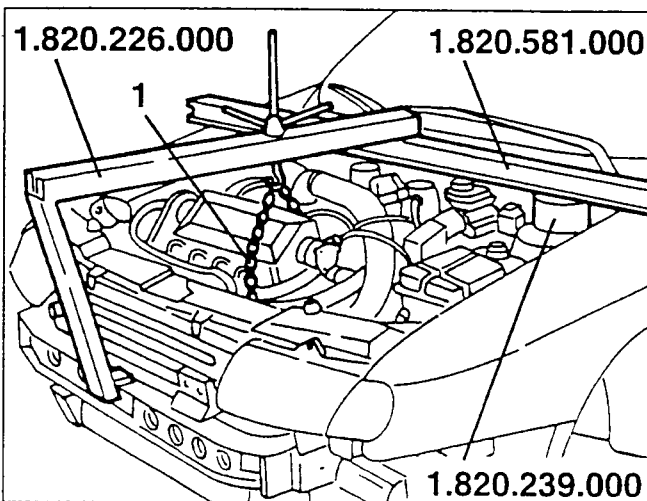


1. Slacken the four nuts and the bolt fastening the rear power unit support to the gearbox.

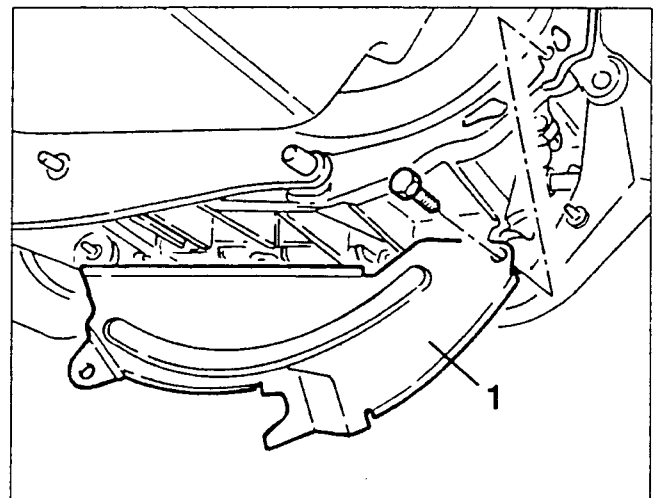


- Lower the car.

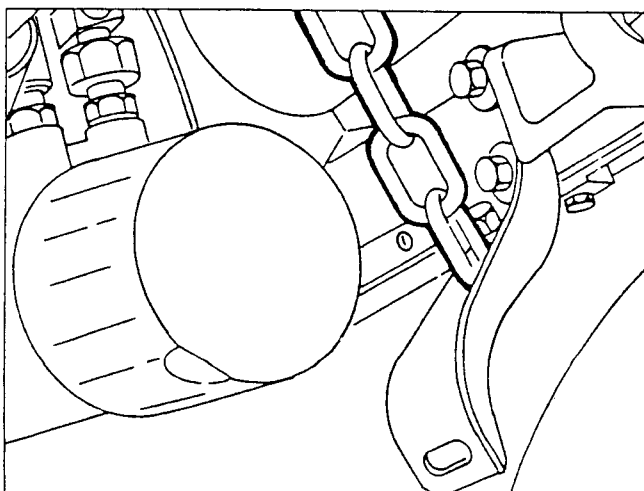
1. Using tools N° 1.820.239.000, N° 1.820.581.000 and N° 1.820.226.000 support the engine appropriately.



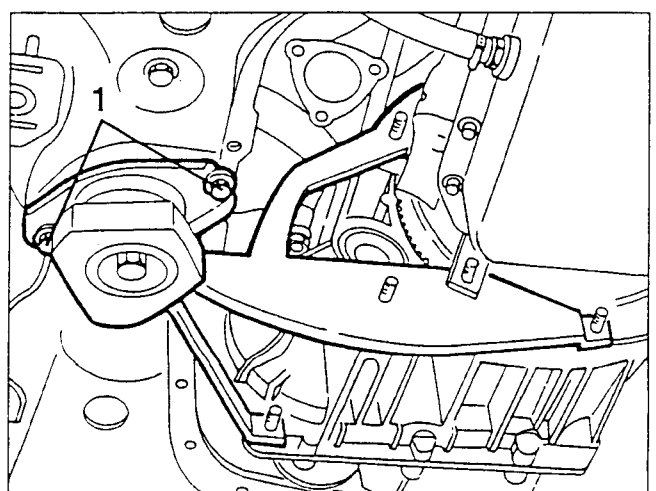
1. Slacken the two fastening screws and remove the flywheel guard.



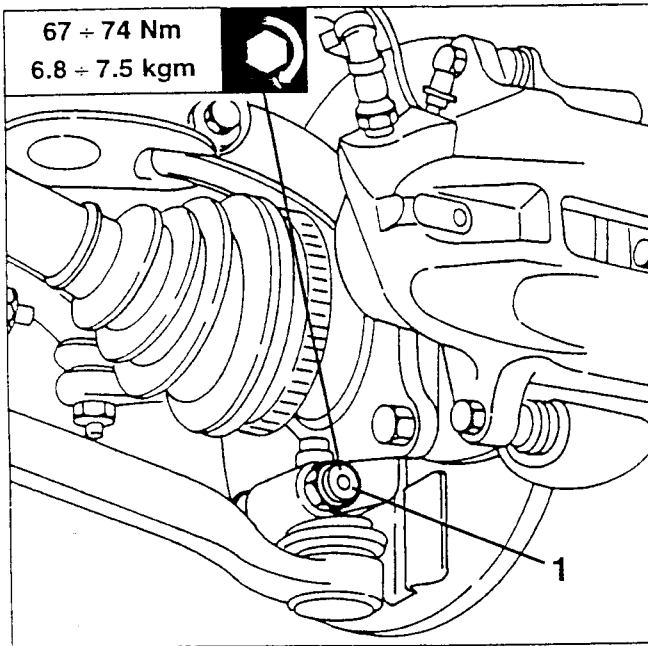
Fasten the chain on the rear side of the engine using the support bracket of the front section of the exhaust pipe.



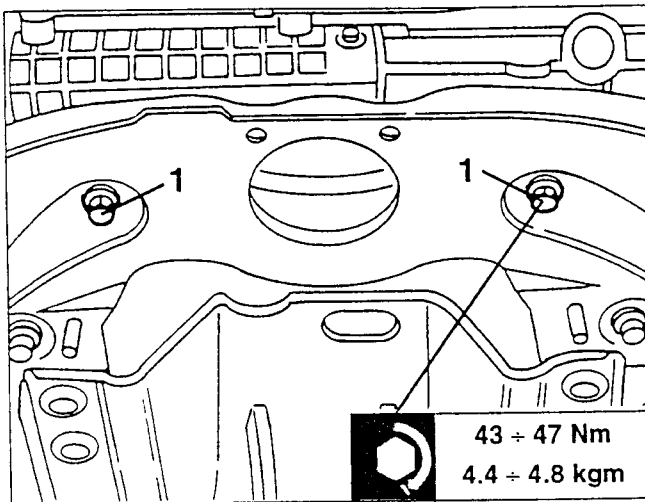
1. Slacken the two screws fastening the rear power unit support to the body and remove it.



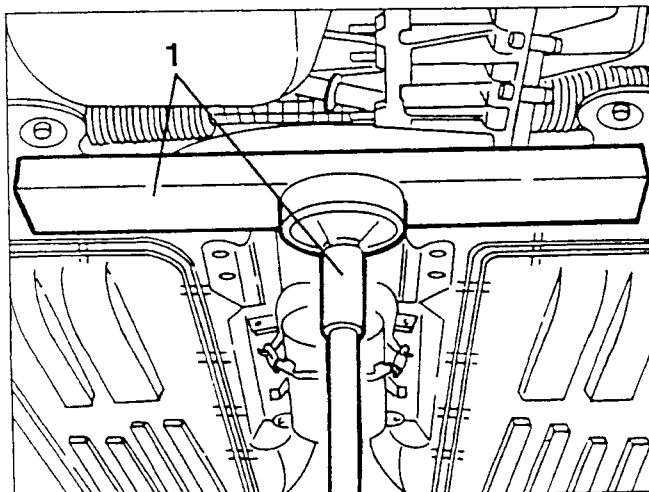
1. Slacken the two bolts fastening the right and left wishbone to the corresponding wheel hubs.



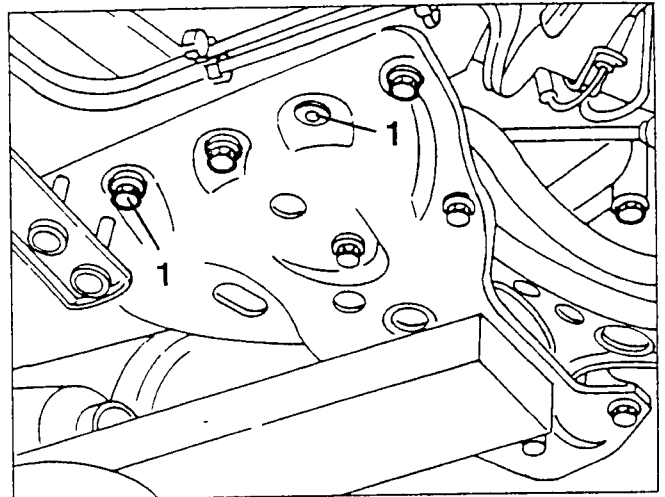
1. Slacken the two screws fastening the power steering box to the crossmember.



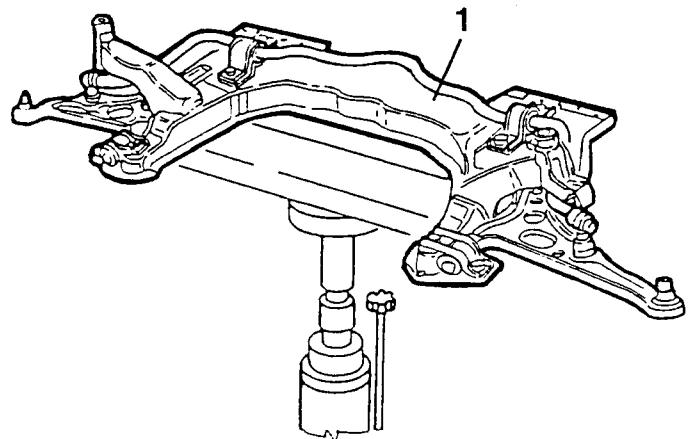
1. Position a hydraulic jack with special support under the crossmember.



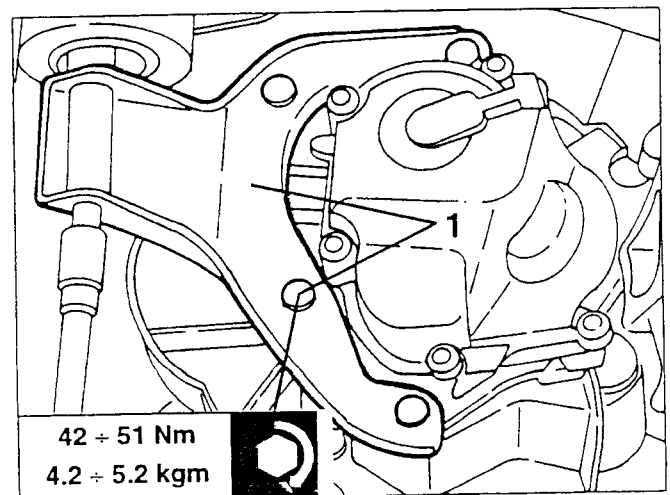
1. Slacken the fastening screws and remove the plastic crossmember fastening plugs.



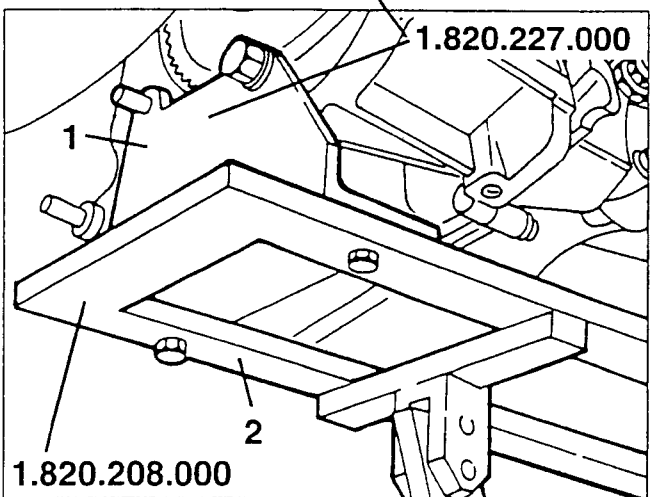
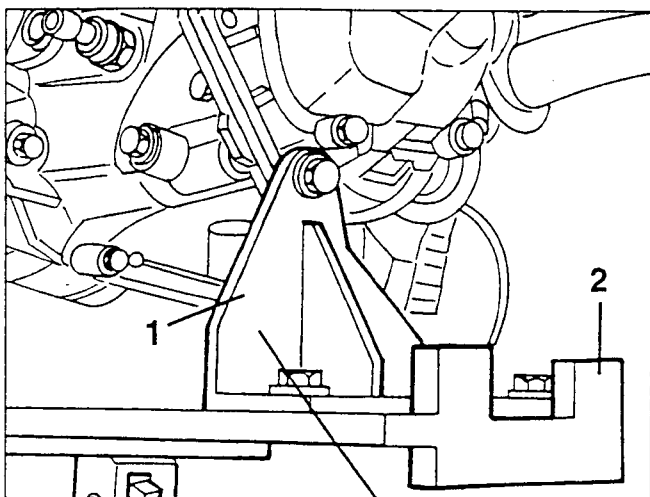
1. Lower the hydraulic jack and remove the crossmember complete with wishbones and stabilizer bar.



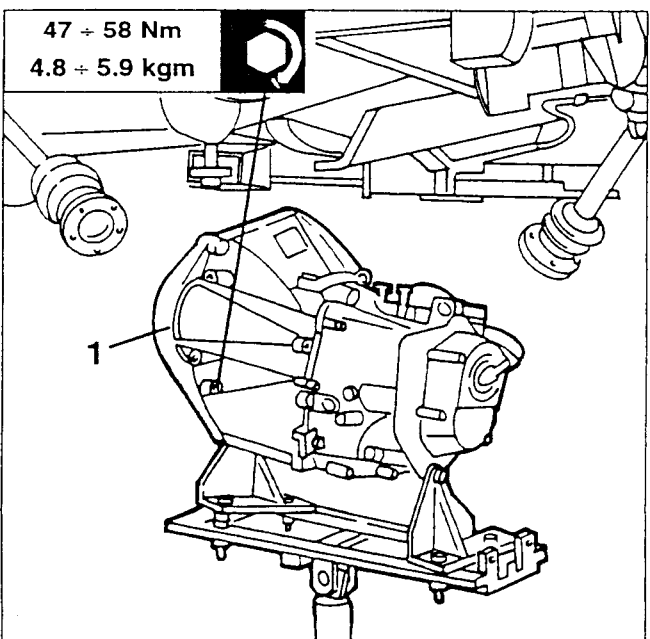
1. Slacken the fastening screws and remove the gearbox side power unit support.



1. Fasten brackets N° 1.820.227.000 at the sides of the gearbox as illustrated.
2. To the brackets fastened previously fit support N° 1.820.208.000 and using a hydraulic jack support the gearbox-differential unit.



1. Slacken the screws fastening the gearbox-differential unit to the engine and to the starter motor, then remove it.

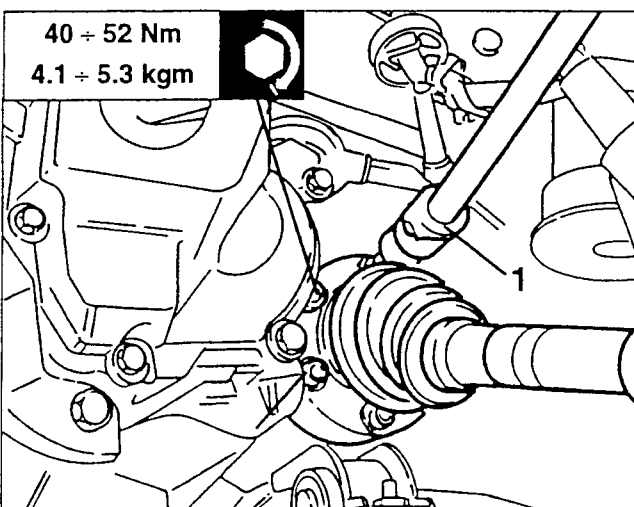


**CAUTION:**  
After refitting the gearbox-differential unit, always check and if necessary, adjust, the clutch pedal (see GROUP 18).

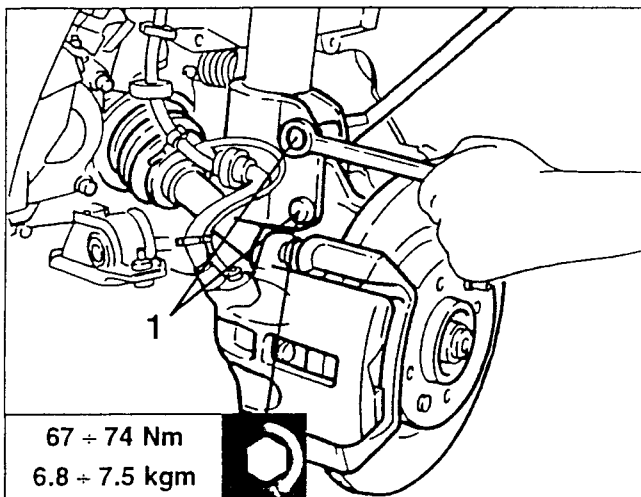
## OPERATIONS IN THE CAR

### CHANGING THE GEARBOX SIDE DIFFERENTIAL CARRIER OIL SEAL

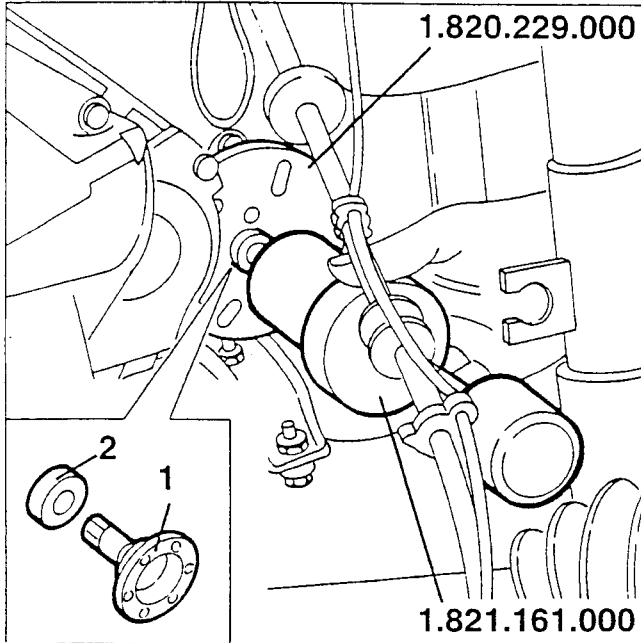
- Set the car on a lift.
  - Disconnect the battery (-) terminal.
  - Raise the car.
  - Remove the left front wheel and mudflap.
  - Working from the lefthand wheel arch, disconnect the electrical connection of the brake pad wear sensor.
  - Slacken the screw fastening the ABS inductive sensor support bracket.
1. Slacken the left axle shaft fastening screws from the differential.



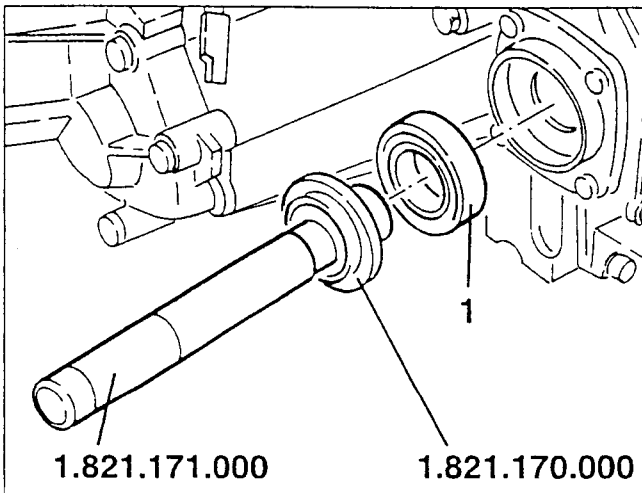
1. Slacken the two bolts fastening the left upright to the shock absorber, then withdraw the upper bolt only.



- Using tools N° 1.820.229.000 and N° 1.821.161.000, remove the differential flange.
- Remove the oil seal to be changed.



- Using tools N° 1.821.170.000 and N° 1.821.171.000 install the new oil seal.

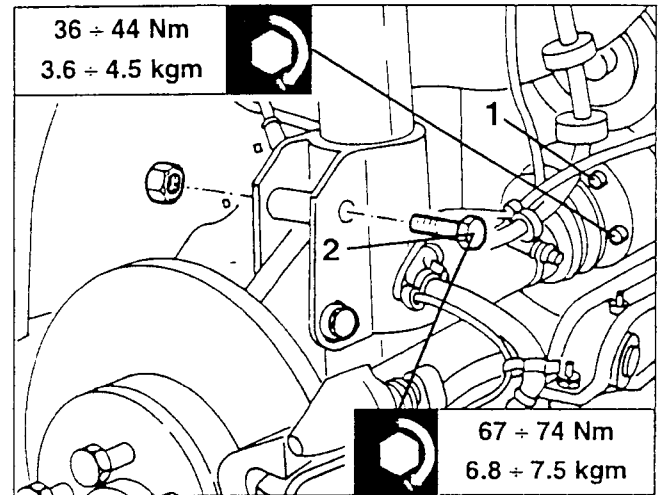


- Complete re-assembly reversing the procedure followed for removal.

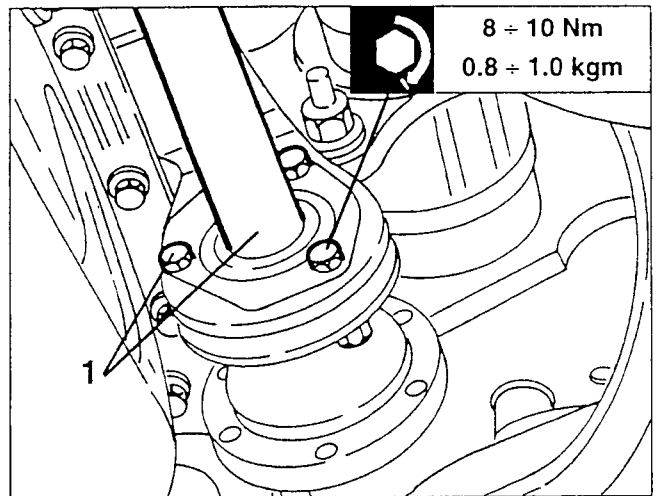
## CHANGING THE DIFFERENTIAL CARRIER ENGINE SIDE OIL SEAL

- Set the car on a lift.
- Disconnect the battery (-) terminal.
- Raise the car.
- Remove the right front wheel and mudflap.
- Working from the righthand wheel arch, disconnect the electrical connection of the brake pad wear sensor.
- Slacken the screw fastening the ABS inductive sensor support bracket.

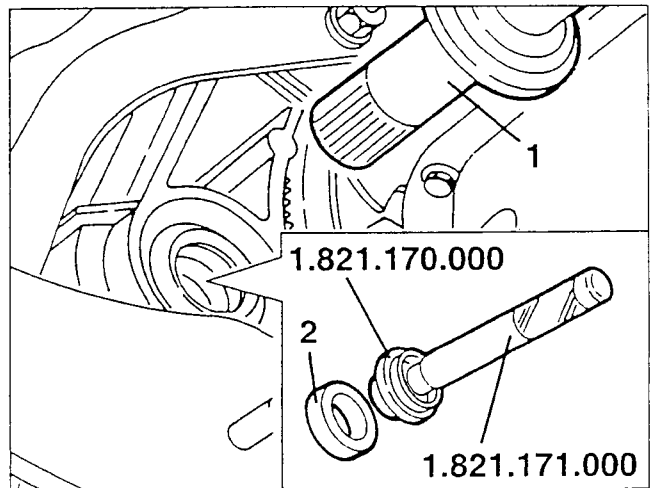
- Slacken the left axle shaft fastening screws from the intermediate shaft.
- Slacken the two bolts fastening the right upright to the shock absorber, then withdraw the upper bolt only.
  - Move the axle shaft backwards just enough to disconnect it from the intermediate shaft and keep it as illustrated.



- Slacken the three intermediate shaft fastening bolts.



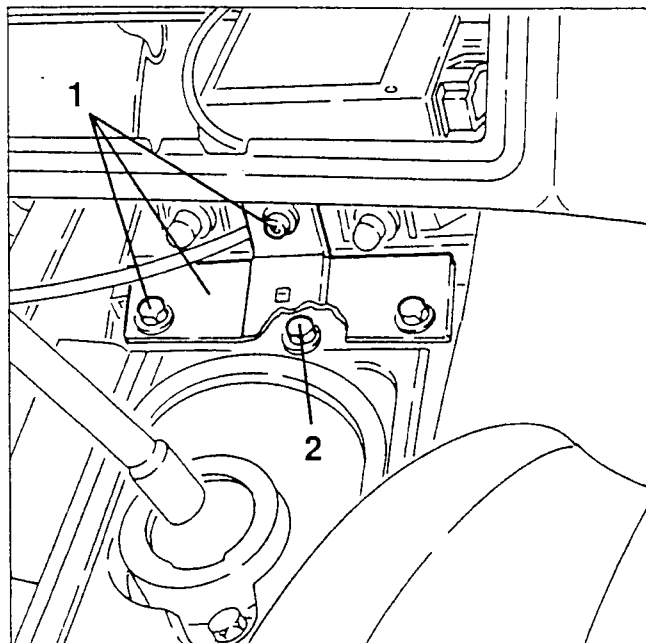
- Take the intermediate shaft off the differential.
- Using tools N° 1.821.170.000 and N° 1.821.171.000 install the new ring.



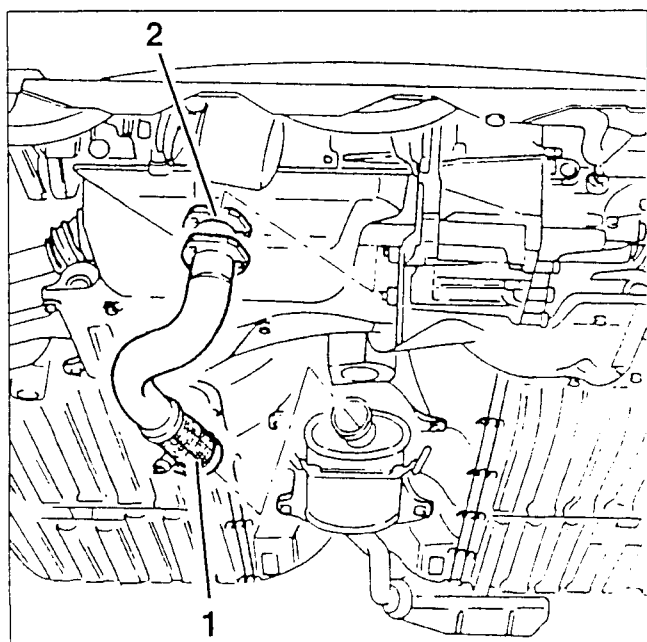
## GEARSHIFT CONTROL ROD

### REMOVING/REFITTING

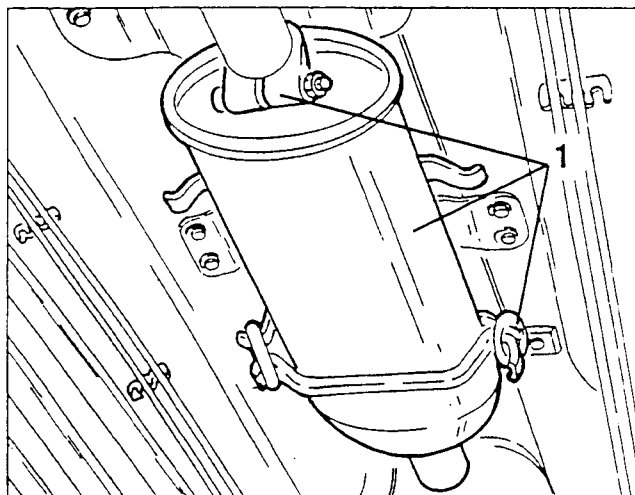
- Set the car on a lift.
- Remove the gearbox centre console (see GROUP 70).
- 1. Slacken the fastening screws and remove the dashboard lower fastening bracket.
- 2. Slacken the gearshift controls support fastening screw.



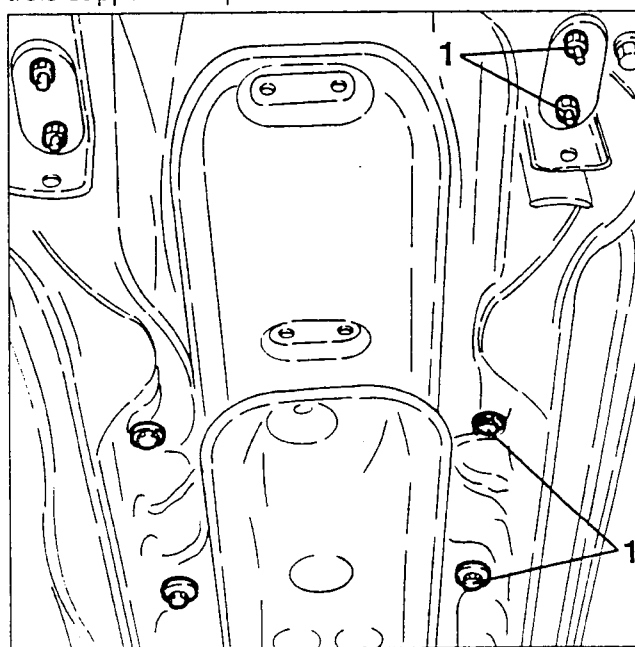
- 1. Remove the exhaust pipe front section.
- 2. Remove the seal.



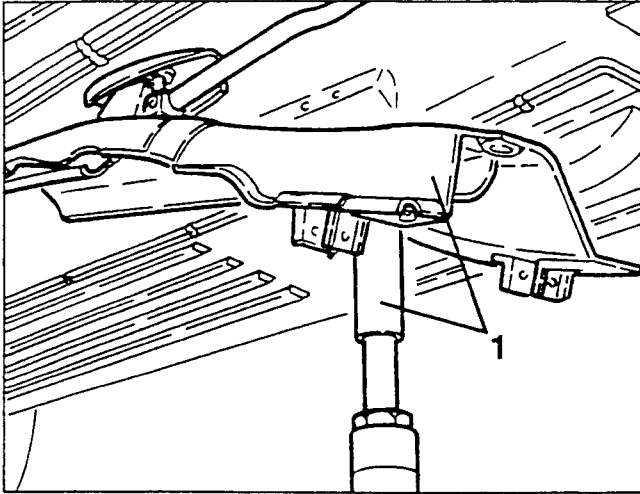
- 1. Slacken the clamp fastening the centre silencer to the rear section of the exhaust pipe, then remove it after freeing it from the support rings.



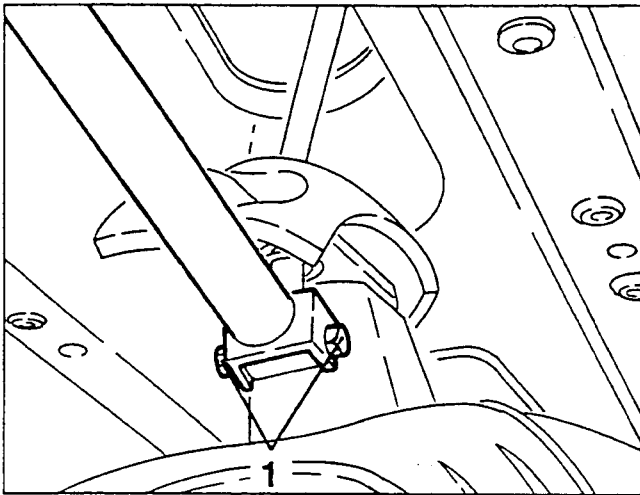
- 1. Slacken the fastening screws of the gearshift controls support except the two rear ones.



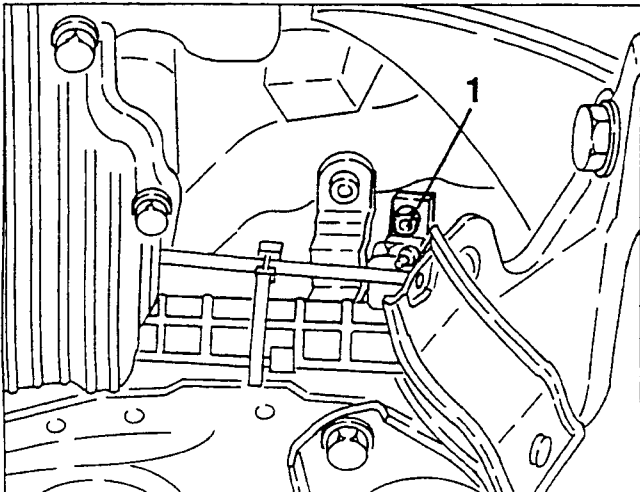
1. Using a hydraulic jack as support, lower the front of the gearshift controls support as illustrated.



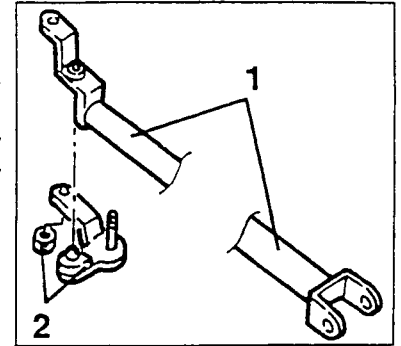
1. Disconnect the gearshift control rod from the lever slackening the fastening bolt.



1. Disconnect the gearshift control rod from the support on the power steering box slackening the fastening nut.



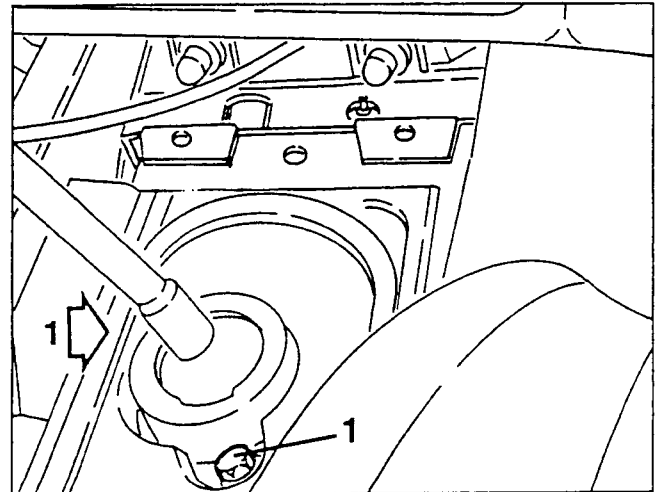
1. Remove the gearshift control rod.  
2. If necessary remove the relay levers slackening the remaining fastening nut.



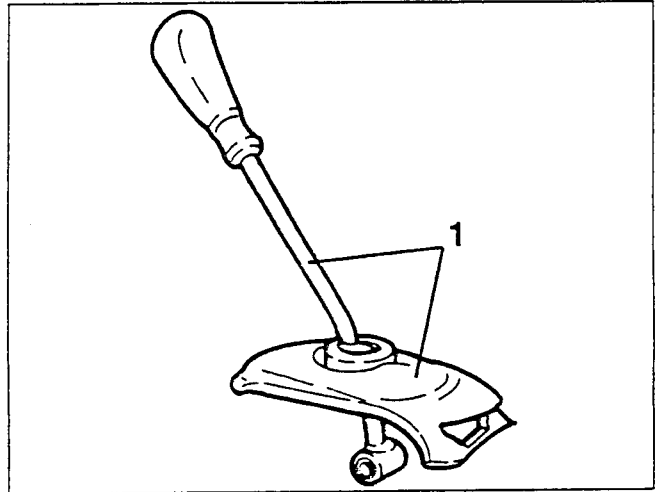
## GEARSHIFT CONTROL LEVER

### REMOVING/REFITTING

Proceed as described in the procedure "Gearshift control rod - Removing/Refitting" as far as disconnection of the gearshift control lever from the rod and taking care to slacken the two screws (1) fastening the gearshift control lever to the support, before slackening the fastenings of the gearshift controls support.

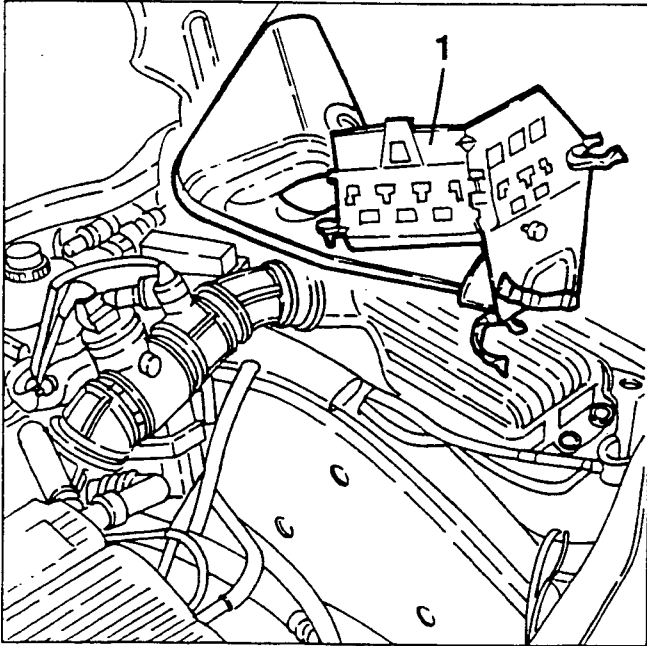


1. From under the car, retrieve the gearshift control lever complete with joint and frame.

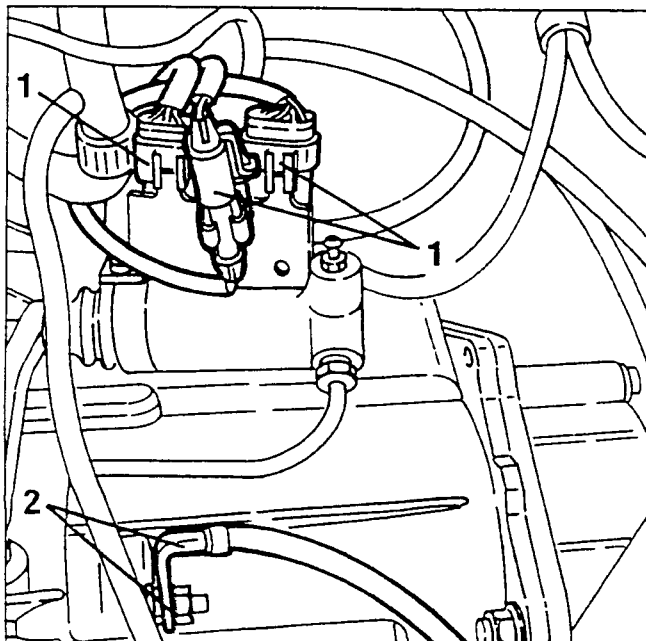


**REMOVING/REFITTING**

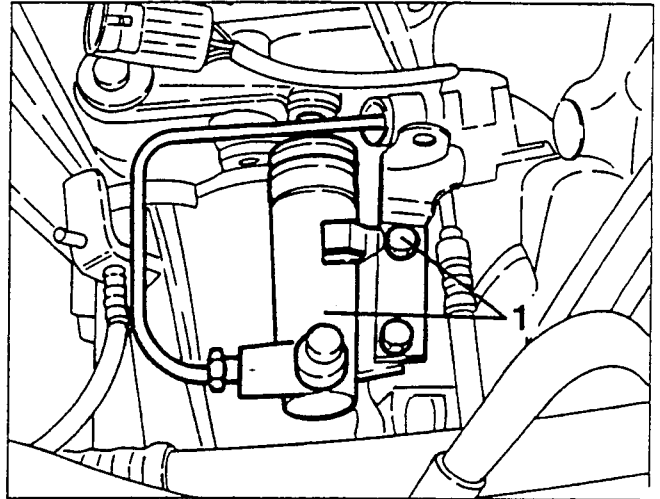
- Set the car on a lift.
  - Remove the front wheels and mud flaps.
  - Remove the battery.
  - Remove the relays from the battery support moving them to one side with their wirings so that they do not hinder the following operations.
1. Slacken the fastening screws, then remove the battery support after removing the rear cable support bracket from it.



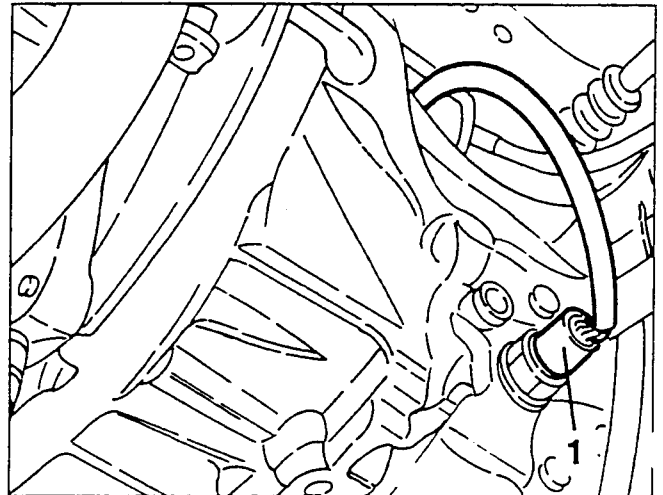
1. Remove the electrical connections from the support bracket fastened with the clutch control cylinder.
2. Disconnect the earth cable from the gearbox cover.



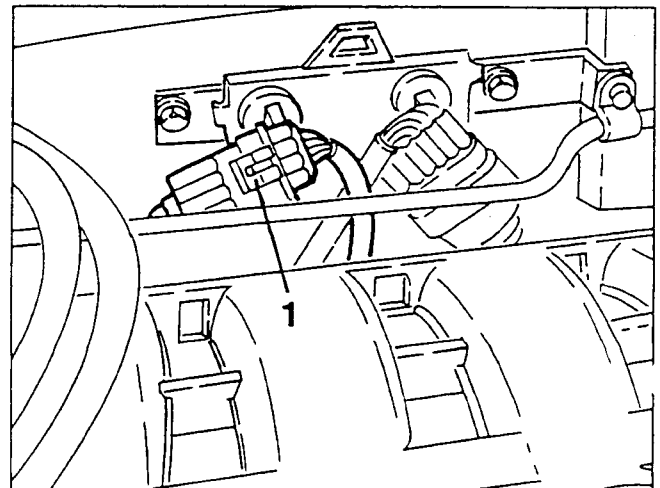
1. Slacken the fastening screws, then move aside the clutch control cylinder without disconnecting the hoses.



1. Disconnect the electrical connection from the reversing switch.

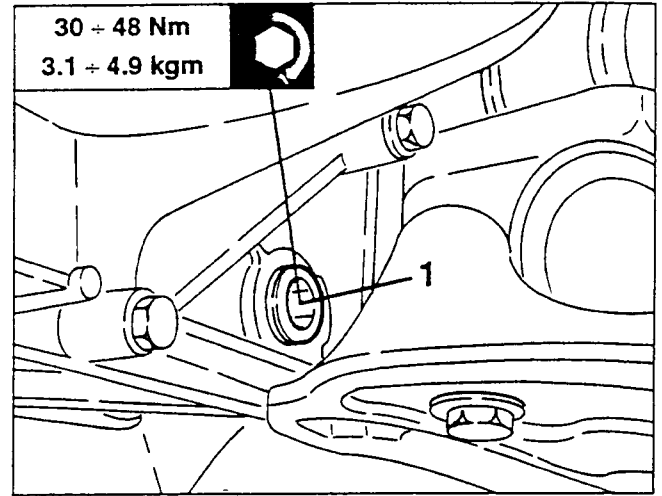
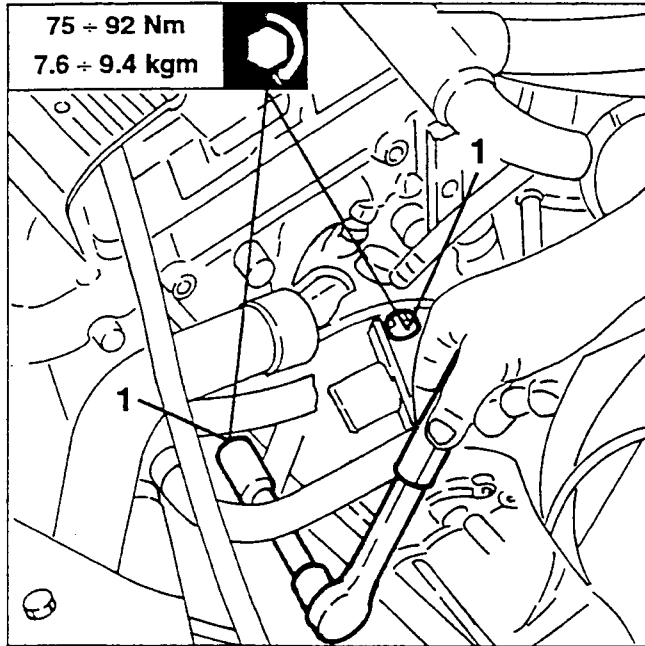


1. Disconnect the electrical connection of the lambda sensor.

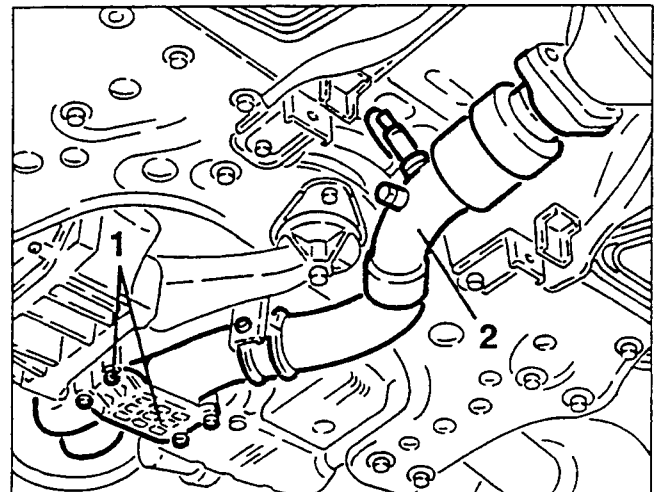




1. Slacken the two upper screws fastening the gearbox to the engine.



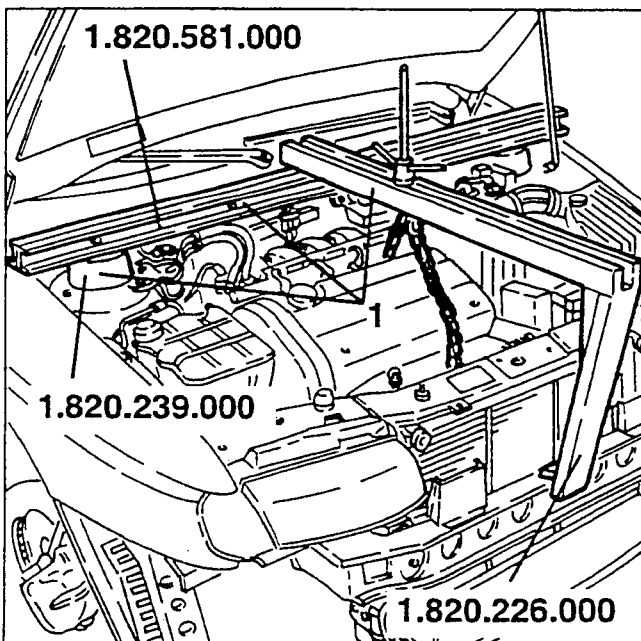
1. Slacken the fastening screws and remove the reinforcement bracket.  
2. Remove the front section of the exhaust pipe complete with lambda sensor after slackening the fastenings concerned.



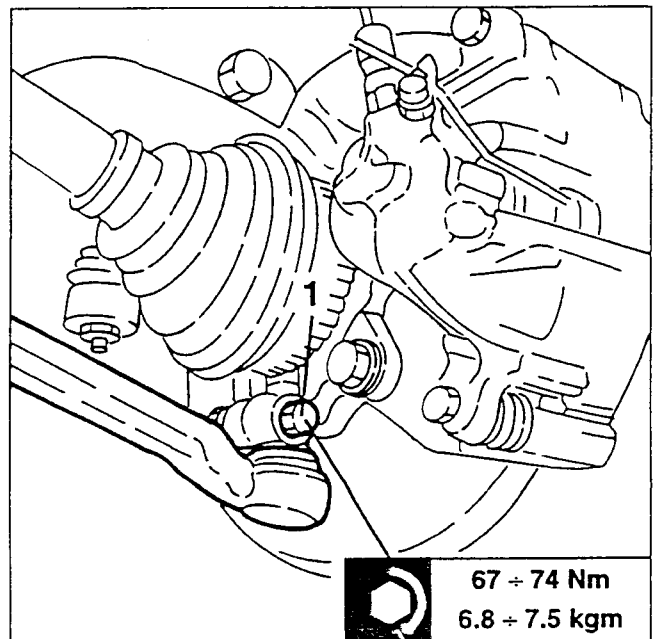
- Remove the front bumper (see GROUP 70).

1. Position the engine support no. 1.820.226.000, with the corresponding supports no. 1.820.239.000 and crossrail no. 1.820.581.000 as illustrated.

- Install two suitable support squares on the crankcase, then using a chain connect the support tool to the squares supporting the power unit in this manner.



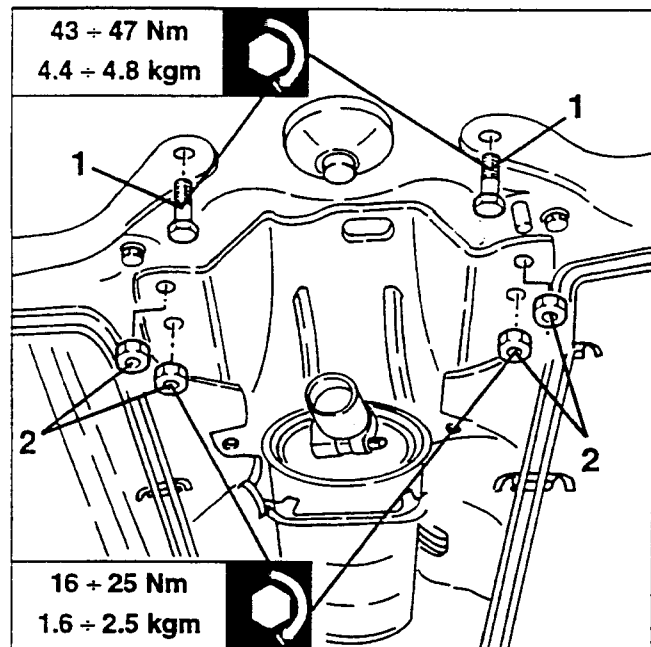
1. Slacken the bolts fastening the wishbones to the wheel uprights.



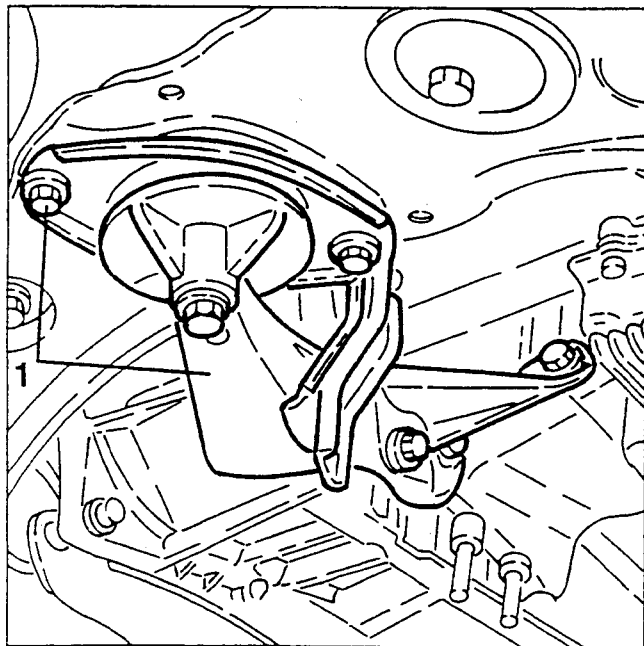
1. Raise the car, slacken the plug and drain the gearbox- differential oil into a suitable recipient.



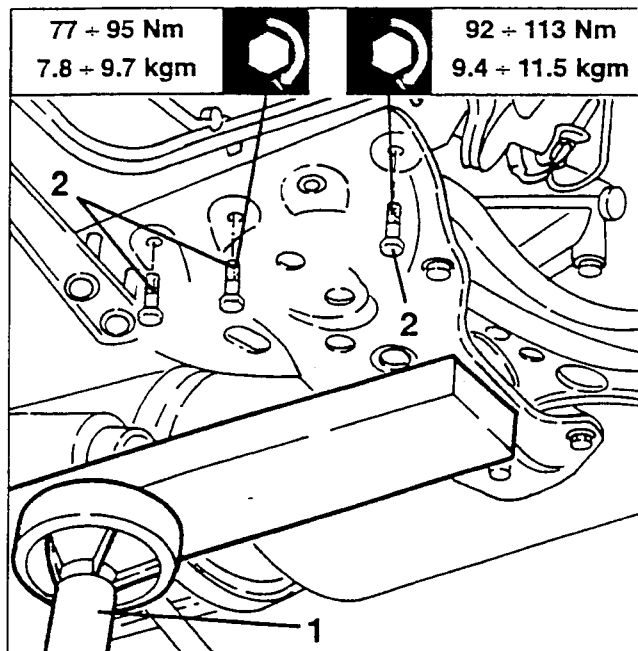
1. Slacken the two screws fastening the power steering to the front crossmember.
2. Slacken the four front nuts and slacken the other screws fastening the gearshift controls support, which must be slightly lowered to enable release from the front crossmember.



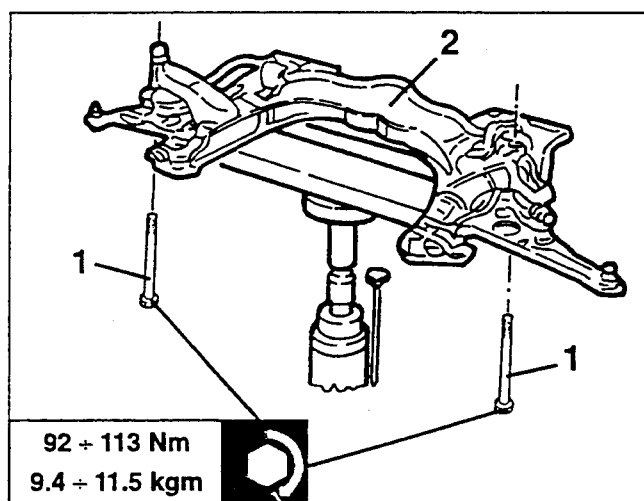
1. Slacken the fastening screws and remove the power unit rear support.



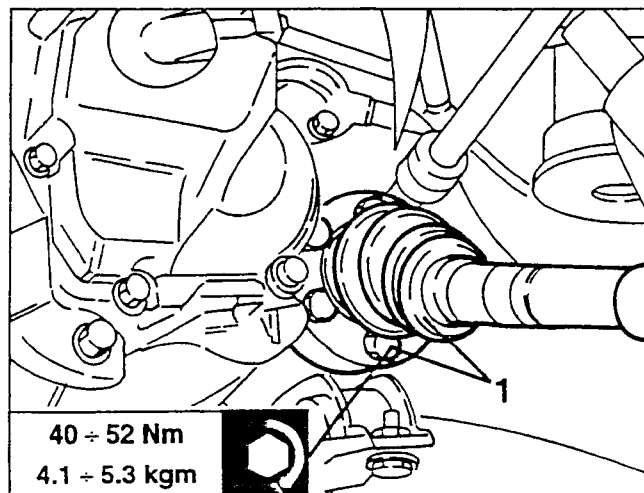
1. Set a hydraulic jack under the crossmember.
2. Slacken the six rear screws fastening the crossmember to the body.



1. Slacken the two front screws fastening the crossmember to the body.
2. Lower the hydraulic jack and remove the crossmember.

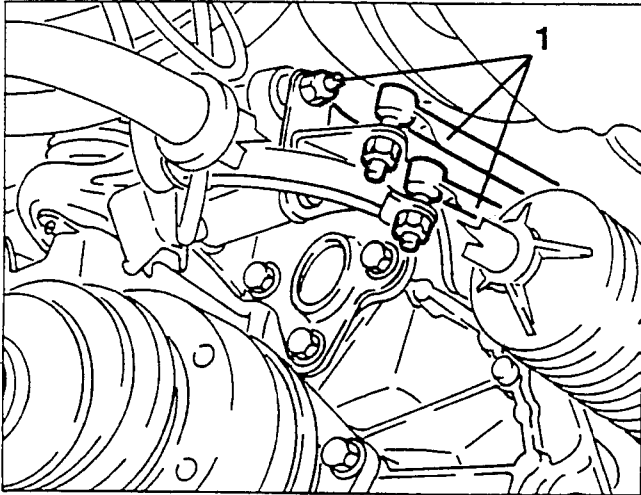


1. Slacken the fastening bolts and disconnect the left-hand CV joint of the differential side axle shaft.





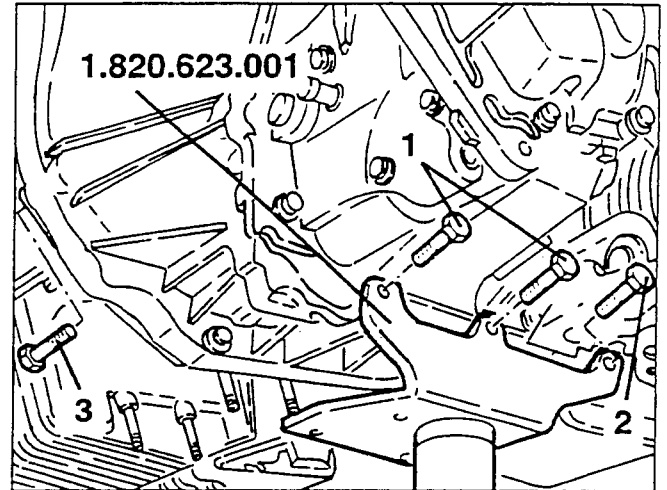
1. Working from the left-hand wheelhouse, slacken the fastening nuts and disconnect the gearshift control rods.



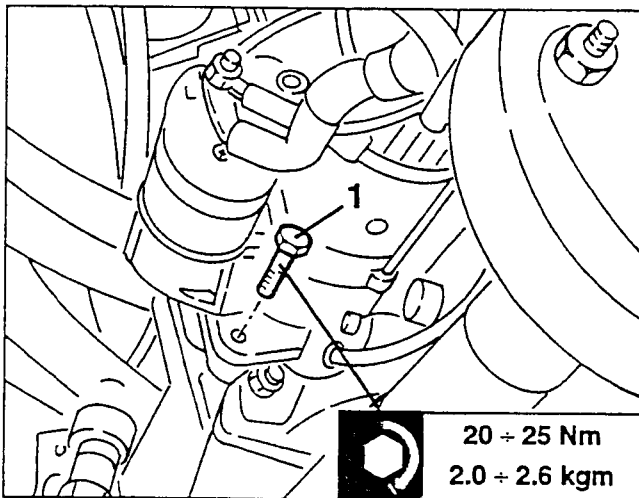
1. Slacken the two lower screws fastening the gearbox cover and in their holes insert bracket no. 1.820.623.001.

**NOTE:** For fastening the bracket use slightly longer screws than the ones removed.

2. Add a suitably sized bolt in the hole on the right of the bracket.  
3. Slacken the screw fastening the gearbox to the engine.

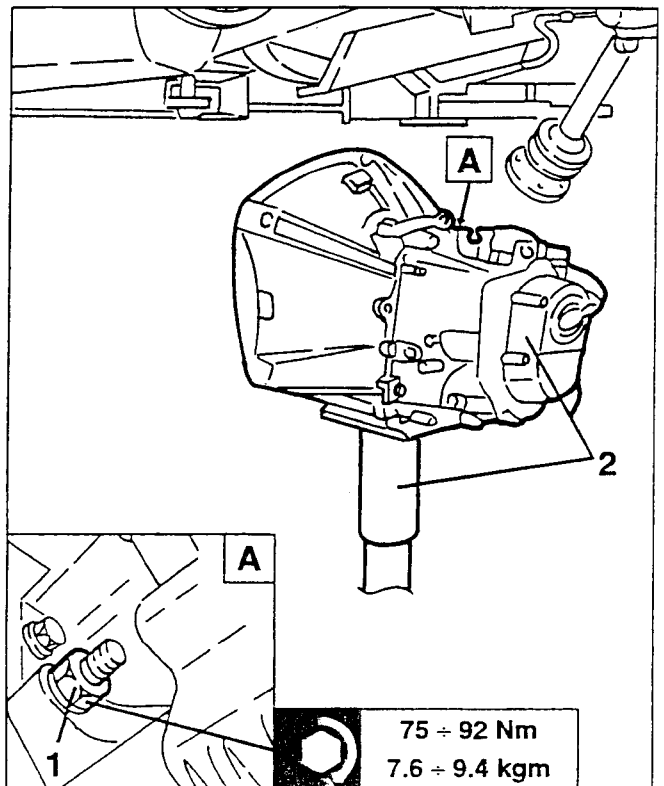


1. Slacken the three screws fastening the starter motor to the gearbox.



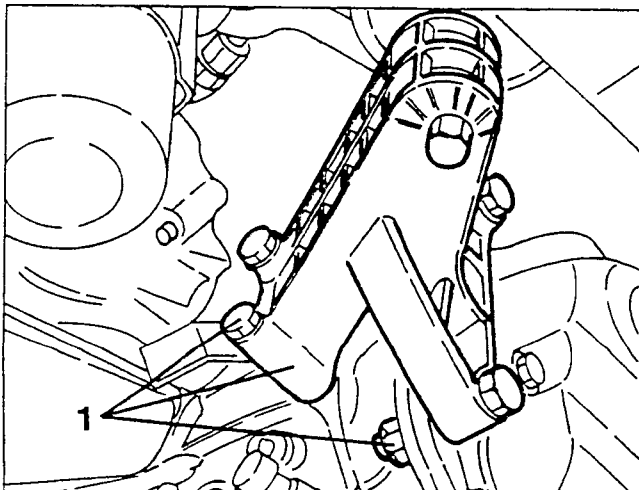
20 ÷ 25 Nm  
2.0 ÷ 2.6 kgm

1. Slacken the remaining nut fastening the gearbox to the engine.  
2. Lower the hydraulic jack and remove the gearbox-differential unit.



75 ÷ 92 Nm  
7.6 ÷ 9.4 kgm

1. Slacken the fastening screws and bolts and remove the gearbox side power unit support.

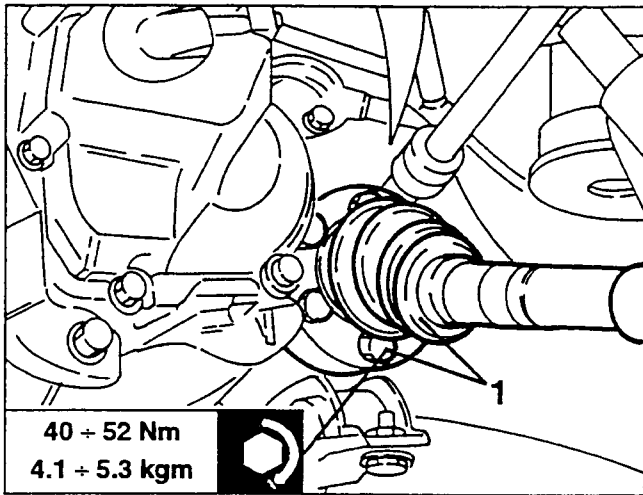


## ON-VEHICLE OPERATIONS

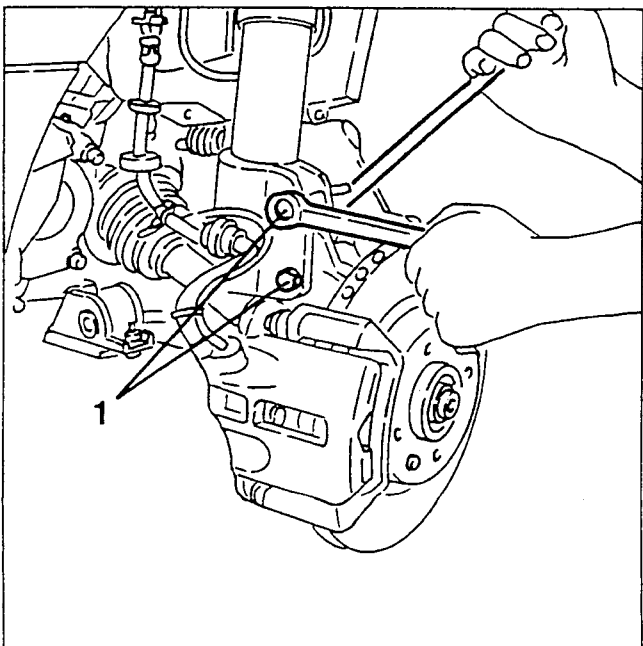
### CHANGING THE DIFFERENTIAL CARRIER OIL SEAL GEARBOX SIDE

- Set the car on a lift.
- Disconnect the battery (-) terminal.
- Raise the car.
- Remove the left front wheel and mud flaps.
- Working from the left front wheelhouse, disconnect the electrical connection of the brake pad wear sensor.
- Release the ABS inductive sensor cable from the support bracket.

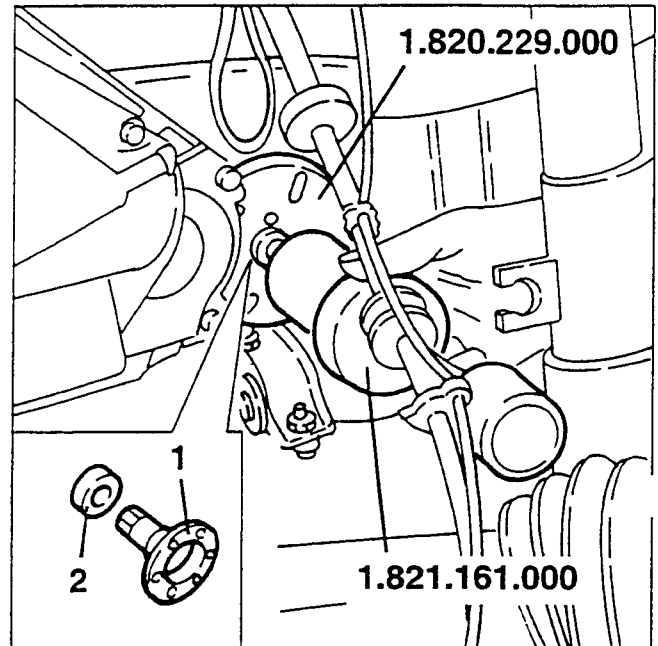
1. Slacken the fastening bolts and disconnect the left-hand CV joint from the differential side axle shaft.



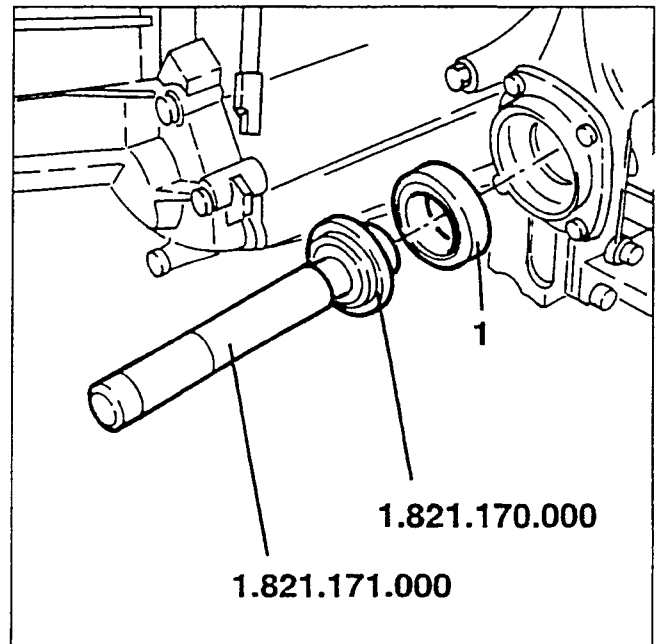
1. Slacken the two bolts fastening the left-hand upright to the shock absorber, then withdraw the upper bolt only.



1. Using tools no. 1.820.229.000 and no. 1.821.161.000, remove the flange from the differential.
2. Remove the oil seal to be changed.



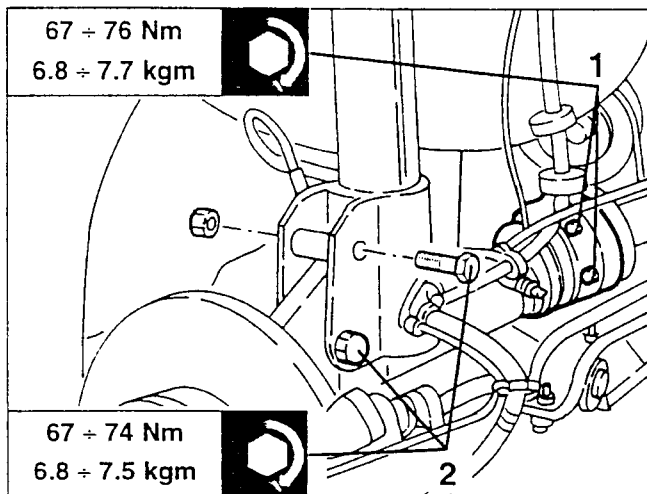
1. Using tools no. 1.821.170.000 and no. 1.821.171.000 install the new oil seal.



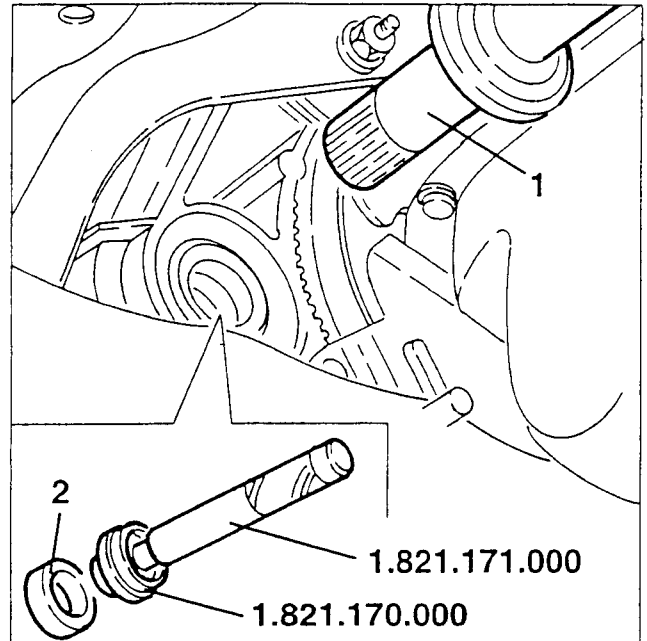
Complete re-assembly reversing the sequence followed for removal.

**CHANGING THE DIFFERENTIAL  
CARRIER OIL SEAL  
ENGINE SIDE**

- Set the car on a lift.
  - Disconnect the battery (-) terminal.
  - Raise the car.
  - Remove the right-hand wheel and wheelhouse.
  - Working from the left-hand wheelhouse, disconnect the electrical connection of the brake pad wear sensor.
  - Release the A.B.S. inductive sensor cable from the support bracket.
1. Slacken the fastening bolts and disconnect right-hand CV joint from the intermediate shaft.
  2. Slacken the two bolts fastening the right upright, then withdraw the upper bolt only.
- Move back the right axle shaft just enough to disconnect it from the intermediate shaft.

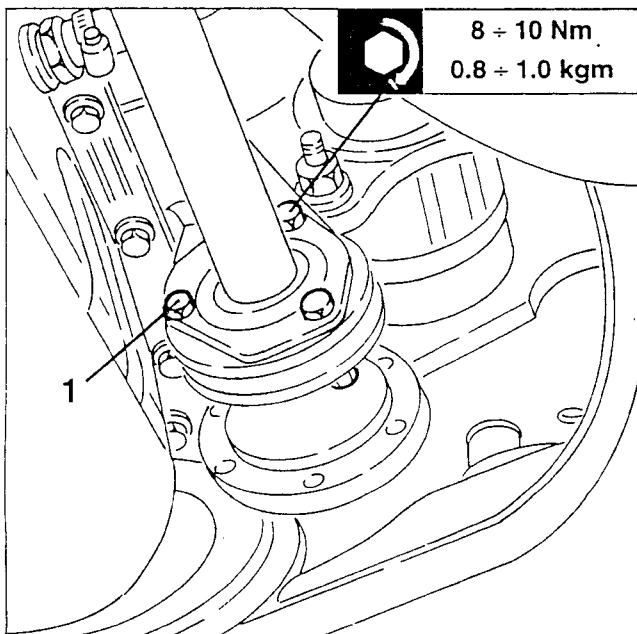


1. Withdraw the intermediate shaft from the differential and remove the oil seal to be changed.
2. Using tools no. 1.821.170.000 and no. 1.821.171.000 install the new oil seal.



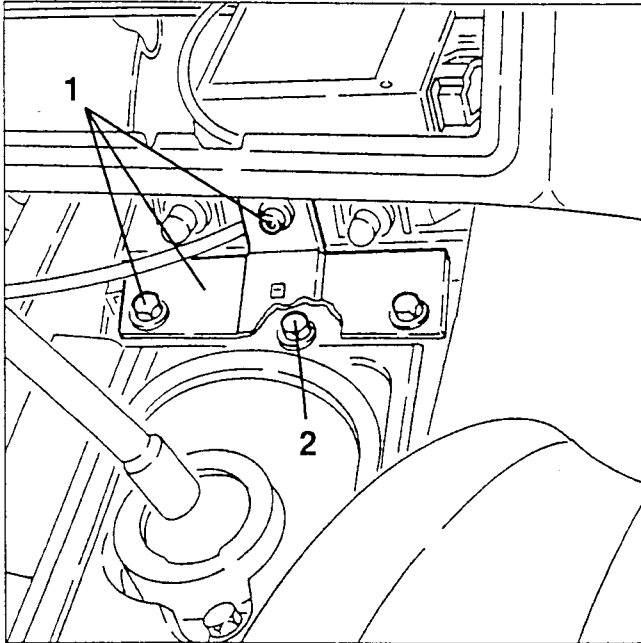
Complete re-assembly reversing the sequence followed for removal.

1. Slacken the screws fastening the intermediate shaft.

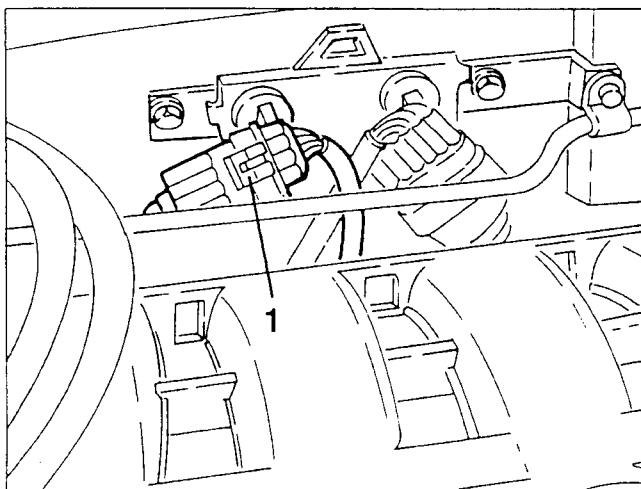


**GEARSHIFT CONTROL ROD****REMOVING/REFITTING**

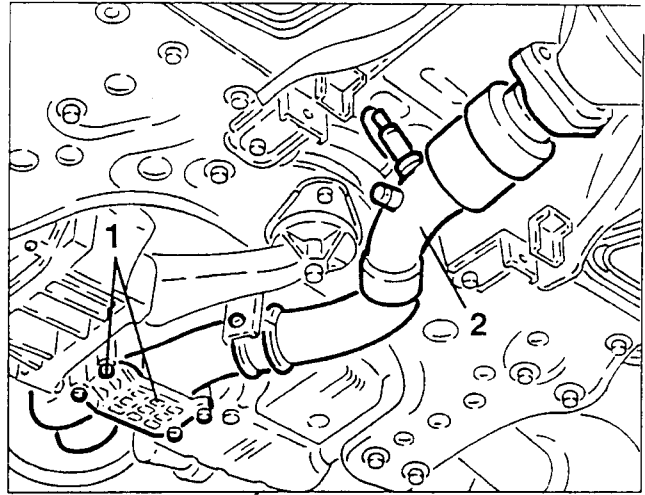
- Set the car on a lift.
- Remove the centre console (see GROUP 70).
- 1. Slacken the fastening screws and remove the lower dashboard fastening bracket.
- 2. Slacken the screw fastening the gearshift controls support.



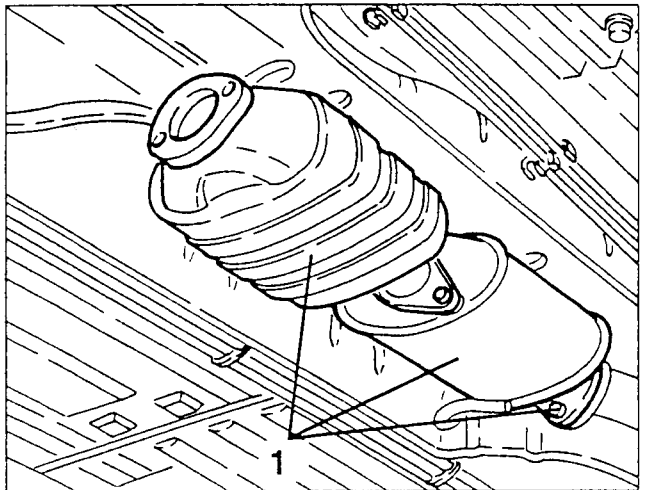
- 1. Disconnect the electrical connection of the lambda sensor.



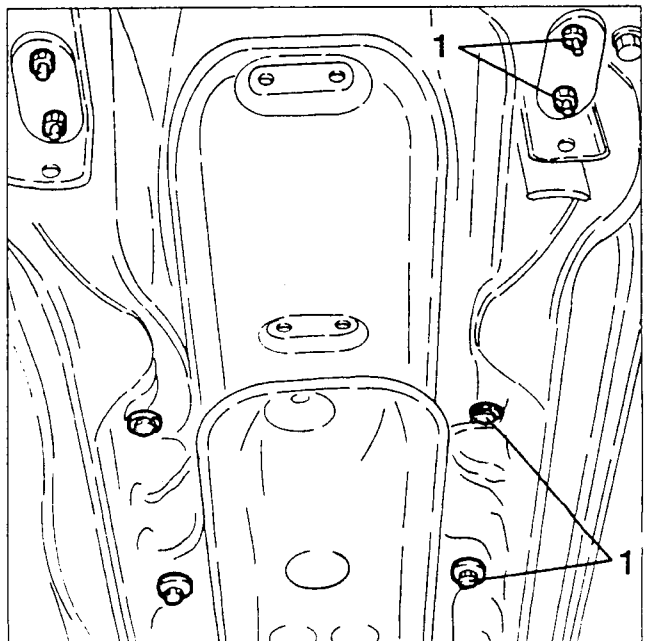
- 1. Raise the car, slacken the fastening screws and remove the reinforcement bracket.
- 2. Remove the front section of the exhaust pipe complete with the lambda sensor after loosening the fastenings.



- 1. Slacken the fastening bolts and remove the catalytic converter complete with the first silencer of the exhaust system.

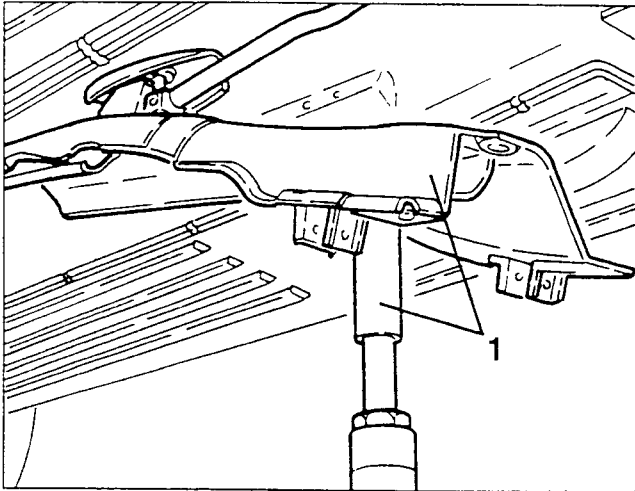


- 1. Slacken the screws fastening the gearshift controls support with the exception of the two rear ones.

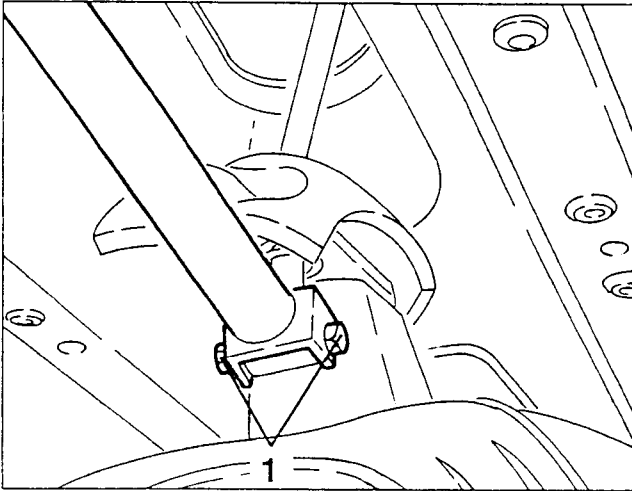




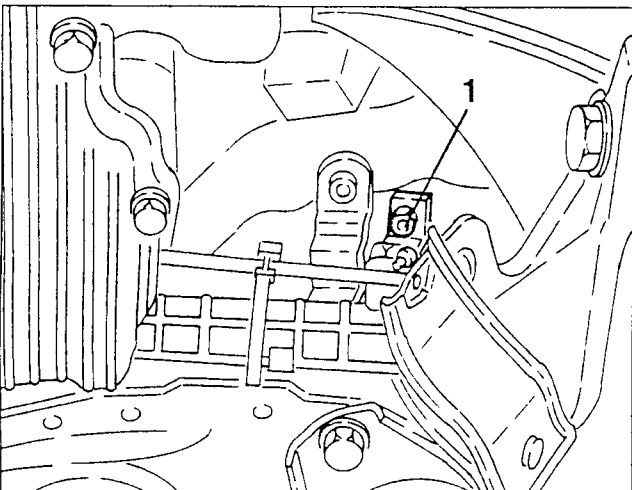
1. Using a hydraulic jack as support, lower the front of the gearshift controls support as illustrated.



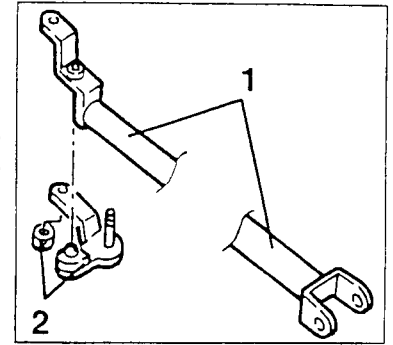
1. Disconnect the gearshift control rod from the lever slackening the fastening bolt.



1. Disconnect the gearshift control rod from the support on the power steering box slackening the fastening nut.



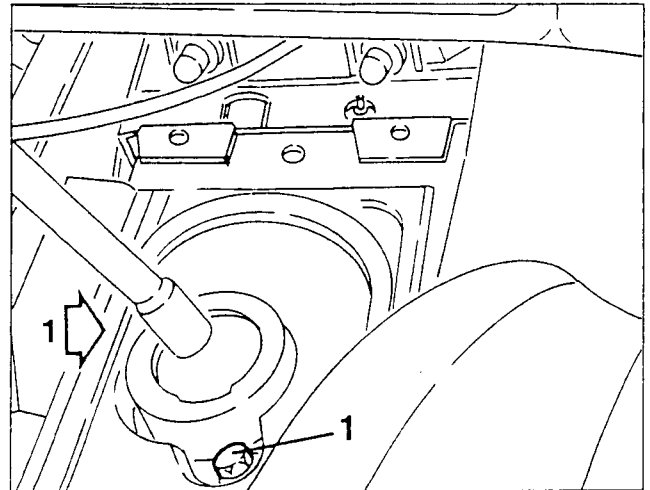
1. Remove the gearshift control rod.  
2. If necessary remove the relay levers slackening the remaining fastening nut.



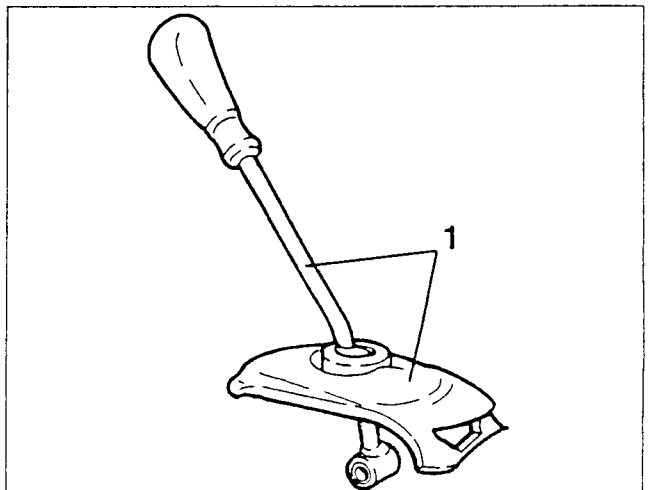
## GEARSHIFT CONTROL LEVER

### REMOVING/REFITTING

Proceed as described in the procedure "Gearshift control rod - Removing/Refitting" as far as disconnection of the gearshift control lever from the rod and taking care to slacken the two screws (1) fastening the gearshift control lever to the support, before slackening the fastenings of the gearshift controls support.

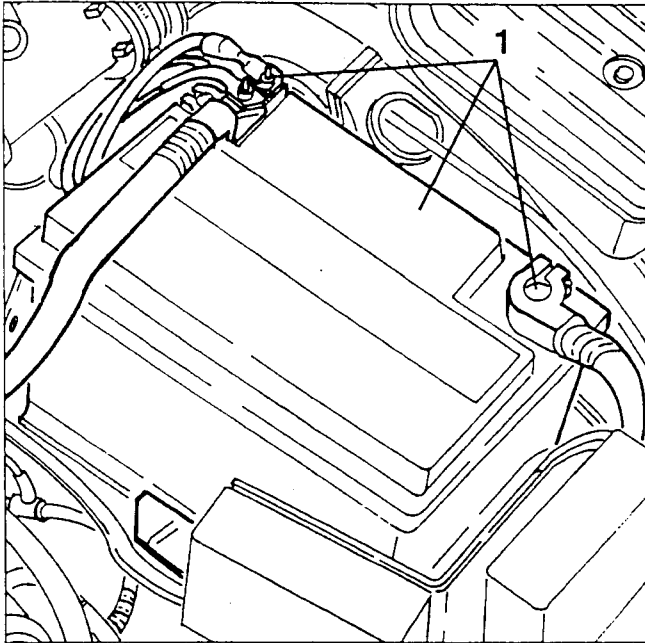


1. From under the car, retrieve the gearshift control lever complete with joint and frame.

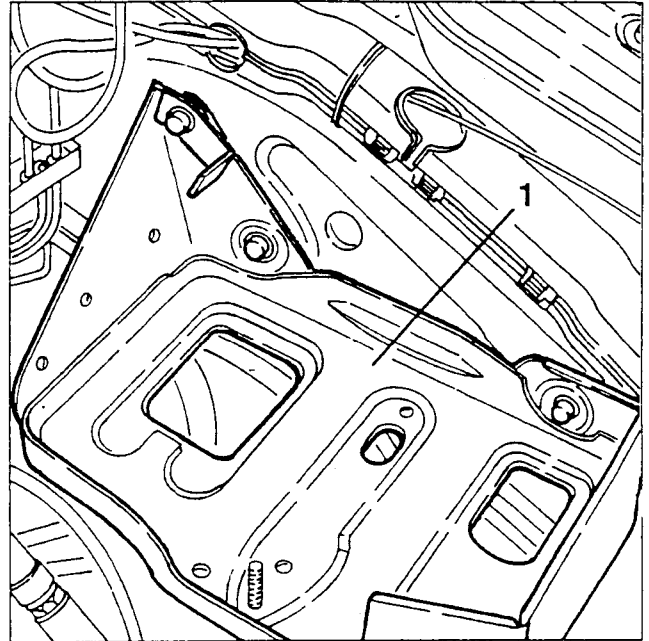


**REMOVING/REFITTING**

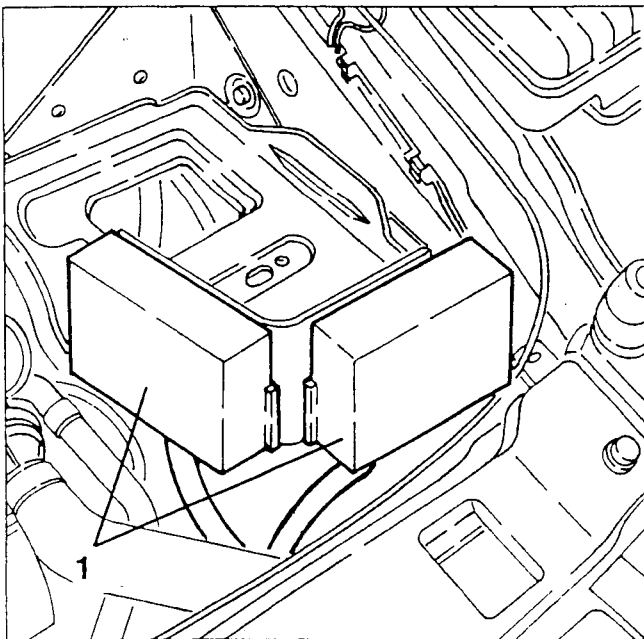
- Set the car on a lift.
- Remove the front wheels and mud flaps.
- 1. Remove the battery after disconnecting the terminals.



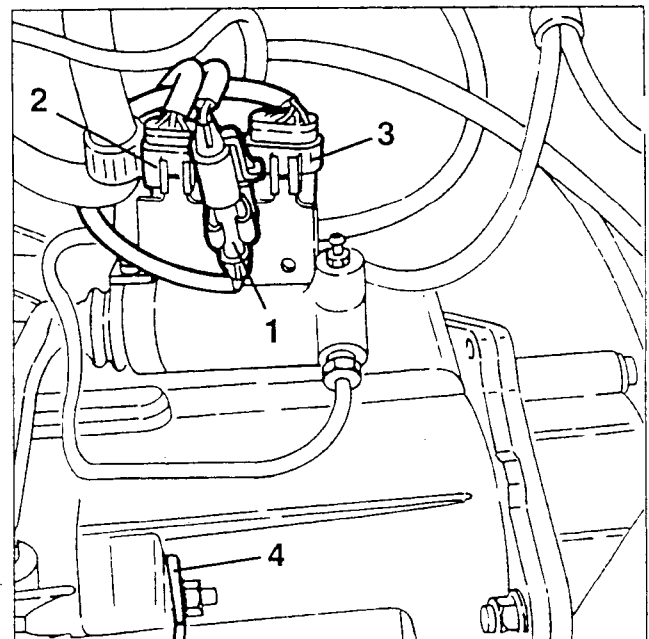
1. Slacken the fastening screws and remove the battery support complete with drain pipe after freeing this from the wheelhouse.



1. Release the two relay boxes from the battery support and set them aside.

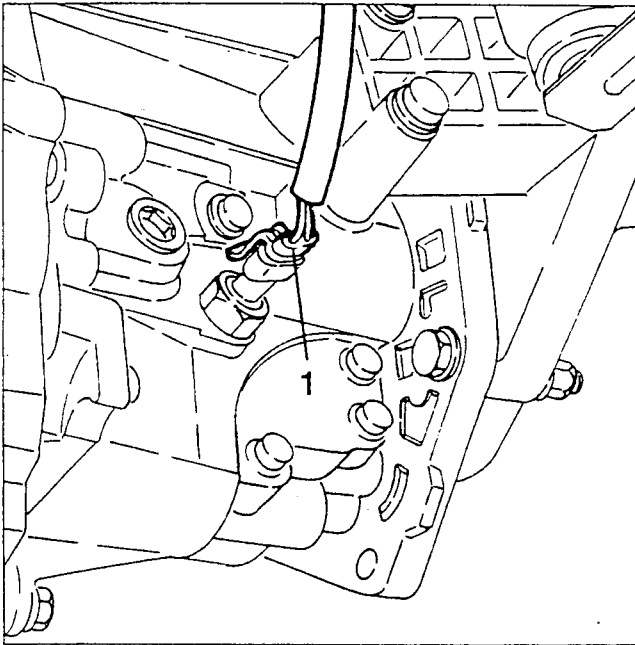


1. Disconnect the electrical connection of the starter motor.
2. Disconnect the electrical connection of the tachometric sensor.
3. Disconnect the electrical connection of the injection system.
4. Disconnect the earth cable from the gearbox cover.

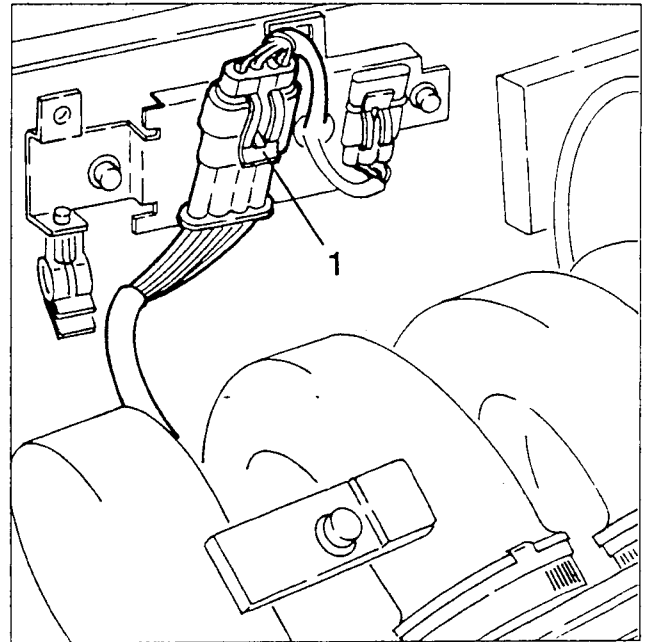




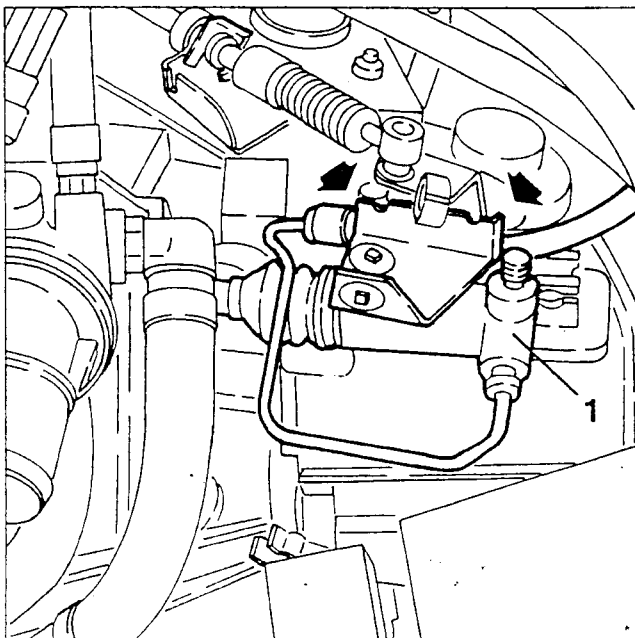
1. Disconnect the electrical connection from the reversing switch.



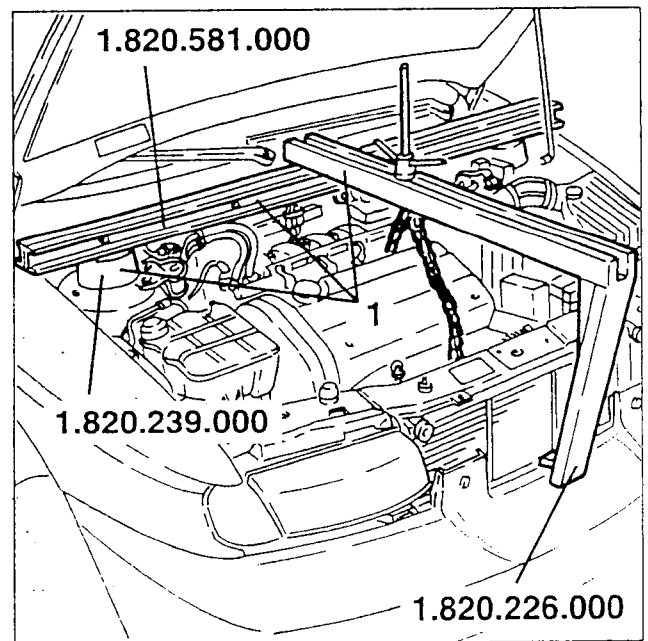
1. Remove the plastic cover, then disconnect the electrical connection of the lambda sensor.



1. Slacken the fastening screws, then move the clutch control cylinder to one side without disconnecting the associated pipes.

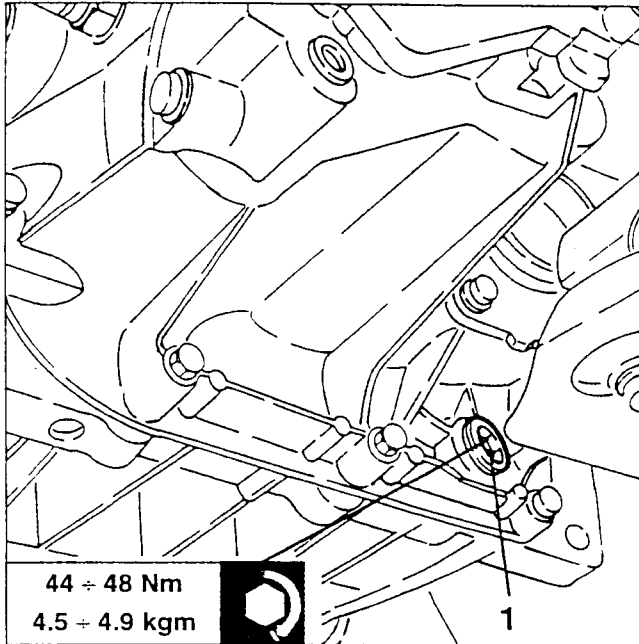


- Remove the radiator grille (see GROUP 70).  
1. Position engine support no. 1.820.226.000, with the corresponding supports no. 1.820.239.000 and cross rail no. 1.820.581.000 as illustrated.  
- Install two suitable support squares on the crankcase, then using a chain, connect the support tool to the squares thereby supporting the power unit.

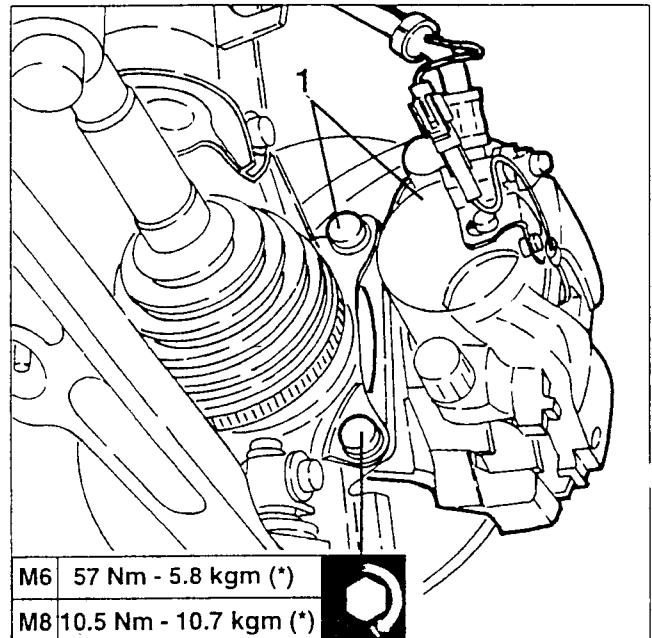




1. Slacken the plug and drain the gearbox-differential oil into a suitable container.

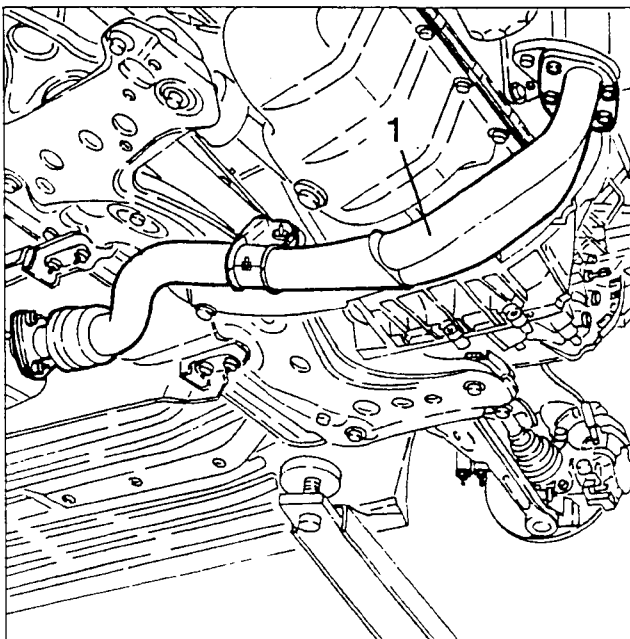


1. Slacken the two fastening screws and remove the left front brake caliper complete, without disconnecting the associated pipes and fasten it to one side to prevent it from hindering the following operations.

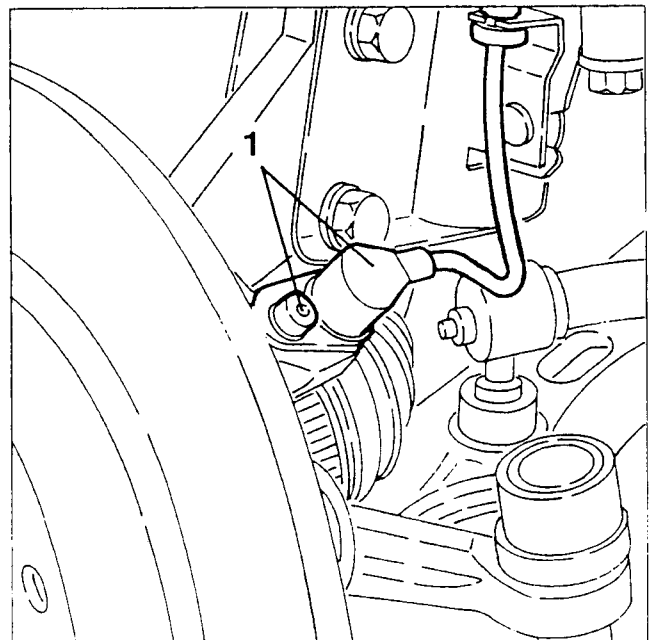


(\*): Screws with "Drilloc"; must be changed every time they are tightened or loosened.

1. Slacken the fastenings and remove the front section of the exhaust pipe complete with lambda sensor.

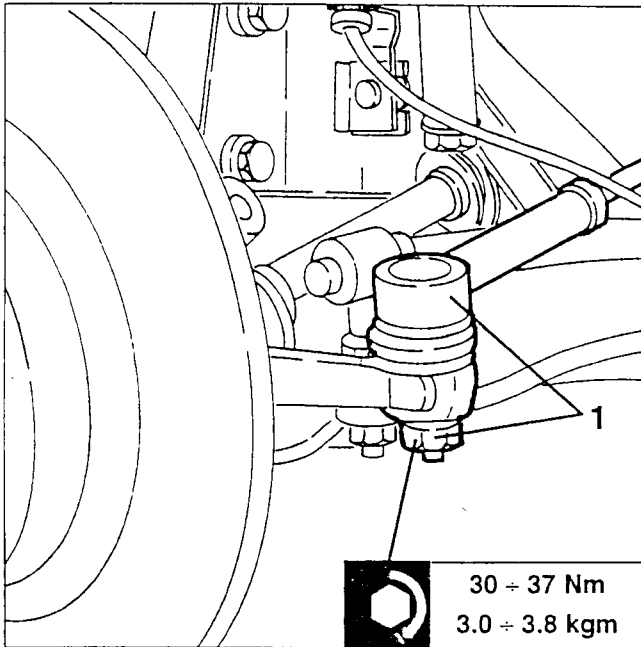


1. Slacken the fastening screw and remove the left front A.B.S. inductive sensor from the wheel upright.

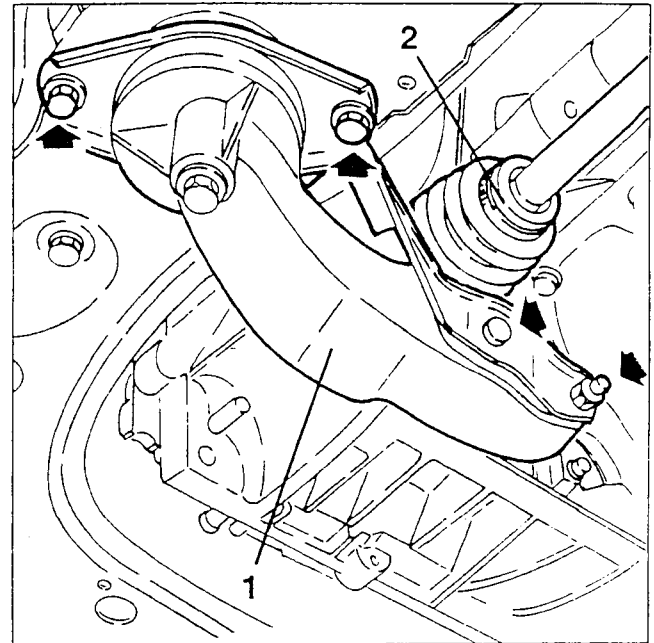




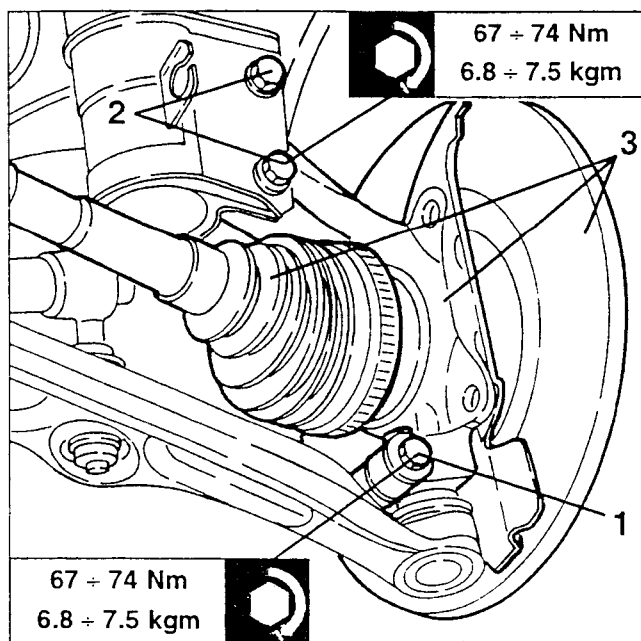
1. Slacken the fastening nut and disconnect the track rod from the wheel upright.



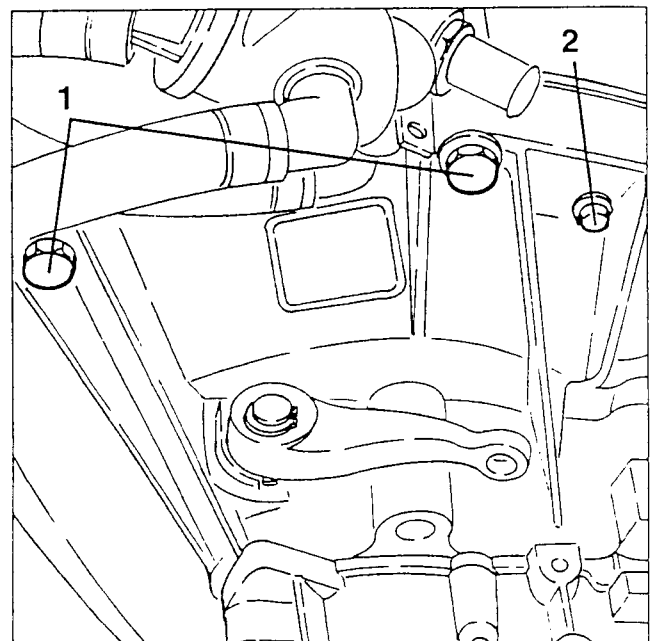
1. Slacken the fastening screws and remove the power unit rear support.
2. Slacken the clamp fastening the right axle shaft from the differential.



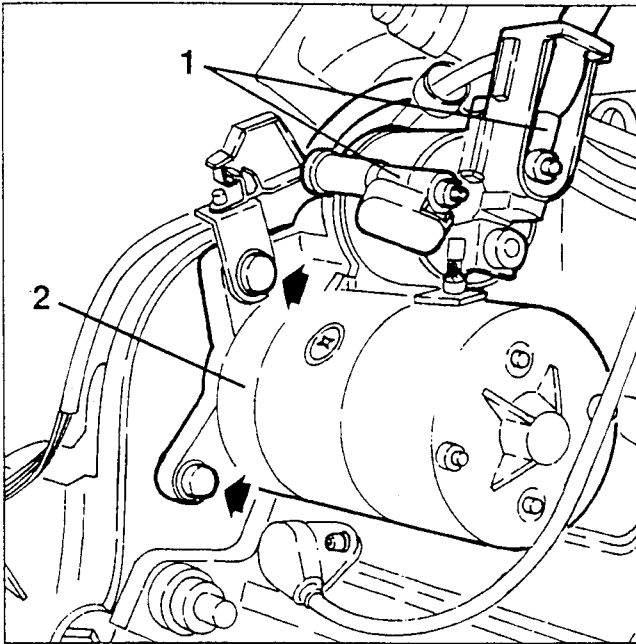
1. Slacken the bolt fastening the wishbone to the wheel upright.
2. Slacken the two bolts fastening the upright to the shock absorber.
3. Withdraw the axle shaft complete with wheel upright and brake disk after freeing the axle shaft boot from the differential.



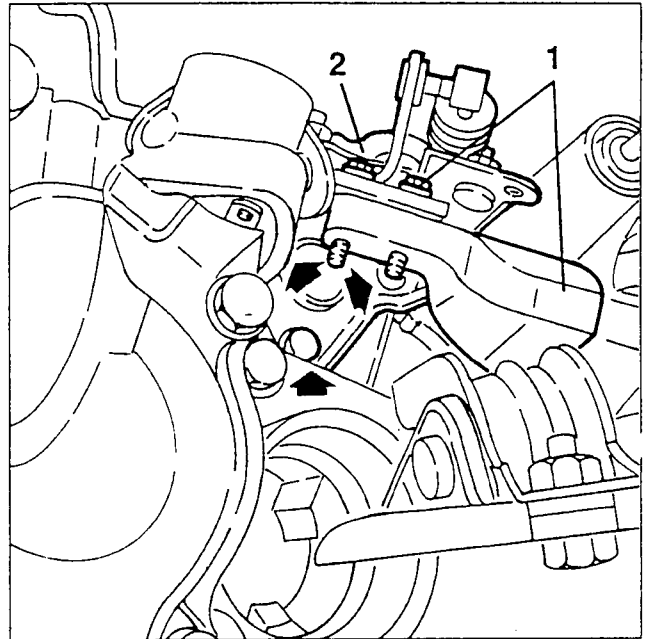
1. Slacken the two upper screws fastening the gear-box to the engine.
2. Slacken the screw fastening the starter motor to the gear-box.



1. Disconnect the electrical connections from the starter motor.
2. Slacken the remaining two fastening screws and remove the starter motor.

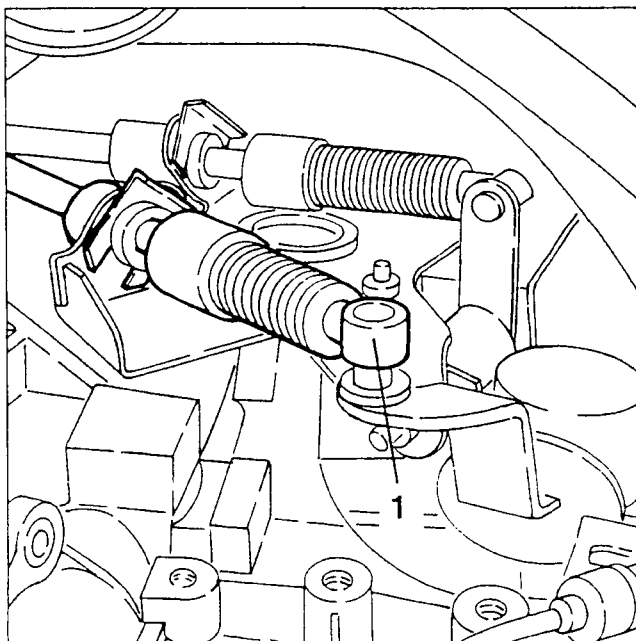


1. Slacken the two fastening screws and remove the damping mass.
2. Slacken the fastening screws and remove the gearshift control bowden connection bracket from the gearbox.



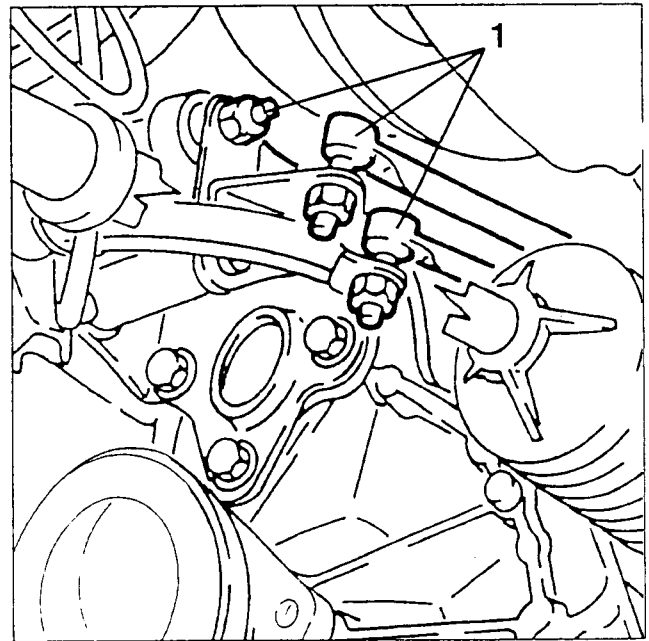
#### Specific for versions with bowden gearshift control

1. Disconnect the gearshift control bowden illustrated.



#### Specific for versions with rod gearshift control

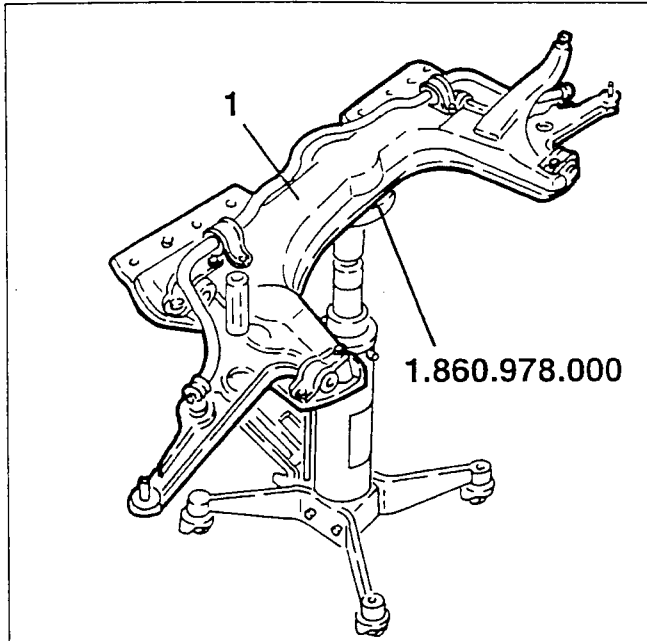
1. Slacken the fastening nuts and disconnect the gearshift control rods.





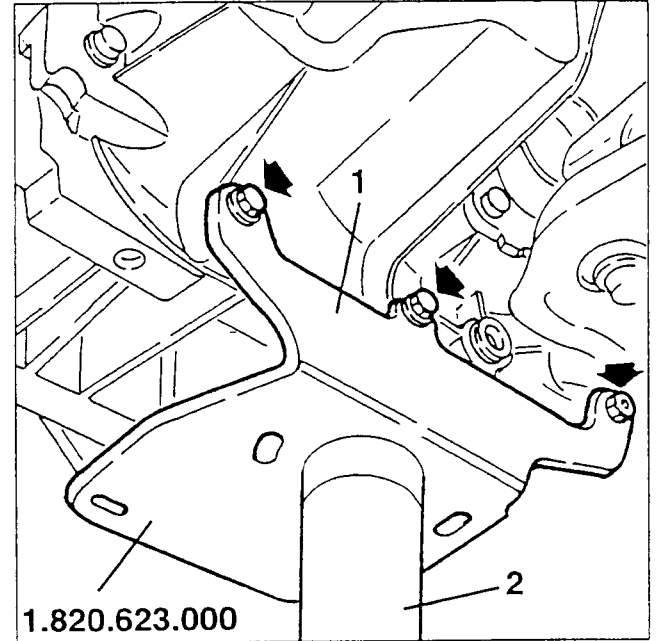
- Using a hydraulic jack support the front suspension crossmember using tool no. 1.860.978.000.

1. Slacken the screws and nuts fastening the crossmember, then remove it complete with wishbones, stabiliser bar and reinforcements.

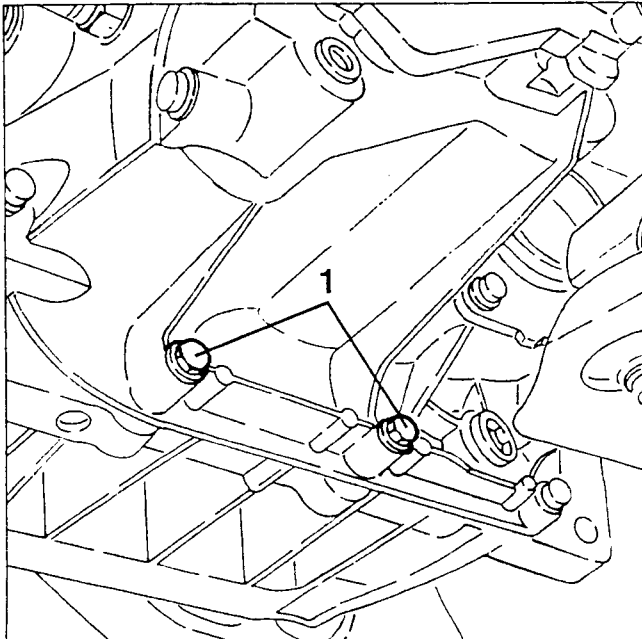


1. Position the bracket of tool no. 1.820.623.000 fastening it to the gearbox with the two screws removed previously and with a bolt in the hole already existing on the gearbox as illustrated.

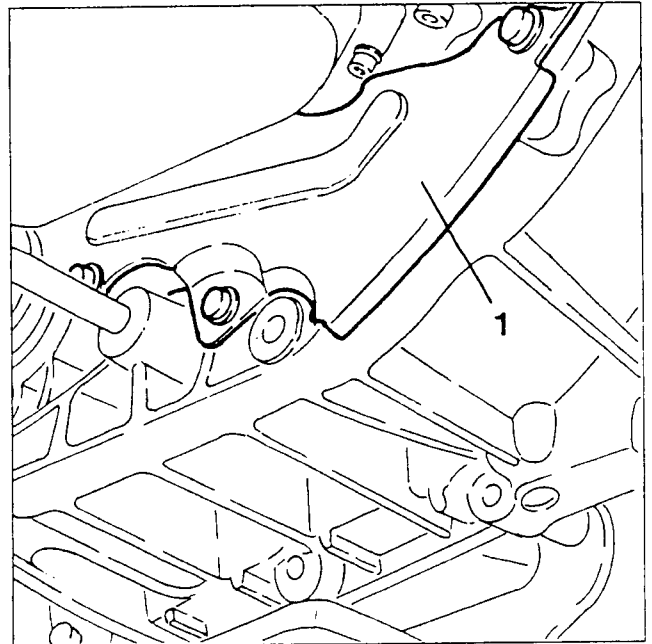
2. Position a hydraulic jack under the support tool.



1. Slacken the two gearbox fastening screws illustrated.

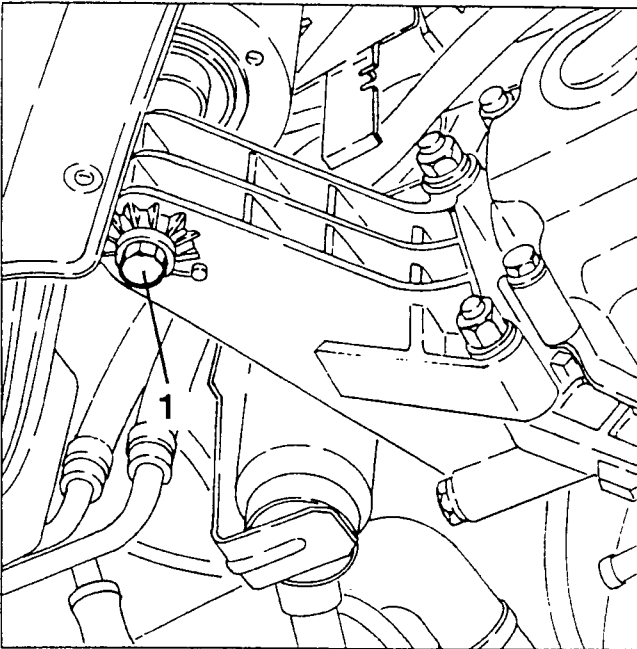


1. Slacken the fastening screws and remove the flywheel guard.

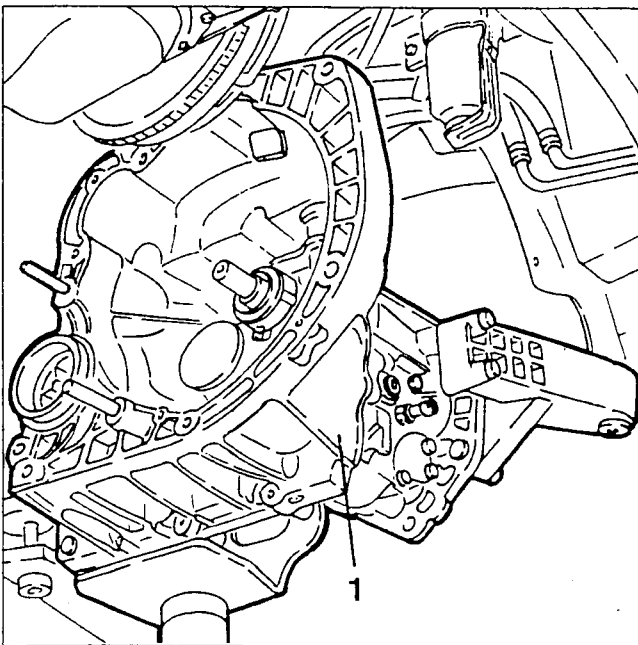




1. Slacken the screw fastening the gearbox side power unit support.



1. Slacken the remaining gearbox fasteners to the engine, then lower the hydraulic jack and remove it, freeing it from the right axle shaft.

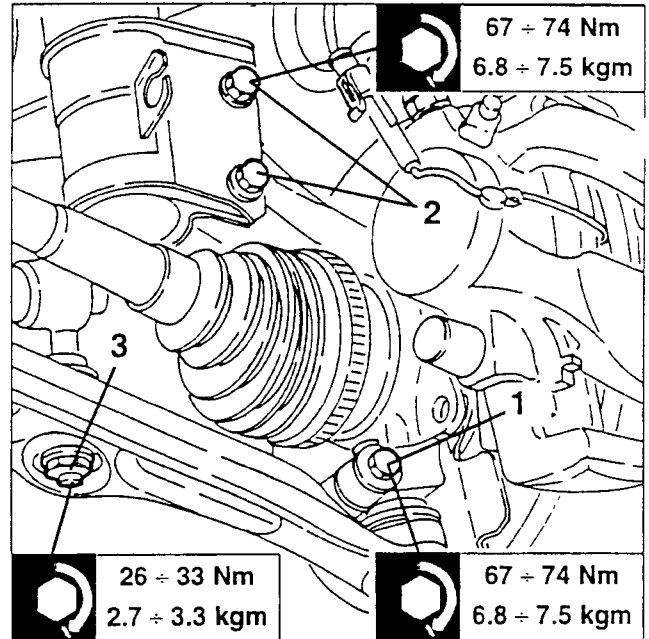


## OPERATIONS IN THE CAR

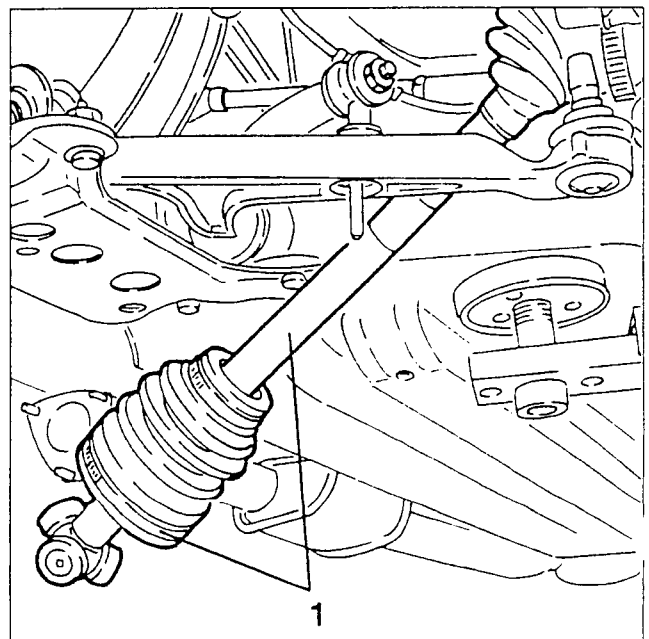
### CHANGING THE GEARBOX SIDE DIFFERENTIAL CARRIER OIL SEAL

- Set the car on a lift.
- Disconnect the battery (-) terminal.
- Raise the car and remove the left front wheel and mud flap.

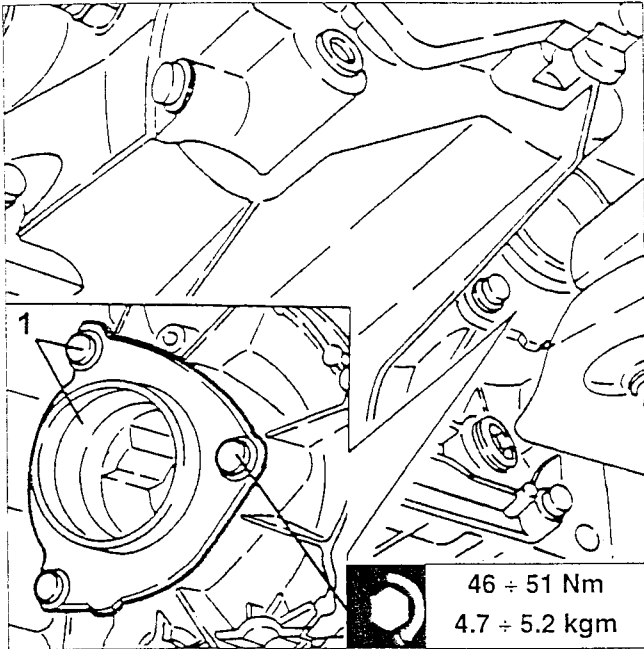
1. Slacken the bolt fastening the left wishbone to the left wheel upright.
2. Slacken the two bolts fastening the upright to the left shock absorber.
3. Slacken the nut fastening the stabiliser bar to the left wishbone.



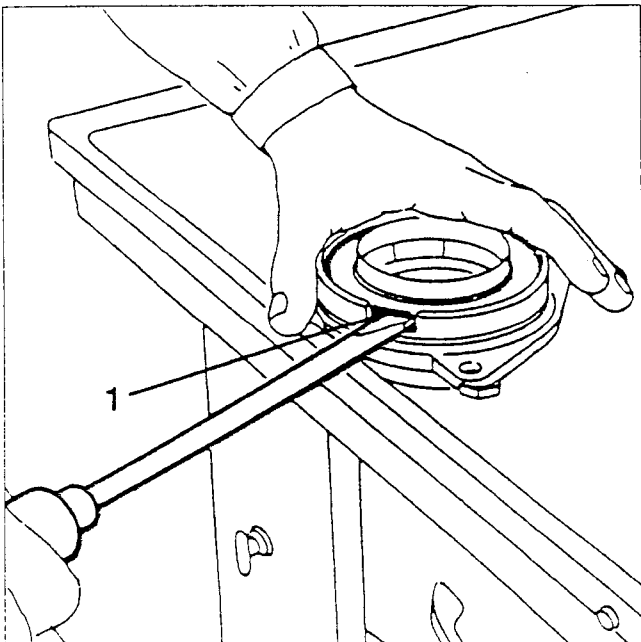
1. Slacken the boot fastening clamp, then withdraw outwards the axle shaft, wheel upright and brake disk assembly until releasing the axle shaft from the differential.



1. Slacken the three fastening screws and remove the differential box sealing cover.

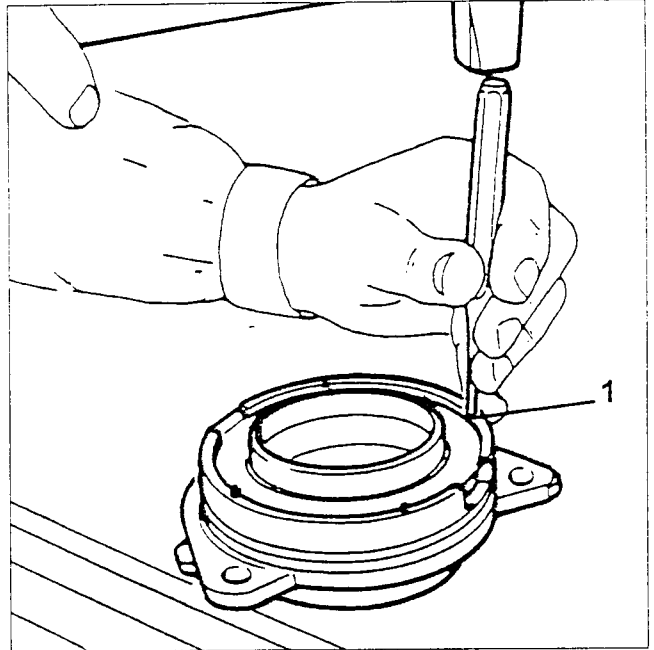


1. On the bench, remove the differential box sealing cover and oil seal using a screwdriver as illustrated.



- Remove the four caulking to make it possible to install a new oil seal.

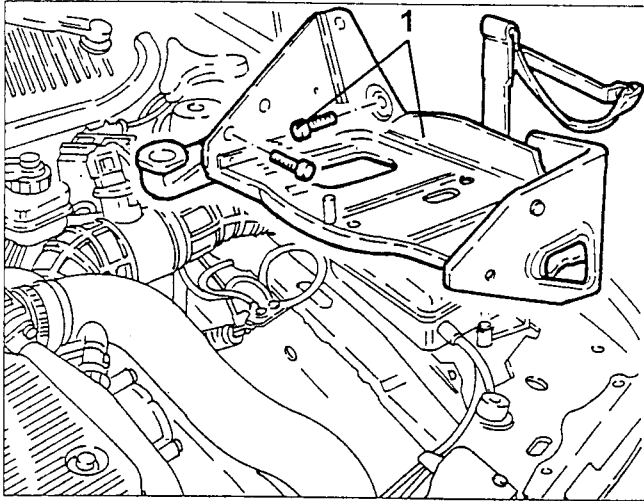
1. Install a new oil seal and remake the four caulking removed previously using a punch and a hammer.



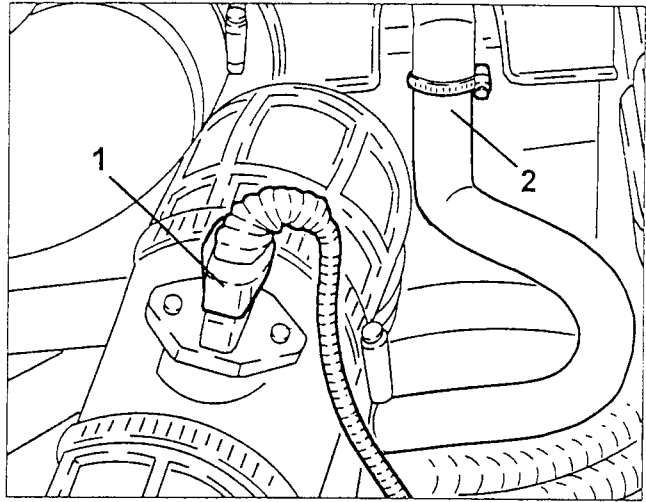
Complete re-assembly reversing the sequence followed for disassembly.

**REMOVAL/REFITTING**

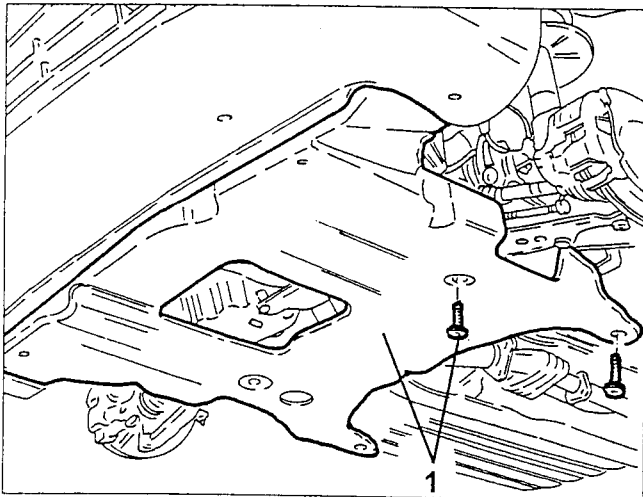
- Set the car on a lift.
  - Remove the battery (see Group 55).
  - Remove the battery acid drain duct.
1. Slacken the fastening screws and remove the battery holder.



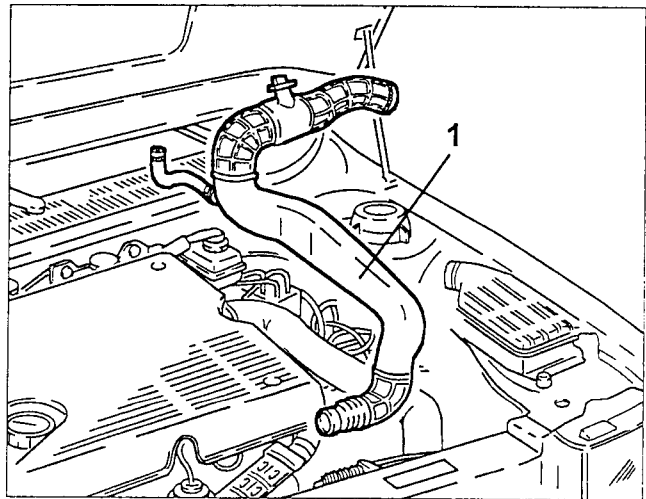
1. Disconnect the electrical connection from the air flow meter.
2. Disconnect the oil vapour re-circulation pipe from the oil vapour separator.



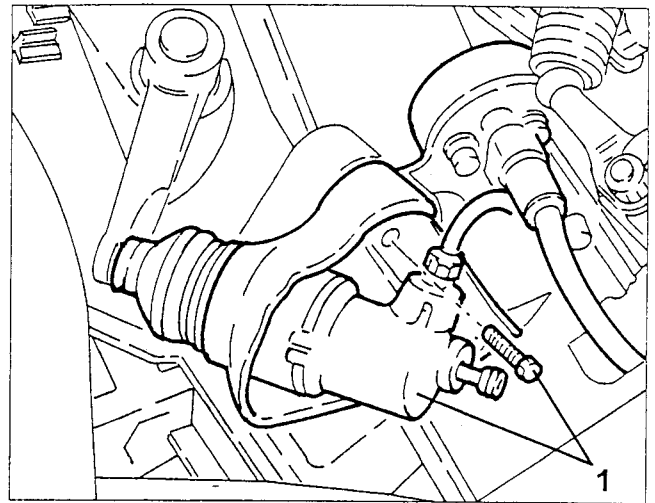
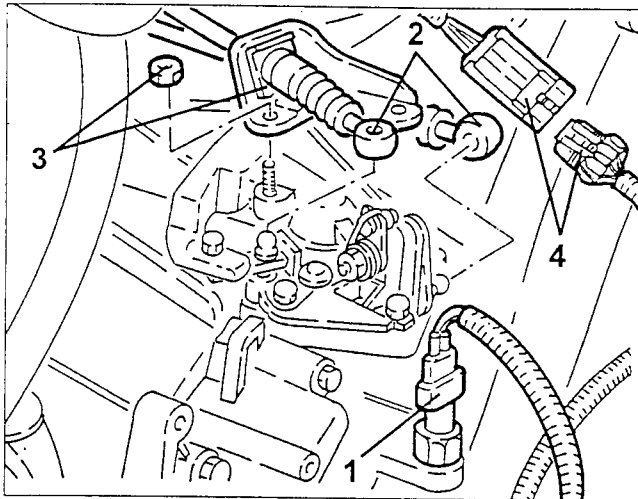
- Remove the front wheels and their dust guards.
1. Slacken the fastenings and remove the under engine guard.



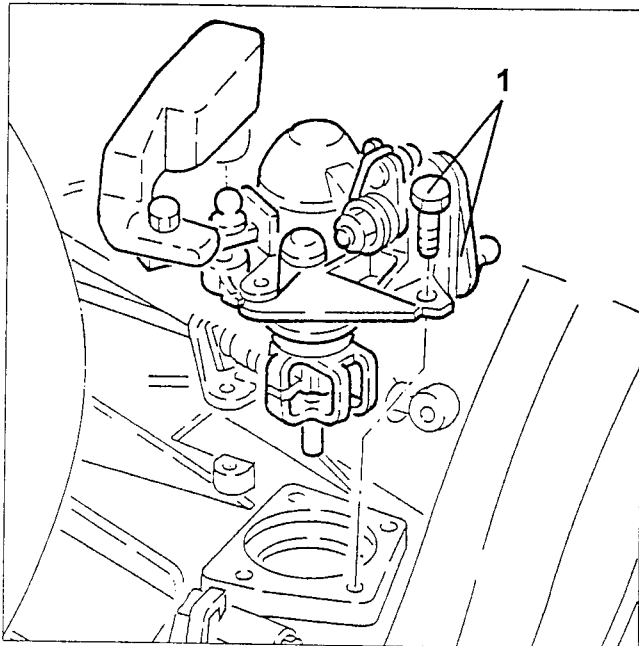
1. Loosen the clamps and remove the complete air delivery pipe from the cleaner to the turbocharger.



1. Disconnect the electrical connection from the reverse gear switch.
2. Disconnect the gearshift selection and engagement cables.
3. Slacken the nuts and move aside the support brackets complete with gearshift selection and engagement cables.
4. Disconnect the electrical connection of the speedometer sensor.

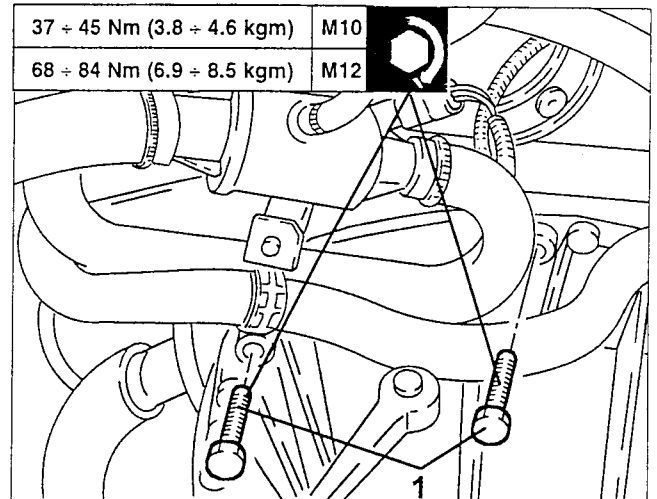


1. Slacken the fastening screws and remove the gear selection and engagement unit.

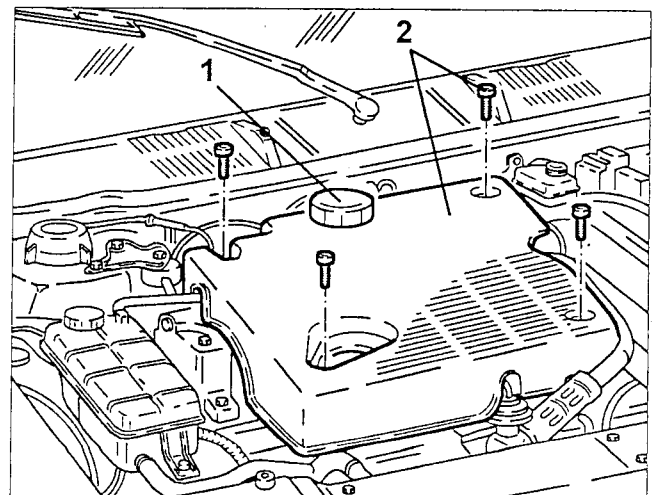


1. Slacken the fastening screws and move the operating cylinder complete with pipes and vibration damper.

1. Slacken the two upper gearbox fastening screws.



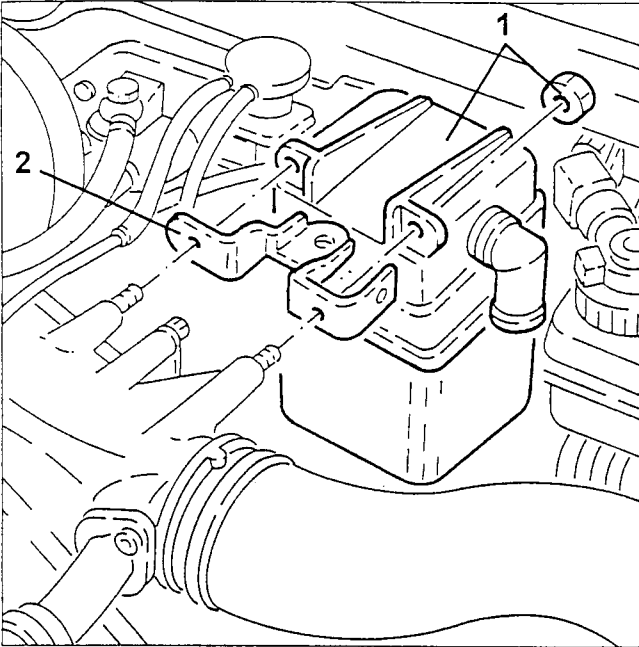
1. Remove the engine oil filler cap.
  2. Slacken the fastening screws and remove the engine cover.
- Refit the engine oil filler cap.



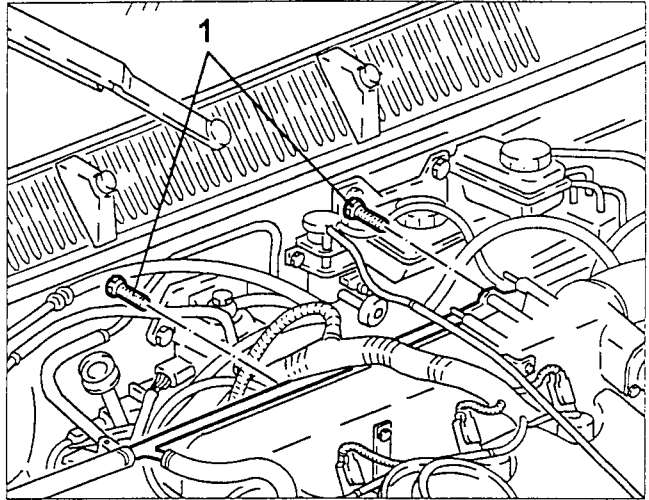


- Remove the front bumper (see GROUP 70).

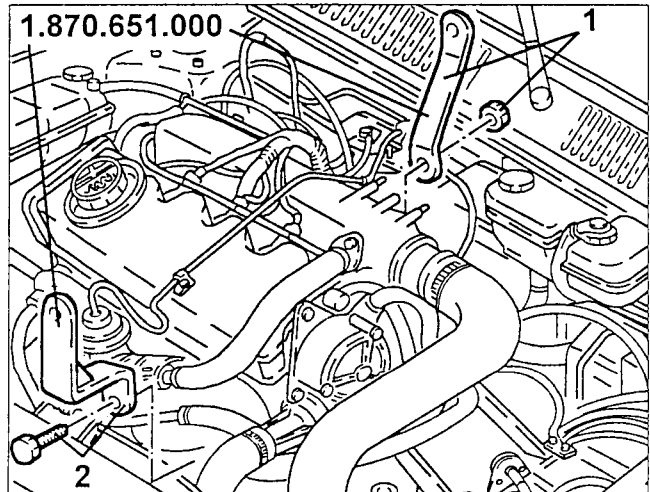
1. Slacken the fastening nuts and move the oil vapour separator just enough to disconnect the corresponding pipes, then remove it.
2. Retrieve the bracket.



1. Slacken the fastening screws of the coolant fluid return pipe to the header tank.

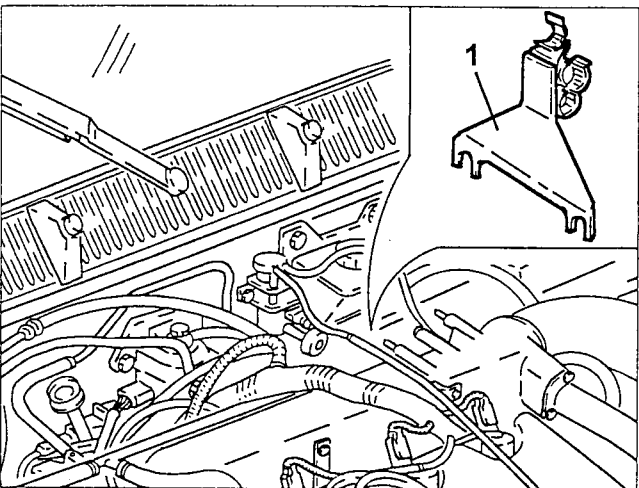


1. Install the rear bracket no. 1.870.651.000 and fasten it with an air box fastening nut.
2. Install the front bracket no. 1.870.651.000 and fasten it with the screw fastening the stiff coolant fluid delivery pipe to the engine oil heat exchanger.

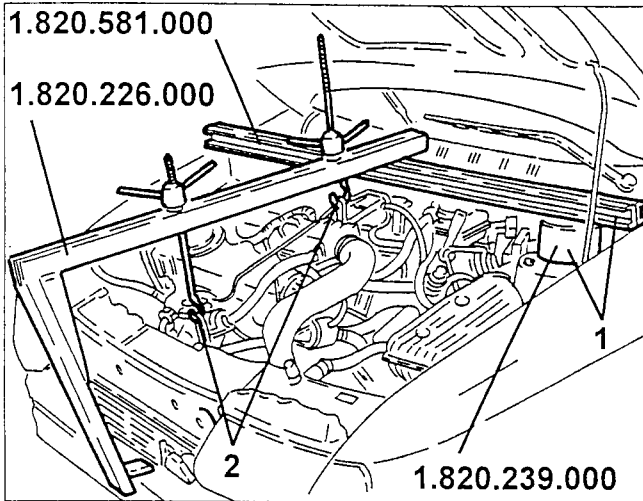


- Release the clamp fastening the oil vapour recovery pipe from the tappet cover.  
- Release the delivery and return pipes to the climate control system heater from the fastening clamps.

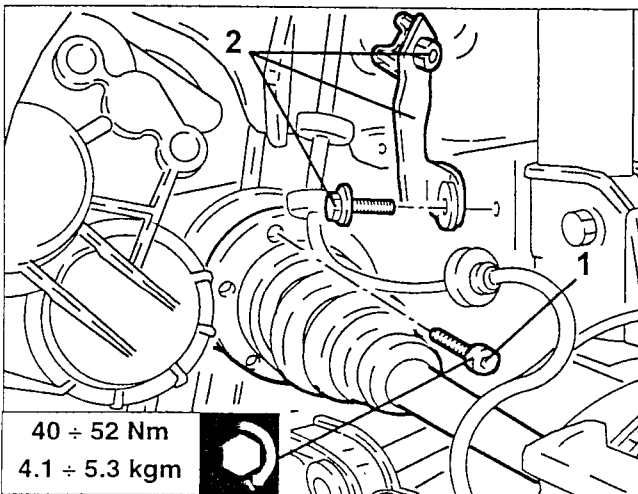
1. Slacken the upper screws fastening the starter motor, then remove the pipe support bracket.



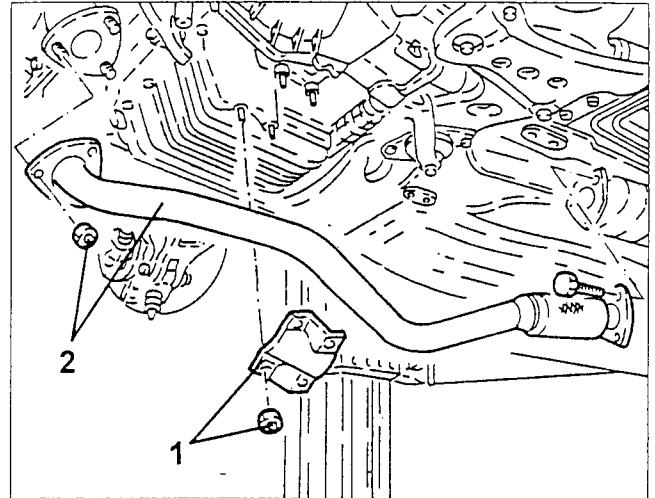
1. Install cross rail no. 1.820.581.000 complete with rest pads no. 1.820.239.000.
2. Install support no. 1.820.226.000 and connect the corresponding tie-rods to the brackets installed previously.



1. Slacken the bolts fastening the left axle shaft to the differential inner shaft.
2. Slacken the fastenings and remove the power steering pipe support bracket.

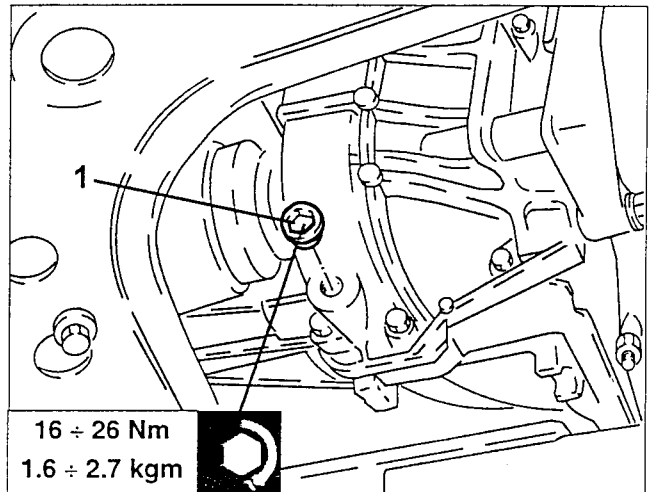


1. Slacken the fastening nuts and remove the reinforcement bracket.
  2. Slacken the nuts and screws and remove the front section of the exhaust pipe.
- Remove the associated pipes.

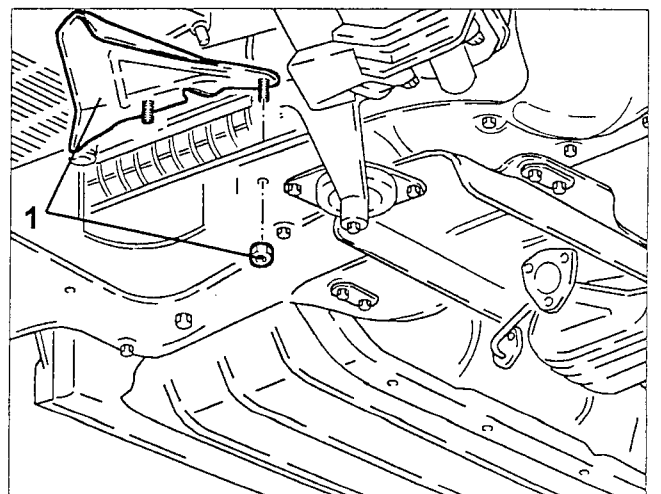


1. Slacken the drain cap and drain the gearbox/differential oil.

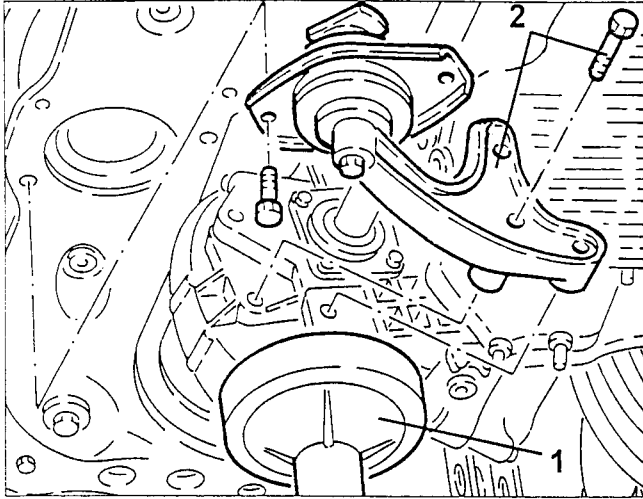
**NOTE:** Collect the gearbox/differential oil in a suitable container.



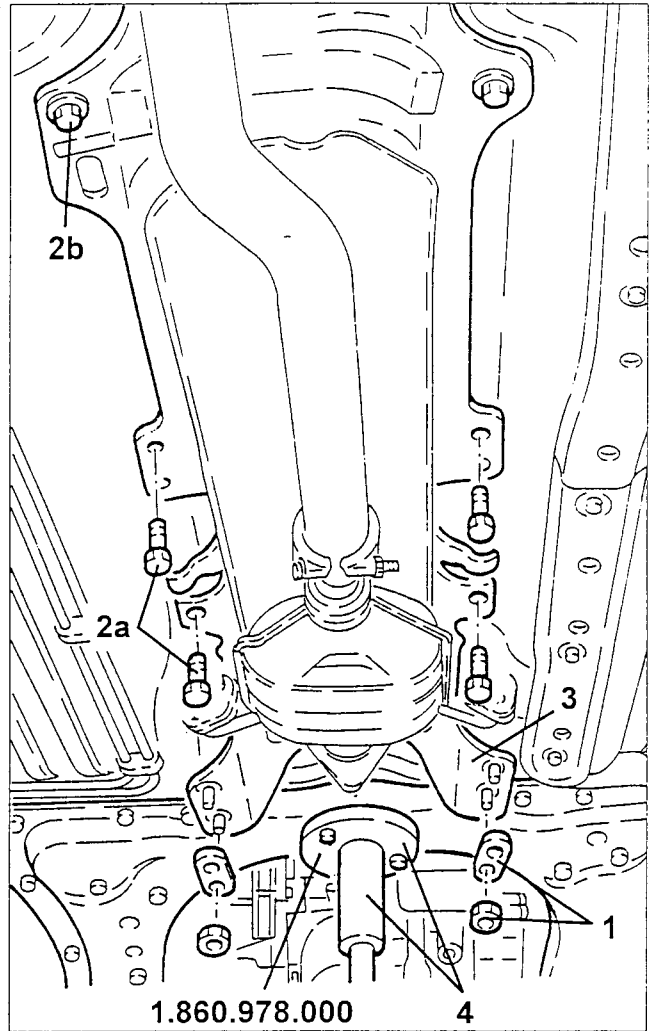
1. Slacken the nuts and remove the power steering box heat shield.



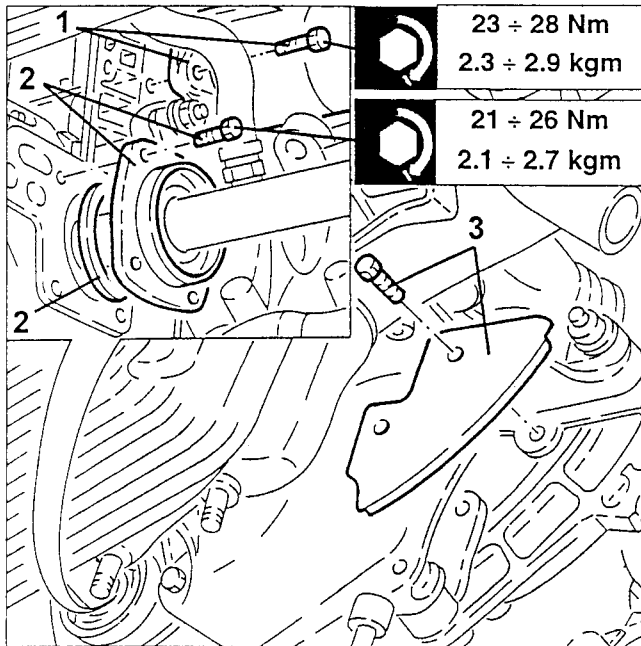
1. Set a hydraulic jack under the gearbox.
2. Slacken the fastening screws and remove the power unit rear rigid support.



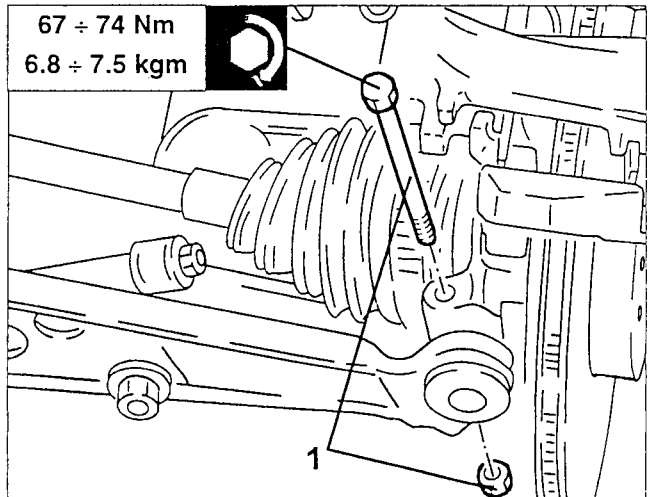
2. Slacken the front screws (2a) and slacken the rear screws (2b) fastening the support for the gearshift and handbrake control levers.
3. Lower the front of the support for the gearshift and handbrake control levers.
4. Support the front suspension cross rail with a hydraulic jack fitted with tool no. 1.860.978.000.



1. Slacken the lower screw fastening the starter motor, then move it aside.
2. Slacken the fastening screws and move the right differential flange complete with thrust ring.
3. Slacken the fastening screws and remove the lower flywheel guard.

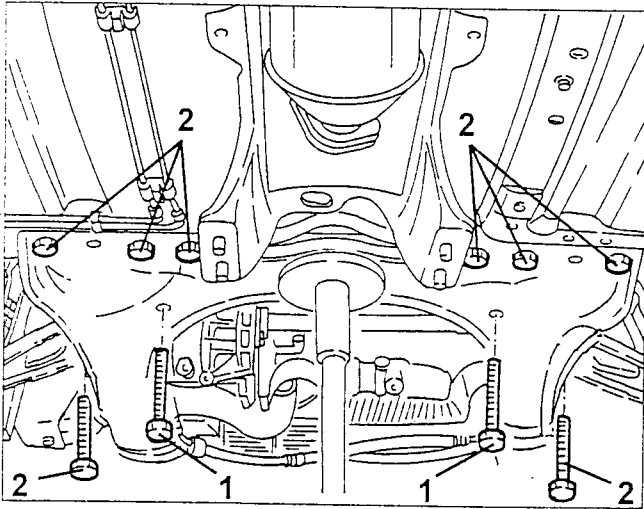


1. Slacken the bolts fastening the wishbones to the wheel uprights.

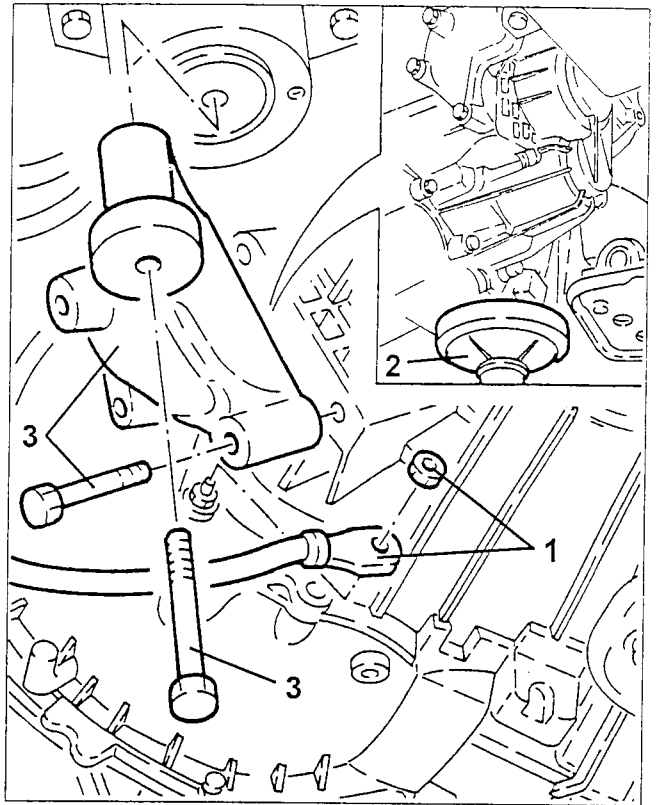


1. Slacken the nuts fastening the support for the gearshift and handbrake control levers and retrieve the corresponding plates.

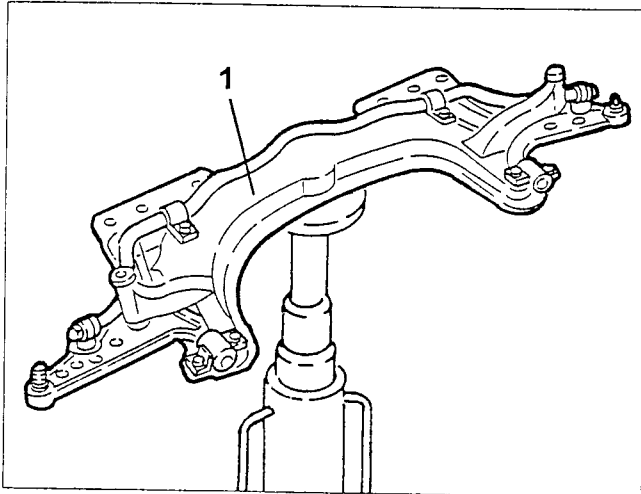
1. Slacken the screws fastening the power steering box to the front suspension cross rail.
  - Slacken the screws fastening sound-absorbing protections to the front suspension cross rail.
2. Slacken the side and rear screws fastening the front suspension cross rail to the body.



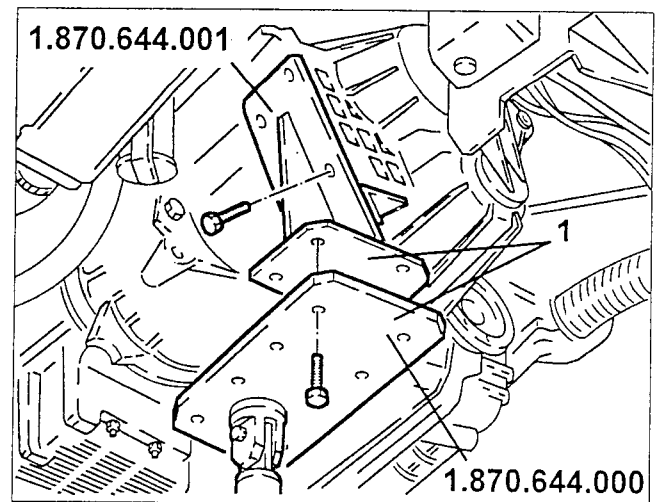
3. Slacken the screws and remove the gearbox stiff side support.



1. Lower the hydraulic jack and remove the front suspension cross rail complete with stabiliser bar and wishbones.

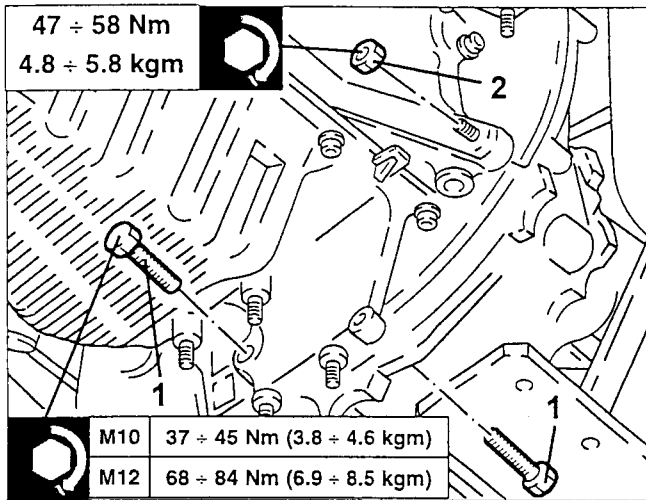


1. Support the gearbox with a hydraulic jack fitted with tools no. 1.870.644.000 and no. 1.870.644.001.

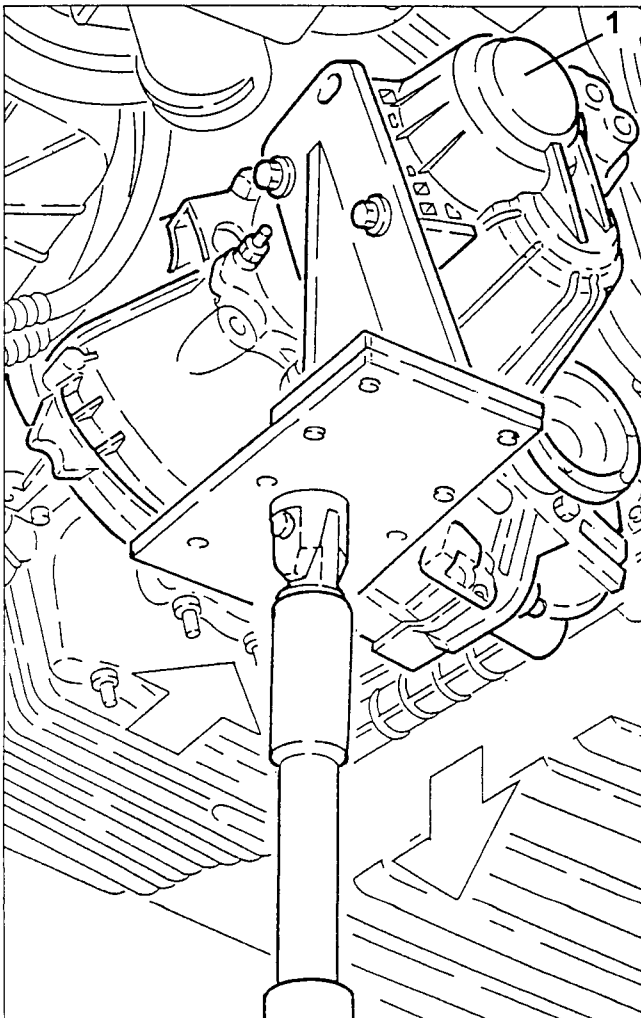


1. Slacken the nut and disconnect the gearbox earth cable.
2. Set a hydraulic jack under the gearbox.

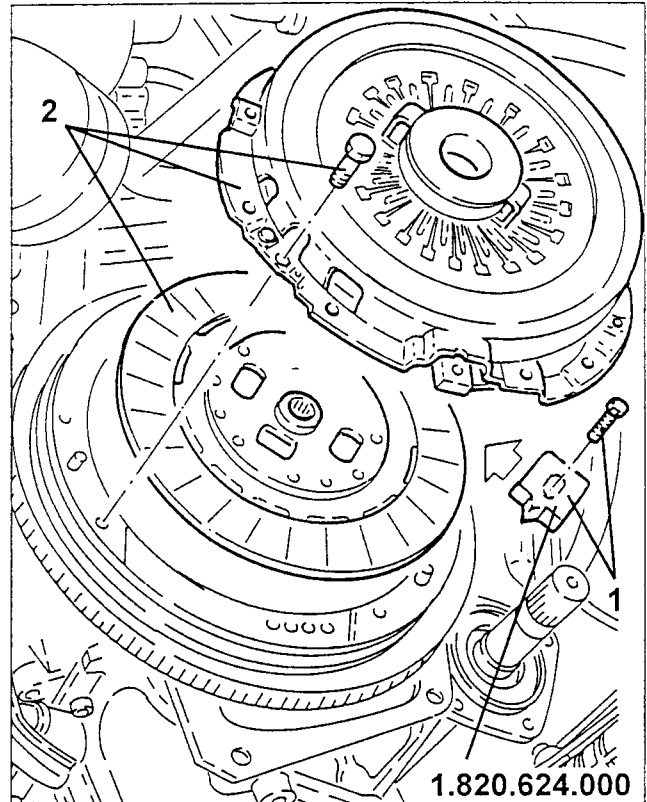
1. Slacken the screws fastening the oil sump to the gearbox.
2. Slacken the nuts fastening the gearbox to the crankcase.



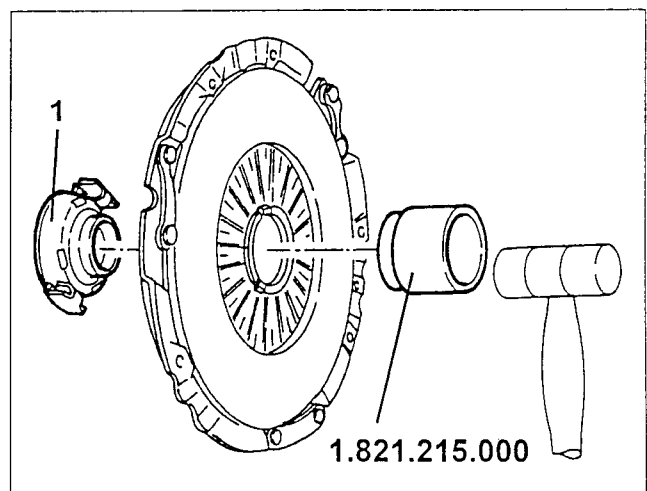
1. Remove the gearbox with differential firstly moving it away from the engine and then lowering it with the hydraulic jack.



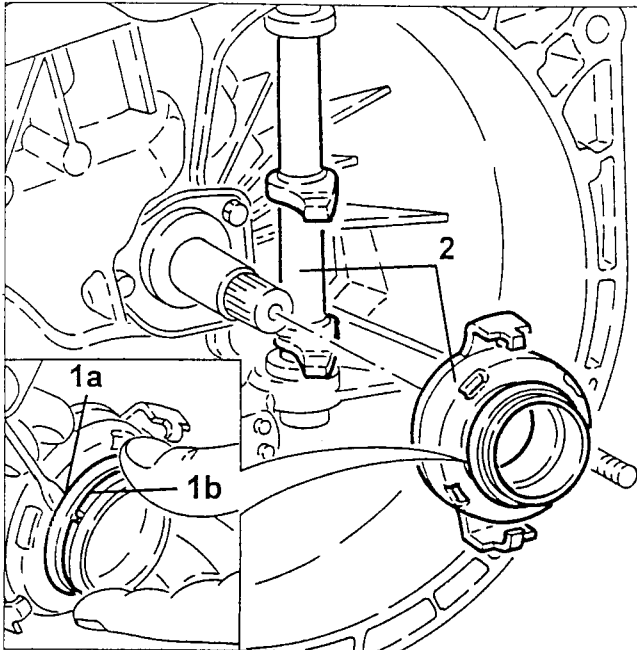
1. Install flywheel stopper tool no. 1.820.624.000.
2. Slacken the screws and remove the clutch box complete with thrust bearing and clutch plate.



- When refitting, follow the instructions given below.
1. Remove the thrust bearing from the clutch box using tool no. 1.821.215.000.

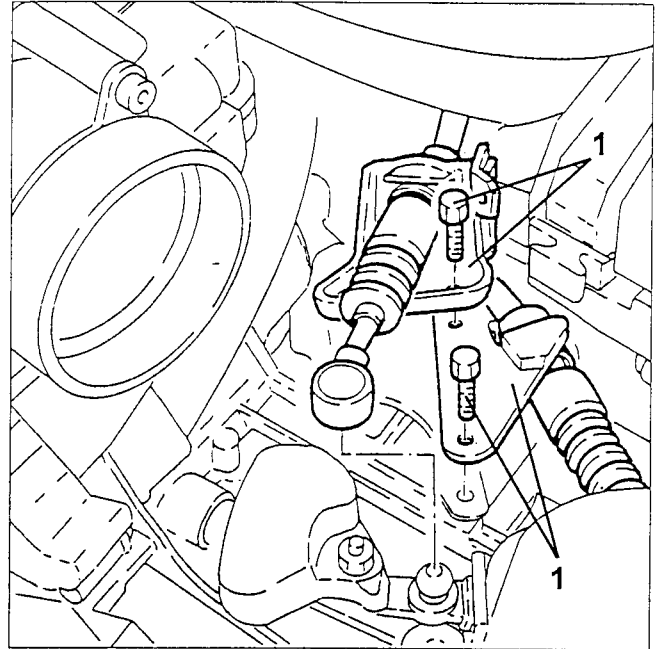


1. Raise the taper ring (1a) of the thrust bearing until covering the spring (1b).
2. Install the thrust bearing on the main shaft and couple it with the fork pin.

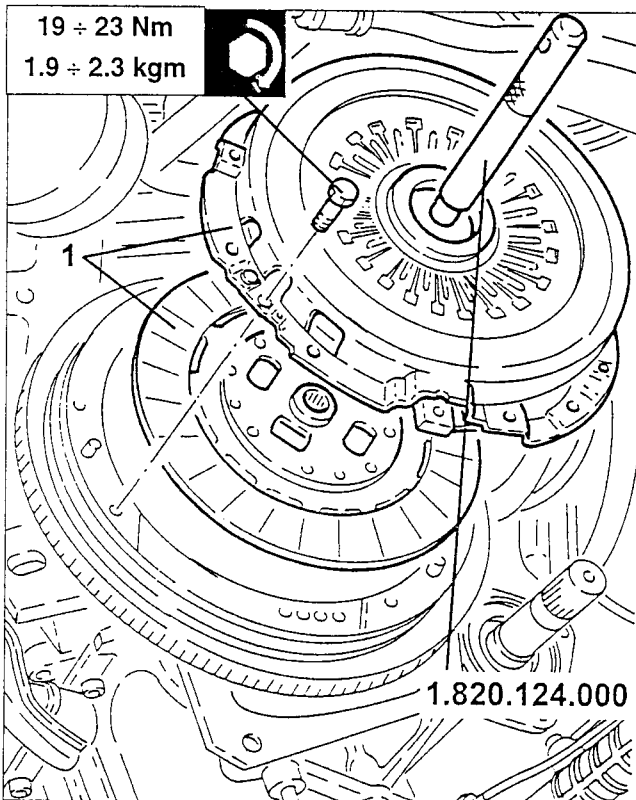


- Complete refitting, reversing the sequence followed for removal up to assembly of the gear selection/engagement unit, then adjust the gear selection/engagement cables as described below.

1. Refit the support brackets complete with gear selection and engagement cables and fasten them with their nuts.



1. Install the clutch plate and clutch box centring them with tool no. 1.820.124.000.



1. Install tool no. 1.870.974.000 under the gear engagement cable catch ball.

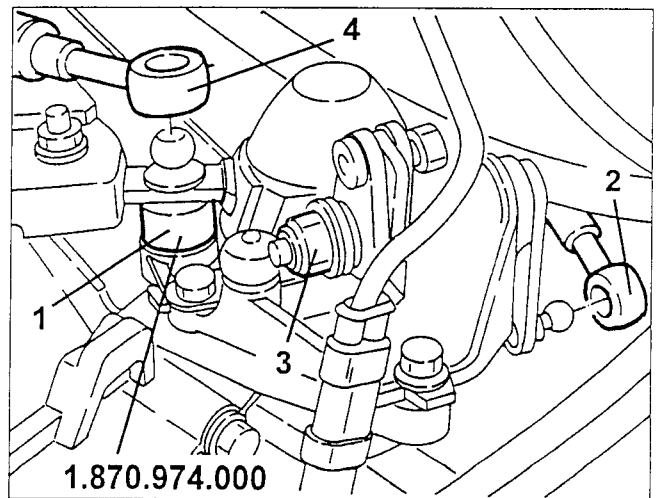
2. Connect the gear selection cable.

3. Loosen the adjustment nut of the gear selection/engagement unit.

- Tighten the adjustment nut of the gear selection/engagement unit after positioning the gearshift lever to neutral and moving it completely to the right.

4. Connect the gearshift engagement cable.

- Position the gearshift lever at reverse and remove the tool no. 1.870.974.000.



- After assembling the gearbox and fastening it with its screws, work on the clutch control lever to engage the thrust bearing on the clutch.

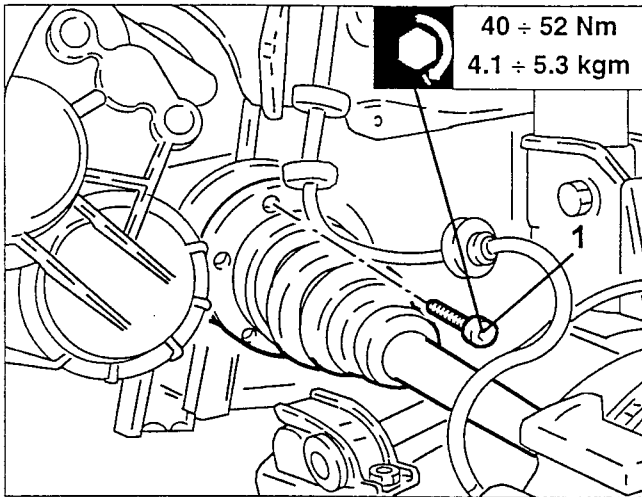
- Complete refitting, reversing the sequence followed for removal.

## OPERATIONS ON THE CAR

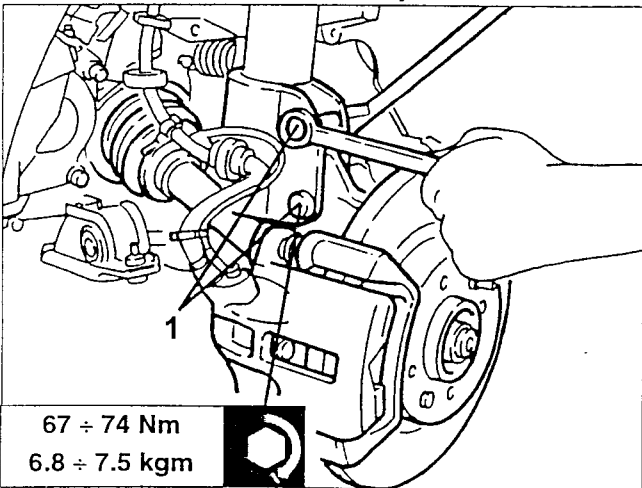
### REPLACING THE GEARBOX SIDE DIFFERENTIAL OIL SEAL

- Set the car on a lift.
- Disconnect the battery (-) terminal.
- Raise the car.
- Remove the left front wheel and mud flap.
- Working from the left wheel arch, disconnect the electrical connection of the brake pad wear sensor.
- Slacken the screw fastening the active A.B.S. sensor cable support bracket.

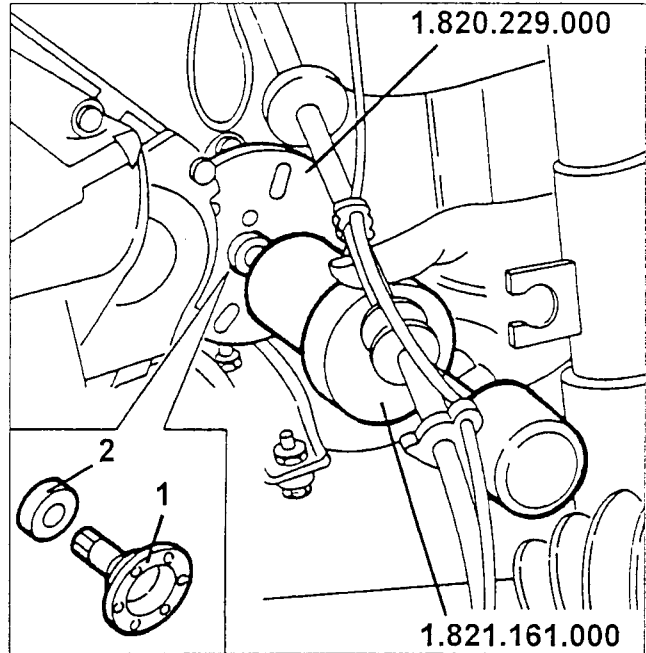
1. Slacken the bolts fastening the left axle shaft to the differential left inner axle shaft.



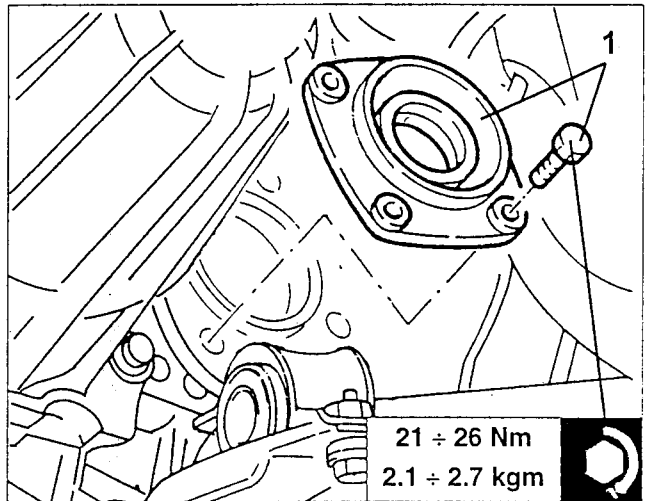
1. Slacken the bolts fastening the left upright to the shock absorber, then remove only the upper bolt.
- Move the left axle shaft back from the differential left inner axle shaft as necessary.



1. Remove the differential left inner axle shaft using tools no. 1.821.161.000 and no. 1.820.229.000.

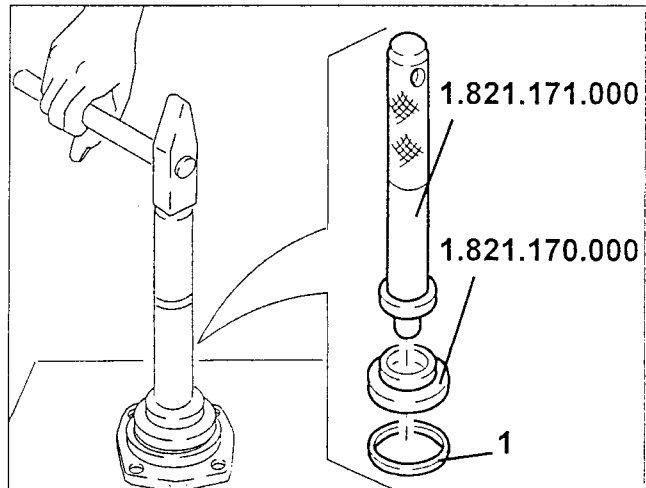


1. Slacken the fastening screws and remove the left flange from the differential complete with oil seal.



- Prise and remove the oil seal from the left differential flange.

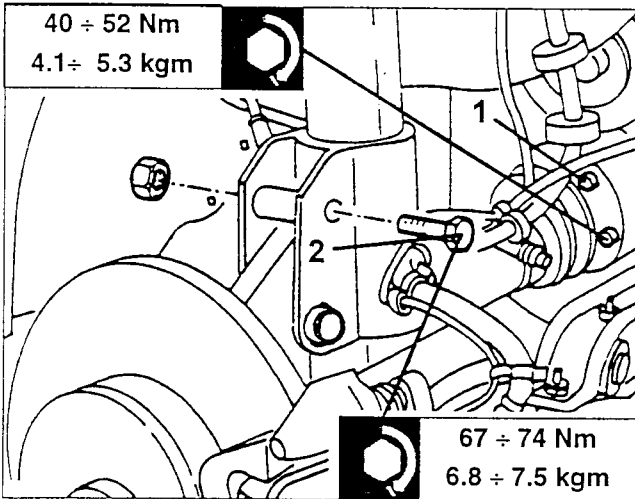
1. Install a new oil seal on the left differential flange using tools no. 1.821.170.000 and no. 1.821.171.000.



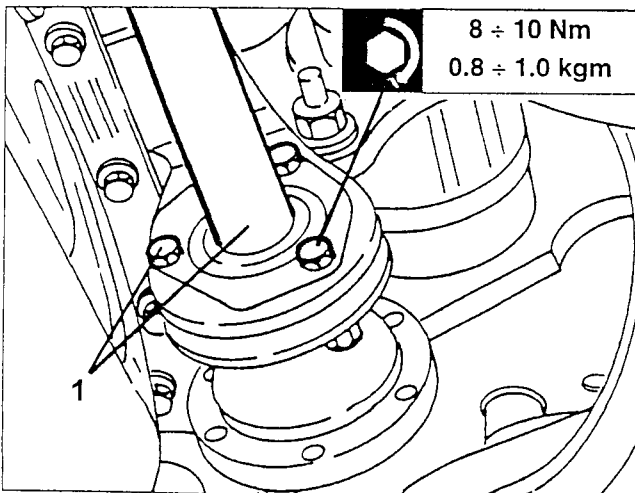
- Complete refitting reversing the sequence followed for removal.

**SOSTIT CHANGING THE ENGINE SIDE DIFFERENTIAL OIL SEAL**

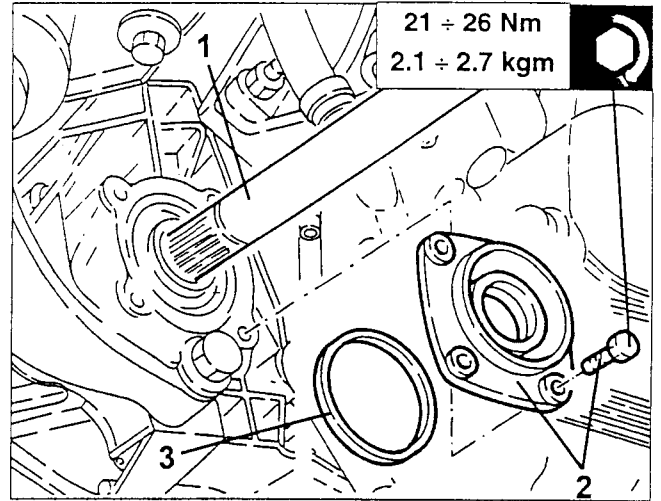
- Set the car on a lift.
- Disconnect the battery (-) terminal.
- Raise the car.
- Remove the right front wheel and mud flap.
- Working from the right wheel arch, slacken the screw fastening the A.B.S. active sensor cable support bracket.
- 1. Slacken the bolts fastening the right axle shaft to the intermediate axle shaft.
- 2. Slacken the bolts fastening the right upright to the shock absorber then remove only the upper bolt.
- Move the right axle shaft back from the intermediate axle shaft as necessary.



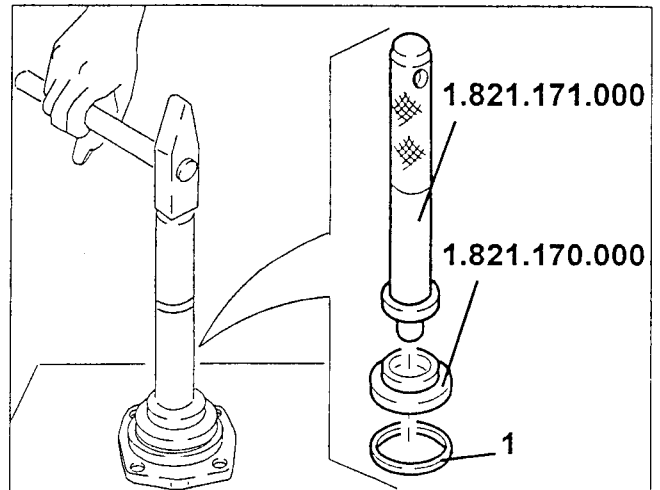
1. Slacken the screws fastening the intermediate axle shaft to its support.



1. Withdraw the intermediate axle shaft from the differential.
2. Slacken the fastening screws and remove the right flange from the differential complete with oil seal.
3. Remove the thrust washer.



1. Prise and remove the oil seal from the right differential flange.
2. Install a new oil seal on the right differential flange using tools no. 1.821.171.000 and no. 1.821.170.000.

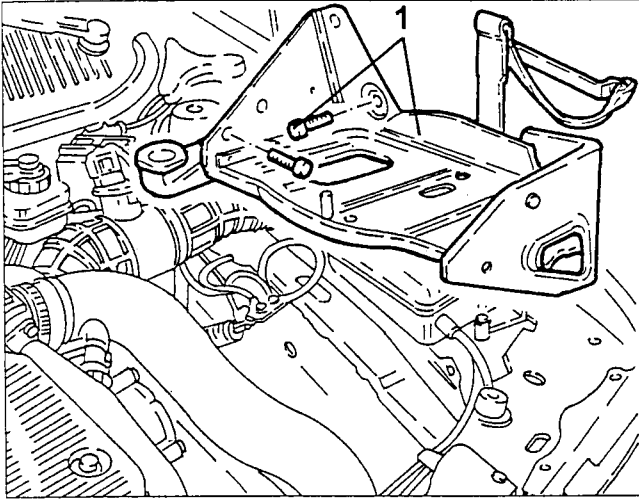


- Complete refitting reversing the sequence followed for removal.



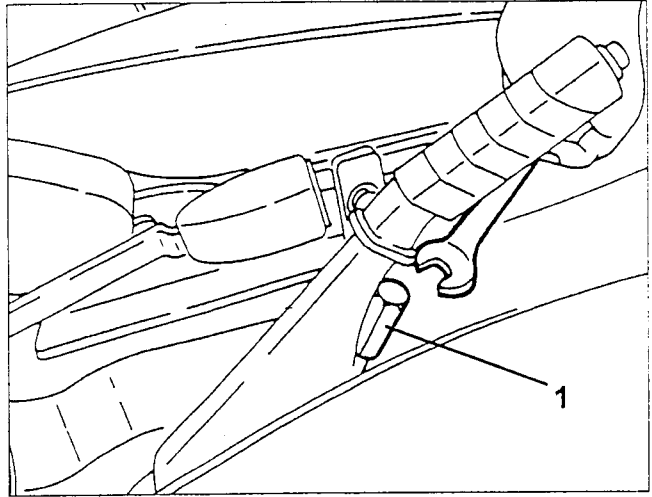
**SUPPORT FOR GEARSHIFT AND  
HANDBRAKE CONTROL LEVERS****REMOVAL/REFITTING**

- Set the car on a lift.
  - Remove the battery (see Group 55).
  - Remove the battery acid drain duct.
1. Slacken the fastening screws and remove the battery holder.



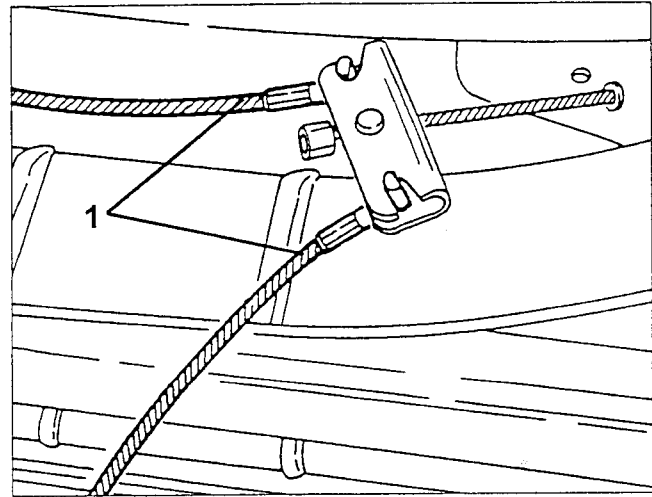
- Working from the passenger compartment, remove the gearshift lever cover and the handbrake lever cover.

1. Raise the handbrake lever and loosen the tensioning nut of the handbrake cables.

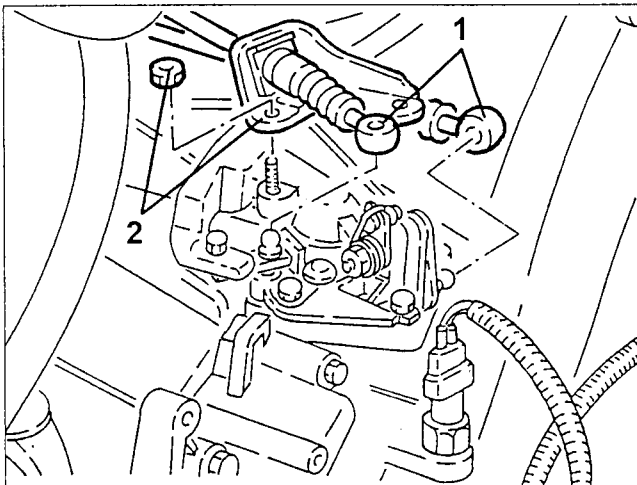


- Remove the catalytic converter (see Group 10).

1. Disconnect the handbrake cables.

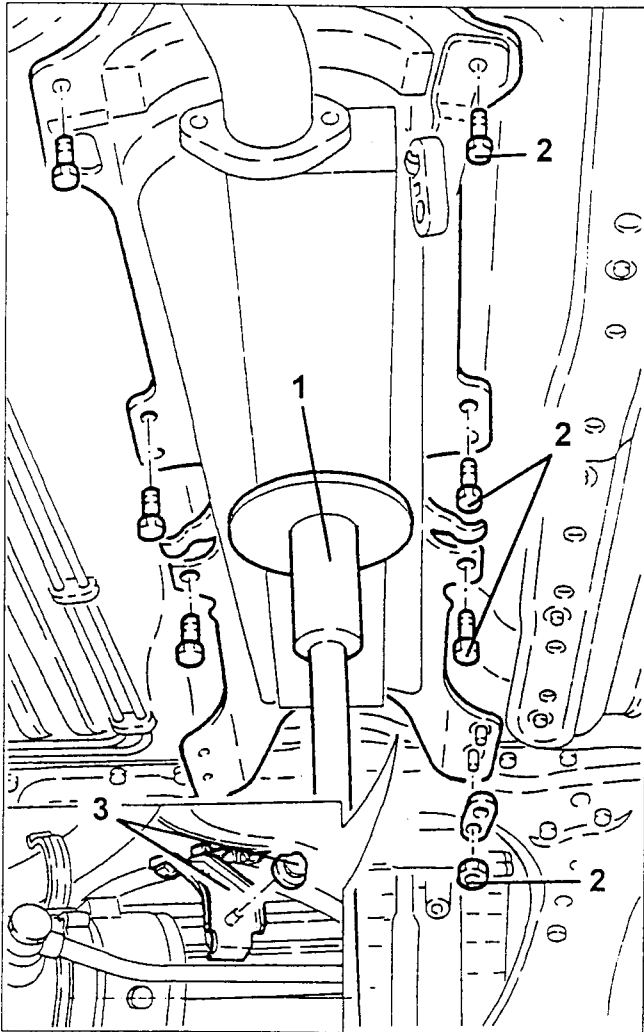


1. Disconnect the gear selection/engagement cables.
2. Slacken the fastening nuts and move aside the bracket complete with gear selection/engagement cables.

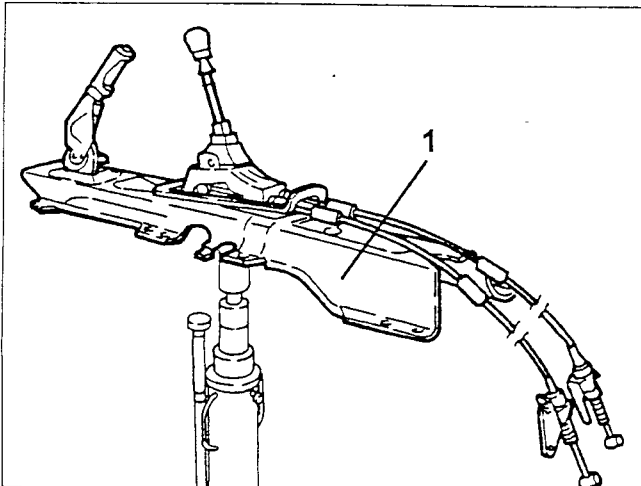




1. Place a hydraulic jack under the gearshift and handbrake lever support.
2. Slacken the screws and nuts fastening the gearshift and handbrake lever support to the body.
3. Lower the hydraulic jack enough to slacken the nut fastening the support of the gear selection/engagement cables.

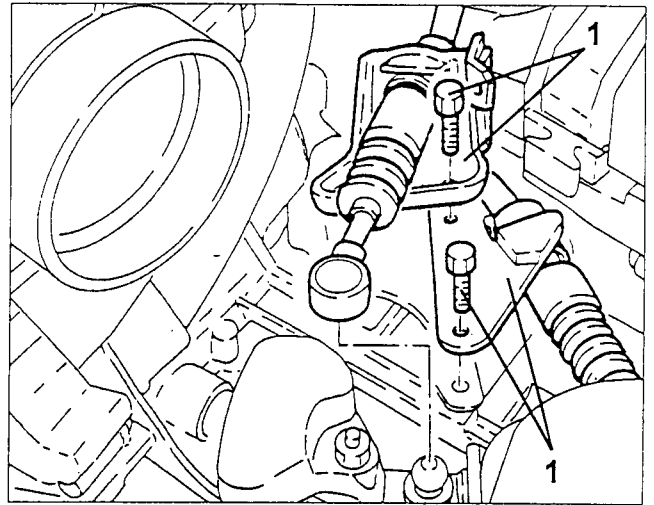


1. Lower the hydraulic jack completely and remove the complete gearshift and handbrake lever support.

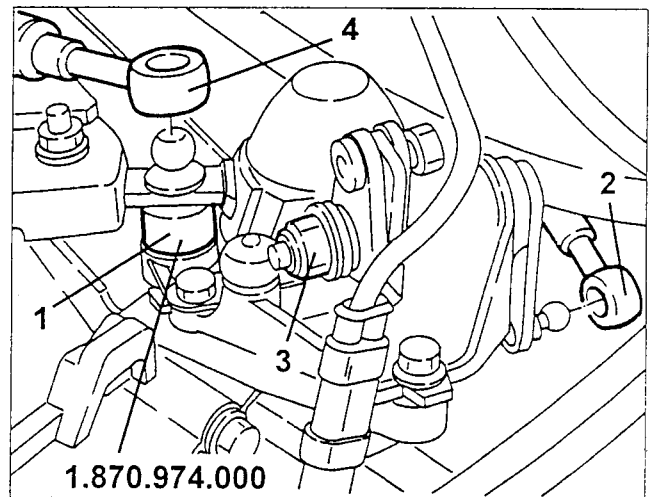


- Complete installation reversing the sequence followed for removal up to assembly of the cables on the gear selection/engagement unit, then adjust the cables, proceeding as follows.

1. Refit the support brackets complete with selection and engagement cables and fasten them with their nuts.



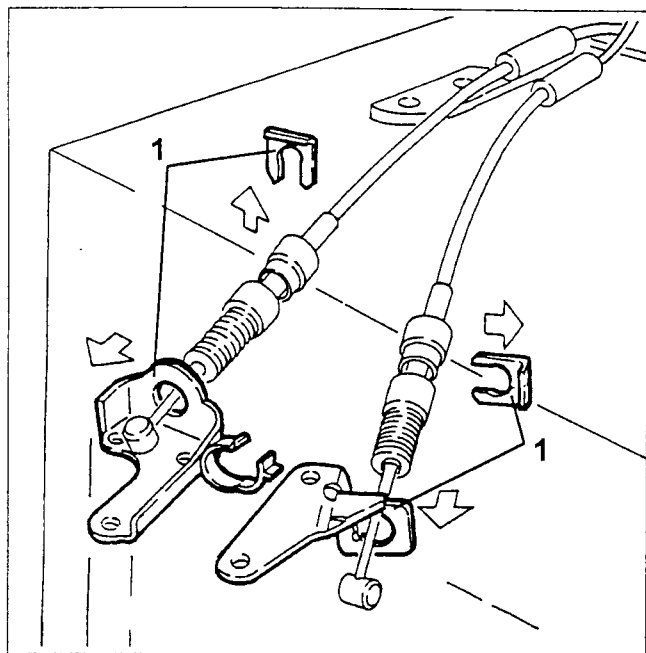
1. Install tool no. 1.870.974.000 under the gear engagement cable connection ball.
  2. Connect the gear selection cable.
  3. Loosen the adjustment nut of the gear selection/engagement unit.
- Tighten the adjustment unit after setting the gearshift lever to neutral and moving it fully right.
4. Connect the gear engagement cable.
- Position the gearshift lever to reverse and remove tool no. 1.870.974.000.



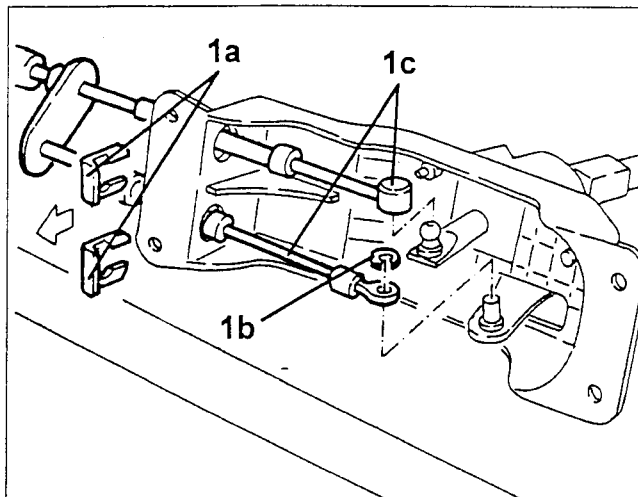
- Complete installation reversing the sequence followed for removal.

**DISASSEMBLY AND REASSEMBLY**

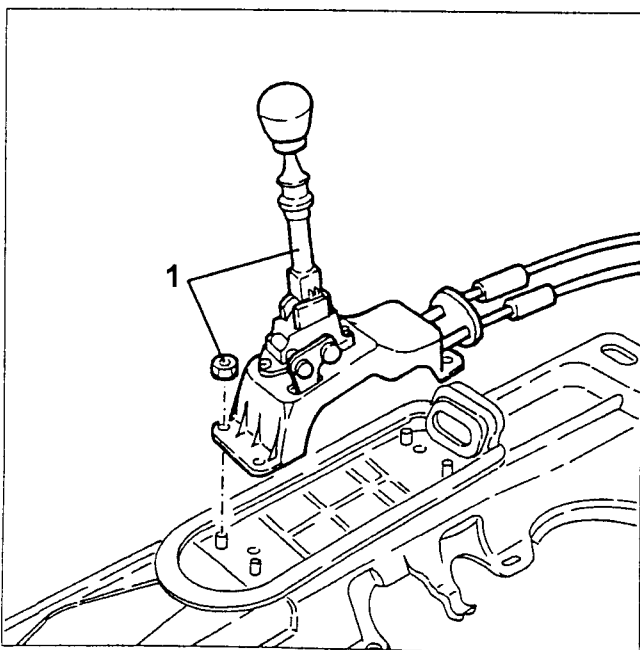
1. Withdraw the stopper plates and remove the support brackets of the gear selection/engagement cables.



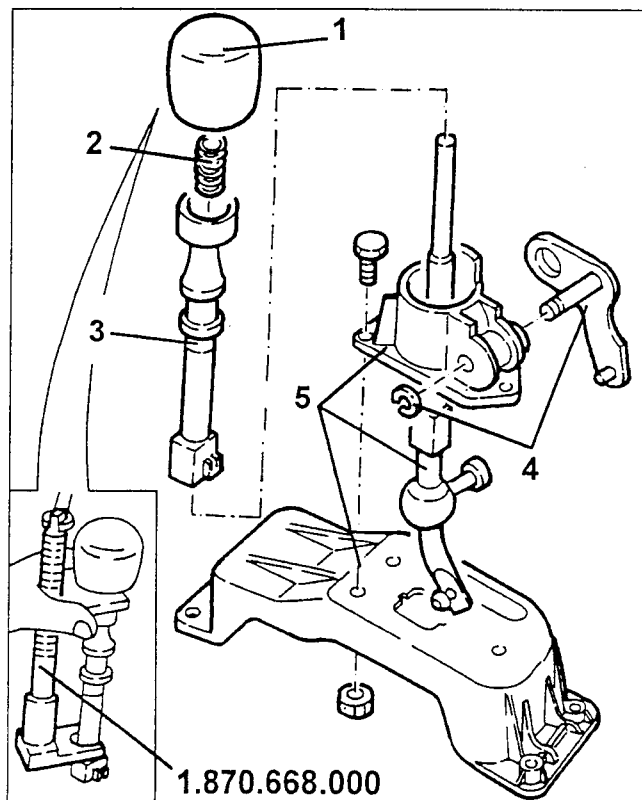
1. Remove the stopper plates (1a), circlip (1b), then disconnect and withdraw the gear selection/engagement cables (1c).



1. Slacken the fastening nuts and remove the gearshift control lever support complete with gear selection/engagement cables.



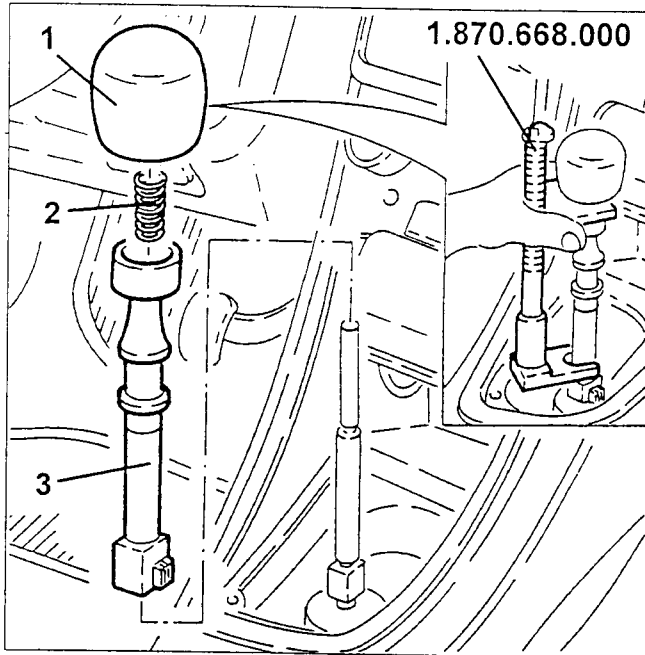
1. Remove the gearshift lever knob using tool no. 1.870.668.000.  
2. Remove the spring.  
3. Remove the reverse gear inhibitor.  
4. Remove the circlip and remove the lever.  
5. Slacken the bolts and separate the gearshift control rod from the supports.



## REVERSE GEAR INHIBITOR

### REMOVAL/REFITTING

- Remove the gearshift lever cover.
- 1. Remove the gearshift lever knob using tool no. 1.870.668.000.
- 2. Remove the spring.
- 3. Remove the reverse gear inhibitor.

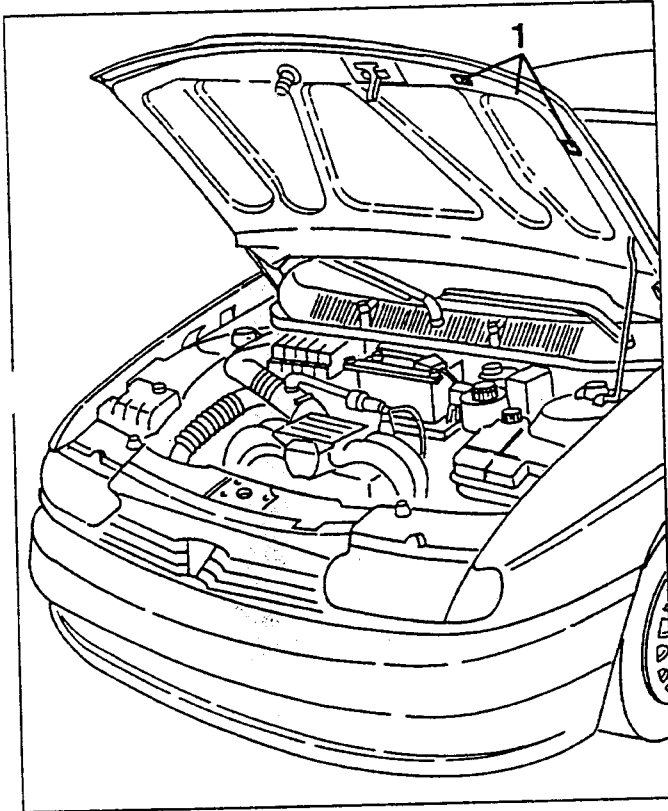




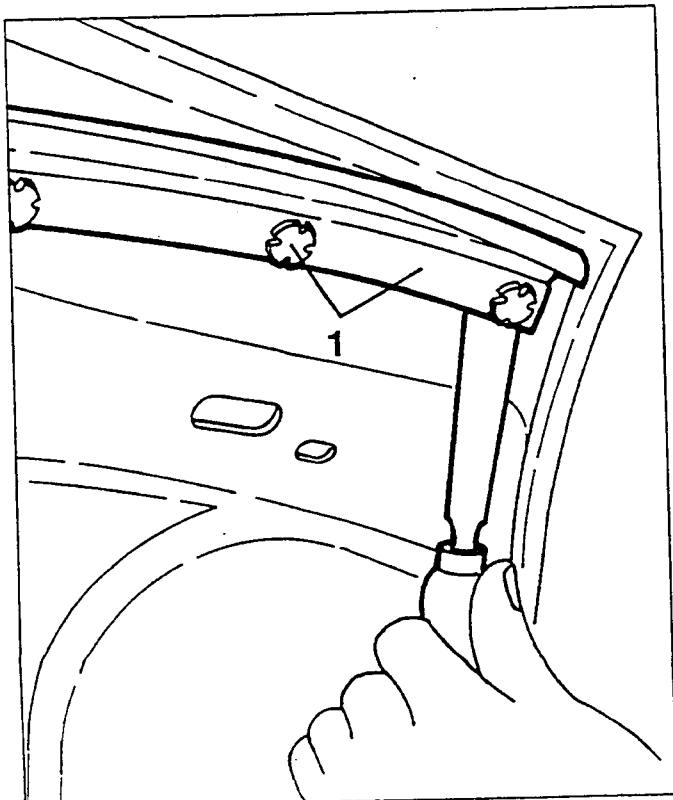
## BONNET TRIM

### REMOVAL/REFITTING

1. Working from the engine bay, pull off the plastic buttons and remove the bonnet trim.



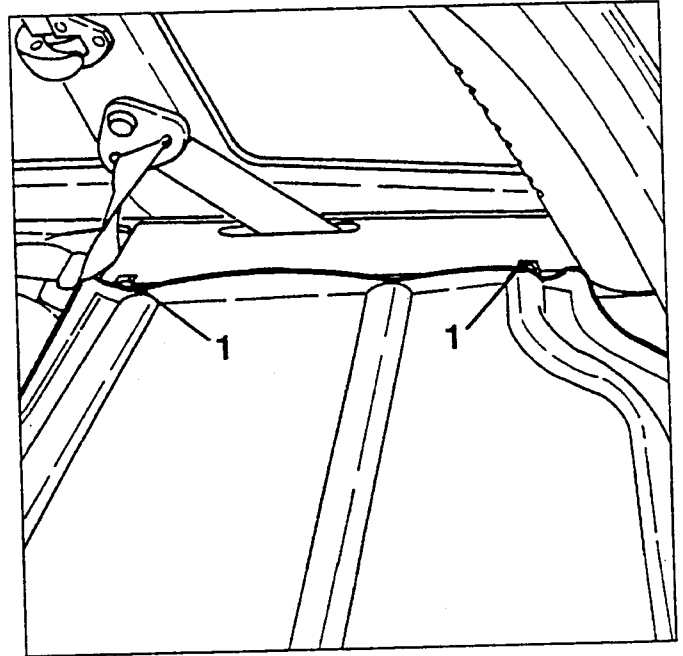
1. If necessary, pull off the plastic buttons and remove the front seal strip.



## HATSELF

### REMOVAL/REFITTING

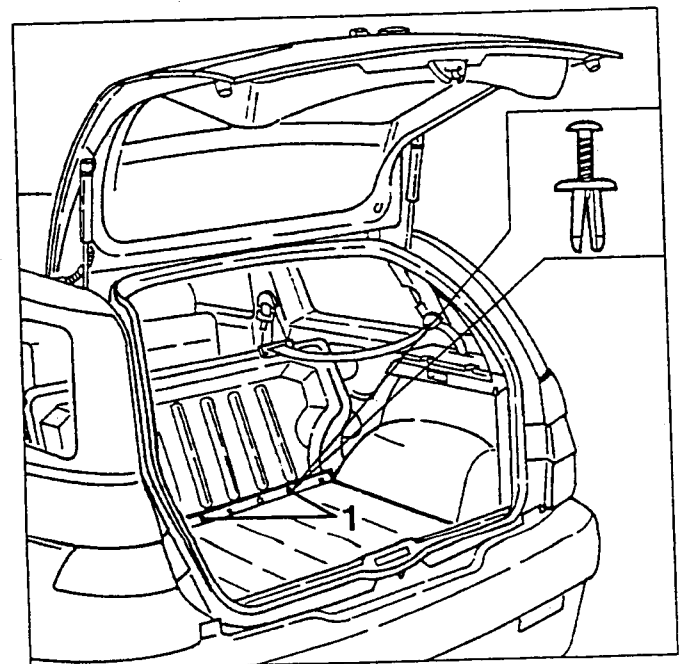
1. Working from the luggage compartment, free the two side hatshelf attachments, wind it up and remove it.



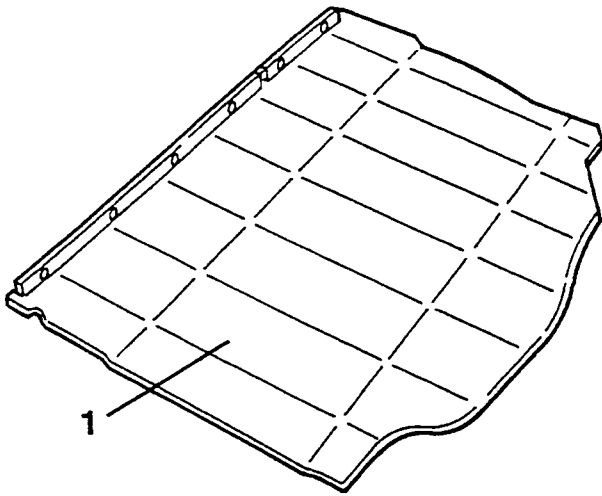
## LUGGAGE COMPARTMENT LOWER TRIM

### REMOVAL/REFITTING

- Tip the rear seat back-rest forward.  
1. Loosen the plastic screws and pull off the buttons the luggage compartment lower trim.



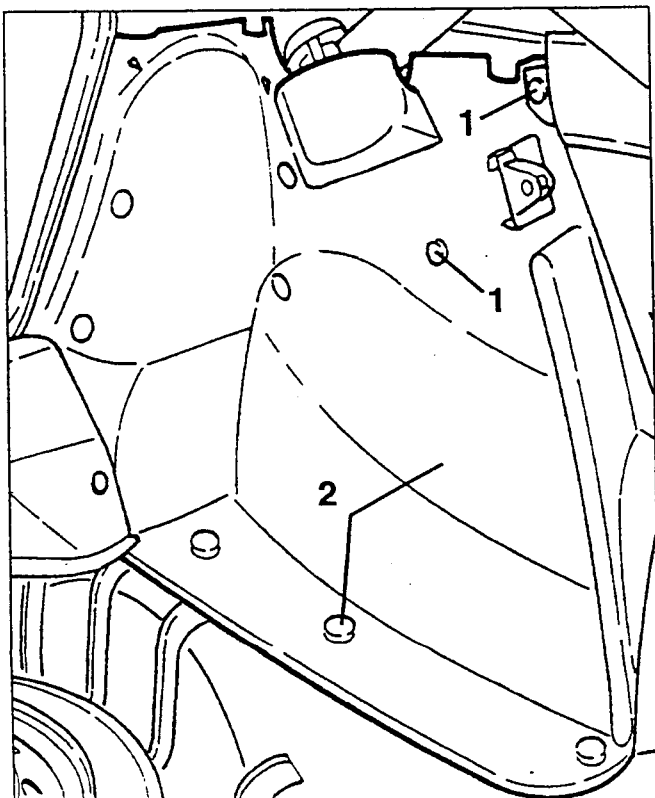
1. Remove the luggage compartment lower trim.



## LUGGAGE COMPARTMENT SIDE TRIM

### REMOVAL/REFITTING

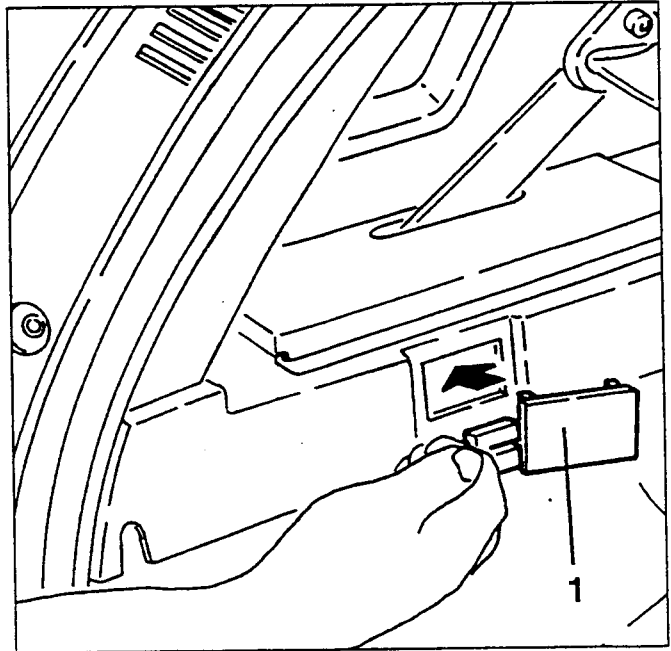
- Remove the side shelves supporting the hatshelf (see specific paragraph).
- Tip the luggage compartment lower trim forward.
- 1. Loosen the two screws securing the luggage compartment side trim.
- 2. Pull off the plastic buttons and remove the luggage compartment side trim.



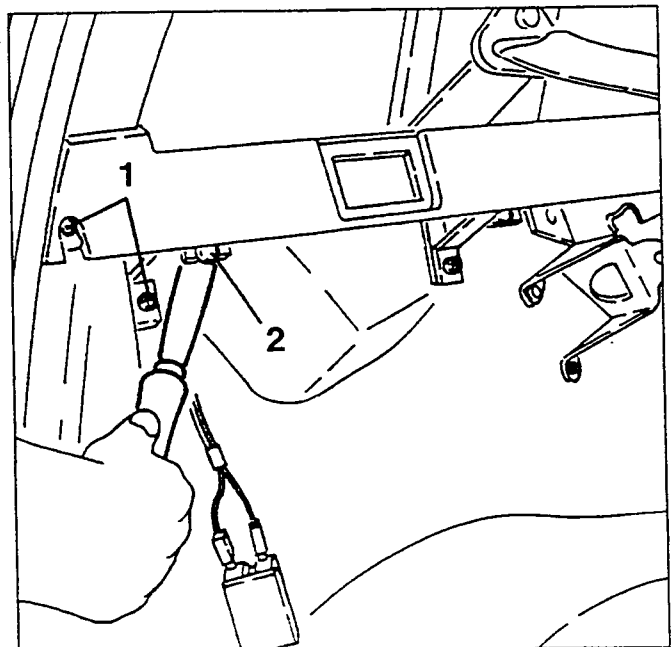
## SIDE SHELVES SUPPORTING THE HATSHLF

### REMOVAL/REFITTING

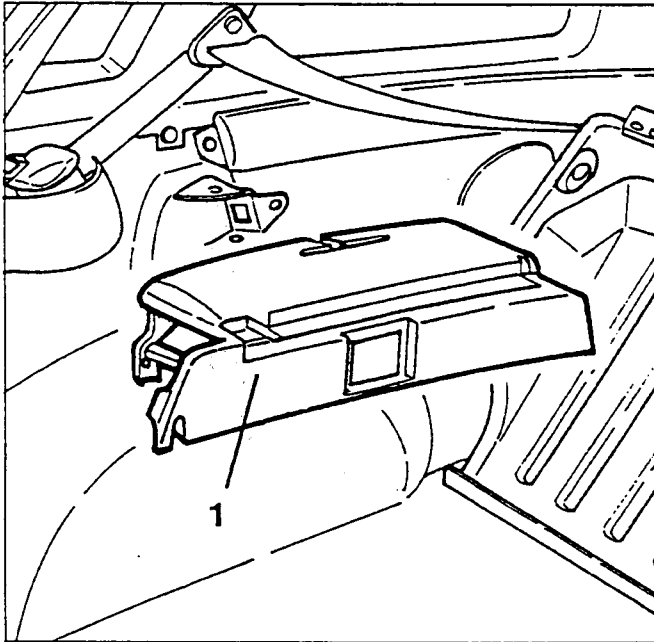
- Remove the hatshelf (see specific paragraph).
- Tip the rear seat back-rest forward.
- 1. Pull the roof light from its seating and without disconnecting the electrical connections, replace it in the attachment hole freeing it from the shelf.



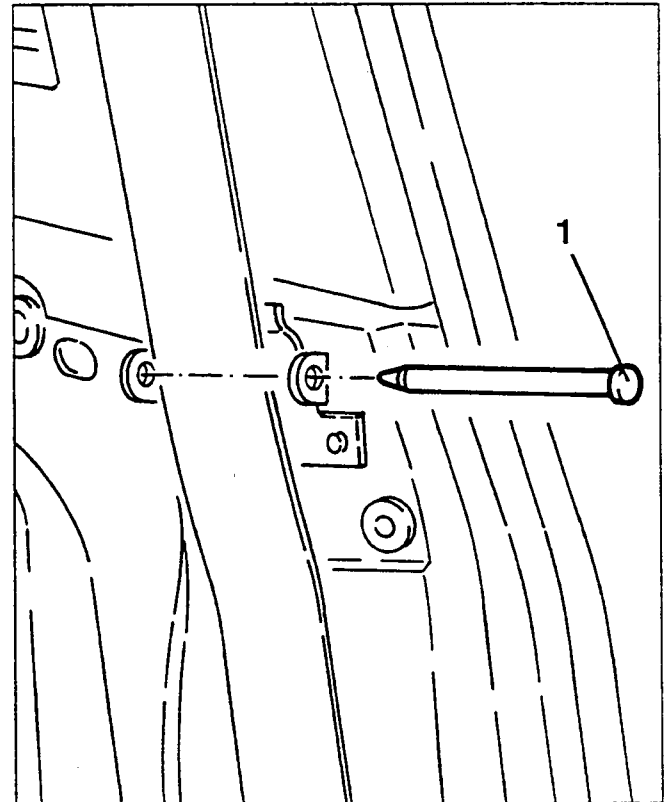
- 1. Loosen the three screws securing the shelf.
- 2. Pull off the two plastic buttons securing the shelf.



1. Remove the side parcel shelf support bracket withdrawing the safety belt from its housing.



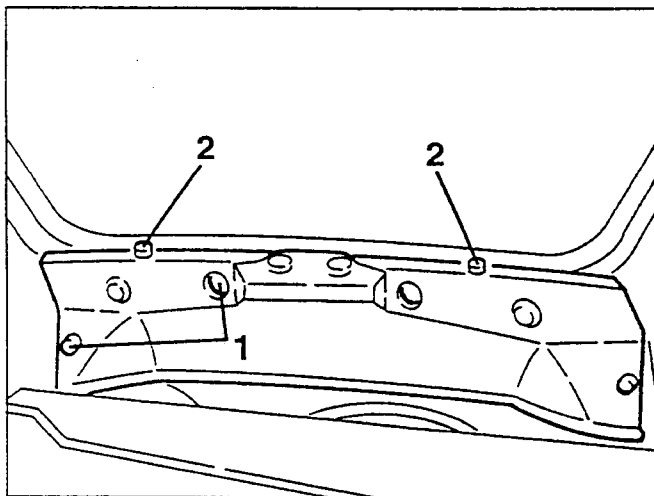
1. Withdraw the belt holder bracket guide pin.



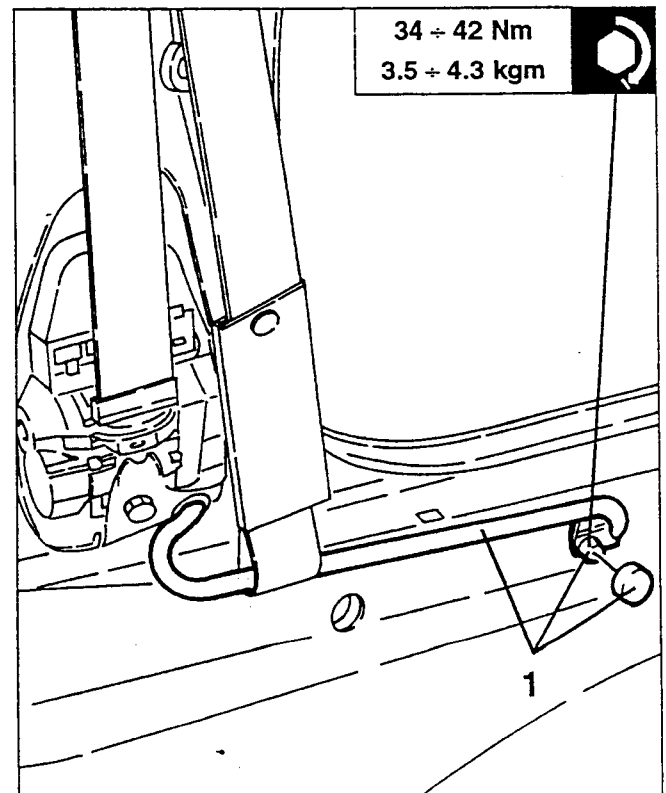
## LUGGAGE COMPARTMENT PROTECTIVE TRIM

### REMOVAL/REFITTING

1. Working from the luggage compartment, remove the four plastic nails fastening the protective trim.
2. Slacken the two screws fastening the luggage compartment protective trim and remove it.



1. Remove the cap, slacken the fastening screw, then remove the lower seat belt slider connection.



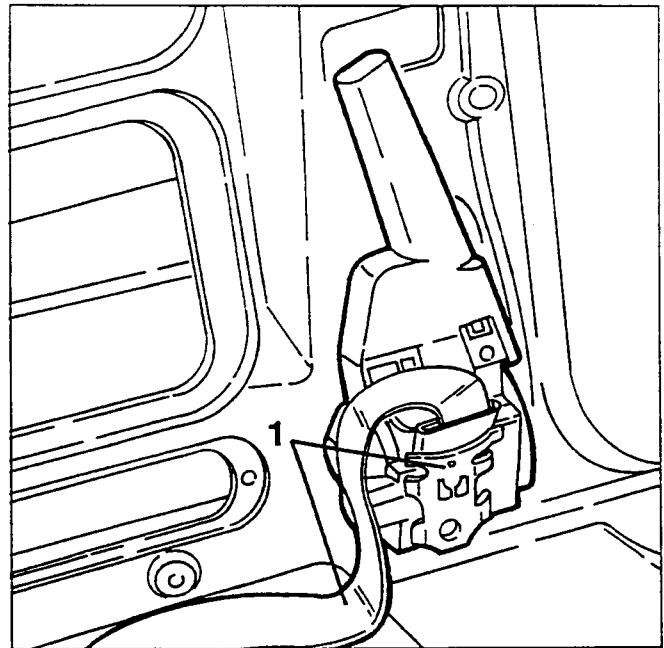
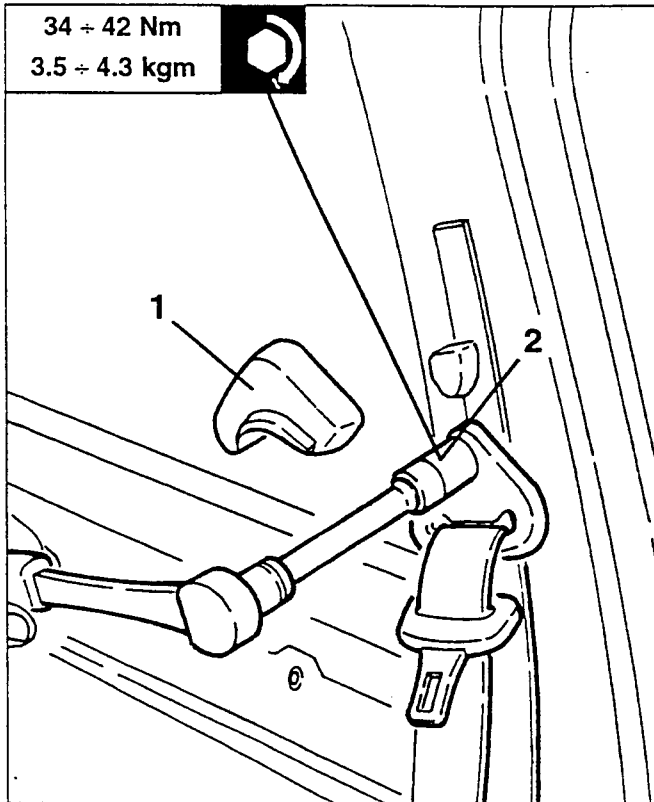
## FRONT SEAT BELTS

### REMOVAL/REFITTING

- Unarm the pre-tensioning device as described in "Removing/Refitting the arming rod".



1. Remove the seat belt runner cover.
2. Slacken the seat belt runner screw.



For refitting, reverse the sequence described for removal taking care to install the arming rod. For this operation follow the cautions given in "Removing/refitting the arming rod".

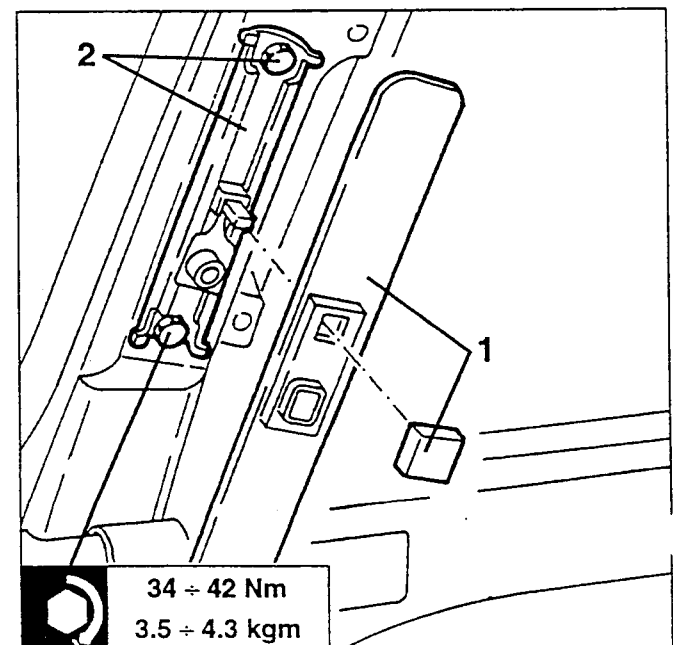
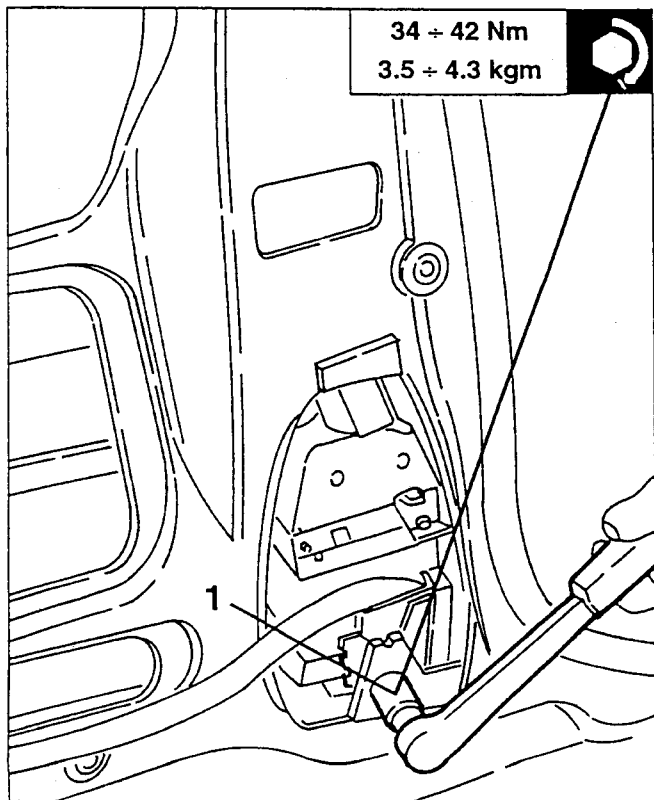
## FRONT SEAT BELTS HEIGHT ADJUSTMENT DEVICE

### REMOVAL/REFITTING

- Remove the window winder moulding (see specific paragraph).

1. Remove the seat belt height adjustment device knob and retrieve the corresponding plate.
2. Slacken the two fastening screws and remove the front seat belt height adjustment device.

1. Slacken the seat belt pre-tensioner fastening screw.



1. Remove the seat belt pre-tensioner withdrawing it from its housing.

## REAR SEAT BELTS

### REMOVAL/REFITTING

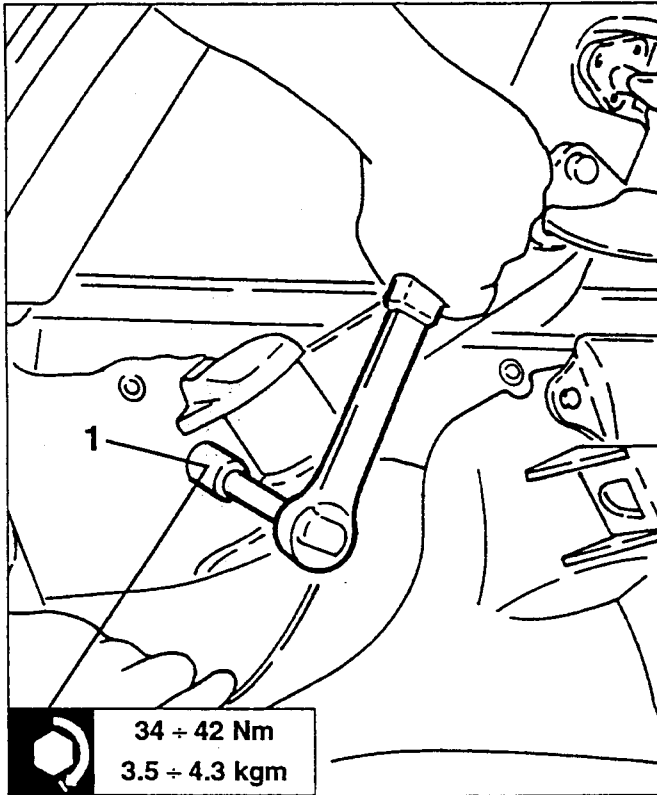
- Remove the side shelves supporting the haltshelf (see specific paragraph).

1. Lower the covering and loosen the re-winding mechanism attachment screw.

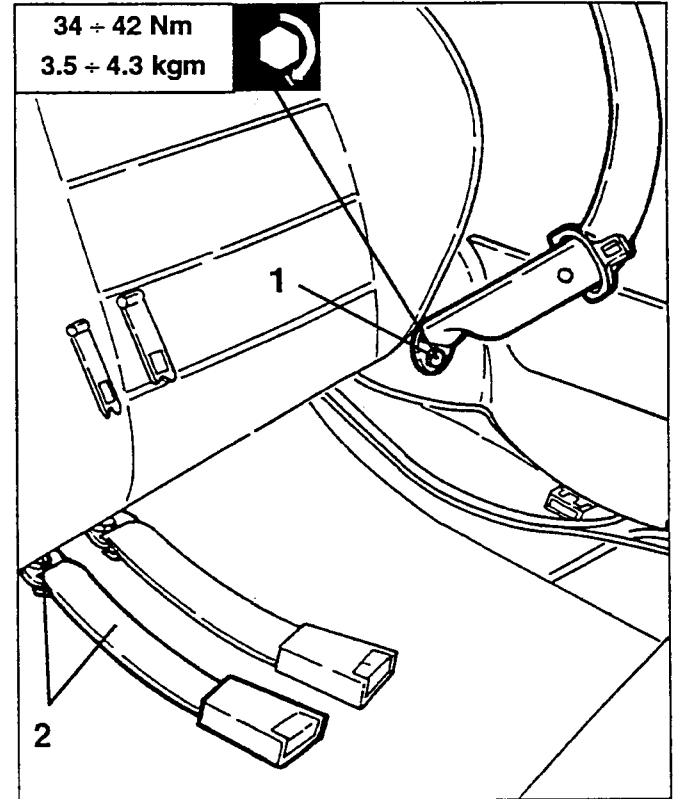
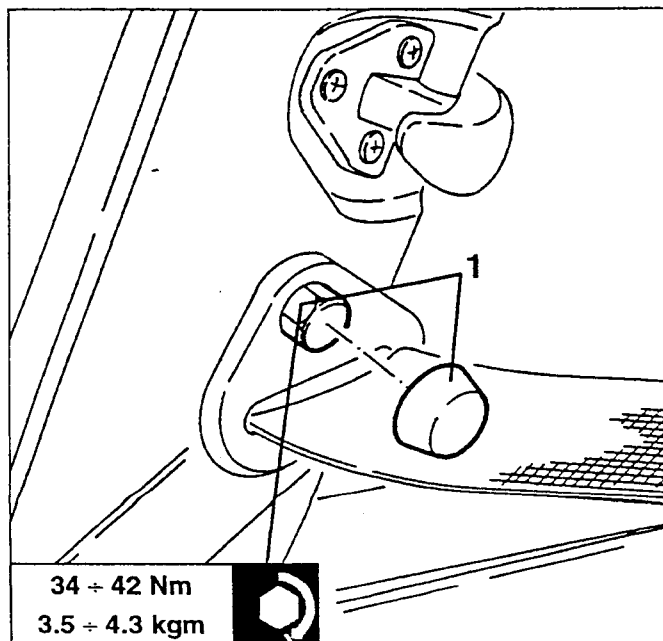
- Return the rear seat backrest to the vertical position.  
- Tip the rear seat cushion forwards.

1. Loosen the screw on the seat belt lower attachment and remove the screw.

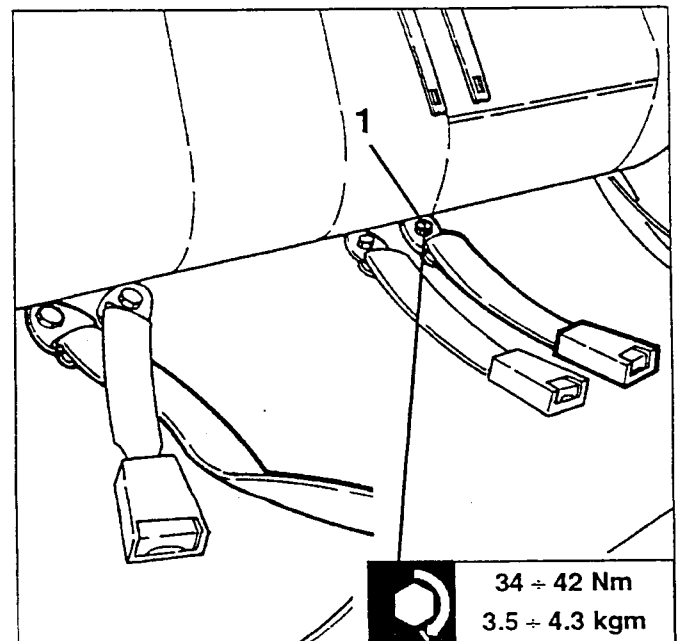
2. Loosen the screw and remove the seat belt stalk.



1. Pull off the cover from the rear seat belt runner attachment screw and then loosen the screw.



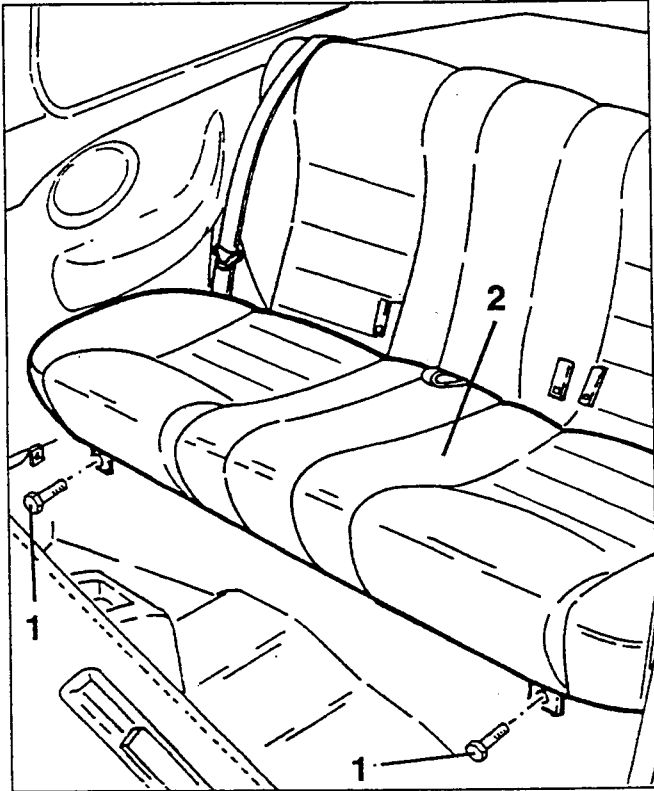
1. Loosen the screws and remove the lap-belt from the central rear seat position.



## REAR SEAT (bench type)

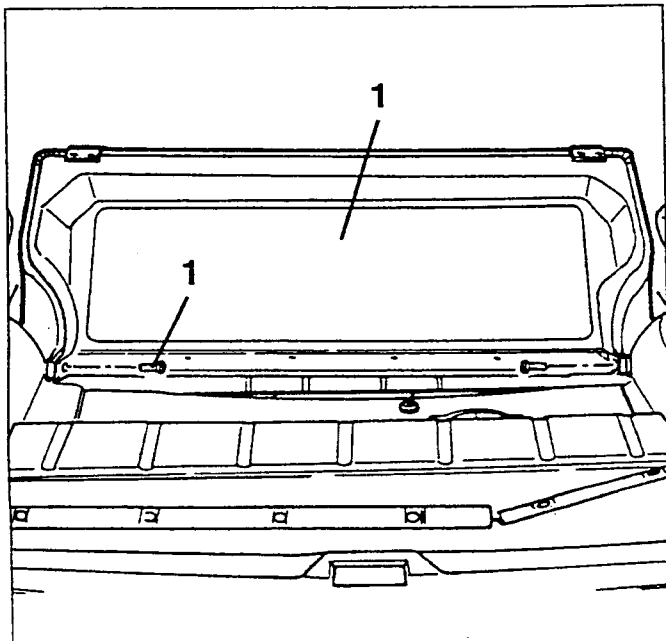
### REMOVAL/REFITTING

1. Loosen the two screws securing the seat to the floor of the vehicle.
2. Lift up and remove the rear seat.



- Remove the lower trim from the luggage compartment (see specific paragraph).

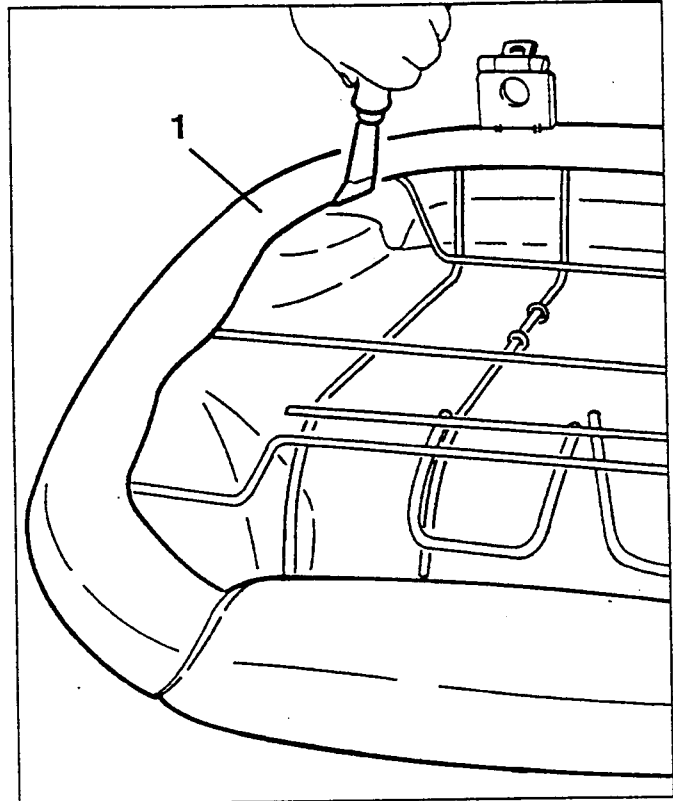
1. Tip the backrest forwards, loosen the two screws and remove the backrest freeing it from the seat belts.



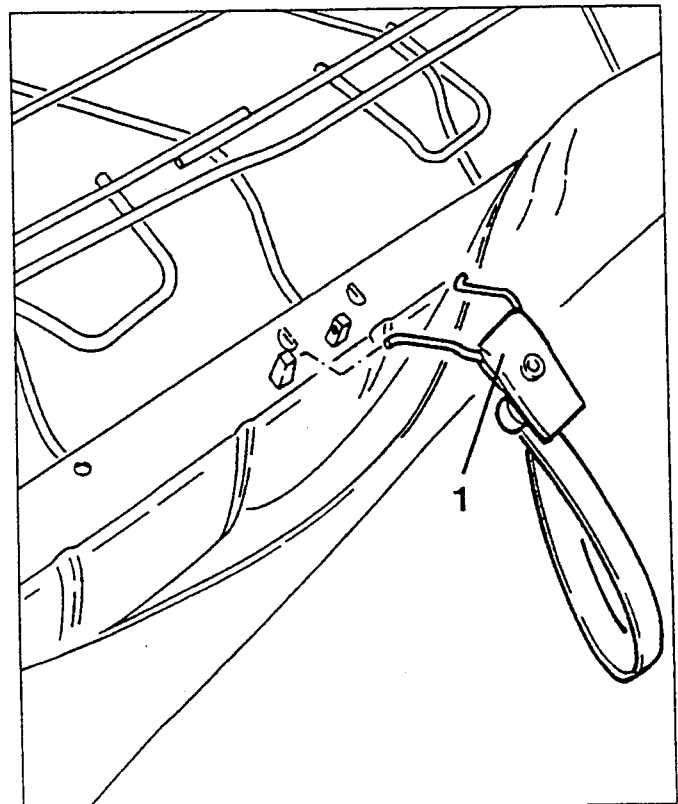
### DISASSEMBLING/REFITTING THE SEAT

- Pull off the plastic buttons and remove the rear seat covering.

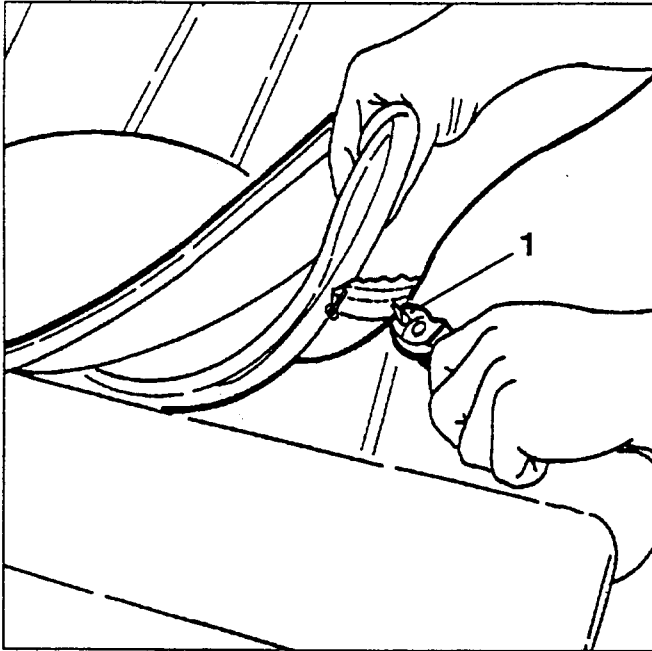
1. Pull the covering from the seat.



1. When pulling off the trim in the area around the handle used for tipping the seat forward, this handle must be removed by freeing the retaining clip.

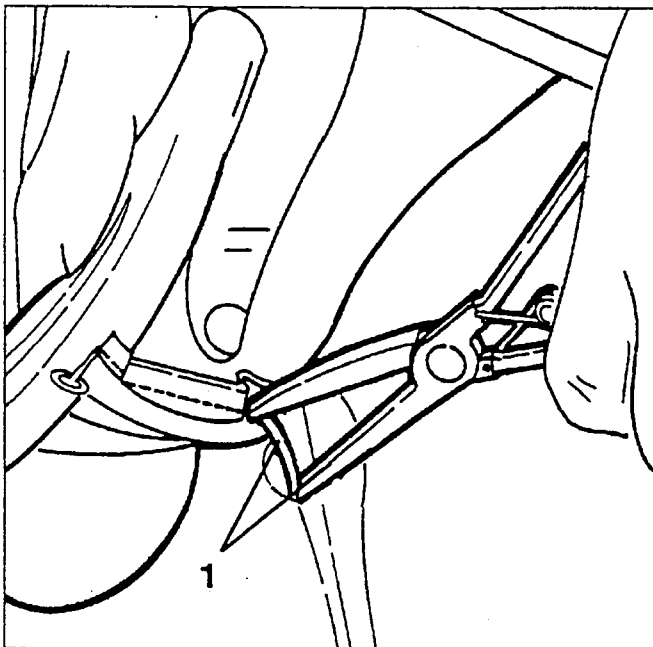


1. Using a pair of shears cut the clips securing the cover to the seat and remove the cover.



**Refit by reversing the procedure followed for removal and note the following:**

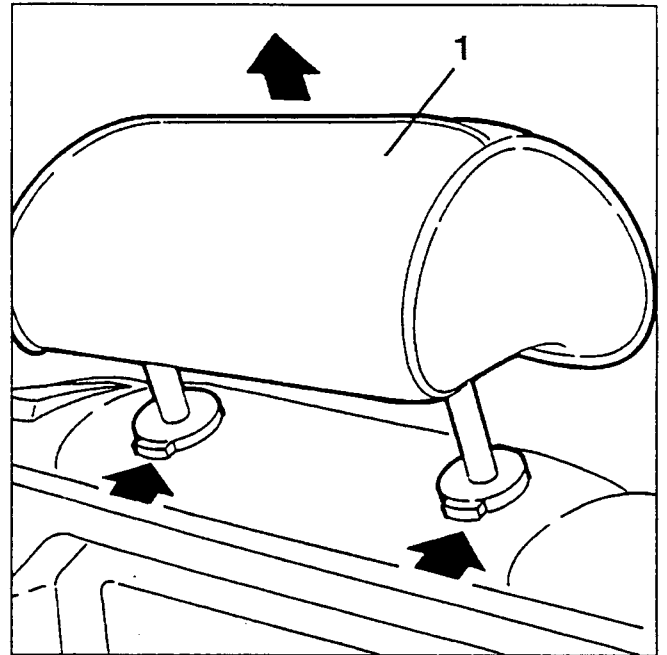
1. Secure the covering with the clips using the appropriate pliers supplied as a spare part.



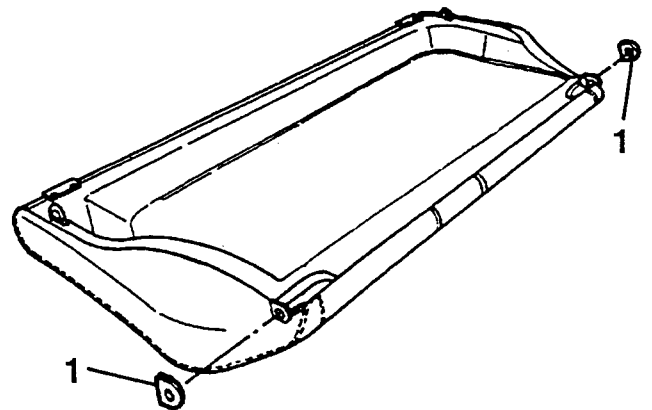
- Using a plastic mallet clinch the edge of the covering attachment.

## DISASSEMBLING/REASSEMBLING THE BACKREST

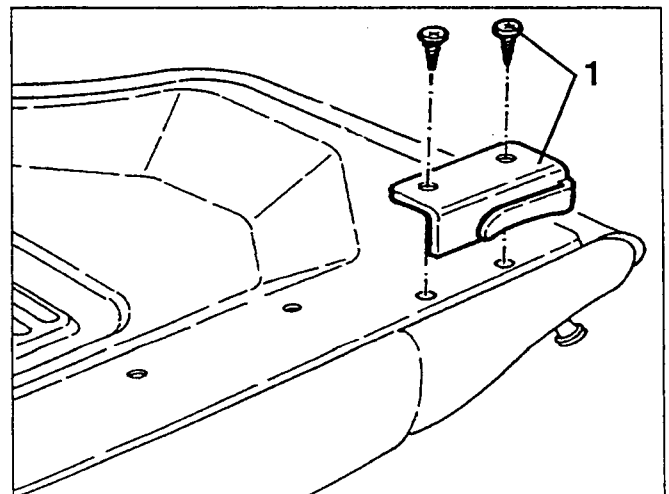
1. Remove the headrest by pressing the clips and at the same time pulling the headrest upwards.



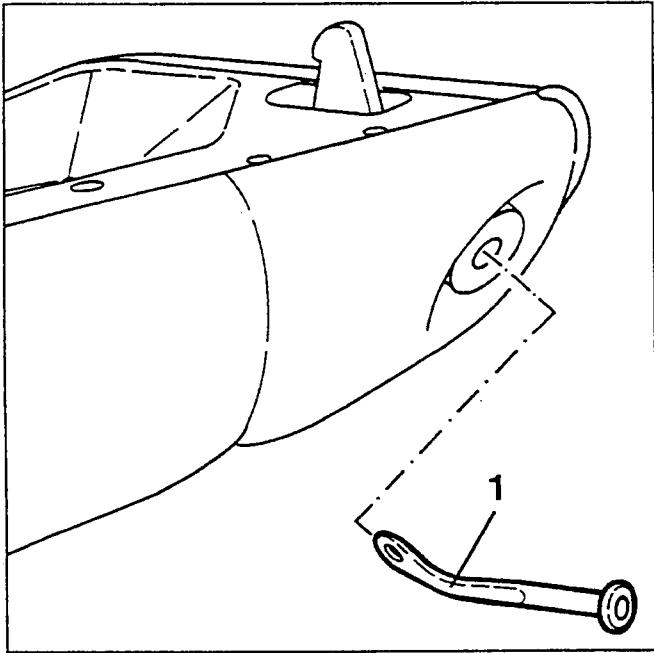
1. Remove the two plastic trim pieces from the backrest hinge.



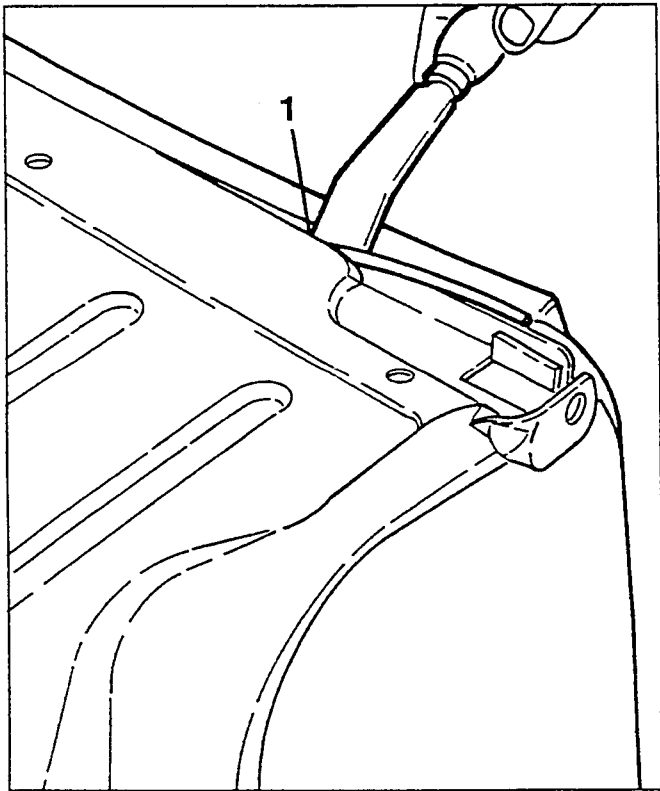
1. Loosen the two screws and remove the seat belt runners.



1. Remove the pins releasing the backrest catch.

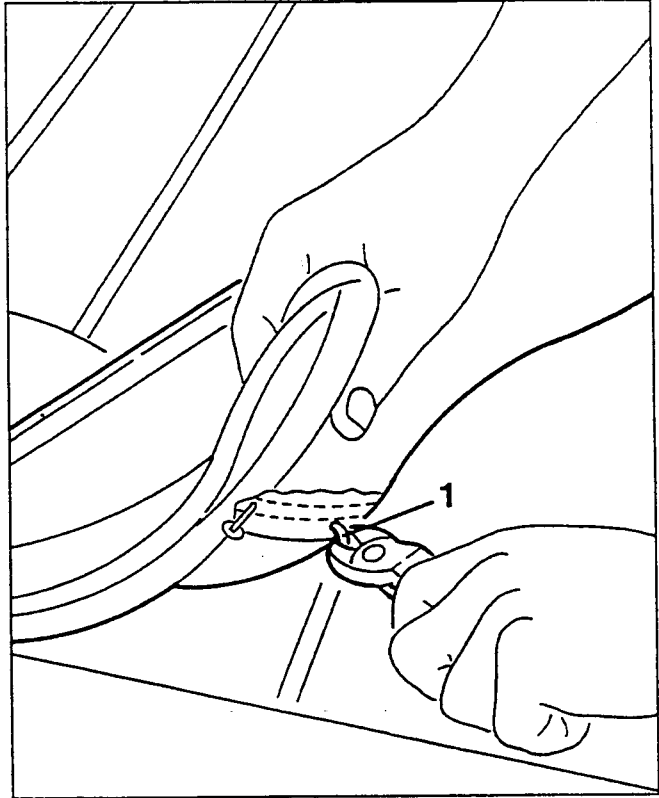


1. Working as shown in the diagram, pull the covering from the backrest.

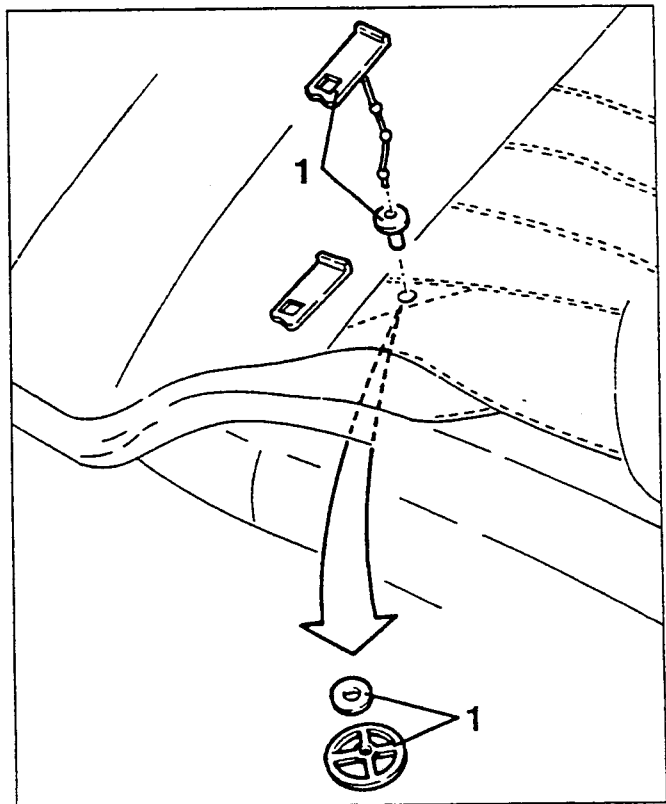


**NOTE:**  
Care should be taken when removing the covering from the backrest release pins trim.

1. Using a pair of shears, cut the clips securing the backrest covering.



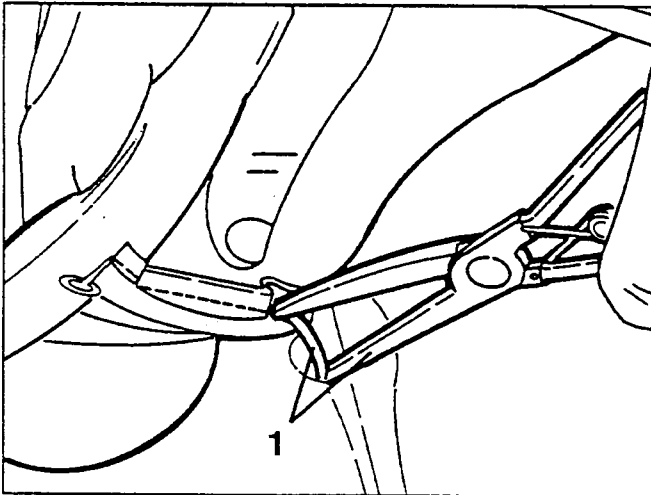
1. Remove the seat belt support attachments from the backrest and remove the covering.





Refit by reversing the procedure followed for disassembly and note the following:

1. Fix the covering with the clips using the appropriate pliers supplied as a spare part.

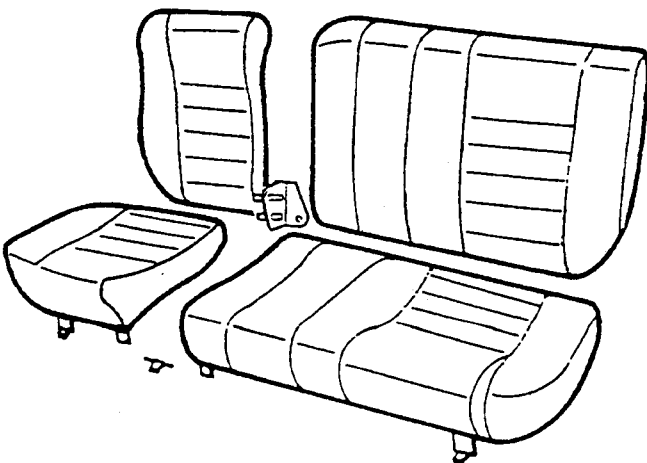


- Using a plastic mallet, clinch the edge of the covering.

## REAR SEATS (split version)

### REMOVAL/REFITTING

- Remove the seats as described in the section relative to the bench-type seats ensuring that the screws securing the central hinges are loosened and that the backrests and cushions are withdrawn from their pins.



## DISASSEMBLY/REASSEMBLY

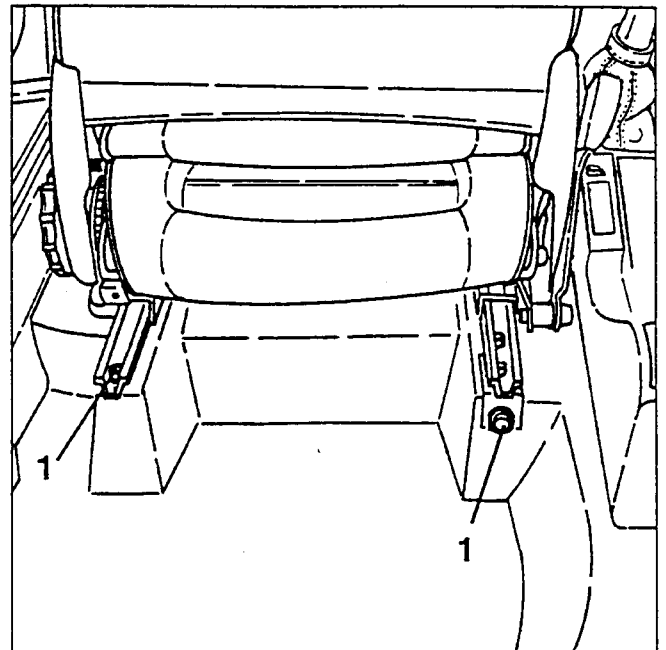
- Proceed as described for the bench-type seat and make the modifications required by the shape of the seat.

## FRONT SEATS

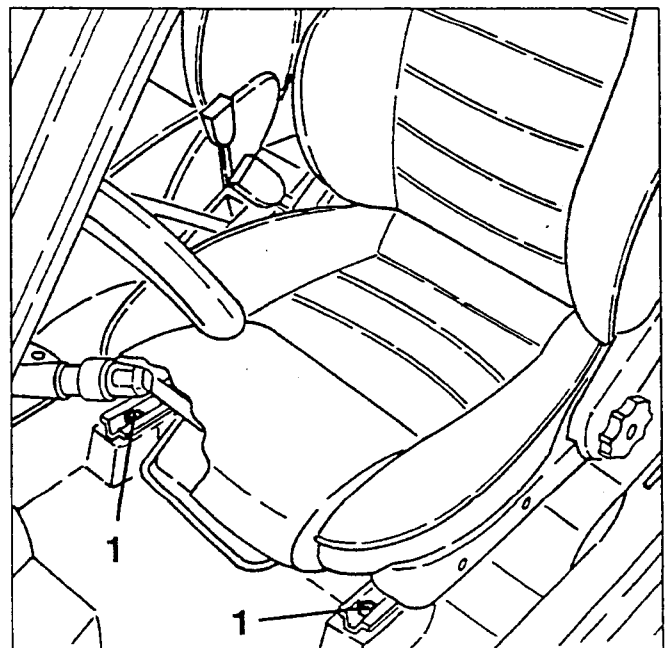
### REMOVAL/REFITTING

- Slide the seat fully forwards.

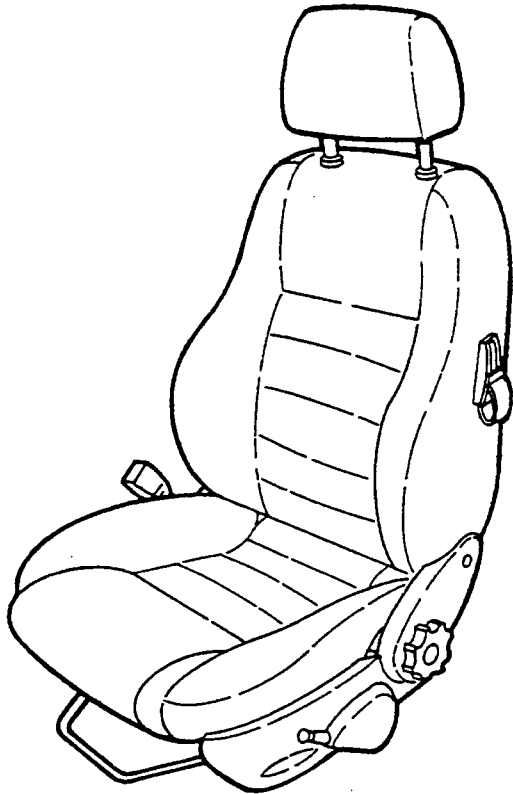
1. Loosen the two rear screws securing the runner to the floor.



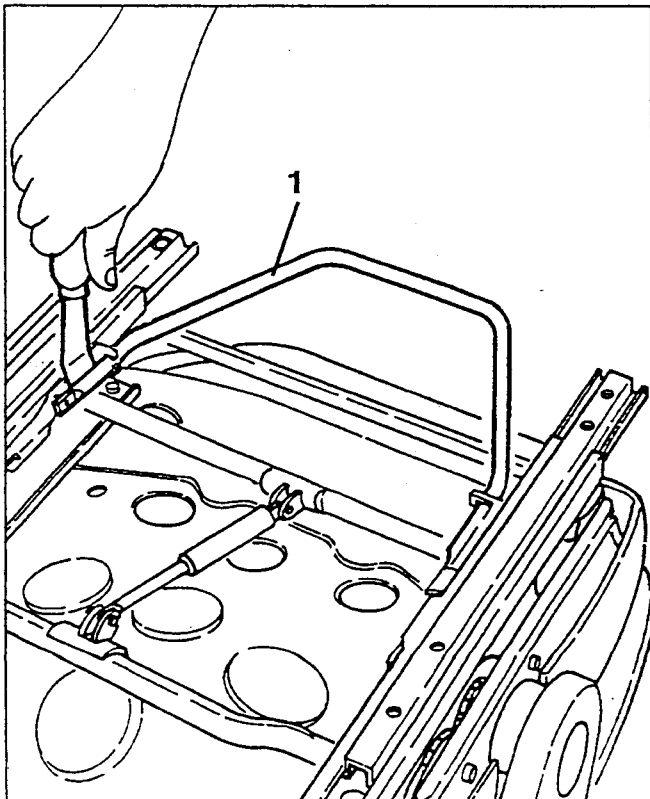
1. Slide the seat fully backwards, loosen the two front screws securing the runners to the floor and remove the seat.



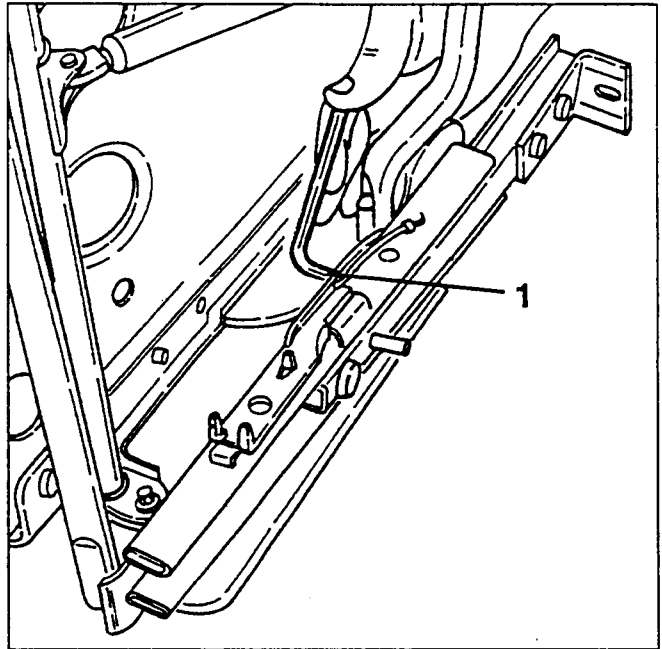
## DISASSEMBLING/REASSEMBLING THE DRIVER'S SEAT (WITH HEIGHT ADJUSTMENT)



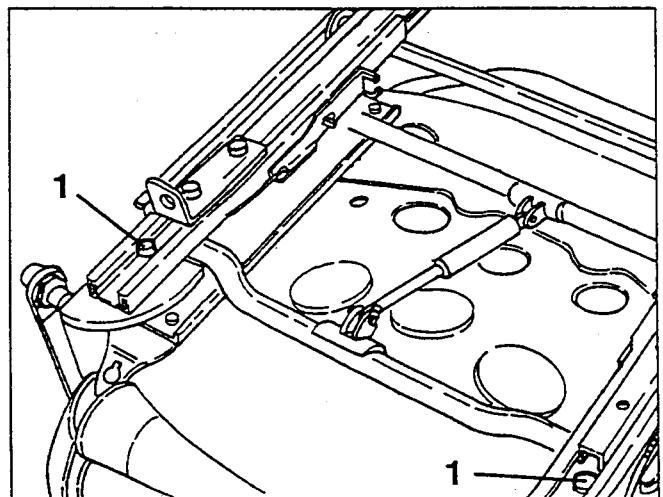
1. Remove the seat sliding control lever as shown in the diagram.



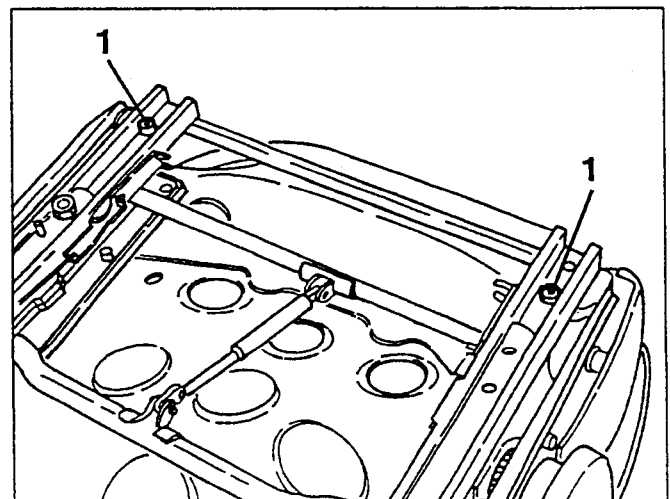
1. Loosen the upper screw securing the right-hand runner.



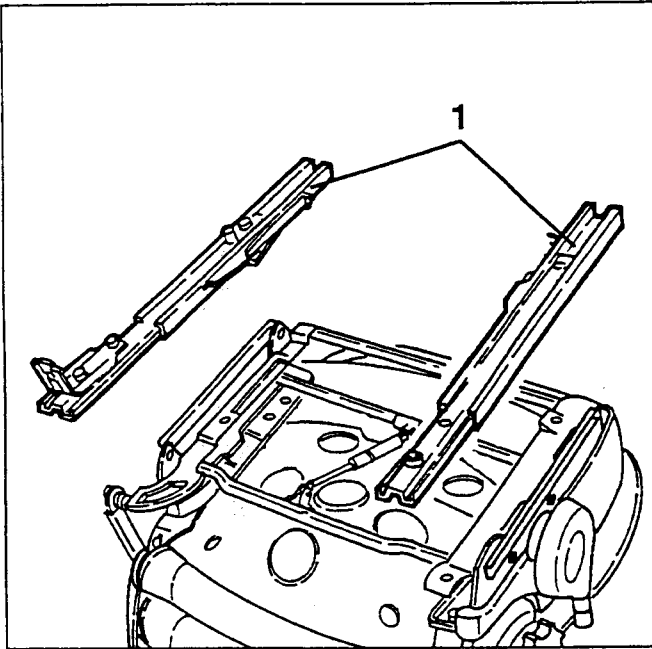
1. Move the guides forward and loosen the rear retaining screws.



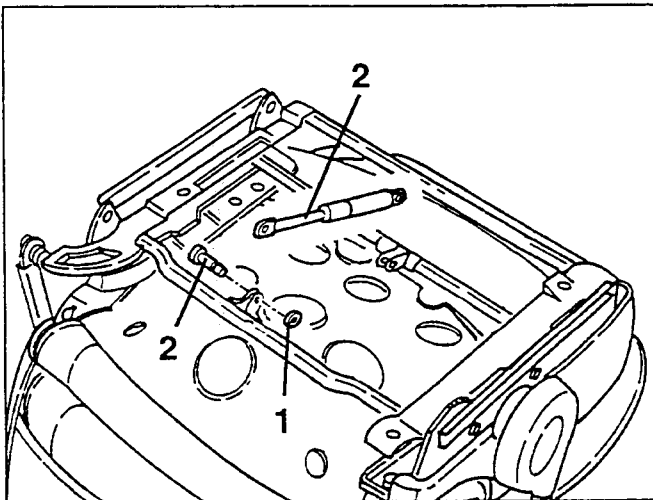
1. Move the guides backwards and loosen the front retaining screws.



1. Remove the seat runners.



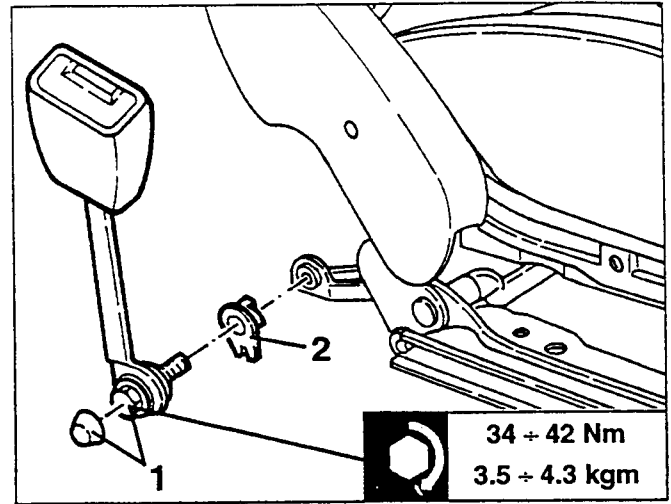
1. Remove the two clips securing the seat height adjustment device shock absorber.
2. Withdraw the pins and remove the seat height adjustment device telescopic support.



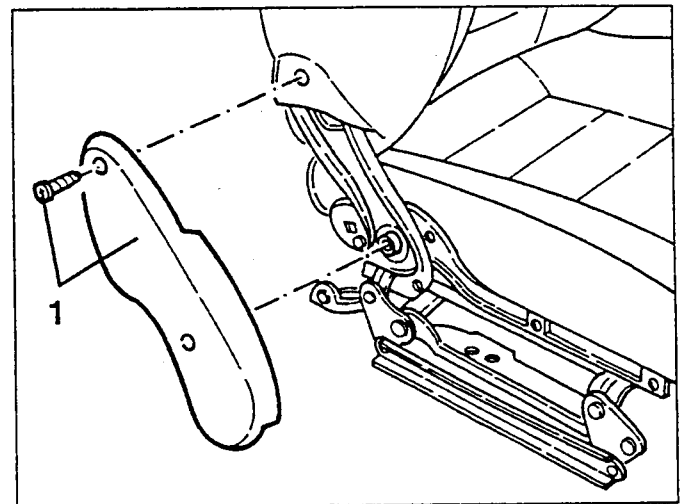
**NOTE:**

Before removing the telescopic support, fully raise the seat regulation device to prevent the telescopic support from leaping free during removal.

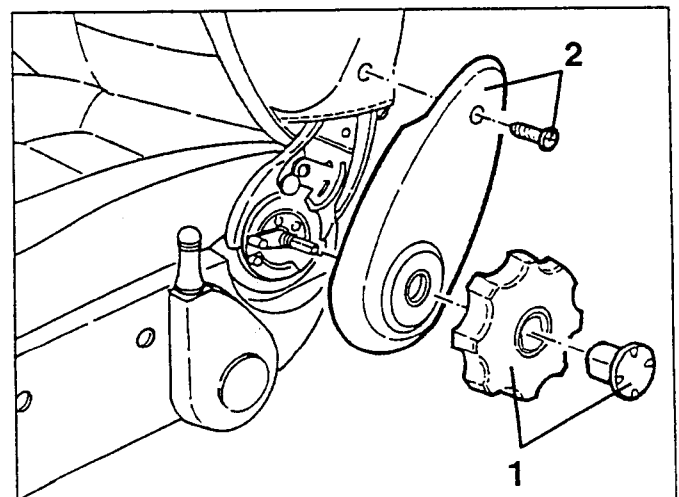
1. Remove the protective cover, loosen the screw and remove the seat belt attachment.
2. Remove the spacer.



1. Loosen the two screws and remove the right-hand hinge moulding by pulling it away from the clips.

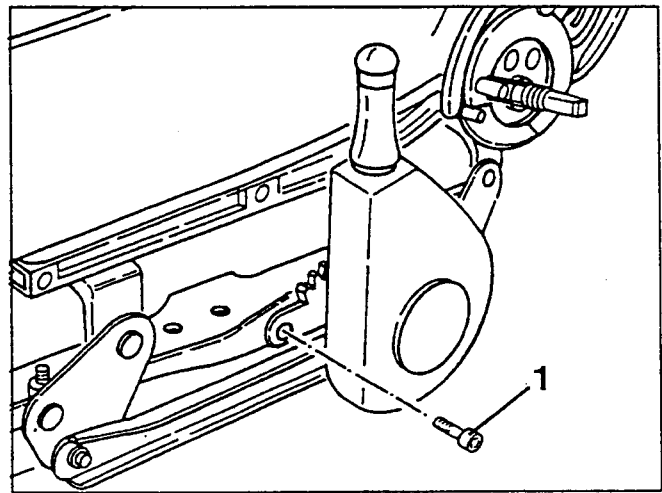
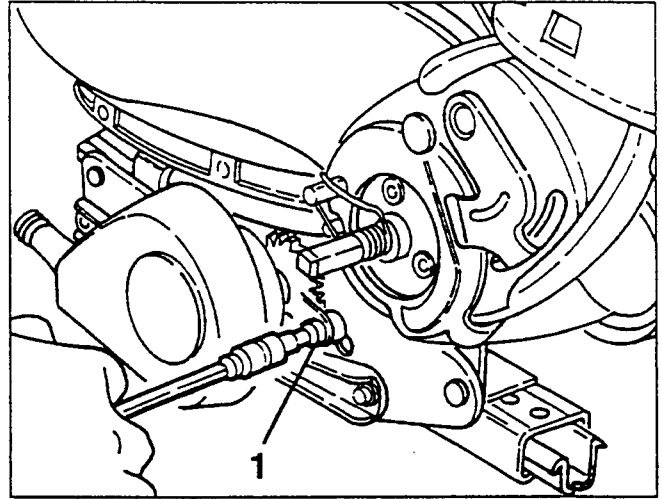
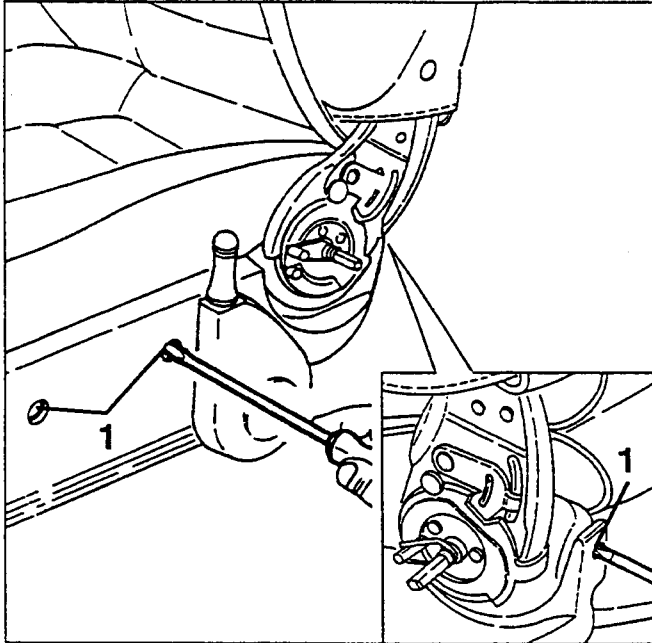


1. Pull off the cap and remove the backrest tilt handle.
2. Loosen the screw and remove the left-hand hinge moulding by pulling it away from the clips.

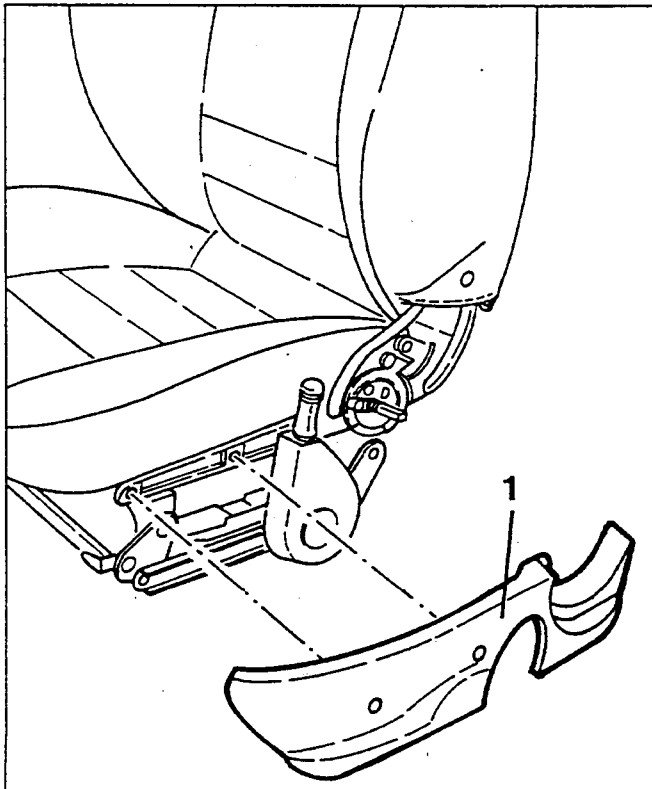




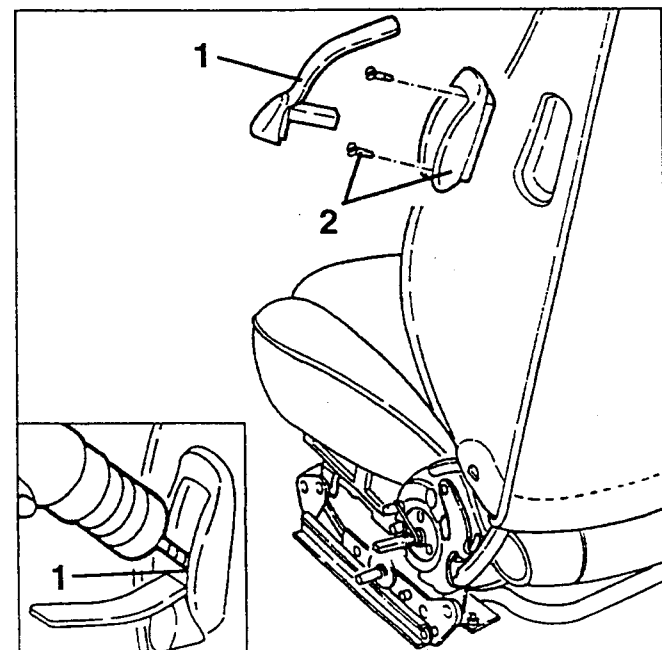
1. Loosen the three screws securing the cushion lower moulding.



1. Remove the lower cushion moulding.

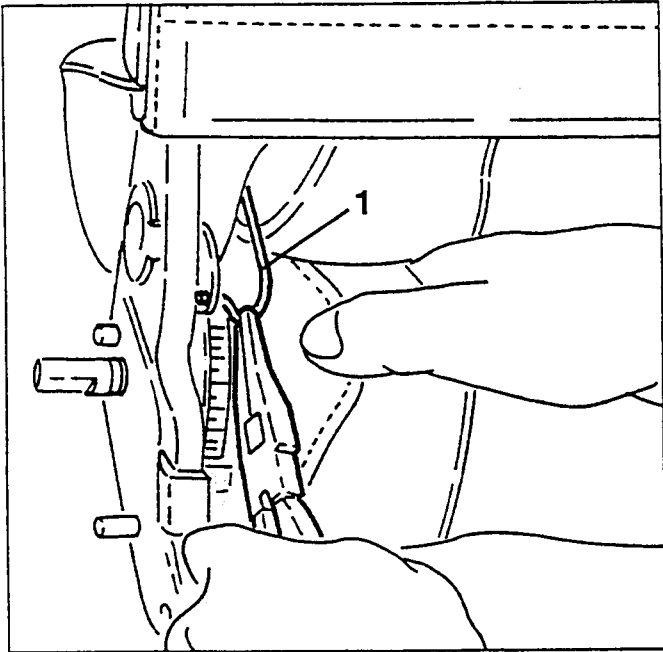


1. Remove the moulding and using a drill remove the rivet securing the handle used for tipping the backrest. Remove the handle.  
2. Loosen the two screws and pull off the trim moulding.

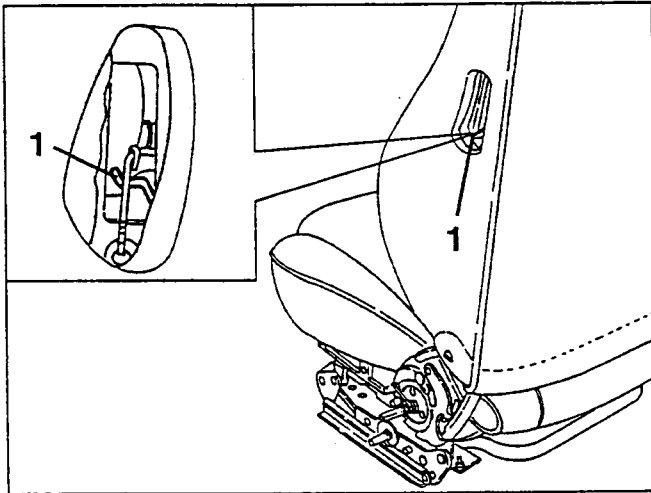
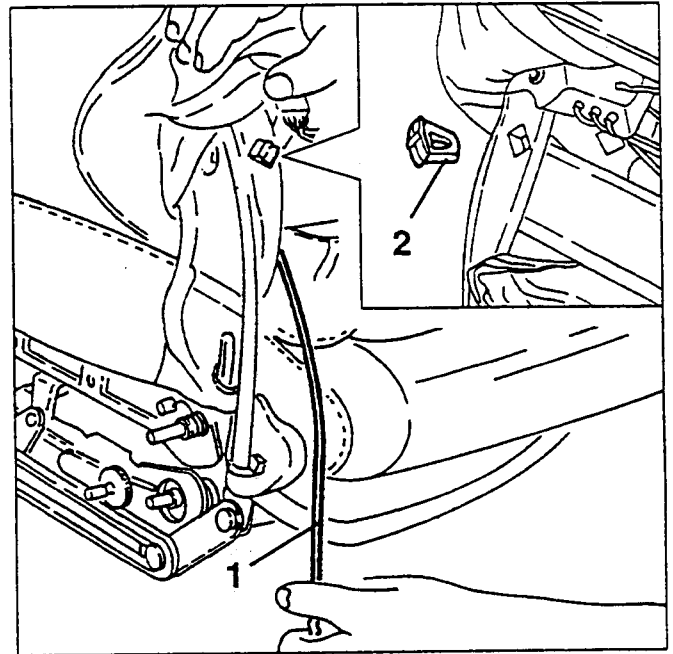


1. Suitably rotating the height regulation device of the seat, loosen the two screws and remove the device.

- Tip the backrest forwards to expose the recess.
- 1. Disconnect the the backrest tilt recess from the relative attachments.

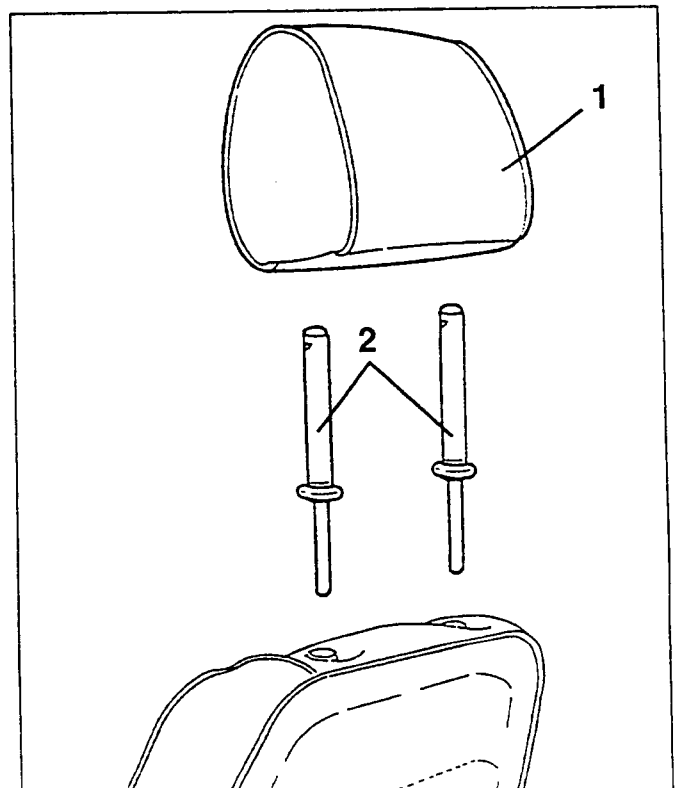
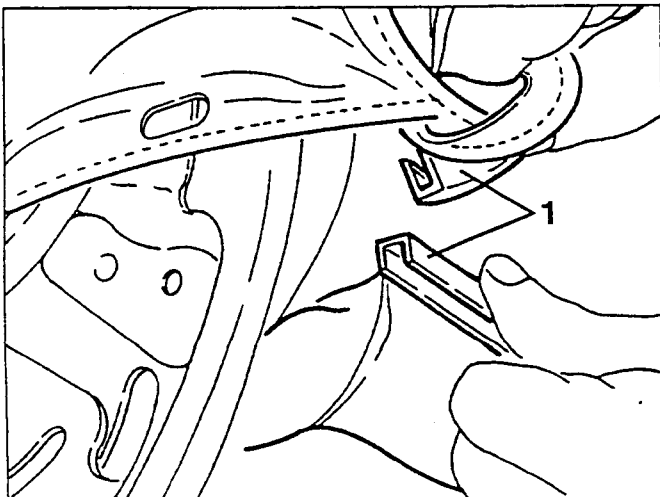


- 1. Remove the backrest tilt recess withdrawing it from the retaining clip.
- 2. Remove the backrest tilt recess passage clip.



- Fully raise the headrest.
- 1. Rotate the support pins 90° anticlockwise and remove the headrest.
- 2. Withdraw the two headrest support pins.

- 1. Open the backrest covering as shown in the diagram.

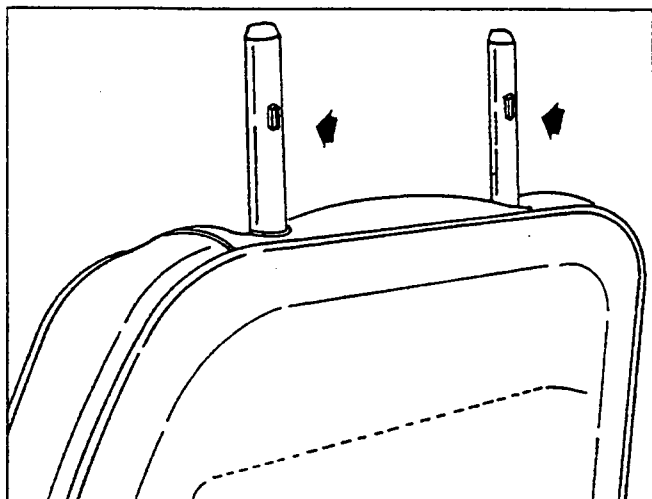




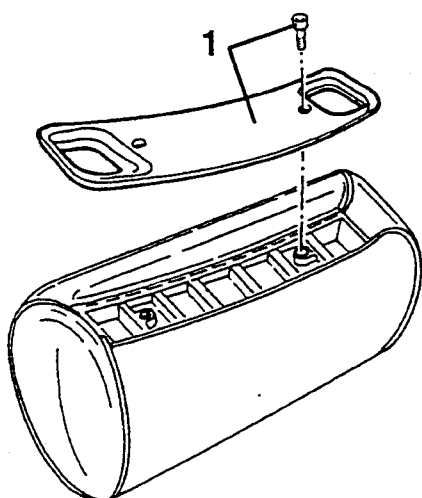
When refitting the headrest ensure that the two teeth on the pins of the headrest support face the rear of the seat.



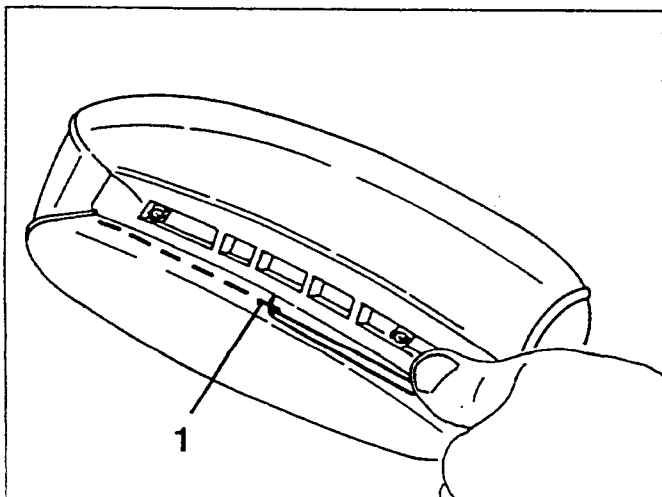
To make it easier to refit the trim onto the headrest use the appropriate material (non-woven fabric) which facilitates the sliding action and correct positioning of the covering itself.



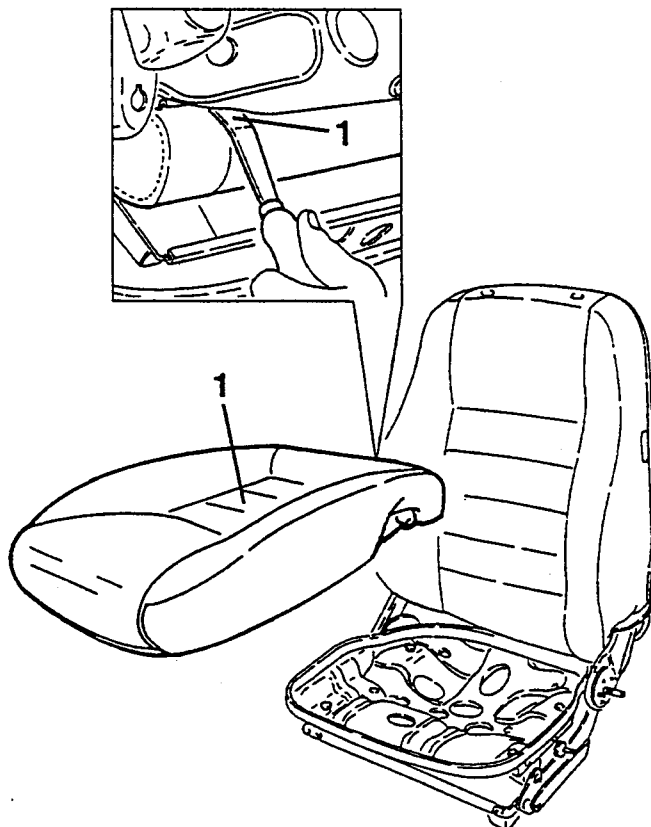
1. Loosen the two screws and remove the headrest lower trim.



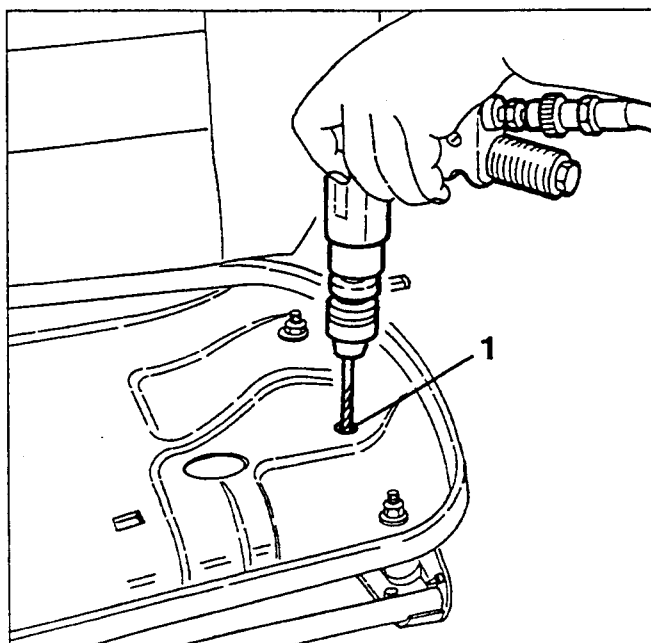
1. Remove the clips and pull off the headrest trim.



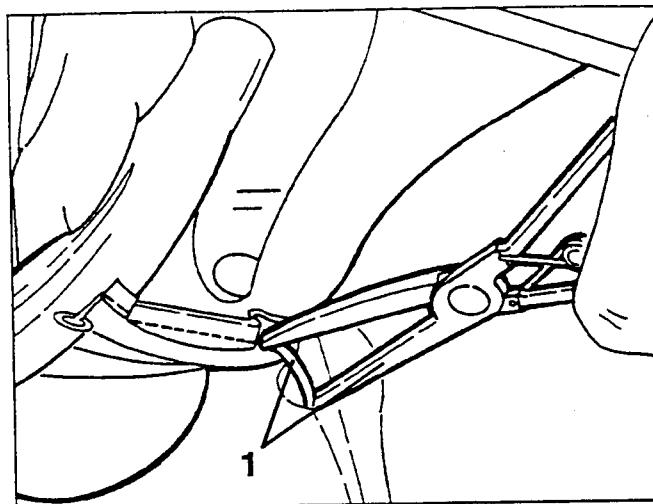
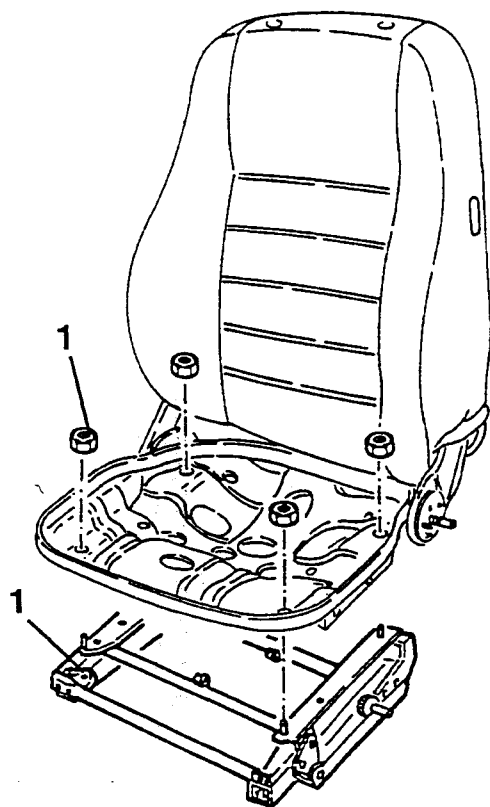
1. Pull off the cushion covering and remove the cushion complete with covering.



1. Using a drill, remove the two rivets securing the seat raising device.

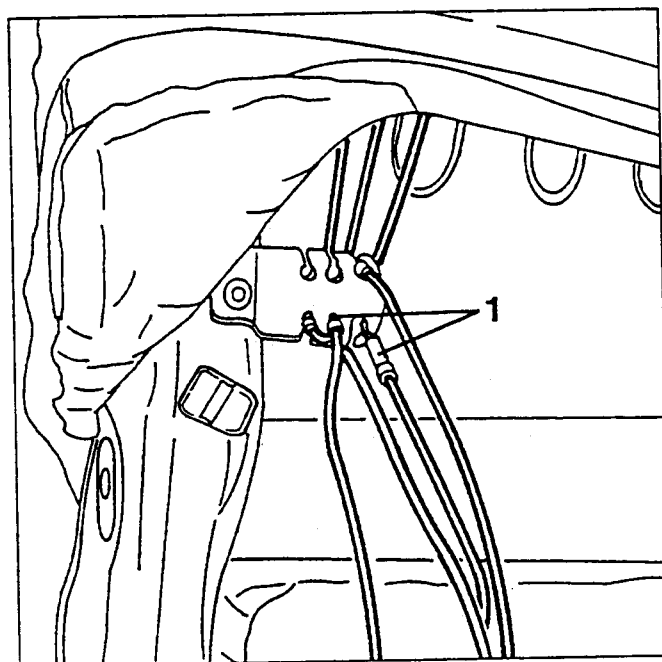


1. Loosen the four nuts and remove the seat raising device.

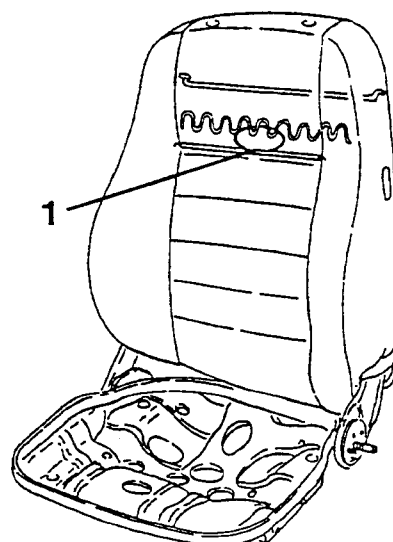
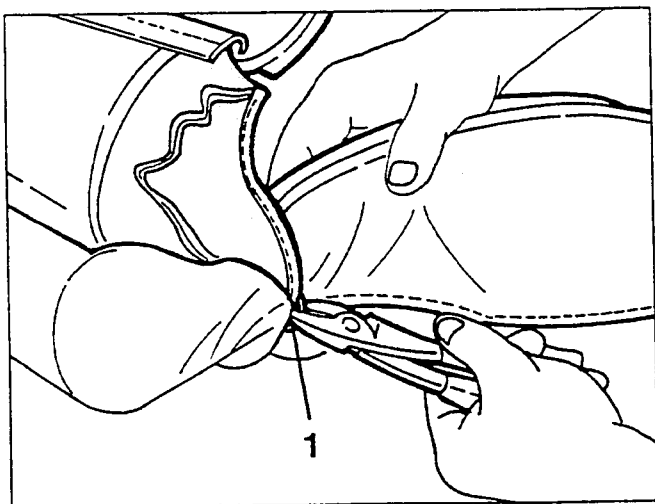


1. Unhook the tensioning/adaptation wires of the backrest covering from the brackets.

1. Using a pair of shears, cut the clips securing the cushion covering and remove the covering.



1. Remove the covering from the backrest after freeing the rear frame tensioning tie-rod and the front rubber ring.



**Refit by reversing the procedure followed for disassembly and note the following:**

1. Fix the covering with the clips using the appropriate pliers supplied as a spare part.  
- Clinch the edge of the covering using a plastic mallet.

**NOTE:**

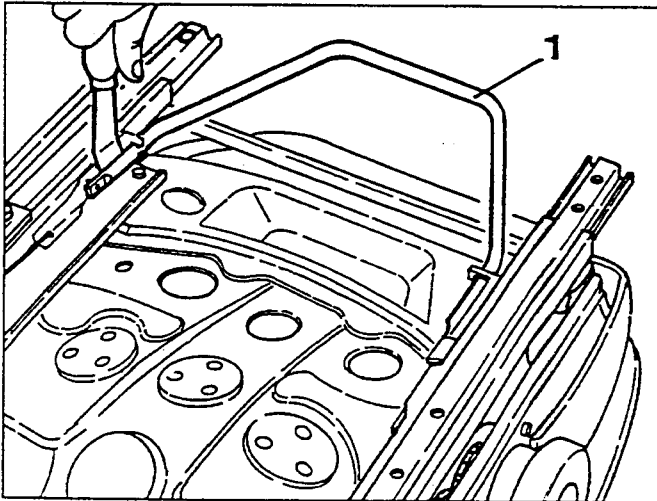
The following components can be removed/refitted from/to the seat whilst it is in the vehicle by following the operations described in the section relative to the bench disassembly of the seat and extrapolating the relative operations:

- Headrest
- Height adjustment device
- Backrest tilt handle.

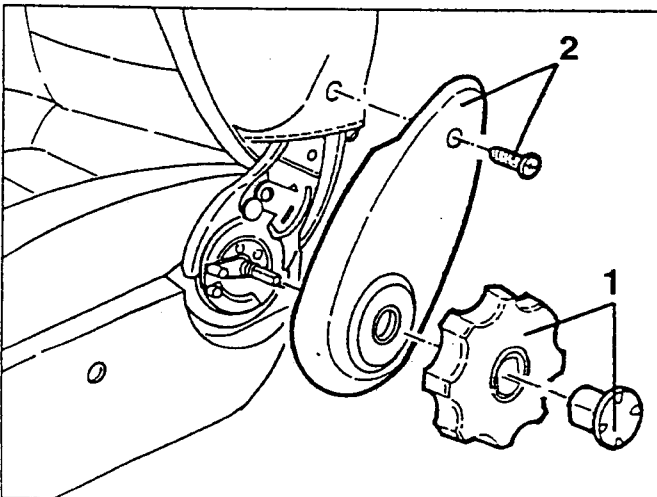
### DISASSEMBLING/REASSEMBLING DRIVER'S SEAT (WITHOUT HEIGHT ADJUSTMENT)

Disassemble as described for the seat with height adjustment except for the procedure relative to the removal of the guide runners which is described below.

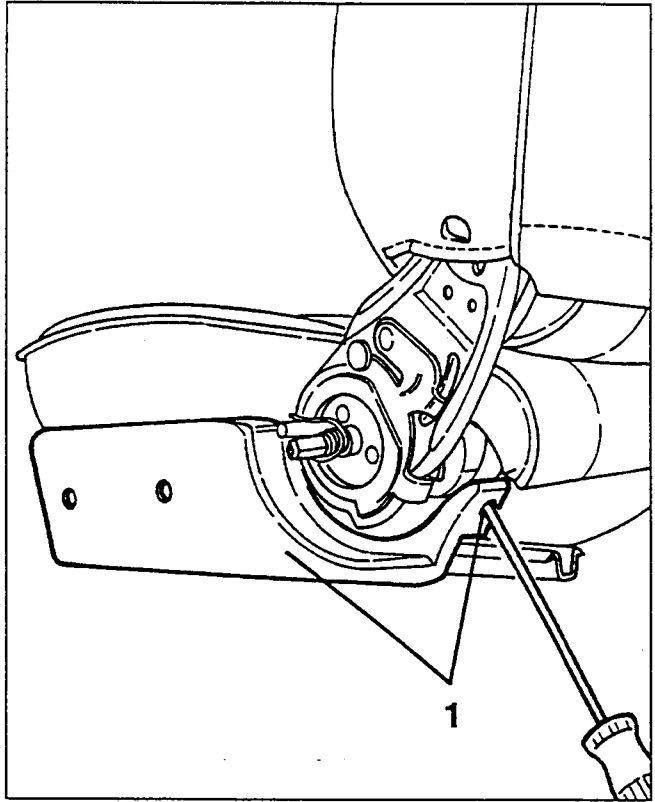
1. Remove the seat runner lever and pull it away from its attachments.



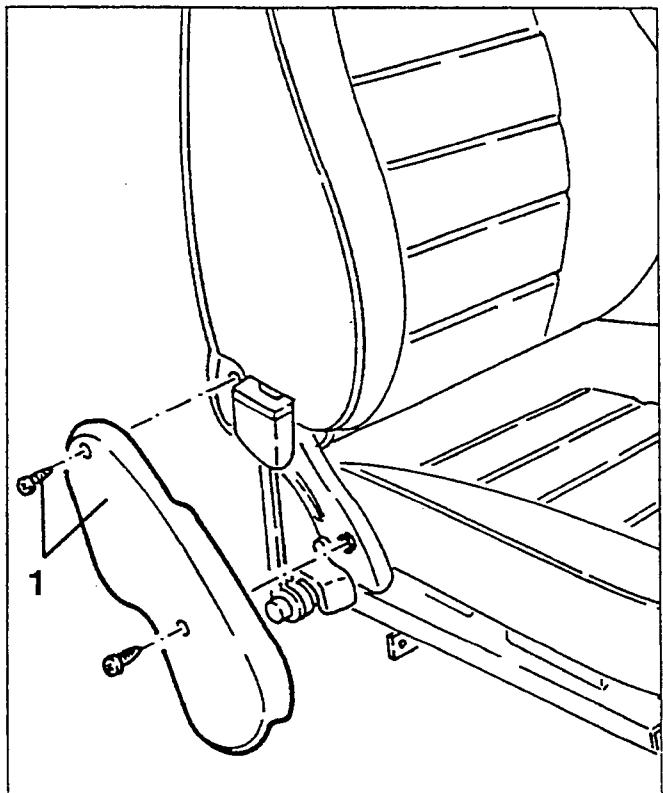
1. Pull off the cap and remove the backrest tilt handle.
2. Loosen the screw and remove the left-hand hinge moulding pulling it away from the clips.



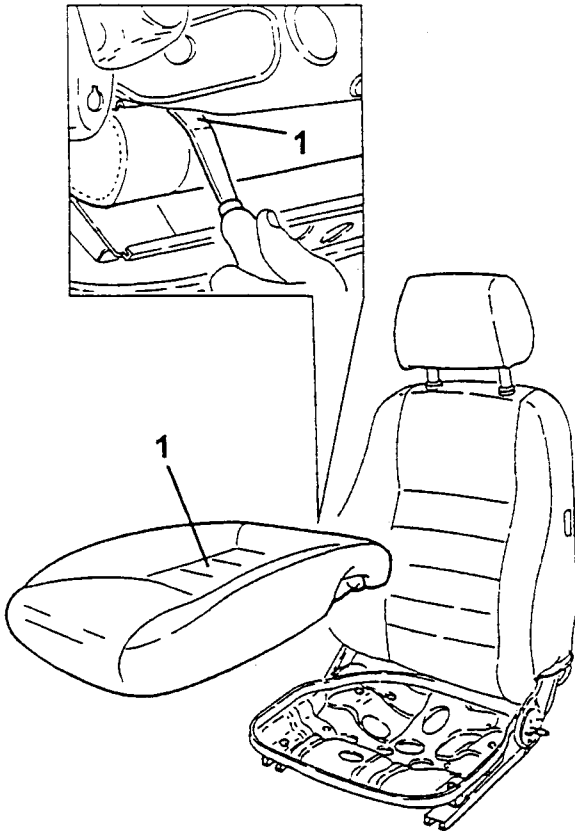
1. Loosen the three screws and remove the lower moulding from the cushion.



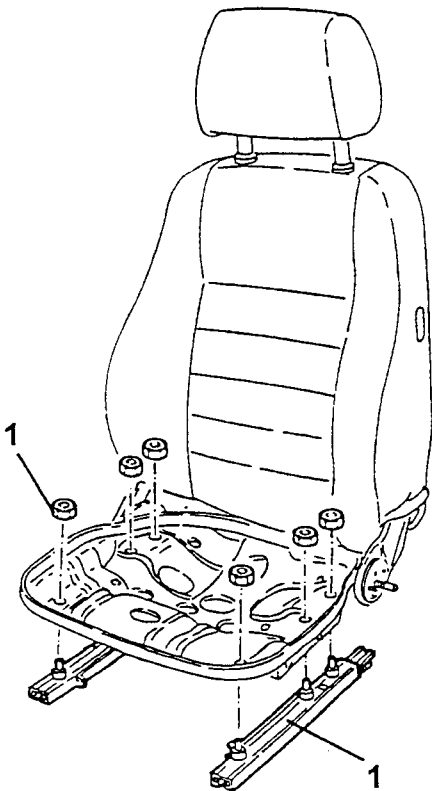
1. Loosen the two screws and remove the right-hand hinge moulding pulling it away from the clips.



... Remove the cushion cover, then remove the cushion complete with cover.



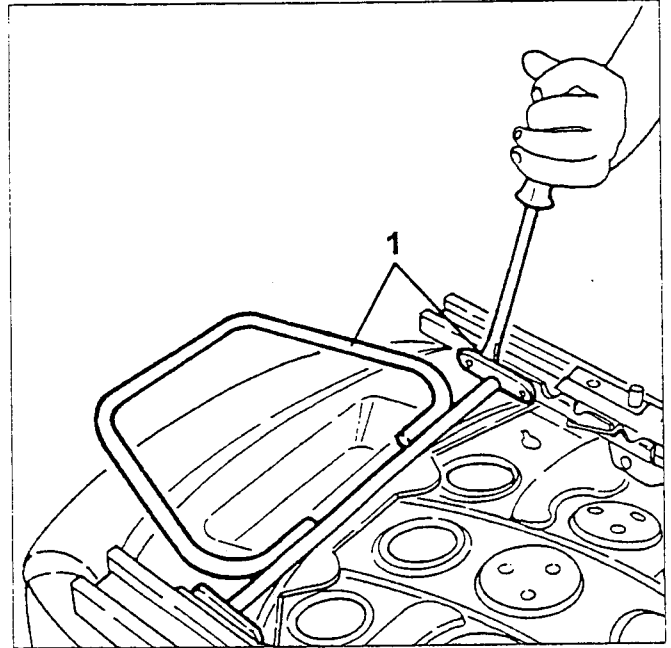
1. Undo the six fixing bolts and remove the seat runners.



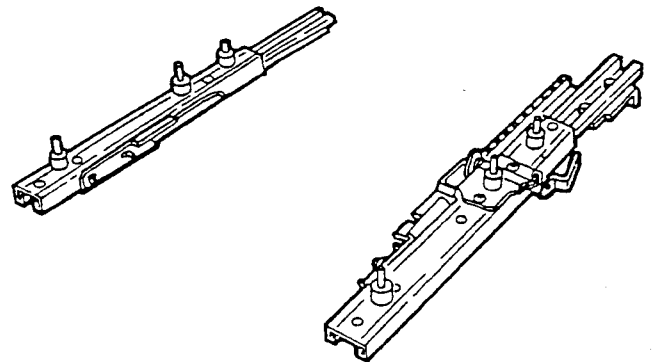
## DISMANTLING/REASSEMBLING PASSENGER SEAT

Proceed with the dismantling, working in the same way as described for the driver's seat without height adjustment, making the following changes.

1. Fully retract the runners, then remove the seat sliding lever, releasing it from the side fastenings.



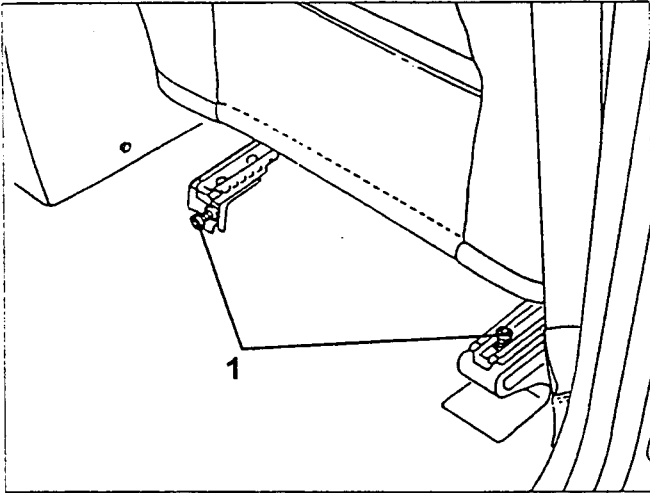
- The seat guides in question do not have a seat height adjustment device, but another device which allows the side to slide forwards and then return to its original position.
- For the removing-refitting, follow the instructions for the driver's seat.



## FRONT SEATS (for versions with Side Bag)

### REMOVING

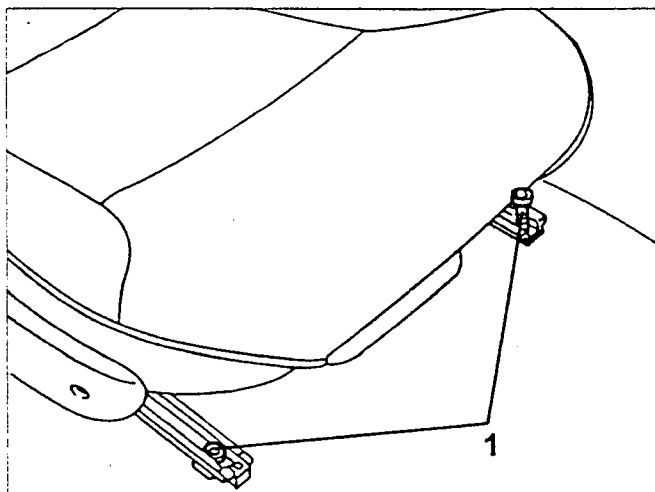
1. Place the seats in the end of travel forwards position and undo the bolts fixing the guides to the floor.



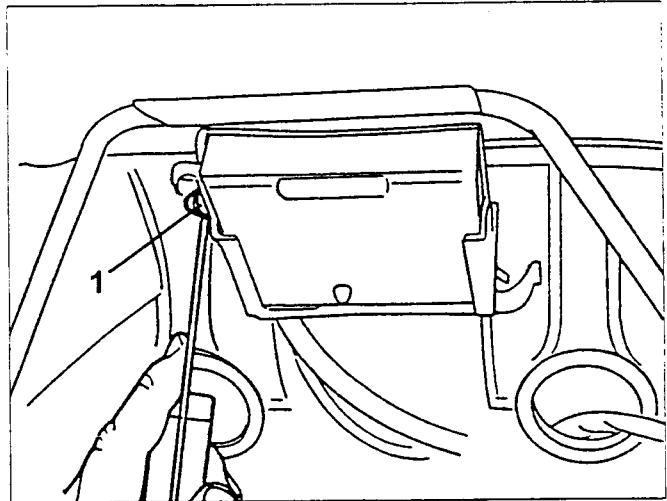
1. Place the seat in the end of travel backwards position and undo the bolts fixing the guides to the floor.

**NOTE:** Before removing the seat:

- disconnect the battery terminals;
- wait for at least 10 minutes before disconnecting the electrical connection for the passenger presence sensor (for vehicles up to June '99) and for the Side Bag, then proceed as described below.

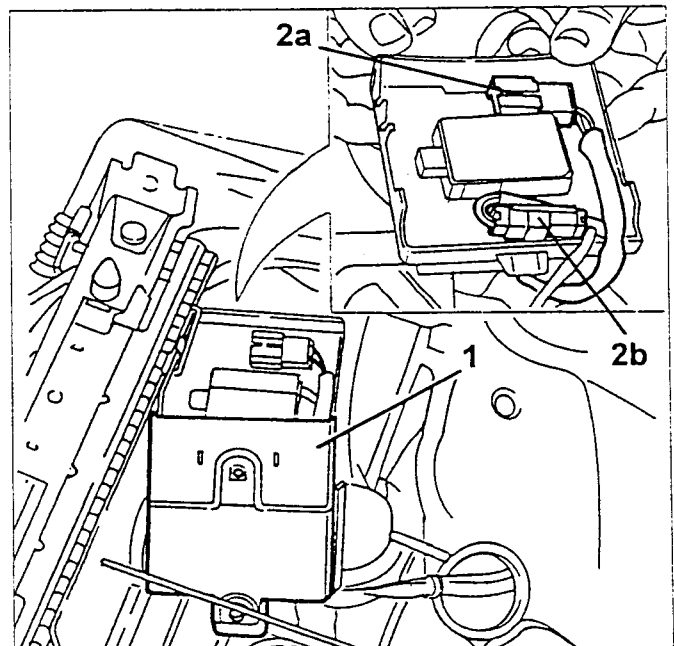


1. Fold the seat backwards and remove the connector box safety plug.



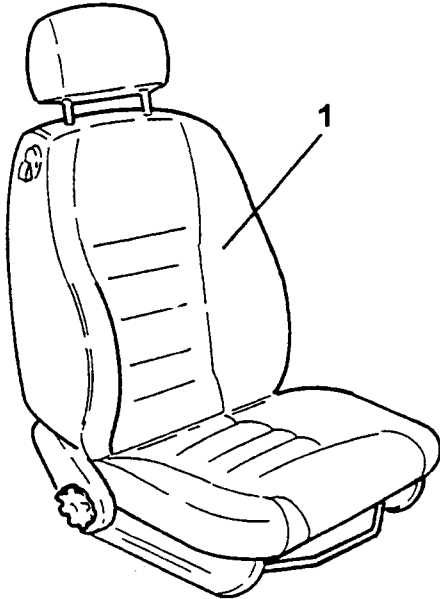
1. Extract the connector box flap.
2. Disconnect the electrical connection (2a) for the Side Bag and the electrical connection (2b) for the passenger presence sensor (for vehicles up to June '99).

**NOTE:** There are two connections on the passenger seat, one for the Side Bag and one for the passenger presence sensor (for vehicles up to June '99), whilst on the driver's seat there is only the connection for the Side Bag.



1. Remove the seat from the vehicle.

**NOTE:** Do not extract the seat from its housing using the seat lever shown by the arrow in the diagram or else the guides will not be aligned.

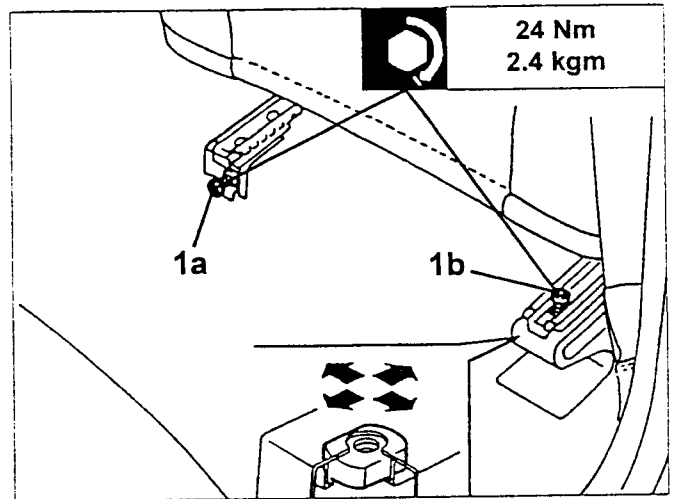


1. Tighten the rear fixing bolts starting from the one on the inside (1a) and continuing with the one on the outside (1b).



The seat should be fixed to the floor without the guides being distorted; if necessary, adjust the nuts shown in the diagram making sure that they are free.

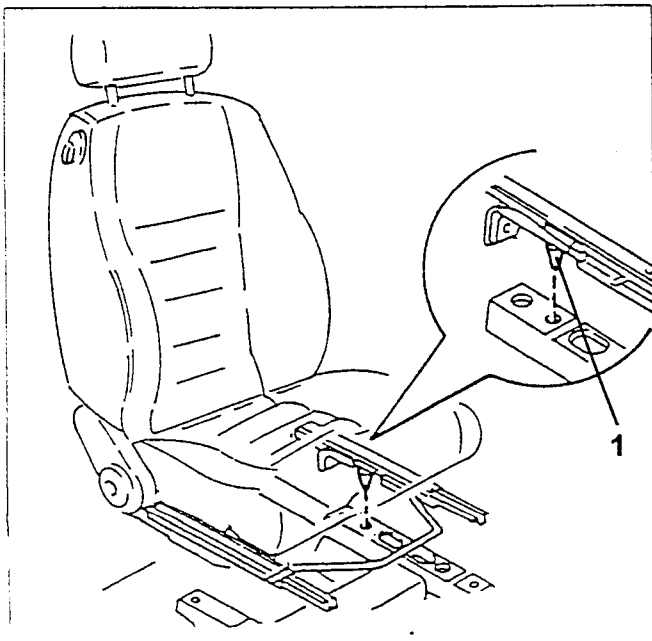
**NOTE:** During this stage do not lift up the seat to fit the fixing bolts.



### REFITTING

- Place the seat in its housing in the vehicle.
  - Connect the electrical connections.
1. Check that the centering pin on the seat guide is correctly positioned.

**NOTE:** Check that the carpet does not interfere with the seat guide support areas.

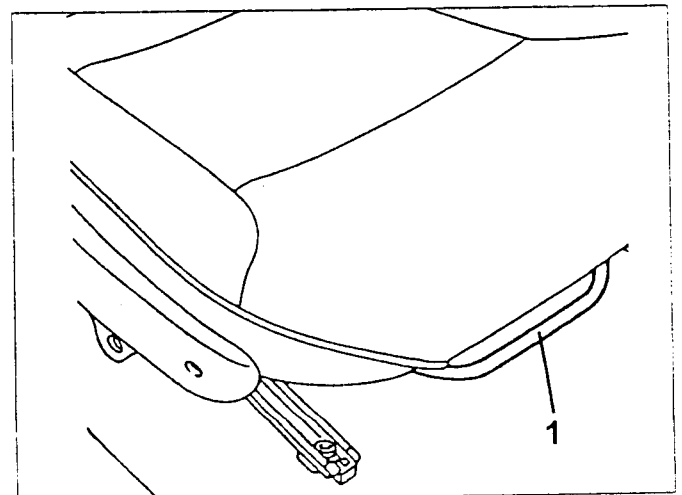


1. Place the seat in the fully retracted end of travel position using the guide control lever.



Always make sure that the guide control lever is correctly attached.

**NOTE:** For 145 version avoid folding the backrest when sliding the seat in order not to free the guides and prevent them from being out of alignment.



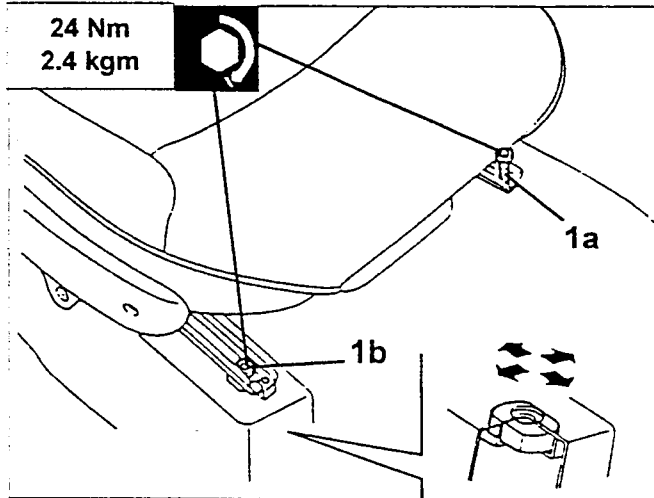


1. Tighten the front fixing bolts, starting from the one on the inside (1a) and continuing with the one on the outside (1b).



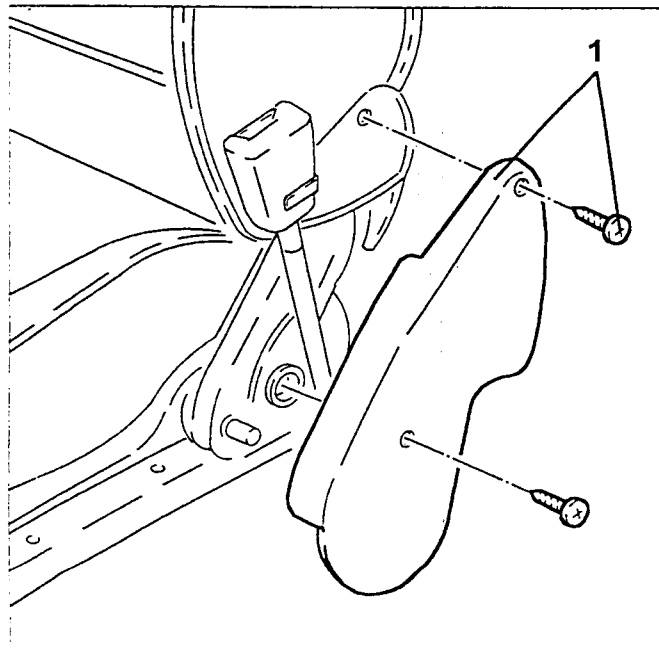
The seat should be fixed to the floor without distorting the sliding guides; if necessary, adjust the nuts shown in the diagram making sure that they are free.

**NOTE:** Each time operations are carried out on the Air Bag system the operation of the system **MUST** be checked using the diagnostic equipment.

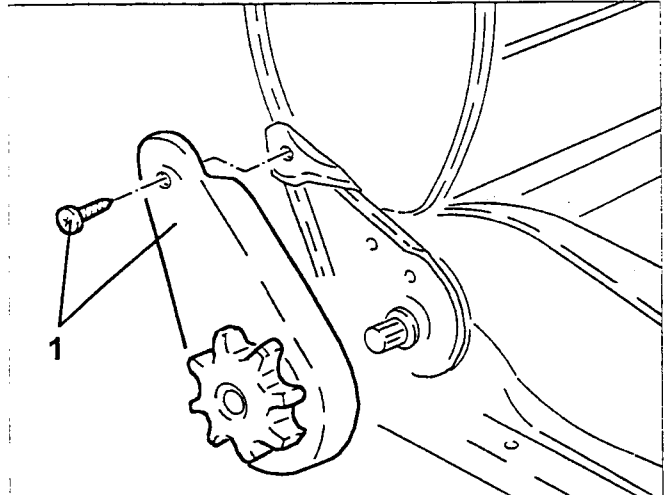


### DISMANTLING-REASSEMBLING FRONT SEAT BACKREST UPHOLSTERY

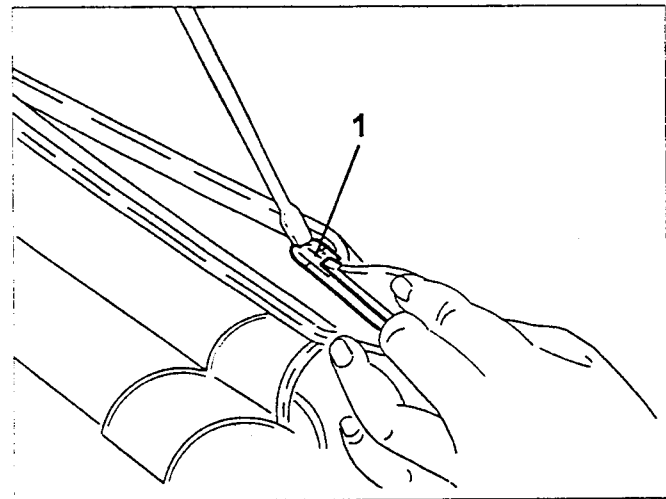
- Remove the front seat (see specific procedure).  
1. Undo the two fixing bolts and remove the hinge trim releasing it from the fastening springs.



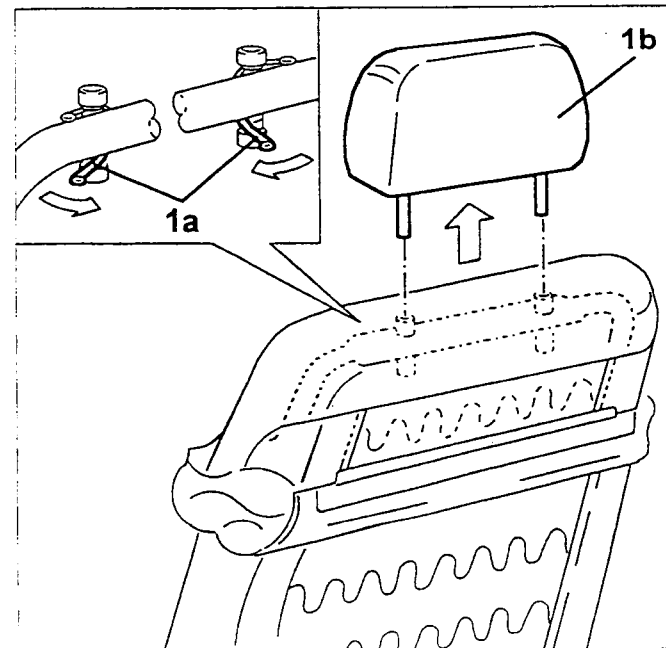
1. Undo the fixing bolt and remove the hinge trim complete with knob releasing it from the fastening springs.



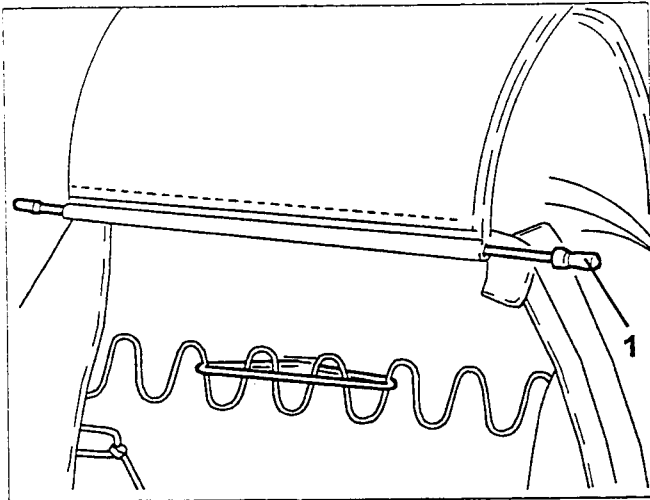
1. Remove the two side profiles for the rear backrest fabric.



1. Rotate the springs (1a) and remove the head restraint (1b).

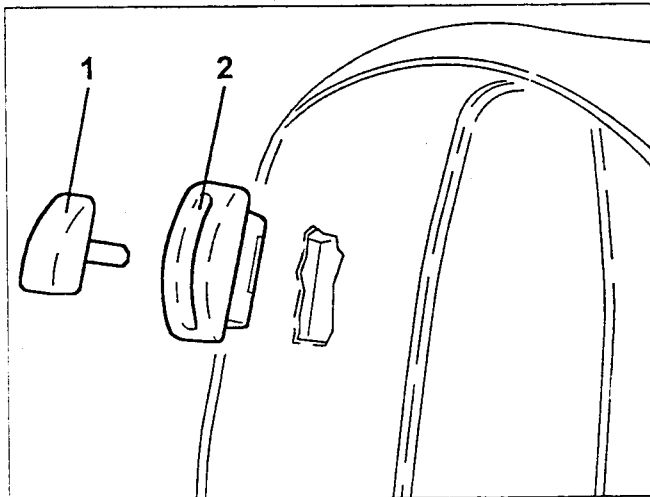


1. Remove the upper backrest cover retaining rod.

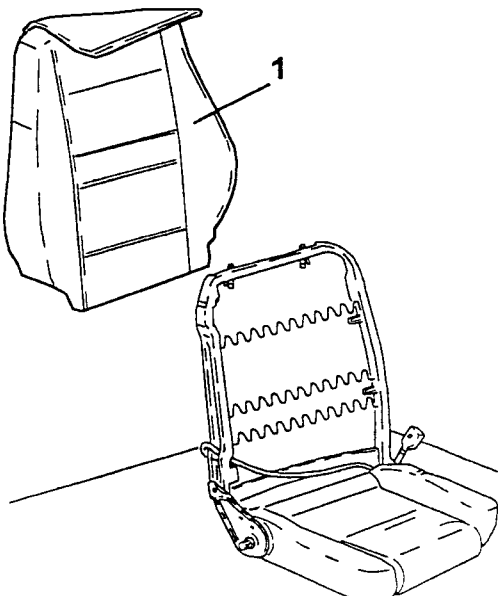


1. Remove the seat folding lever.  
2. Remove the trim.

**NOTE:** When refitting, replace the trim.



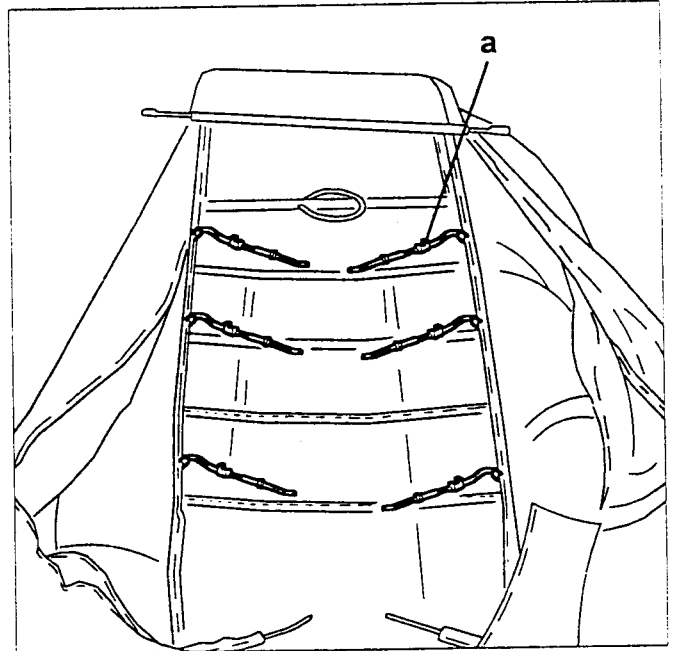
1: Remove the front seat backrest cover complete with upholstery.



**NOTE:** When refitting, check that the seat rods are correctly positioned.



If the rods (a) are incorrectly fitted this will adversely affect the operation of the Side Bag.

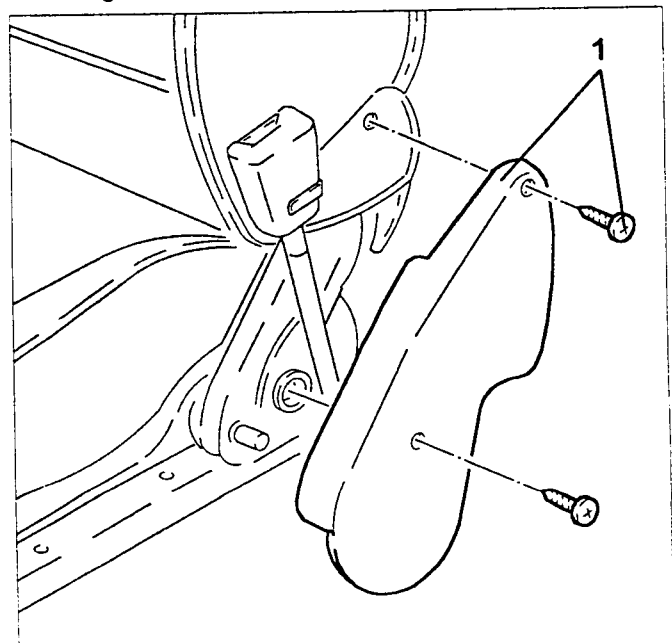


**NOTE:** Before fitting a new backrest cover on the seat, make the openings for the head restraint pins and the folding lever.

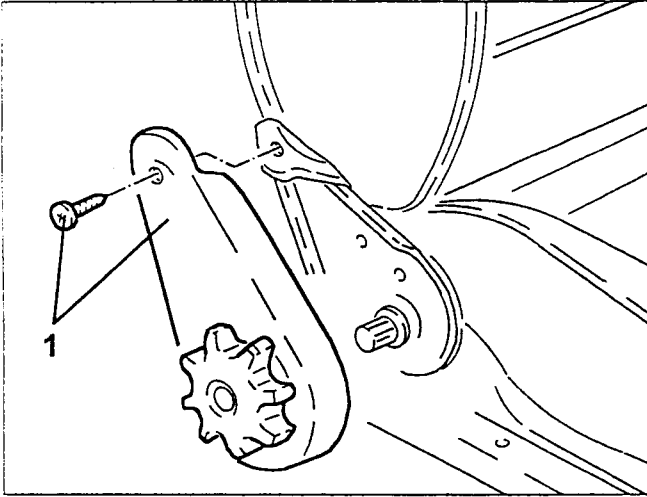
### DISMANTLING/REASSEMBLING FRONT SEAT CUSHION COVER

- Remove the front seat (refer to the specific procedure).

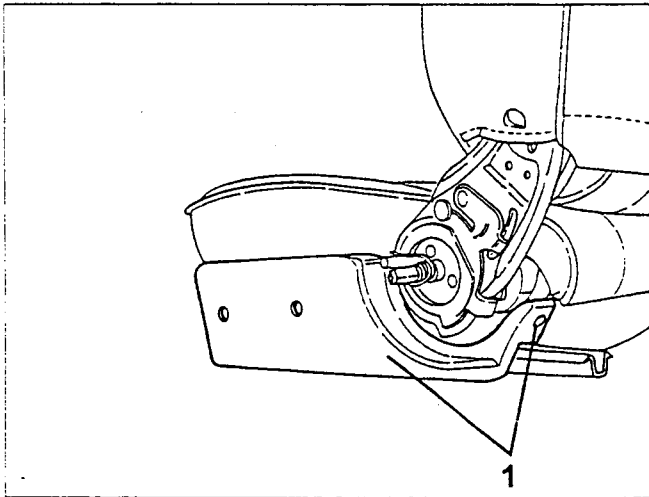
1. Undo the two fixing bolts and remove the hinge trim releasing it from the fastening springs.



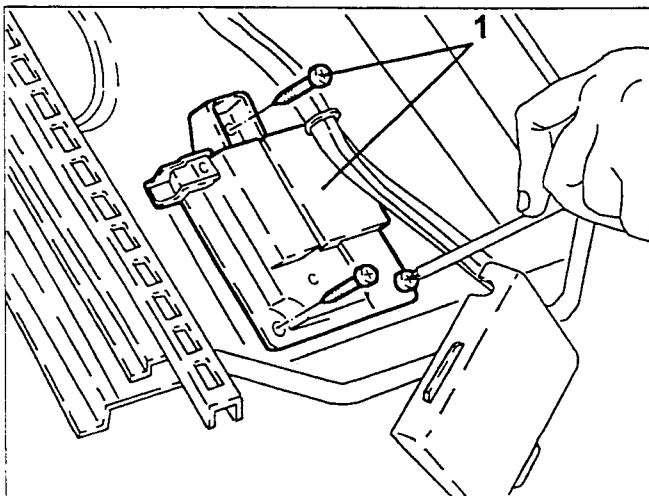
1. Undo the fixing bolt and remove the hinge trim complete with knob releasing it from the fastening springs.



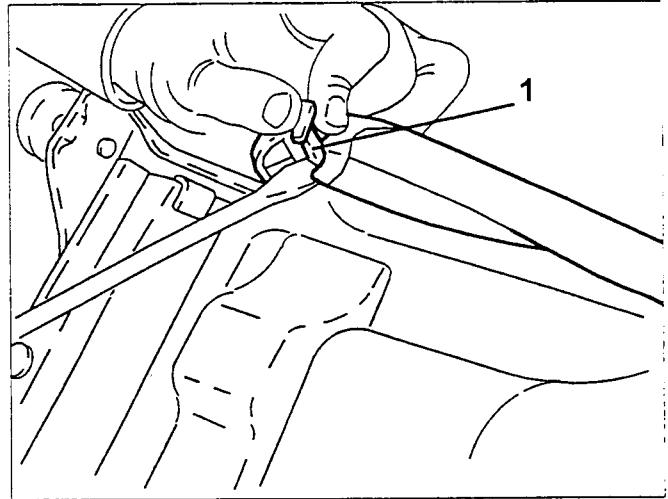
1. Undo the fixing bolts and remove the right and left hinge trim.



1. Remove the connector box fastened to the base of the seat.



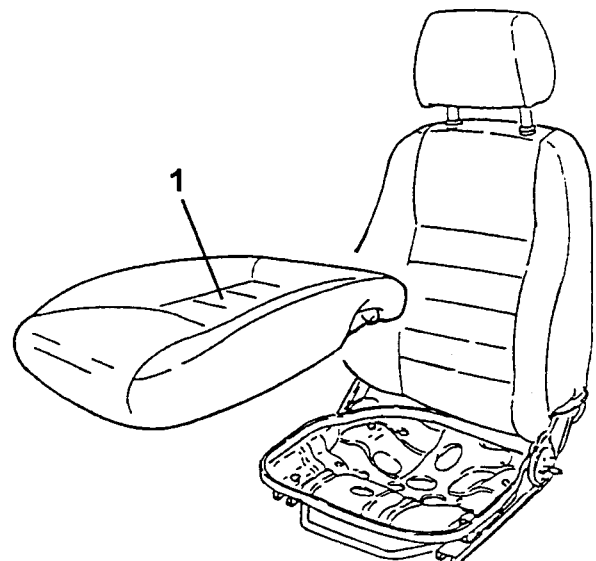
1. Release the seat cover from the base of the rear of the seat.



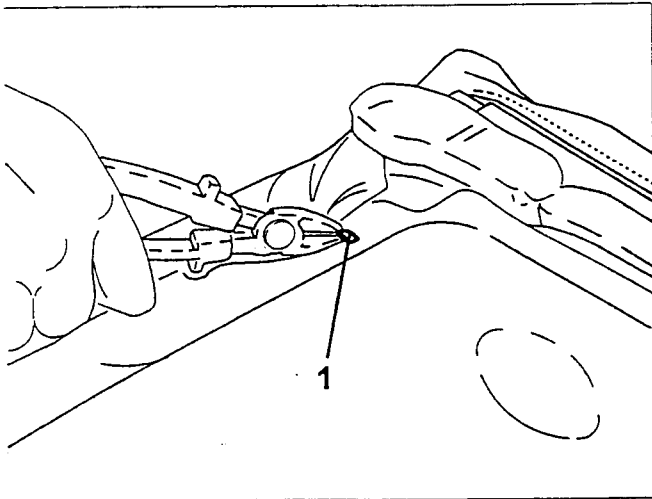
1. Release the seat cover from the base of the seat on the right and left sides.



1. Remove the cushion.



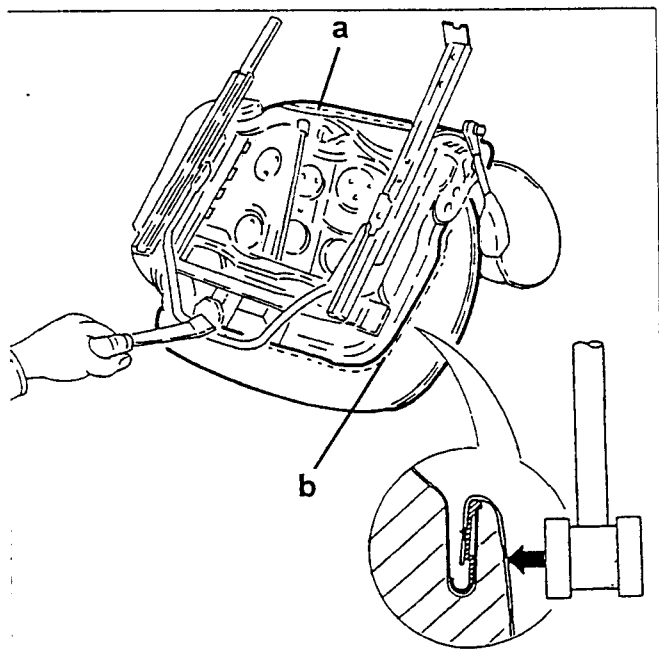
Cut the metal points fixing the seat cover to the seat upholstery.



**⚠** Remove the remaining metal points connected to the upholstery to avoid damaging the cover.

- Proceed with the refitting, reversing the order of the operations carried out for the removal, taking care to observe the following.
- Fit the cushion on the seat frame, attaching the profiles (a) and (b) using a spatula, starting at the centre front area.
- Stake the drip channel using a rubber hammer as illustrated in the diagram.

**⚠** The use of other tools could damage the cover.

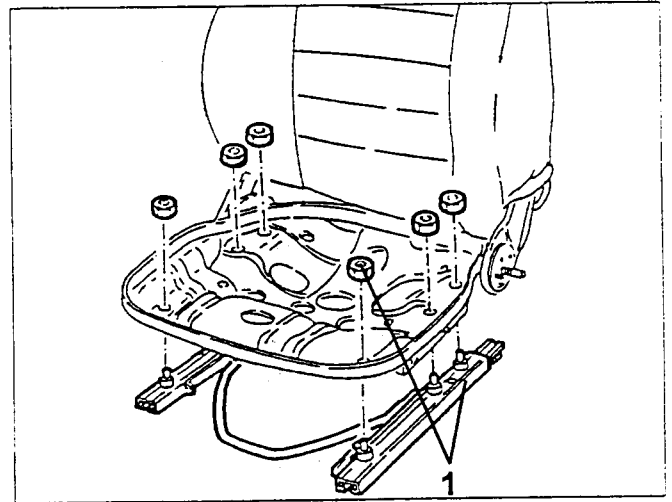


## DISMANTLING/REASSEMBLING PASSENGER SEAT GUIDES

- Remove the cushion from the seat (see "Dismantling/Reassembling front seat cushion cover" procedure).

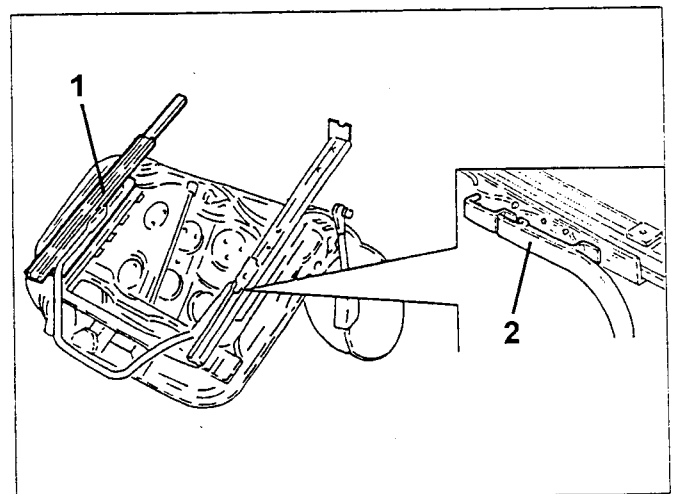
1. Undo the fixing nuts and remove the guides complete with runner.

**⚠** The runner should not be removed before dismantling the guides in order to prevent distortions which could adversely affect operation.



- Proceed with the refitting, reversing the order of the operations carried out for the removal, taking care to observe the following.

1. Position the guide with the memory on the base and fasten it without tightening the two nuts.
  2. Position the runner on the remaining guide taking care to centre the ratchet gears.
- Fit the guide complete with runner and fasten it without tightening the two nuts.



- Place the guides forwards until they are heard to lock.
- Tighten the nuts fixing the guides to the recommended torque.

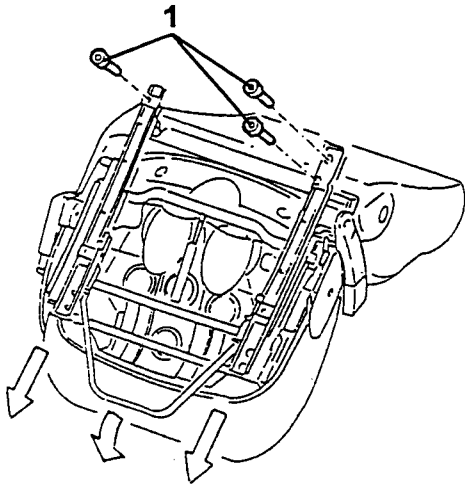


24 Nm  
2.4 Kgm

## DISMANTLING/REASSEMBLING DRIVER'S SEAT GUIDES

- Remove the front seat (see specific procedure).
- At the bench, move the guides forwards with the runner.

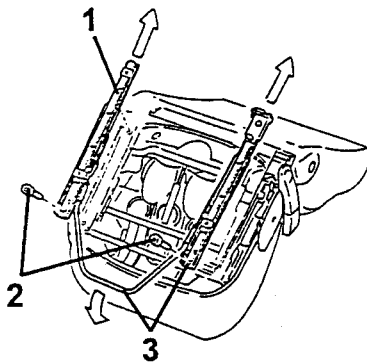
1. Undo the rear guide fixing bolts.



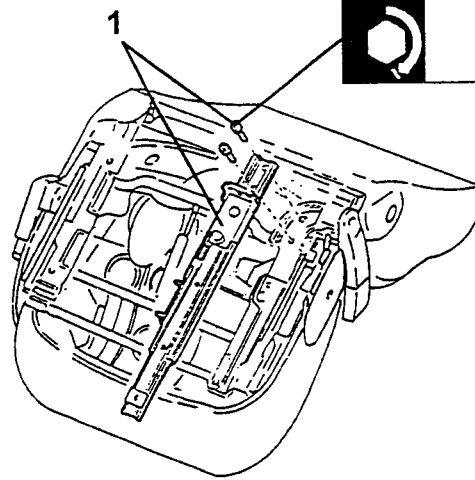
1. Retract the guides with the runner.
2. Undo the front guide fixing bolts.
3. Remove the guides complete with runner.



The runner should not be removed before dismantling the guides to prevent distortions which could adversely affect operation.

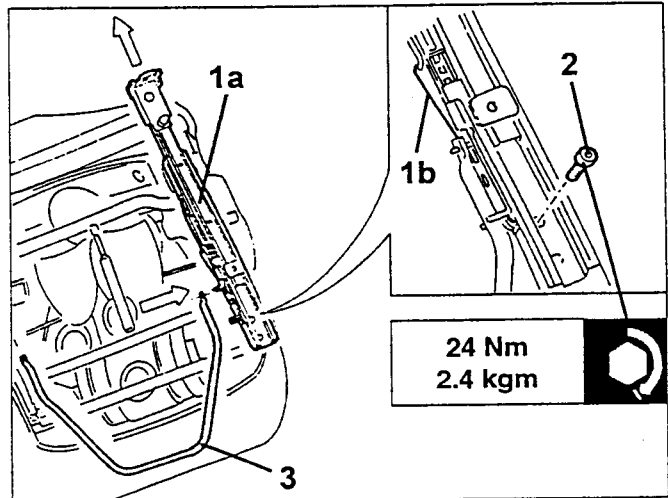


1. Position the inner guide and secure it tightening the rear bolts to the recommended torque.



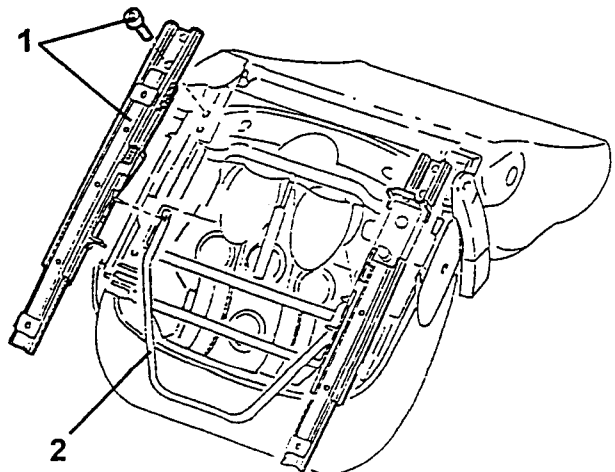
24 Nm  
2.4 kgm

1. Retract the inner guide (1a) manually using the bolt (1b).
2. Tighten the front bolt fixing the guide to the recommended torque.
3. Place the runner back in its housing, taking care to centre the ratchet gears on the guide.



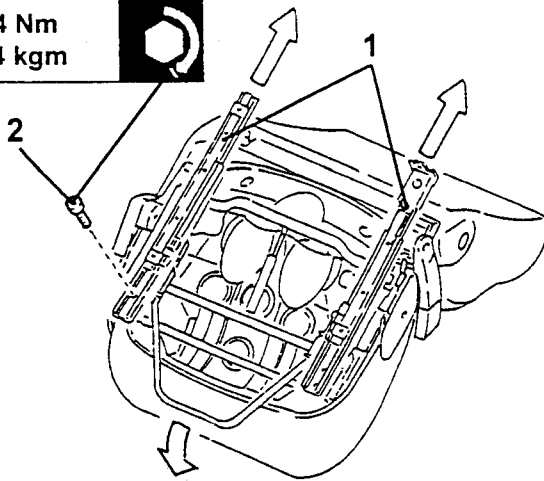
24 Nm  
2.4 kgm

1. Fit the outer guide and secure it without tightening the rear bolt.
2. Attach the runner.

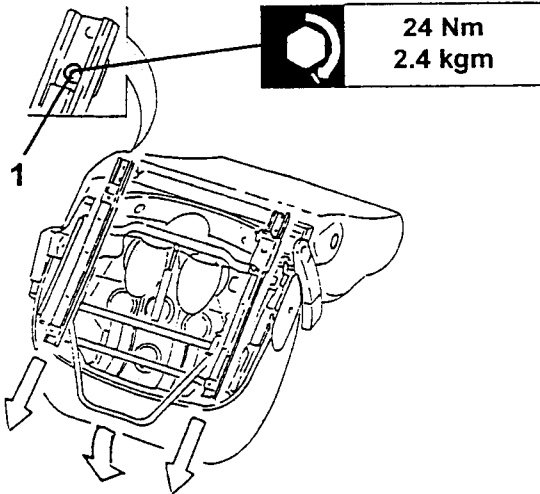


- Retract the guides using the runner.
- 2. Tighten the front bolt fixing the outer guide to the recommended torque.

24 Nm  
2.4 kgm



- Move the guides forwards using the runner.
- 1. Tighten the rear bolt fixing the outer guide to the recommended torque.

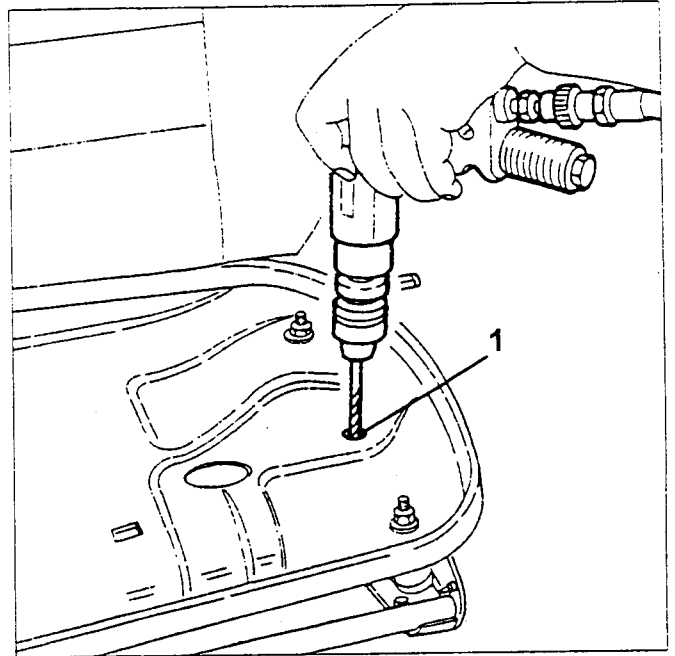


- Fit the front seat (refer to the specific procedure).

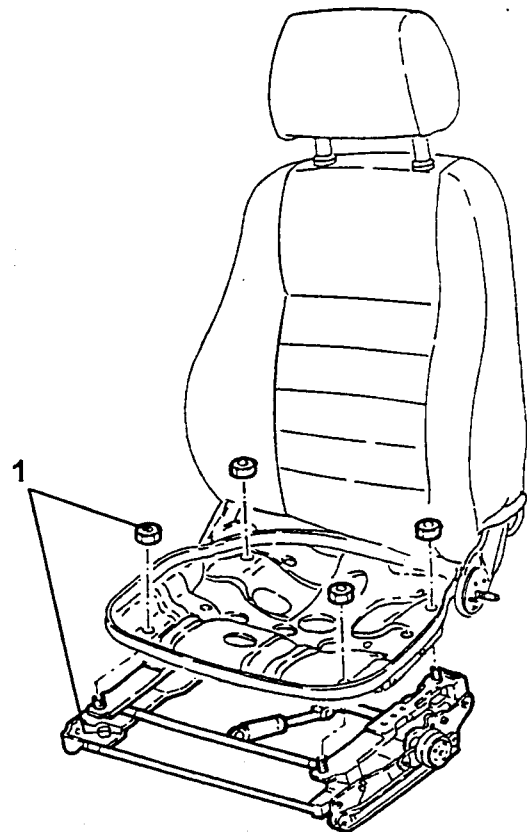
### DISMANTLING/REASSEMBLING SEAT LIFTING DEVICE

- Remove the seat guides after having place the seat in the highest position (see "Dismantling/Reassembling driver's seat guides").

- 1. Using a drill, remove the two rivets fixing the seat lifting device.



- 1. Undo the four fixing nuts and remove the seat lifting device.
- Recover the seat lifting lever.



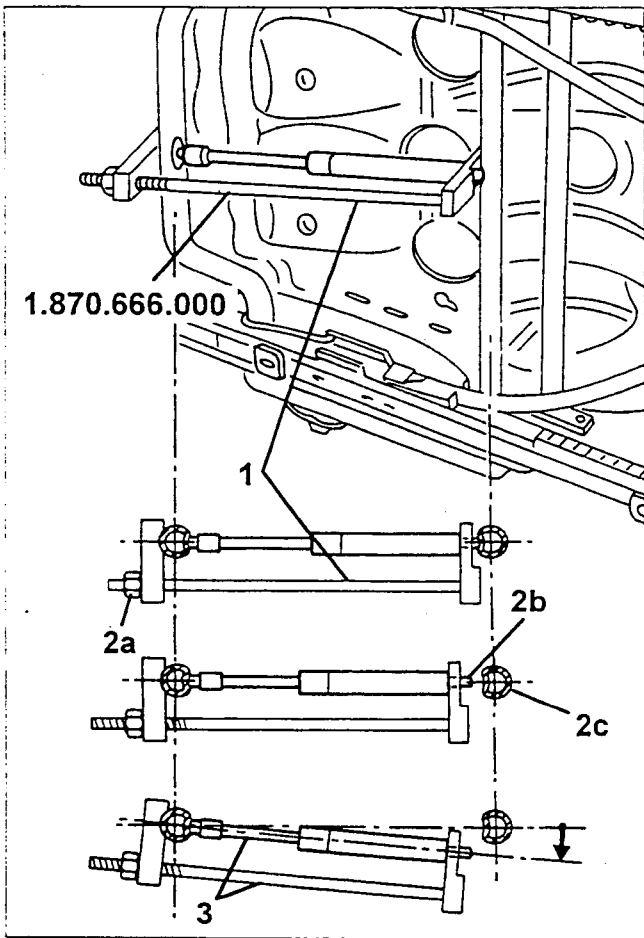
## DISMANTLING/REASSEMBLING DRIVER'S SEAT LIFTING DEVICE GAS SPRING

- Remove the front seat (see specific procedure).
- Place the seat in the completely raised position.
- 1. Fit tool N° 1.870.666.000 on the gas spring as shown in the diagram.
- 2. Tighten the nut for the tool (2a) to compress the gas spring until the gas spring pin (2b) is released from the housing (2c).

**X** Whilst tightening the nut, keep the tool in position and carry out the operation very carefully.

- 3. Rotate the tool assembly with the gas spring, as necessary, then undo the nut for the tool until the gas spring is completely removed.

**X** Whilst undoing the nut, keep the tool in position.



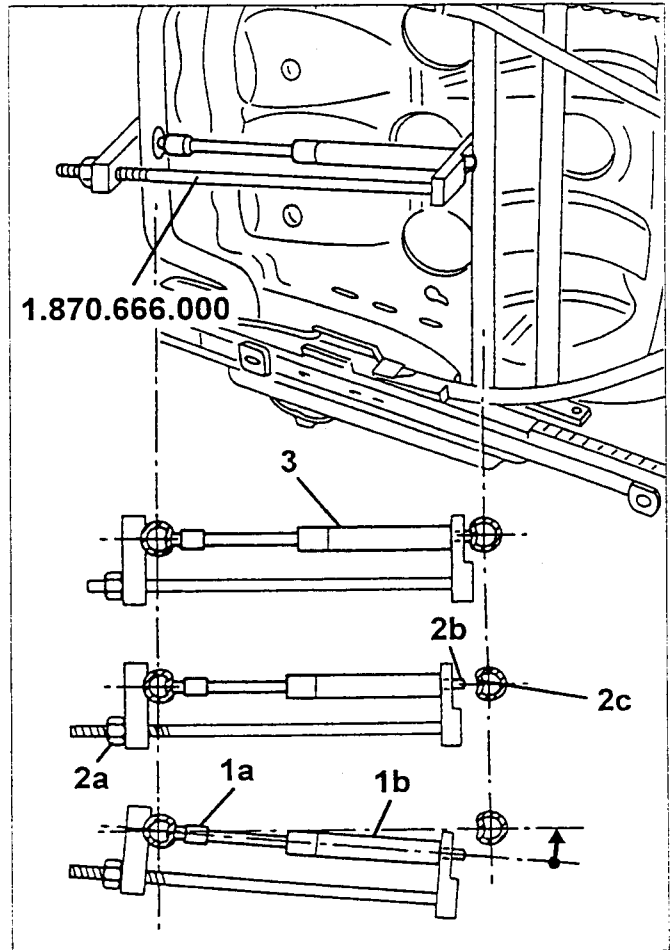
- Check that the gas spring is not damaged and provides a suitable load.

- 1. Rest the head (1a) of the gas spring (1b) in its housing in the tube, then fit tool No. 1.870.666.000 as illustrated in the diagram.
- 2. Tighten the nut (2a) for the tool to compress the gas spring in order to be able to align the device pin (2b) with the housing (2c) in the tube.

**X** Whilst tightening the nut, keep the tool in position and carry out the operation very carefully.

- 3. Undo the nut for the tool until the gas spring is completely inserted in the housing.

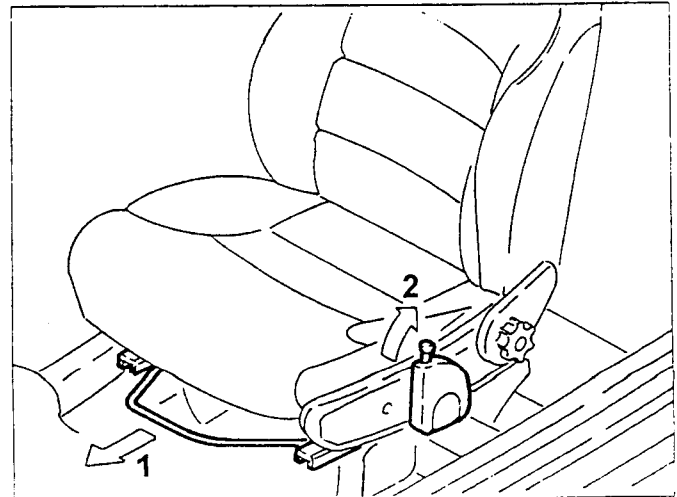
**X** Whilst undoing the nut, keep the tool in position.



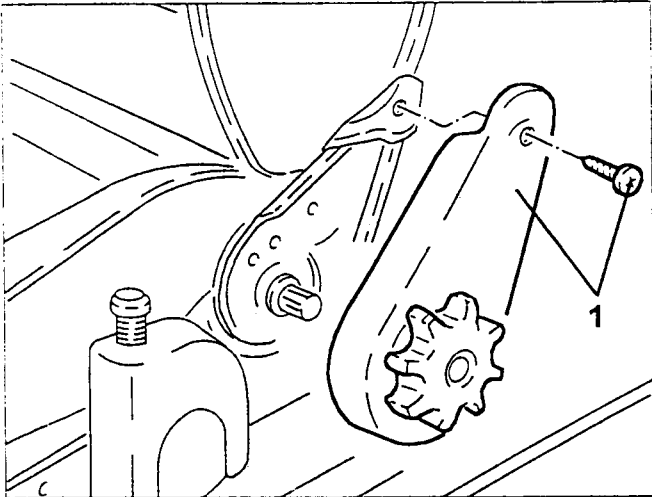
- Fit the front seat (see specific procedure) and check the operation of the device.

## REMOVING/REFITTING SEAT LIFTING CLUTCH IN VEHICLE

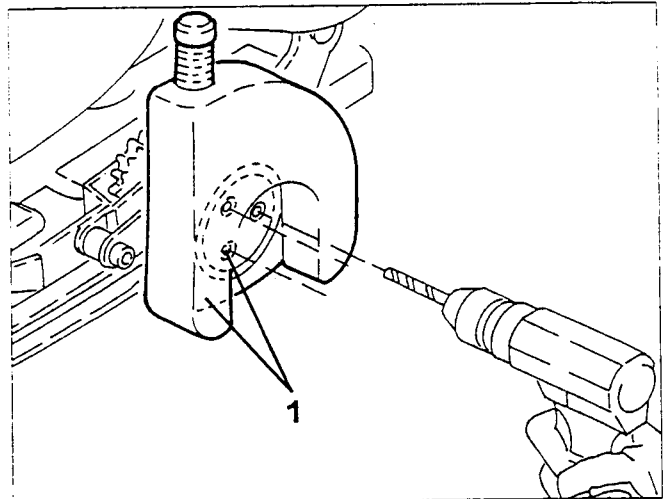
- 1. Position the seat completely forwards.
- 2. Position the seat lifting device completely upwards.



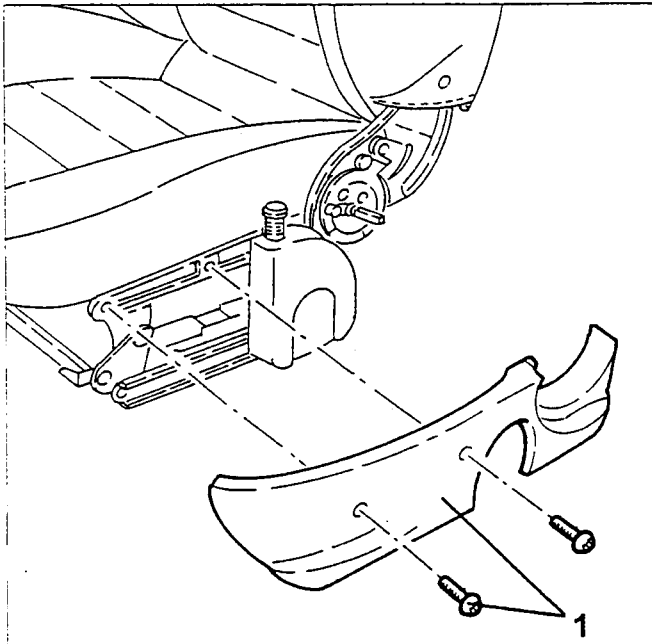
Undo the bolt and remove the hinge trim, complete with knob, releasing it from the fastening springs.



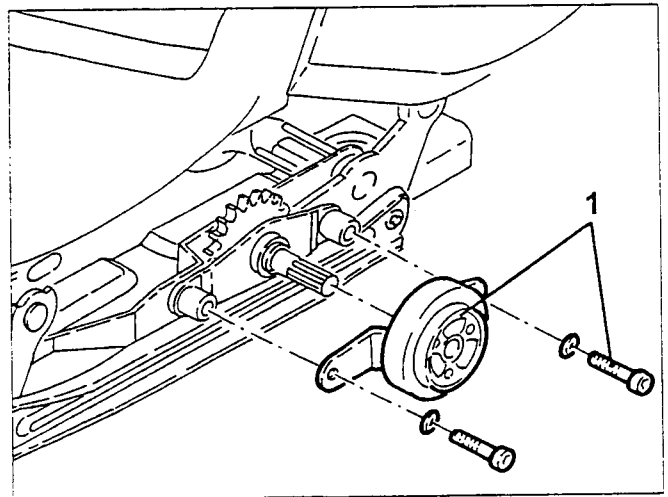
1. Remove the head of the rivets using a drill with a 4 mm bit and remove the lifting device.



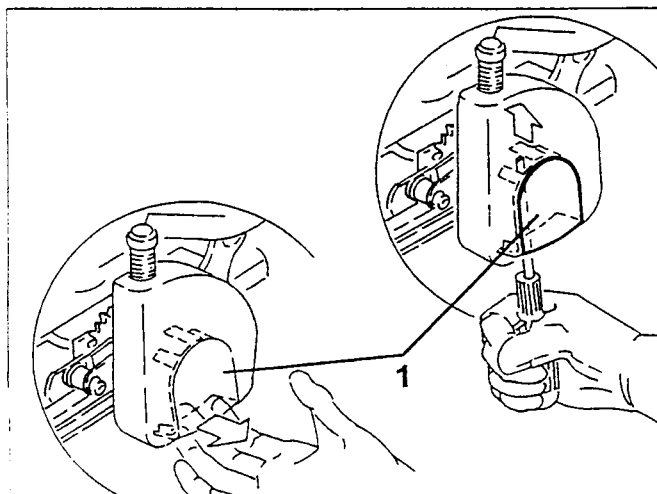
Undo the fixing bolts and remove the right hinge trim.



1. Undo the fixing bolts and remove the seat lifting clutch.

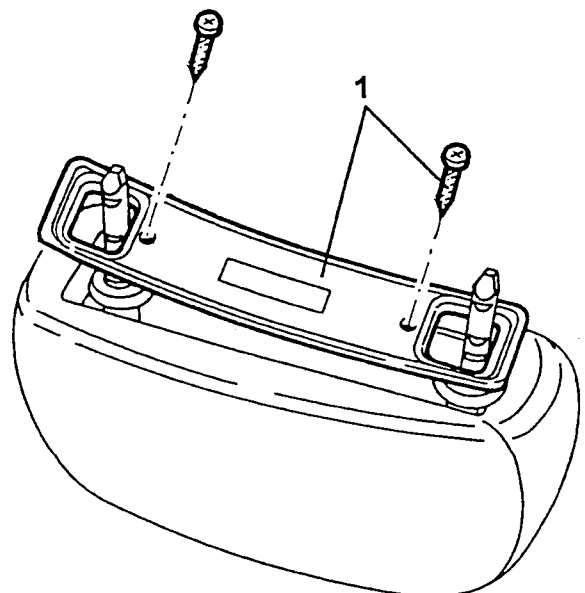


1. Remove the seat lifting lever trim, firstly detaching the lower part by hand and then using a screwdriver on the upper tab.



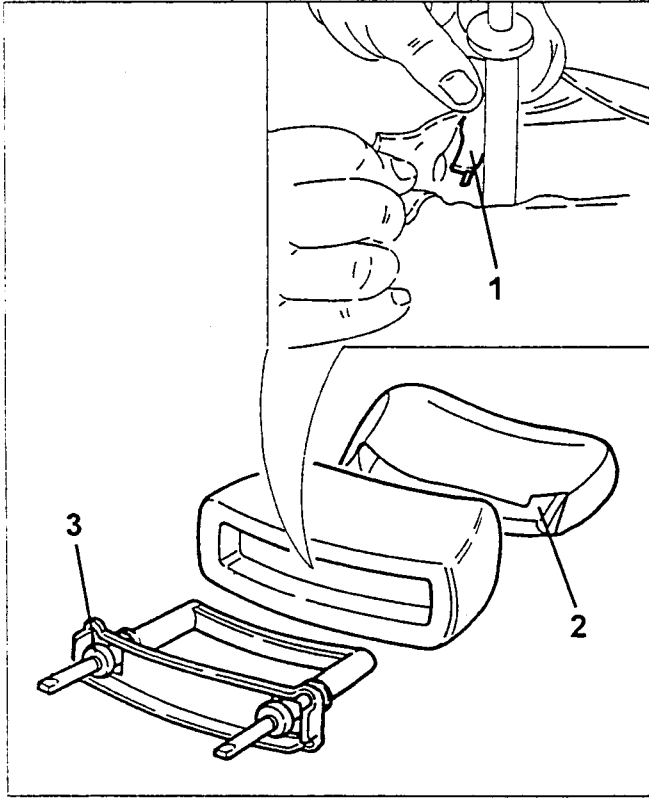
## DISMANTLING/REASSEMBLING HEAD RESTRAINT

1. Undo the bolts and remove the trim.

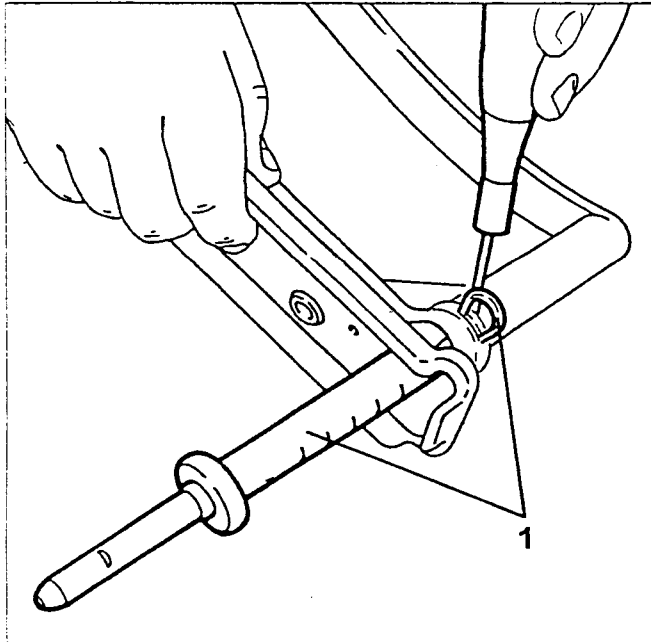




- Remove the metal points fixing the fabric to the structure.
- 1. Remove the ends of the strengthening wire from the upholstery.
- 2. Remove the fabric from the head restraint upholstery.
- 3. Remove the structure from the head restraint upholstery.



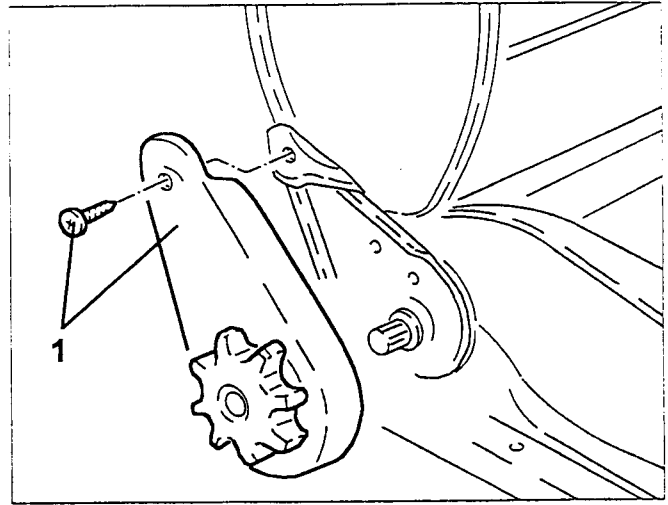
- 1. Remove the retaining springs and remove the pins from the structure.



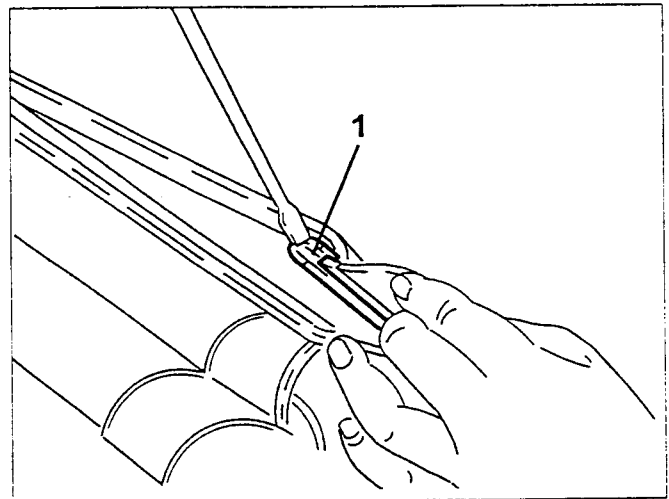
## REMOVING/REFITTING BACKREST FOLDING CABLE ON VEHICLE

- 1. Undo the fixing bolt and remove the hinge trim, complete with knob, releasing it from the fastening springs.

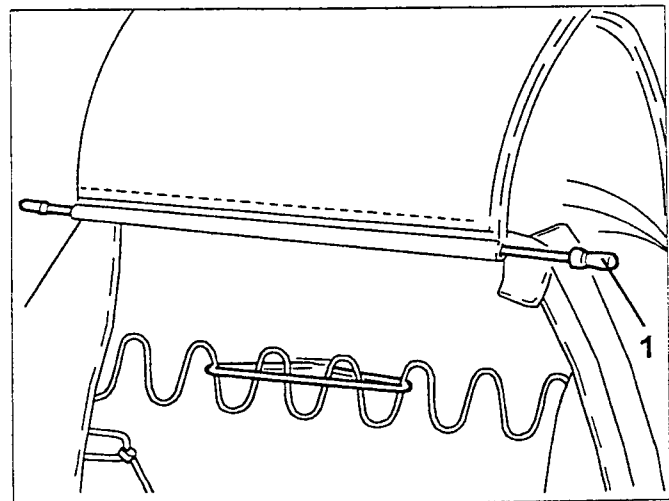
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- 1. Remove the two side profiles for the backrest rear fabric.

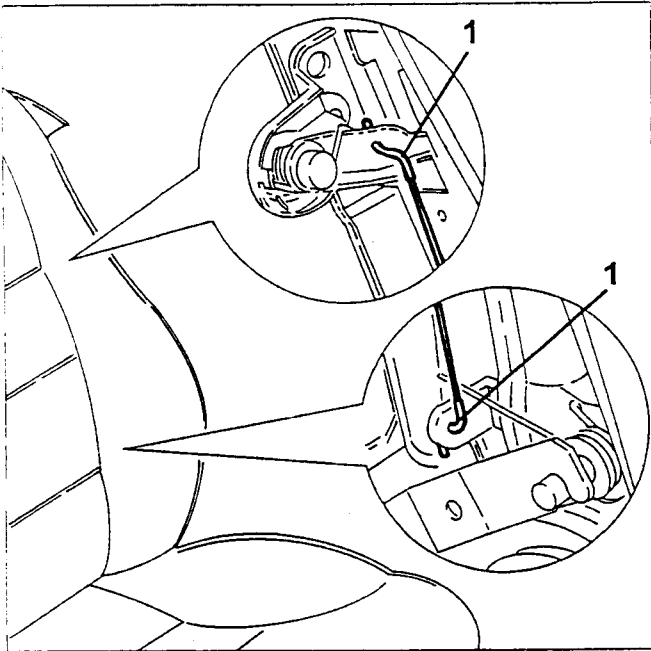


- 1. Remove the upper backrest cover retaining rod.



- Fold the backrest forwards.

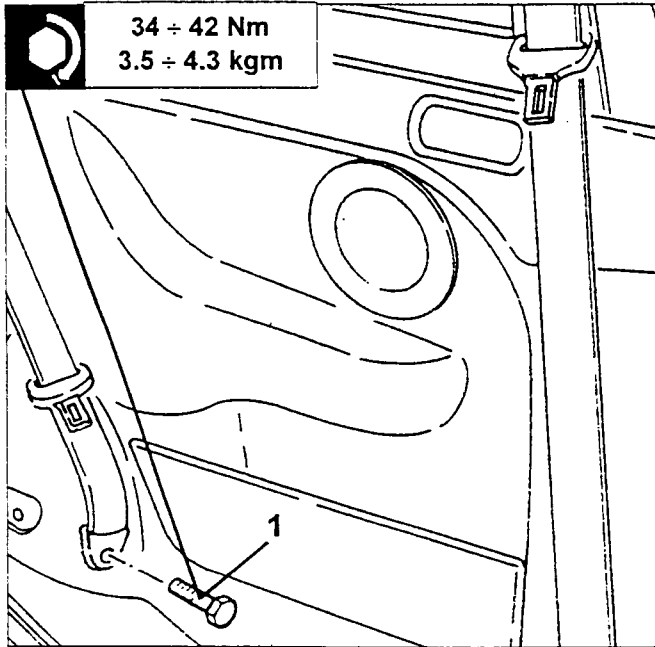
1. Release the two ends of the backrest folding cable and remove it.



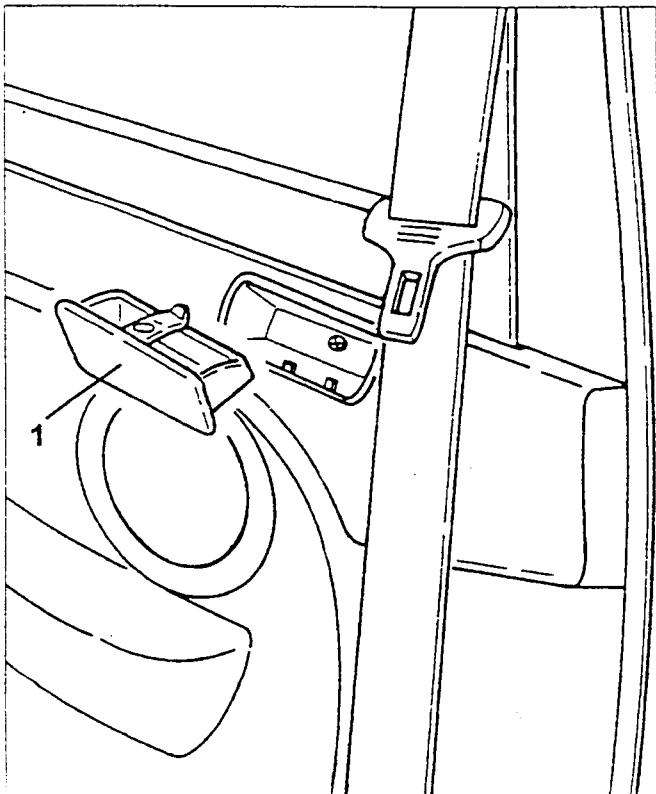
## SIDE PANELS

### REMOVING/REFITTING

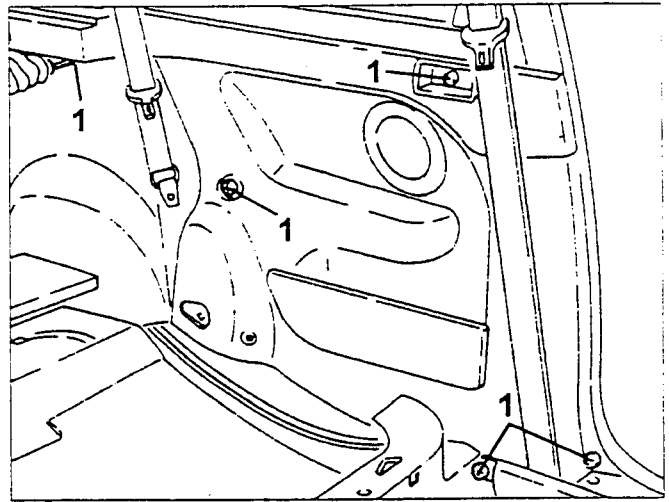
- Remove the rear seats (see specific paragraph).
- 1. Undo the bolt fixing the rear seat belt lower mounting.



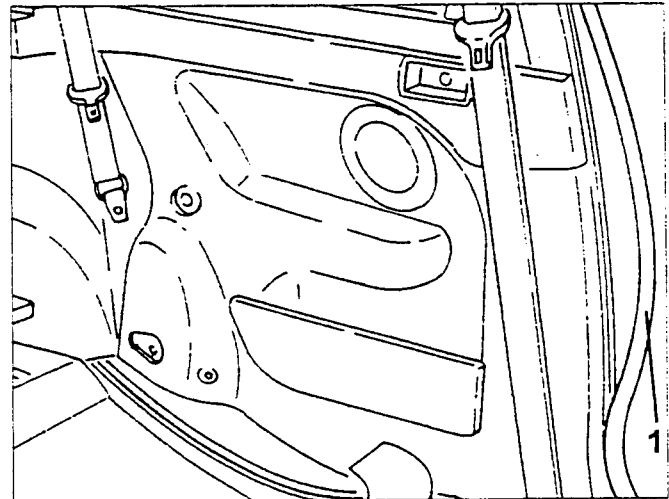
- 1. Release and remove the ashtray from the housing.



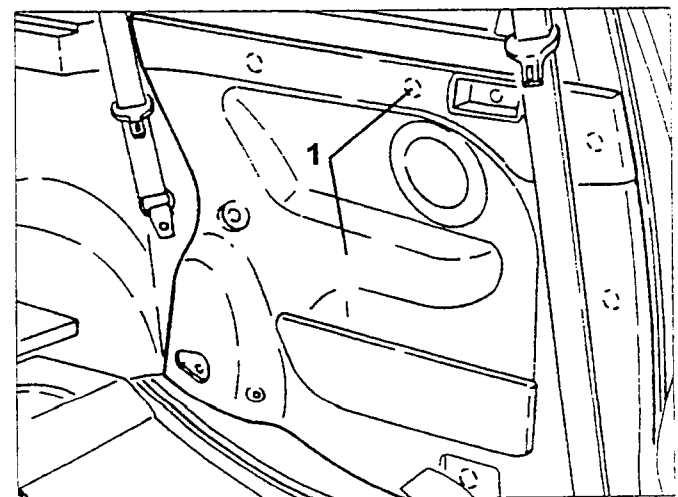
- 1. Undo the five bolts fixing the panel to the bodyshell.



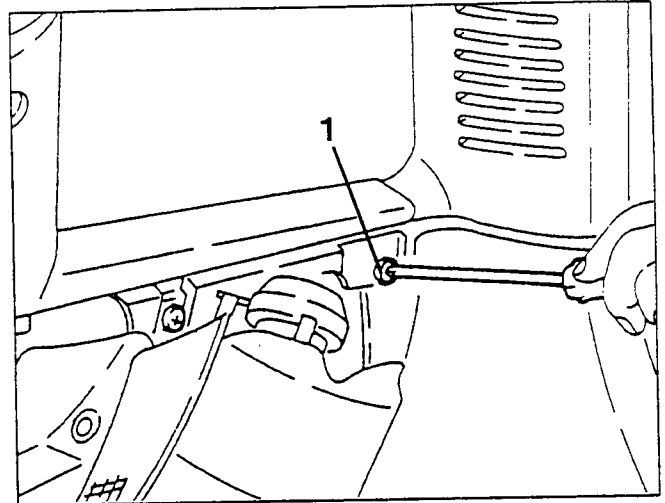
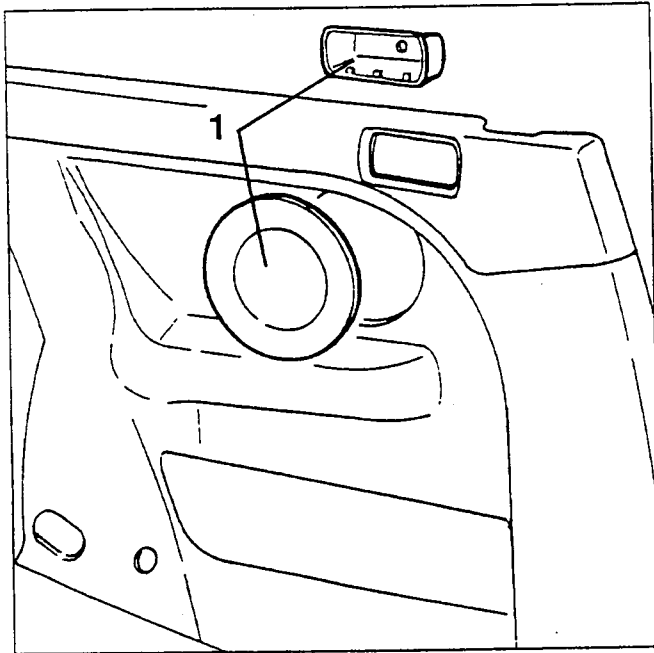
- 1. Remove the door trim, as necessary.



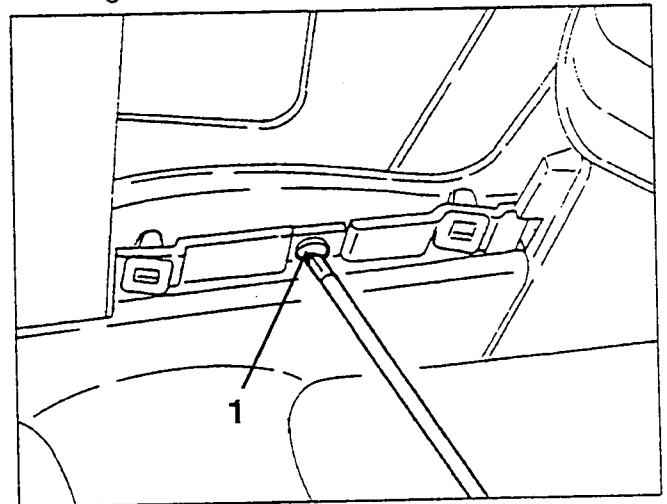
- 1. Remove the five plastic nails positioned as illustrated in the diagram and remove the side panel.



1. On the bench, if necessary, remove the ashtray support and speaker grille.



- Remove the rear roof lining (see specific paragraph).  
1. Slacken the upper screw fastening the window moulding.

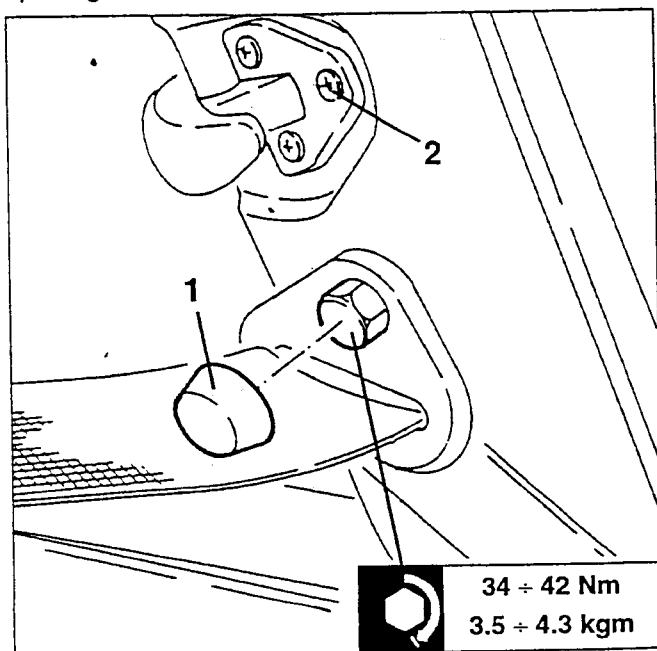


## WINDOW MOULDING

### REMOVING/REFITTING

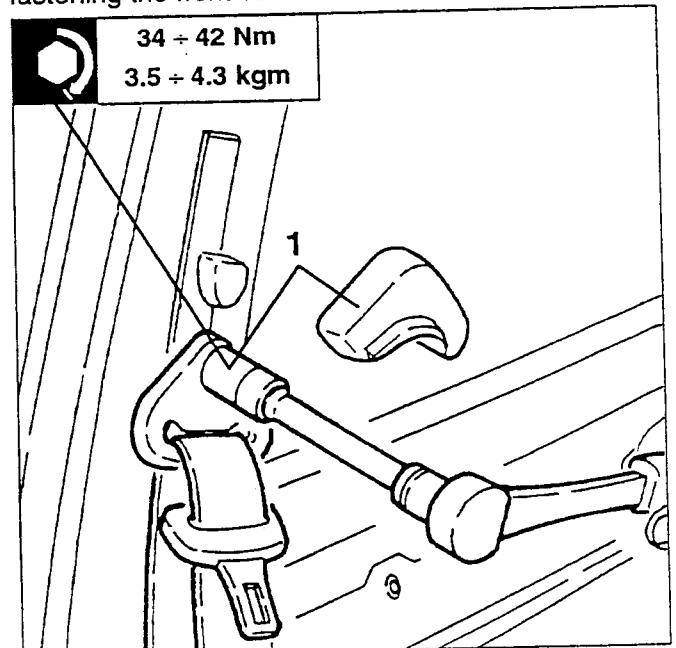
- Remove the parcel shelf side support (see specific paragraph).

1. Remove the cap and slacken the screw fastening the rear seat belt runner.
2. Slacken the three screws fastening the quarter light opening device.

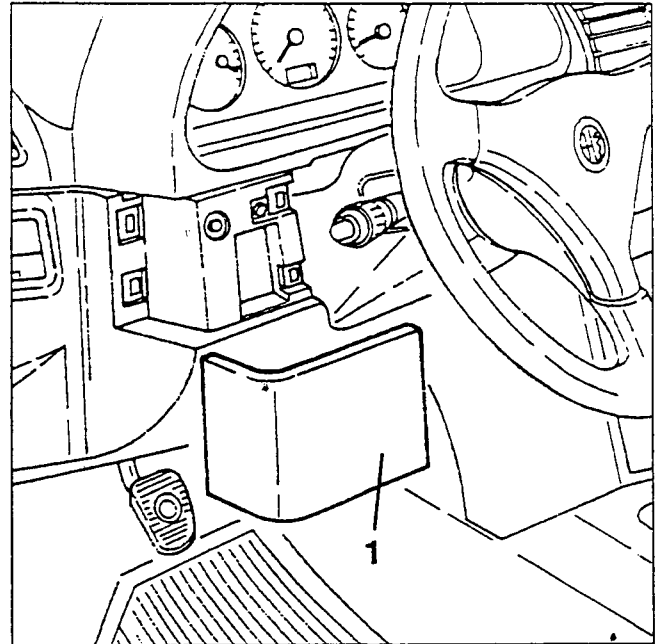
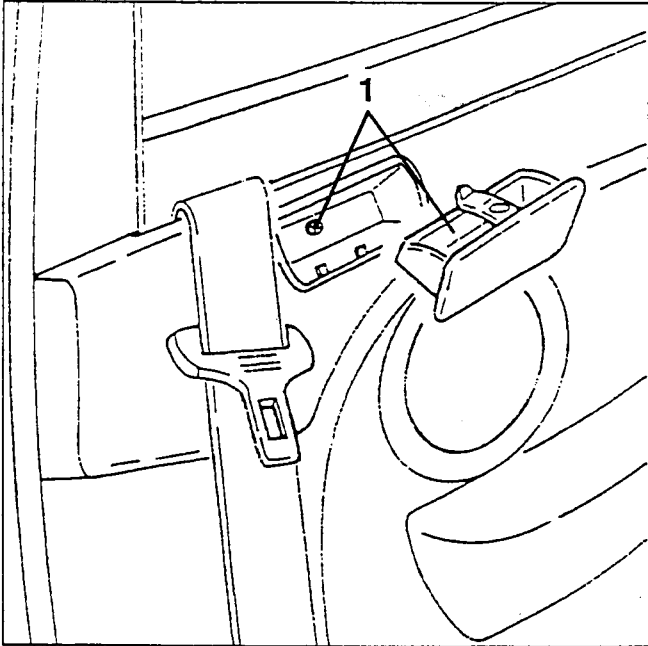


1. Slacken the three lower screws fastening the window moulding.

1. Remove the trim plate and slacken the screw fastening the front seat belt runner.

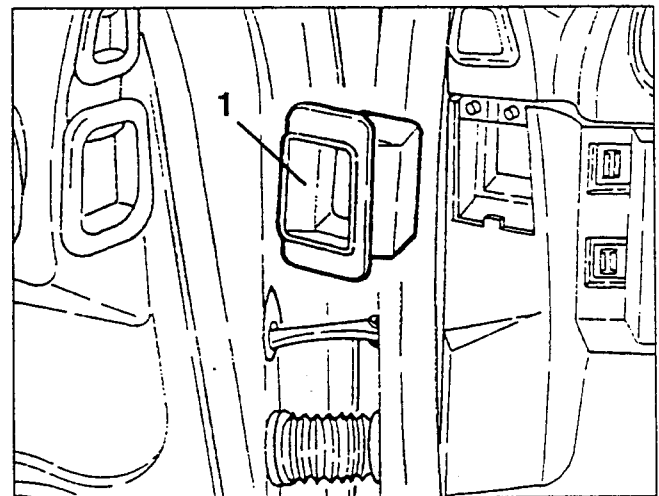
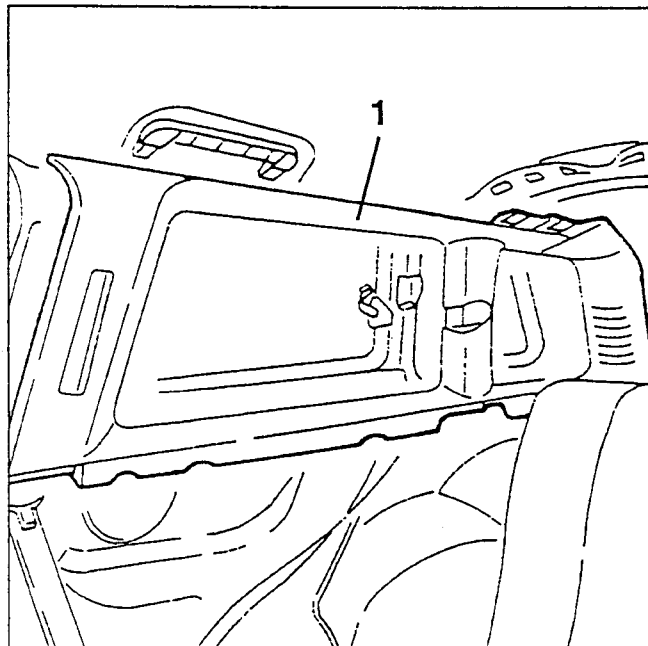


- Prise off the door surround moulding as necessary.  
 1. Prise and remove the ashtray from its housing, then slacken the screw below fastening the window moulding.

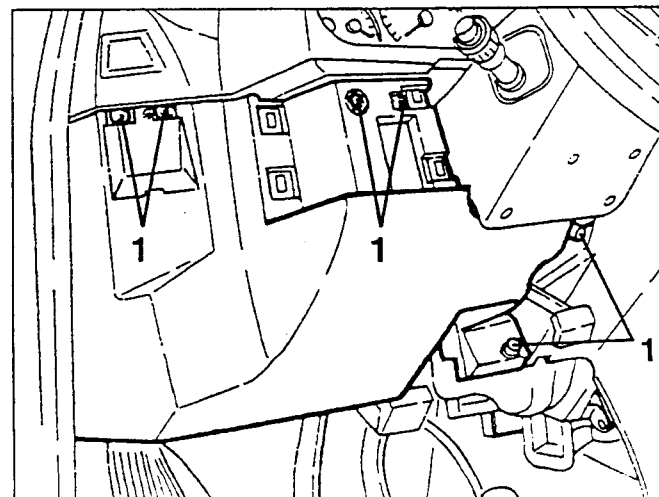


1. Remove the driver's air vent from the dashboard.

1. Prise the upper part of the side panel, then remove the window moulding prising it off the plastic rivets.



1. Slacken the six fastening screws and remove the fusebox trim.

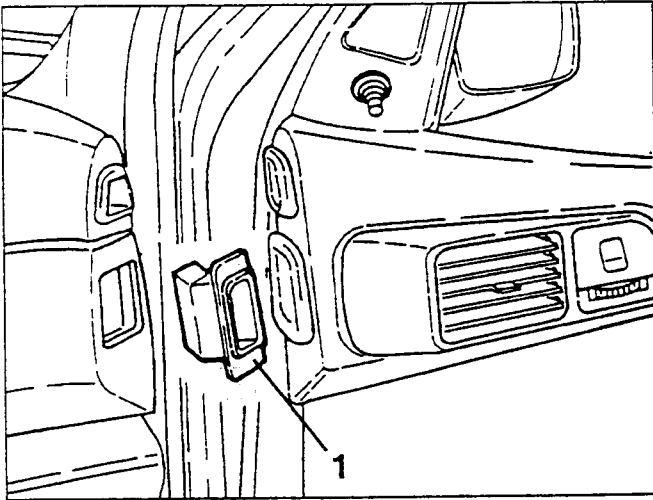


## DASHBOARD

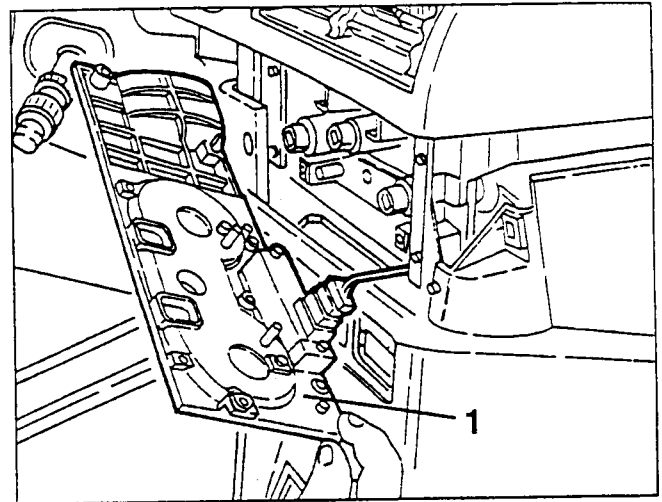
### REMOVING/REFITTING

- Disconnect the battery (-) terminal.  
 - Remove the centre console (see specific paragraph).  
 1. Prise and remove the left-hand side dashboard trim.

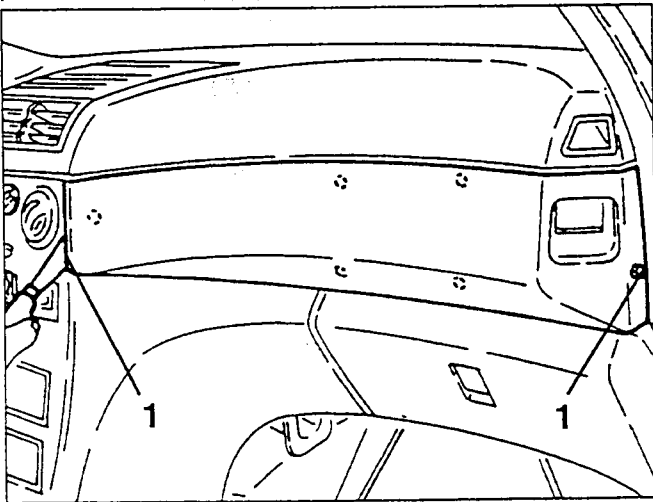
1. Remove the passenger air vent from the dashboard.



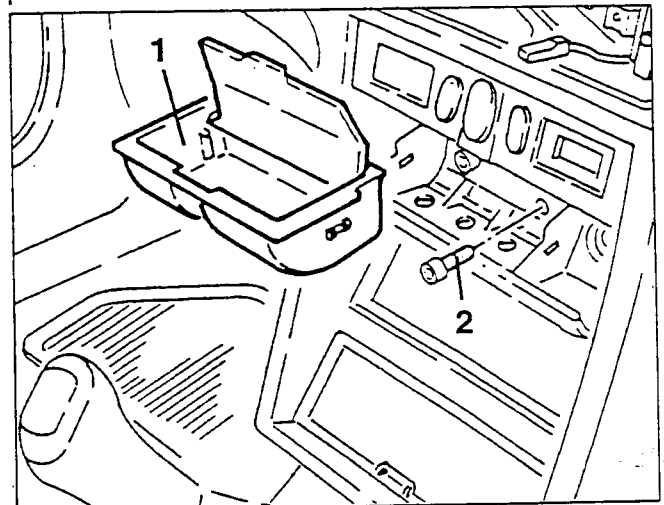
1. Prise the climate control system controls trim from the plastic rivet, then remove it after disconnecting the electrical connection for recirculation control.



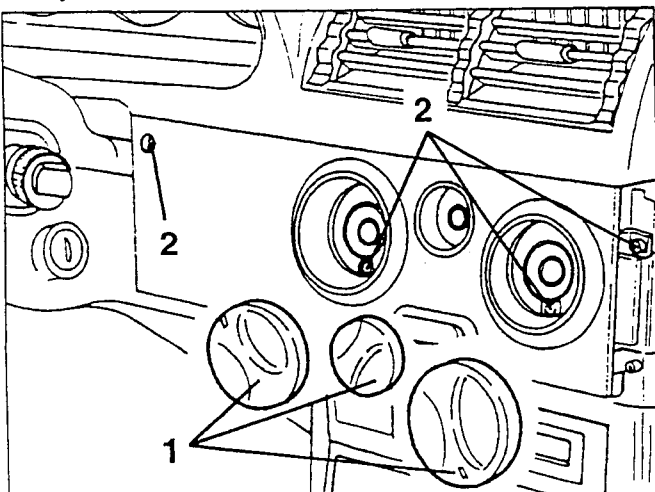
1. Slacken the fastening screw then remove the right hand dashboard trim prising it off the plastic rivets positioned as illustrated.



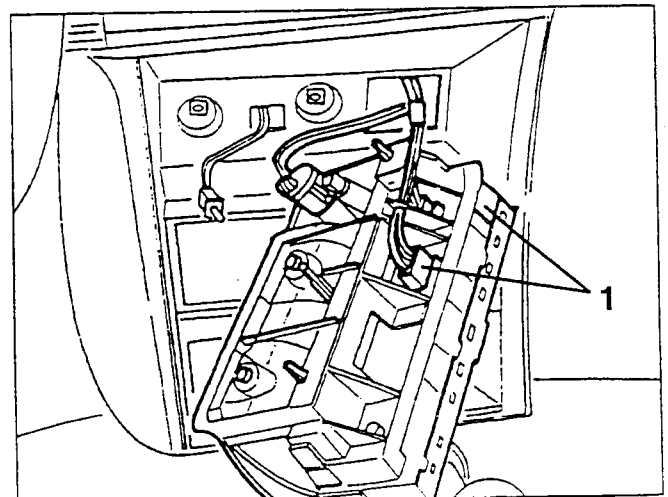
1. Remove the ashtray.  
2. Slacken the two screws fastening the ashtray support.



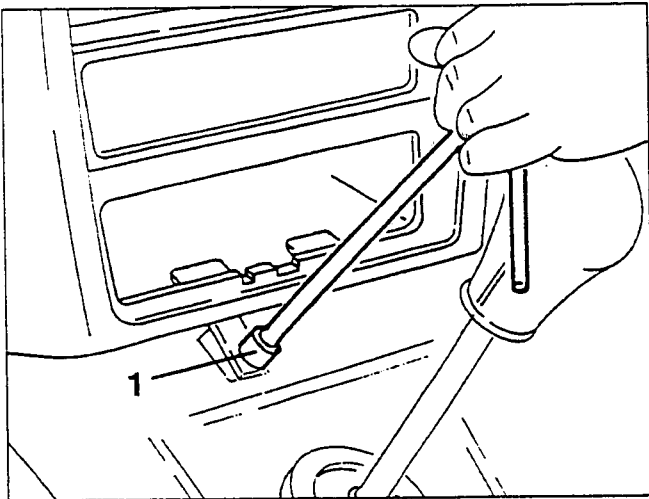
1. Prise and remove the climate control knobs.  
2. Slacken the four screws fastening the climate control system controls.



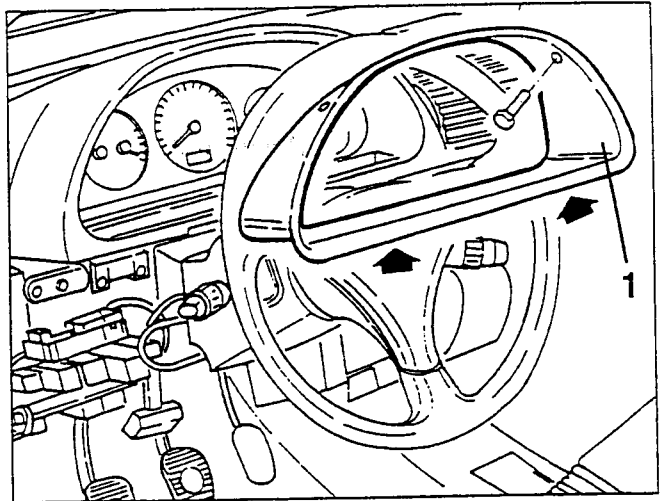
1. Remove the ashtray support complete with the services control unit and remove it after disconnecting the electrical connections.



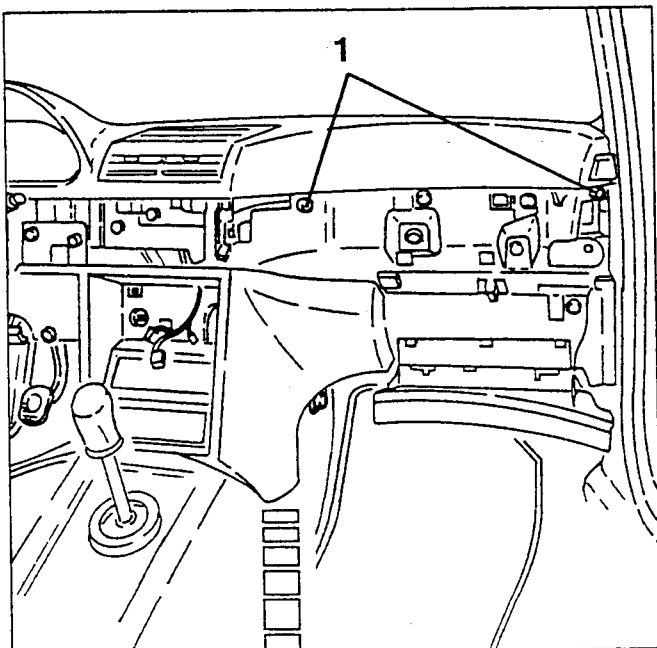
1. Slacken the lower screw fastening the centre console.



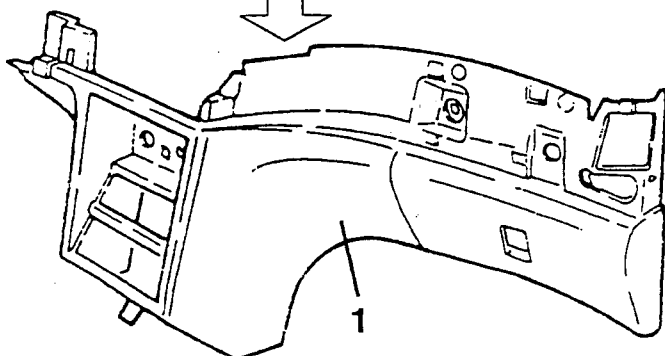
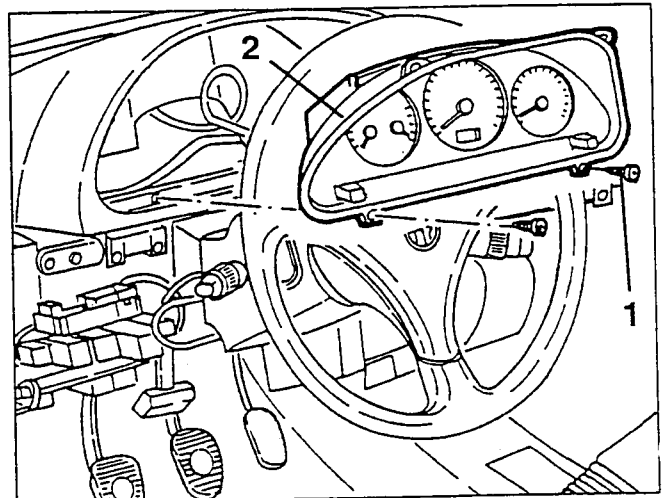
1. Slacken the two fastening screws and remove the plate prising in the points shown by the arrows.



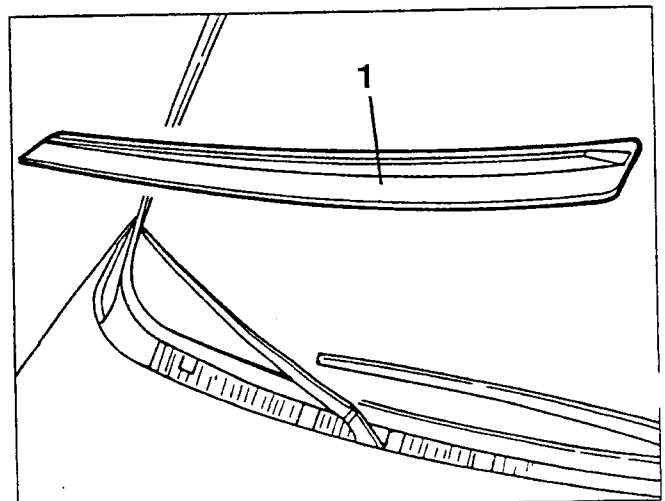
1. Slacken the screws fastening the lower part of the dashboard and remove it.



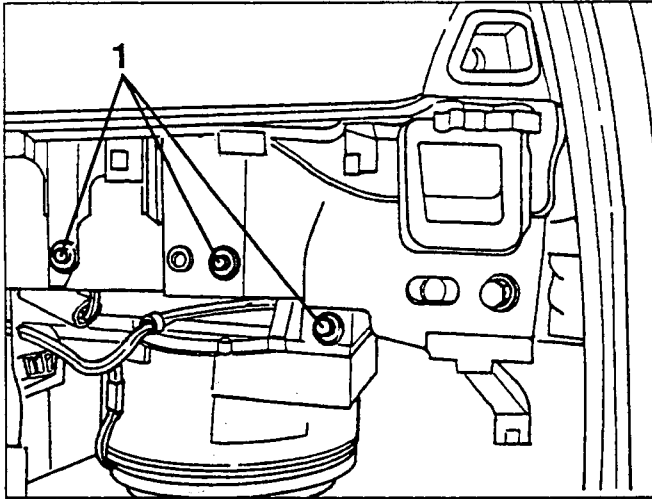
1. Slacken the four screws fastening the instrument cluster.  
2. Disconnect the two side electrical connections and remove the instrument cluster.



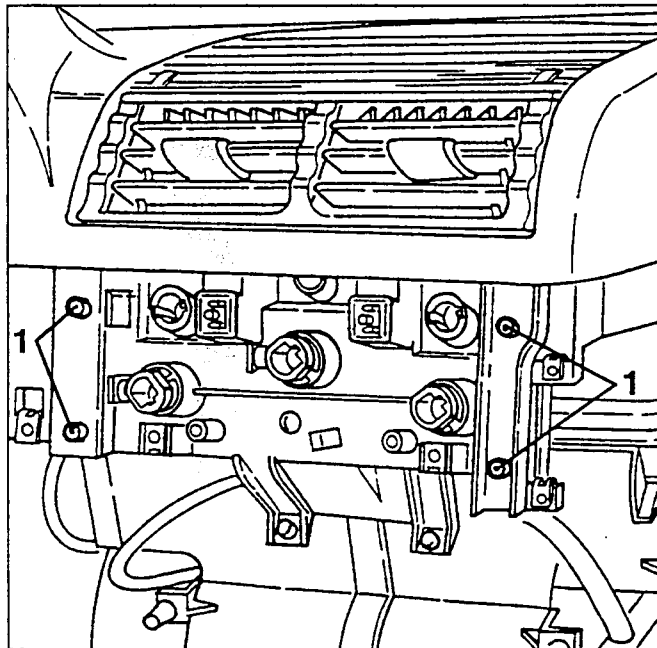
1. Prise and remove the windscreen air grille.



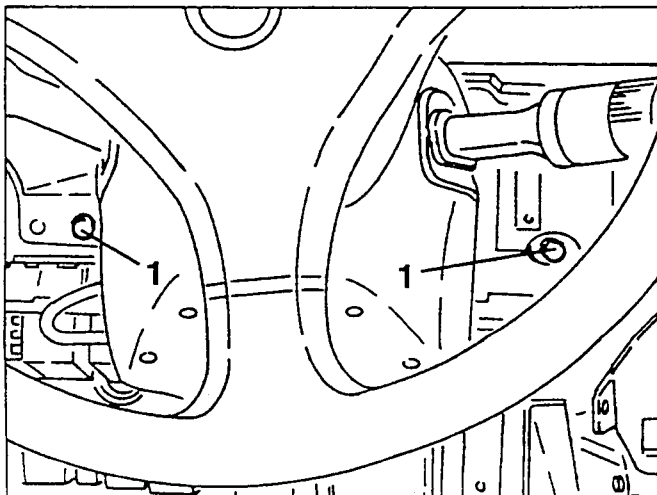
1. Loosen the screws on the passenger side securing the dashboard.



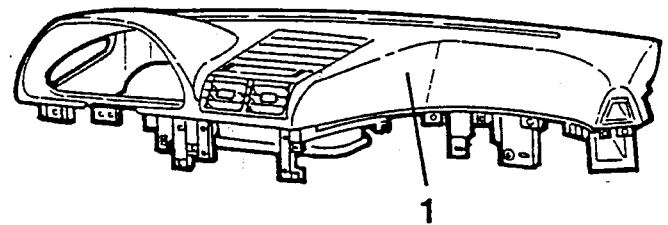
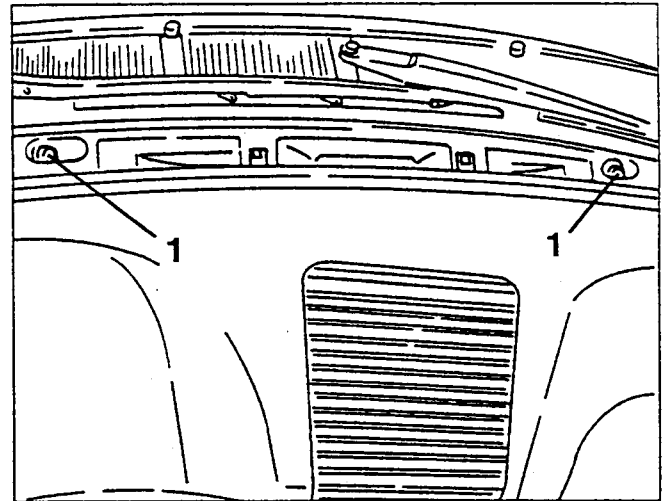
1. Loosen the four central screws securing the heating-ventilation controls.



1. Loosen the two screws on the driver's side securing the dashboard.



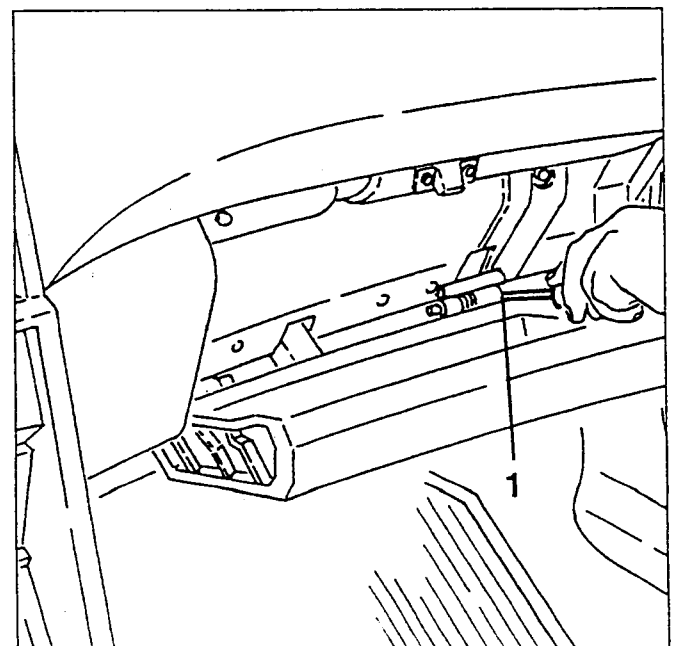
1. Loosen the two screws securing the dashboard shown in the diagram and remove the upper part of the dashboard.



## GLOVE COMPARTMENT

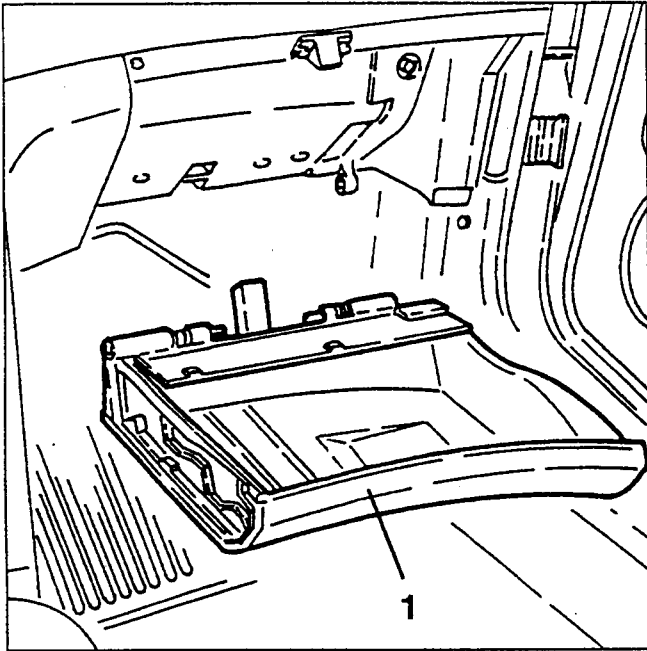
### REMOVAL/REFITTING

1. Open the glove compartment and holding the spring flap downwards use a screwdriver as a lever to free it from the attachments.



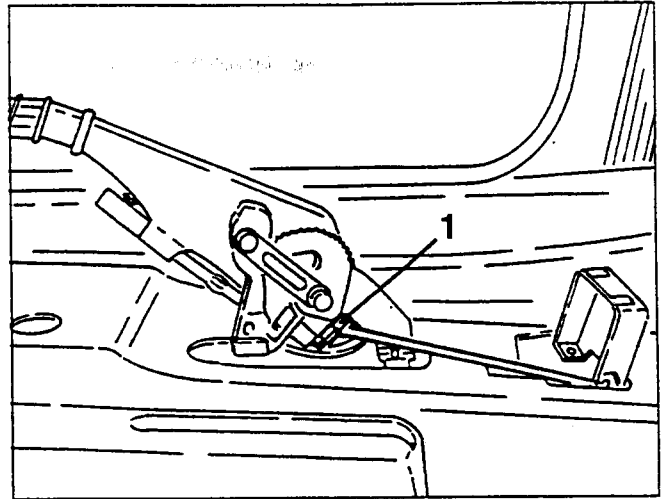


1. Remove the glove compartment.



- Remove the gear lever cover and the central console (see specific paragraphs).

1. Disconnect the electrical connections from the handbrake switch.



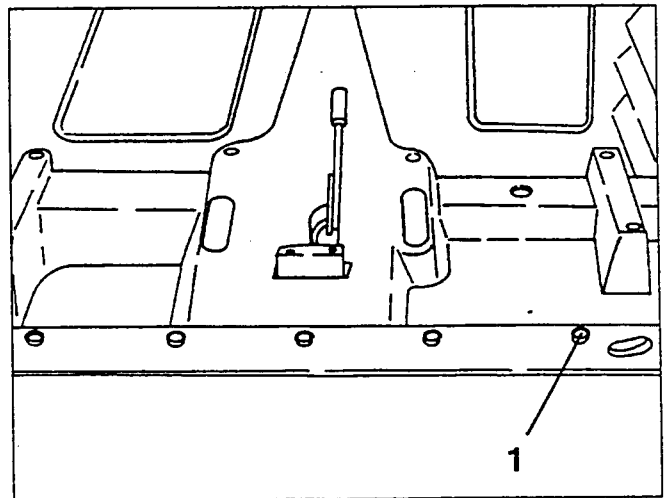
1. Pull off the five plastic nails securing the rear floor trim.

## FLOOR TRIM

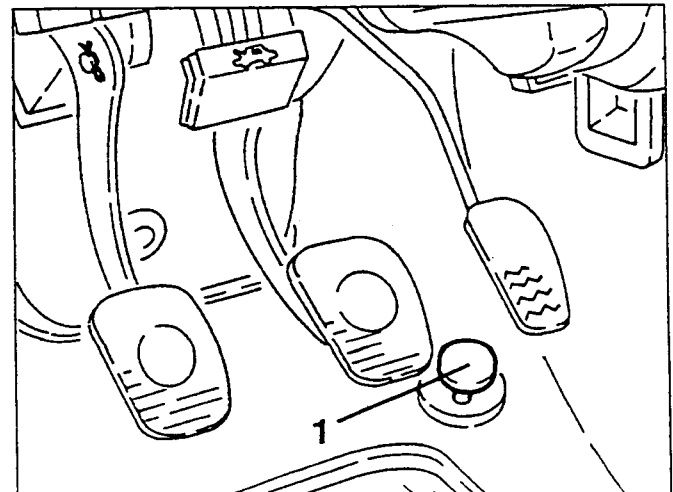
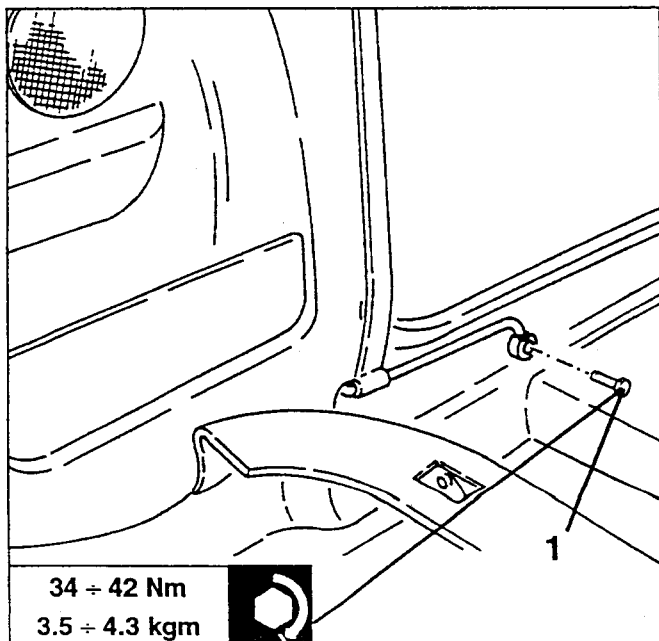
### REMOVAL/REFITTING

- Remove the front seats (see specific paragraph).
- Remove the rear seat cushion (see specific paragraph).
- Remove the heel pads (see specific paragraph).
- Remove the lower part of the dashboard (see specific paragraph).

1. Loosen the front screws securing the front seat belt sliding attachments.

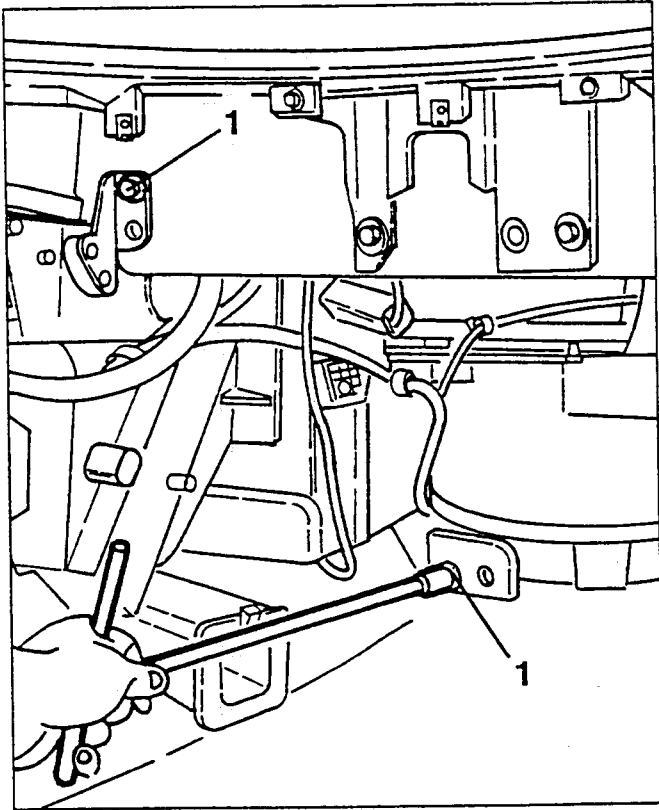


1. Unscrew and remove the accelerator pedal stop limit.

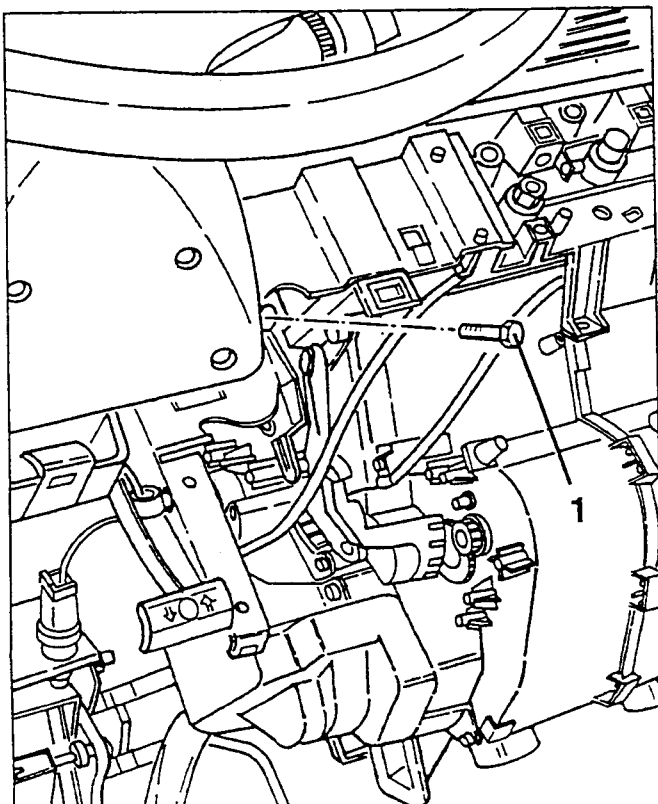


- For vehicles with air conditioning remove the vents delivering air to the floor of the rear part of the passenger compartment (see specific paragraph).

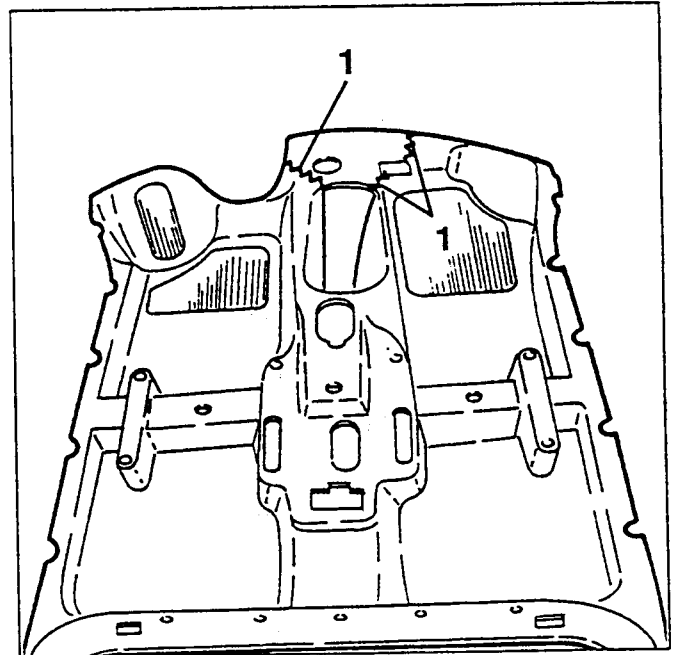
1. Loosen of the four screws securing the heating-ventilation group right side.



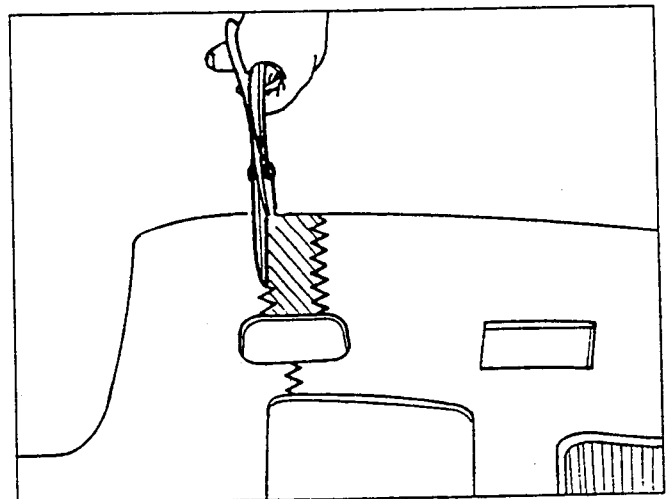
1. Loosen the screw securing the heating-ventilation group left side.



1. Cut the front part of the floor trim as shown in the diagram and then remove it together with the cut part from behind the heating-ventilation group.



Cut the new floor trim as shown in the diagram and fit it on behind the heating-ventilation group and then refit by reversing the procedure followed for removal.

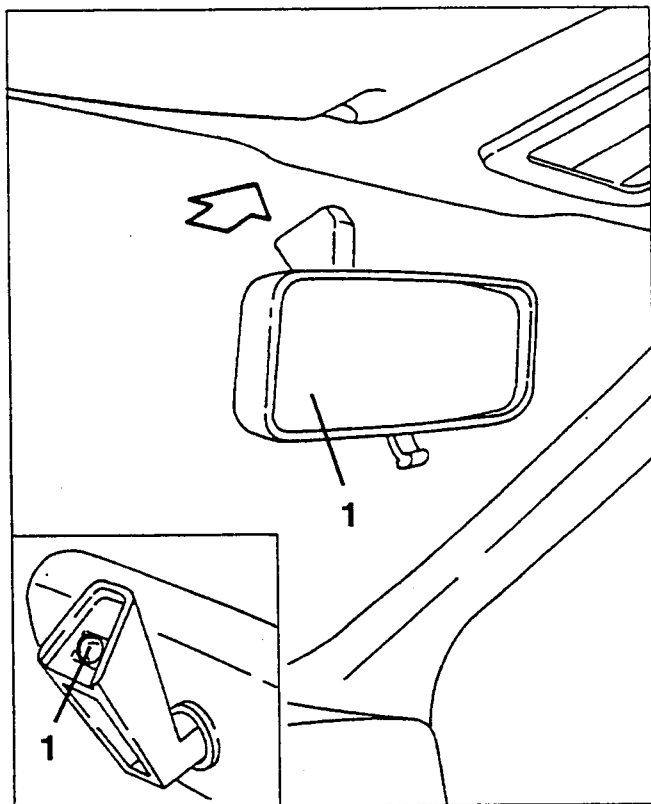
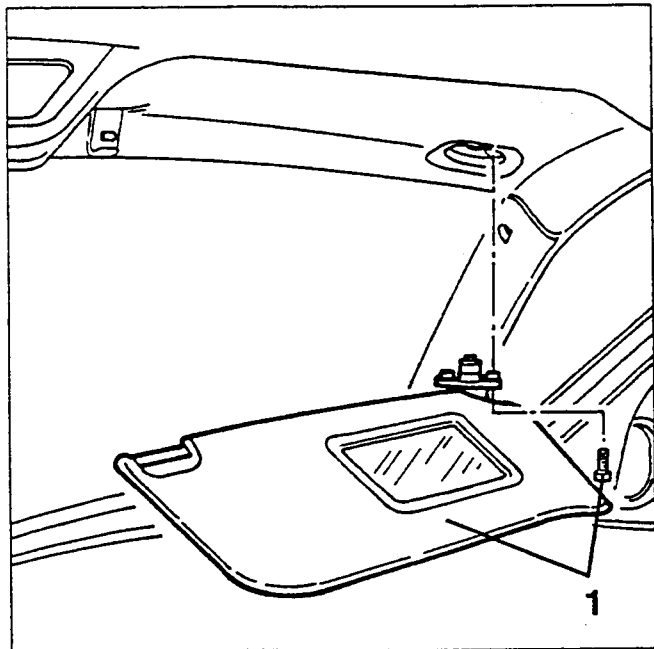


## SUN VISORS

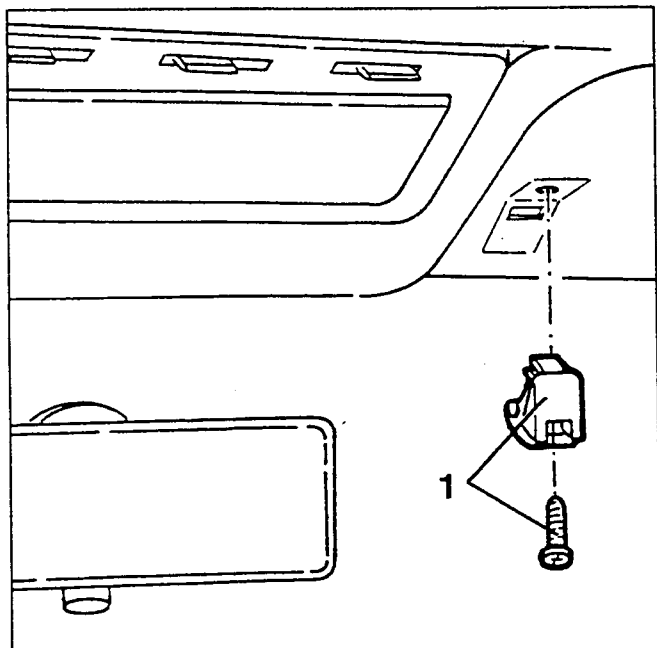
### REMOVAL/REFITTING

- Tip the sun visor down to gain access to the relative screws.

1. Loosen the two screws and remove the sun visor.



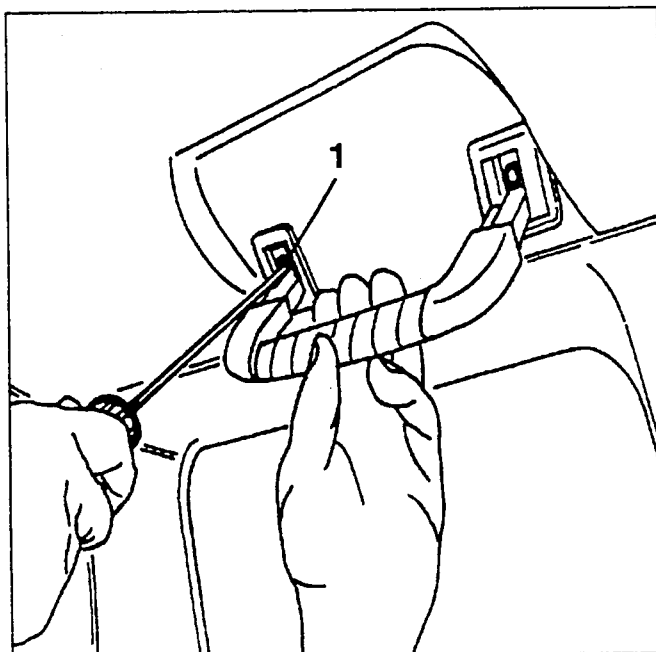
1. Pull off the cover, loosen the screw and remove the sun visor support.



## PASSENGER GRAB HANDLES

### REMOVAL/REFITTING

1. Lower the passenger grab handle, loosen the two screws and remove it.



## REAR-VIEW MIRROR

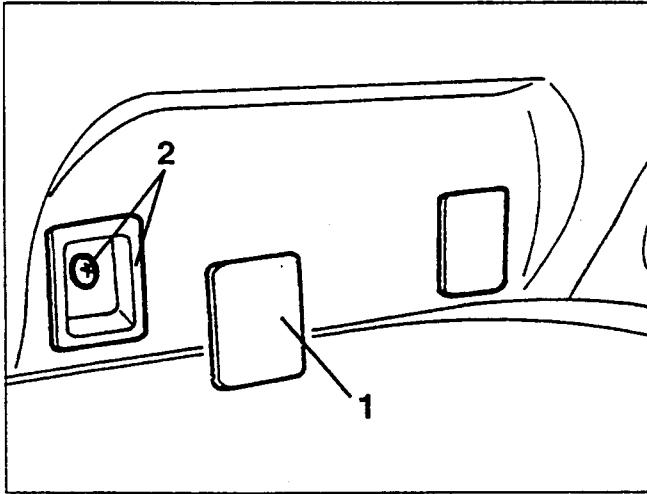
### REMOVAL/REFITTING

1. Remove the rear-view mirror by pushing it upwards overcoming the force exerted by the locking ball.

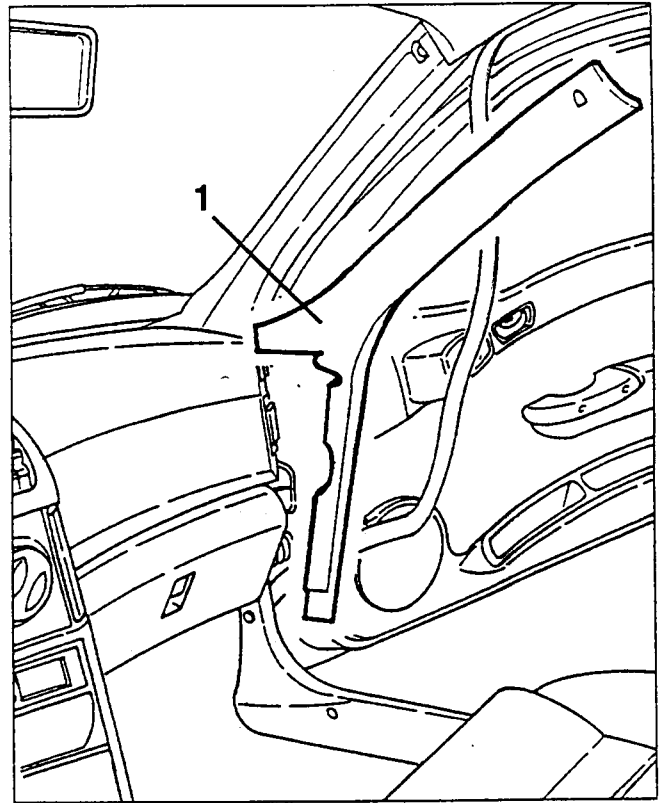
## CAPS ON DRIVER'S SIDE

### REMOVAL/REFITTING

1. Pull off the protective cap.
2. Loosen the screw and remove the cap for the handle on the driver's side.



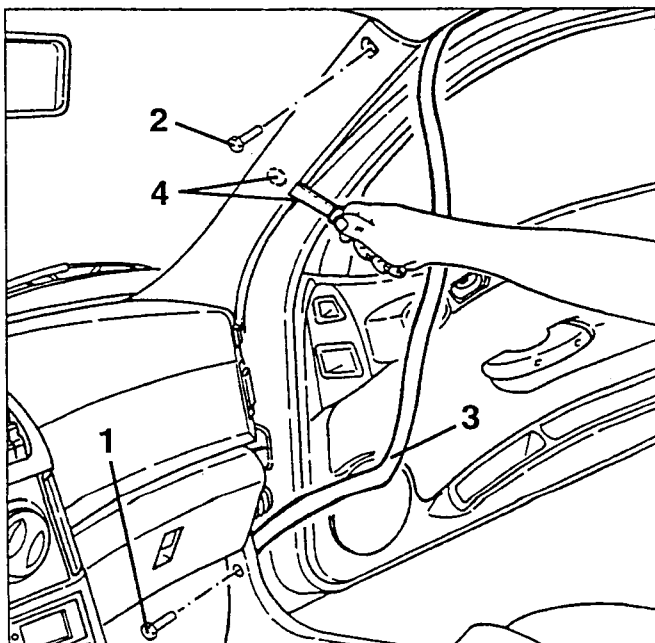
1. Remove the trim from the front pillar.



## TRIM ON FRONT PILLARS

### REMOVAL/REFITTING

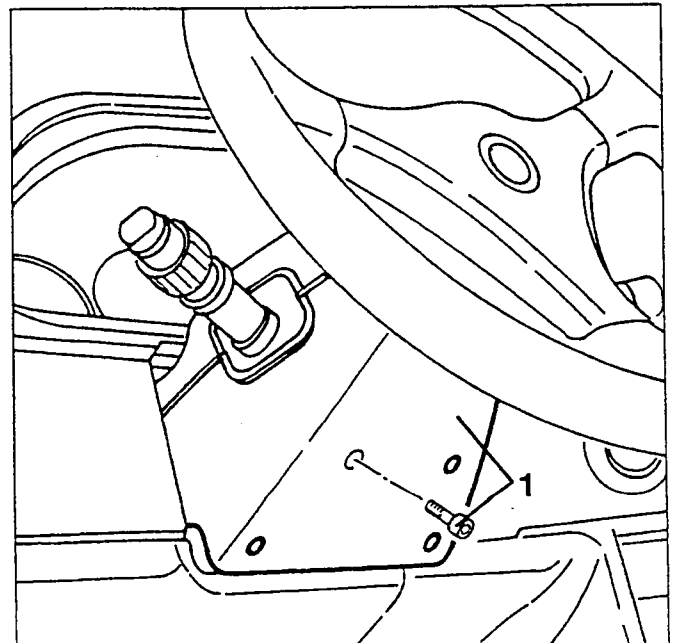
1. Loosen the screw securing the heel rest as shown in the diagram.
2. Loosen the screw securing the trim to the front pillar.
3. Pull the door seal from its seating as required.
4. Pull the on the front pillar away from the plastic nail.



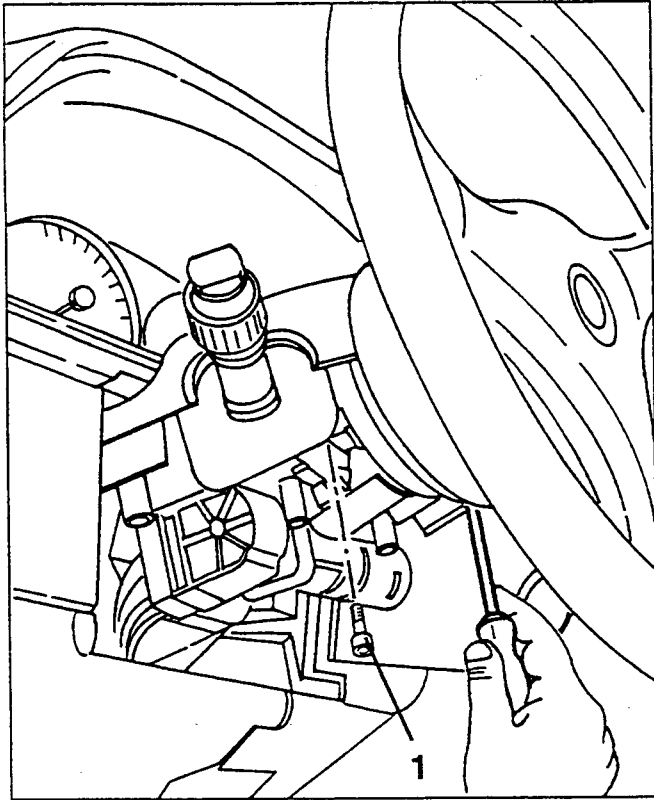
## STEERING COLUMN CASING HALF

### REMOVAL/REFITTING

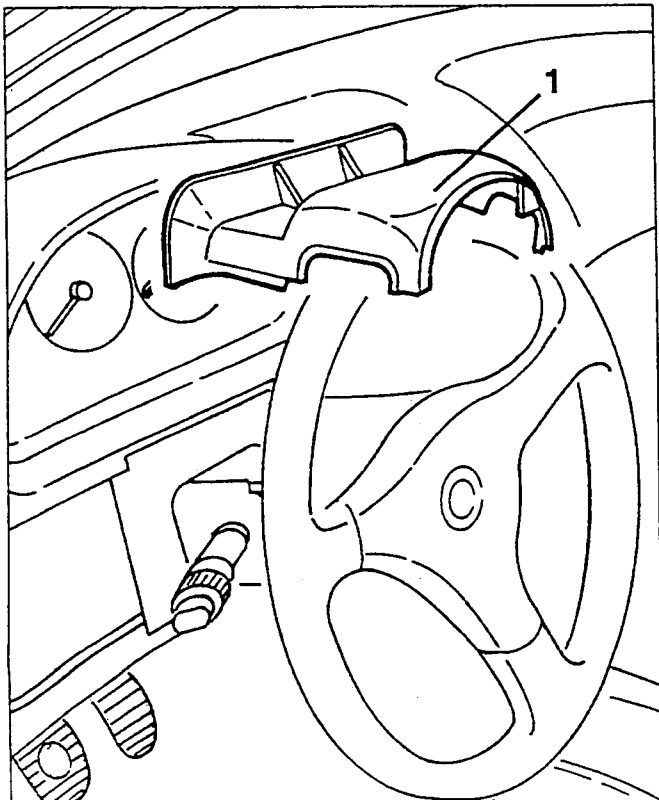
1. Loosen the four screws and remove the steering column lower casing half.



1. Loosen the two screws securing the steering column upper casing half.



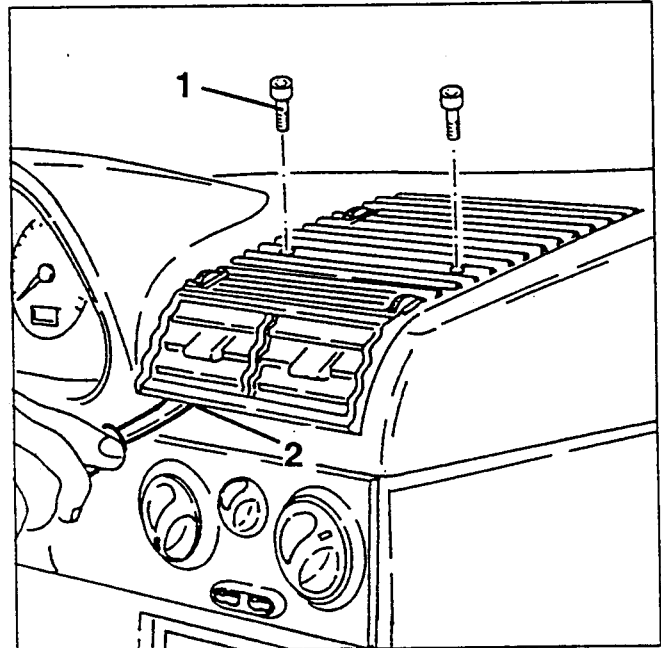
1. Remove the steering columns upper casing half.



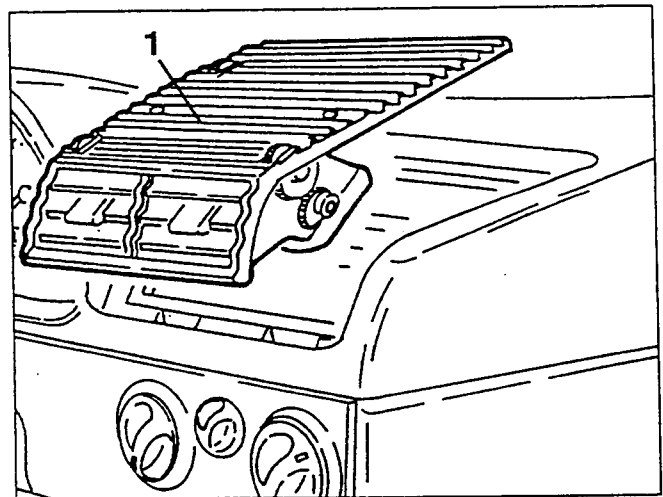
## AIR VENT ON DASHBOARD

### REMOVAL/REFITTING

1. Loosen the two screws securing the air vent to the dashboard.  
2. Pull the air vent from the dashboard as shown in the diagram.



1. Remove the air vent from the dashboard.

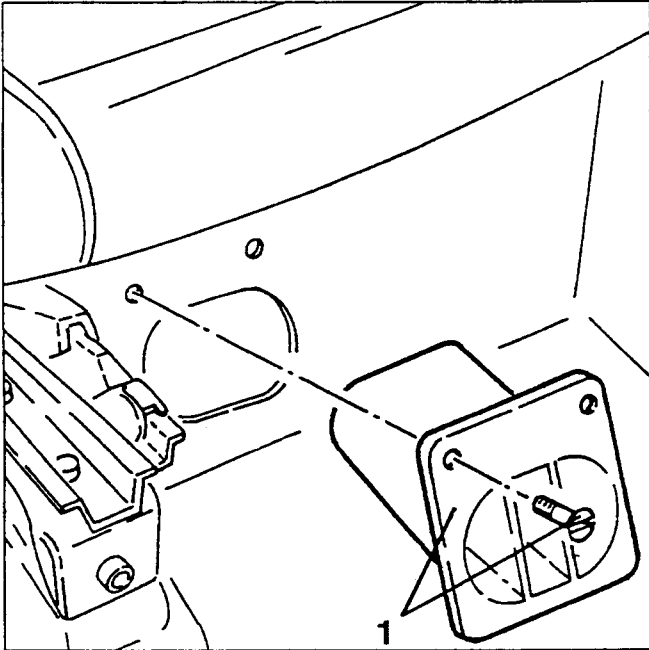


## REAR FLOOR AIR VENTS

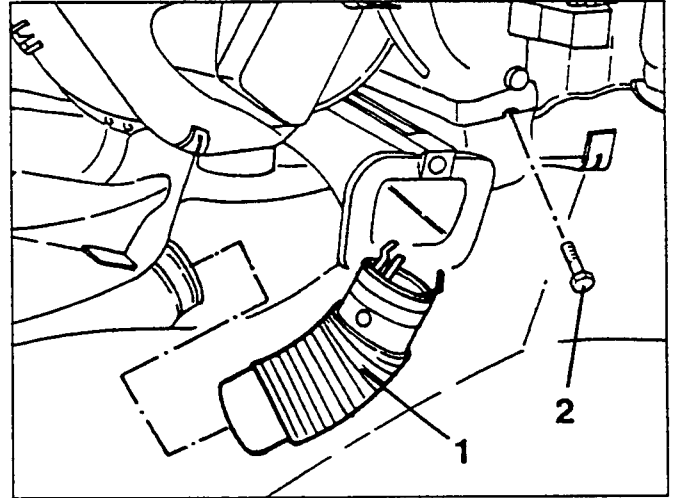
### REMOVAL/REFITTING

- Slide the front seat forwards on the relative side.

1. Loosen the two screws securing the air vent and remove it.



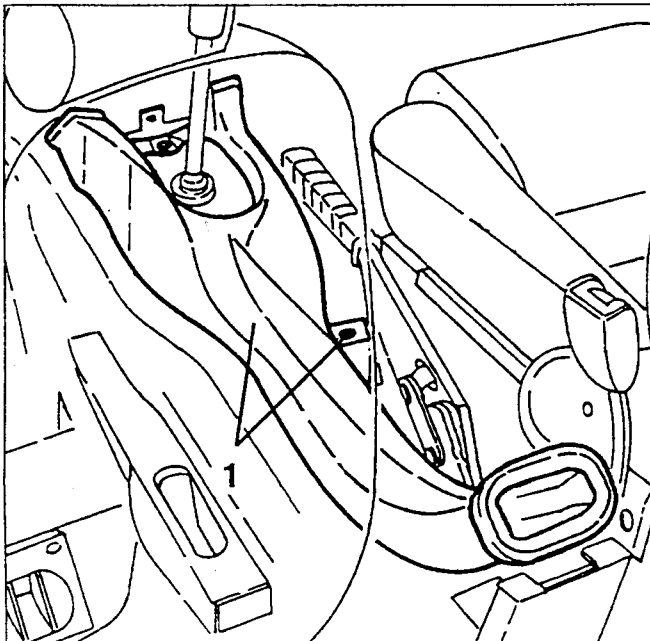
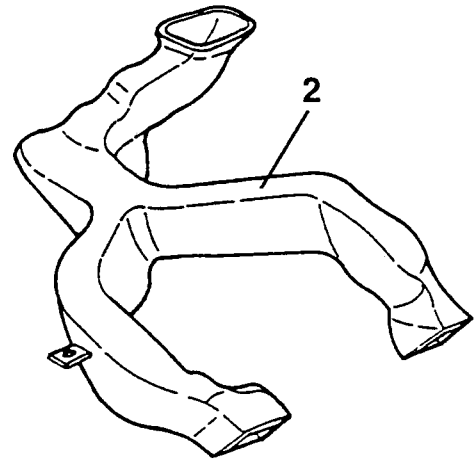
1. Remove the right air delivery elbow to the rear passenger feet from the climate control unit.  
2. Slacken the fastening screw and remove the front section of the air delivery duct to rear passenger face level.



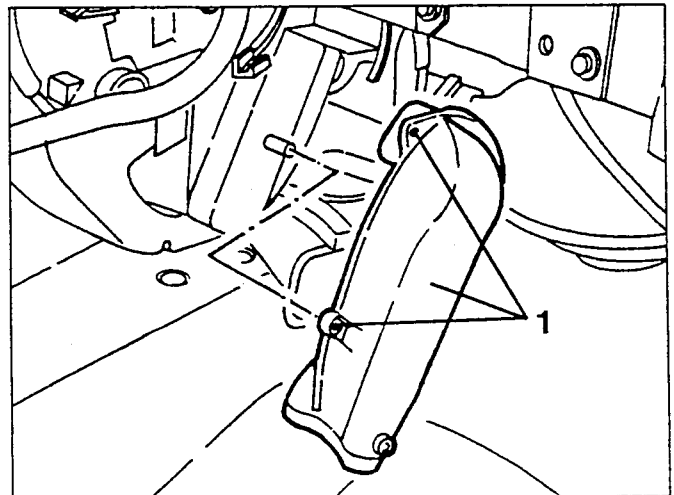
## AIR DELIVERY DUCTS

### REMOVAL/REFITTING

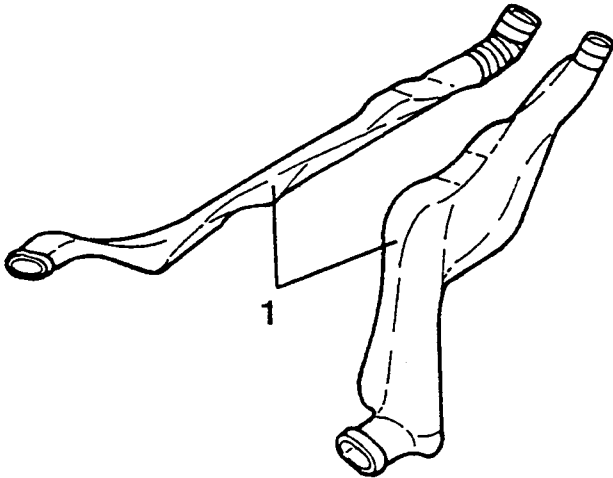
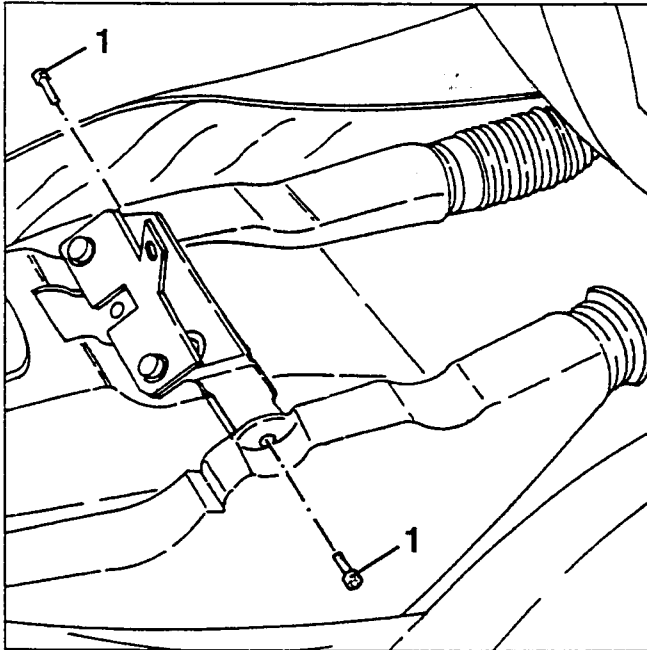
- Remove the centre console (see specific paragraph).
  - Remove the lower dashboard (see specific paragraph).
1. Slacken the fastening screws and remove the air delivery duct to rear passenger face level.



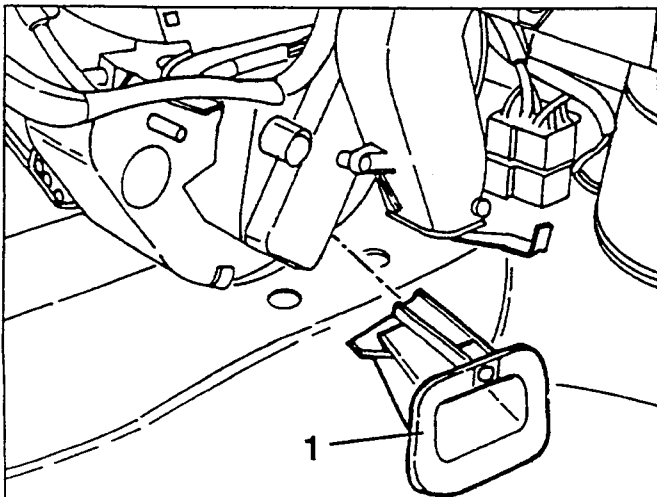
1. Slacken the remaining fastening screw and remove the air delivery duct to rear passenger face level from the climate control unit.



1. Slacken the screw at each side and remove the two air delivery ducts to the rear passenger feet area.



1. Slacken the fastening screws and remove the air flow vents driver and front passenger feet area.

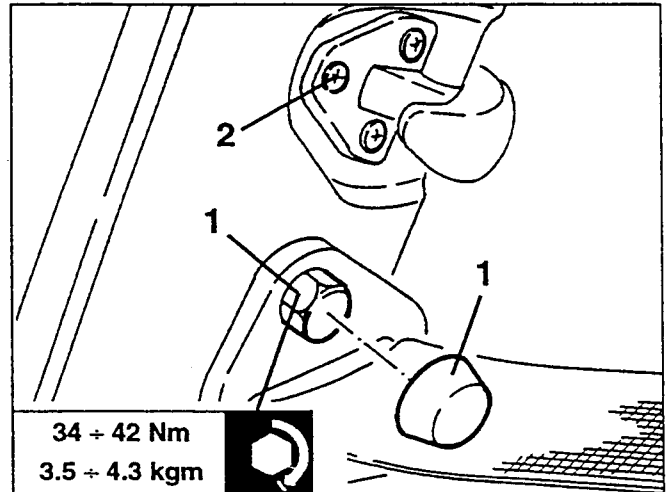


## ROOF PANEL (FOR VERSIONS WITH SUNROOF)

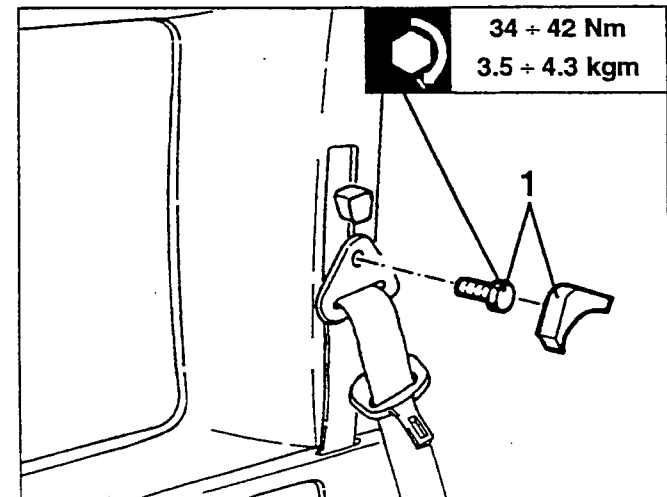
### REMOVAL/REFITTING

- Disconnect the negative cable from the battery.
- Remove the passenger grab handles and the caps on the driver's side (see specific paragraphs).
- Remove the rear trim from the roof panel (see specific paragraph).
- Remove the sun visors (see specific paragraph).
- Remove the front roof light (see GROUP 55).
- Remove the trim from the front pillars (see specific paragraph).

1. Pull off the covers and unscrew the screws securing the rear seat belt runners.
2. Loosen the screws securing the quarterlight opening catches on the rear windows.

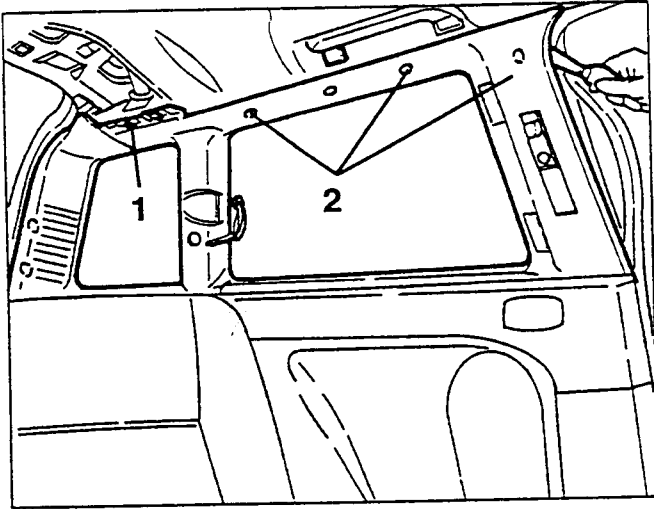


1. Remove the trim and loosen the screws securing the front seat belt runners.

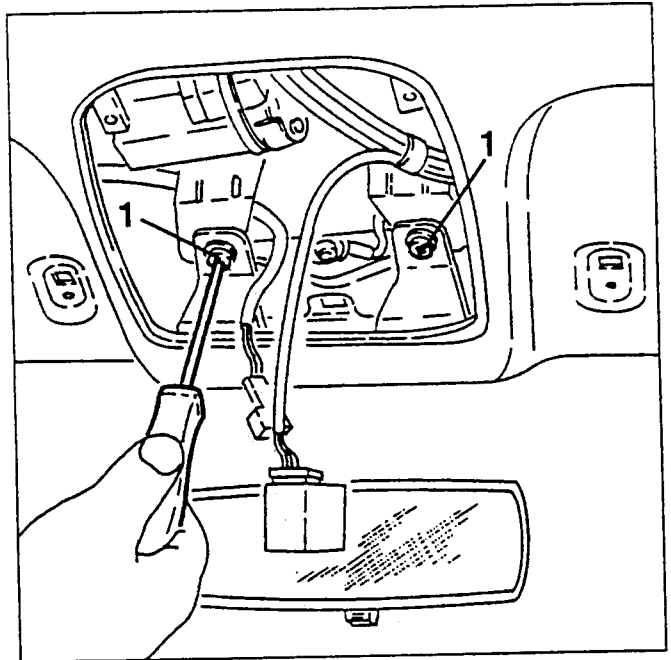


- Pull the door and boot seals away from their seatings as required.

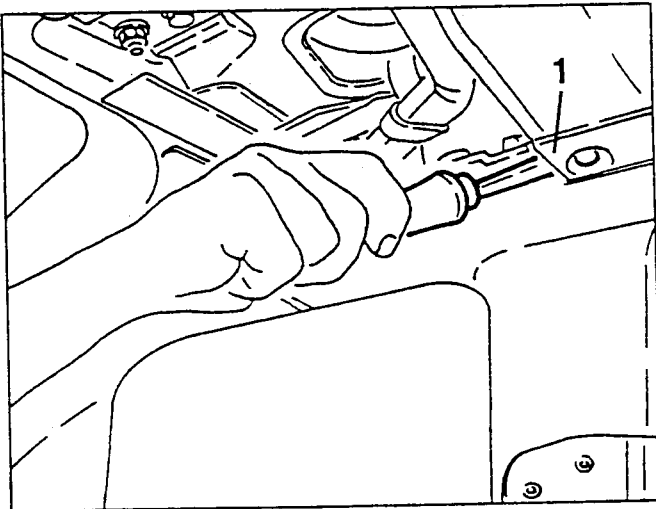
1. Loosen the screw securing the window surround.
2. Pull the window mouldings away from the plastic nails positioned as shown in the diagram.



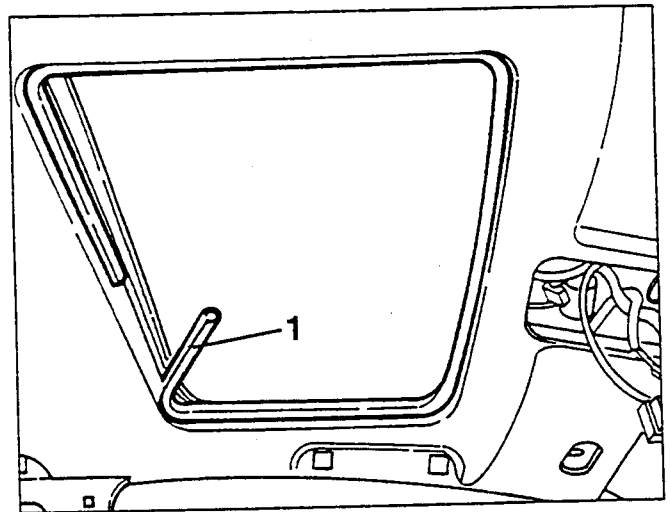
1. Loosen the two front screws securing the roof panel.



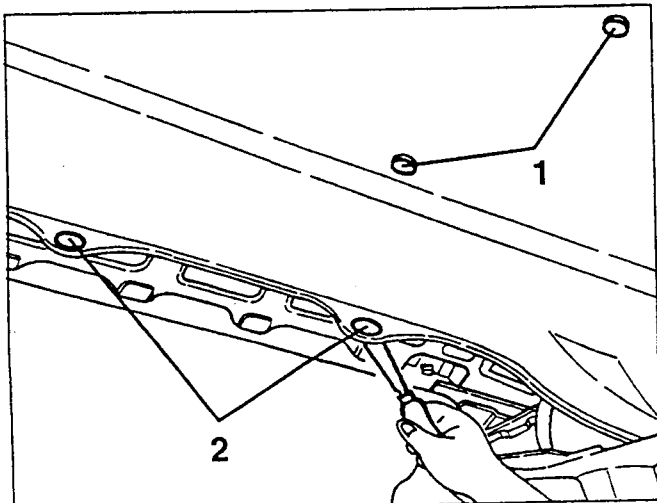
1. Pull off the button on the roof panel rear attachment.



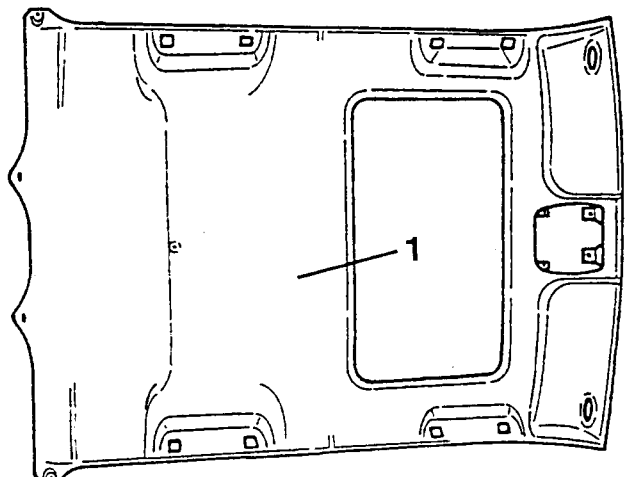
1. Pull off and remove the sun roof seal strip.



1. Loosen and remove the two central buttons.
2. Pull off and remove the two rear buttons.



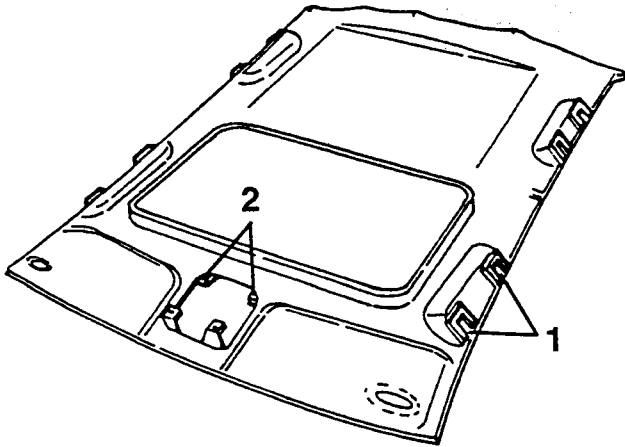
1. Remove the roof panel moving it first to one side to free it and then to the other and remove from the vehicle through the right-hand door.



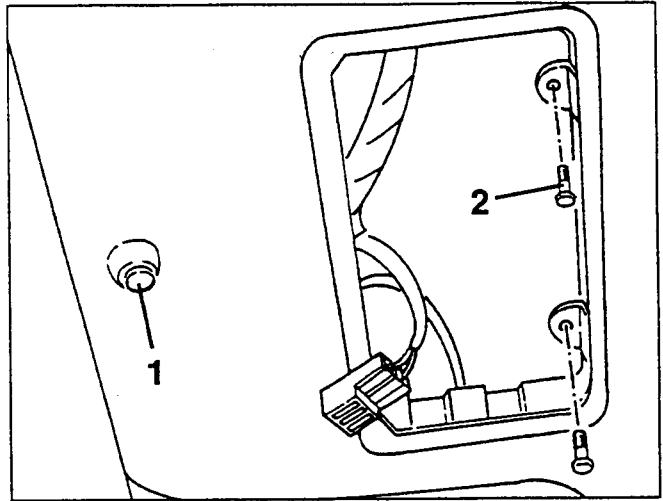




When refitting check that the gaskets (1) and the clip (2)s for the front screws, indicated in the diagram, are present on the roof panel.



1. Remove the plastic nail securing the front part of the roof panel.
2. Loosen the two screws securing the front of the roof panel.



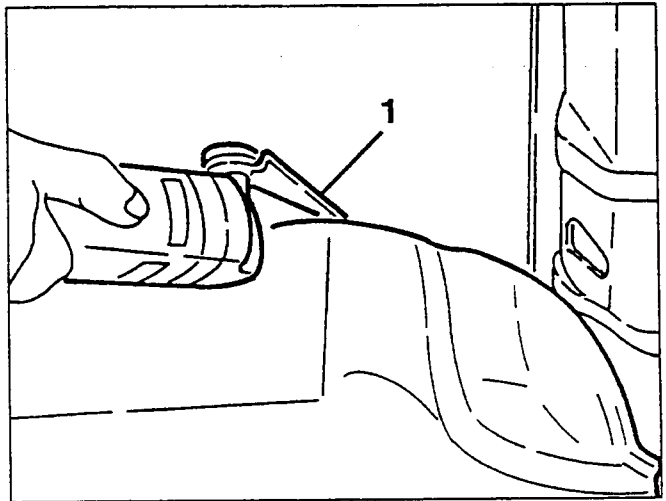
## GLUED ROOF PANEL (FOR VERSIONS WITHOUT SUNROOF)

### REMOVAL/REFITTING

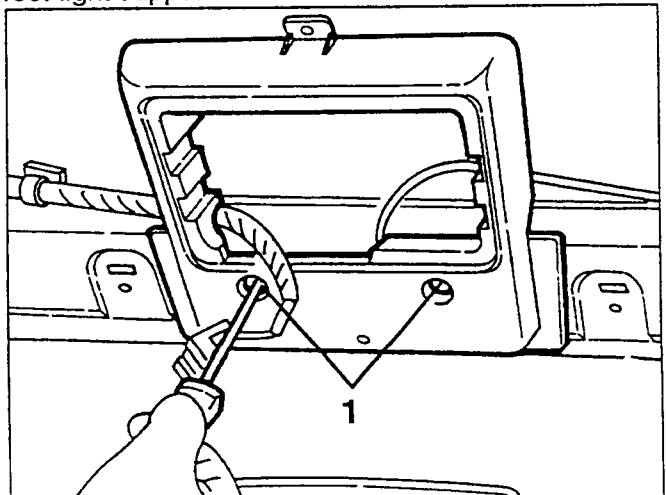
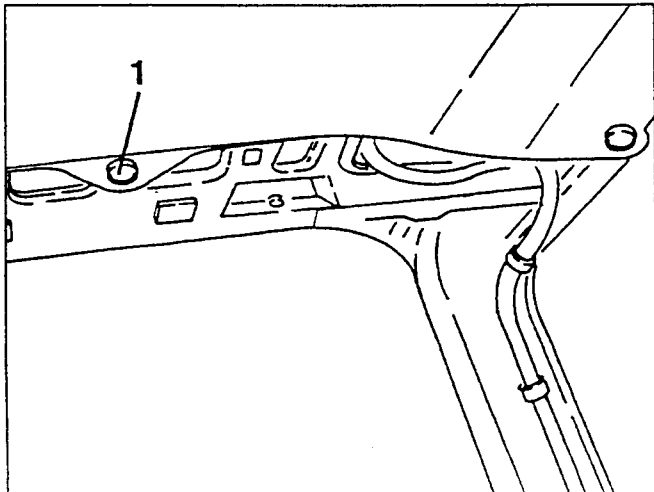
- Disconnect the negative cable from the battery.
- Remove the front and rear seats (see specific paragraphs).
- Remove the rear window mouldings (see specific paragraph).
- Remove the front roof light (see GROUP 55).
- Remove the passenger grab handles and the caps on the driver's side (see specific paragraphs).
- Remove the sun visors (see specific paragraph).
- Remove the trim from the front pillars (see specific paragraph).

1. Remove the four plastic nails securing the rear part of the roof panel.

1. Lower the rear part of the roof panel just enough to permit the glue to be cut as shown in the diagram.



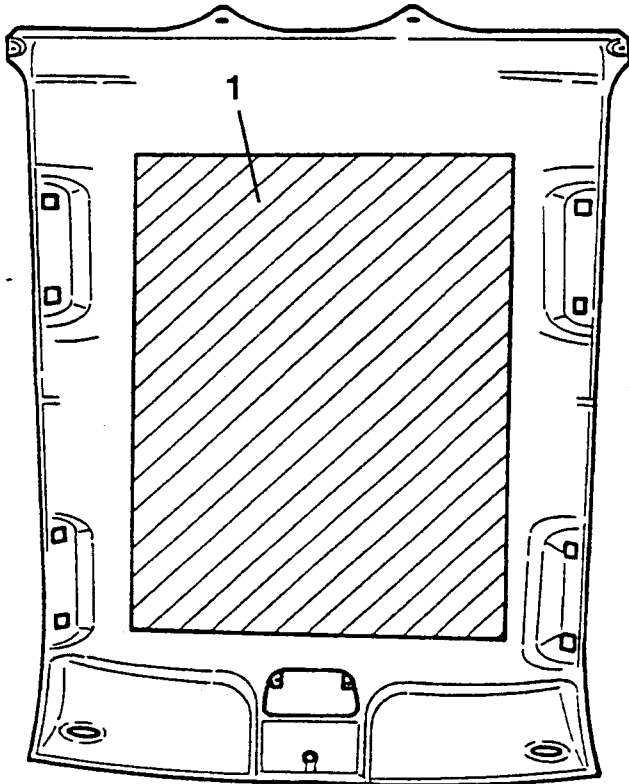
1. If necessary loosen the two screws and remove the roof light support.



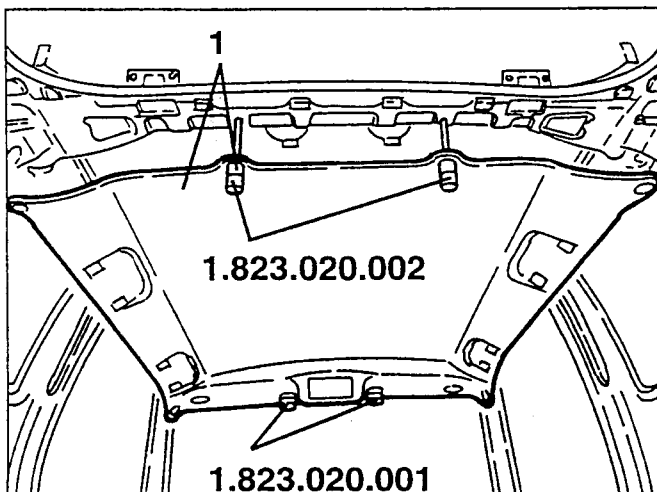


Refit the roof panel by reversing the procedure followed for removal and note the following:

1. Apply the specified glue to the new inner and outer roof panels as shown in the diagram.



1. Position the roof panel using guide pins 1.823.020.002 and 1.823.020.001 as shown in the diagram and press it using your hand around the glued parts.

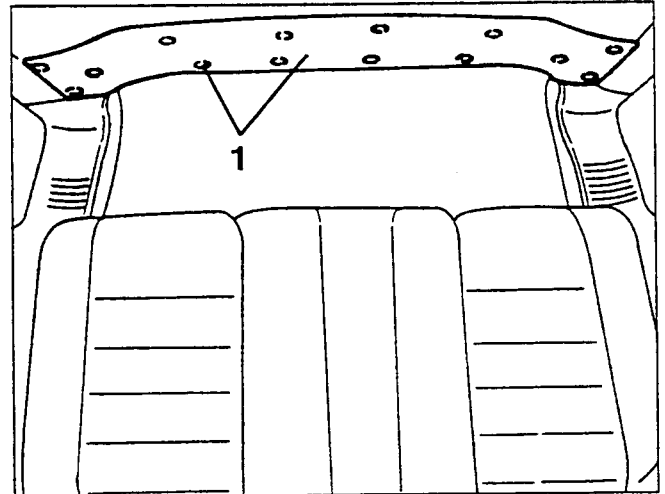


- Remove the centering pins and install the plastic nails in their place to secure the roof panel.

## ROOF PANEL REAR TRIM

### REMOVAL/REFITTING

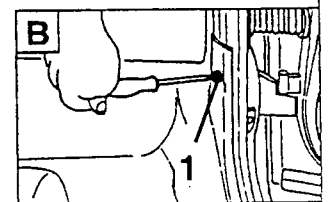
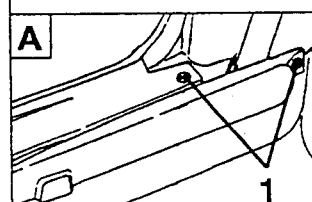
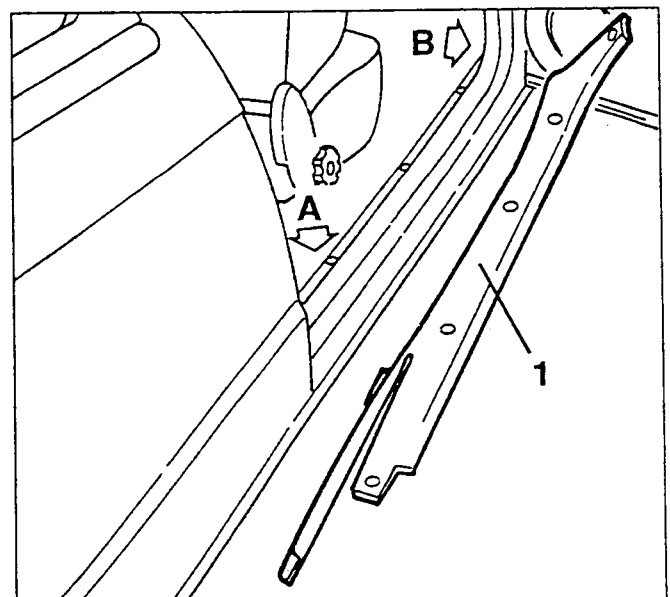
1. Pull the rear trim on the roof panel away from the plastic nails positioned as shown in the diagram and remove .



## HEEL REST

### REMOVAL/REFITTING

1. Loosen the six screws securing the heel rest and remove .

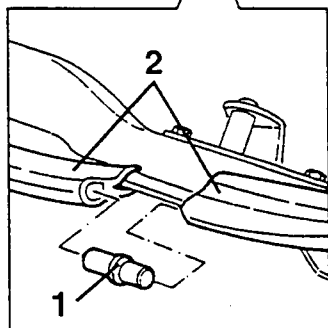
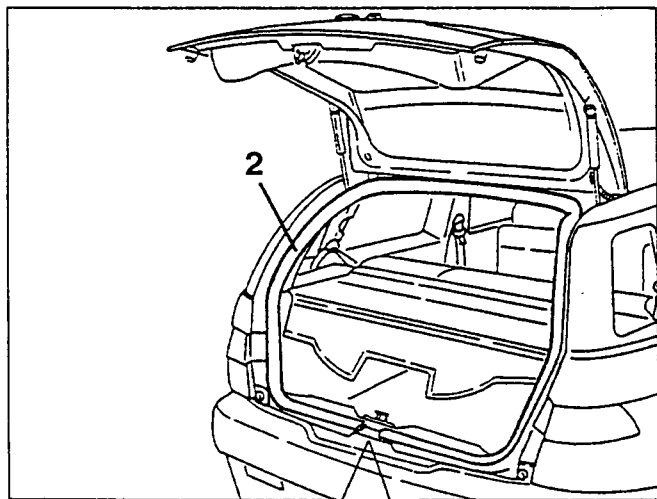


## LUGGAGE COMPARTMENT SEAL

### REMOVAL/REFITTING

- Remove the protective covering (see specific paragraph).

1. Remove the joins from the ends of the seal.
2. Pull away the seal beginning from the join.



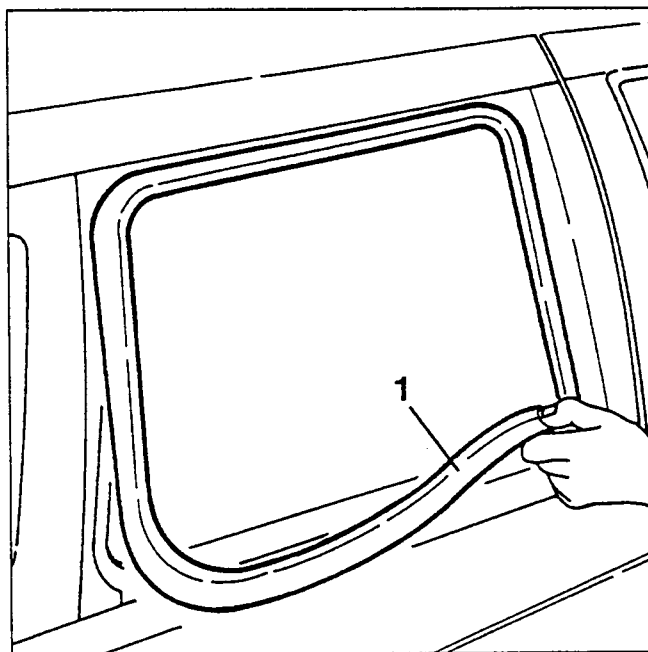
## SEAL ON QUARTERLIGHT WINDOW

### REMOVAL/REFITTING

- Remove the window mouldings (see specific paragraph).

- Remove the quarterlight window (see specific procedure).

1. Pull off and remove the quarterlight seal.

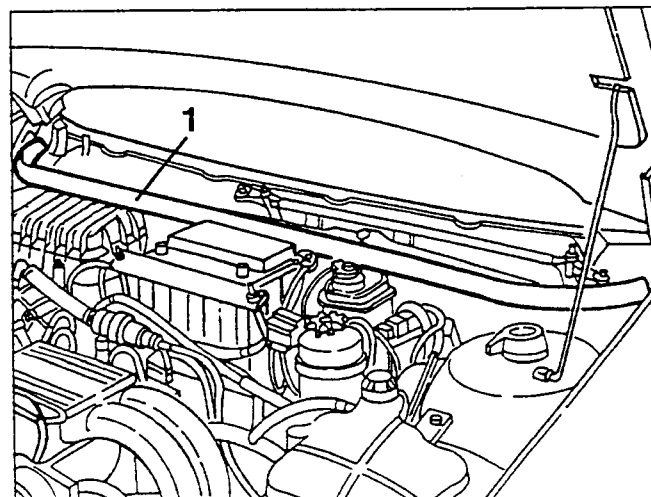


## SERVICES TANK SEAL

### REMOVAL/REFITTING

- Remove the air intake grille (see specific procedure).

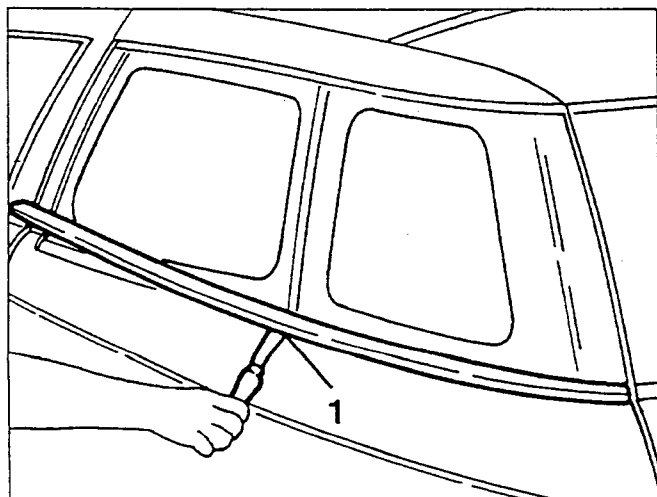
1. Pull off and remove the services tank seal.



## SIDE WINDOW LOWER SEAL

### REMOVAL/REFITTING

1. Pull off and remove the side window lower seal.

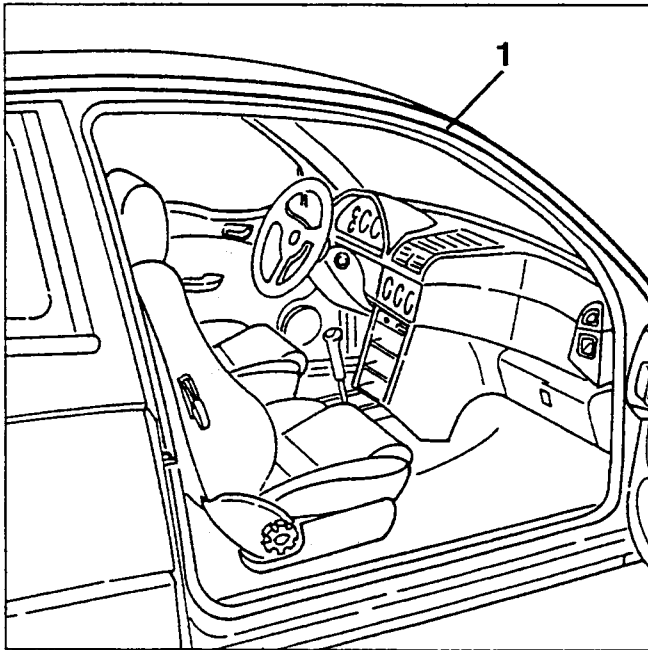


## ROOF PANEL SIDE SEALS

### REMOVAL/REFITTING

- Remove the upper window strip (see specific procedure).

1. Pull off and remove roof panel side seal.

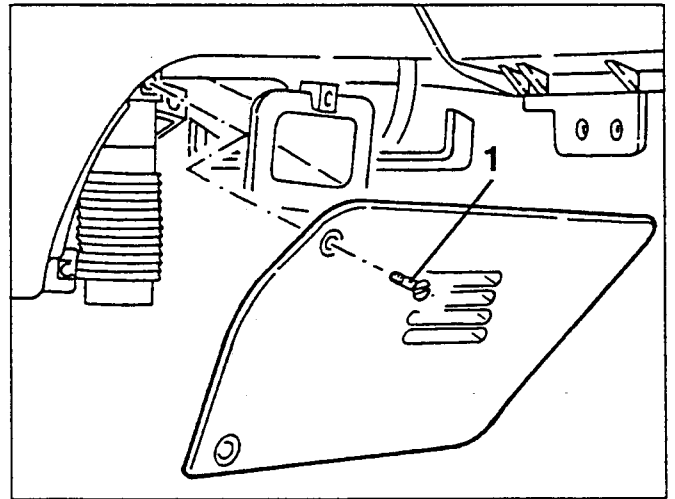


Refit by reversing the procedure followed for removal ensuring that the inner edge of the seal covers the internal trim.

## FRONT FLOOR VENT MOULDINGS

### REMOVAL / REFITTING

1. Loosen the two screws and remove the floor vent moulding by backing it off from the retaining bracket.

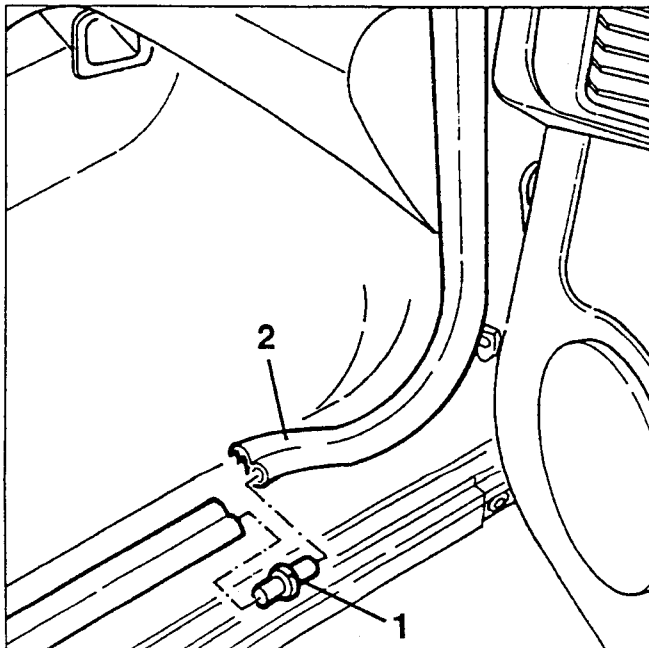


## DOOR SEALS

### REMOVAL/REFITTING

- Remove the heel rest (see specific paragraph).

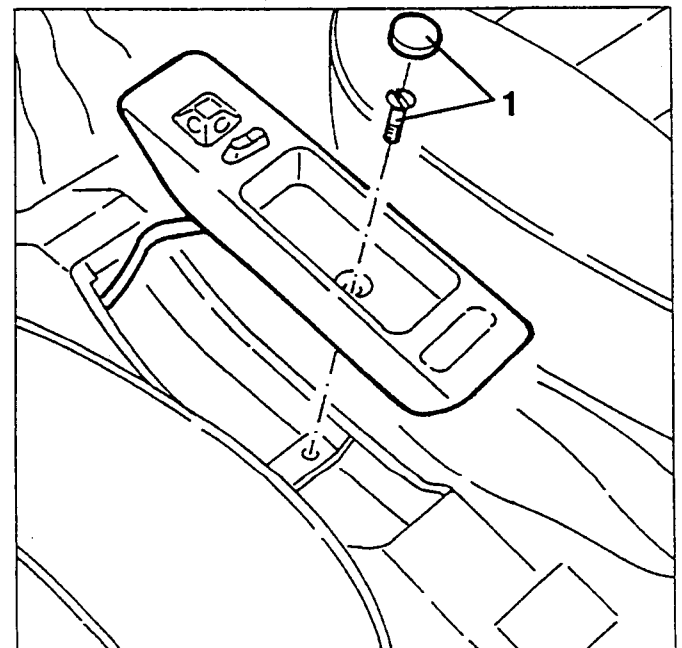
1. Remove the join from the ends of the seal.
2. Pull off the seal starting from the join.



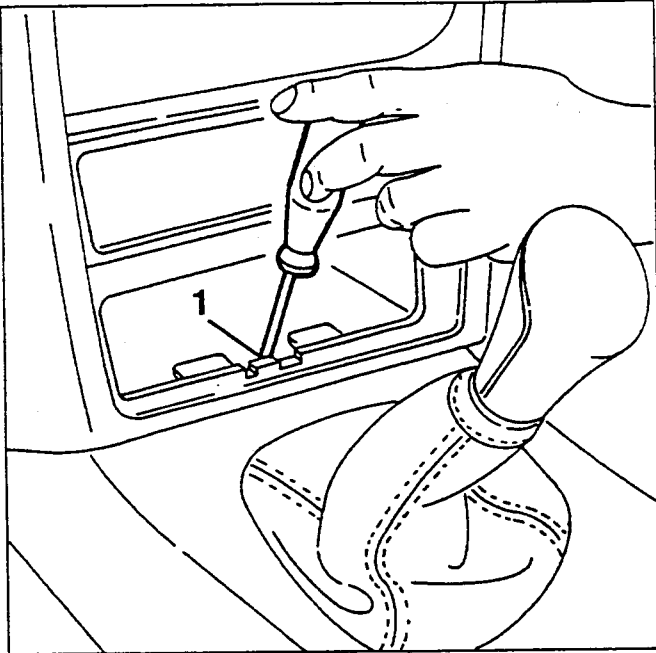
## CENTRAL CONSOLE

### REMOVAL / REFITTING

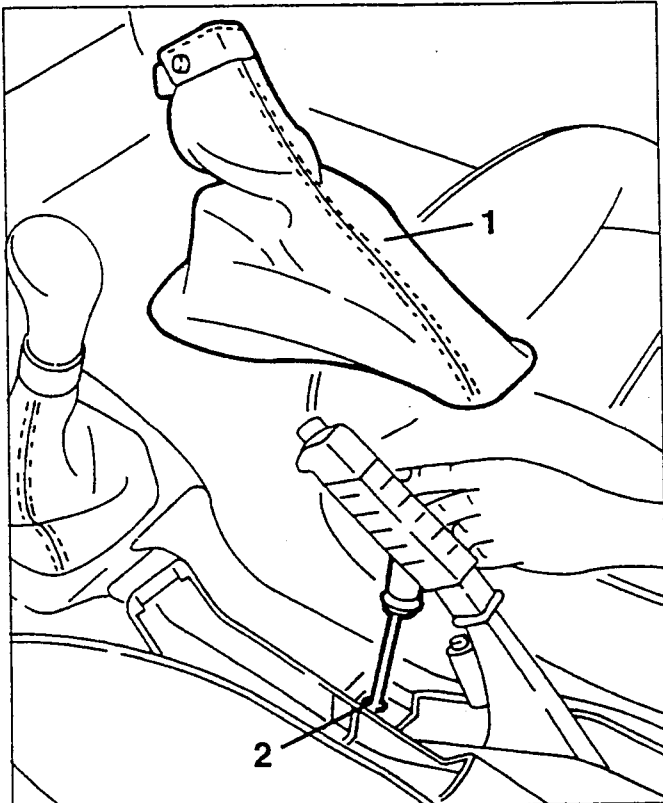
- Disconnect the negative (-) cable from the battery .
1. Pull off the plastic cap, loosen the screws and lift the moulding just enough to allow the electrical connection of the electric mirrors to be removed .



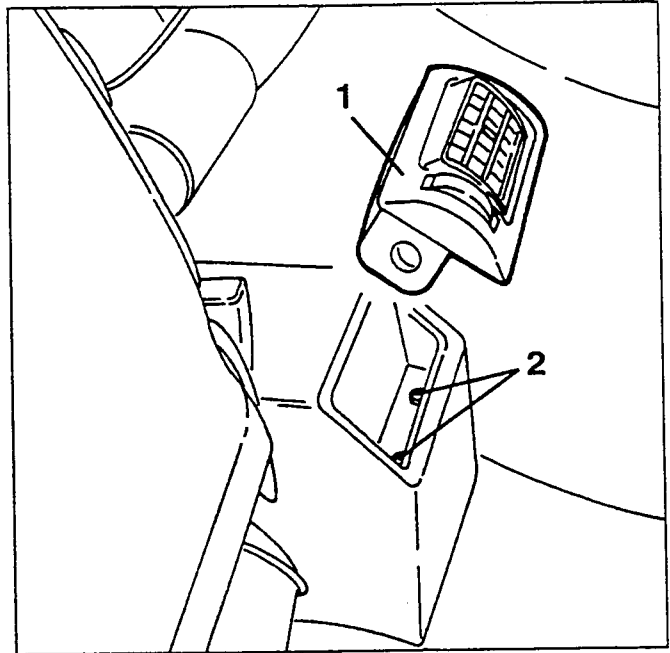
1. Remove the object tray and loosen the front screw securing the central console .



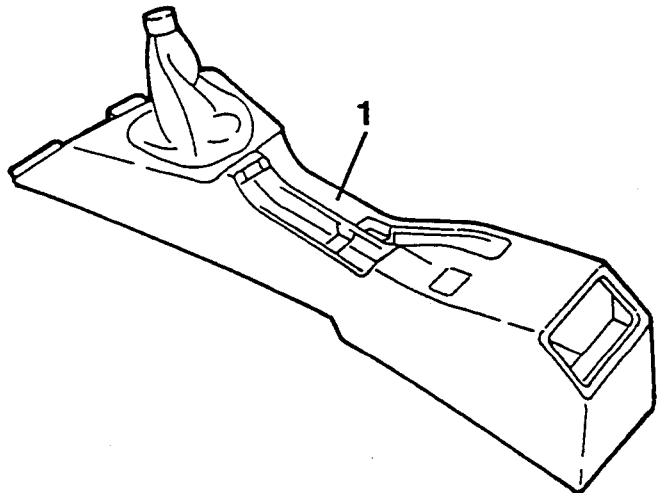
1. Pull off and remove the covering from the hand brake .
2. Loosen the central screw securing the central console .



1. Pull and remove the rear air distribution vent from the console .
2. Loosen the two rear screws securing the central console .



1. Withdraw and remove the central console .



**AIR BAG****DESCRIPTION**

The AIR BAG is a passive safety device consisting of:

- twin front Air Bags, driver and passenger (where fitted) for front protection;
- side bags (where fitted).

The system operates:

- the driver and passenger Air Bags in the case of a frontal impact of a certain severity.
- on the other hand, in the case of a side impact of a certain severity, the corresponding side bag is operated (only on the side where the impact occurred).

The system consists of the following components:

- electronic control unit (1);
- driver's Air Bag (2);
- passenger Air Bag (3);
- passenger side automatic disabling sensor (only up to June '99) (4);
- side impact sensors in the left door pillar (5);
- side impact sensors in the right door pillar (6);
- right Side Bag (7);
- left Side Bag (8);
- diagnostic socket for checking the system using the Examiner or other diagnostic equipment (9).

An electronic control unit manages the entire system checking all the components and activating the appropriate systems (pretensioners and Air Bags) when necessary.

**Operation in the case of a frontal impact**

Inside the control unit there is an accelerometric sensor whose signal, appropriately processed by a microprocessor, allows the severity of an impact to be assessed and, as a result, the operation of the Air Bags to be decided upon.

A second sensor with safety functions gives the go ahead to activate the Air Bags. The control unit only detects frontal impacts. No intervention takes place in the case of side impacts, shunts or if the vehicle overturns.

**Operation in the case of a side impact**

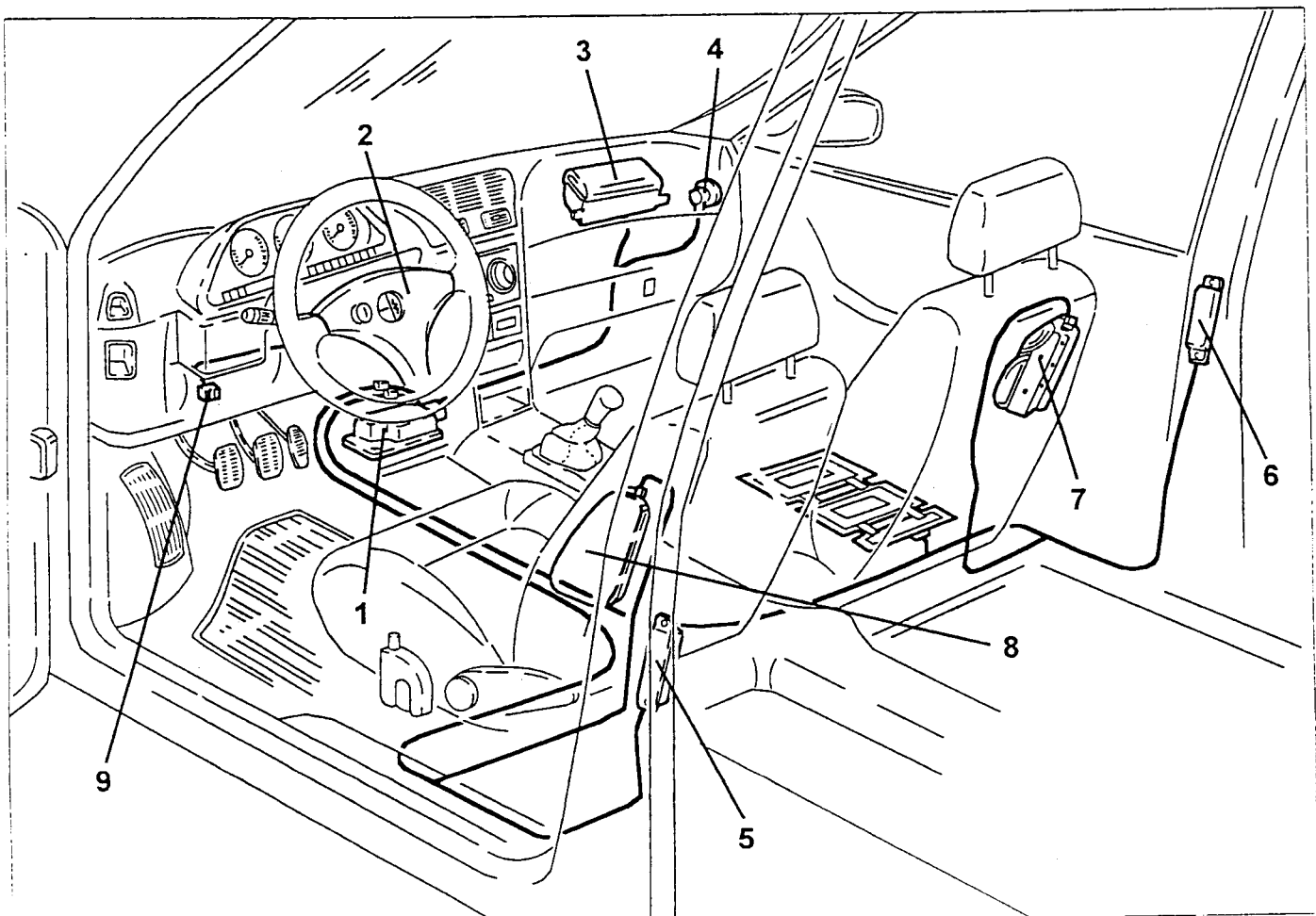
There is an accelerometric sensor in the two front door pillars which detects side impacts and transmits a signal to the control unit.

This signal, suitably processed by a microprocessor inside the control unit, makes it possible to assess the severity of a side impact and, as a result, decide upon the operation of the Side Bag on the side where the impact has taken place, but only if the safety sensor gives the go ahead.

**NOTE: The Side Bags are activated independently of one another and the front Air Bags.**

**WARNING: On vehicles with Side Bags:**

- do not wash the seat backrest with water or pressurized steam in automatic car washes for seats;
- do not cover the front seat backrests with loose covers.



## SAFETY REGULATIONS TO BE OBSERVED DURING OPERATIONS ON VEHICLES EQUIPPED WITH AIR BAG SYSTEMS

Below are several rules which **SHOULD, UNDER ALL CIRCUMSTANCES, BE OBSERVED** when carrying out an operation on vehicles equipped with Air Bags.

### PRELIMINARY INSTRUCTIONS

It should be remembered that Air Bag modules are devices which should be handled with caution. Their use, transportation and storage are governed by the procedures for handling these components illustrated below.

Before starting to carry out:

- bodywork repairs;
- welding operations;
- work for which the Air Bag modules or the control unit have to be removed.

Remove the ignition key.

Always disconnect the battery, i.e. disconnect the two terminals from the poles and insulate them by taping them carefully.

Disconnect the control unit connector waiting at least **10 minutes** after having disconnected the battery.

If one of the Air Bag modules is being removed, observe the following procedure scrupulously:

1. Wait at least **10 minutes** after having disconnected the battery before starting to remove the module.
2. Undo the fixing bolts.
3. Disconnect the connector for the inflation devices.
4. Place the devices, with the cover facing upwards, in a locked metal cupboard. This cupboard, designed exclusively for this purpose, should not, under any circumstances, be used to store other types of material, especially if they are inflammable. The cupboard should meet the specifications for storing pyrotechnic charges (metal, impact-resistant cupboard with grilles to allow natural ventilation inside) and should have notices as laid down by the laws in force (**DANGER EXPLOSIVES - NO NAKED FLAMES - NOT TO BE OPENED BY UNAUTHORIZED PERSONNEL**).

All the connectors used in Air Bag modules contain a shortcircuit clip: until the Air Bag modules are connected to a suitable energy source via a suitable connector there is no possibility of their accidental activation.

A system component which has not been activated in the case of an accident should be considered as still "active" therefore components which are unexploded because they are defective or have reached the end of their warranty period or for other reasons have to be replaced and returned to the special centre following the procedure described below.

The assembly and dismantling of safety system components should **ONLY** be carried out by suitably trained and authorized personnel.

The failure to respect the above instructions could lead to the undesired activation of the system resulting in personal injury or unnecessary repairs to the system.

**THE AIR BAG MODULES MUST NOT BE DISMANTLED, UNDER ANY CIRCUMSTANCES, INTO THEIR COMPONENTS.**

All the system components have been specifically designed to work on a particular marque and type of vehicle, therefore Air Bags should not be adapted, reused or fitted on other vehicles, but only on these for which they were designed and produced. Any attempt to reuse, adapt or fit one on a different type of vehicle could result in serious injury or even be fatal for the occupants of the vehicle in the case of an accident.

Replacing an Air Bag (because of defects or the expiry of the warranty)

If an Air Bag module is being replaced because it is defective or the warranty period has expired it is necessary to:

1. Remove the new adhesive label from the module, placing it in a special file with the vehicle data (chassis no., registration date, model, etc.) and add the serial number of the old module. The file with the recorded data should be kept for future checks.
2. Before being stuck on top of the existing plate, the plate should be perforated by the month and ten years after the date when the module is being fitted (e.g. 2007 for 1997).
3. Connect the module to the appropriate connector.
4. Fit the Air Bag module in the appropriate housing checking that the connecting cable is correctly routed and tighten the bolts to the recommended torque.

### Replacing the control unit

The electronic control unit should **ALWAYS** be replaced in the case of an impact involving the activation of the system.

**Do not, under any circumstances, attempt to reuse the electronic control unit.**

If the control unit is being replaced the adhesive label must be replaced and stuck in the above mentioned file.

For the withdrawal from and depositing in the storage area an incoming and outgoing register must be kept.

Fragile. Handle with extreme caution. Do not drop.

If the Air Bag control unit is accidentally dropped it must be checked over with the ALFA TESTER cancelling the error messages where necessary. If the unit has been dropped from a height above 75 cm it must be replaced.

The loaded AIRBAG module, after disassembly must immediately be placed in the appropriate cabinet.

## 2) ASSISTANCE INTERVENTION

Do not use tools like hammers or percussion screw-drivers which could transmit shock waves to the inflation device. Do not cut or puncture the AIRBAG module.

Do not tamper with any part of the AIRBAG. Any attempt at tampering with the module could provoke the activation of the system and result in personal injury.

Handle the AIRBAG module with extreme caution. If the inflation device is broken materials which are extremely dangerous may be projected from the device:

The surface of an AIRBAG which has detonated inside the vehicle may be covered with a dust residue. This dust contains some sodium compounds which are a by-product of the reaction which generated the gas used to inflate the cushion. The sodium compounds are, for the most part composed of sodium carbonate and trace quantities of sodium hydroxide.

This dust is slightly alkaline but is not held to be toxic. In addition to the dust there may be a small quantity of unused sodium azide and potassium nitrate inside the gas generator. These components are dangerous. In the even of contact with these substances, refer to the "FIRST AID" section.

Never use naked flame near the AIRBAG module.

Do not allow the module to come into contact with acids, water, other liquids or sprays as this could cause the chemical elements within the module to react dangerously.

## First aid

In the event of contamination by one of the components involved in the production of the gas, the following first aid procedures should be applied:

### INGESTION:

Induce vomiting if the subject is conscious. Do not provoke vomiting in an unconscious patient. Consult a doctor.

### CONTACT WITH SKIN:

Immediately wash the area with neutral soap and running water. Remove contaminated items of clothing and wash them before putting them on again. Seek the advice of a doctor.

### CONTACT WITH THE EYES:

Immediately rinse with copious quantities of running water for at least 15 minutes. Remove contact lenses to ensure complete washing. Seek the advice of a doctor.

### INHALATION:

Help the accidented patient into the fresh air. Treat any irritation on the basis of the symptoms. Seek the advice of a doctor.

**A DOCTOR SHOULD ALWAYS BE CONSULTED AFTER EXPOSURE TO THE COMPONENTS USED IN THE PRODUCTION OF THE GAS.**

## 3) AFTER THE ASSISTANCE INTERVENTION

Following each service operation concerning the Air bag the operation of the entire system should be checked using the ALFA TESTER.

If the intervention did not require the substitution of the AIRBAG module, check that the specific labels are present and restore them if necessary.

If the intervention required the substitution of the AIRBAG module, a new label showing the new date of expiry (month and year) written in indelible ink should be applied.

## 4) TRANSFER OF OWNERSHIP, DEMOLITION

The vehicle must not be demolished when the AIRBAG module is still intact or when the module is out of its seating. If the vehicle is to be demolished the personnel charged with this operation must be informed of the presence of the AIRBAG so that the appropriate measures and precautions can be taken (see also relative paragraph below). The detonated modules must be destroyed in accordance with the regulations in force in the each country.



The detonated modules should be kept in sealed plastic bags ready for disposal.

If the vehicle is to be sold, the new owner must be informed of the presence of the AIRBAG module.

Check the labels and if necessary have them replaced.

### 5) DURATION OF THE AIRBAG SYSTEM

The AIRBAG module should last for 10 years (see expiry date on specific label). It must be replaced when this period expires and a new label showing the new date of expiry (month and year) written in indelible ink should be applied.

### 6) IDENTIFICATION LABELS

On vehicles fitted with an AIRBAG two adhesive labels are present which warn the owner of the presence of the device and its date of expiry.

**AIRBAG**

**ATTENZIONE:** consultare il libretto di manutenzione. sostituire la carica entro il \_\_\_\_\_

**CAUTION:** see owner's manual. replace gas generator by \_\_\_\_\_

**ATTENTION:** consulter la notice d'entretien. remplacer la charge avant le \_\_\_\_\_

**ACHTUNG:** Bedienungsanleitungen nachsehen. Ladung ersetzen vor \_\_\_\_\_

|      |      |      |
|------|------|------|
| 2003 | 2004 | 2005 |
| 01   | 02   | 03   |
| 04   | 05   | 06   |
| 07   | 08   | 09   |
| 10   | 11   | 12   |



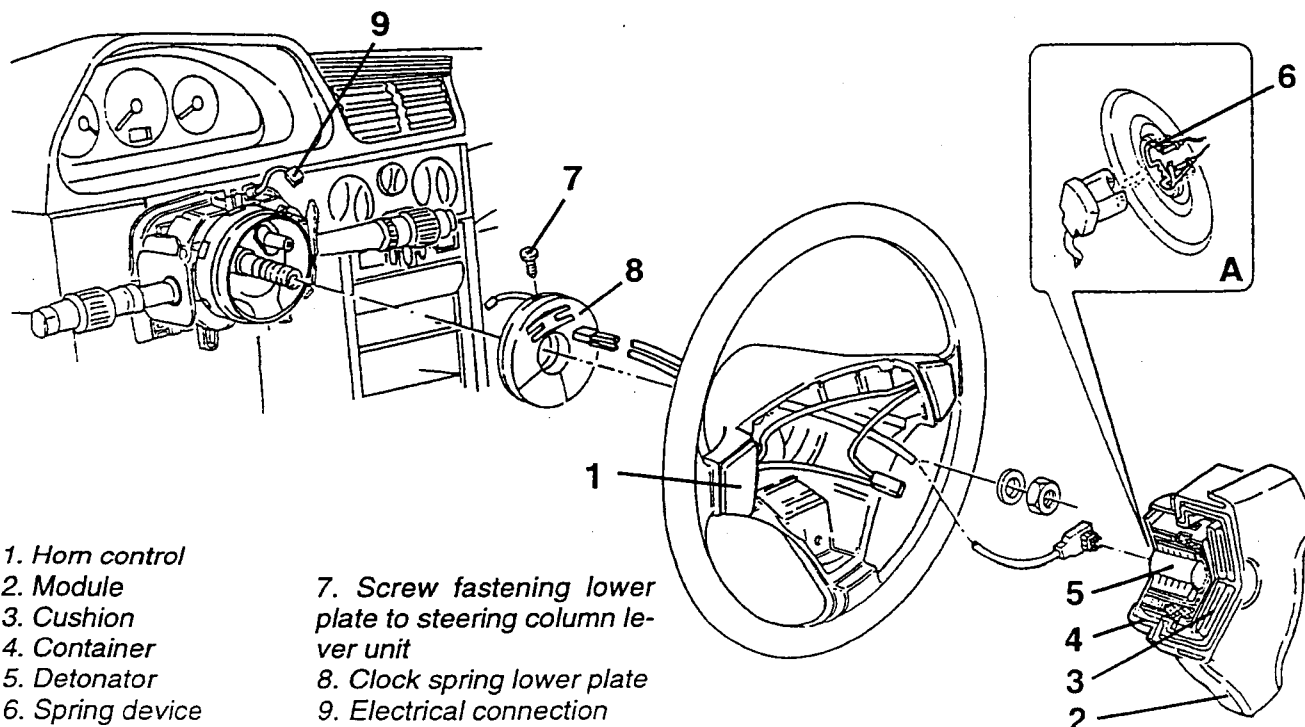
### WARNING !

The operators authorized to handle the AIRBAG modules, in addition to scrupulously respecting the indications given above, must be extremely attentive and informed regarding the potential danger resulting from the involuntary intervention of the module.

## AIR MBAG MODULE ON DRIVERS'S SIDE

The new type of steering wheel is fitted with lateral commands for the horns. The centre of the steering wheel houses the AIR BAG module. It is fixed with three screws to the rear part of the steering wheel. The module is composed of a steel plate covered with a plastic container which forms the hub of the steering wheel.

The container holds a folded cushion and the inflation device. The inflation device contains a detonator which is activated electrically producing a chemical compound (sodium azide) forming nitrogen gas. The rear part of the cushion has holes of a suitable size to allow the cushion to deflate immediately after inflation.



1. Horn control
2. Module
3. Cushion
4. Container
5. Detonator
6. Spring device

7. Screw fastening lower plate to steering column lever unit
8. Clock spring lower plate
9. Electrical connection

**DRIVER'S AIR BAG MODULE**

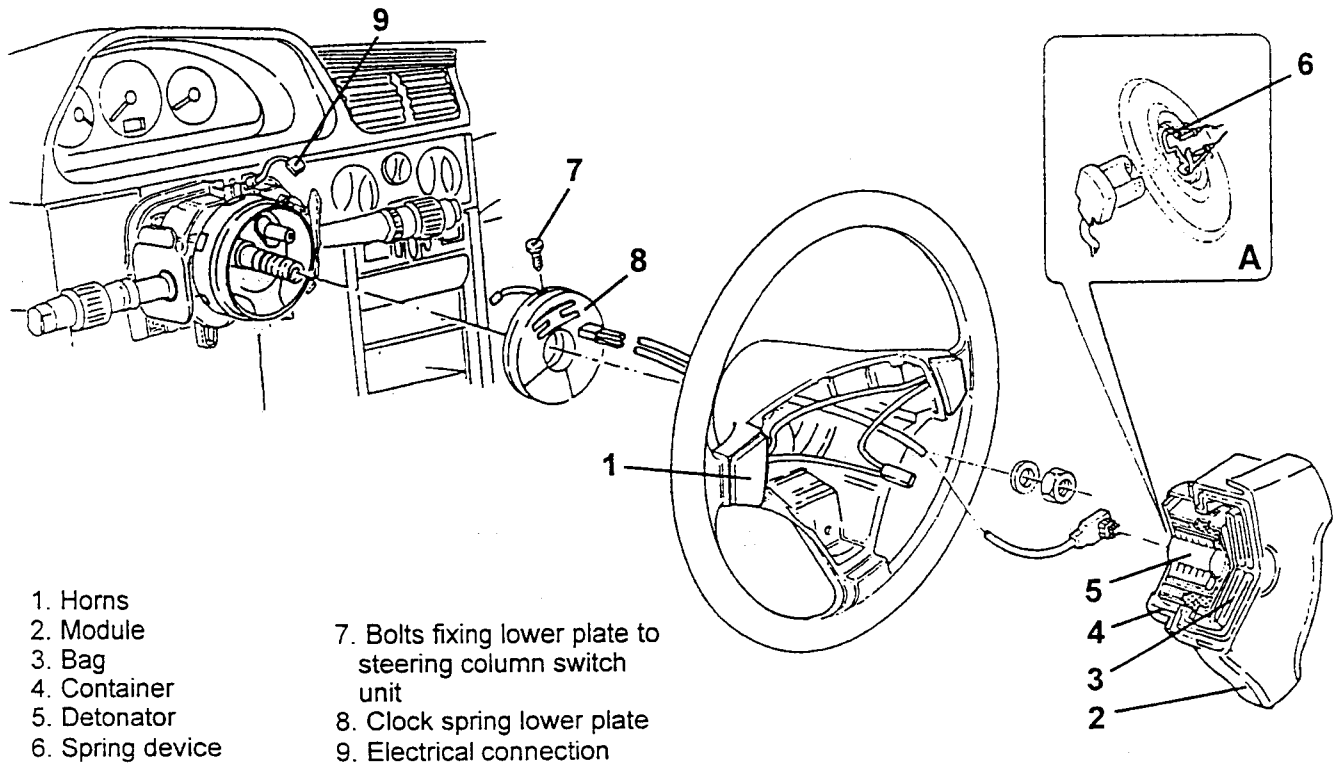
The new type steering wheel has side controls for the horns and the centre section contains the housing for fitting the module.

It is secured by three bolts to the rear of the steering wheel.

The module is made up of a steel plate covered by a plastic container which constitutes the centre of the steering wheel.

The container houses the suitably folded bag and the inflation device. The inflation device contains a detonator which can be electrically activated and a chemical compound (sodium nitride) for the formation of the gas (nitrogen).

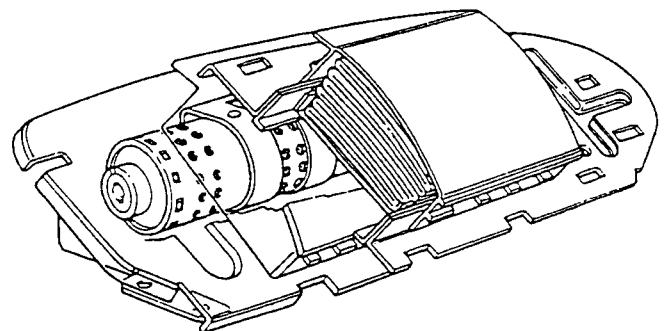
The rear of the bag houses suitable sized openings for deflating the bag immediately after it has been inflated.

**AIR BAG MODULE  
PASSENGER SIDE**

The passenger AIR BAG module is also enclosed in a container which is fixed to a metal fram. The composition and operating principle is the same as for the one on the driver's side.

When the connector is disconnected from the Air Bag modules, they are shortcircuited: a special spring device incorporated in the module connectors joins the two terminals. In this way they cannot be activated by means of a direct supply.

**NOTE:** Air Bag modules should be replaced 10 years after fitting, the date is given on the label.



## CLOCK SPRING

The clock spring (1) is a device which is fitted on the steering column switch unit and is designed to allow the Air Bag module cables fitted on the steering wheel to follow the rotation of the latter without danger of breaking.

The device consists of two plates, the lower one fixed to the steering column switch unit by means of bolts (2), the upper one attached by means of two elements on the upper section.

Inside the two plates, the connecting cables for the module and the horn buttons are wound around to allow the movements of the steering wheel to be followed.

The clock spring is fitted with a device which automatically stops it from rotating when the steering wheel is removed.

This operation is designed to prevent the upper plate, no longer attached to the steering wheel, from rotating freely causing the cables to be unwound or wound, with the possibility of them breaking.

When fitting the steering wheel the device is automatically locked.

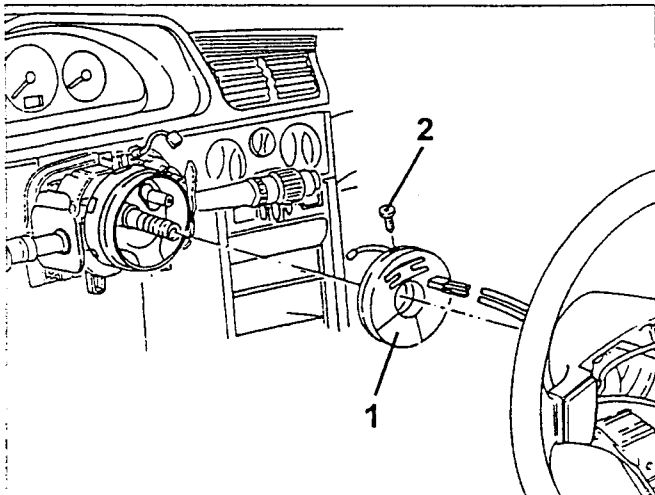
**NOTE: When removing-refitting the clock spring, make sure that it is refitted on the steering column switch unit in the same position in which it was removed.**

If, for any reason, the upper clock spring plate should rotate in relation to the lower one so that its position during removal is not known, the CLOCK SPRING MUST BE REPLACED.

When replacing, if the clock spring is supplied as spares separately from the steering column switch unit, it should be fitted with the wheels straight because this is the corresponding position for the new device.

The new device is fitted with a safety tab which keeps it locked.

This tab should be removed when fitting the steering wheel to allow the system to rotate correctly.



## SIDE BAGS

### Impact sensors

There is an accelerometric sensor on the two front doors which, in the case of a side impact, transmits a signal to the control unit.

This side is also processed inside the control unit which, as a result, decides to operate the Side Bag on the side the impact has occurred on.

In effect, the control unit is equipped with a second safety sensor, which detects side impacts, in exactly the same way as the sensor which detects frontal impacts, and gives the go ahead for the activation of the Side Bag on the side where the impact has occurred.

This sensor is positioned so that it only detects impacts on the side on which it is located: e.g. the sensor in the driver's pillar only detects impacts which occur on the left and does not detect impacts on the right side.

**NOTE: The sensor should be fitted with the arrow pointing in the direction of travel.**

### Side Bag module

The Side Bag is housed in the outer part of the front seats towards the window.

It consists of a container, incorporated in the seat backrest, which houses the gas generator and the folded bag.

The container is fixed to the backrest frame by means of a special bracket.

The gas generator can be electrically activated by means of a signal coming from the electronic control unit.

In this way a propellant charge is triggered which releases a compressed gas (argon) which expands in the bag, which is smaller than the front bags.

The bag deflates immediately after inflation thanks to an opening in the rear.

The seat cover stitching has predetermined rupture lines which allow the bag to come out completely.

### Disabling passenger Side Bag (device fitted up to June '99)

When the "no passenger" condition is detected, constantly for at least thirty seconds, the control unit excludes the activation of the passenger Air Bag and the Side Bag.

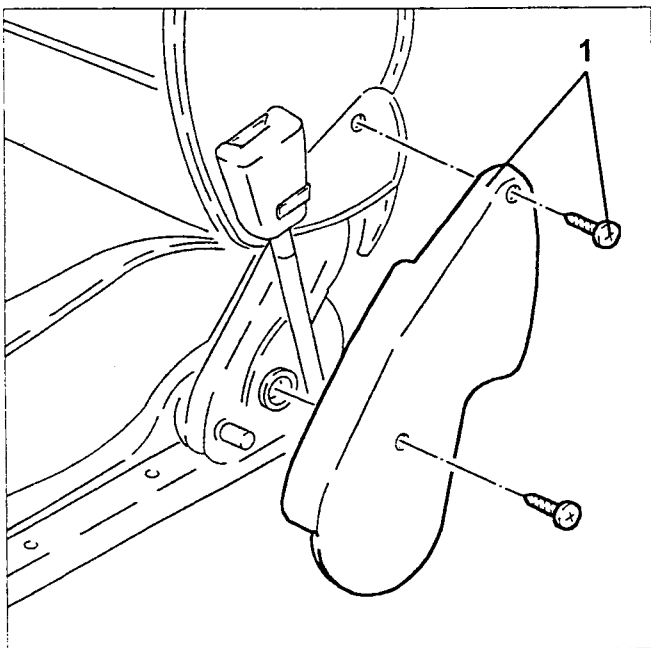
If the sensor then detects the "passenger present" condition, the control unit immediately reactivates the passenger Air Bag and the Side Bag.

## REMOVING-REFITTING AIR BAG MODULE SIDE

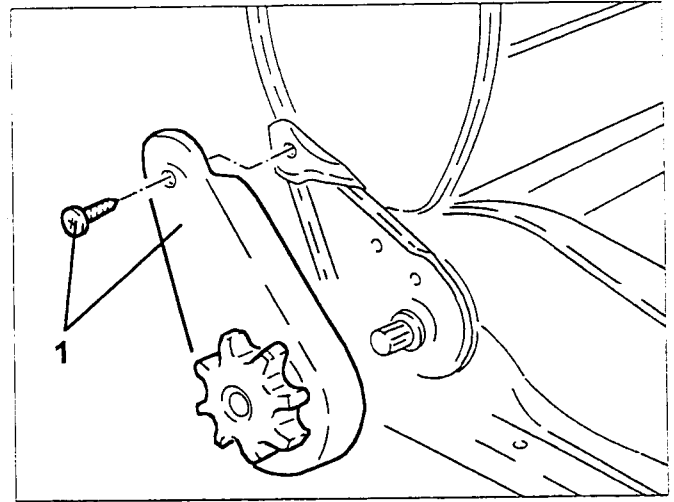
Operations on Air Bag components should be carried out by suitably trained personnel **SCRUPULOUSLY** following the safety measures listed below.

- During removal or replacement operations, polythene gloves and protective goggles must be worn.
- Before removing the Air Bag, disconnect the battery terminals, insulate them and wait for 10 minutes.
- Do not use naked flames in the vicinity of Air Bags or system components.
- Damaged or defective individual components should not be repaired or tampered with, but replaced in their entirety.
- For further clarifications on the safety instructions, see "Safety Measures" at the beginning of this chapter.

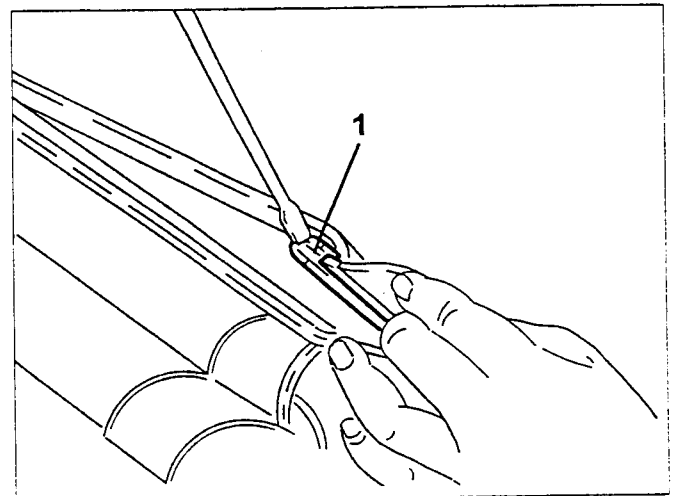
- Remove the front seat (see specific procedure).  
 1. Undo the fixing bolts and remove the hinge trim, releasing it from the fastening springs.



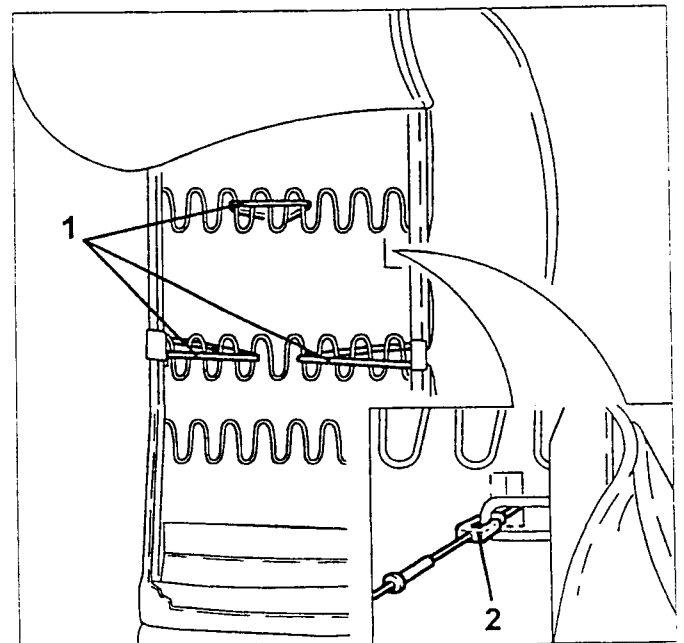
1. Undo the fixing bolts and remove the hinge trim complete with knob, releasing it from the fastening springs.



1. Remove the two side profiles for the backrest rear cloth.

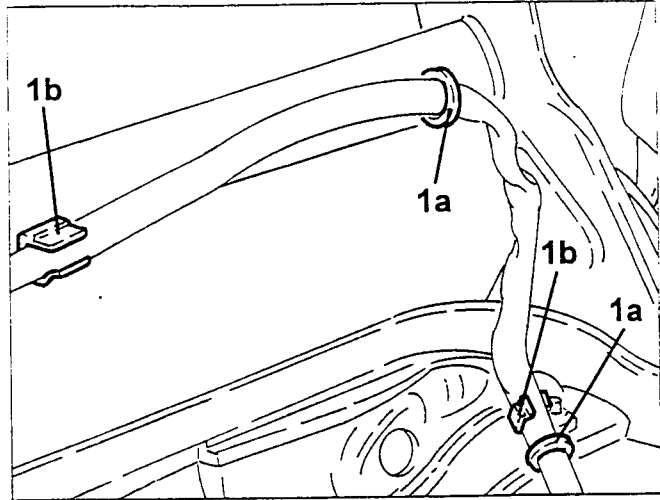
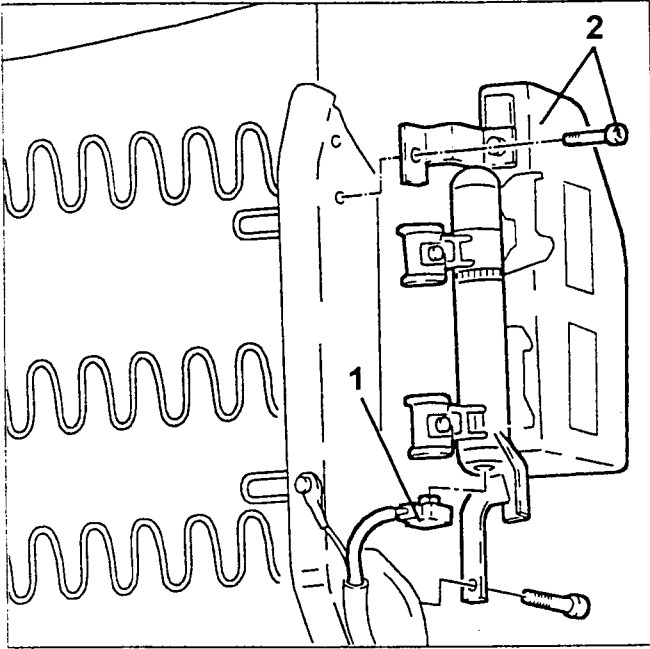


1. Release the three upholstery flexible bands.  
 2. Release the three right and left upholstery rods.

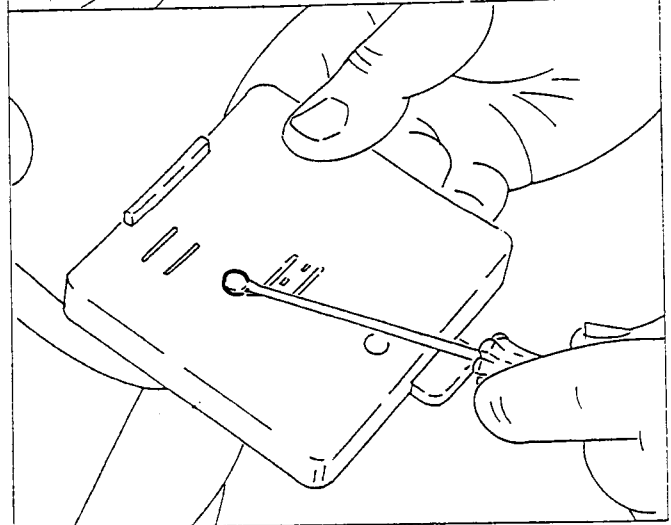
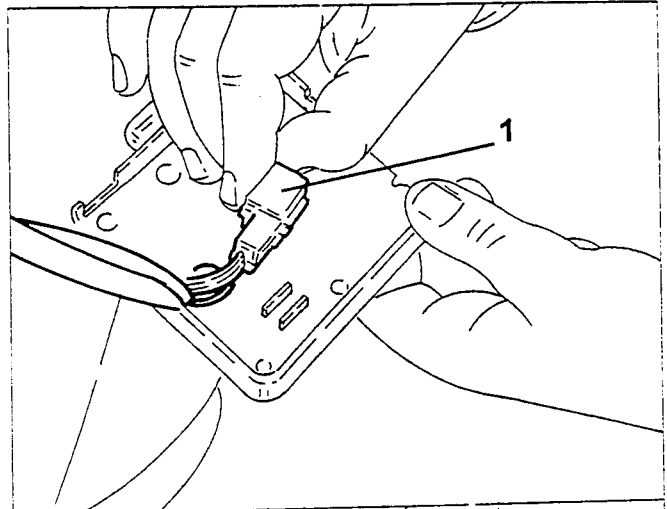


- Lift up the backrest fabric and remove the upholstery in the area of the Side Bag module.

1. Disconnect the electrical connection from the Side Bag module.
2. Undo the fixing bolts and remove the Side Bag module.



1. Release the electrical connections from the connector box.



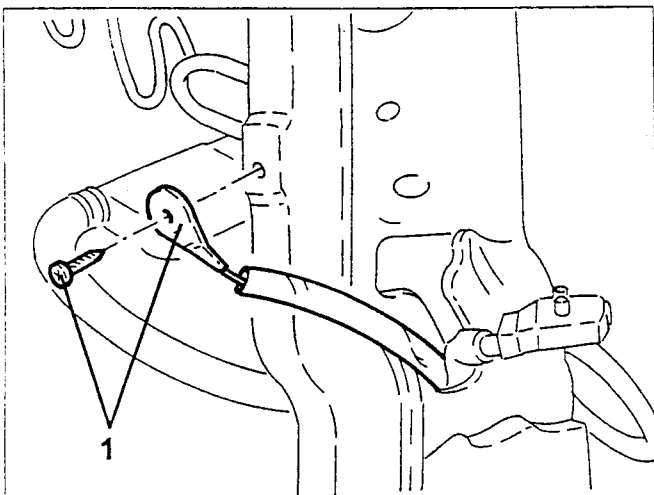
- Remove the Side Bag supply cable, releasing it.

## DISMANTLING/REASSEMBLY SIDE BAG SUPPLY CABLE

- Remove the front seat (see specific procedure).
- Remove the Side Bag module (see specific procedure).

- Remove the cushion from the seat (see "Disassembling-Reassembling front seat cushion" procedure).

1. Disconnect the earth lead from the backrest frame.



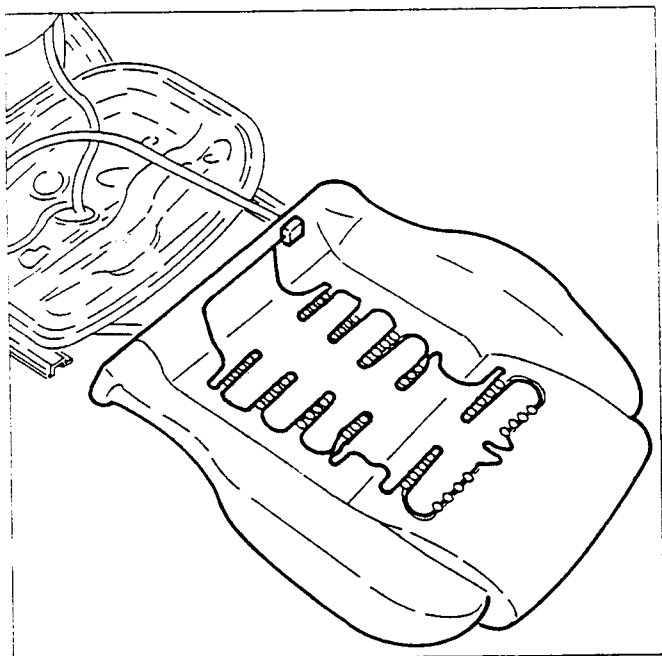
1. Remove the bands (1a) and the springs (1b) fixing the Side Bag supply cable.

PA49300000013

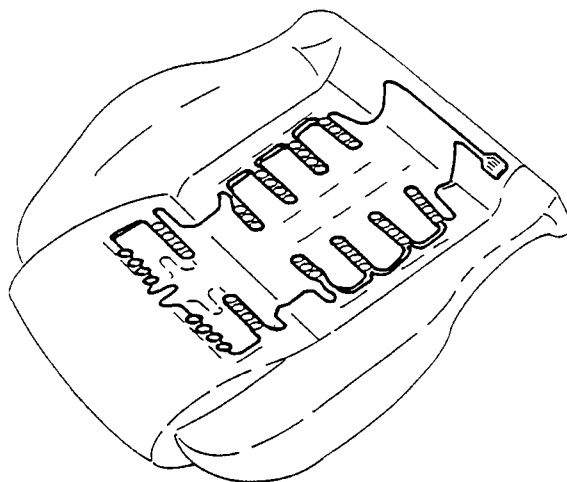
## DISMANTLING/REASSEMBLING PASSENGER PRESENCE SENSOR (Device present until June '99)

- Remove the front seat (see specific procedure).

- Remove the front seat cushion upholstery (see specific procedure).



- When refitting, position the passenger presence sensor with the adhesive part facing the upholstery.

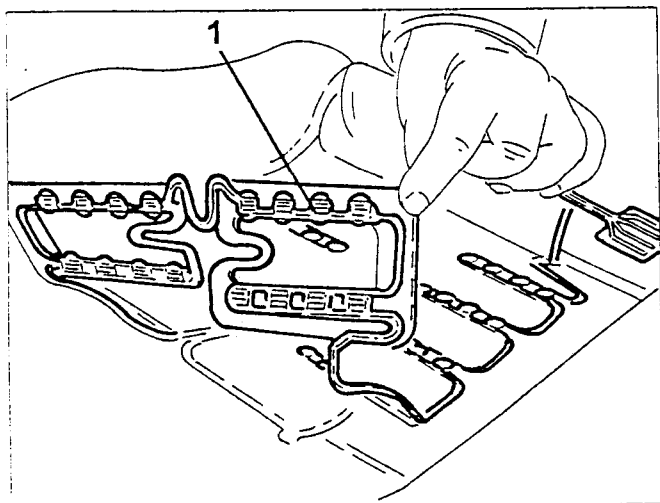


- Disconnect the electrical connection for the passenger presence sensor fixed to the connector box under the base.

1. Remove the passenger presence sensor from the cushion upholstery.



**Work carefully so as not to damage the connections and the structure of the sensor.**

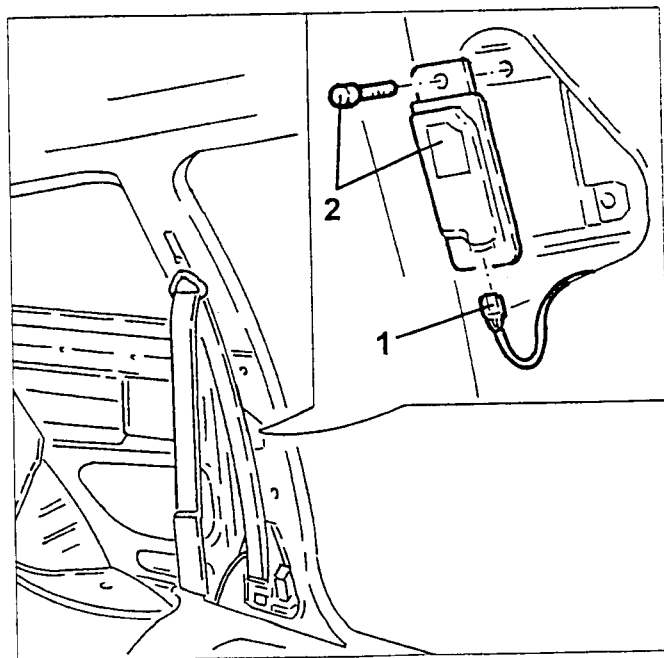


## REMOVING-REFITTING IMPACT SENSORS FOR SIDE BAGS

- Remove the side panel (see specific procedure).

1. Move the seat belt and disconnect the electrical connection from the Side Bag impact sensor.  
2. Undo the two bolts and remove the Side Bag impact sensor.

**NOTE:** The sensor should be fitted with the arrow pointing in the direction of travel.



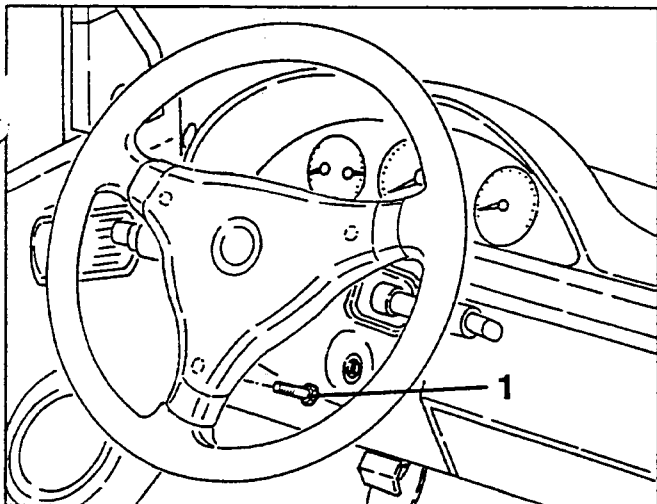
**WHITE**

## REMOVING THE DRIVER'S SIDE AIR BAG MODULE - CLOCK SPRING DEVICE

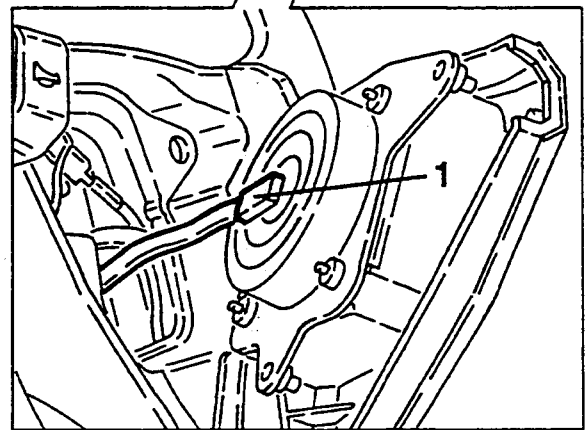
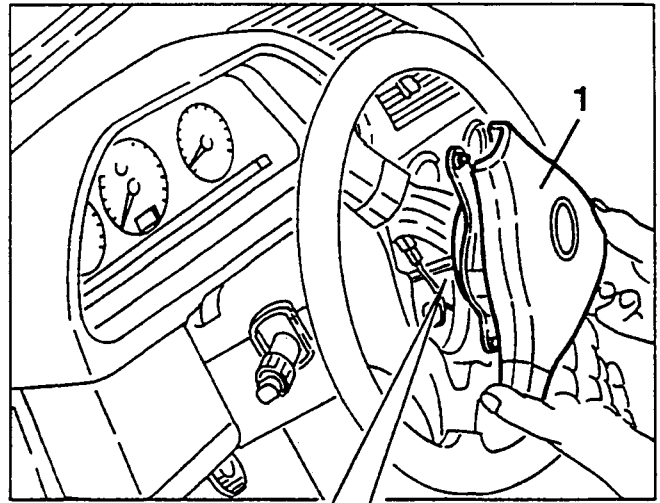
Operations on Air Bag components must be carried out by suitably trained personnel, CLOSELY adhering to the safety instructions given below.

- For removal or replacement operations it is always necessary to use polyethylene gloves and protective goggles.
- Before disconnecting the Air Bag, disconnect the battery terminals, isolate them suitably and wait for 10 minutes.
- Non usare fiamme libere nelle vicinanze del dispositivo Air Bag e dei relativi componenti del sistema.
- The single damaged or faulty components must not be repaired or tampered with in any way, they must be wholly replaced.  
For further explanations on the safety instructions, see "Safety Measures" at the beginning of this chapter.

1. Slacken the the 5mm hexagon socket screws a 5 mm in the rear of the steering wheel.



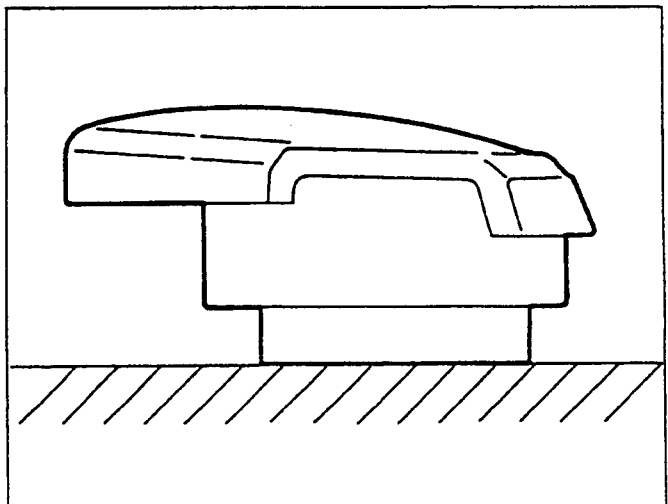
1. Withdraw the Air Bag module just enough to disconnect white, two-way electrical connection, then move it.



### WARNING:

Air Bags not deployed after removal, should be immediately placed in a special cabinet, suitably identified and key-locked.

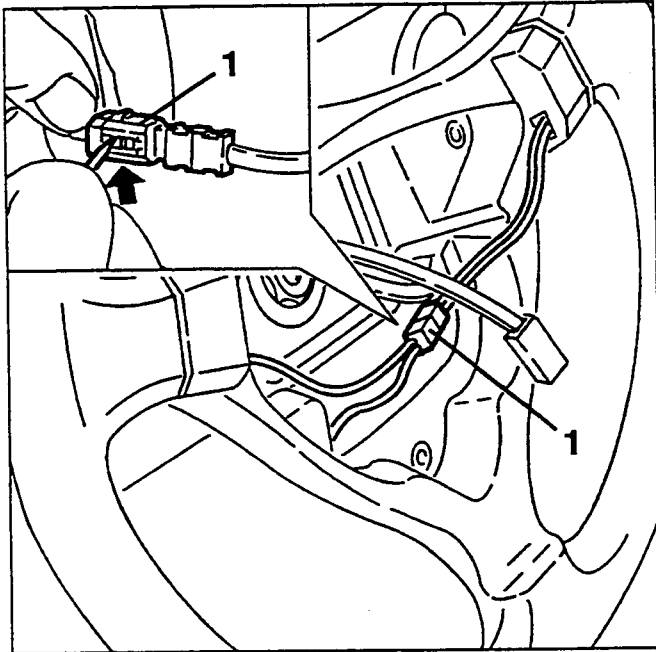
The figure below shows how to place the module with the metal part resting on the shelf.





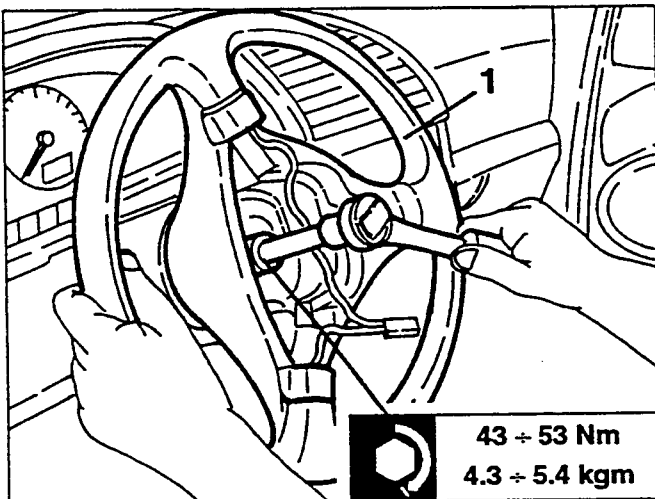
Remove the clock spring device after removing the driver's side Air Bag module proceeding as follows.

1. Disconnect the two-way black electrical connection for supplying the horns working on the tab as illustrated.

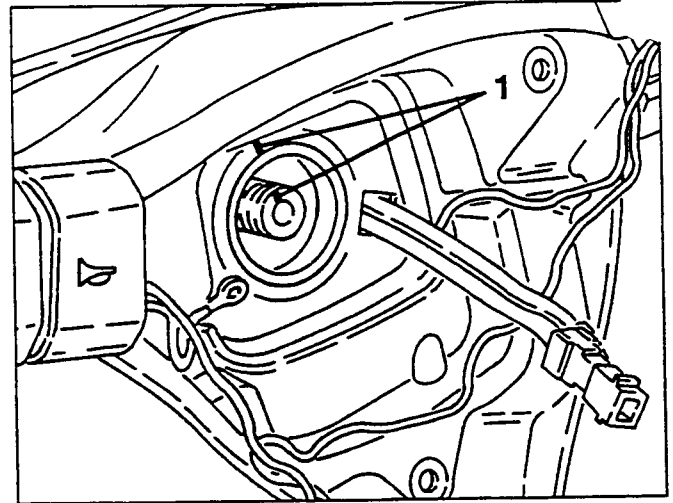


**WARNING:**  
Set the car with the wheels **STRAIGHT** and check that, during the whole operation they remain in this position.

1. Completely back off the nut fastening the steering wheel to the steering column.



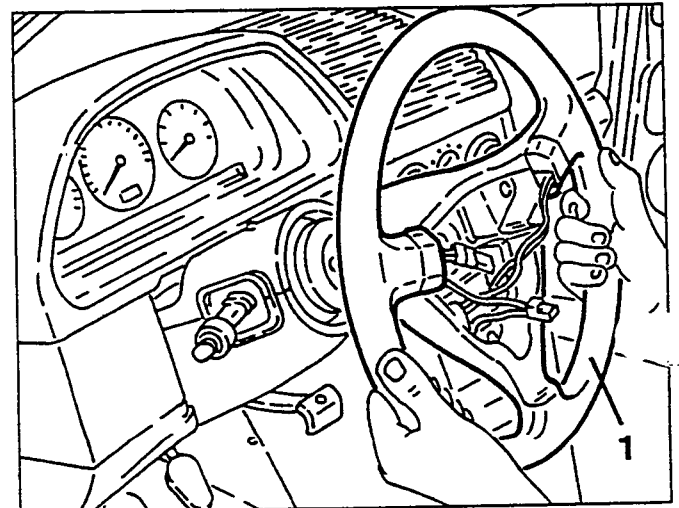
1. Still with the car with the wheels **STRAIGHT**, mark the reciprocal position between the steering wheel hub and the steering column.



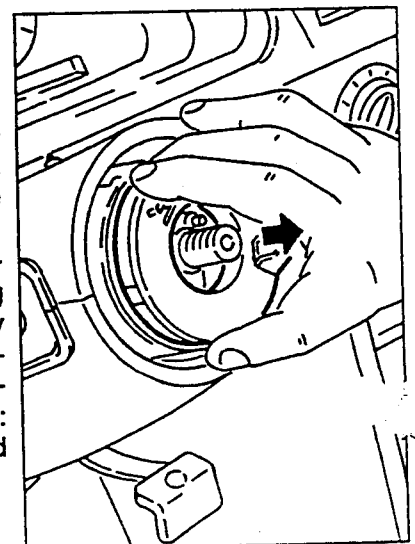
1. Completely remove the steering wheel with the Air Bag module and horn supply cables.



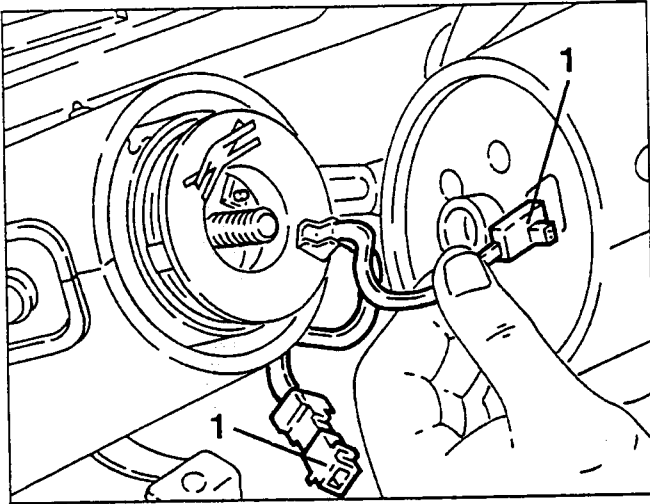
**WARNING:**  
During removal operations take care not to knock the steering wheel violently.



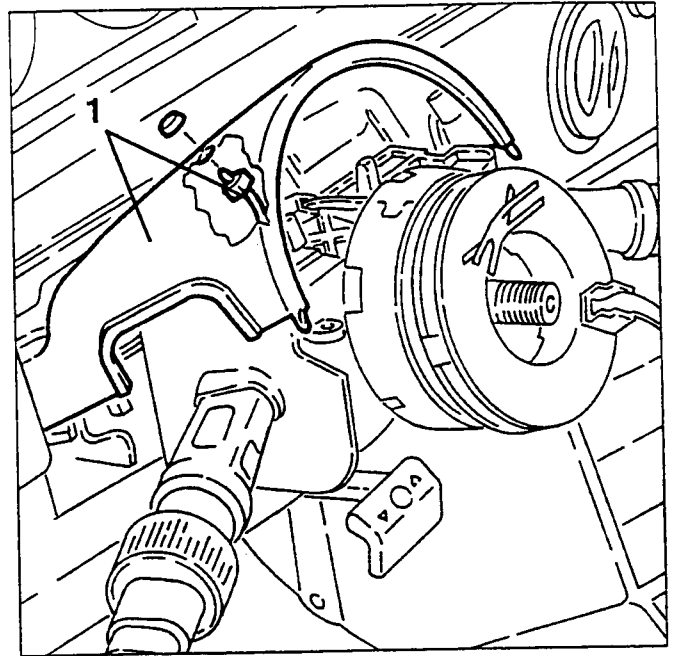
- Make sure that the removal of the steering wheel has raised the upper ring of the clock spring device. If the clock spring device upper spring turns, it is necessary to grasp it diametrically and pull it upwards as illustrated: a click will be heard upon locking.



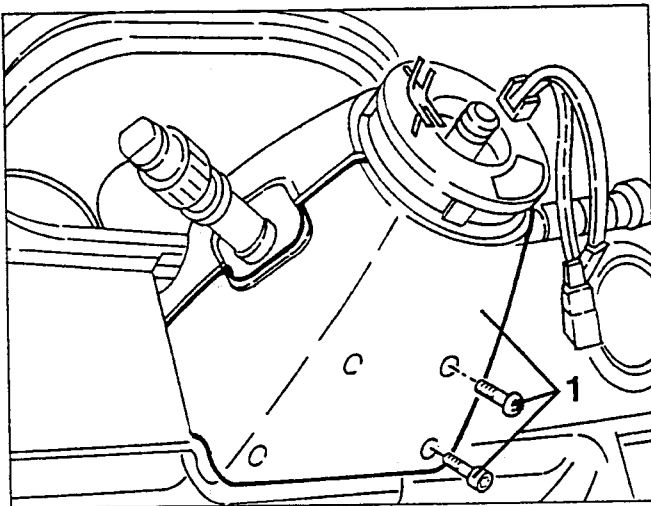
1. From the slot on the steering wheel hub, carefully remove the horn and Air Bag module supply cables.



1. Disconnect the upper half cover just enough to slacken the locknut fastening the alarm system led, then remove the upper half cover.



1. Raise the steering column as far as possible, slacken the four fastening screws (the two at the front of the car are 3mm hexagon socket screws, the two at the rear are cross-slotted) and remove the lower half cover.

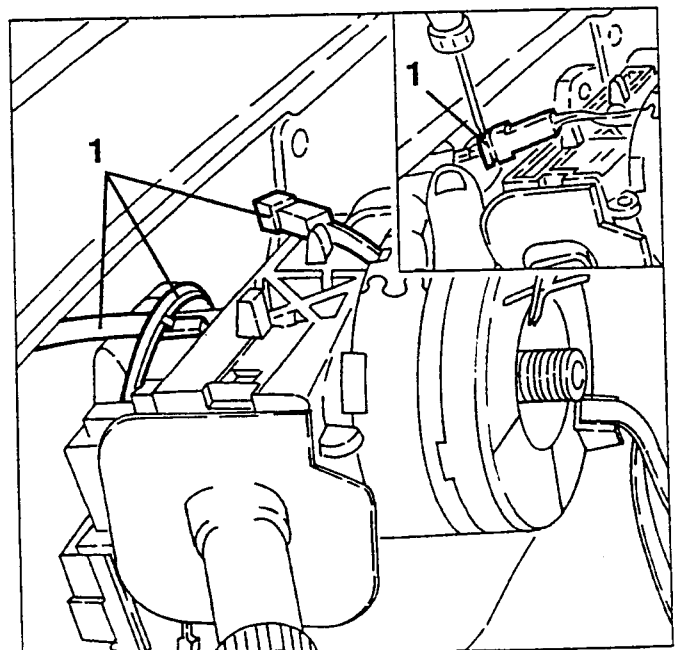
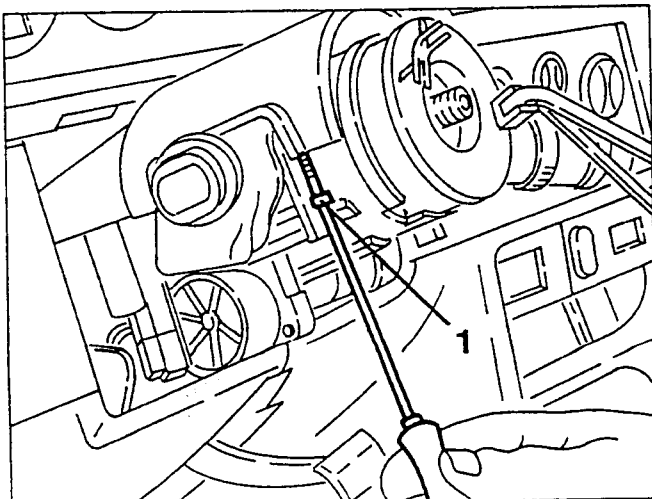


1. Cut the fastening clamp and disconnect the electrical connection of the cable with yellow sheath connecting the Air Bag control unit to the clock spring device.

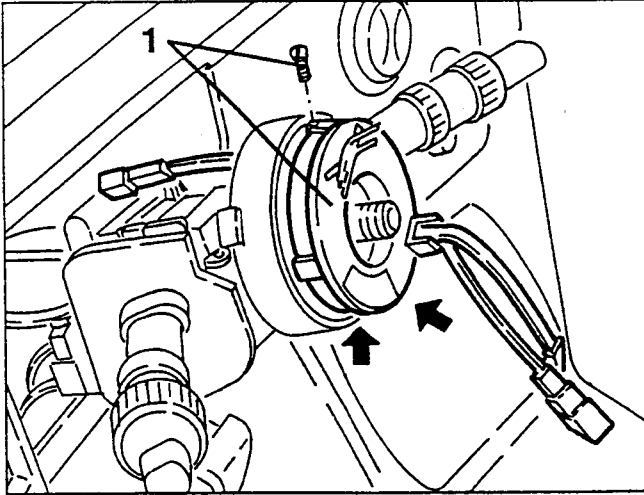


**WARNING:**  
To disconnect the electrical connection always work on the tab and never on the electric cable.

1. Lower the steering column as far as possible and slacken the two upper half cover fastening screws.

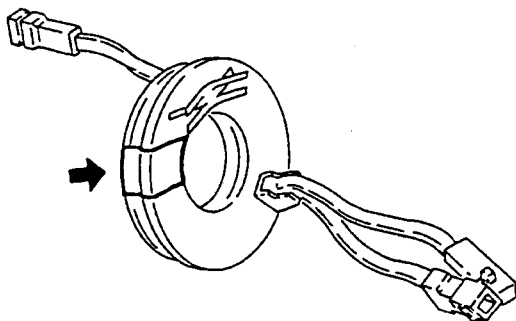


1. Slacken the three screws fastening the clock spring device to the steering column lever unit then remove it.

**WARNING:**

The clock spring device is fitted with a device which automatically prevents it from turning when the steering wheel is removed.

It is necessary to remove the clock spring device without turning the upper ring and, for further safety, holding it in place, with a clamp or adhesive tape.

**REFITTING THE DRIVER'S SIDE MODULE - CLOCK SPRING DEVICE**

**NOTE:** For the illustrations not given here, refer to those given in the removal procedure.

**WARNING:**

Make sure that the wheels are STRAIGHT.

- If it is not necessary to change the clock spring device, assemble it, after removing the adhesive tape or clamp used previously, without turning the upper ring, then tighten the three fastening screws.

**WARNING:**

Should the upper ring of the clock spring device release during assembly, it is sufficient to pull it upwards until it clicks meaning that it has locked.

- When fitting a new clock spring device, after fastening it to the steering column lever unit, tear the plastic tab to lock the upper ring and check that it does not turn; if it does turn, pull the ring upwards until it clicks.

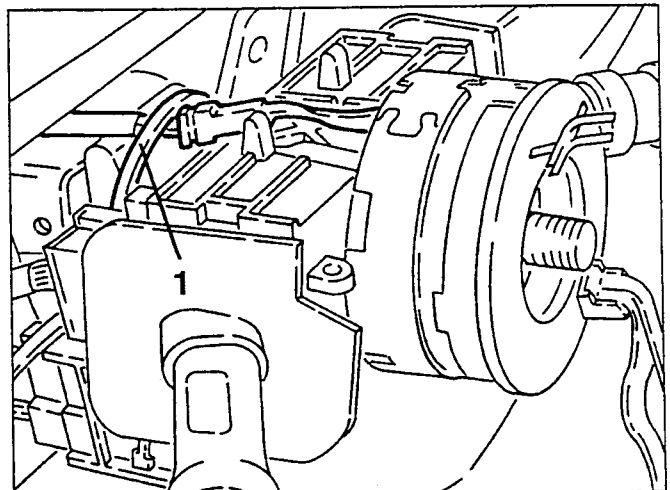
- Completely remove the red guarantee adhesive tape.

**WARNING:**

The failure to or incomplete removal of this tape may cause noise due to interference with the upper section of the steering column lever unit when the steering wheel is turned.

- Connect the electrical connection of the cable with the yellow sheath for connecting the Air Bag control unit to the clock spring device and check that it has coupled.

1. Fasten the above cable to the steering column using a suitable clamp.



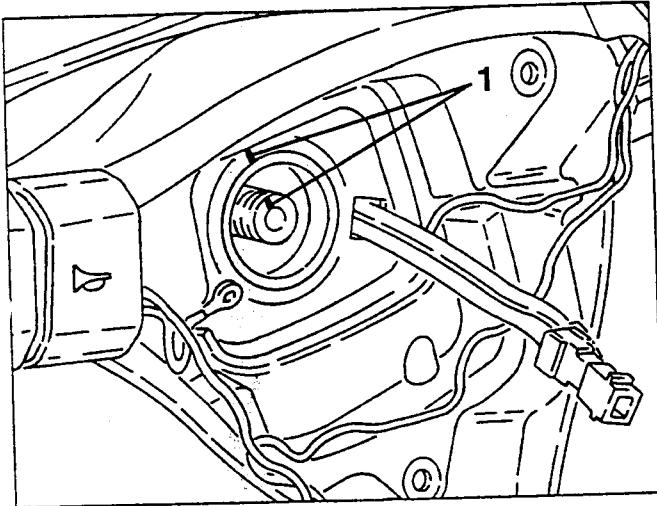
- Assemble the steering column half covers and fasten them with the special screws..

- Through the special slot on the steering wheel hub, carefully insert first the cable with the white connection for supplying the Air Bag module and then the cable with the black connection for supplying the horns.

Engage the ignition key and turn it to prevent the steering lock from engaging.

1. Turn the steering wheel to make the references marked previously coincide.

**NOTE:** Before assembling the steering wheel, position the direction indicator return bushes so that the tooth on it corresponds to the special notch on the steering wheel.



- Push the steering wheel in the taper housing; it will automatically lock the upper ring of the clock spring device.
- Tighten the steering wheel fastening nut to the specified torque.
- Connect the electrical connection for supplying the horns.

**NOTE:** Pass horn cable in the special notches on the edges of the steering wheel to avoid any interferences.

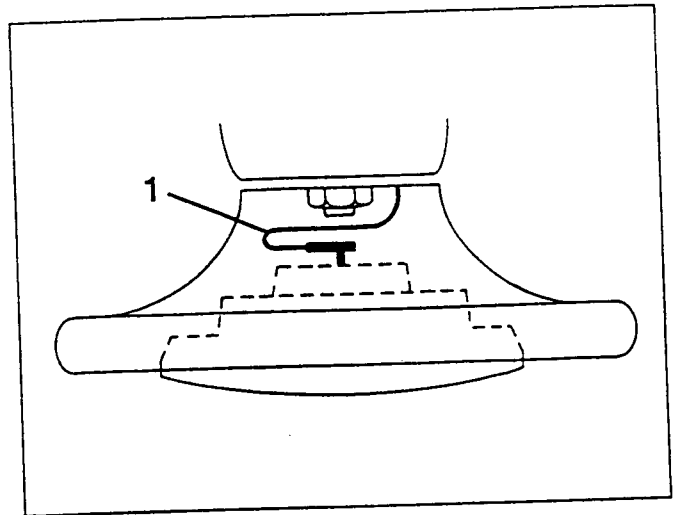
- Reconnect the battery terminals, on the white Air Bag module supply connector, assemble the electrical resistance (2 Ohm), supplied with the Alfa Tester, then using the Tester check that the system is working properly.
- After testing, disconnect the electrical resistance, remove the battery terminals and wait for 10 minutes.

1. Connect the electrical connection to the Air Bag module, then assemble it in its housing checking that the cable follows the routing illustrated.



**WARNING:**  
Before making the electrical connection of the Air Bag the ignition key must be in the OFF position.

- Fasten the Air Bag module tightening the three fastening screws



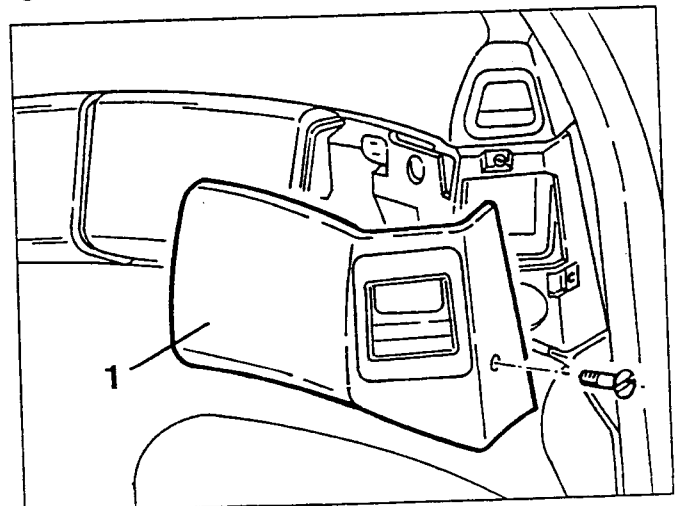
### REMOVING/REFITTING THE PASSENGER'S SIDE MODULE

Work on components of the Air Bag must be carried out by suitably trained personnel, CLOSELY adhering to the safety instructions given below.

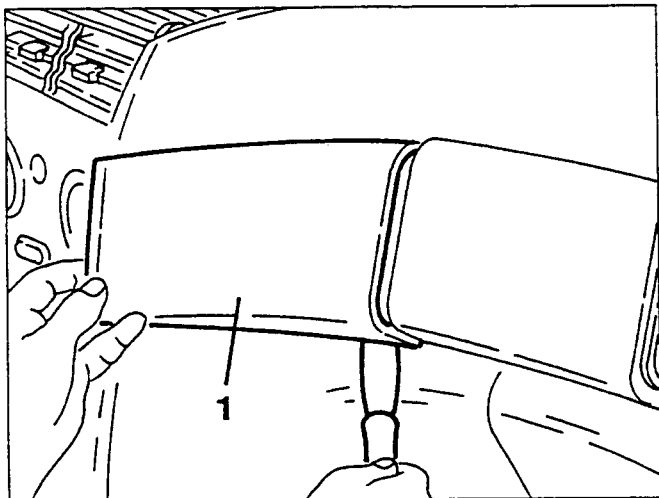
- For removal or replacement operations polyethylene gloves and protective goggles must be used.
- Before removing the Air Bag device, disconnect the battery terminals, suitably isolate them and wait for 10 minutes.
- Do not use naked flames in the vicinity of the Air Bag and other components of the system.
- Single damaged or faulty components must not be repaired or tampered with, they must be changed wholly.

For further explanations on the safety instructions see "Safety Measures" at the beginning of this chapter

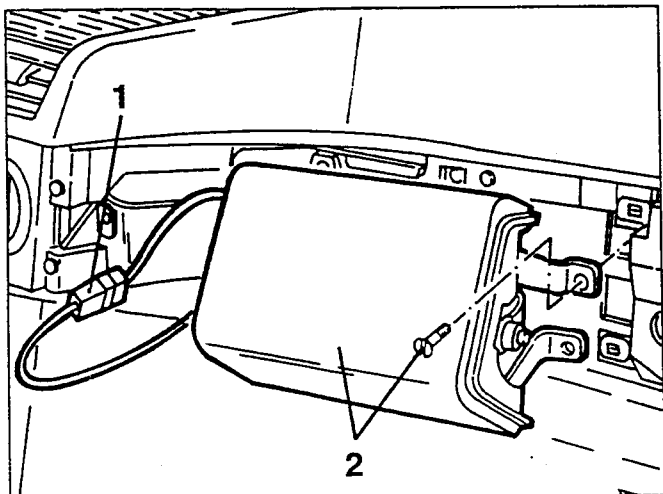
1. Slacken the fastening screw, then remove the right-hand trim.



1. Prise and remove the left-hand trim.



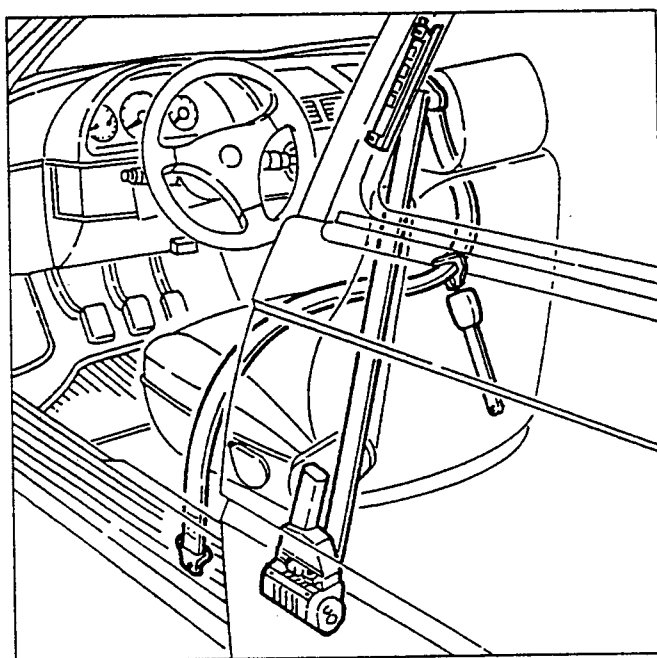
1. Disconnect the electrical connection of the passenger side Air Bag module.  
2. Slacken the fastening screws and remove the passenger side Air Bag module.



The seat belts must adhere as closely as possible to the wearer in order to gradually absorb the kinetic energy to which he is subject during impact. The main reasons for which the seat belts may not always press the wearer towards the seat back during an impact are mainly due to:

- a delay in the intervention of the inertial locking device;
- stretching of the fibers in the seat belt;
- spooling effect;
- clothes of a certain thickness which create an excessive space between the belt and the thorax.

Combining all these causes it can easily be seen that the seat belt may only become effective as a restraining device after the wearer has moved some distance forwards.



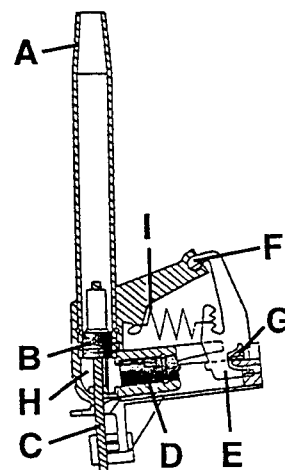
## FRONT SEAT BELT PRE-TENSIONING DEVICES

### DESCRIPTION

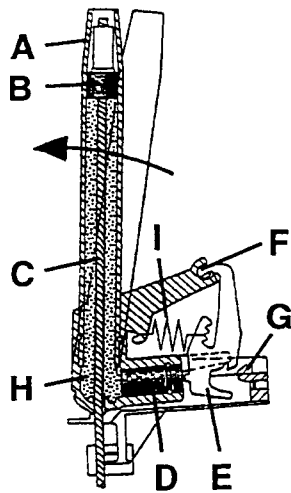
The seat belt pre-tensioners are devices which are integrated in the rewinding mechanisms and which, during an impact, take up the slack caused by the weight of the wearer so that he or she is pressed firmly against the back of the seat. A second device makes it possible to activate the pretensioner only when the seat belt is fastened. Knocks (other than those caused by irregularities in the road surface of bumping over kerb stones etc.), vibration or heat applied to the pre-tensioners may cause their activation. Seat belt pre-tensioners are pyrotechnical devices which are commanded mechanically to intervene during impact, to take up the slack in the seat belt caused by the pressure of the wearer's body.

### PRINCIPLES OF OPERATION

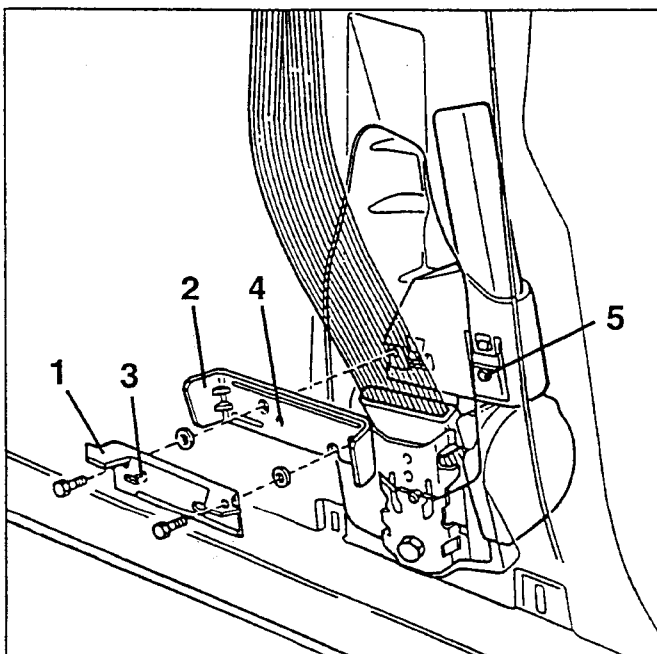
The operation of these devices is based on the inertia force which arises during deceleration on the vehicle in relation to the mass of the cylinder-piston assembly. Lever A is hinged onto the piston-cylinder assembly on pin F. When in the rest position this lever is subject to the tension exercised by spring I and locked by tooth G. When, following impact, the force of inertia acting on the mass of the assembly A overcomes force I, the assembly rotates slightly and frees the lever E from tooth G.



The lever, pulled by spring I acts as a percussion head to trigger charge D. The gas freed by combustion, which is for the most part harmless nitrogen, pushes piston B along tube A. The piston tows the steel cable C behind it which is fixed to the other end of the seat belt rewinding device, causing it to rewind to a degree suited to the variable factors of vehicle type and speed of impact. Following its intervention the seat belt is locked thus signalling that the device has in fact intervened.



To prevent the device from being triggered if an inertia reel is removed, it is fitted with a security or arming system which locks the deceleration sensor/trigger mechanism.



1. Outer arming bracket
2. Inner bracket
3. Centering pin
4. Centering hole
5. Inner bracket retainer pin

## REMOVING/REFITTING ARMING BRACKET

When removing/refitting the arming bracket, the sequence given below must be strictly adhered to.



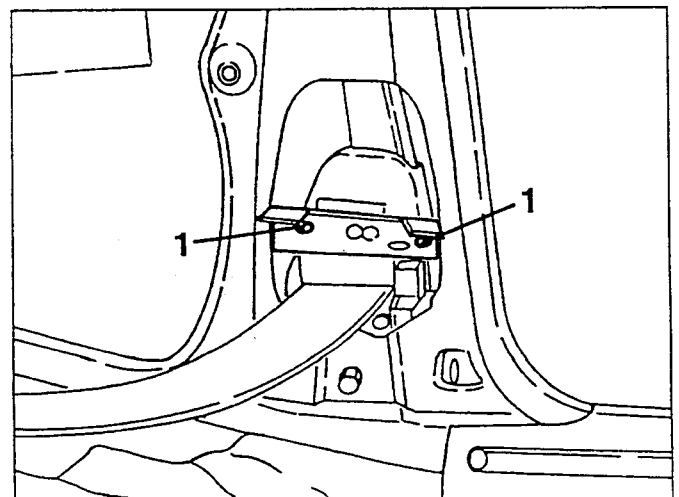
### WARNING:

The removal of the arming bracket is the only way to prevent the pyrotechnic device from being triggered accidentally. This procedure must therefore be carried out every time mechanical or body servicing operations on the car might cause the device to be operated by accident; the arming rod must absolutely be removed to obtain the necessary security conditions before proceeding with removal of the inertia reel - belt pretensioner unit, and also when handling and refitting. The arming bracket must **ALWAYS** be refitted **ONLY WITH THE INERTIA REEL - PRETENSIONER UNIT FITTED ON THE CAR**, in order to prevent any harm to personnel.

**NOTE:** The arming bracket comprises an inner bracket and an outer arming bracket which improve fastening the inertia reel - pretensioner unit to the pillar.

- Remove the sill (see specific paragraph).
- Remove the side panel (see specific paragraph).
- check that the paint applied to the inertia reel/pretensioner unit is intact meaning that the components have been installed correctly; check the way this paint is applied to restore the same conditions after assembly of the arming bracket.

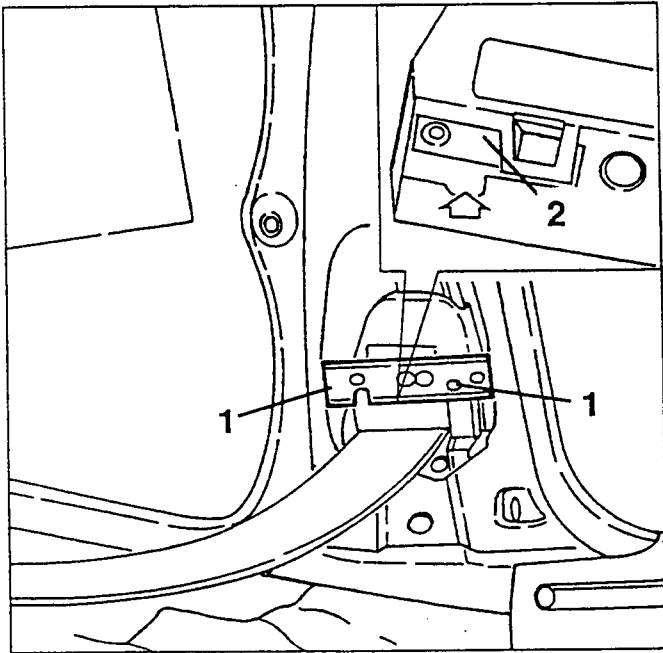
1. Slacken the two fastening screws and remove the outer arming bracket.



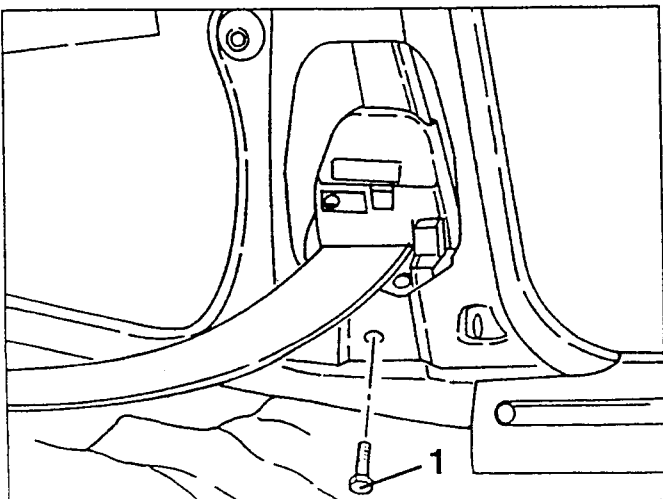
1. Separate the inner bracket from the retainer pin on the reel, then take it off the pillar.
2. Through the special window, make sure that the safety device has been engaged, checking that the spring indicated by the arrow has returned to the rest position against the pretensioner cover; if not, suspend the procedure and be very careful because the device might be triggered.



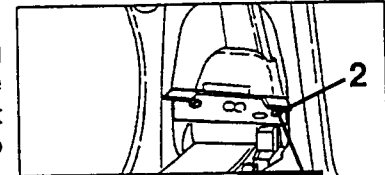
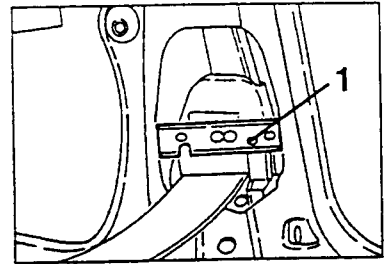
**WARNING:**  
The operator must be suitably protected (polyethylene gloves, safety goggles and ear muffs), never go close to the device with the face and he must keep as far away as possible when carrying out the operation.



1. Slacken the screw fastening the inertial reel - pretensioner unit to the pillar.



1. Position the inner bracket in its housing in the pillar, inserting it in the retainer pin.
2. Working from outside the pillar, couple the arming bracket on the inner bracket, so that the centering pin is correctly inserted on the corresponding hole, then tighten the outer arming bracket fastening screws to the specified torque.



3.5 Nm



**WARNING:**  
Never use percussion screwdrivers.

- Tighten the screw fastening the inertia reel - pretensioner unit slackened previously to the specified torque of 34 to 42 Nm (3.5 to 4.3 kgm).
- Restore the original seal conditions of the inertia reel - pretensioner unit, suitably painting the areas concerned to warrant that the device is intact and correctly assembled.
- Complete refitting operations reversing the sequence followed for removal.

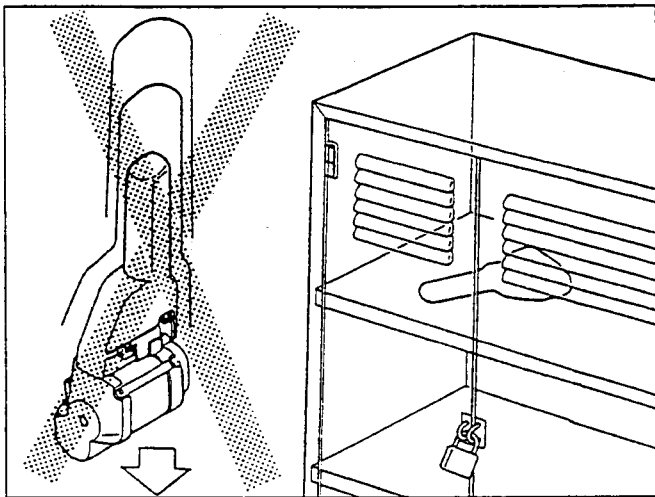
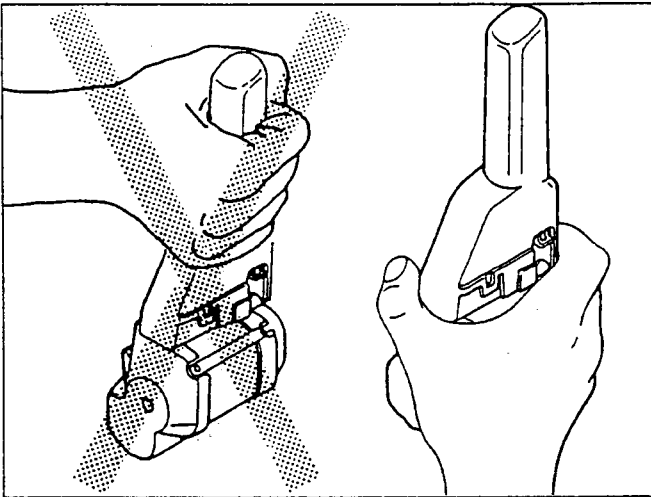
## SAFETY RULES TO BE FOLLOWED FOR SAFETY BELTS WITH PRETENSIONERS



**WARNING:**  
The following rules must ABSOLUTELY be adhered to for the safety of operators, the integrity of the belt unit with pretensioner and in observance of the law explosives.

- When handling a safety belt unit with pretensioner, hold it as shown in the figure.
- NEVER hold the unit by the lever.
- ALWAYS remove the arming lever before disassembly.
- Never drop the unit or subject it to shocks.
- When operations on the car require its temporary removal, the unit should be stored in a key-lockable metal cabinet as required by law.

- Do not carry out repairs on the pretensioner, apply only to the Service Network for its replacement.



**WARNING:**

The pretensioner requires no maintenance whatsoever and must absolutely never be lubricated.

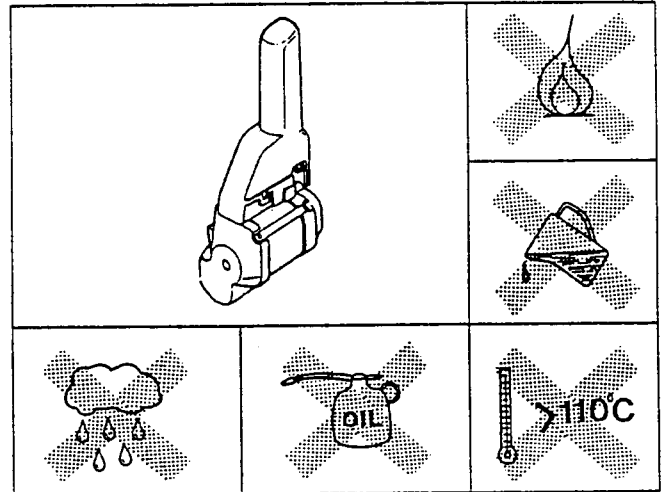
Any attempt to change its original conditions will invalidate its efficiency.

- Never allow naked flames, fluids, solvents or lubricants near the device.
- Do not expose it to temperatures above 110°C.
- When needing to handle a device that has been triggered, use polyethylene gloves and protective goggles.
- If the device has been triggered, ALWAYS wait for at least 30 minutes from activation before doing any type of work on it.
- Wash your hands with soap and water after handling the device.



**WARNING:**

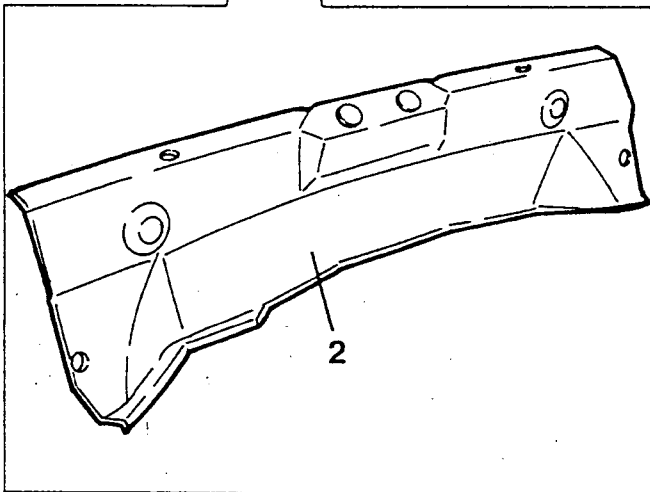
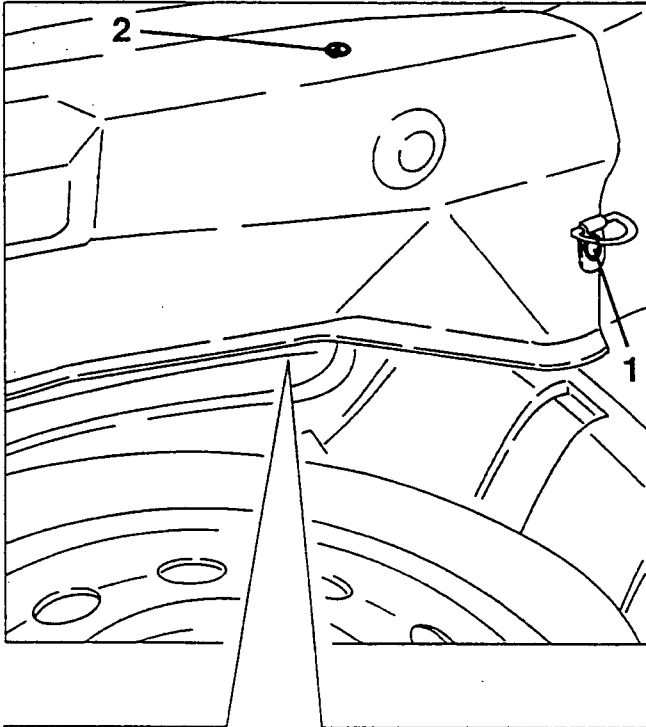
If due to exceptional events (floods, sea storms, etc.) water and mud reach such a level as to involve the components of the device, it must absolutely be replaced.



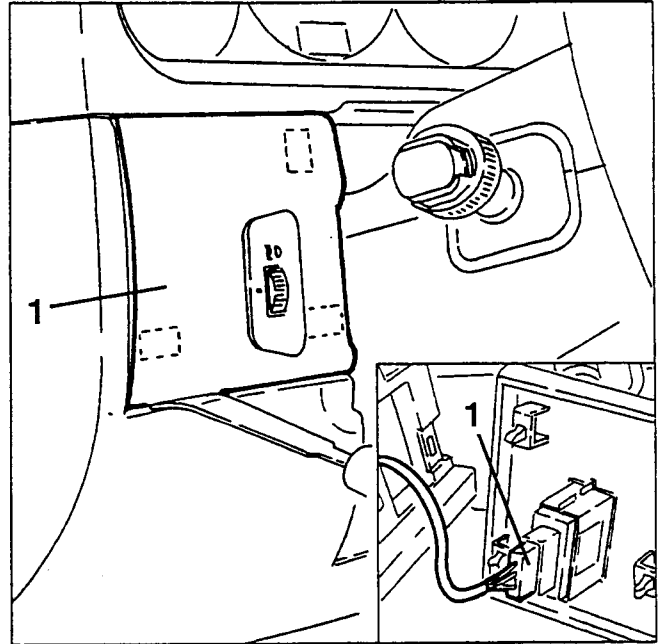


**LUGGAGE GUARD****REMOVING/REFITTING**

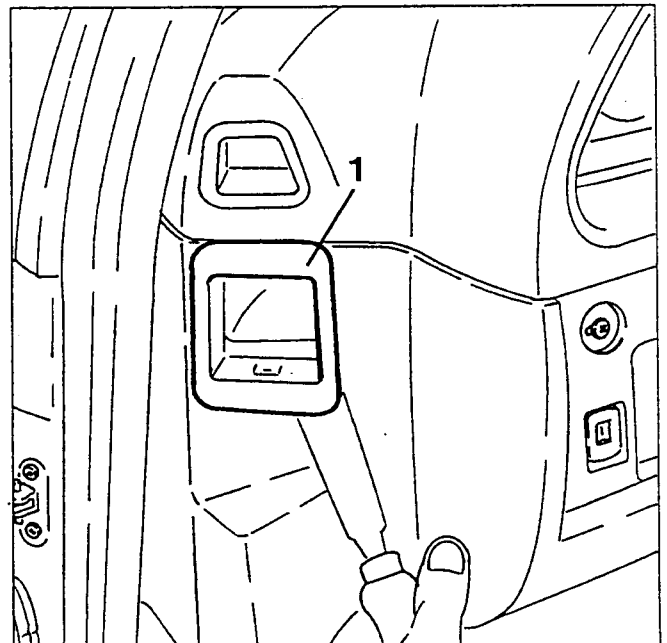
1. Working from the luggage compartment, prise the two plastic rivets fastening the luggage check strap.
2. Slacken the two fastening screws and remove the luggage guard.

**FUSEBOX COVER TRIM****REMOVING/REFITTING**

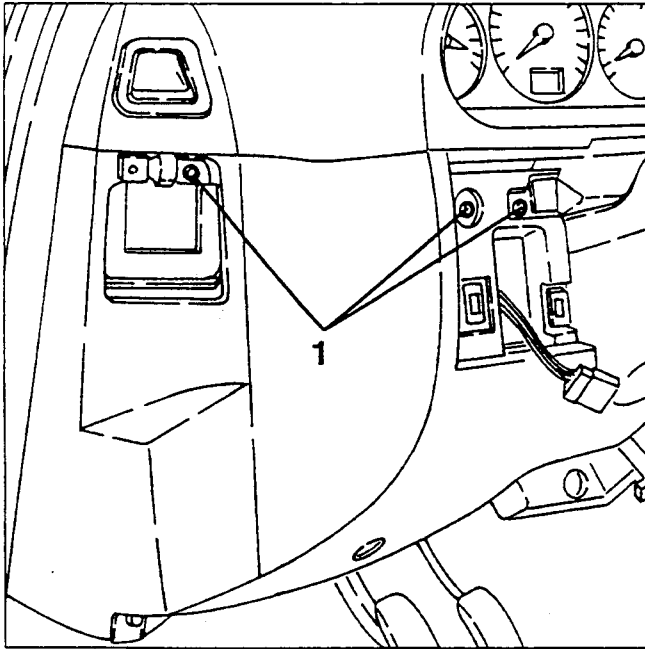
- Disconnect the battery (-) terminal.
1. Prise the dashboard left hand trim and move it back just enough to disconnect the electrical connection from the headlamp aiming device switch, then remove it.



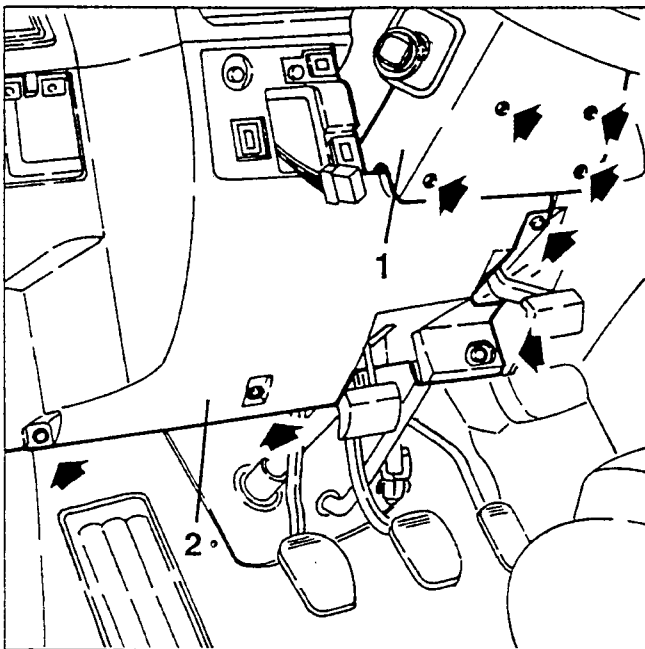
1. Remove the air delivery vent to the driver's door from the dashboard.



1. Slacken the three upper screws fastening the fuse-box cover trim.



1. Slacken the four fastening screws and remove the steering column lower half box.  
2. Slacken the four lower screws fastening the fuse-box cover trim and remove it.

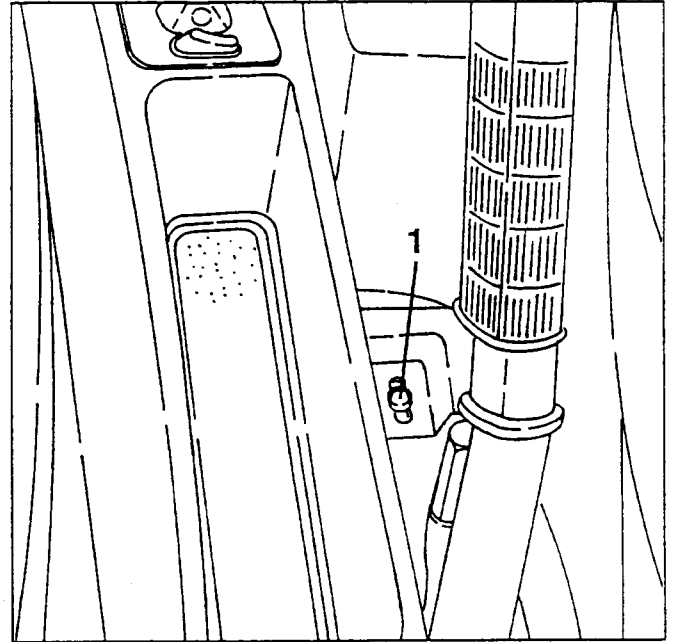


## CENTRE CONSOLE

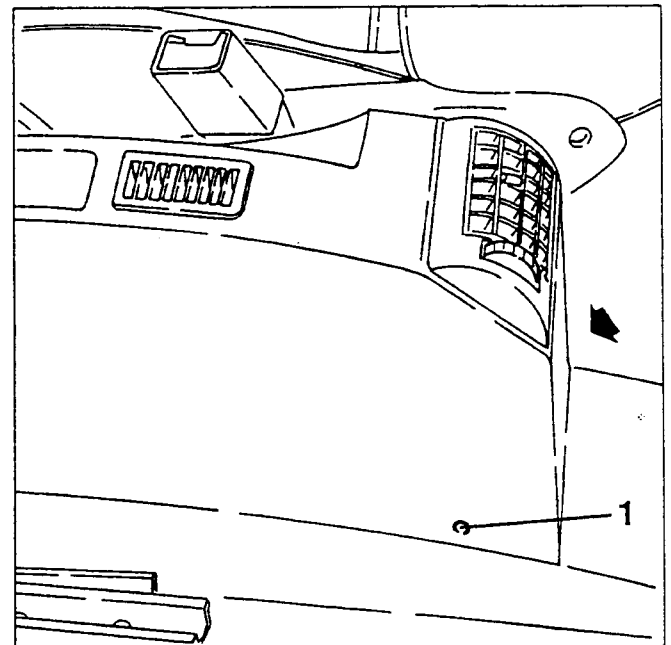
### REMOVING/REFITTING

- Disconnect the battery (-) terminal.

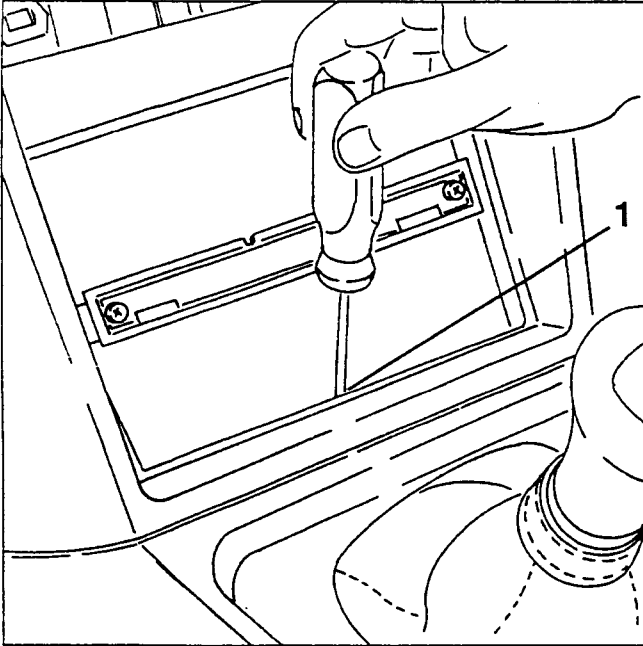
1. Remove the protective cover from the handbrake lever, then slacken the screw below fastening the centre console.



1. Slacken the two rear screws fastening the centre console.

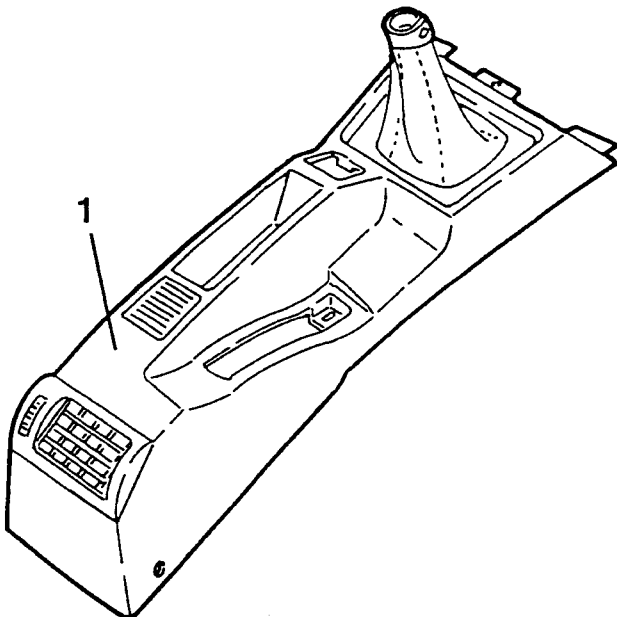


1. Remove the glovebox from the lower part of the dashboard and slacken the centre console front screw.



- Remove the wing mirror adjustment switch from the centre console, then remove it after disconnecting the associated electrical connection.

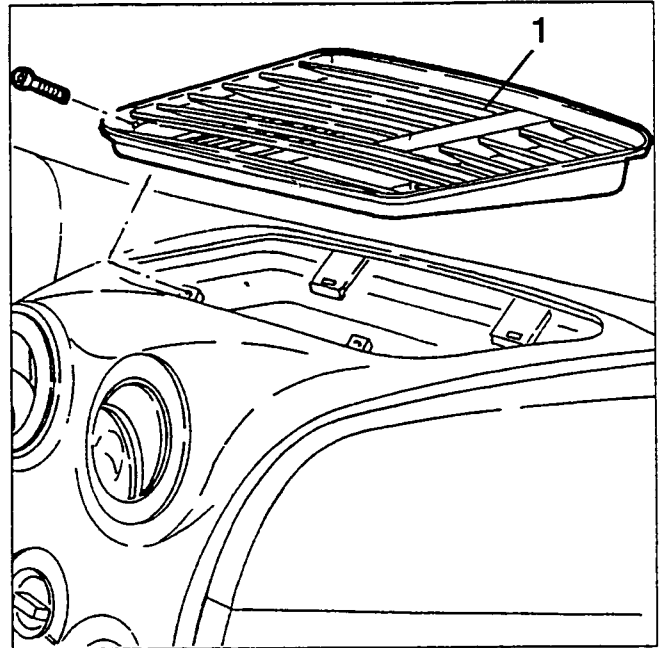
1. Release the gearshift lever from its protective cover and remove the centre console.



## AIR VENT ON DASHBOARD

### REMOVING/REFITTING

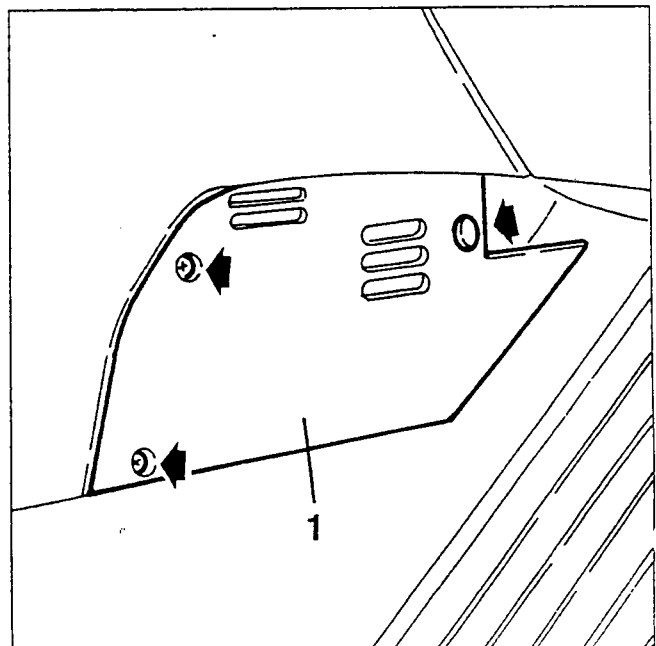
1. Slacken the two fastening screws, then prise and remove the air vent from the dashboard.



## FOOT LEVEL AIR VENT TRIMS

### REMOVING/REFITTING

1. Slacken the two fastening screws, prise the plastic rivet, then remove the foot level air vent trims.

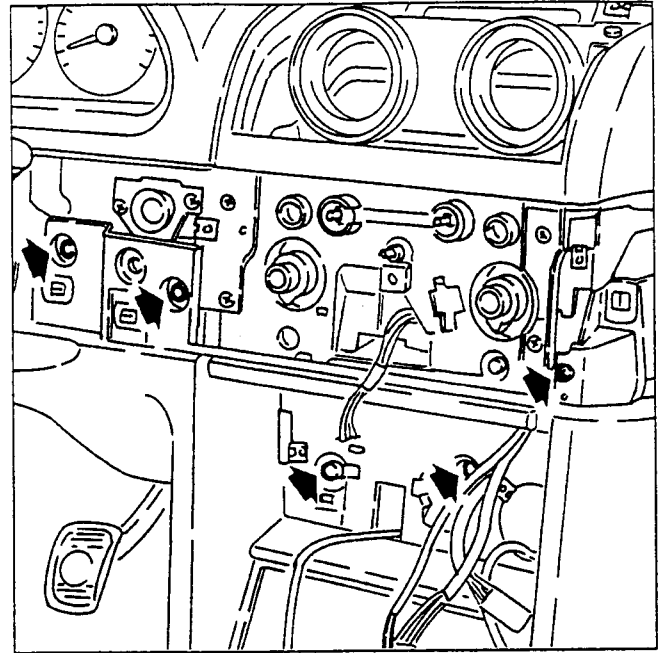
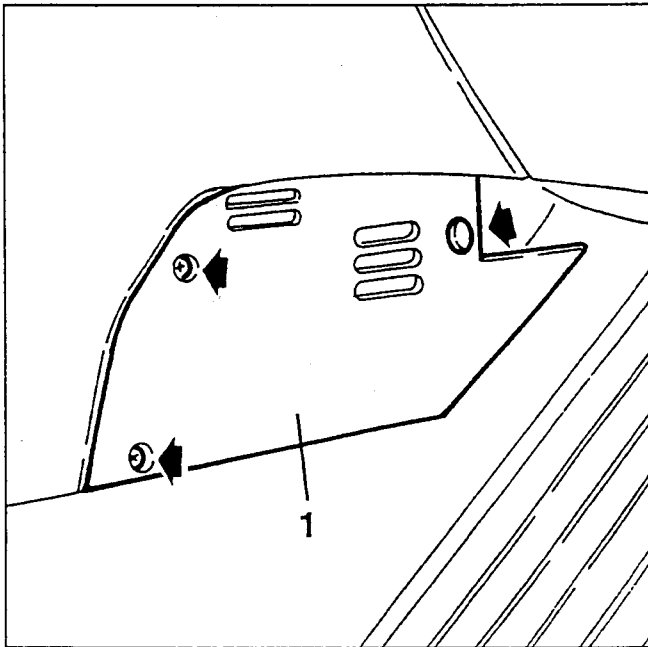


## DASHBOARD

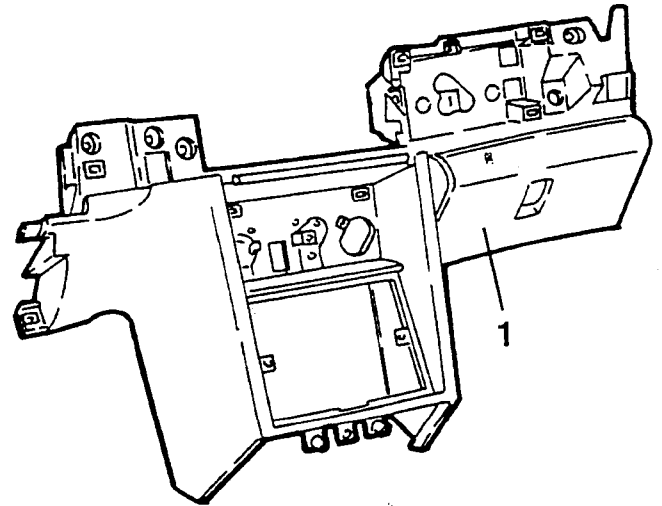
### REMOVING/REFITTING

- Disconnect the battery (-) terminal.
- Remove the centre console (see specific paragraph).
- Remove the fusebox cover trim (see specific paragraph).
- Remove the climate control system controls module (see GROUP 50).

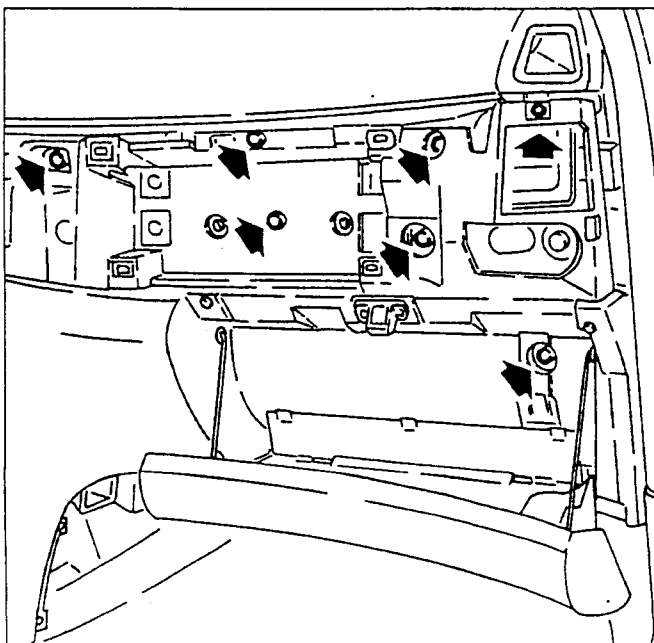
1. Slacken the two fastening screws, prise the plastic rivet, then remove the foot level air vent trims.



1. Remove the lower part of the dashboard.



- Slacken the screws fastening the lower part of the dashboard.

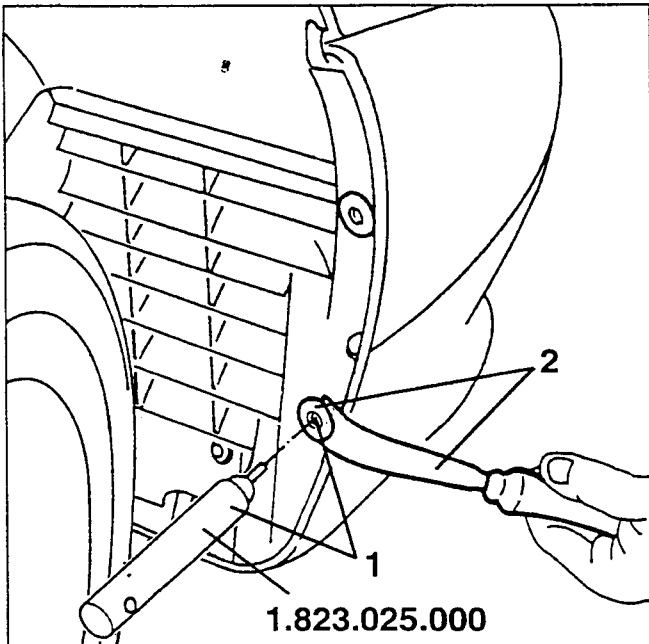


Complete removal of the dashboard (upper part), proceeding as described in the procedure "DASHBOARD - Removing/Refitting" for the previous versions.

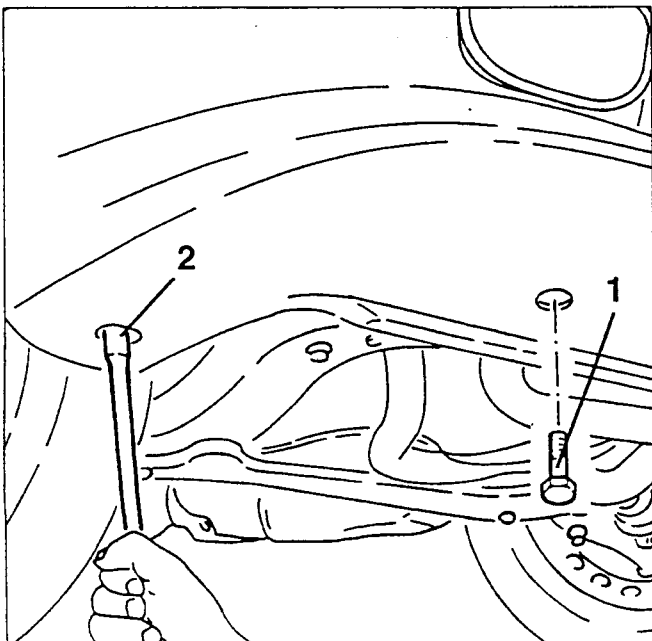
## FRONT BUMPER

### REMOVING/REFITTING

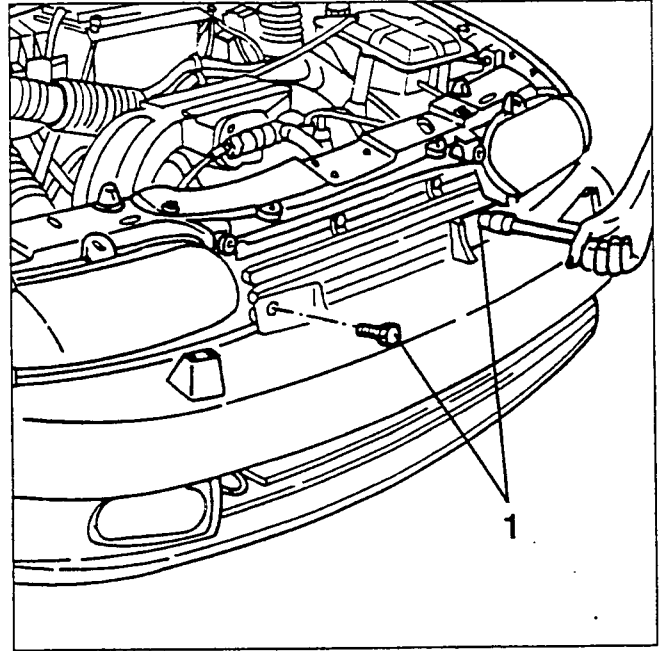
- Disconnect the battery (-) terminal.
  - Remove the radiator grille (see specific paragraph).
1. Using tool no. 1.823.025.000 release the catches of the centre part from the plastic rivets fastening the side bumper to the gravel guard.
  2. Remove the above-mentioned rivets using the special tool.



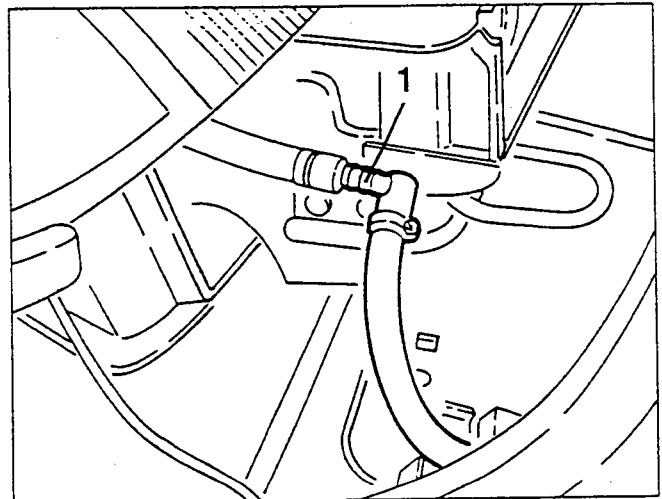
1. Slacken the two lower fastening screws illustrated.
2. Slacken the two lower bumper fastening screws illustrated.



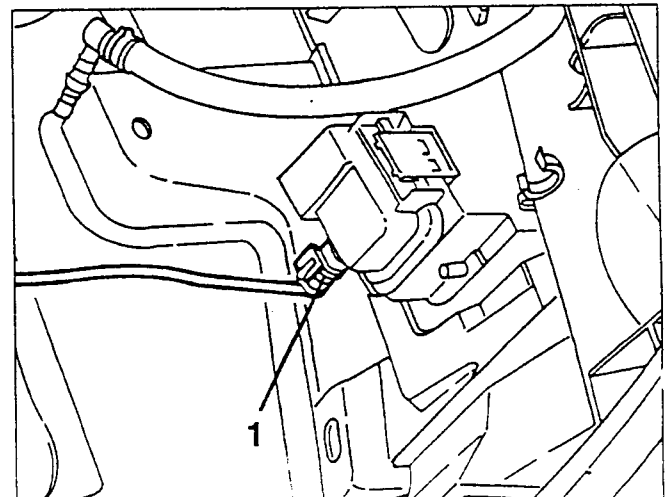
1. Slacken the two upper bumper fastening screws.



1. Move away the bumper just enough to disconnect the headlamp washer pipe connection.



1. Disconnect the electrical connections from the fog lamps.

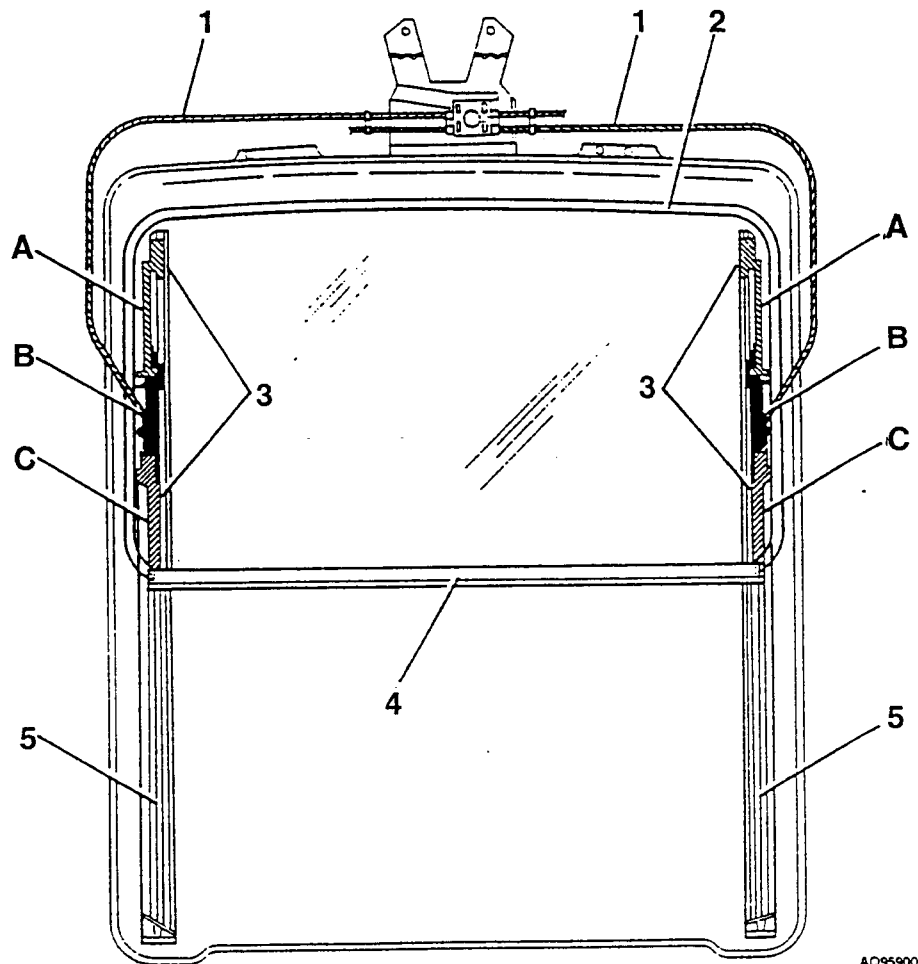


The sliding guides (5) are fastened at the two sides of the glass holder frame. Three runners are inserted in each guide: a front one (A), an intermediate one (B) and a rear one (C). The intermediate runners are connected to the flexible racks (1) and their purpose is to draw the entire kynematism; the brackets (3) carrying the sunroof are fastened to the front and rear runners; therefore, the

brackets are the interconnection between runners A and C.

The rear runners cause "quarterlight" opening of the sunroof and move the mobile rib (4) during complete opening and closing.

During the latter the rib opens the sunshade, if this has been closed.



AQ95900

- A. Front runner
- B. Intermediate runner
- C. Rear runner
- 1. Flexible rack
- 2. Glass holder frame
- 3. Bracket fastening points
- 4. Mobile rib
- 5. Guide

*Location of main components*

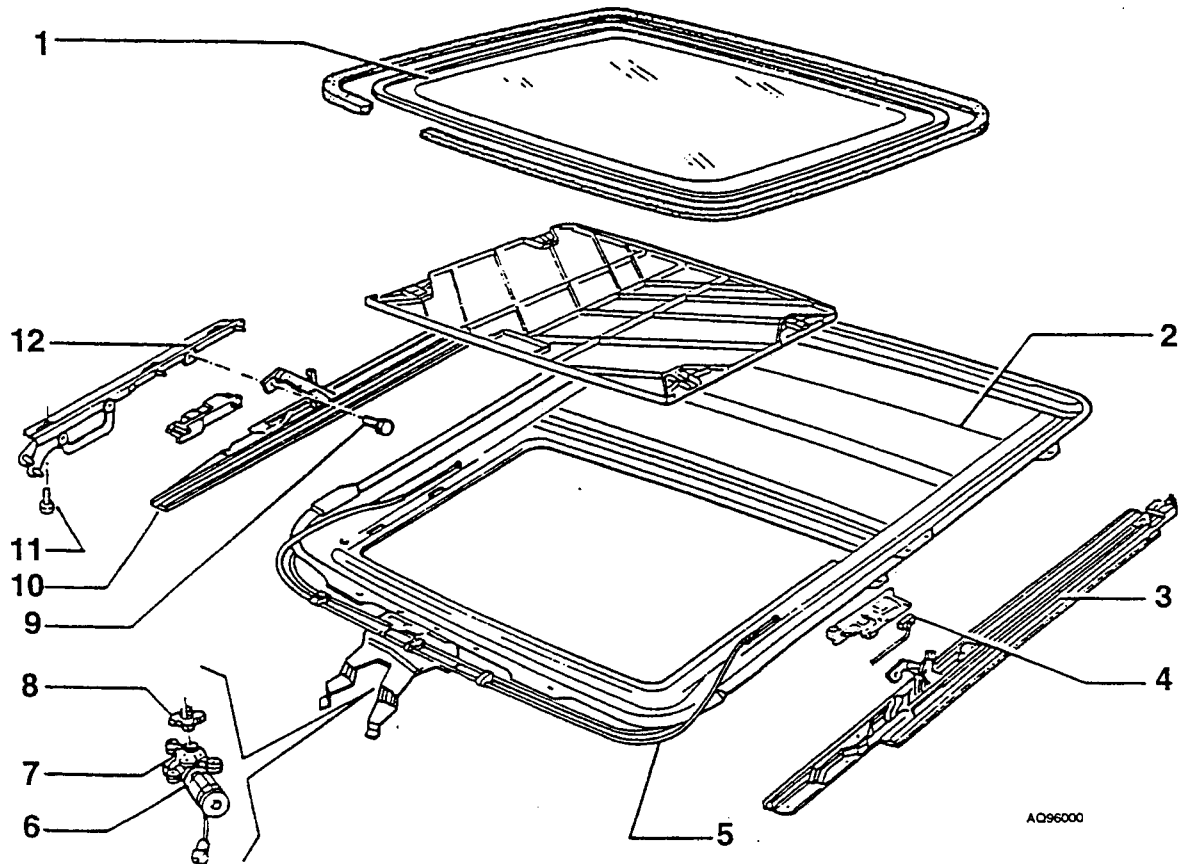
Fastened to the glass holder frame (1) there are two carrier brackets (12) which enable connection with the front and rear runners; the screws (11) fastening the brackets to the glass holder frame are those for lengthwise adjustment of the sunroof position, while the screws (9) fastening the brackets to the runners enable height adjustment.

Under the roof lining, concealed from view, we find the

support frame (2) for guides (3 and 10).

The movement device mainly comprises two flexible racks (5) which pull the runners; the motion is transmitted by the motor (6) to the racks through a driving gear (7) and a gear (8) keyed onto the motion output shaft.

On the left-hand guide (3) there is the stroke limit microswitch (4) which determines the roof closed position by stopping the motor.



- |                         |                                   |
|-------------------------|-----------------------------------|
| 1. Glass holder frame   | 7. Driving gear                   |
| 2. Guides support frame | 8. Gear                           |
| 3. Left-hand guide      | 9. Bracket/runner fastening screw |
| 4. Microswitch          | 10. Right-hand guide              |
| 5. Flexible rack        | 11. Frame bracket fastening screw |
| 6. Motor                | 12. Carrier bracket               |

#### Sunroof components

The cam (1) for connecting the carrier bracket (3) is machined on the front of the runner (A), and the puller pins (4 and 5) which run respectively in cams (6 and 15) are located on the rear.

The runner is connected to the bracket (3) by pin (2) and its movements are determined through this connection. The end of the flexible rack (8) engages on the intermediate runner (B) which draws the complete kynematism.

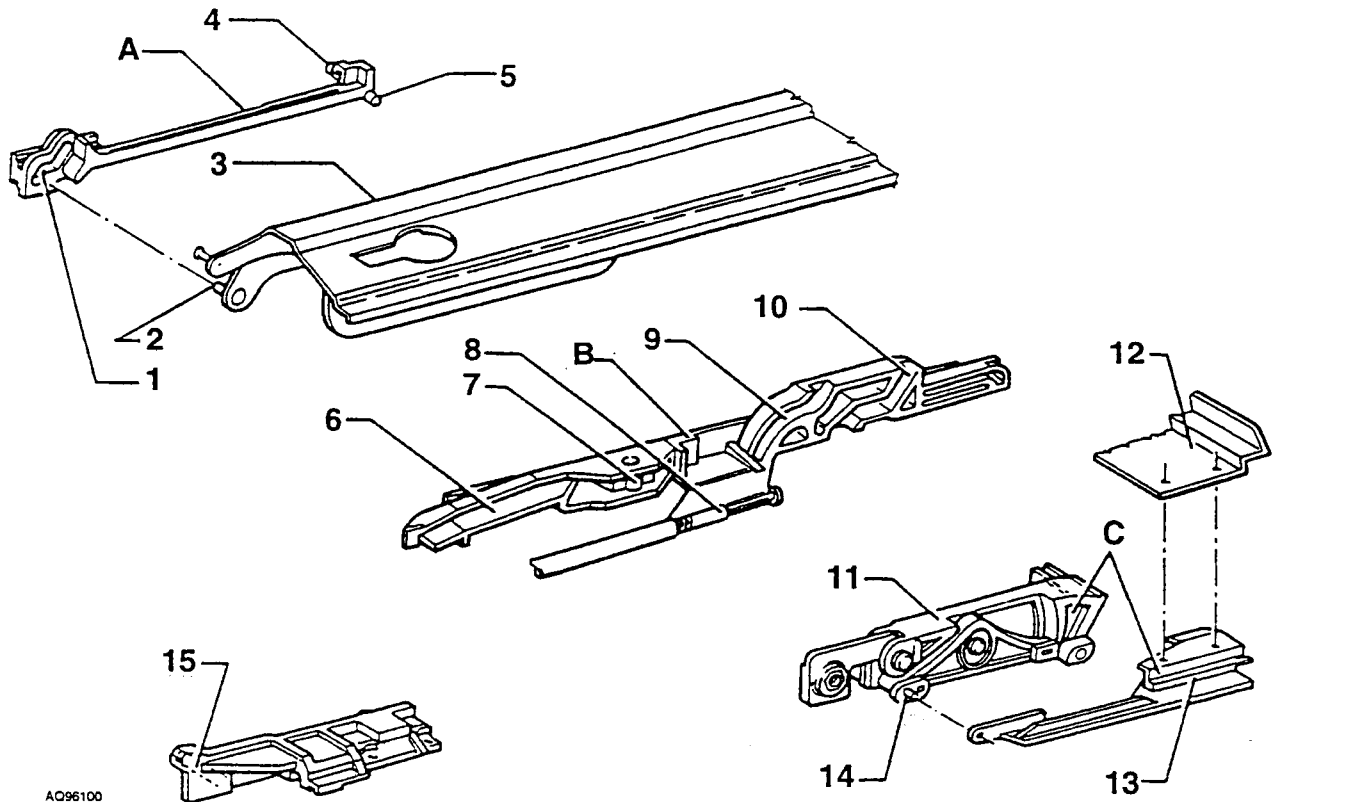
The element (7) for operating the microswitch is positioned

on the left centre runner.

Cams (9 and 10) are machined on the rear section of the runner. These cams determine the movement of the pantograph device (11) located on the rear runner.

The rear runner (C) comprises two components (11 and 13) which are strictly inter-connected by pin (14).

The front section (11) consists of the pantograph device which enables "quarterlight" opening of the sunroof, the rear section (13) is the support for the mobile rib (12) and it is the piece which counters the rear stroke limit.



AQ96100

- |                                         |                              |                                     |
|-----------------------------------------|------------------------------|-------------------------------------|
| A. Front runner                         | 4. Runner "A" inner pin      | 10. Pantograph rear cam             |
| B. Intermediate runner                  | 5. Runner "A" outer pin      | 11. Pantograph (Runner "C")         |
| C. Rear runner                          | 6. Runner "B" front cam      | 12. Mobile rib                      |
| 1. Cam on runner "A"                    | 7. Reference for microswitch | 13. Mobile rib support (Runner "C") |
| 2. Pin connecting bracket to runner "A" | 8. Flexible rack             | 14. Connection pin                  |
| 3. Carrier bracket                      | 9. Pantograph front cam      | 15. Microswitch support cam         |

### Runners

The opening of the roof to the completely open position makes it possible to raise the spoiler (1) which in this position suitably diverts the flow of air.

The spoiler is kept in the lowered position by the sunroof itself when it is closed or in the "quarterlight position", while it is raised by two reaction springs coupled with two shock dampers.

Any water that drips through the glass seal is suitably drained by gutters obtained on the three fixed sides of the frame and on the mobile rib; the gutters are connected to hoses (3) by unions (2) set at the four corners of the

frame.

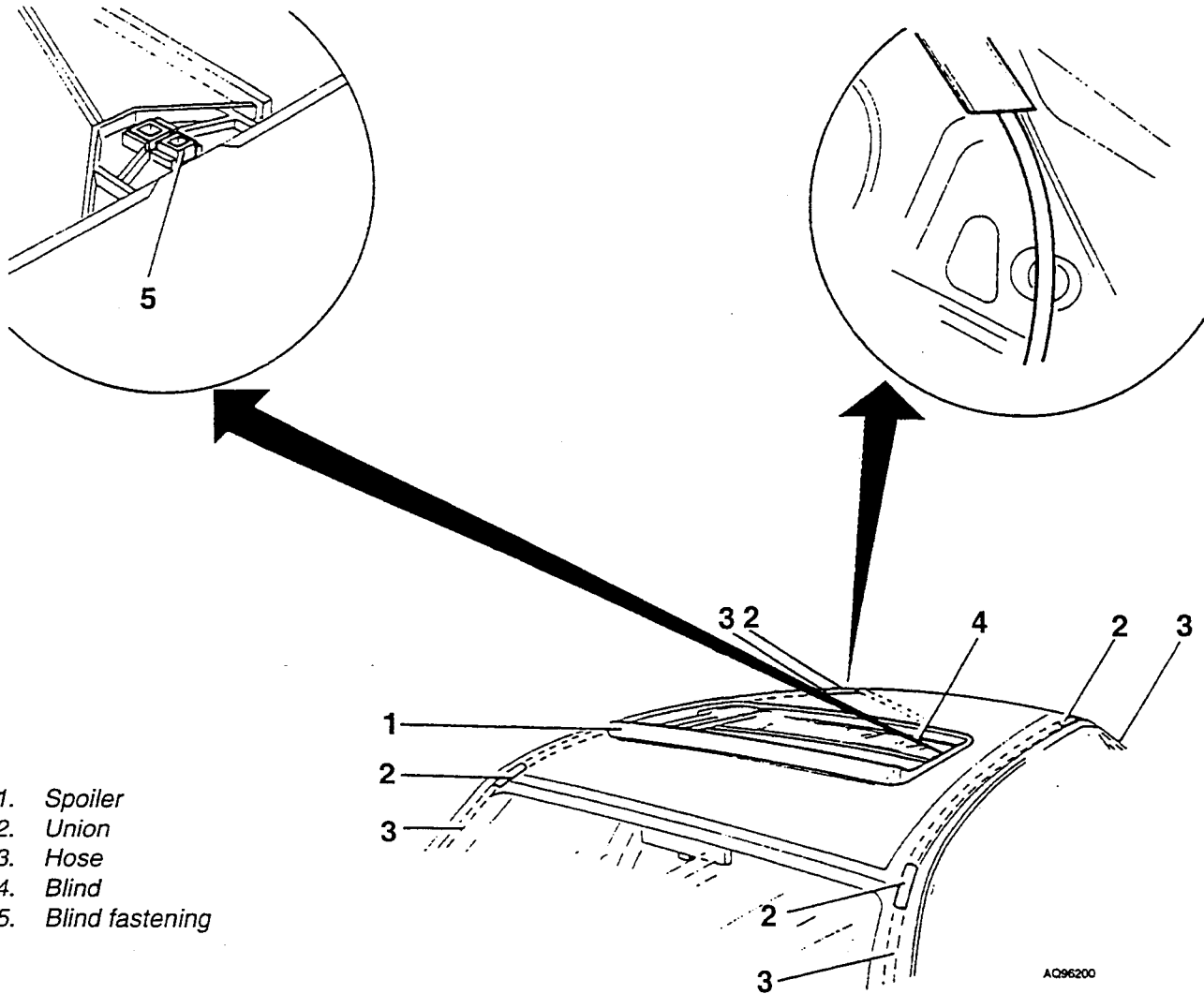
The hoses drain at the front and rear through the engine compartment and boot drains respectively.

The inner sun blind (4) is connected to the frame by four spring fasteners (5); these fasteners act as pads for the running in the guide formed on the frame.

When the sunroof is closed the blind can be drawn by hand.

When the sunroof is opened to the "quarterlight" position, the blind is pulled by the mobile rib into the space between the body and the roof lining.





- 1. Spoiler
- 2. Union
- 3. Hose
- 4. Blind
- 5. Blind fastening

AQ96200

### Drenaggio

### OPERATION

As mentioned previously, the possible movements of the sunroof are two closing strokes and two opening strokes, for the two "quarterlight" and completely open "concealed" conditions the device makes possible.

The following paragraphs illustrate and describe the positions of the system during the complete operating cycle, starting from the sunroof completely open position up to return to the same position through the sunroof

closed and "quarterlight" open positions.

**NOTA: because of the complexity of the device it is advisable to follow the description of how it works observing it directly on the car.**

Pressing the pushbutton, the sunroof moves from the completely open "concealed" position to the closed position.

## Section T0 - T1

During this phase the intermediate runner (B) moved by the rack fastened in (3) pulls the rear runner (C) via pins (6 and 8); the rear runner in turn pushes the front runner (A) by pin (1) of the carrier bracket (2).

Pins (6 and 8) do not run along the profiles of cams (5 and 7) as the counter piece (4), inserted in the guide only allows longitudinal translation of the kynematism.

## Section T1 - T2

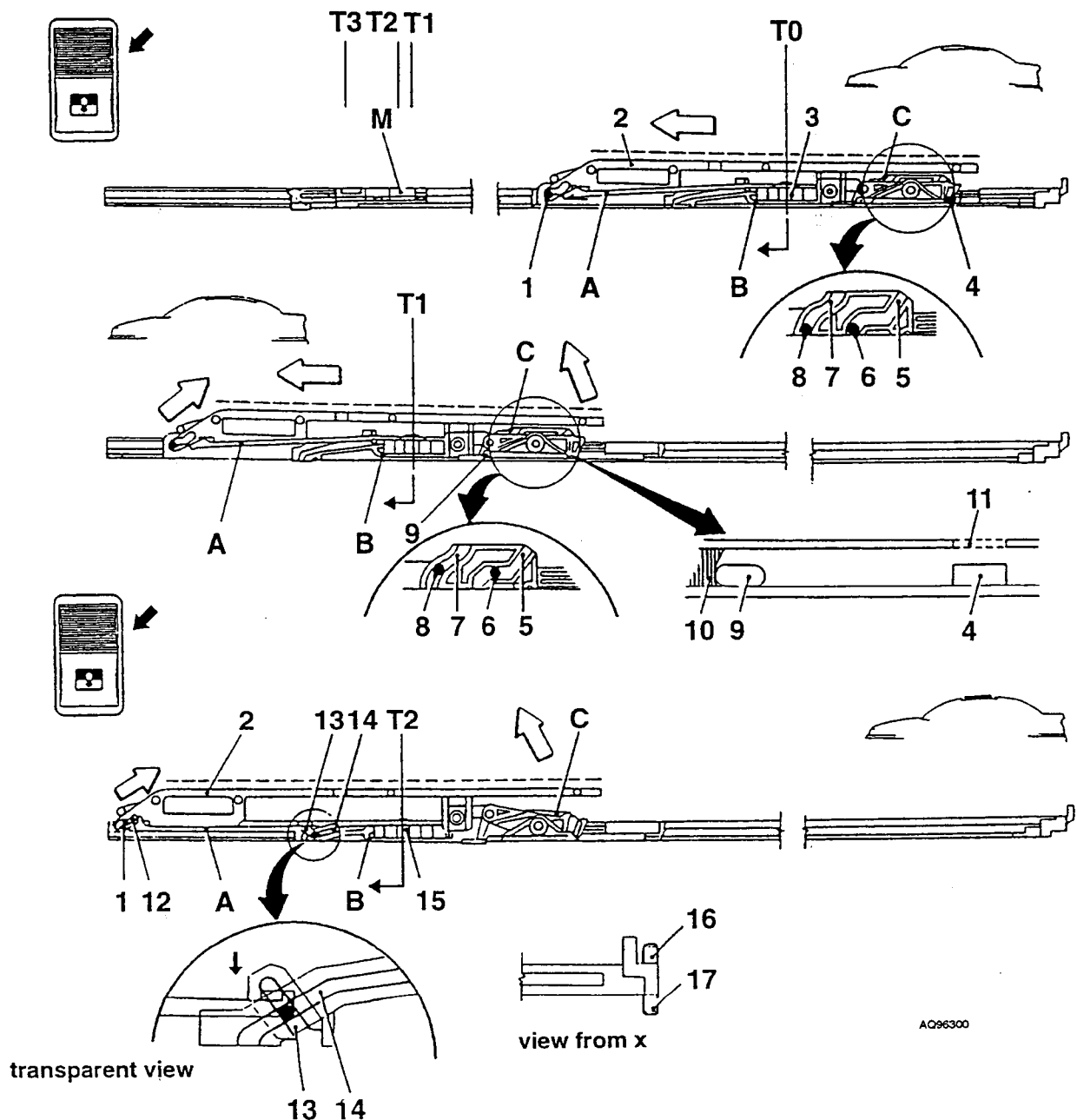
In position T1 the reference (9) of the rear runner (C) reaches its front stroke limit stopping against the stopper (10) on the guide and the counter piece (4) is in

correspondence of slott (11); this way the pantograph device is released, allowing pins (6 and 8) to run respectively along the profile of cams (5 and 7).

The intermediate runner (B) moves along the guide until piece (15) sets itself on the microswitch (M), position T2, causing the motor to stop.

During this section the intermediate runner (B) which pushes the front runner (A) through the combined action of the two cams (14 and 15) on pins (16 and 17).

The motion of the front runner causes the movement of the connection pin (1) of the carrier bracket (2), along the profile of the front cam (12); the action of the pantograph device and the running along the front cam enable the raising of the sunroof which reaches the position flush with the body (roof closed).



AQ96300

Pressing the pushbutton again, the sunroof passes from the closed position to the "quarterlight" open position.

### Section T2 - T3

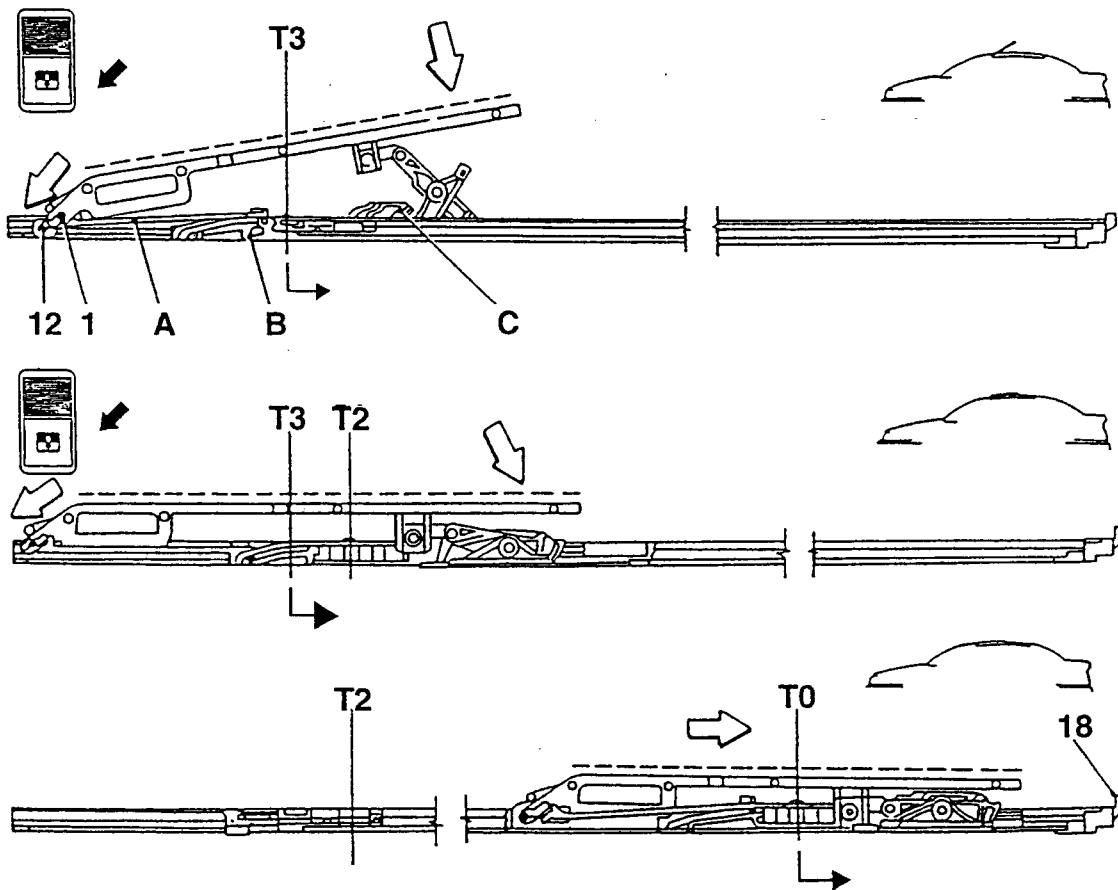
The intermediate runner (B) goes through the last section of its movement completing the raising of the pantograph. At the front, pin (1) reaches the upper stroke limit in cam (12) of the front runner (A). Once the pantograph stroke limite has been reached, an overcurrent relay stops the motor. At this point, to complete the cycle it is necessary to press the pushbutton again to invert the direction of rotation of the motor.

### Section T3 - T2

The sunroof goes back along the closing section from the "quarterlight" open position until the microswitch stops it.

### Section T2 - T0

After lowering to make access possible in the space between the roof panel and the roof lining (section T2 - T1), it runs along the guides until it reaches the rear stroke limit (18), where the overcurrent relay stops the motor (sunroof completely open in the "concealed" position).

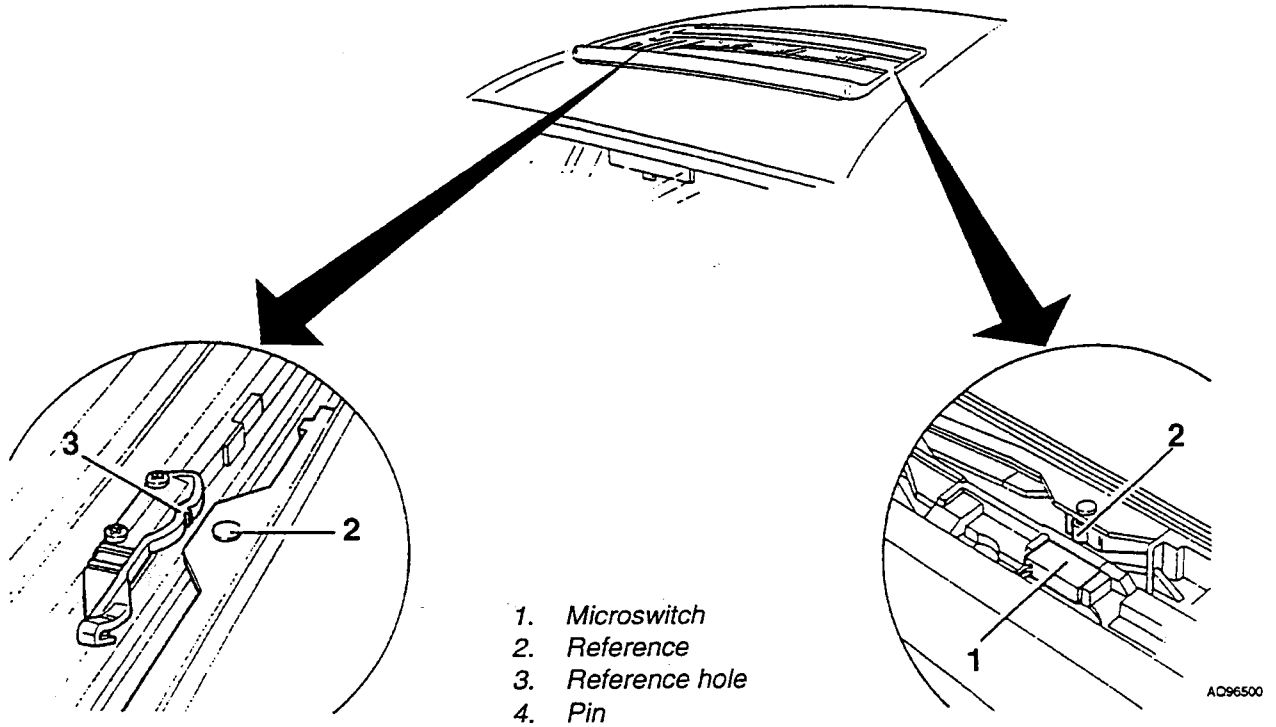


AO96400

**NOTA:** if after servicing operations, it is necessary to adjust the coupling of the racks, the system must be positioned in a determinate point of the cycle.

The position is shown in the diagram by the correspondence of the microswitch (1) with

the reference (2) for the left-hand guide, and the reference pin (4) placed on the rack locking cover with the hole (3) on the intermediate runner for the right-hand guide. Refitting of the electric motor may begin starting from this position.

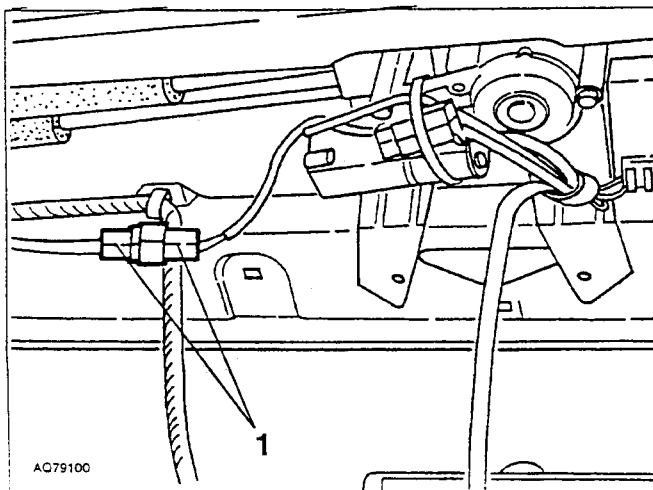


*Positioning of runners*

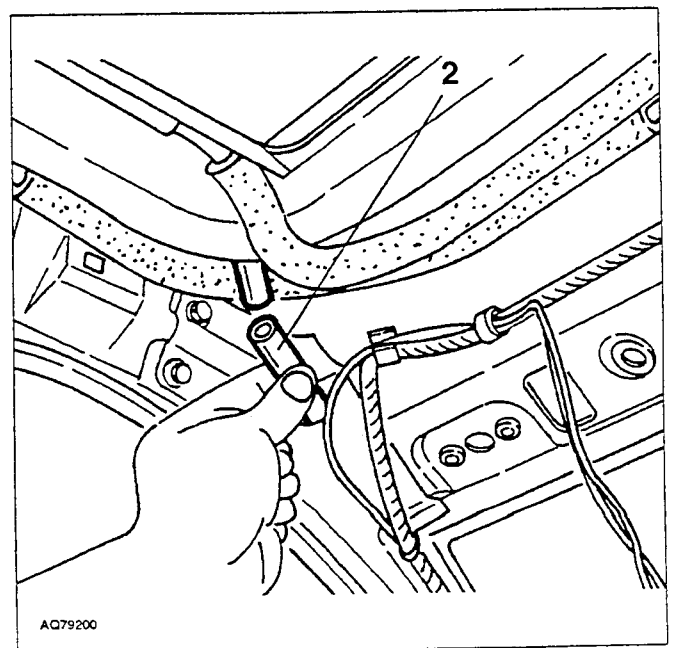
## REMOVAL/REFITTING

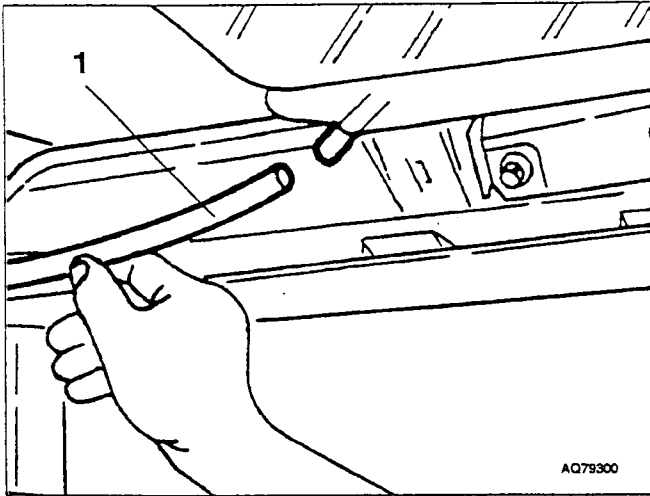
- Disconnect the battery negative pole (-).
- Remove the roof lining (see specific paragraph).

1. Disconnect the sunroof motor electrical connection.

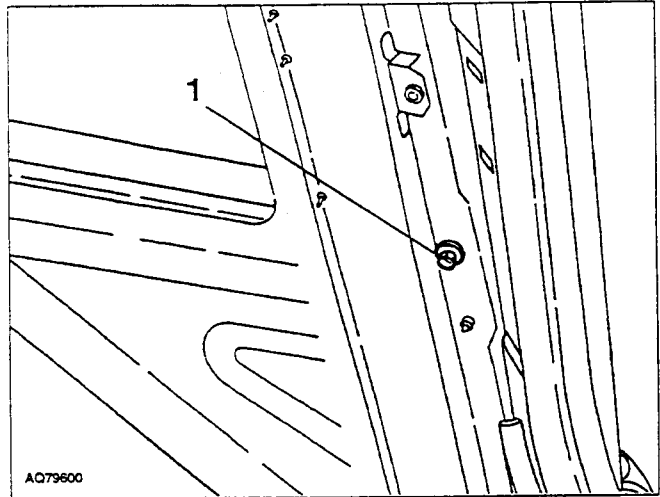


1. Disconnect the front and rear water drain pipes.

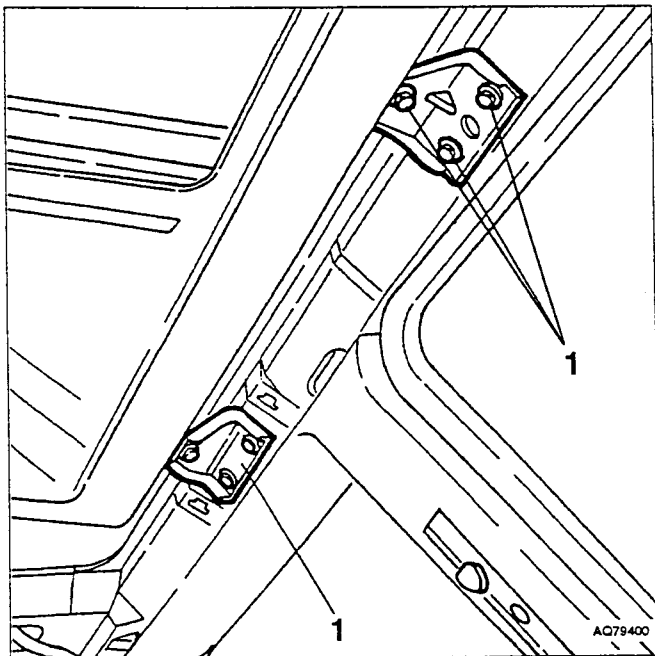




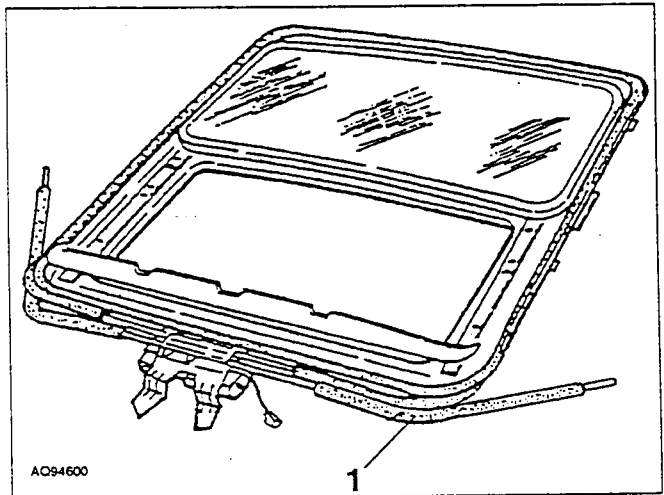
1. Slacken and remove the screws fastening the brackets to the sunroof and then remove the brackets.



1. Remove the sunroof complete, withdrawing it through the front door.



1. Slacken the six screws fastening the sunroof to the roof panel.



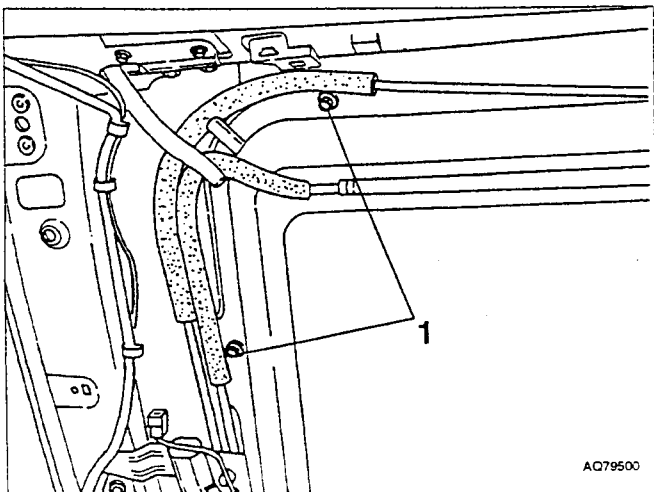
When refitting the sunroof check the presence of the perimeter seals, the tubular ones on the rack guide pipes and the vibration damper caps on the centering pins; for refitting, reverse the sequence followed for removal.

After refitting, check the alignment of the roof and that it works properly.

## SUNROOF ELECTRIC MOTOR

### REMOVAL/REFITTING

**NOTA:** in the event of a failure to the electric motor, the sunroof can be moved to the position required, operating the motor by hand (see: EMERGENCY MANUAL OPERATION OF THE ELECTRIC SUNROOF)





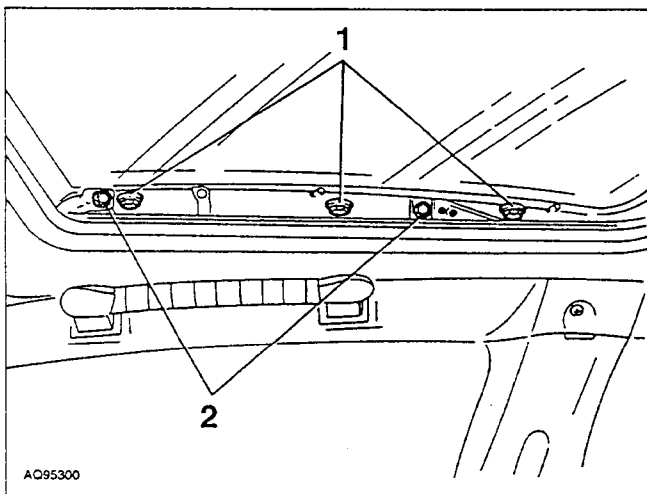
After refitting adjust the vertical and crosswise position.

## ADJUSTING THE POSITION THE SUNROOF GLASS

**NOTA:** To adjust the position of the sunroof glass two operators are required, one operating inside the vehicle and one outside.

The operator on the outside centres the glass in relation to its housing on the car roof and flush with the roof surface; the operator on the inside tightens the adjustment screws.

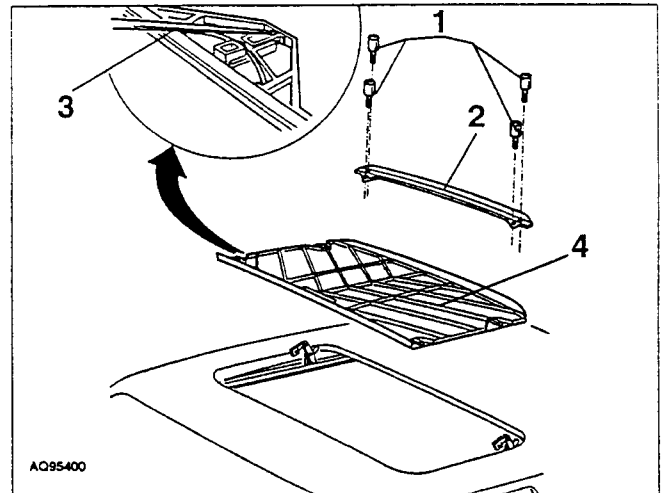
- Open the roof to the "quarterlight" position.
- Remove the plates protecting the sliding mechanism.
- Close the roof.
- 1. Slacken the six crosswise adjustment nuts.
- Position the glass correctly.
- Tighten the six nuts.
- 2. Slacken the four vertical roof adjustment screws.
- Position the glass so that it is flush with the car roof surface.
- Tighten the four screws.



## SLIDING BLIND

### REMOVAL/REFITTING

- Remove the sunroof (see specific paragraph).
- Set the blind to the closed position.
- 1. Slacken the four rear screws fastening the rib.
- 2. Remove the rib.
- 3. Using a screwdriver release two of the four clips fastening the blind to the sunroof guides (on the same side of the vehicle).
- 4. Remove the sliding blind.



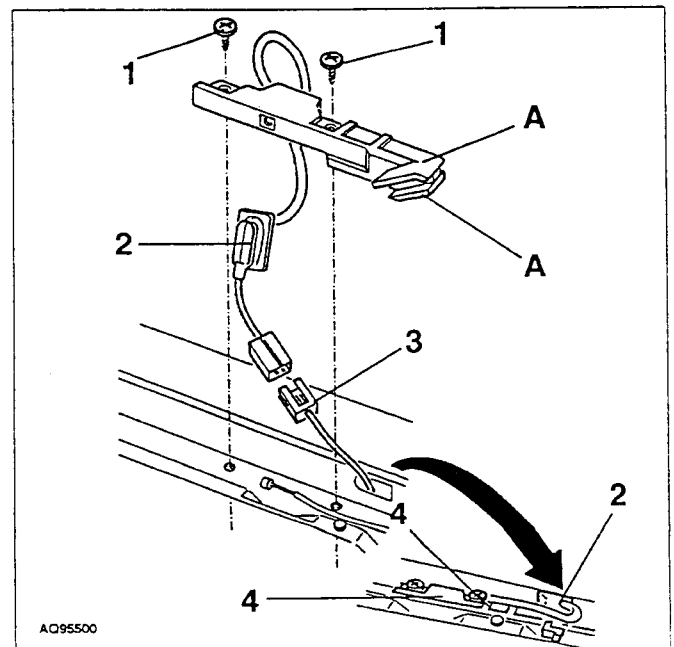
## STROKE LIMIT MICROSWITCH

### REMOVAL/REFITTING

- Completely open the sunroof to the "concealed" position.
- Disconnect the battery negative pole (-).
- 1. Slacken the two screws fastening the microswitch to the left-hand guide.
- 2. Remove the rubber protection from the cable fastened to the guide.
- 3. Withdraw the cable and disconnect the microswitch connector.
- 4. Remove the microswitch.



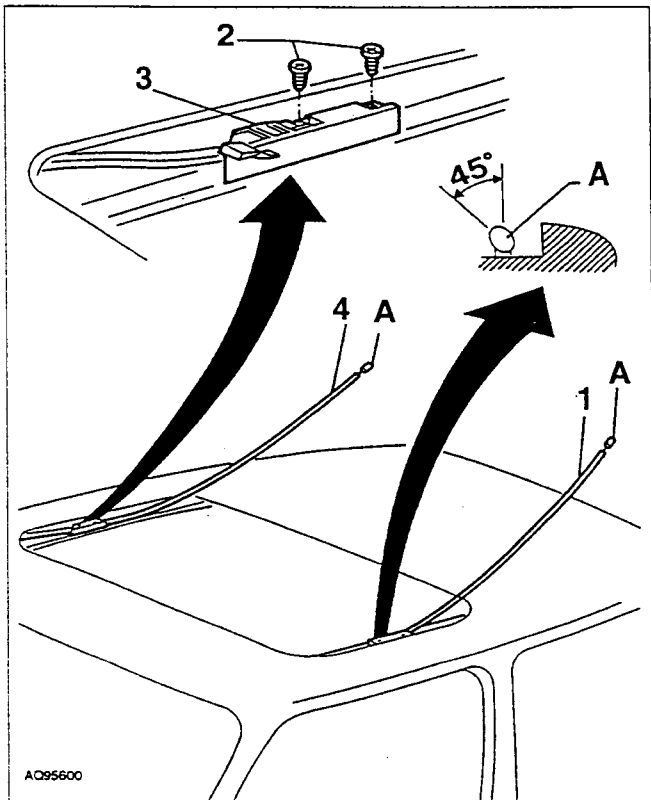
When refitting correctly position the cable so that it fits in the housing without hindering the movement of the flexible rack drawing the sunroof. Correctly couple the guide (A) on the microswitch to the pin of the sliding guide.



## FLEXIBLE RECKS DRAWING THE SUNROOF

### REMOVAL

- Remove the sunroof motor (see specific paragraph).
  - Remove the sunroof (see specific paragraph).
  - Remove the sliding blind (see specific paragraph).
  - Remove the stroke limit microswitch (see specific paragraph).
1. Withdraw the left rack from the guide sheath.
  2. Slacken the two screws fastening the rack stop plate.
  3. Remove the rack stop plate from the right guide.
  4. Withdraw the right rack from the guide sheath.



AQ95600

### REFITTING

-Insert the right rack in the guide sheath.

**NOTA:** When the end of the rack is level with the drawing gear housing, check that it centres the second section of the guide.

Once it is completely inserted, check that the elliptical head (A) is positioned in its housing sloping 45° towards the inside of the car.

- Position the rack stop plate and fasten it with the two screws.
- Repeat the operation for the left rack, then complete refitting reversing the sequence described for removal.
- Position the control system (see specific paragraph).

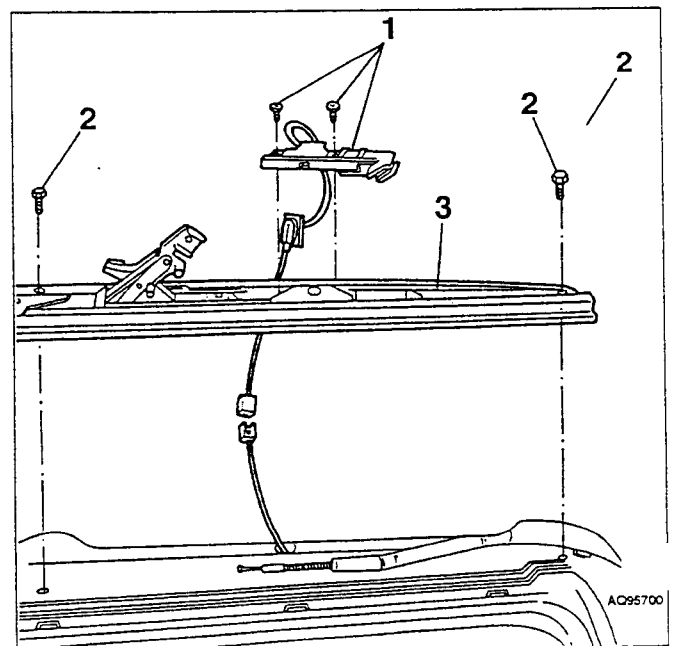
### POSITIONING THE SUNROOF CONTROL SYSTEM

- Move the front runner to the foremost position.
- Position the rear runner so that the pin of the safety microswitch (left guide) or the hole (right guide) coincide respectively with the switch or reference pin; this way the two guides will correspond perfectly.

### GUIDES

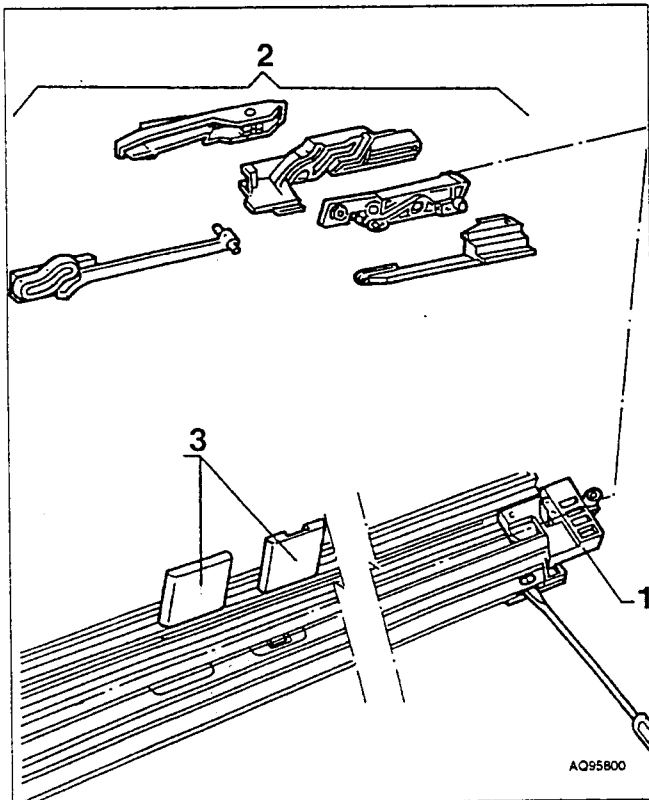
#### REMOVAL/REFITTING

- Disconnect the battery negative pole (-).
  - Remove the sunroof glass (see specific paragraph).
  - Remove the sliding blind (see specific paragraph).
1. Slacken the two screws fastening the microswitch to the guide and remove it releasing the left rack.
  - Slacken the two screws fastening the cable clamp plate.
  2. Slacken the four screws fastening the guide to the frame.
  3. Remove the guides releasing them from the retainer clips of the centering device fastened behind the frame.



AQ95700

1. Using a screwdriver, lever on the rail and release the mechanical stop limit blocking the runner located on the end part of the guide.
2. Withdraw the entire quarterlight lever unit from the guide and dis-assemble it.
3. Withdraw the mechanical quarterlight references.







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##### T. SPARK 16V

- Description . . . . .
- Steering wheel (with Air Bag) . . . . . (\*)
- Steering wheel (without Air Bag) . . . . . (\*\*)
- Ignition block . . . . . (\*\*)
- Steering column . . . . .

#### POWER STEERING T. SPARK 16V

- Power steering box . . . . .
- Power steering pump . . . . .
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- Ignition block . . . . . (\*\*)
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##### T. SPARK 16V T. SPARK 16V

- Power steering box . . . . .
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- Power steering guards . . . . .

(\*): See GROUP 70 - Interior trim "Air Bag"

(\*\*): See    16V

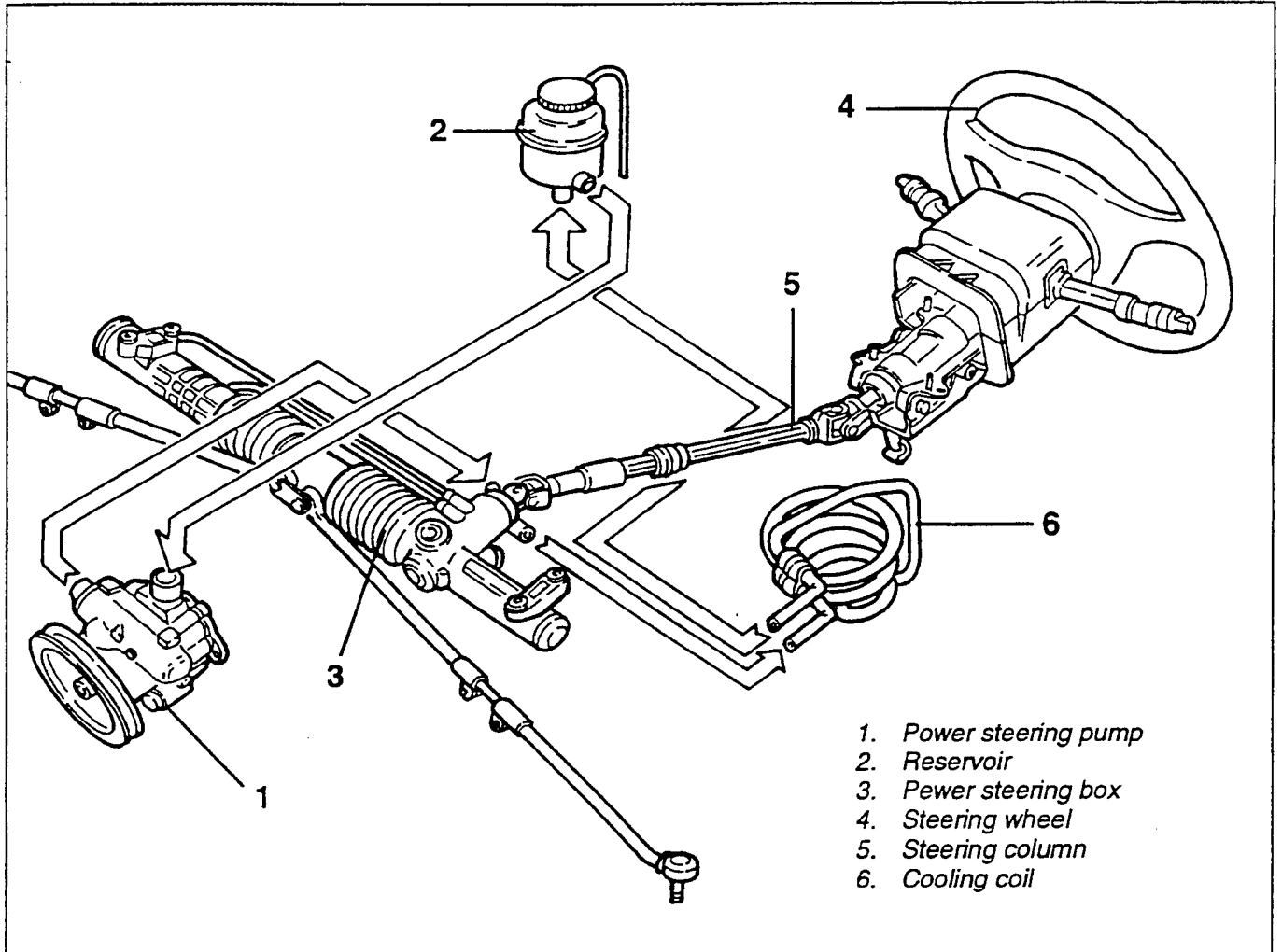
: See  T. SPARK 16V



**DESCRIPTION**

The power steering system enables the effort required to turn the steering wheel to be reduced when manoeuvring from a standstill and it keeps the steering steady at high speeds. The composition of the steering column (5), articulated in two parts ensures greater passive safety in the event of a frontal impact. The system comprises a pump (1) operated directly by the engine through a belt.

The pump withdraws oil through the delivery line from the reservoir (2) located in the engine compartment and sends it under pressure through a hose to the distribution valve located on the power steering box (3). The distributing valve connected by a hose to the reservoir allows the outgoing oil to return to the reservoir. Inside this hose there is a coil (6) which cools the oil.



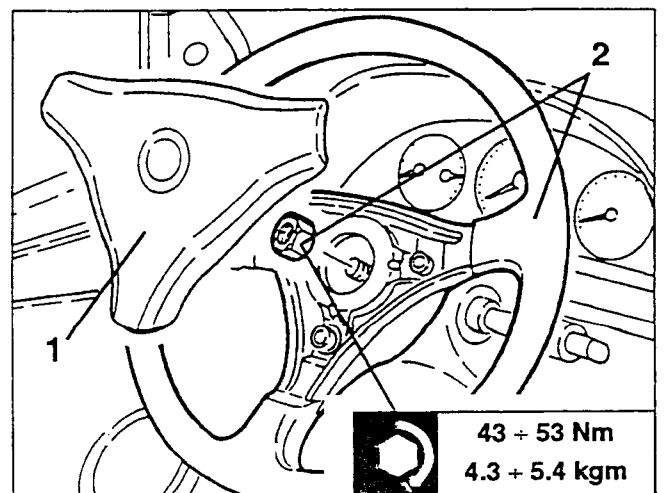
**STEERING WHEEL (WITH AIR BAG)**

For removing/refitting refer to GROUP 70 - INTERIOR TRIM "AIR BAG".

**STEERING WHEEL (WITHOUT AIR BAG)**

**REMOVAL/REFITTING**

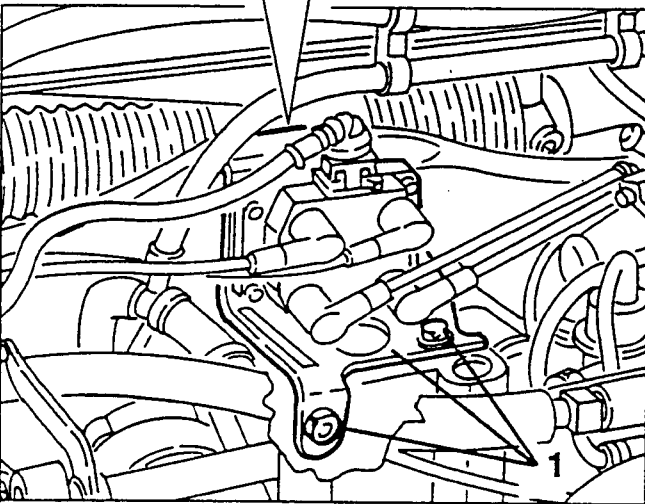
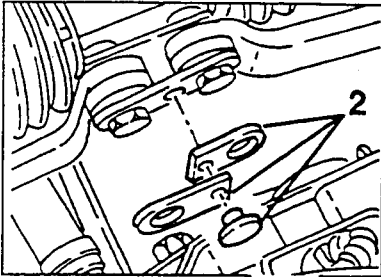
- Disconnect the battery (-) terminal.
- 1. Prise up the horn control and remove it after disconnecting the electrical connection.
- 2. Slacken the fastening nut and remove the steering wheel.



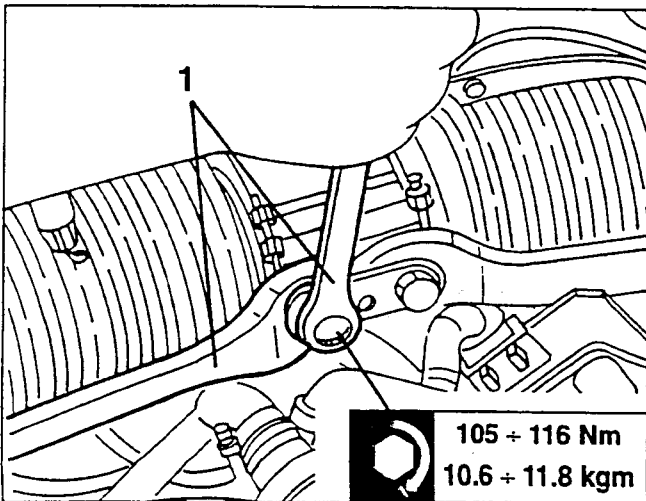
## STEERING LINKAGES

### REMOVAL/REFITTING

- Remove the air intake box (see GROUP 10).
- 1. Slacken the screw and nut fastening the ignition coil support bracket, then move it to one side.
- 2. Remove the plastic button and retrieve the two safety catches.

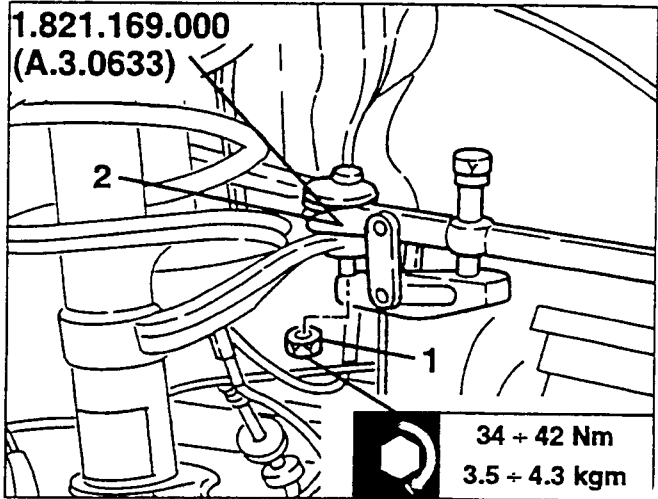


- 1. Slacken the fastening screw and disconnect the track rod concerned from the power steering box.

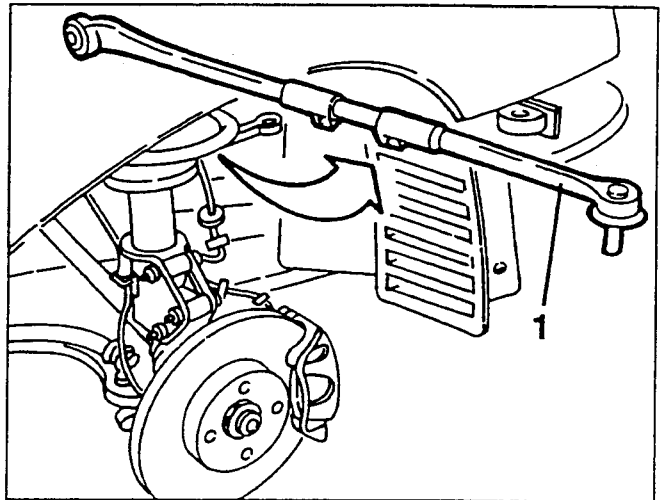


- Remove the wheel on the side concerned.
- 1. Slacken the nut fastening the track rod from the connection on the shock absorber.

- 2. Using tool N° 1.821.169.000 (A.3.0633), disconnect the steering knuckle from the connection on the shock absorber.

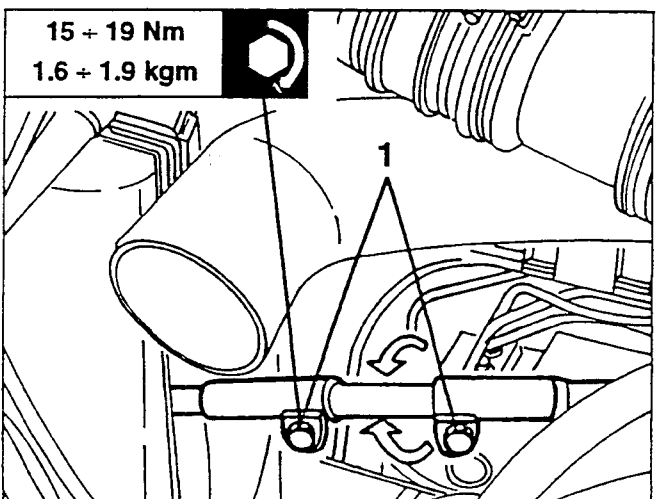


- 1. Working from the wheel house, remove the complete track rod.



**When refitting, adjust the track rods as described below.**

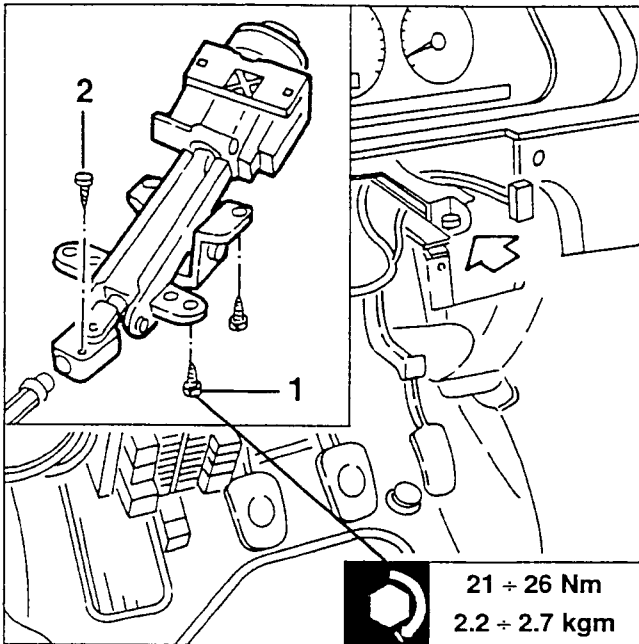
- 1. Slacken the two fastening screws and work on the adjustment coupling until the specified toe-in has been obtained (see GROUP 44).



15 + 19 Nm  
1.6 + 1.9 kgm

**STEERING COLUMN****REMOVAL/REFITTING**

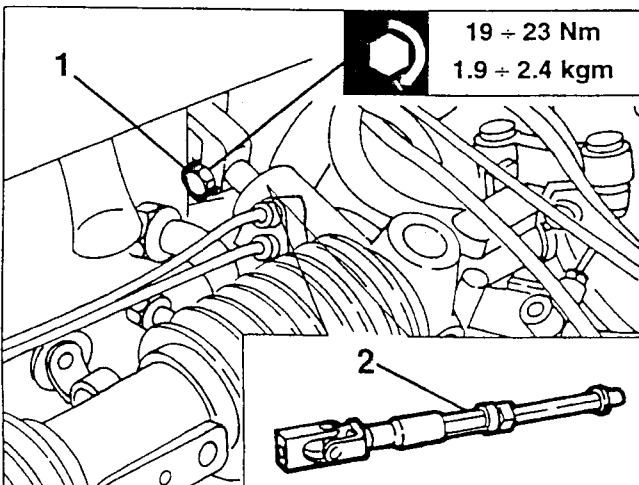
- Remove the steering wheel (see specific paragraph).
  - Remove the steering column control lever unit (see GROUP 55).
  - Remove the fusebox cover (see GROUP 70).
1. Slacken the four screws fastening the upper steering column to the body.
  2. Slacken the screw fastening the upper steering column to the lower steering column, then remove the upper steering column.



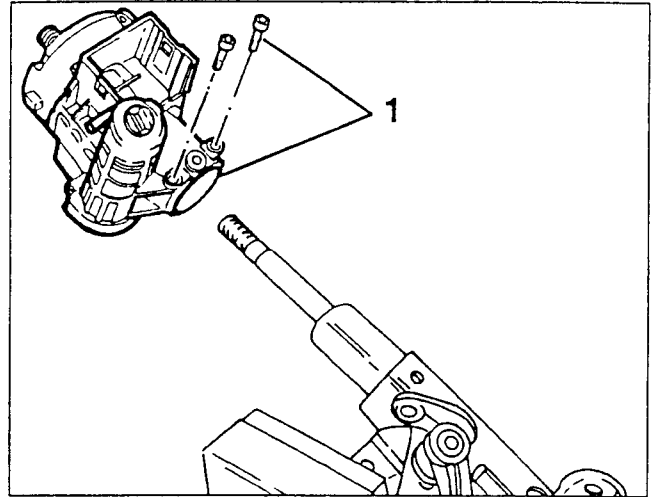
1. Slacken the screw fastening the lower steering column to the power steering box pinion.

To gain access to the screw, proceed as described in "Power steering box - Removal/Refitting" without disconnecting the track rods.

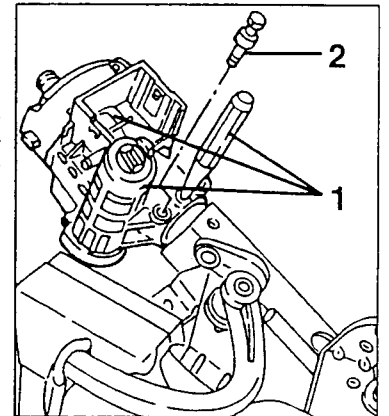
2. Still working from the engine compartment, remove the lower steering column.



1. On the bench, if necessary, using a suitable punch, slacken the two fastening pins and separate the control unit and ignition block support from the upper steering column.

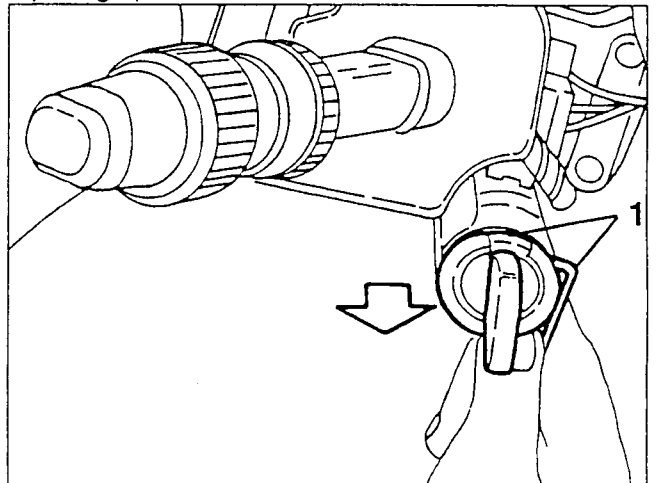


When refitting, using a pin (1) as illustrated, correctly position the control unit and ignition block support, then fasten it with the special screws (2) with preset breakage load.

**IGNITION BLOCK****REMOVAL/REFITTING**

- Remove the steering column half cover (see GROUP 70).

1. Take the ignition block to the "MAR" position and working on the fastener catch with a punch withdraw it pulling upwards.



**POWER STEERING BOX****REMOVAL/REFITTING**

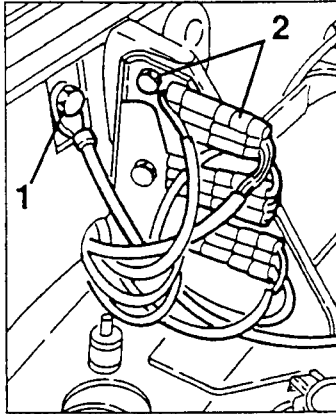
- Empty the oil from the power steering reservoir, using a suitable syringe.

- Remove the battery and the acid drain tray (see GROUP 55).

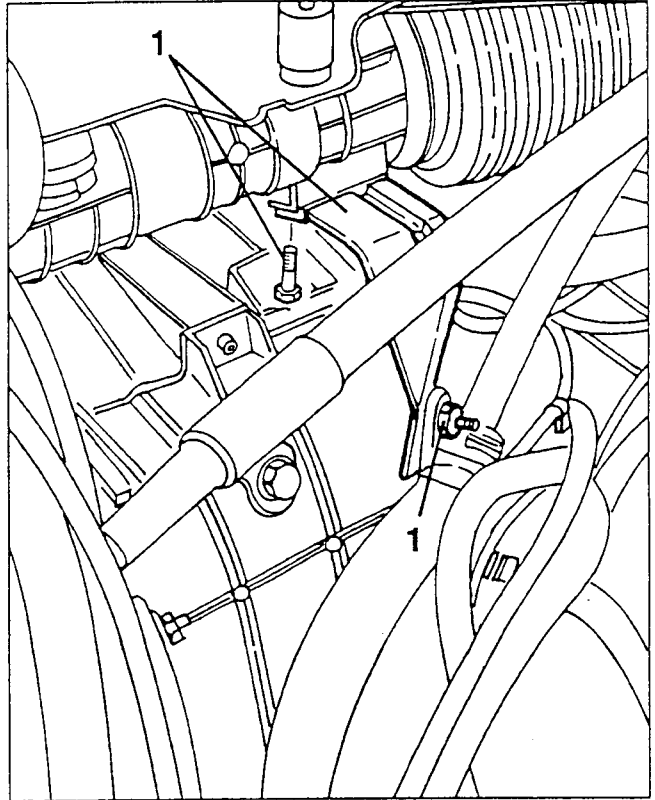
- Remove the air cleaner unit and intake box complete (see GROUP 10).

1. Disconnect the earth from the engine bulkhead.

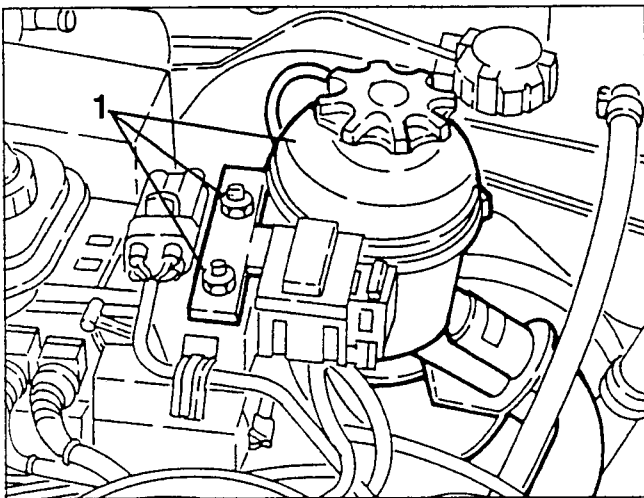
2. Slacken the screw and remove the electrical connection support bracket.



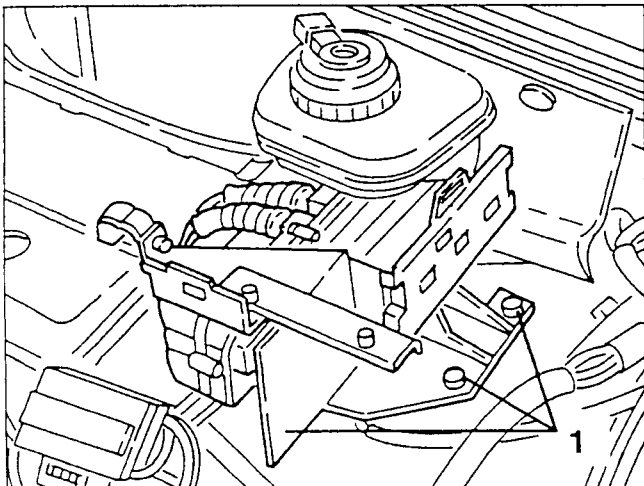
1. Slacken the fastening screw and bolt and remove the power steering hose support bracket.



1. Slacken the two fastening nuts and move the power steering reservoir to one side without disconnecting the hoses.

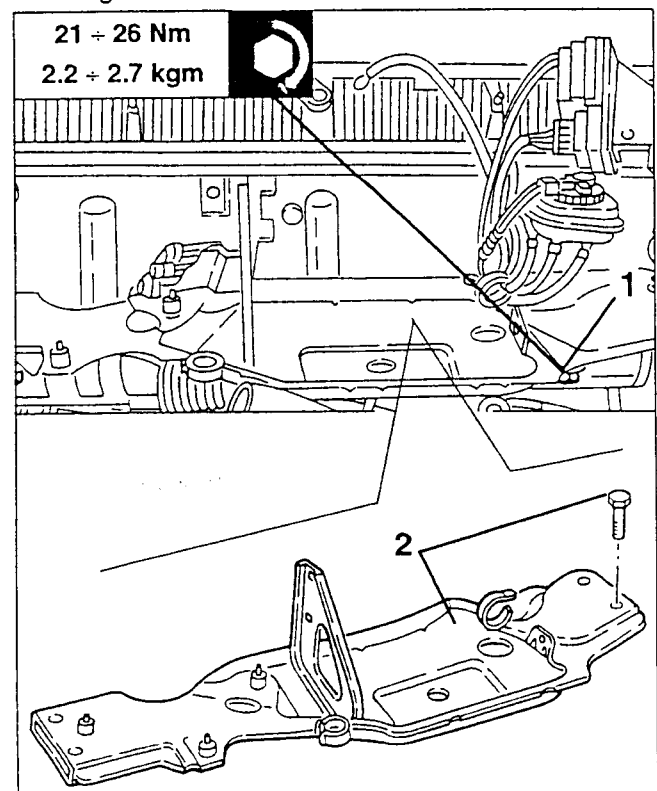


1. Remove the relay switches from the support bracket then move the bracket upwards after unscrewing the fastening screws.

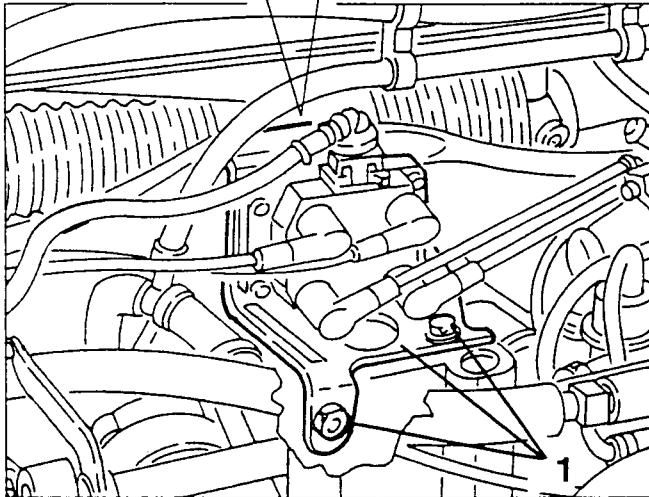
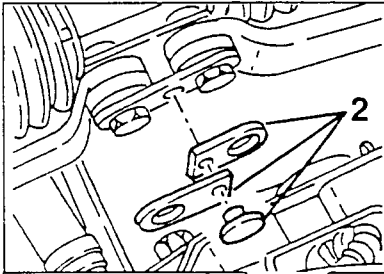


1. Slacken the four screws fastening the power steering box to the crossmember.

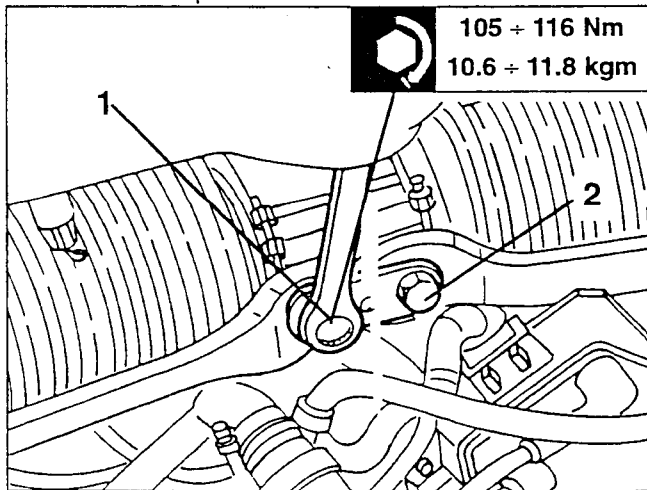
2. Slacken the five fastening screws and remove the crossmember supporting the battery and the power steering box.



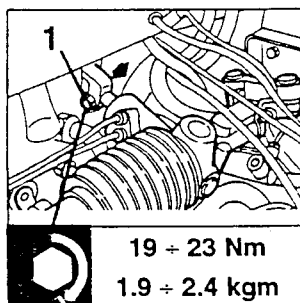
1. Slacken the screw and nut fastening the ignition coil support bracket then move it to one side.
2. Remove the plastic button and retrieve the two safety catches.



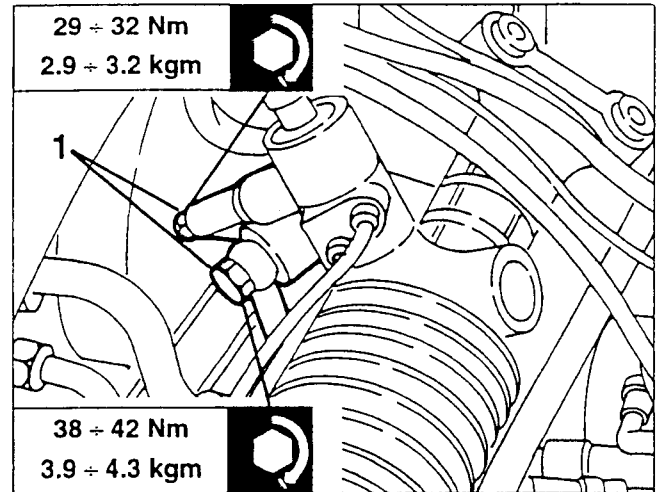
1. Slacken the screws fastening the power steering to the track rods.
2. Retrieve the plate.



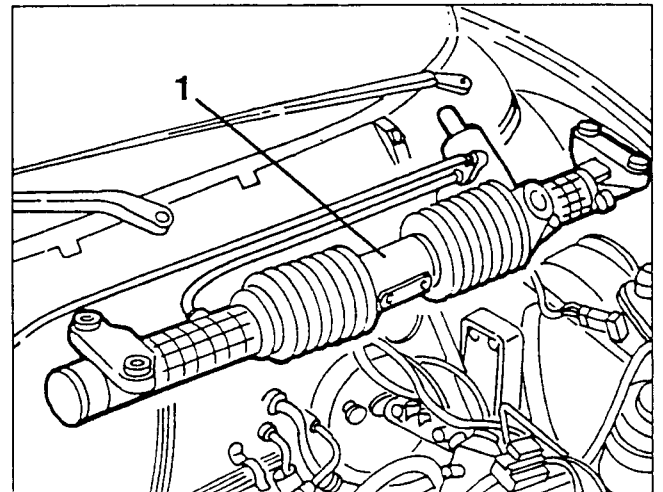
1. Slacken the screw fastening the steering column to the pinion of the power steering box, then move aside the latter.



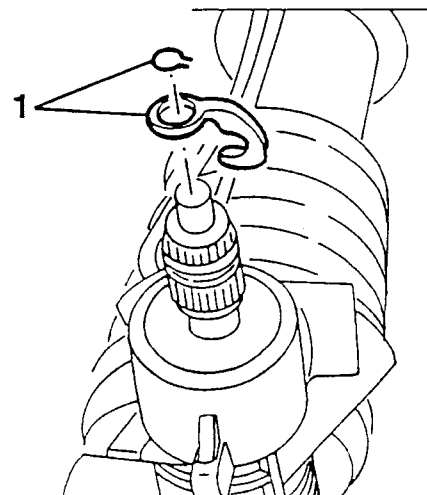
1. Disconnect the two oil inlet and outlet hoses from the power steering box.



1. Remove the power steering box.



1. On the bench, if necessary, remove the circlip and withdraw the positioning plate from the power steering box pinion.



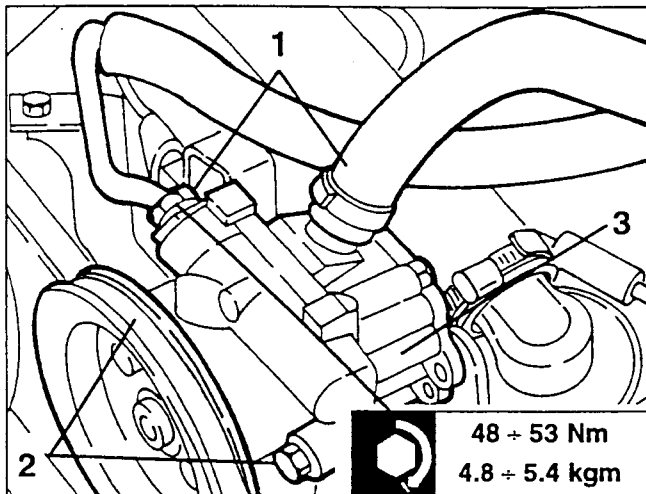


## POWER STEERING PUMP

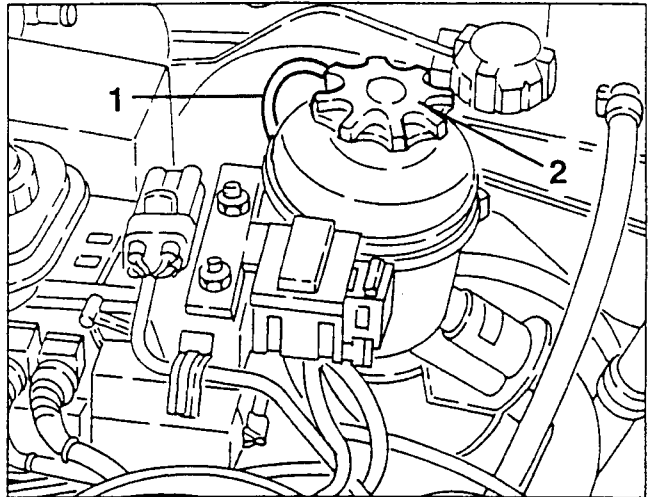
### REMOVAL/REFITTING

- Empty the oil from the power steering reservoir, using a suitable syringe.

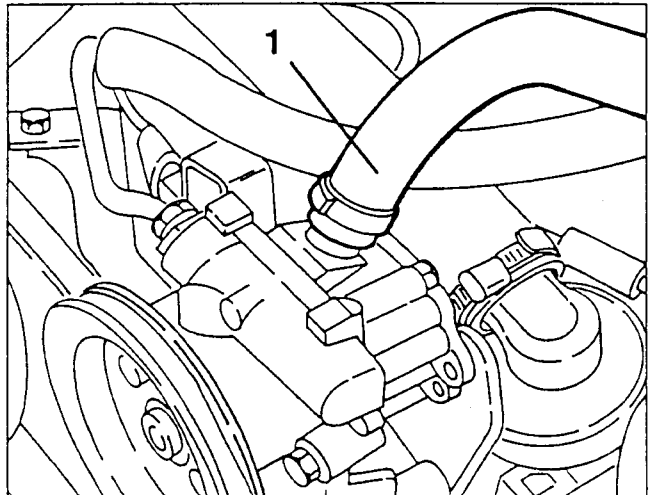
1. Disconnect the oil inlet and outlet hoses from the power steering pump.
2. Slacken the two bolts fastening the power steering pump and remove it from the drive belt.
3. Slacken completely the two fastening bolts and remove the power steering pump.



2. Remove the cap and fill the reservoir with the specified oil.



1. Disconnect the inlet hose on the power steering pump until oil flows out, then re-connect it.



### CHECKS AND INSPECTIONS

#### WARNING:

The power steering pump, like the steering box, should not be dis-assembled for any reason whatsoever and must be sent to the Manufacturer for overhauling.

- Check the rolling torque of the steering wheel with the car stationary and the engine running. The torque must be between 0.6 daN with the engine at idle speed and 0.75 daN with the engine at maximum: if these limits are exceeded check the pressure in the system with the wheels completely turned. Insert a pressure gauge using a suitable Tee connection on the pressurised oil delivery hose leading from the pump to the power steering and turn the steering wheel fully in one direction. Further forcing the steering wheel, the pressure indicated on the pressure gauge should rise to appr. 85 bar. If this fails to happen, there is either a failure in the pump or in the distributing valve of the power steering box.

- With the engine running at idle speed, ensure that the reservoir does not empty. Turn the steering wheel completely a few times to bleed the air from the system. Then top up the reservoir to the maximum level mark.

#### WARNING:

The power steering system is self-purging; the air is removed steering completely to the right and to the left with the engine running and the car stationary. This operation should be carried out each time the connection hoses are removed and refitted.

- Completely insert the breather pipe and refit the reservoir cover.

### REFILLING THE POWER STEERING CIRCUIT AND BLEEDING THE AIR

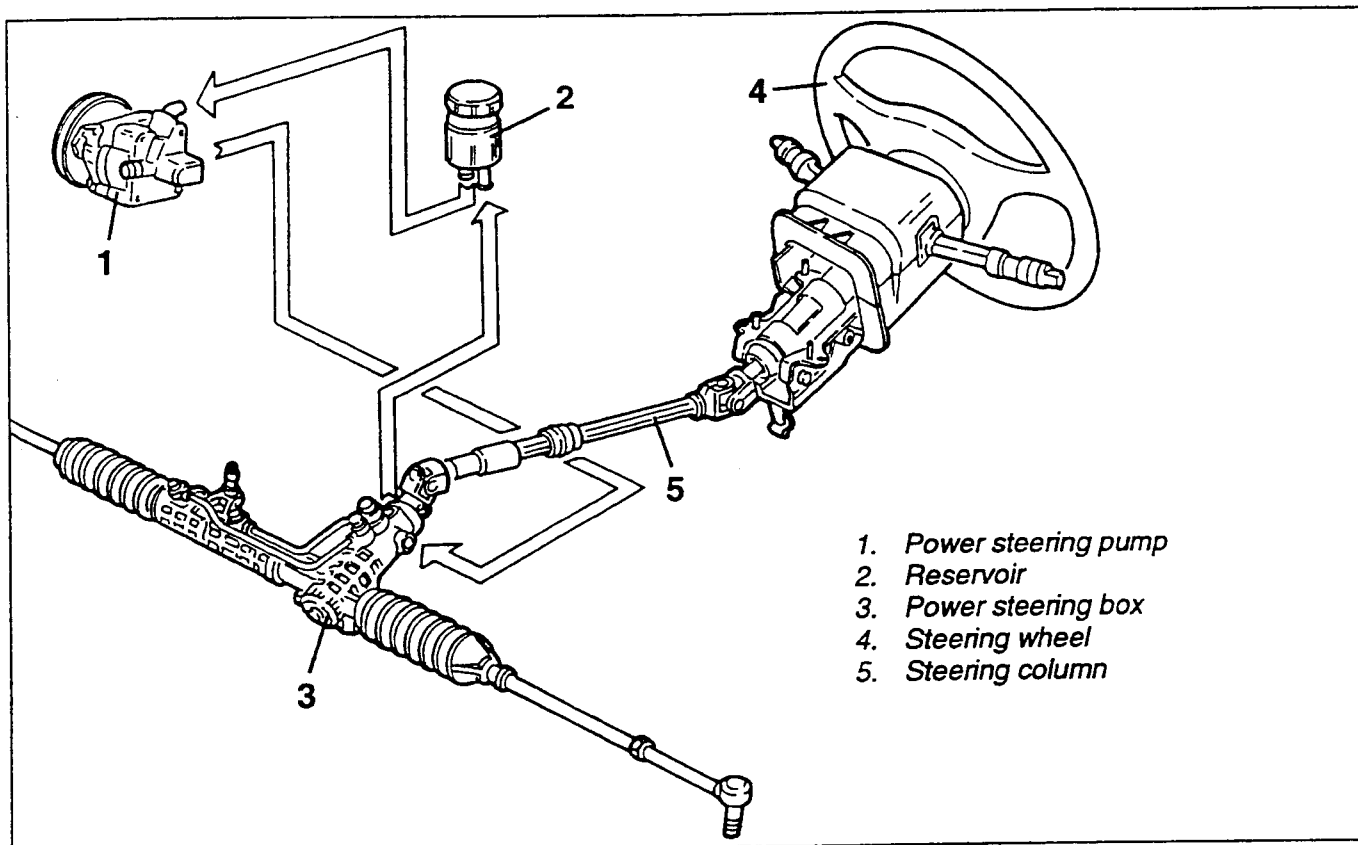
1. Disconnect the reservoir breather pipe.

Stiffening of the steering might be due to slipping of the pump drive belt or to low oil level. In the event of a failure to the pump, operating cylinder or distributing valve, the power steering system will work like a normal mechanical gearbox.

## DESCRIPTION

The power-assisted steering system enables the effort at the steering wheel to be reduced when manoeuvring from a standstill and keeps steering steady at high speeds. The conformation of the steering column (5) articulated in two sections, confers greater passive safety in the event of frontal impact.

The system comprises a pump (1) operated directly by the engine through a belt. The pump withdraws oil through the delivery hose from the reservoir (2) located in the engine compartment, and sends it under pressure through a hose to the distributing valve located in the power steering box (3). The distributing valve connected through a hose to the reservoir allows the oil from the operating cylinder to return to the reservoir.



1. Power steering pump
2. Reservoir
3. Power steering box
4. Steering wheel
5. Steering column

## STEERING WHEEL (WITH AIR BAG)

For removing/refitting refer to GROUP 70 - INTERIOR TRIM "AIR BAG".

## STEERING WHEEL (WITHOUT AIR BAG)

For removing/refitting refer to Boxer engines.

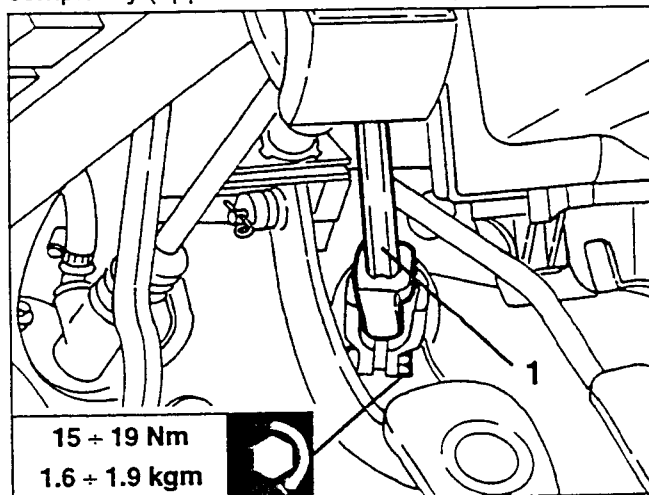
## IGNITION BLOCK

For removing/refitting refer to Boxer engines.

## STEERING COLUMN

### REMOVAL/REFITTING

See the Boxer engines, with the exception of the removal of the steering column (1) from the power steering box pinion as the steering column is removed completely (upper and lower section).



15 + 19 Nm  
1.6 + 1.9 kgm

## POWER STEERING BOX

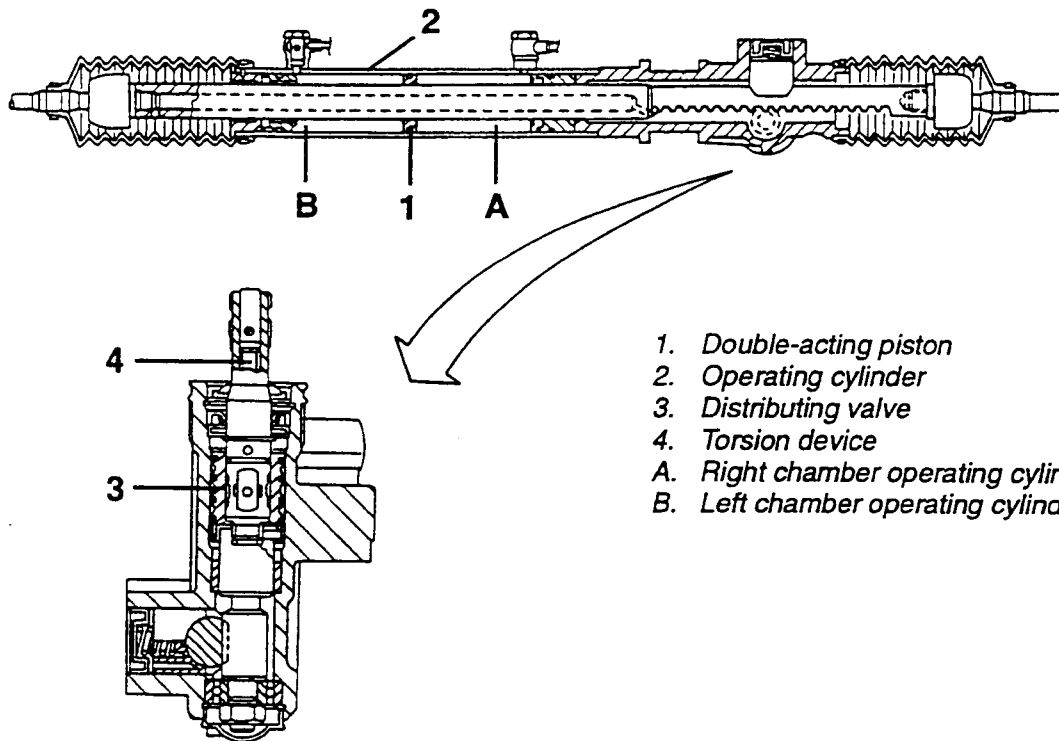
### DESCRIPTION

The power steering box assembly is similar to a conventional rack and pinion steering system with the exception of the following:

- an operating cylinder (2) has been made in the steering box in which a double-acting piston (1) runs that is integral with the rack rod;

- a distributing valve (3) with the corresponding ducts is located in the housing of the worm screw. This is controlled by a torsion device (4) in the end of the worm screw.

Depending on the torsion transmitted by the steering wheel to the device, the oil from the pump is sent to the reservoir, or to one of the two chambers A or B of the operating cylinder. The force generated by the pressure of the oil on the side surface of the piston determines its movement, thus also of the rack.



1. Double-acting piston
2. Operating cylinder
3. Distributing valve
4. Torsion device
- A. Right chamber operating cylinder
- B. Left chamber operating cylinder

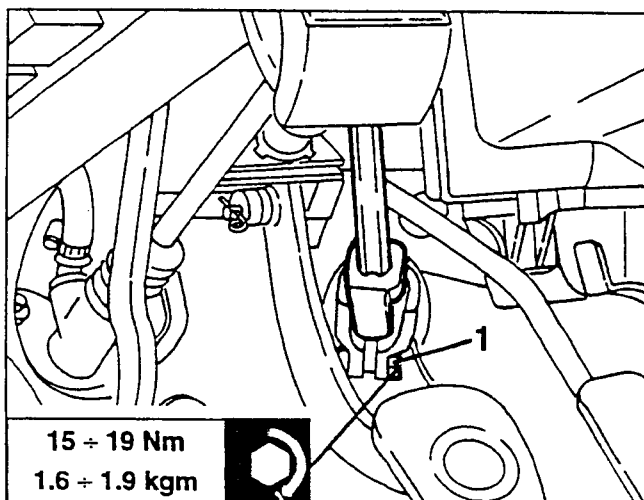
### REMOVAL/REFITTING

- Set the car on a lift.
- Using a suitable syringe, empty the power steering system reservoir.
- Remove the front wheels.

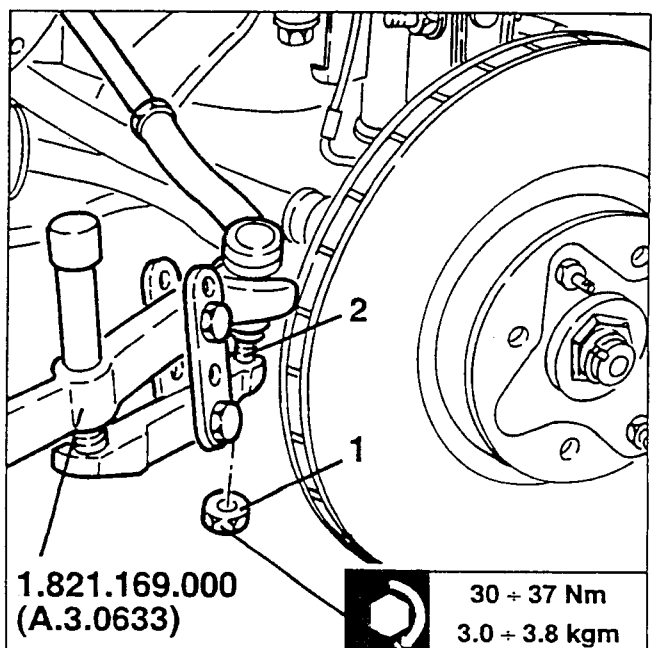
1. Working from inside the car, slacken the bolt fastening the steering column to the power steering box pinion.

- Raise the car.

1. Slacken the nuts fastening the track rod ball joints to the wheel hubs.
2. Using tool N° 1.821.169.000 (A.3.0633), disconnect the ball joints from the hubs.



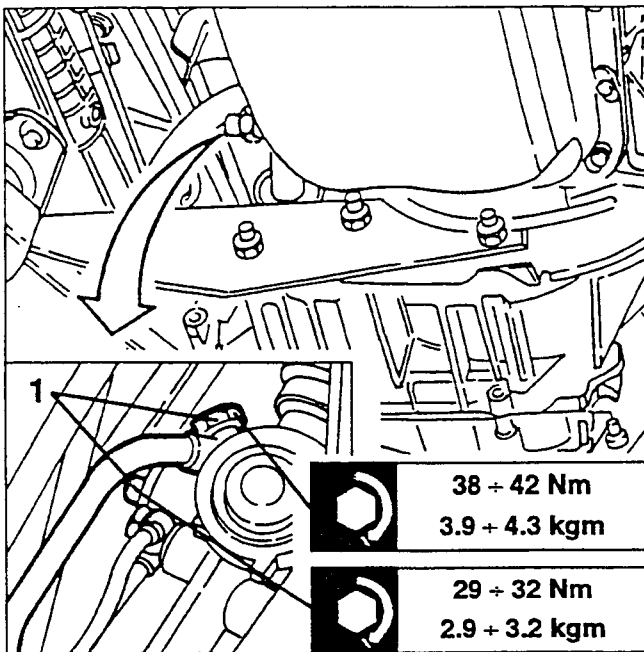
15 ÷ 19 Nm  
1.6 ÷ 1.9 kgm



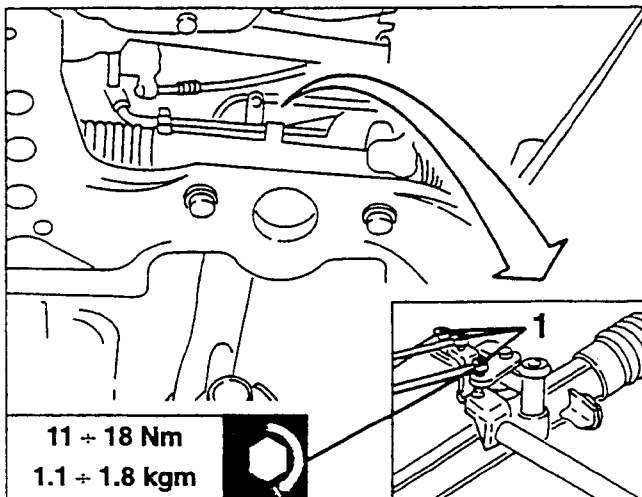
1.821.169.000  
(A.3.0633)

30 ÷ 37 Nm  
3.0 ÷ 3.8 kgm

- Raise the car.
- 1. From the power steering box disconnect the couplings of the oil inlet and outlet hoses.



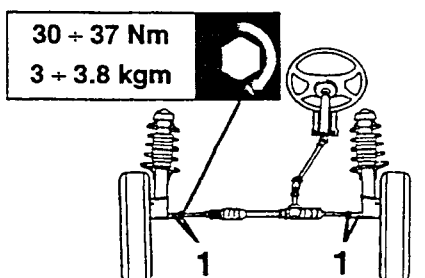
- 1. Disconnect the speed engagement rods from the support.



- Remove the front crossmember (see GROUP 44) and remove the power steering box.

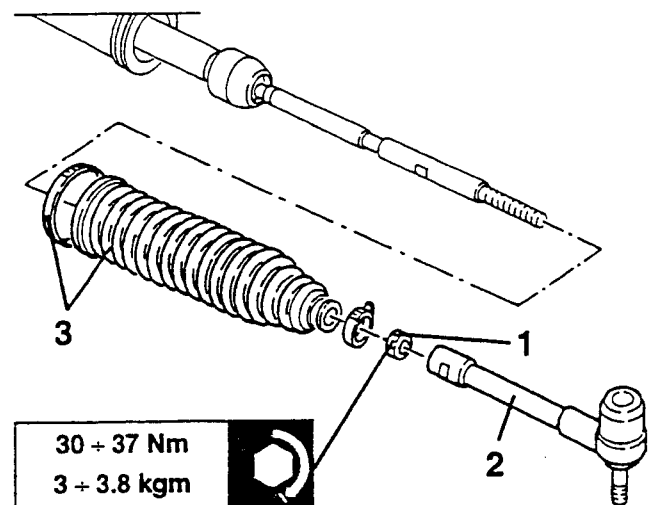
When refitting, if necessary, adjust the track rods as described below.

- 1. Slacken the two fastening nuts and tighten or slacken the track rods until the specified toe-in is obtained (see GROUP 44).



### DIS-ASSEMBLY/REASSEMBLY

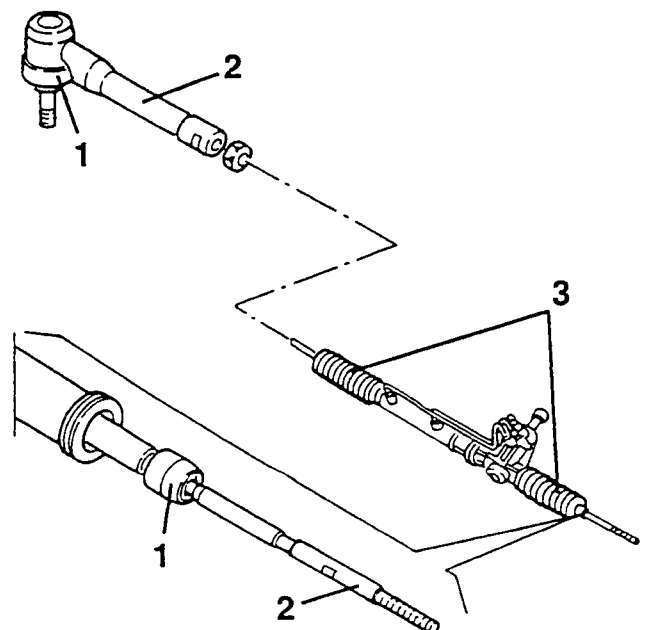
- 1. Slacken the locknut of the track rods.
- 2. Slacken the track rods and remove them from the arm.
- 3. Slacken the clamps and remove the bellows.



When refitting lubricate the contact area between the bellows and the shaft with silicone grease. When the clamp is installed and closed to the second or third from last tooth this will enable the arm to turn freely inside the bellows.

### CHECKS AND INSPECTIONS

- 1. Check that the ball joints are not damaged or worn and that they can turn freely in their housings without sticking or excessive play.
- 2. Check that the track rods are not damaged or distorted.
- 3. Make sure that the bellows are intact.



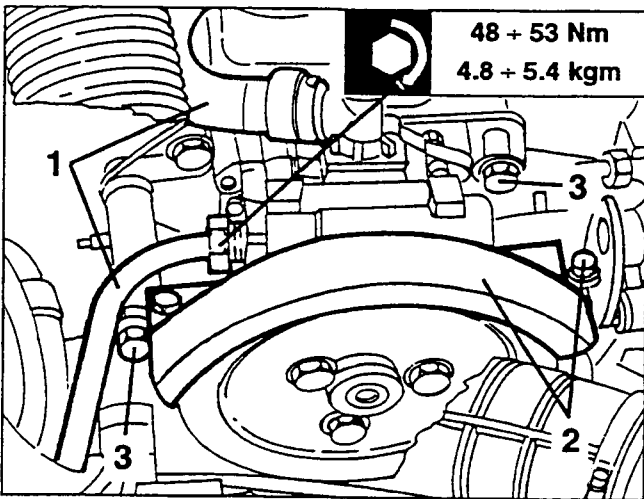
## POWER STEERING PUMP

### REMOVAL/REFITTING Specific for Turbodiesel engine

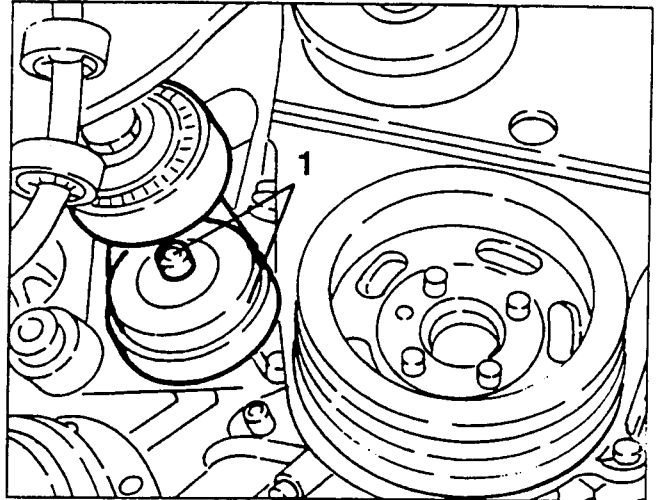
- Empty the oil from the power steering system, using a suitable syringe.

1. From the power steering pump disconnect the oil inlet and outlet hoses.
2. Slacken the two screws and remove the power steering pump drive belt guard.
3. Slacken the screws fastening the power steering pump and working on the micrometric tensioner, slacken the belt tension and remove it.

- Remove the screws slackened previously and remove the power steering pump.

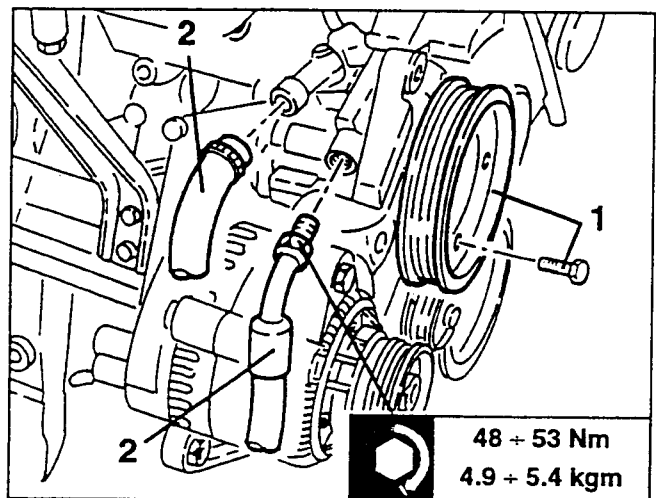


1. Slacken the screw fastening the belt tensioner.



1. Holding the pump shaft still, slacken the three screws fastening the power steering pump pulley and remove the latter.

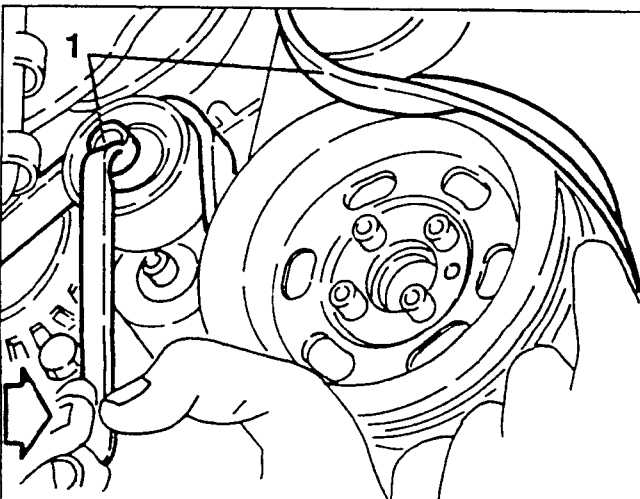
2. Working from above, disconnect the two intake and delivery pipes from the power steering pump.



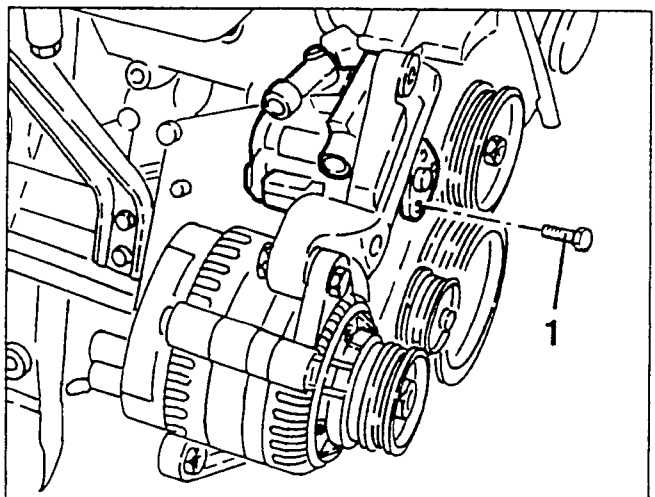
### REMOVING/REFITTING Specific for T.Spark 16V engine

- Set the car on a lift.
- Remove the right front wheel and mud flap.
- Empty the power steering tank oil using a suitable syringe.

1. Raise the car and proceeding as illustrated on the belt tensioner, slacken the tension of the auxiliary components drive belt and remove it.



1. Slacken the three fastening screws and remove the power steering pump.



## TESTS AND CHECKS

### IMPORTANT:

Never disassemble the power steering pump or the power steering unit. These units can only be overhauled by the manufacturer.

Check the rolling torque with the vehicle stationary and the engine running.

The torque should be included between 0.6 daN when the engine is idling and 0.75 daN when the engine is running at maximum rating.

If these values are exceeded, check system pressure with the wheels completely steered.

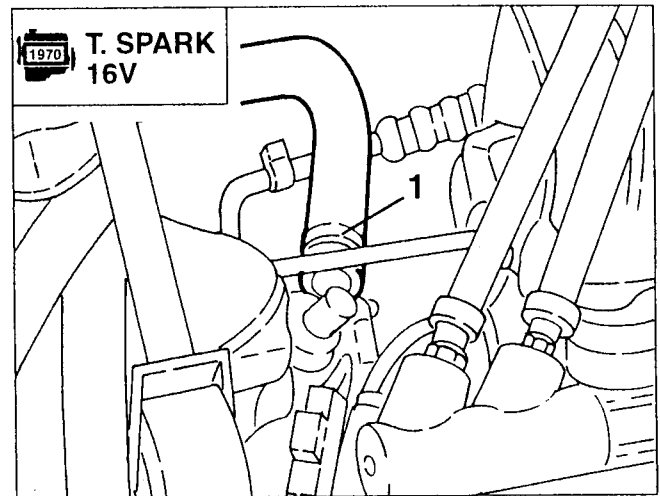
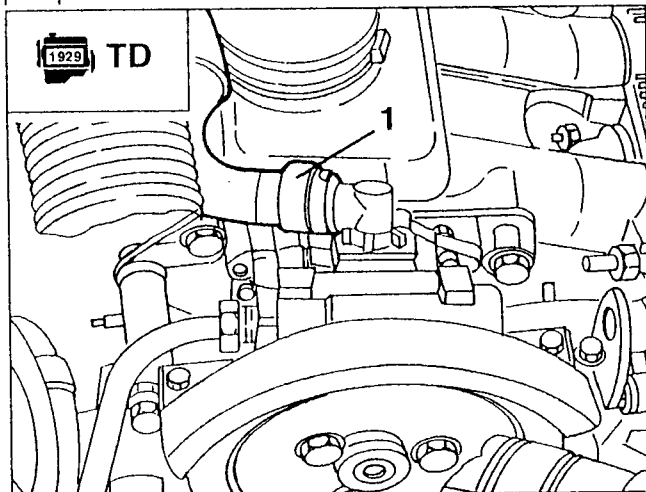
For this test, connect a pressure gauge with a suitable T fitting on the pressurised oil pipe leading from the pump to the power steering unit and steering completely to one side.

When the steering wheel is forced, the pressure shown should increase to approximately 85 bar. If this does not happen, either the pump or the power steering distribution valves are faulty.

## TOPPING-UP THE POWER STEERING CIRCUIT AND BLEEDING THE AIR

- Remove the filler cap and top up the reservoir with the prescribed type of oil.

1. Loosen the intake pipe clip on the power steering pump and bleed the circuit until oil flows out.




- Idle the engine. Check that the reservoir does not empty completely and turn the steering wheel completely to the left and to the right to bleed the air. Top up to the maximum notch on the reservoir.

### IMPORTANT:

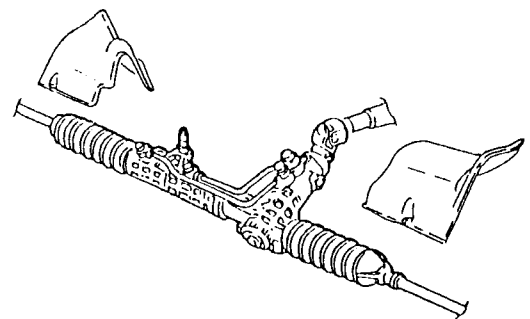
The power steering system is self-bleeding. It is bled by steering completely to the left and to the right with the engine running. Perform this operation whenever the connecting pipes are connected/disconnected.

Steering stiffness can be caused by the pump drive pulley belt slipping or insufficient oil level. If the pump, the operating cylinder or the distribution valve break down, the power steering unit will work like an ordinary mechanical steering system.

## POWER STEERING GUARDS

Specific for  T. SPARK  
16V

Two sound-proofing guards are fitted on the ends to the power steering unit, as shown in the illustration.



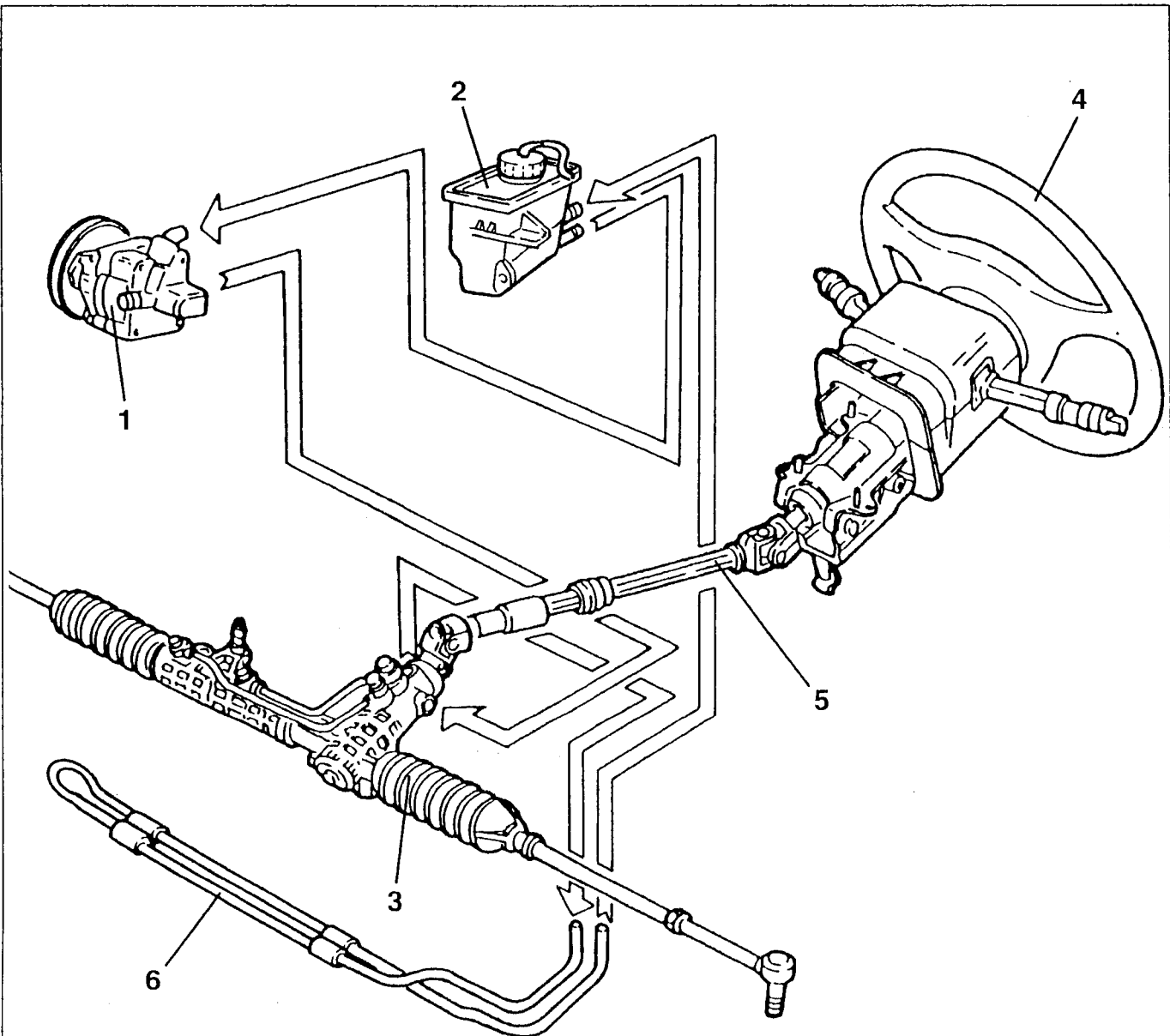
**DESCRIPTION**

The power steering unit reduces the force required to turn the steering wheel when the vehicle is stationary and ensures accurate steering at high speeds. Moreover, it allows a special steering column (5) structure in two sections which confers a higher degree of passive safety in the event of front crashes. The system consists of a pump (2) directly operated by the engine by means of a belt.

The pump collects oil via the delivery manifold from the reservoir (2) located in the engine compartment. It sends the pressurised oil through a pipe to the distribution valve located on the power steering unit (3).

The distribution valve is connected by means of a pipe to the reservoir to allow the oil let out of the cylinder flow back to the reservoir.

This pipe contains a oil cooling serpentine (6).



- 1. Power steering pump
- 2. Reservoir
- 3. Power steering unit

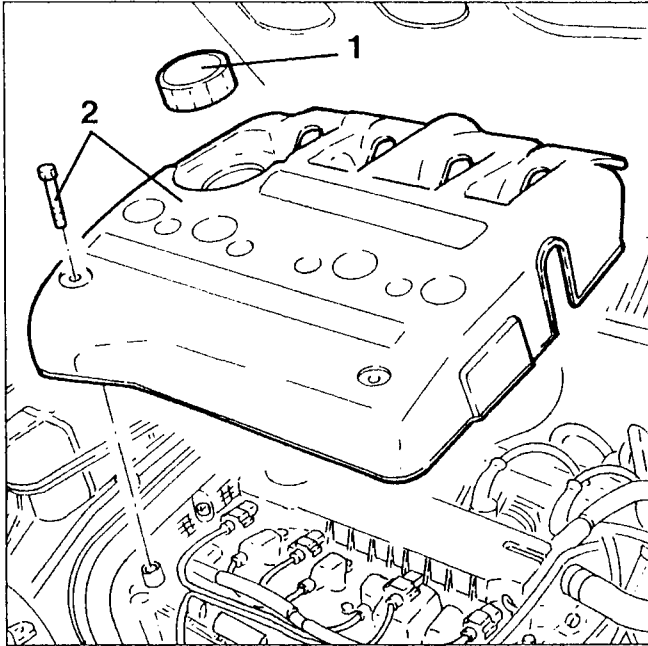
- 4. Steering wheel
- 5. Steering column
- 6. Cooling serpentine

## POWER STEERING RESERVOIR

### REMOVAL/REFITTING

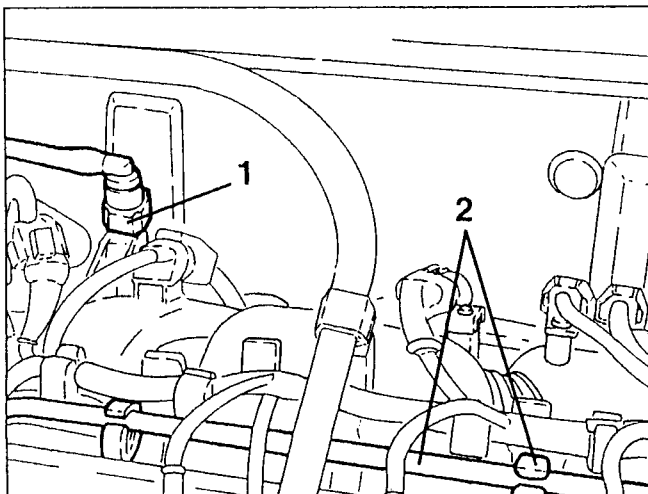
- Remove the power steering reservoir cap and suck the oil with a suitable syringe.

1. Remove the oil filler cap.
2. Remove the fastening screws and remove the tapet cover.

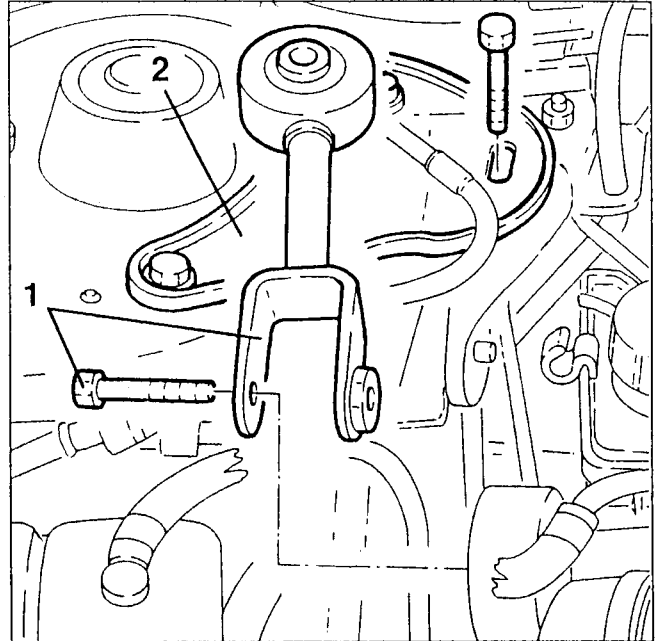


- Refit the engine oil filler cap.

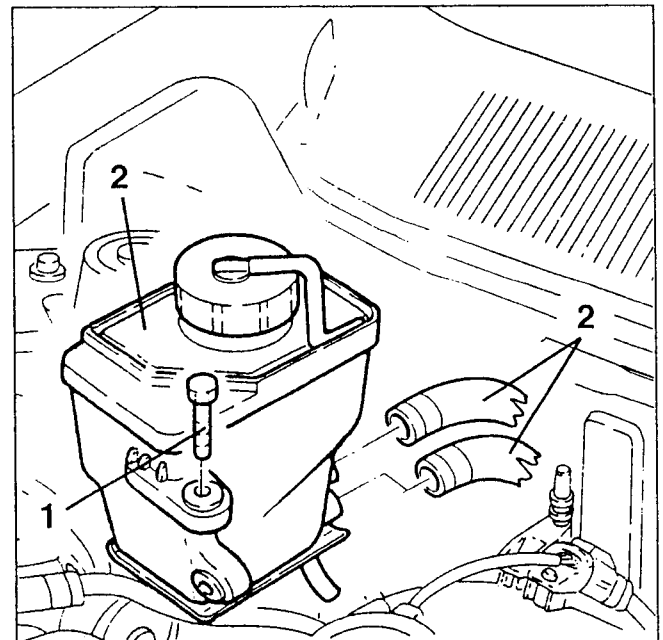
1. Disconnect the fuel fume re-circulation quick coupling pipe.
- Release the fuel fume re-circulation pipe from the power steering reservoir clip and shift it.
2. Release the coolant return to reservoir pipe from the clips on the intake manifold.



1. Remove the fastening screws and remove the engine reaction tie-rod.
2. Remove the fastening screws and remove the upper engine reaction tie-rod support.



1. Remove the power steering reservoir fastening screws.
2. Disconnect the power steering reservoir delivery/return pipes and remove the reservoir.

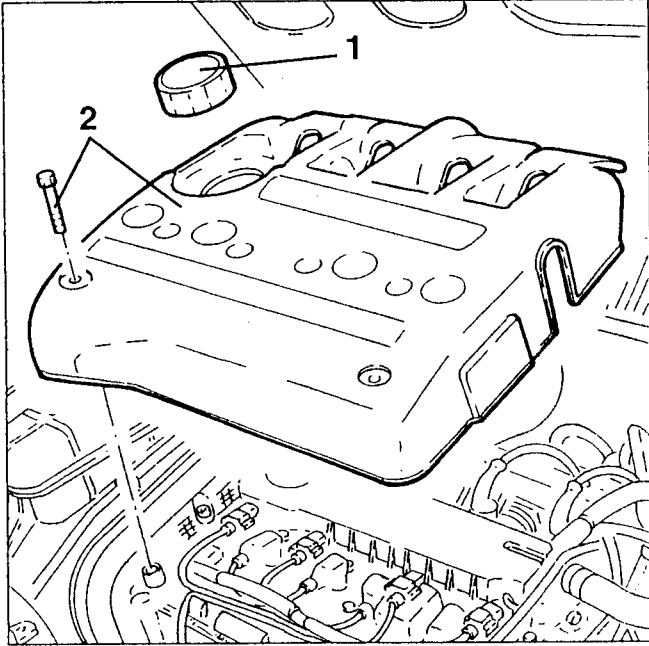




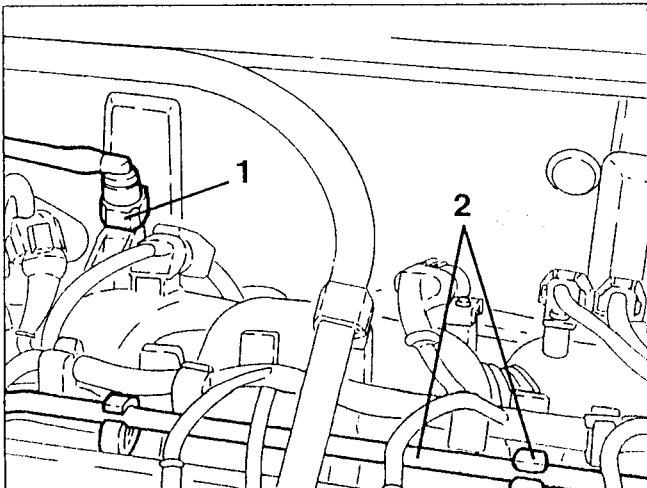
**POWER STEERING PUMP****REMOVAL/REFITTING**

- Position the vehicle on a shop jack.
- Remove the power steering reservoir cap and suck the oil with a suitable syringe.

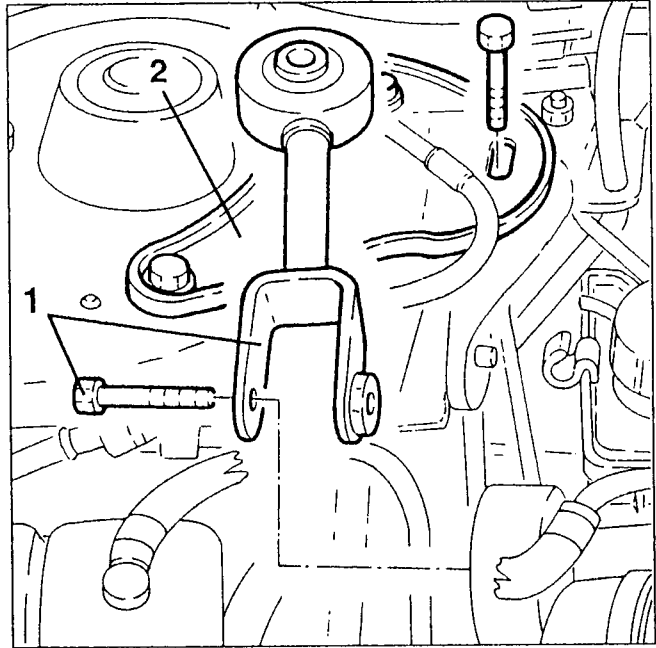
1. Remove the oil filler cap.
2. Remove the fastening screws and remove the tappet cover.



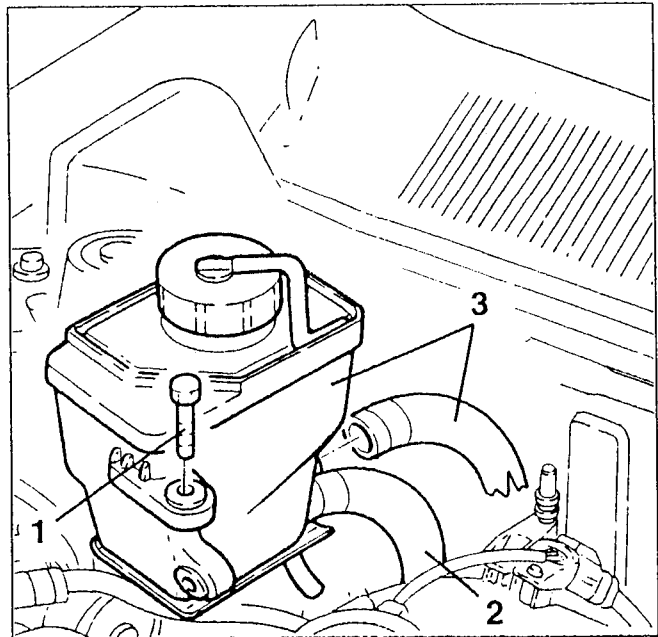
- Refit the engine oil filler cap.
- 1. Disconnect the fuel fume re-circulation quick coupling pipe.
- Release the fuel fume re-circulation pipe from the power steering reservoir clip and shift it.
- 2. Release the coolant return to reservoir pipe from the clips on the intake manifold.



1. Remove the fastening screws and remove the engine reaction tie-rod.
2. Remove the fastening screws and remove the upper engine reaction tie-rod support.



1. Remove the power steering reservoir fastening screws.
2. Disconnect the intake pipe from the power steering unit.
3. Disconnect the power steering reservoir delivery/return pipes and remove the reservoir.



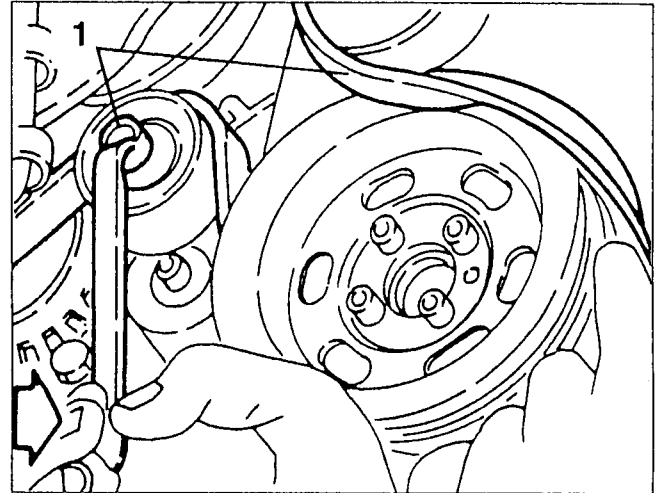
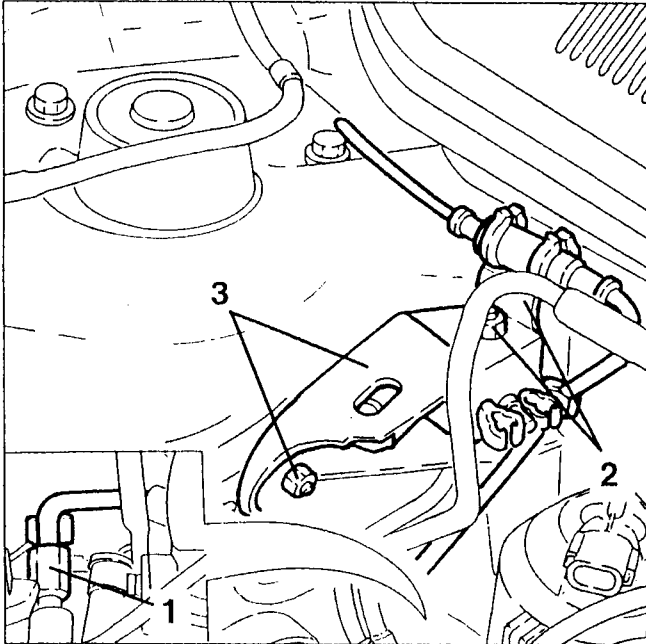


T. S.  
16V

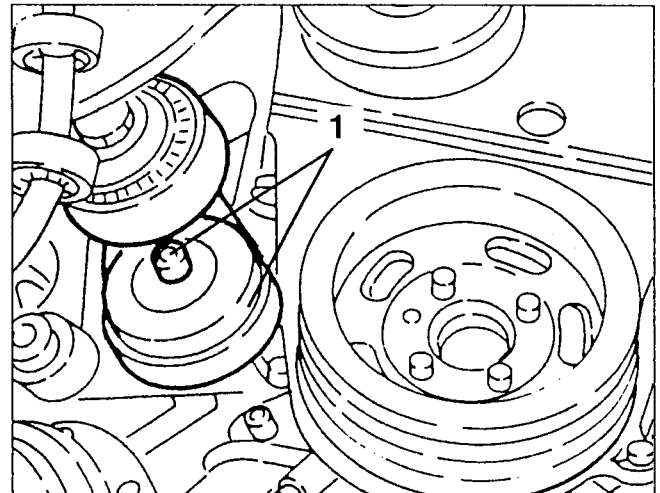


T. S.  
16V

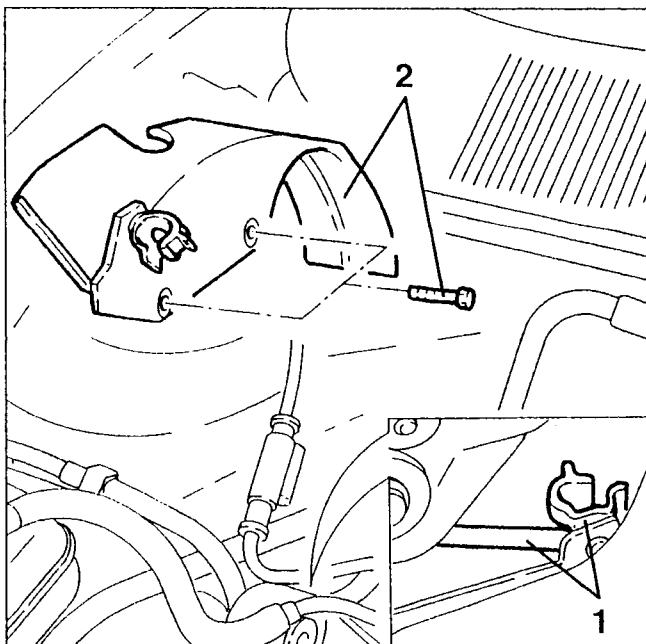
1. Disconnect the power steering unit delivery pipe from the pump.
2. Remove the fastening nut and shift the ABS electric connection support rod.
3. Remove the fastening nut and screw and remove the lower engine reaction tie-rod support.



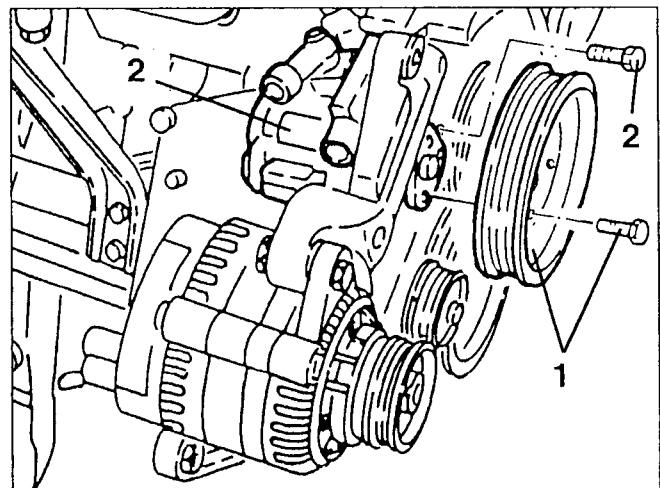
1. Remove the fastening screw and remove the belt take-up device.



1. Release the timing sensor wiring from the clip on the guard.
2. Remove the fastening screws and remove the guard.



1. Hold the pump shaft still and remove the power steering pump pulley. Remove the pulley.
2. Remove the fastening screws and remove the power steering pump.



- Lift the vehicle.

1. Slacken the auxiliary unit belt, by means of the belt take-up, and remove it.



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#### FRONT SUSPENSION

#### T. SPARK 16V

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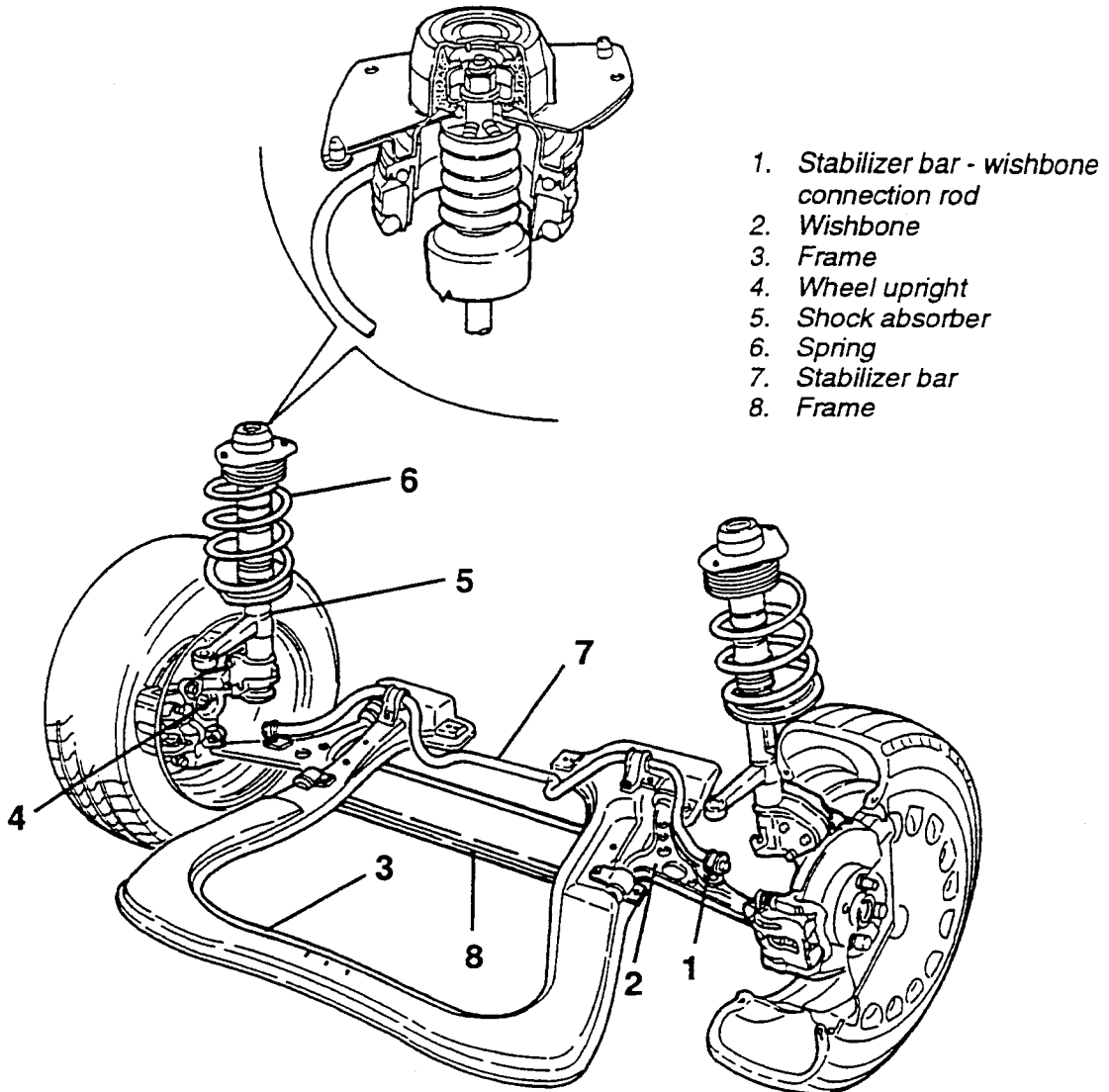
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(\*): See  T. SPARK 16V



**DESCRIPTION**



- 1. Stabilizer bar - wishbone connection rod
- 2. Wishbone
- 3. Frame
- 4. Wheel upright
- 5. Shock absorber
- 6. Spring
- 7. Stabilizer bar
- 8. Frame

The front suspension to independent wheels is of the McPherson type with telescopic struts and negative kingpin offset.

The front suspension assembly can be broken down into the following main components:

- The frame (3) supporting the power unit which is rigidly fastened to the body which besides integrating the bearing structure, also supports the cast iron suspension wishbones (2).

- The telescopic struts which comprise the helical springs (6) and the shock absorbers (5).

The offset and tapered springs make it possible to reduce the thrust on the shock absorber stem and facilitate steering.

This solution also eliminates shock absorber noise when the car is on the move, consequently improving comfort.

The newly-designed shock-absorbers are pressurised with lamellar inlet valves with plates with particularly fine tolerances, thereby achieving outstanding results in terms of comfort and noiselessness over large obstacles while maintaining the necessary damping action.

- The cast iron wishbones (2), carry the ball joints connected with the wheel upright (4) and the silent-blocks with steel sheet reinforcement for fastening the wishbones themselves to the frame (3).

The rotation of the wishbones on the silent-block confers high transversal rigidity and low longitudinal rigidity to the suspension.

These operating conditions make it possible to:

- improve vehicle behaviour even under particularly critical roadholding conditions.

- improve driving comfort.

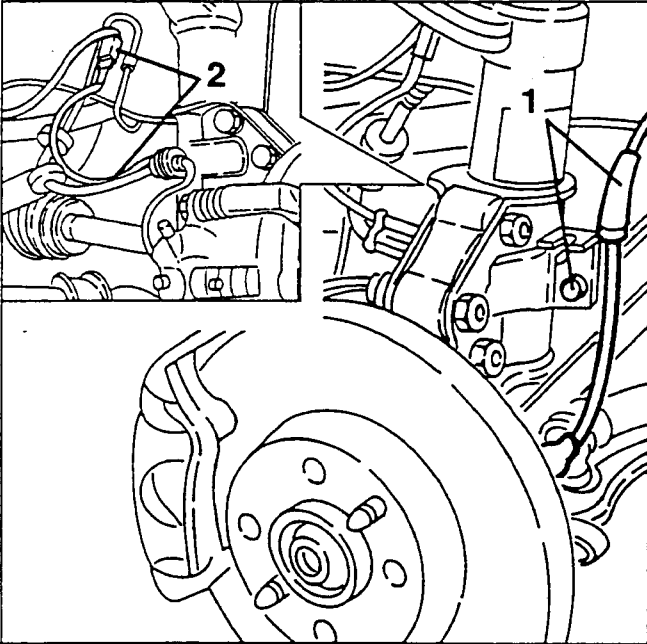
Increasing the rigidity of the suspension on one side of the vehicle and lowering it on the other, the stabilizer bar (7) serves to limit transversal inclination of the car body.

This makes it possible to increase the speed limits when cornering as it counters the increase in the roll of the body caused by the centrifugal stresses which occur as the speed increases.

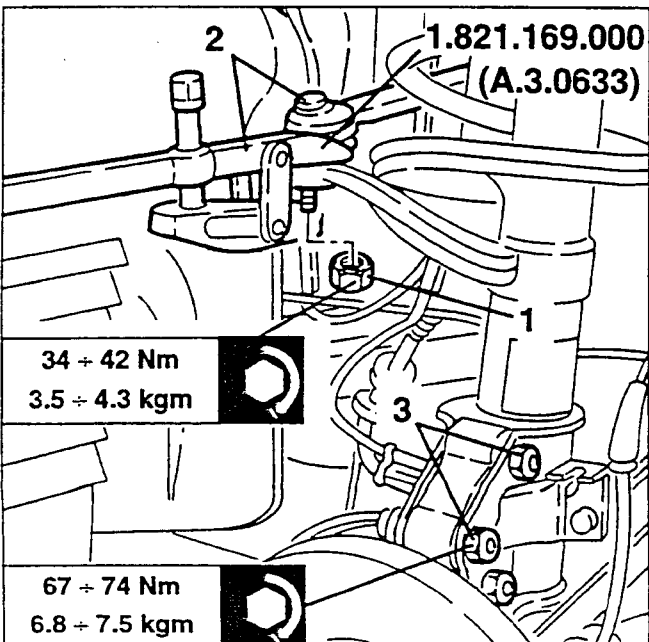
## HELICAL SPRING AND SHOCK ABSORBER ASSEMBLY

### REMOVAL/REFITTING

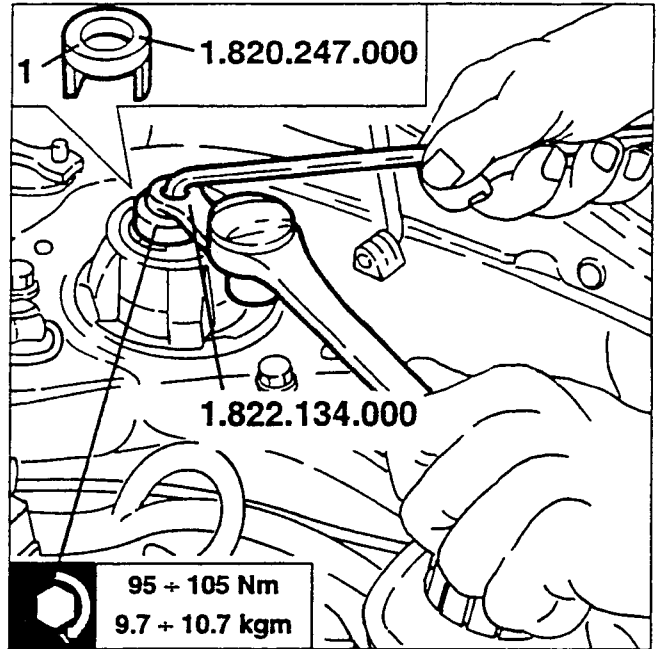
- Remove the front wheel on the side concerned.
- 1. Disconnect the cable of the A.B.S. inductive sensor from the fastening on the shock absorber.
- 2. Disconnect the cable of the brake pad wear sensor and the brake hose from the connection on the shock absorber.



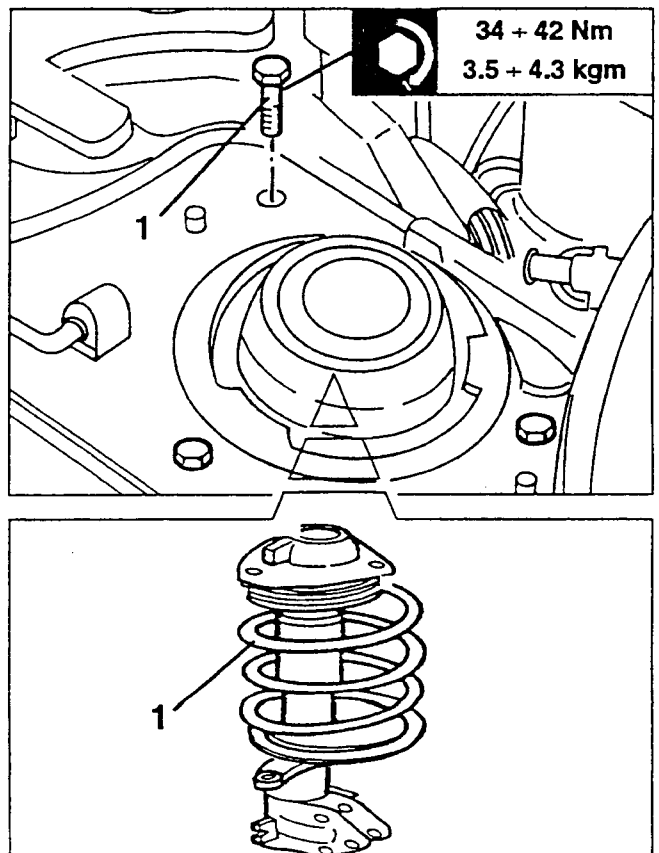
- 1. Unscrew the nut fastening the track rod from the connection on the shock absorber.
- 2. Using tool N° 1.821.169.000 (A.3.0633), disconnect the track rod from the connection on the shock absorber.
- 3. Slacken the three bolts fastening the shock absorber to the wheel upright.



- Lower the car.
- 1. If needing to separate the spring from the shock absorber on the bench, remove the protective cover and using the shock absorber stem retainer tool N° 1.820.247.000 and the extension for wrench N° 1.822.134.000, slacken the centre spring retainer nut.



- 1. Slacken the three screws fastening the shock absorber to the body.
- 2. Remove the spring-shock absorber assembly from the wheel house.





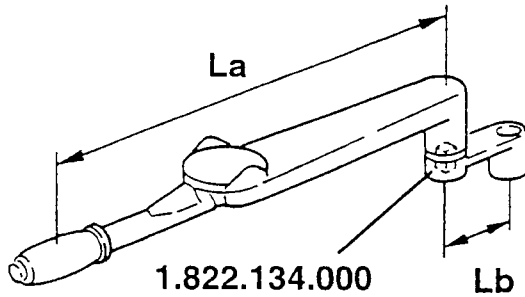
For tightening the spring retainer nut, use wrench N° 1.822.134.000 coupled to a torque wrench, the correct tightening torque must therefore be calculated by applying the following formula:

$$Cr = \frac{La \cdot Cn}{La + Lb}$$

La : length of torque wrench (in m)

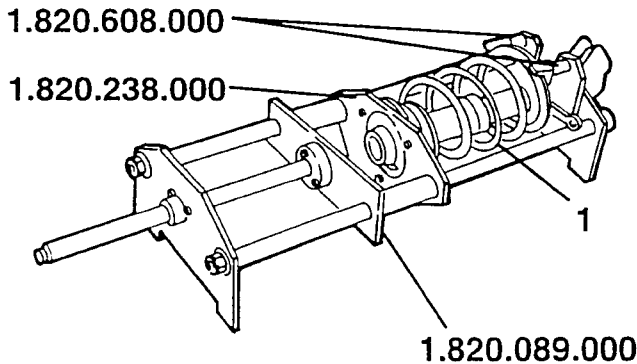
Lb : length of wrench N° 1.822.134.000 (in m)

Cn : nominal torque (95 ÷ 105 Nm)

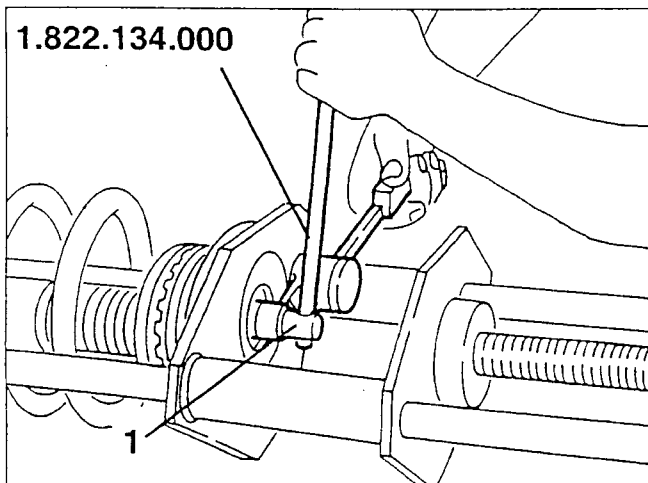


### DIS-ASSEMBLY/RE-ASSEMBLY

1. Position the spring-shock absorber assembly on tool N° 1.820.089.000 fitted with rest plates N° 1.820.238.000 and blocks N° 1.820.608.000 and compress it.



1. Using wrench N° 1.822.134.000 unscrew the retainer nut loosened previously.



- Decompress the spring-shock absorber assembly and disassemble them.

### CHECKS AND INSPECTIONS

- Check that the fastener components of the helical spring - shock absorber assembly show no signs of abnormality that might adversely affect operation.
- Check the conditions of the shock absorber and ensure that they work correctly and are not leaking, in any case change the whole shock absorber.
- Visually check the springs for cracks, distortions and failures in general that might adversely affect operation.

The helical springs are subdivided into classes of stiffness and marked with coloured paint to simplify identification. If one or both of the springs is replaced, check that the new springs are marked with the same colour as those being replaced.

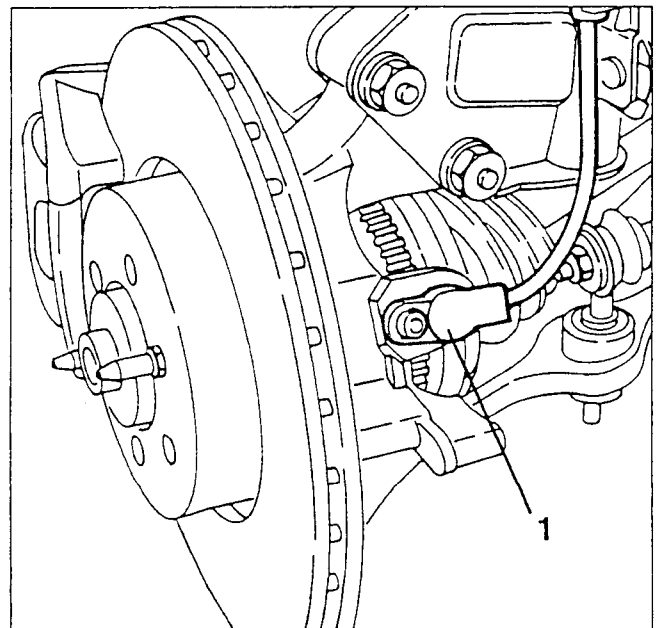
- Check that the rubber parts are intact and change them if they are damaged, deformed or obviously worn.

### WISHBONES

#### REMOVAL/REFITTING

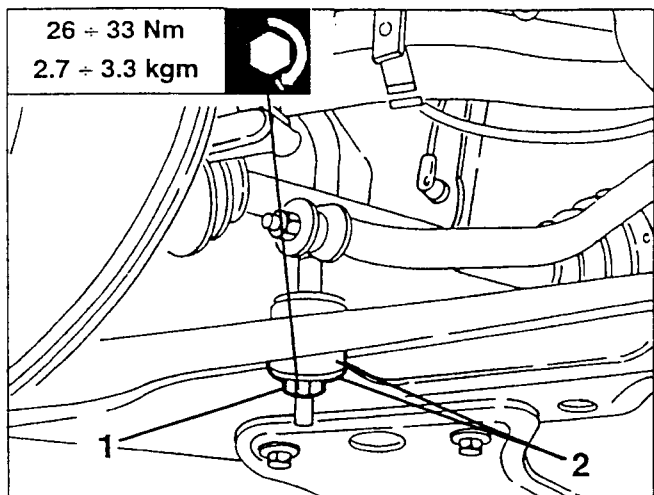
- Set the car on a lift.
- Disconnect the battery (-) terminal.
- Remove the front wheel on the side concerned.
- Raise the car.

1. Slacken the fastening screw and remove the inductive A.B.S. sensor from the wheel upright.

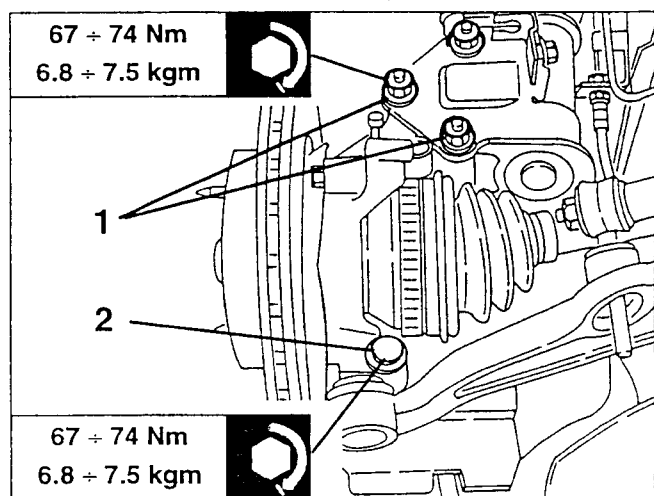




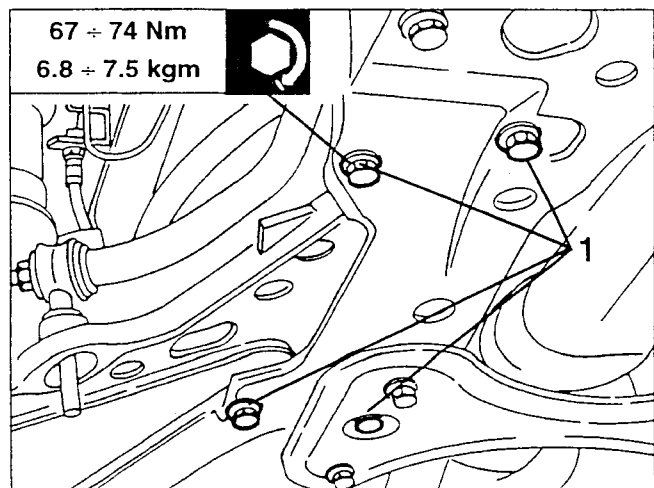
1. Unscrew the nut coupling the stabilizer bar connecting rods from the right and left wishbones.
2. Retrieve the washer and pad.



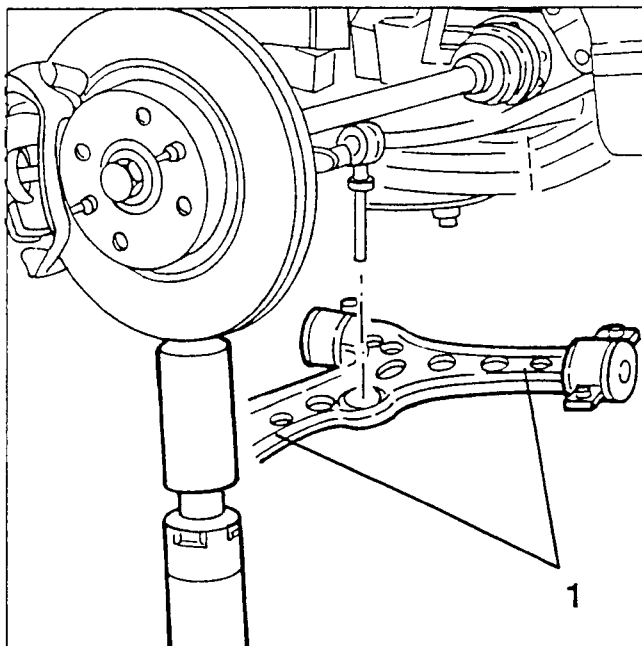
1. Slacken the three bolts fastening the wheel upright to the shock absorber stem.
2. Slacken the bolt fastening the wishbone to the wheel upright.



1. Slacken the four screws fastening the wishbone to the engine support frame.

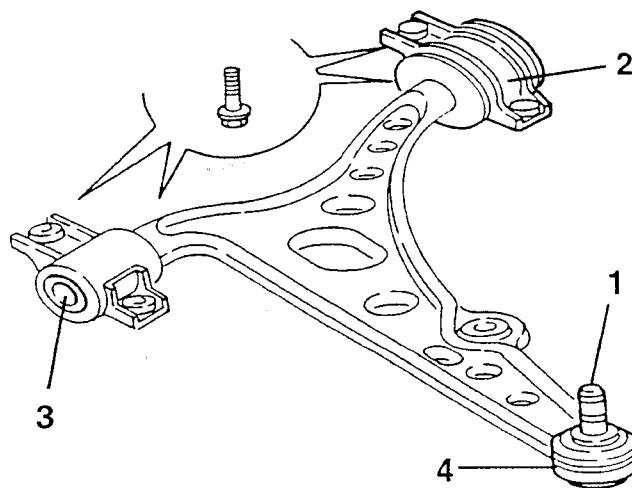


1. Support the suspension with a hydraulic jack as illustrated and remove the wishbone.



### CHECKS AND INSPECTIONS

1. Check the wear conditions of the ball pin connection between the wishbone and the wheel upright and that it is intact, change it if necessary.
2. Check the wear conditions of the U-bolts between the wishbone and front frame and that they are intact, change them if necessary.
3. Check the conditions of wear of the rubber bushes of the U-bolts between the wishbone and the front frame and that they are intact, change them if necessary.
4. Check the conditions of wear of the rubber boots of the ball pin between the wishbone and the wheel upright and that they are intact, change them if necessary.

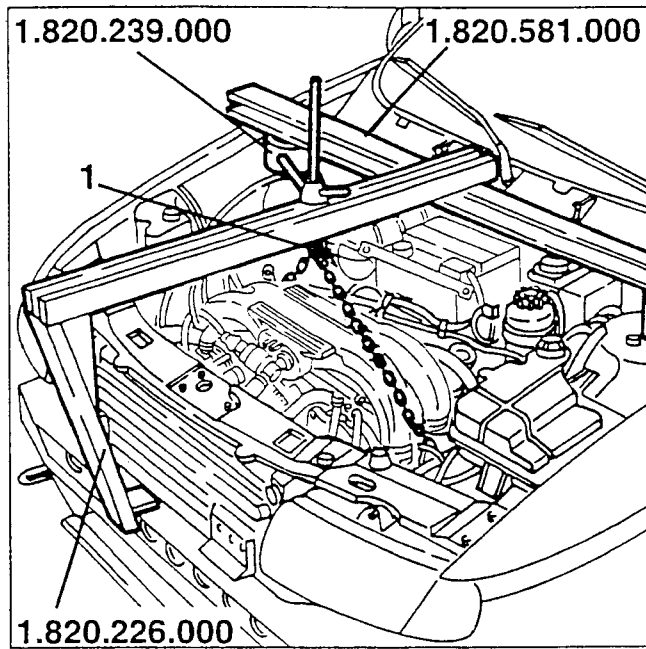




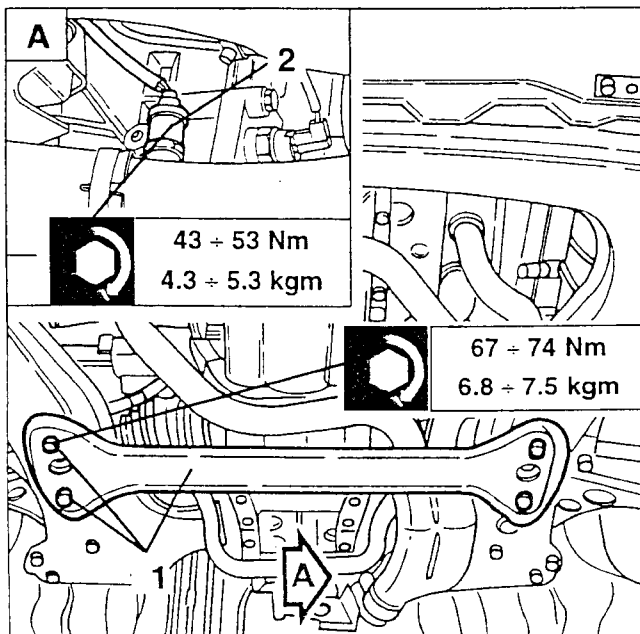
### ENGINE SUPPORT FRAME AND STABILIZER BAR

#### REMOVAL/REFITTING

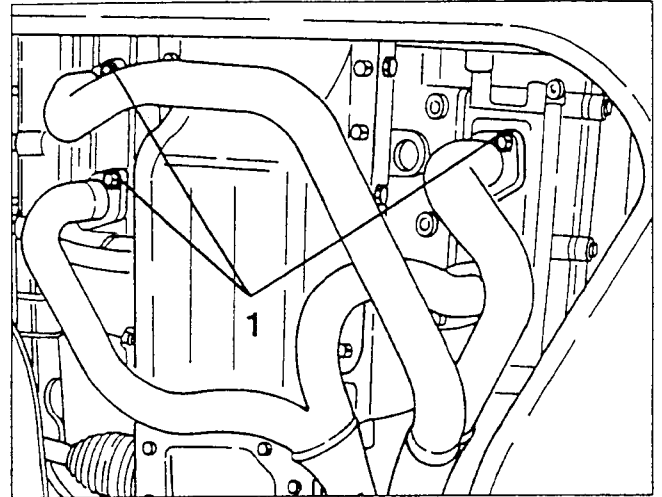
- Set the car on a lift.
  - Remove the front wheels.
  - Remove the radiator grille and bumper (see GROUP 70).
1. Using tools N° 1.820.239.000, N° 1.820.581.000 and N° 1.820.226.000 suitably support the engine.



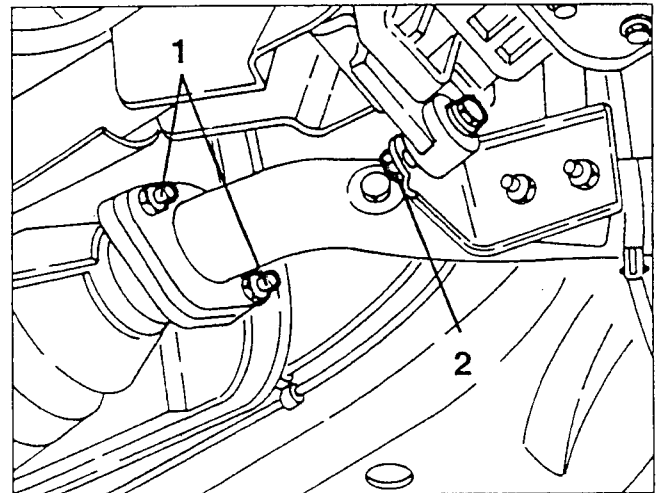
1. Slacken the four fastening screws and remove the engine support frame crossmember.
2. Slacken e remove the lambda sensor from the exhaust manifolds.



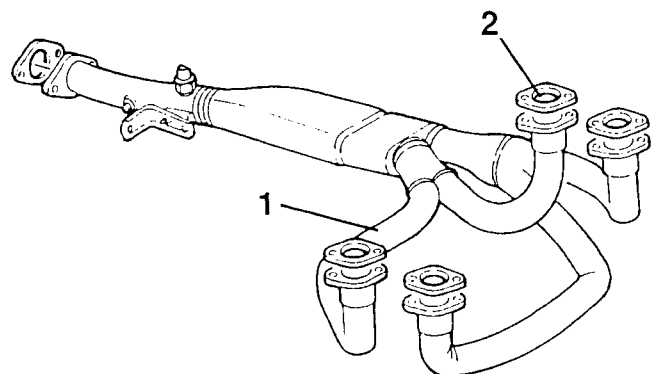
1. Slacken the nuts fastening the exhaust manifolds to the cylinder heads.



1. Slacken the two bolts fastening the exhaust manifolds to the catalytic converter.
2. Slacken the bolt fastening the exhaust manifold support bracket.

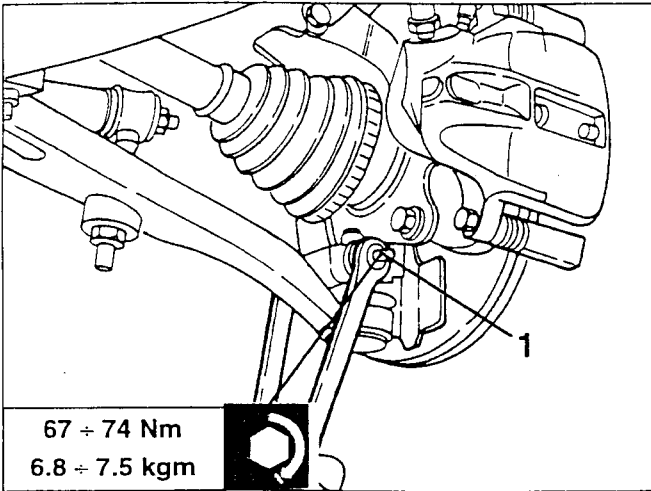


1. Remove the exhaust manifolds.
2. Remove the seals.

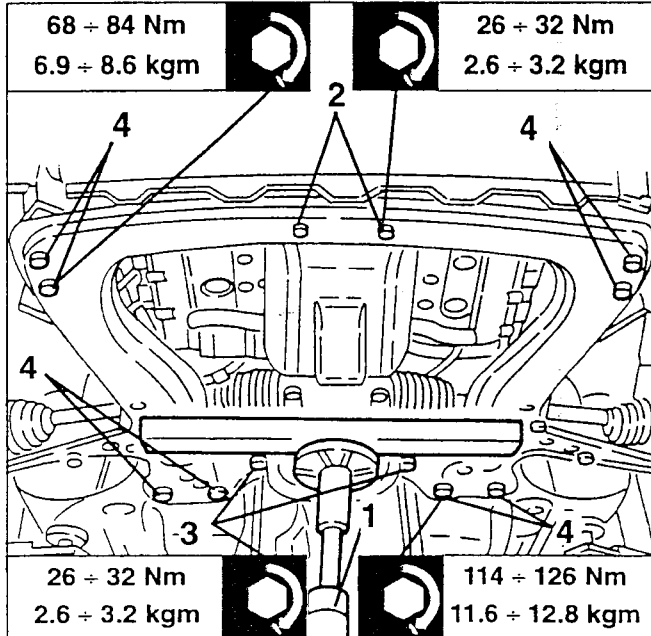




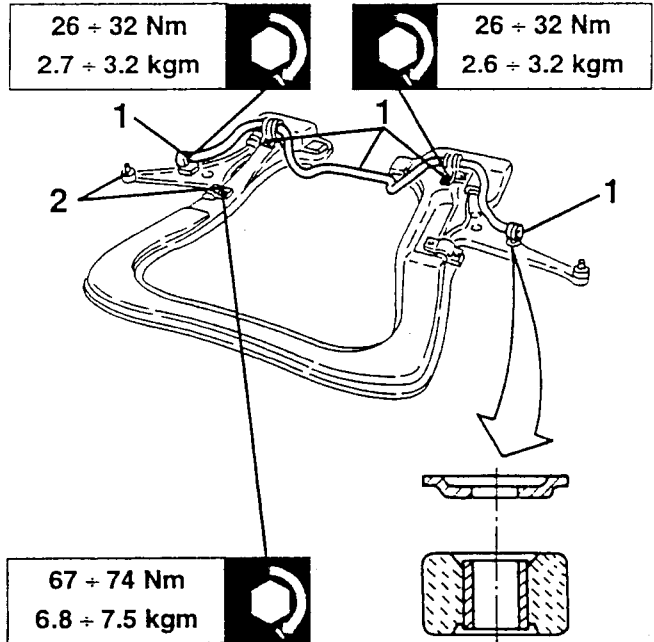
1. Slacken the bolts fastening the wishbones to the wheel uprights.



1. Suitably support the engine support frame with a hydraulic jack.  
 2. Slacken the two screws fastening the frame to the front flexible engine mount.  
 3. Slacken the two screws fastening the frame to the gearbox flexible mounts.  
 4. Slacken the screws fastening the frame to the body and remove it complete with wishbones and stabilizer bar.



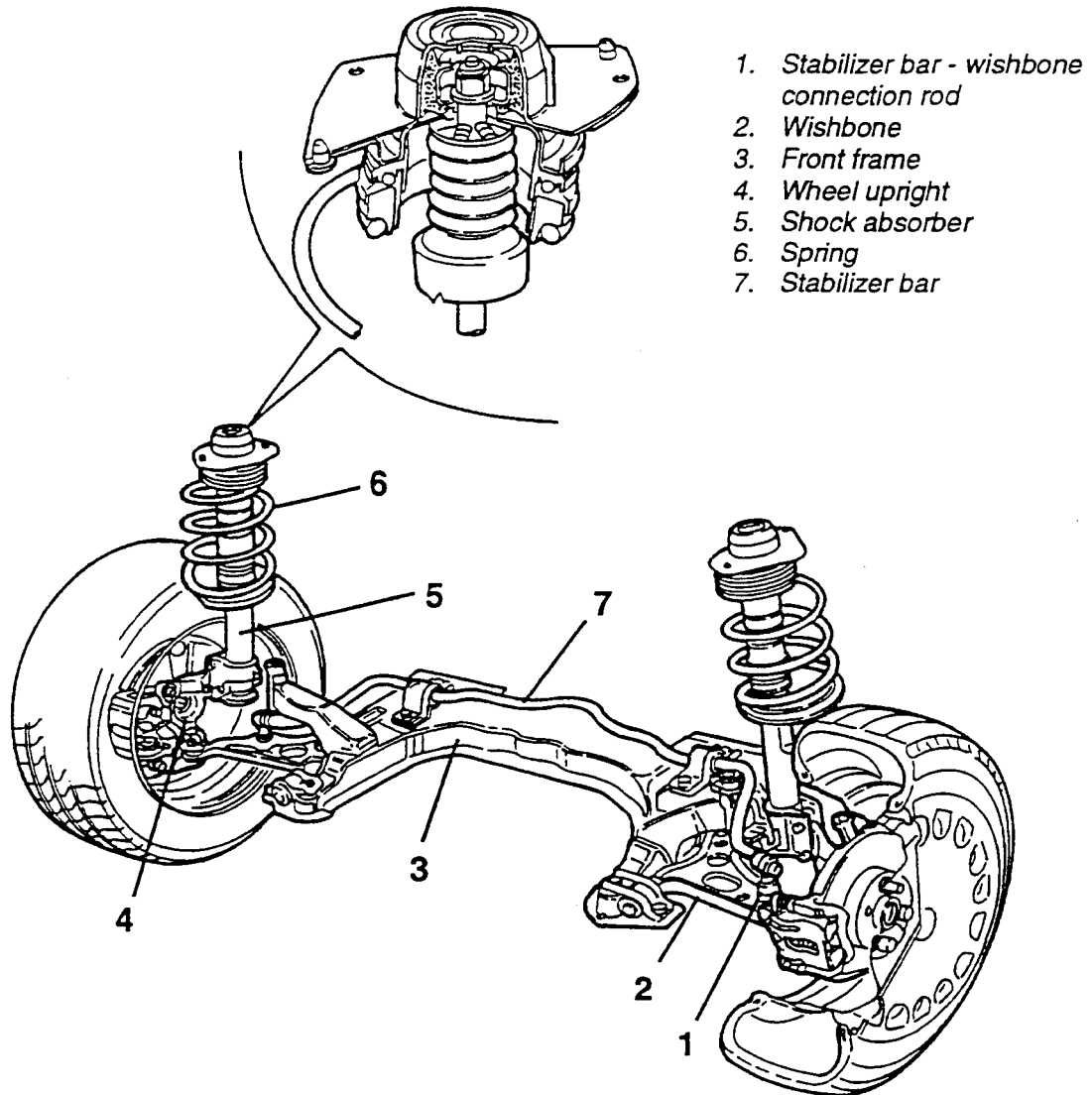
1. If necessary, remove the stabilizer bar, slackening the nuts of the U-bolts securing the nuts fastening the connecting rods to the wishbones.  
 2. If necessary, remove the wishbones slackening the nuts of the U-bolts.



When refitting the stabilizer bar on the frame check that the washers are facing the flexible pad as illustrated, as incorrect assembly could compromise the life of the actual pad.

### CHECKS AND INSPECTIONS

- Visually check the frame to make sure there are no cracks or distortions that might adversely affect operation, if so, change it.
- Visually check the stabilizer bar for cracks and distortions and change it if necessary.
- Check that the U-bolts joining the stabilizer bar to the frame are intact and free of distortion or signs of oxidation, if not change them.
- Check that the flexible pads do not reveal signs of wear, if so, change them.

**DESCRIPTION**

The front suspension to independent wheels is of the Mc Pherson type with telescopic struts and negative kingpin offset.

The front suspension assembly can be broken down into the following main components:

- The frame (3) supporting the power unit which is rigidly fastened to the body and besides integrating the bearing structure, it also supports the cast iron suspension wishbones (2).

- The telescopic struts which comprise the helical springs (6) and the shock absorbers (5).

The offset and tapered springs make it possible to reduce the thrust on the shock absorber stem and facilitate steering.

This solution also eliminates shock absorber noise when the car is on the move, consequently improving comfort.

The newly-designed shock-absorbers are pressurised with lamellar inlet valves with plates with particularly fine tolerances, thereby achieving outstanding results in terms of comfort and noiselessness over large obstacles while maintaining the necessary damping action.

- The cast iron wishbones (2), carry the ball joints connected with the wheel upright (4) and the silent-blocks with steel sheet reinforcement for fastening the wishbones themselves to the frame (3).

The rotation of the wishbones on the silent-block confers high transversal rigidity and low longitudinal rigidity to the suspension.

These operating conditions make it possible to:

- improve vehicle behaviour even under particularly critical roadholding conditions.
- improve driving comfort.

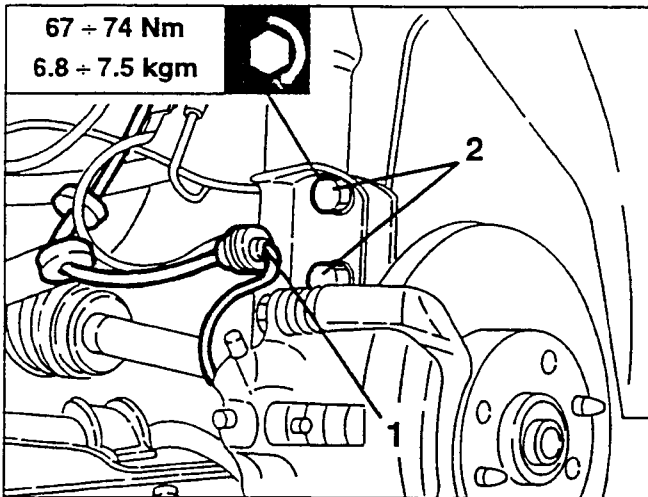
Increasing the rigidity of the suspension on one side of the vehicle and lowering it on the other, the stabilizer bar (7) serves to limit transversal inclination of the car body.

This makes it possible to increase the speed limits when cornering as it counters the increase in the roll of the body caused by the centrifugal stresses which occur as the speed increases.

## HELICAL SPRING AND SHOCK ABSORBER ASSEMBLY

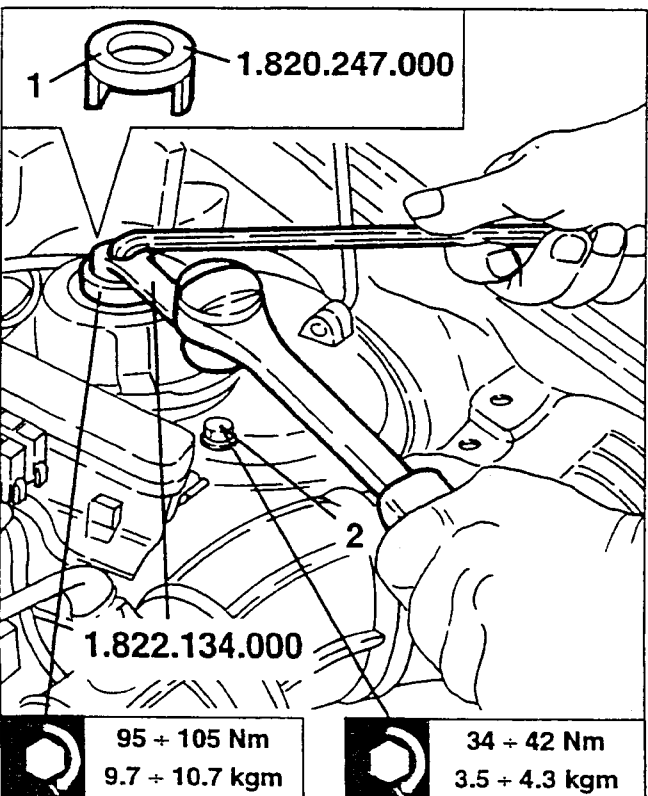
### REMOVAL/REFITTING

- Remove the front wheel on the side concerned.
- 1. Disconnect the brake hose retainer grommet from the vertical guide with shock absorber.
- 2. Slacken the two bolts fastening the shock absorber guide to the wheel upright.



67 ÷ 74 Nm  
6.8 ÷ 7.5 kgm

- Using the shock absorber stem retainer tool N° 1.820.247.000, extension for wrench N° 1.822.134.000 and a 6 mm hexagon socket wrench, slacken the centre spring retainer nut.
- Slacken the three screws fastening the shock absorber to the dome and remove the helical spring assembly and shock absorber.



1.822.134.000

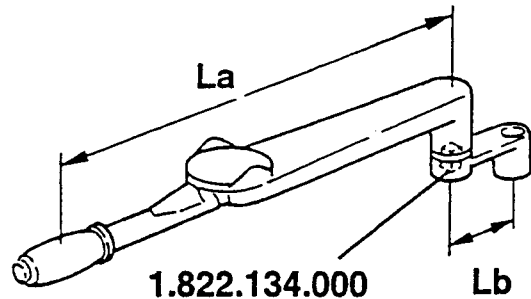
95 ÷ 105 Nm  
9.7 ÷ 10.7 kgm

34 ÷ 42 Nm  
3.5 ÷ 4.3 kgm

For tightening the spring retainer nut, use wrench N° 1.822.134.000 coupled to a torque wrench, therefore the true tightening torque must be calculated applying the following formula:

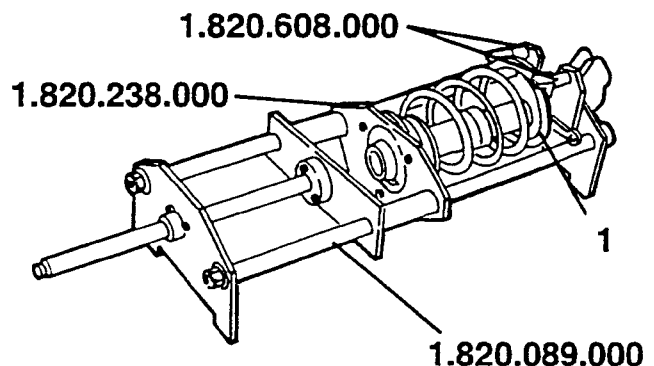
$$Cr = \frac{La \cdot Cn}{La + Lb}$$

- La : length of torque wrench (in m)
- Lb : length of wrench N° 1.822.134.000 (in m)
- Cn : nominal torque (95 ÷ 105 Nm)

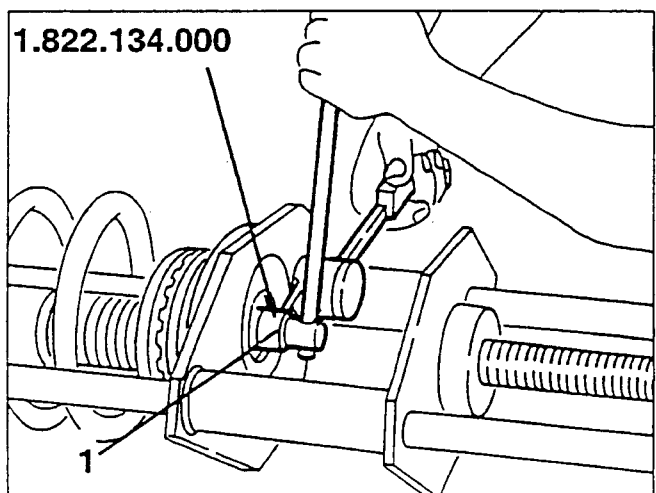


### DIS-ASSEMBLY/RE-ASSEMBLY

- Position the spring-shock absorber assembly on tool N° 1.820.089.000 fitted with resting plates N° 1.820.238.000 and blocks N° 1.820.608.000 and compress.



- Using wrench N° 1.822.134.000 unscrew the spring retainer nut slackened previously.



1.822.134.000

1

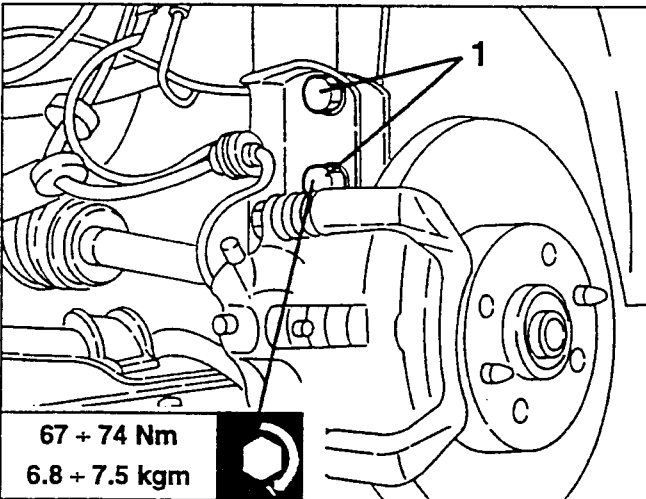
- Decompress the spring-shock absorber assembly and separate them.

For CHECKS AND INSPECTIONS proceed as described for the Boxer engines.

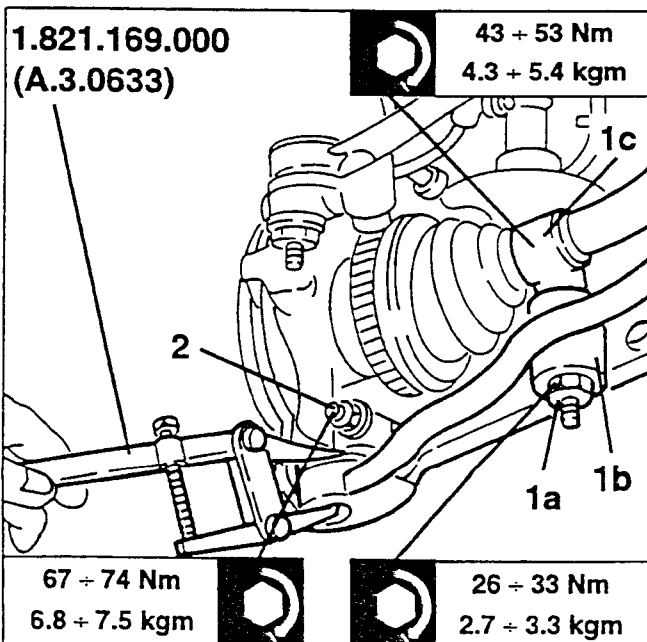
## WISHBONE

### REMOVAL/REFITTING

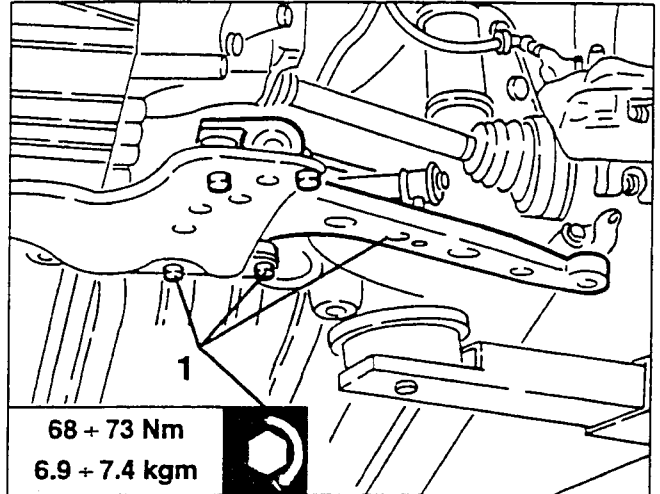
- Remove the front wheel on the side concerned.  
1. Slacken the two bolts fastening the wheel upright to the shock absorber stem.



1. Slacken the nut fastening the connecting rod to the wishbone (1a) and remove it together with the rubber pad (1b) then slacken the nut fastening the connecting rod- stabilizer bar and remove it.  
2. Slacken the bolt fastening the ball pin coupling the wishbone and wheel upright, then, using tool N° 1.821.169.000 (A.3.0633), disconnect the ball joint from the wishbone.



1. Slacken the screws fastening the U-bolts coupling the wishbone to the front crossmember and remove the wishbone.



For CHECKS AND INSPECTIONS proceed as described for the Boxer engines.

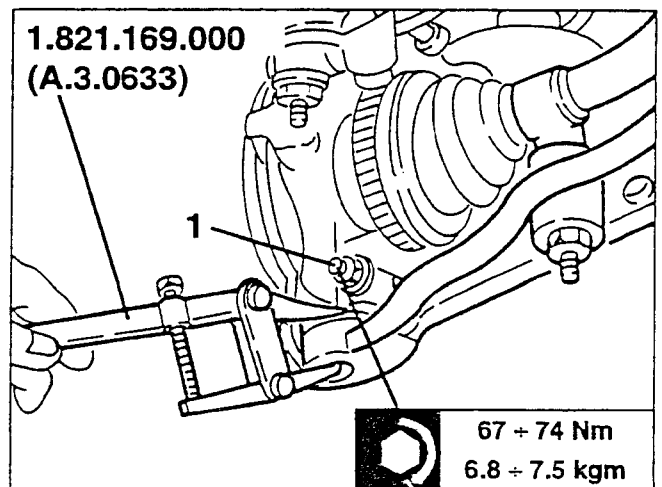
## FRONT CROSSMEMBER AND ANTIROLL BAR

### REMOVAL/REFITTING

When needing to change only the antiroll bar or only the front crossmember it is still necessary to remove the whole crossmember, proceeding as described below:

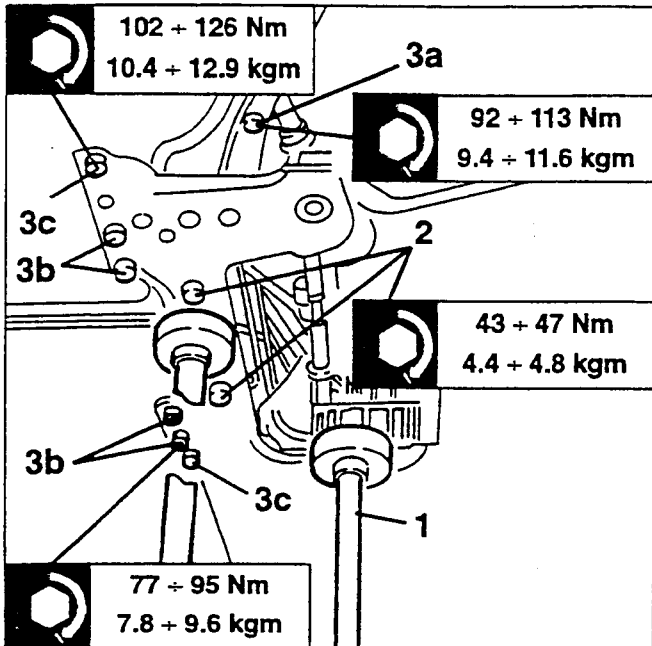
- Remove the front section of the exhaust pipe (see GROUP 10).

1. Slacken the bolt fastening the ball pin coupling between the wishbone and the wheel upright, then using tool N° 1.821.169.000 (A.3.0633), disconnect the ball joint from the wishbone.

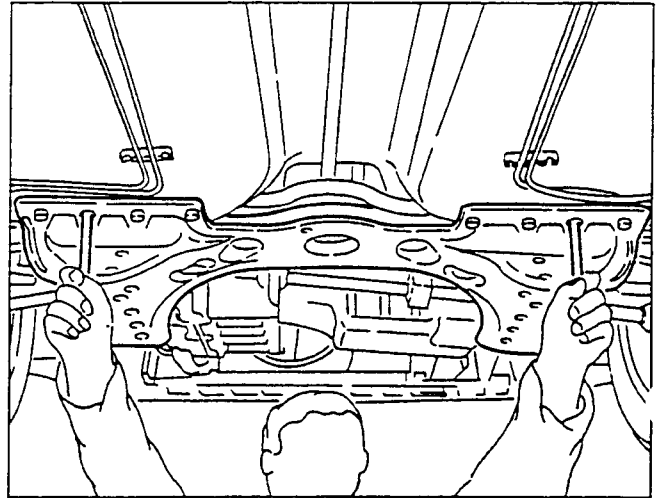


- Remove the power unit centre support (see GROUP 10).

- Using a hydraulic jack, support the front crossmember.
- Slacken the screws fastening the steering box to the crossmember.
- Firstly slacken the two front screws (3a) fastening the crossmember to the body and then the six rear screws (3b) and (3c); then lower the jack and remove the front crossmember together with the stabilizer bar.

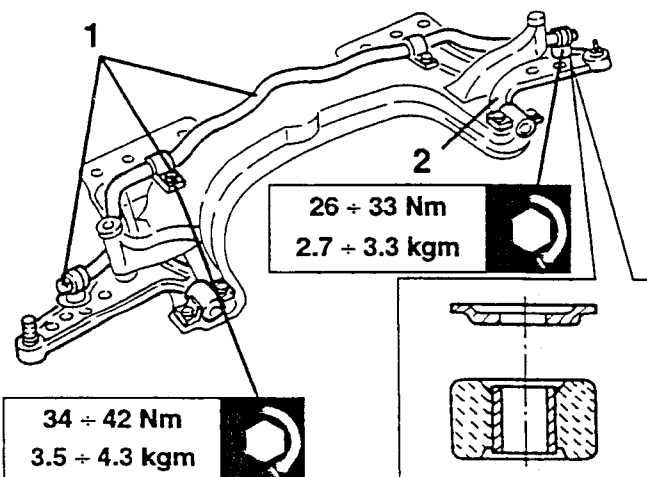


- When refitting the front crossmember it is necessary to fasten it temporarily using two 17.5 mm diameter pins, centre it with the holes on the body and then fasten it definitively tightening the screws to the specified torque.



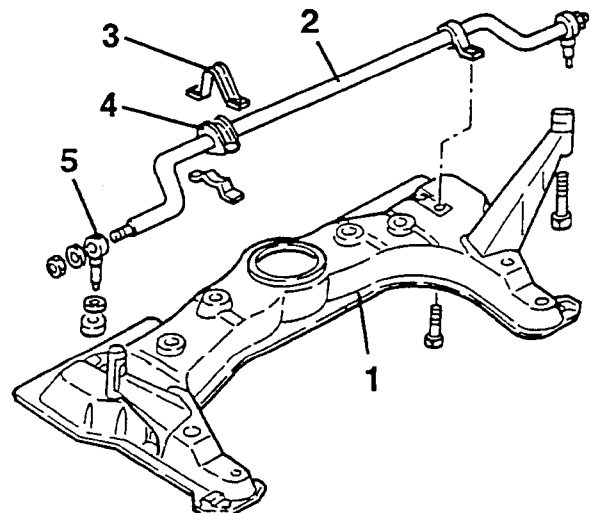
- If necessary, remove the stabilizer bar, slackening the nuts fastening the U-bolts supporting the bar itself on the crossmember and the nuts fastening the stabilizer bar connecting rods to the wishbones.
- If necessary, remove the wishbones.

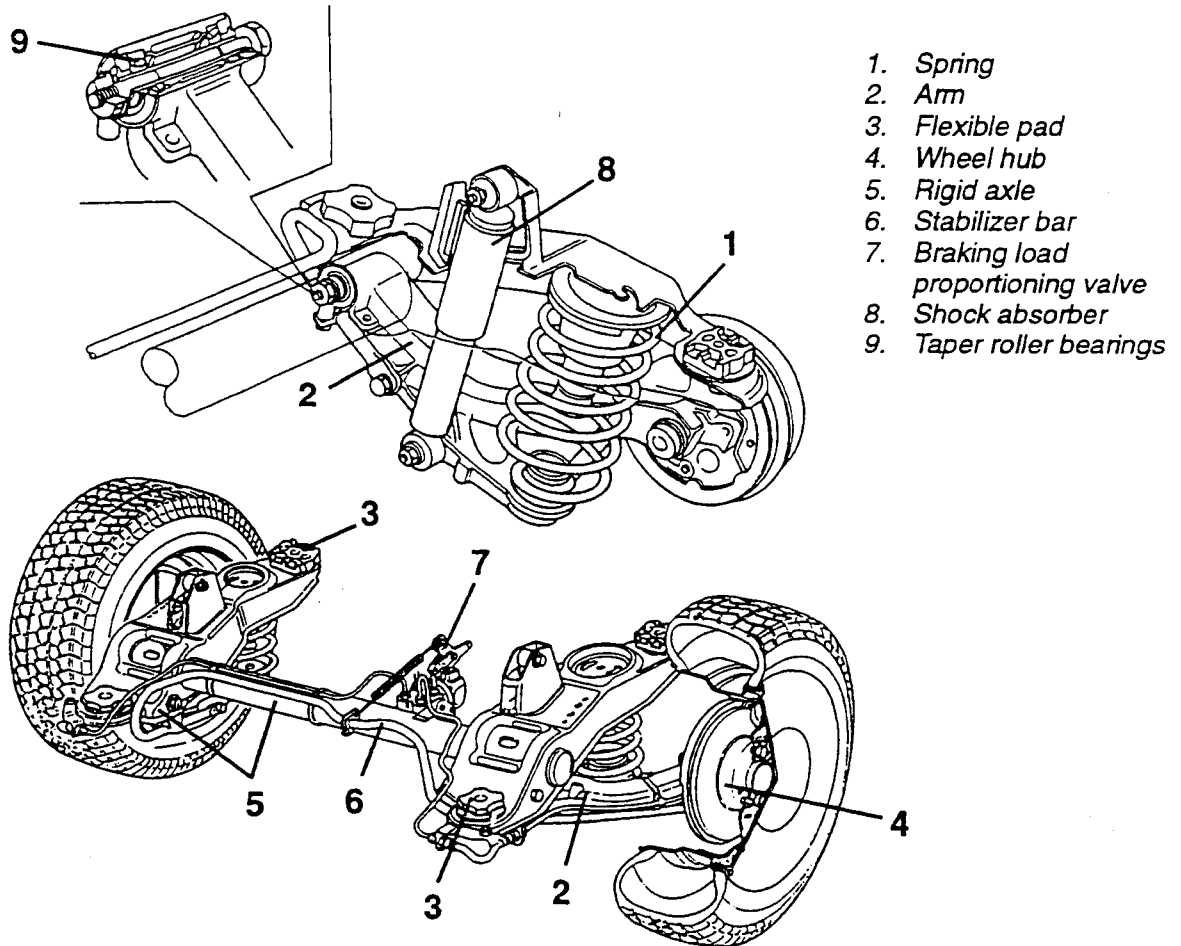
- When refitting the stabilizer bar on the crossmember make sure that the washers are facing towards the rubber pad, as incorrect assembly might adversely affect the life of the pad itself.



## CHECKS AND INSPECTIONS

- Visually check the crossmember for cracks and distortions that might adversely affect its operation and change it, if necessary.
- Visually check the stabilizer bar for cracks and distortion and change it if necessary.
- Check that the U-bolts connecting the stabilizer bar to the crossmember are intact and show no signs of distortion or oxidation and if necessary, change them.
- Check the rubber pads for signs of wear and change them if necessary.
- Check that the ball pins connecting the stabilizer bar to the wishbones are intact and show no signs of distortion or oxidation, if necessary, change them.



**DESCRIPTION**

The rear suspension to independent wheels with longitudinal arms offers the advantage of being significantly reduced in size thereby enabling the adoption of a particularly low and wide luggage compartment. The inherent problem with this type of suspension is that the wheels vary their inclination following the rolling of the vehicle.

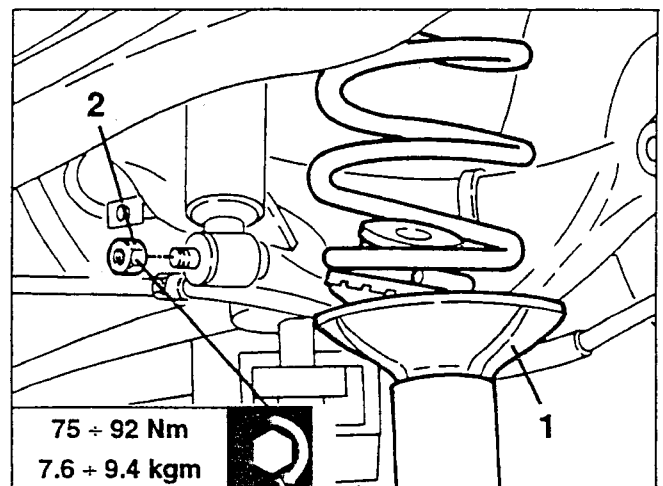
This has been solved through the adoption of a stabilizer bar integral with the longitudinal arms.

The rear suspension assembly can be broken down into the following main components:

- Rear rigid axle (5), in tubular sheet metal, fastened to the body through flexible plugs (3).
- Longitudinal arms (2) integrated with the axle by screws and hinged on taper roller bearings (9). They support the wheel hub (4) and part of the braking system.
- The stabilizer bar (6) connected to the longitudinal arms limits the transversal lean of the car and by its own rotation also controls the operation of the braking load proportioning valve (7) which is connected to it.
- Helical springs (1) which limit the thrust on the shock absorber stem.
- Shock absorbers (8) which are pressurized with lamellar inlet valves that warrant a high degree of riding comfort.

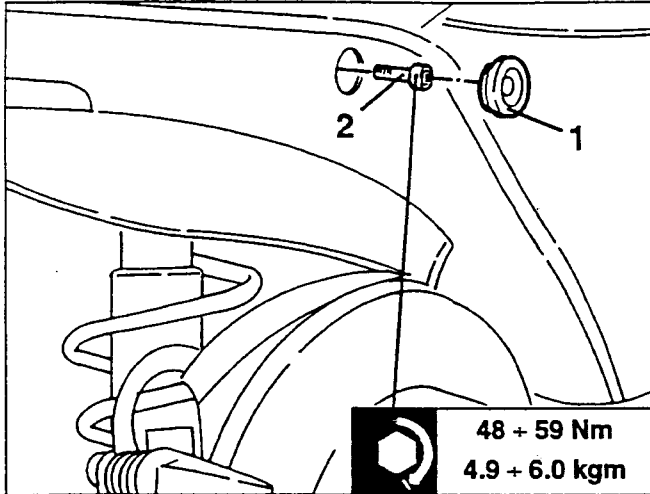
**SHOCK ABSORBERS****REMOVAL/REFITTING**

- Set the car on a lift.
- Remove the wheel on the side concerned.
- 1. Raise the car and using a hydraulic jack placed under the longitudinal arm, preload the spring.
- 2. Slacken the lower nut fastening the shock absorber to the suspension longitudinal arm.



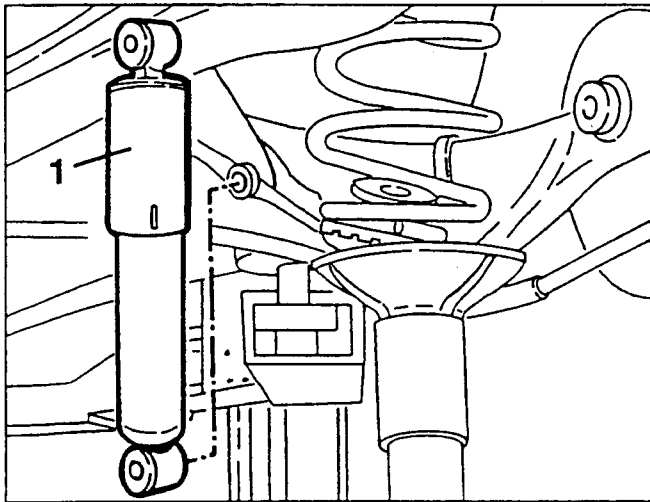


1. Remove the protective cap covering the access hole containing the upper shock absorber fastening screw.
2. Working through the wheel arch unscrew the upper shock absorber fastening screw.



**NOTE:** As the body is boxed around the area affected by the operation, pay particular attention not to drop the screw inside the boxed section.

1. Remove the shock absorber.



### CHECKS AND INSPECTIONS

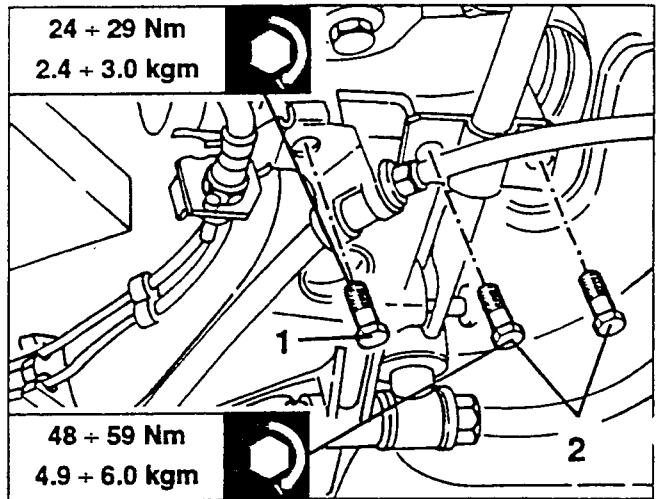
- Check that the shock absorber is working properly and does not leak, when necessary, always replace the whole shock absorber.

### HELICAL SPRING

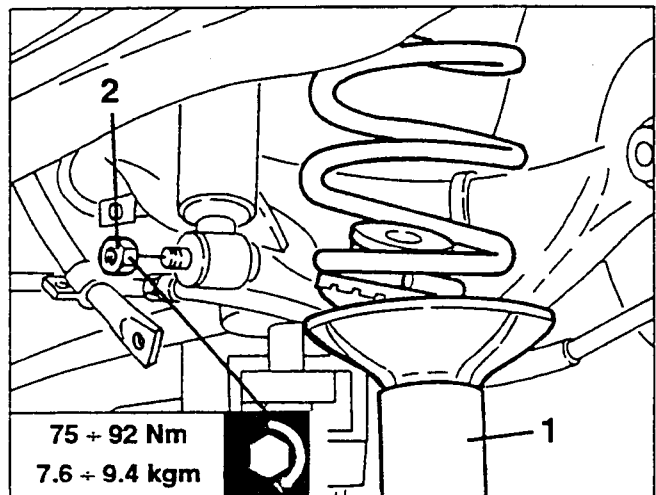
#### REMOVAL/REFITTING

- Set the car on a lift.
- Remove the wheel on the side concerned.

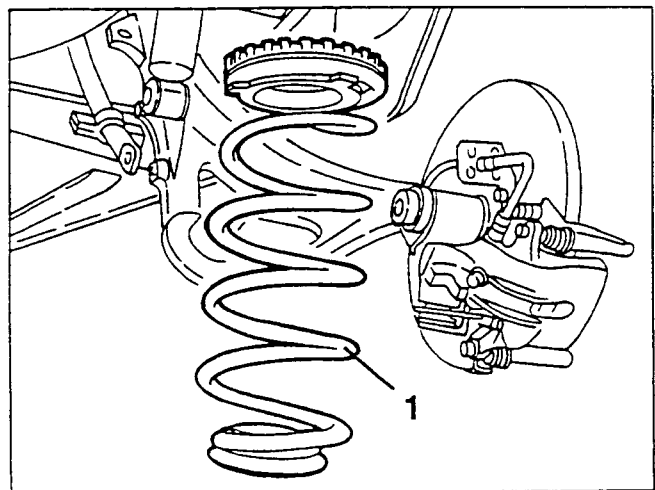
1. Slacken the fastening screw of the handbrake cable and brake hose support bracket.
2. Slacken the screws fastening the stabilizer bar on both sides of the suspension.



1. Place a hydraulic jack under the longitudinal arm and preload the spring.
2. Slacken the shock absorber fastening bolt.



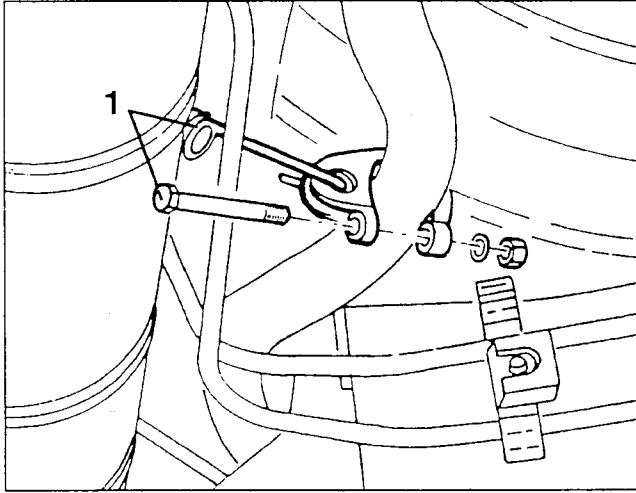
1. Lower the hydraulic jack and remove the spring complete with rebound rubbers.



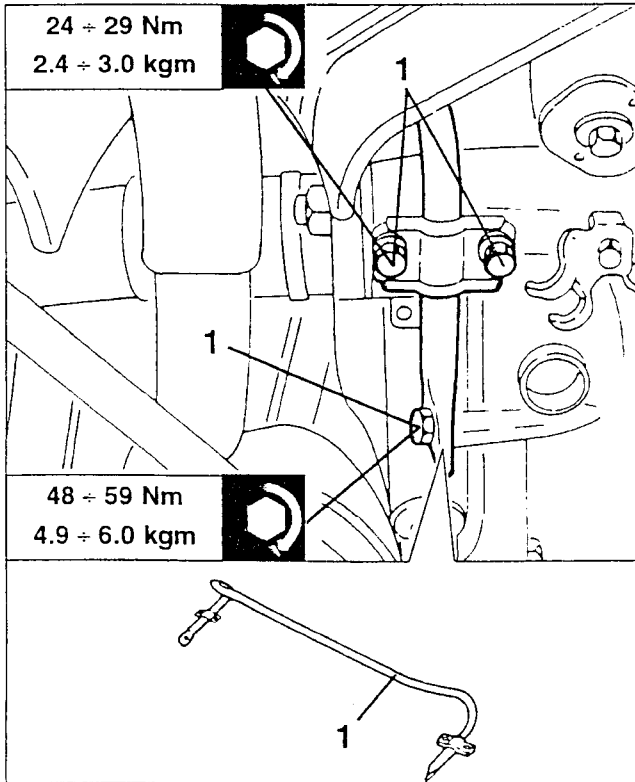
## STABILISER BAR

### REMOVING/REFITTING

- Set the car on a lift.
- Remove the fuel tank (see GROUP 10).
- 1. Slacken the bolt and disconnect the braking load proportioning valve spring from the stabiliser bar.



- Slacken the two nuts fastening the first exhaust silencer guard.
- Slacken the screw fastening the exhaust pipe rear support, then lower it as required.
- 1. Slacken the three screws per side fastening the stabiliser bar, then remove it.

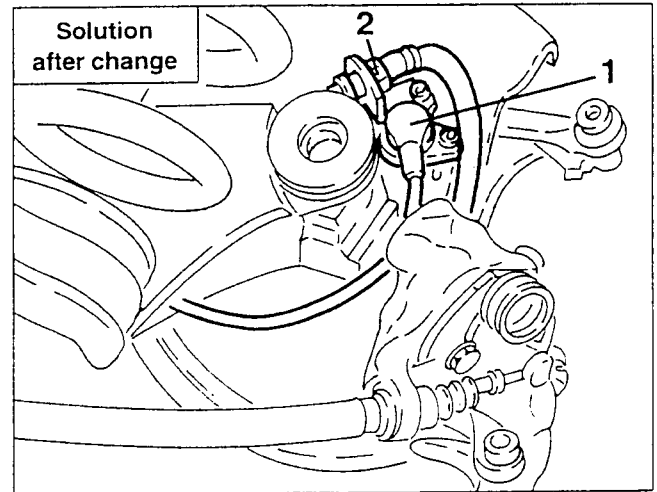
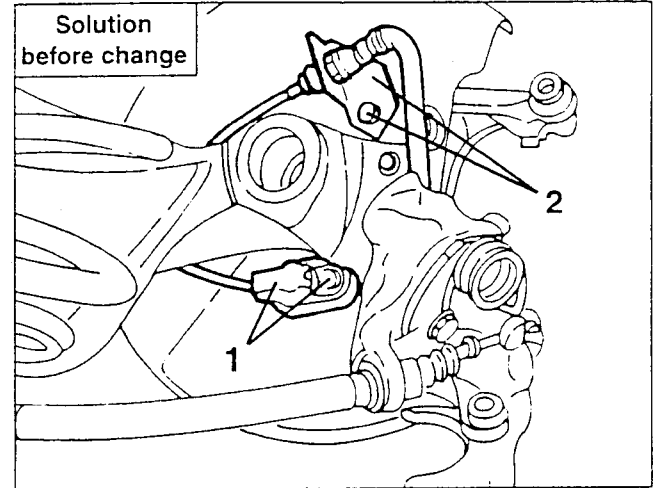


**WARNING:**  
When refitting adjust the braking load proportioning valve (see GROUP 33).

## LONGITUDINAL ARM

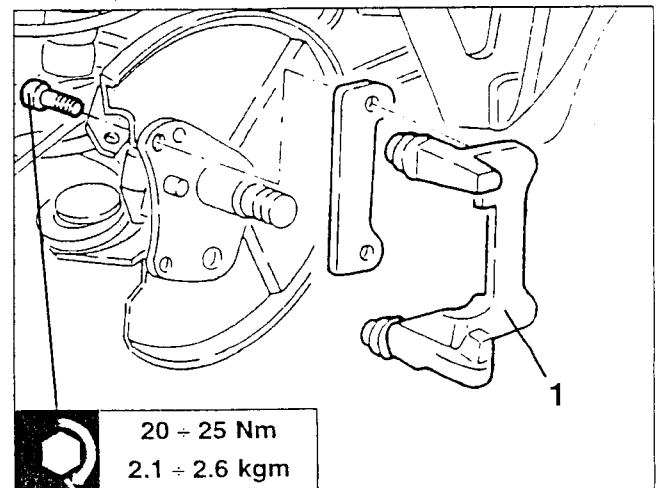
### REMOVING/REFITTING

- Remove the the wheel hub (see specific paragraph).
- 1. Slacken the fastening screw and remove the A.B.S., inductive sensor.
- 2. Slacken the fastening screw and remove the brake piping support bracket.



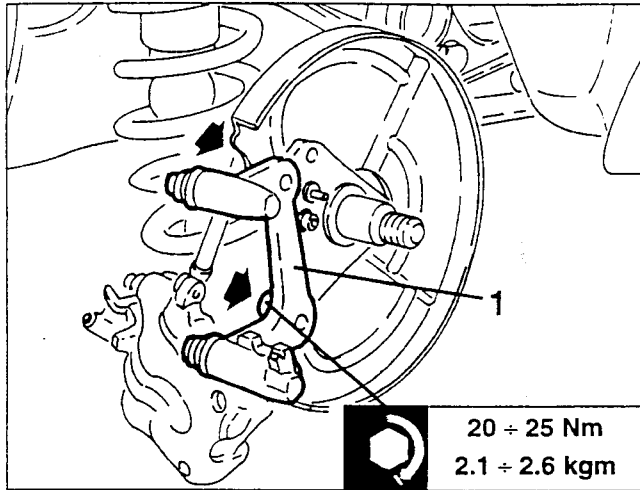
### Solution before change

- 1. Slacken the two fastening screws and remove the brake caliper support and retrieve the spacer.

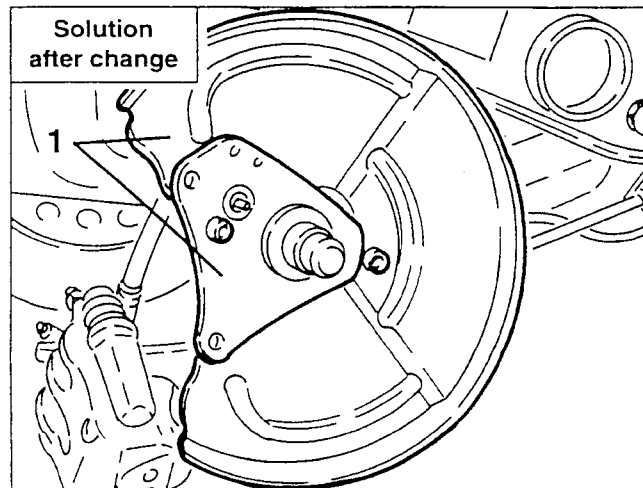
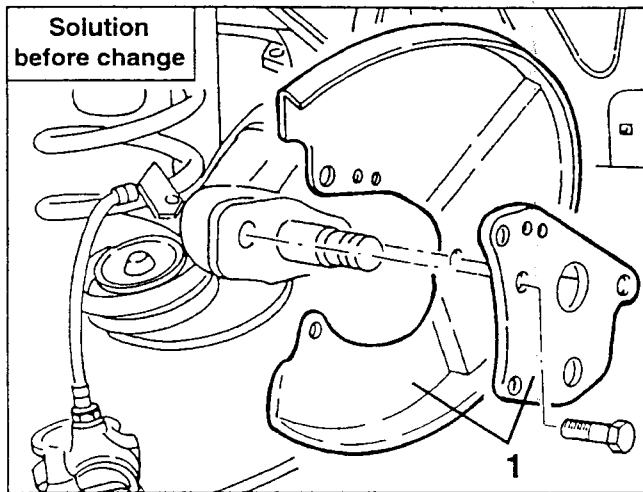


### Solution after change

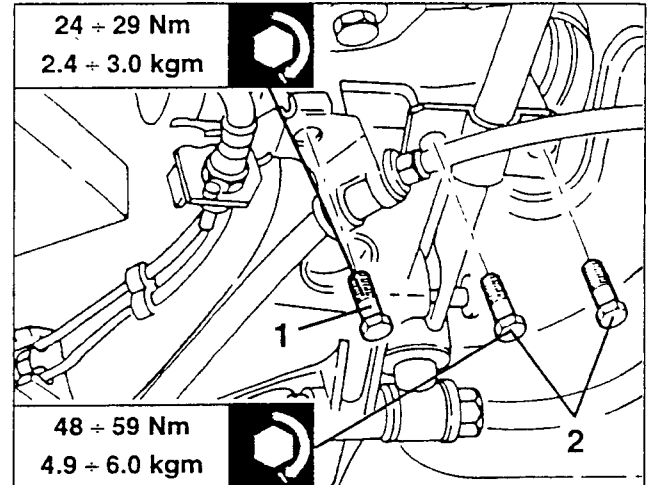
1. Slacken the two fastening screws and remove the brake caliper support.



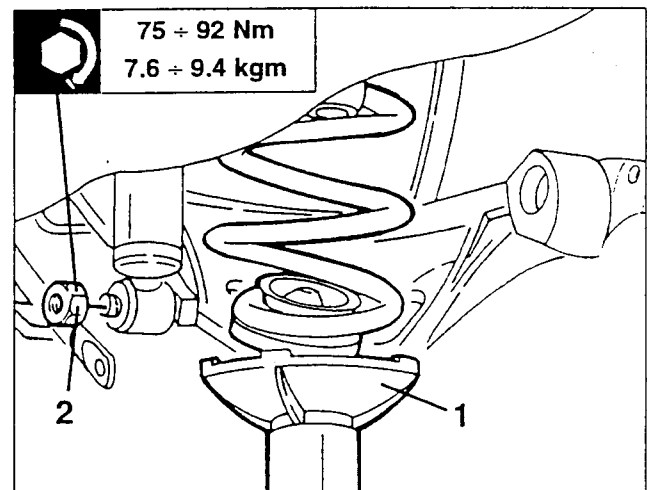
1. Slacken the two fastening screws and remove the brake disk guard and stiffener plate.



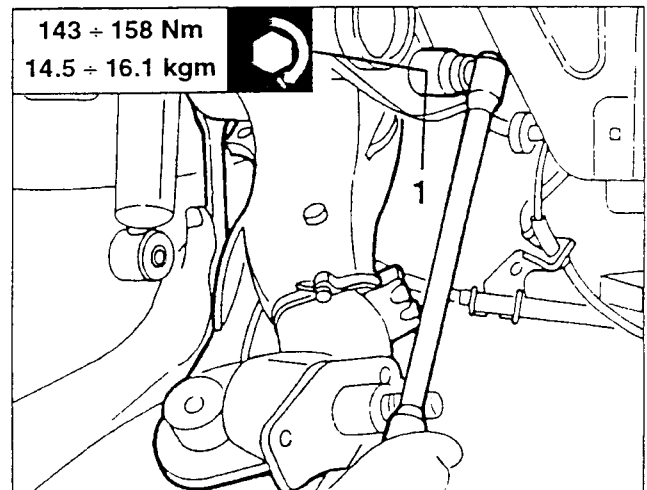
1. Slacken the screw fastening the handbrake cable support bracket, brake pipe and A.B.S. sensor cable.
2. Slacken the three screws per side fastening the stabiliser bar.



1. Set a hydraulic jack under the longitudinal arm of the suspension and preload the spring.
2. Slacken the shock absorber lower fastening bolt, lower the hydraulic jack and remove the spring.



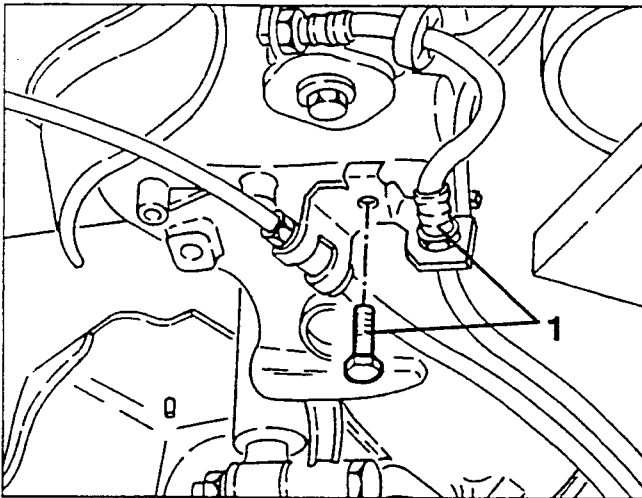
1. Slacken the fastening bolt and remove the longitudinal arm.



### RIGID REAR AXLE

#### REMOVAL/REFITTING

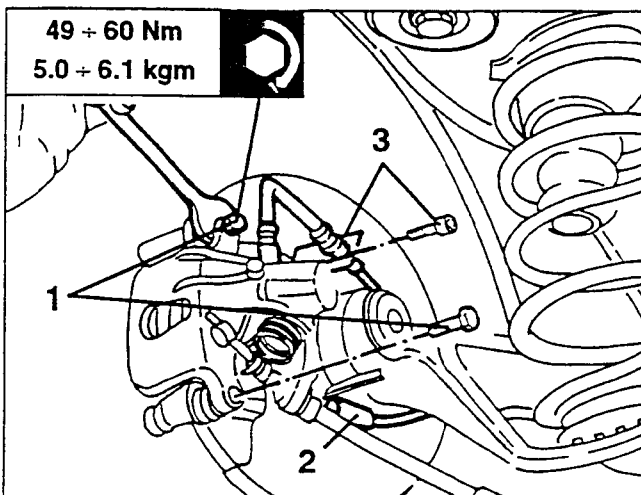
- Set the car on a lift.
  - Remove the rear wheels.
  - Remove the fuel tank and the rear section of the exhaust pipe (see GROUP 10).
  - Remove the stabilizer bar (see specific paragraph).
1. Slacken the screws fastening the A.B.S. sensor and brake hose support bracket.



1. Slacken the two screws fastening the brake caliper without disconnecting it from the pipes and cables.

**When refitting replace the screw securing the brake calipers and tighten them to the specified torque.**

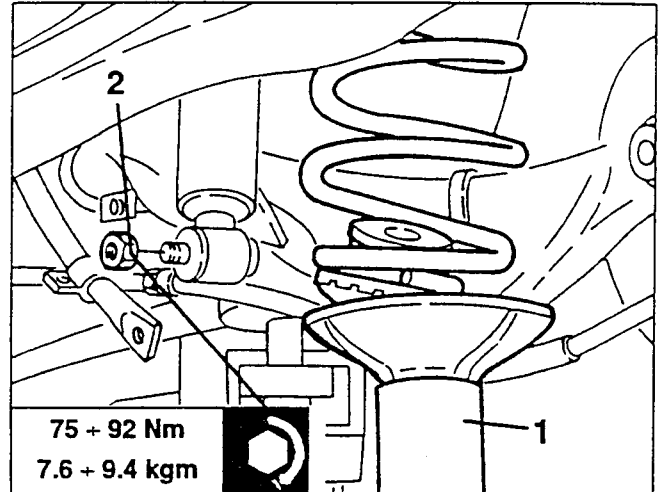
- 2. Slacken the fastening screw and remove the A.B.S. inductive sensor.
- 3. Slacken the fastening screw of the brake pipe support plate from the disk guard.



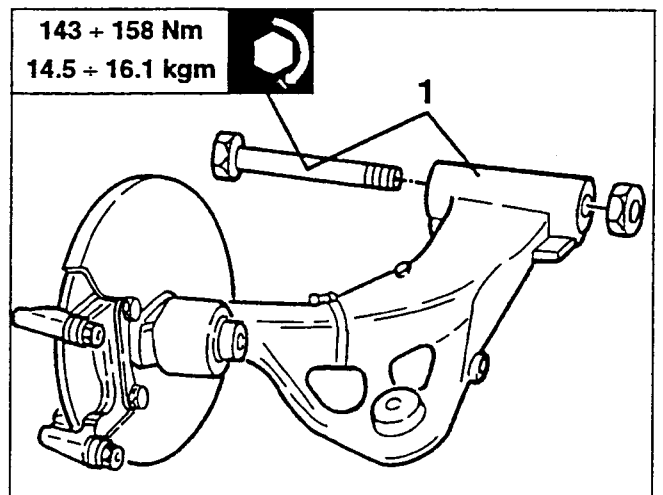
- Move aside the brake calipers complete with pipes and cables so that they do not hinder the subsequent operations

1. Using a hydraulic jack, placed under the suspension longitudinal arm, preload the spring.

2. Slacken the shock absorber lower fastening bolt, lower the hydraulic jack and remove the spring.

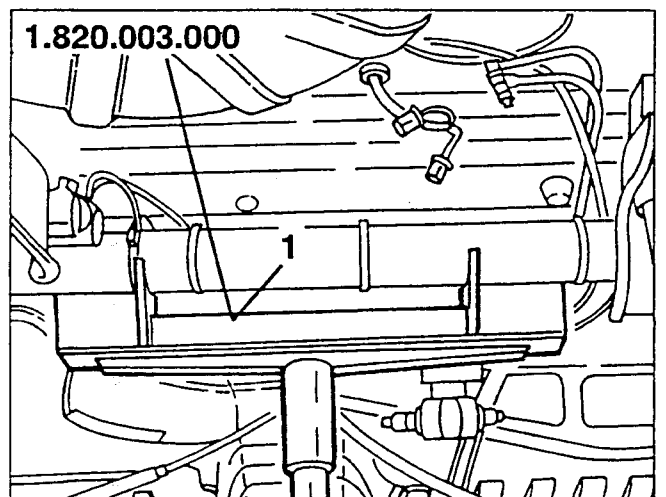


1. Slacken the fastening bolt and remove the longitudinal arm complete.

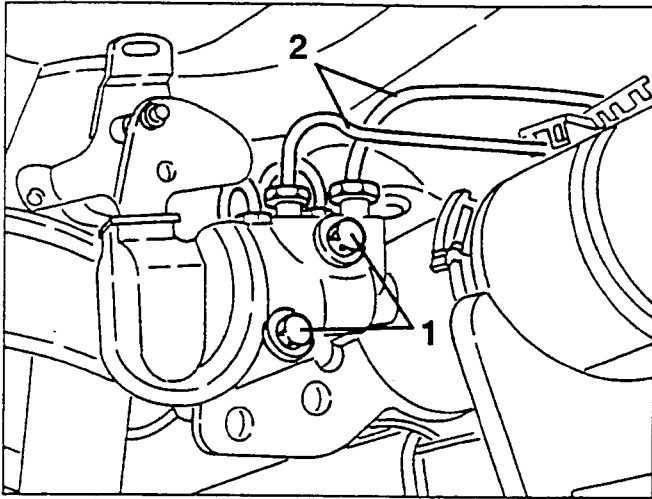


- Remove the other longitudinal arm in the same manner.

1. Place a hydraulic jack fitted with tool N° 1.820.003.000 under the rear axle.



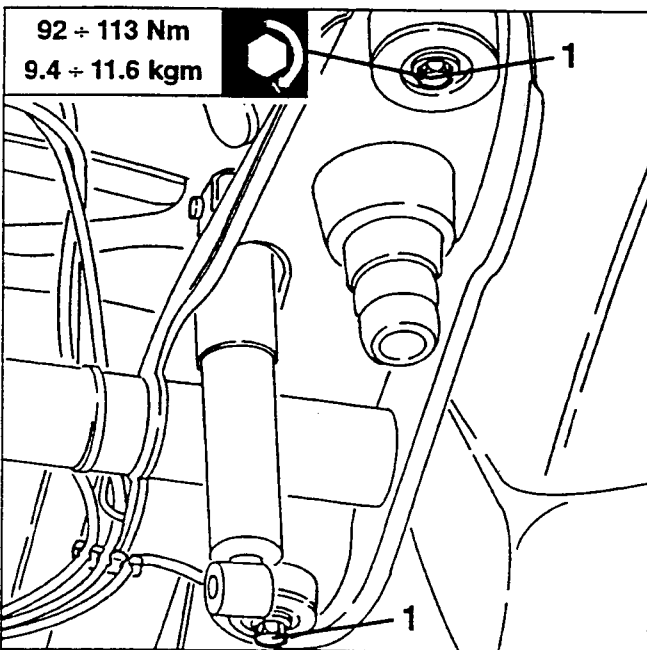
1. Slacken the braking load proportioning valve fastening screws.
2. Free the brake pipes from the fasteners on the axle.



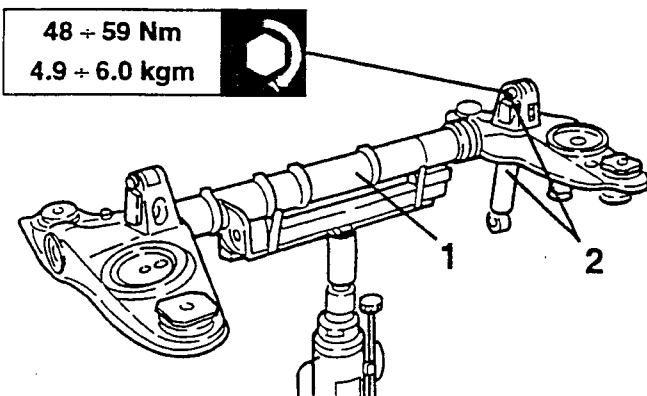
## CHECKS AND INSPECTIONS

- Check the rear rigid axle for distortions, cracks or misalignment between the two side arms.
- Check the conditions of the rebound rubbers.
- If any of the above faults are encountered, replace the whole axle.

1. Slacken the two screws per side fastening the rigid axle flexible mounts to the body.



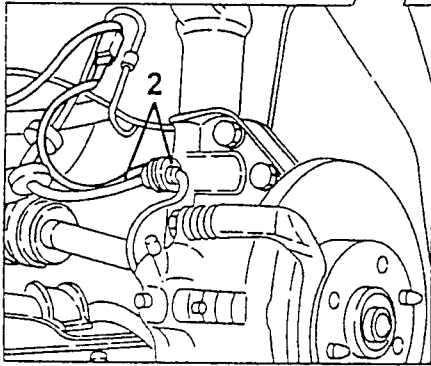
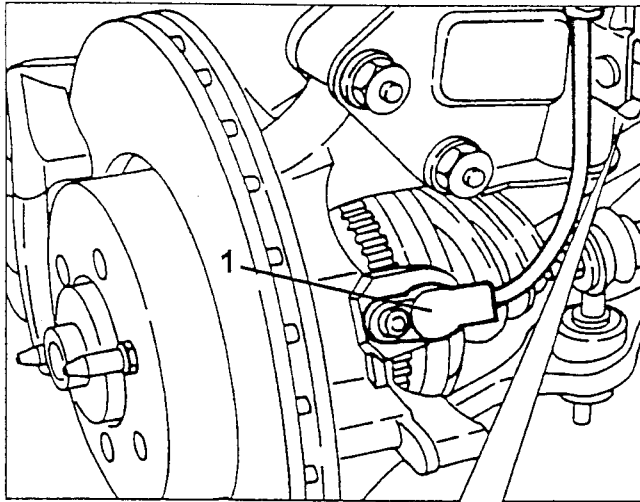
1. Lower the hydraulic jack and remove the rigid axle.
2. If necessary, slacken the shock absorber upper fastening bolts and separate them from the axle.



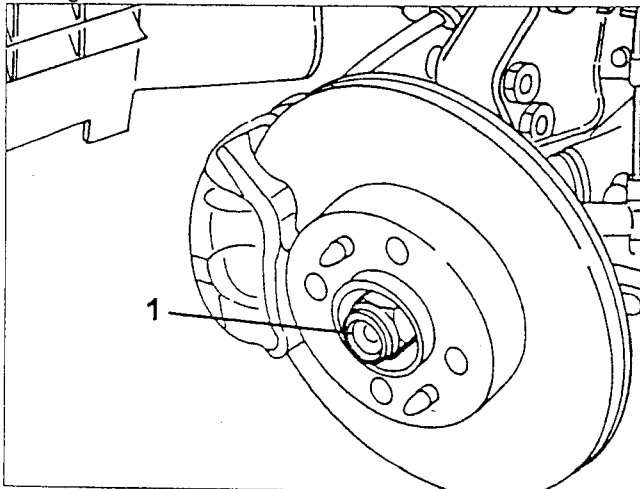
## FRONT WHEEL UPRIGHT (Boxer versions)

### REMOVAL/REFITTING

1. Slacken the fastening screw and remove the inductive A.B.S. sensor from the wheel upright.
2. Disconnect the brake pad wear sensor cable and the brake hose from the coupling on the shock absorber.

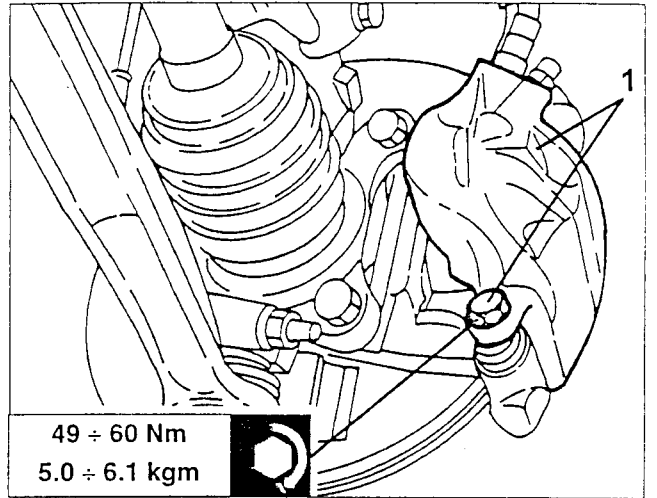


1. Remove the caulking and slacken the nut fastening the axle shaft to the wheel hub.

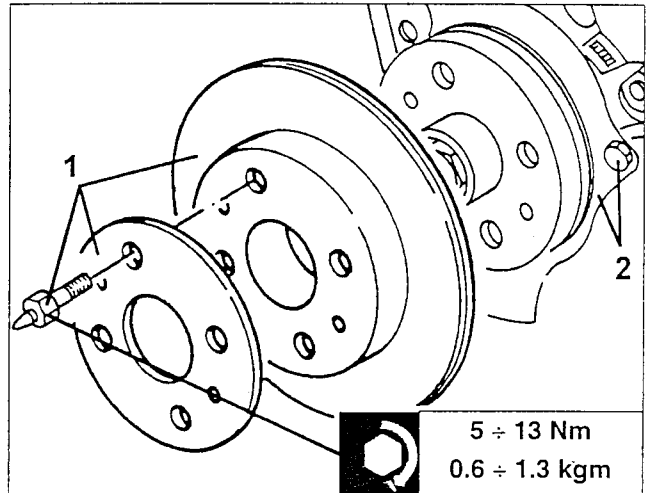


1. Slacken the two brake caliper fastening screws, then move it aside without disconnecting the pipe.  
**When refitting, change the brake caliper fastening screws and tighten them to the specified torque.**

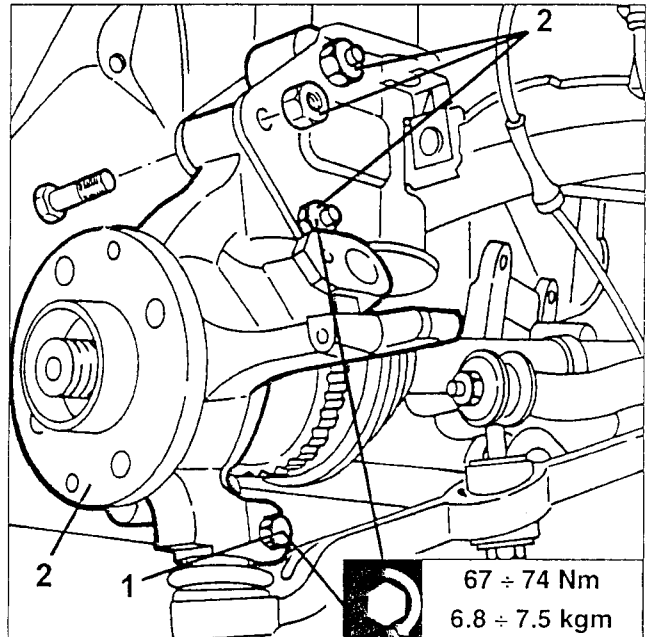
PA49300000002



1. Slacken the two pins and remove the spacer and brake disk.
2. Slacken the remaining fastening screw and remove the brake disk protective cover.




1. Slacken the bolt fastening the wishbone to the wheel upright.
2. Slacken the three bolts fastening the wheel upright to the shock absorber stem, then remove it.



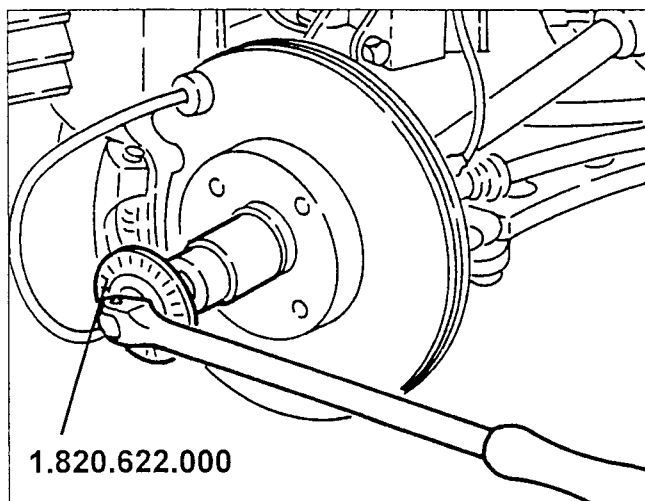
When refitting, caulk the wheel hub fastening nut, proceeding as described below:

- Always use a new nut.
- Carefully clean the threaded tang of the axle shaft using a metal brush and then blowing with compressed air.
- Clean the axle shaft tang thread with ethyl spirits or heptane.
- Tighten the new nut to the specified torque.

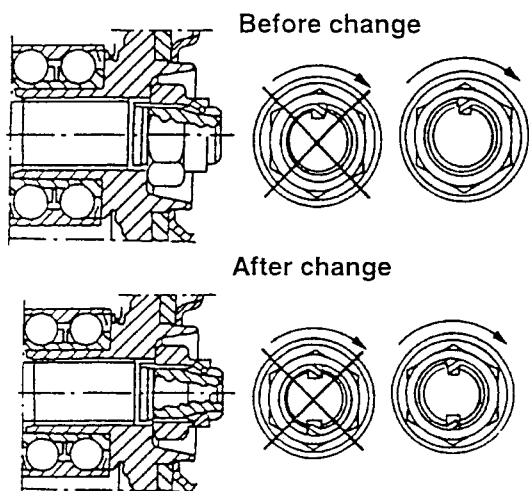
|                                                                                  |                      |                                             |
|----------------------------------------------------------------------------------|----------------------|---------------------------------------------|
|  | <b>Before change</b> | 266 ÷ 294 Nm<br>27.1 ÷ 30.0 kgm             |
|                                                                                  | <b>After change</b>  | 67 ÷ 74 Nm + 62° (*)<br>6.8 ÷ 7.5 kgm + 62° |

(\*): Check that the maximum torque when tightening 62° is between 200 and 360 Nm

- For angle tightening the nut use tool no. 1.820.622.000 as illustrated.



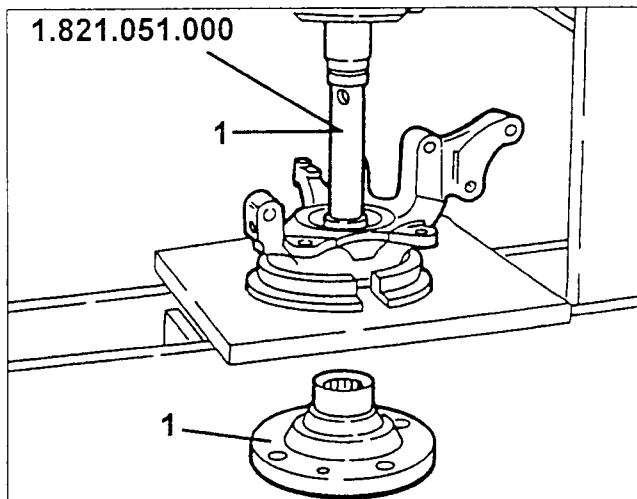
1. Using a chisel, caulk the nut collar with one or two caulks as illustrated.



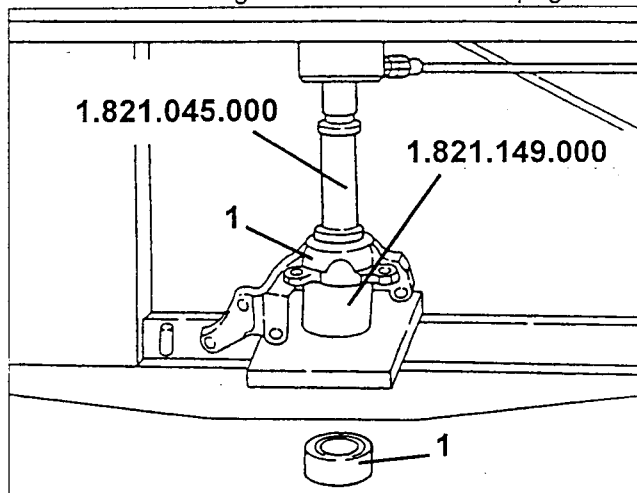
### DISASSEMBLY

- Place the complete upright in a vice grip with protective jaws and remove the hub retainer circlip.

1. Working on the press and using puller tool no. 1.821.051.000 withdraw the wheel hub from the upright.

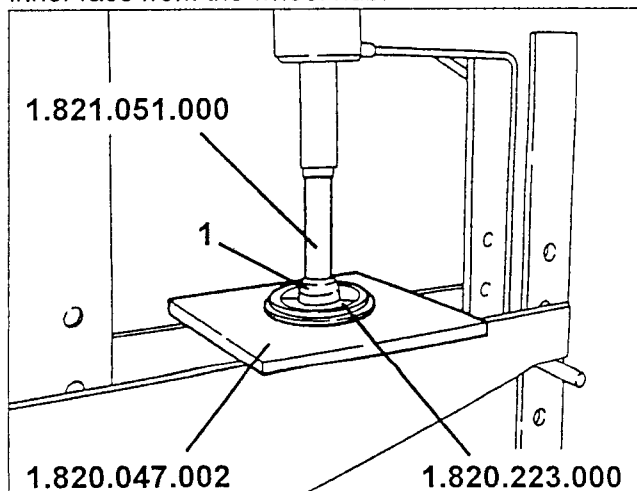


1. Working on the press, using support no. 1.821.149.000 and puller tool no. 1.821.045.000 remove the bearing outer race from the upright.



- Move the bearing inner race away from the wheel hub contact using a suitable tool.

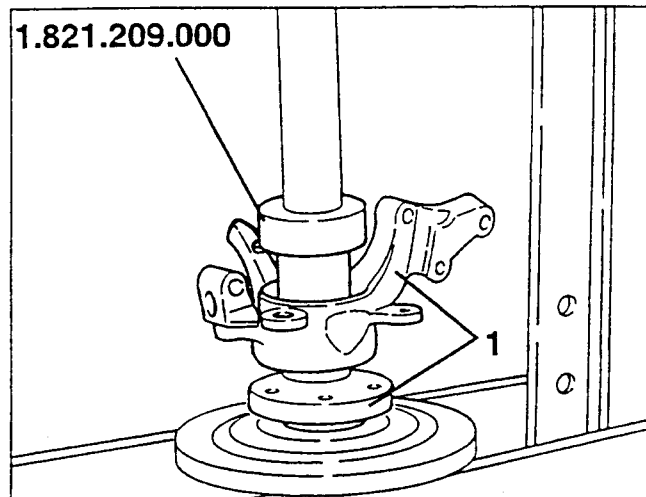
1. Working on the press, and using plate no. 1.820.047.002, half rings no. 1.820.223.000 and puller tool no. 1.821.051.000, withdraw the bearing inner race from the wheel hub.



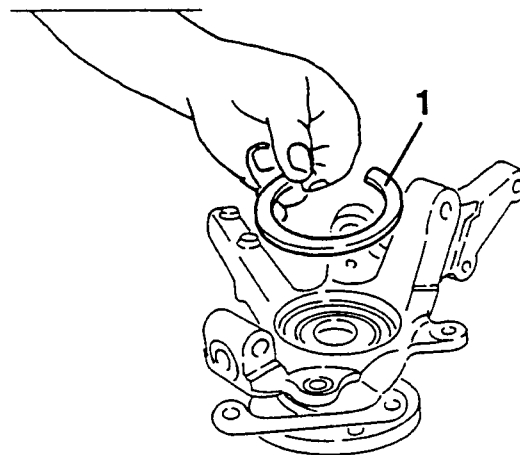
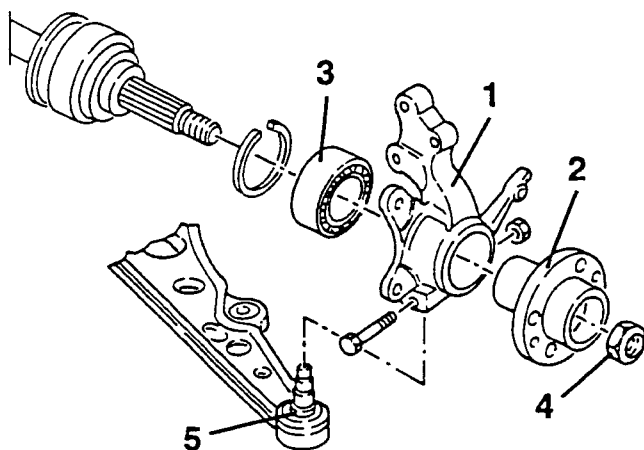
## CHECKS AND INSPECTIONS

1. Check the inner surfaces of the wheel upright for traces of seizing and the wishbones for damage and obvious signs of bumps, distortion or traces of breakage and change the upright if necessary.
2. Check the surfaces of the wheel hub for damage and obvious signs of bumps or traces of breakage and change it if necessary.
3. Check the conditions of the roller bearing for cracks, seizing or sticking and if necessary change the bearing.
4. In any case, always change the C.V. joint locknut before refitting.
5. Check the conditions of the ball pin fastening the wheel upright to the wishbone for distortion, excessive wear, cracks, sticking or signs of oxidation and, if necessary, change the ball pin.

1. Working under the press and using tool N° 1.821.209.000, overturned with respect to the previous step, insert the hub in the wheel upright.

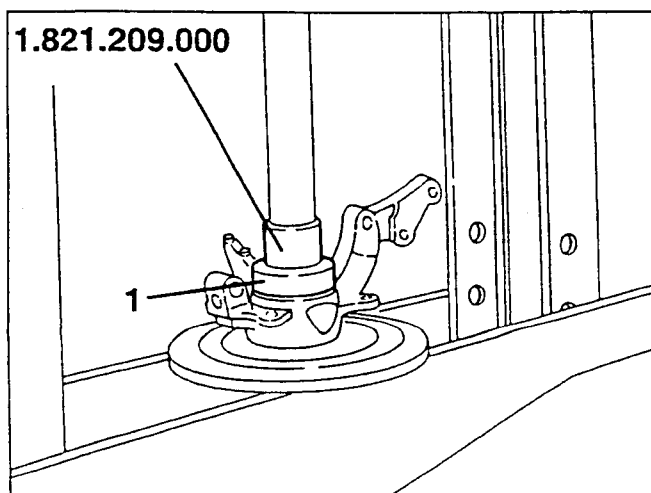


1. Install the bearing retainer ring in the housing on the wheel upright.



## RE-ASSEMBLY

1. Working under the press and using installing tool N° 1.821.209.000 insert the bearing in the wheel upright.

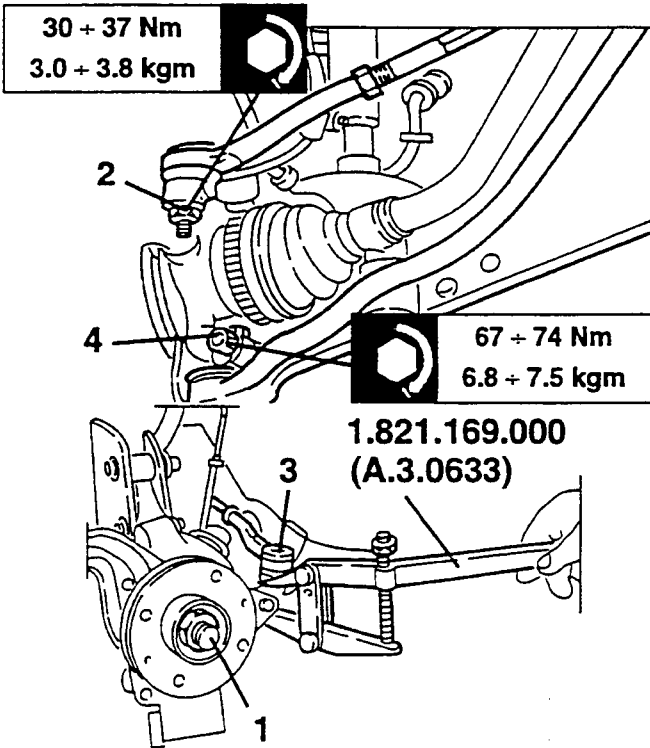




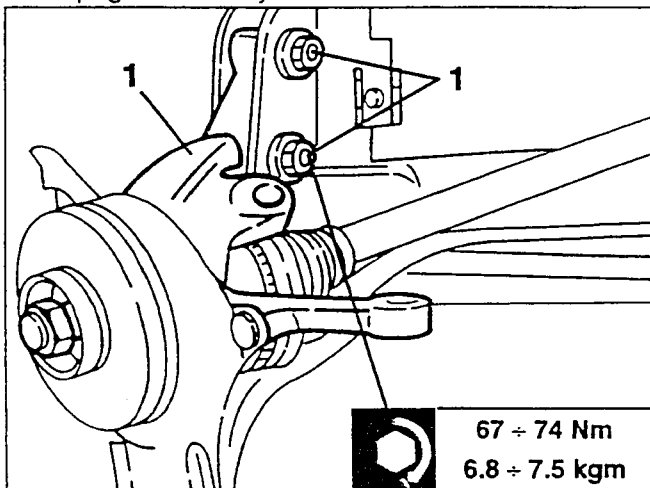
### FRONT WHEEL UPRIGHT (Turbodiesel and T. Spark 16V versions)

#### REMOVAL/REFITTING

1. Remove the caulking and slacken the nut fastening the wheel hub to the constant velocity joint.
  - Remove the complete caliper and set it aside without disconnecting the brake piping (see GROUP 33).
  2. Slacken the nut of the ball joint connecting the side track rod to the wheel upright.
  3. Using tool no. 1.821.169.000 (A.3.0633), disconnect the ball joint from the wheel upright.
  4. Slacken the bolt connecting the wishbone to the upright and pull it off the ball pin.
- When refitting, tighten the nut fastening the axle shaft to the wheel hub as described for the "Front wheel upright (Boxer versions)".**

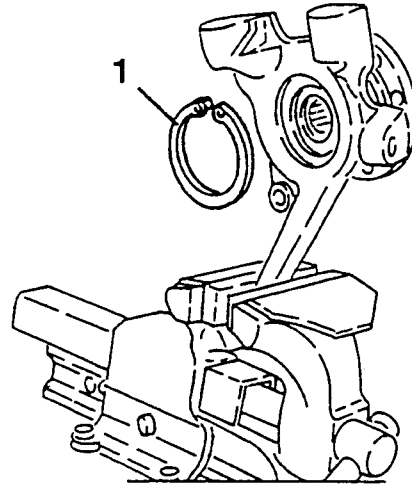


1. Slacken the two bolts and remove the wheel hub/upright assembly.

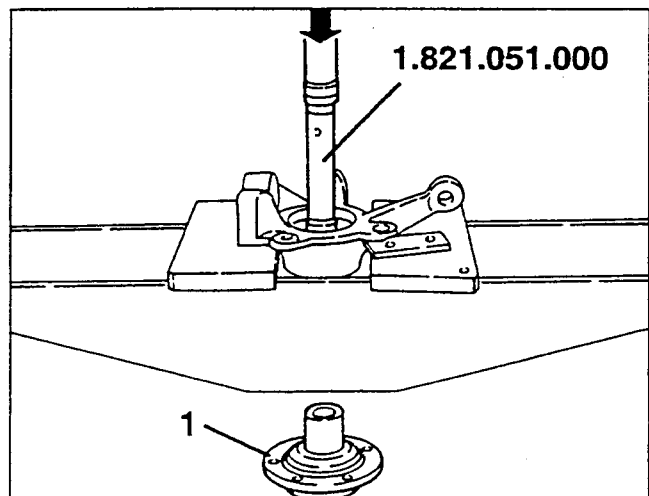


#### DISASSEMBLY

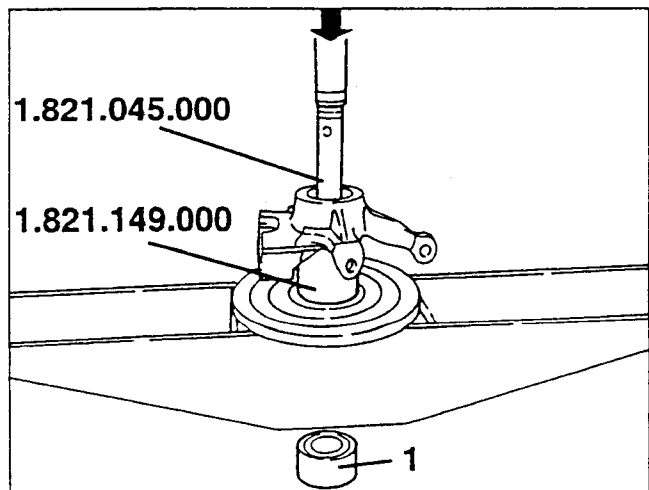
1. Clamp the wheel upright/hub assembly in a vice fitted with protective jaws and remove the hub retainer ring.



- Remove the brake disk protection.
- 1. Working at the press and using puller tool no. 1.821.051.000 pull the wheel hub off the upright.

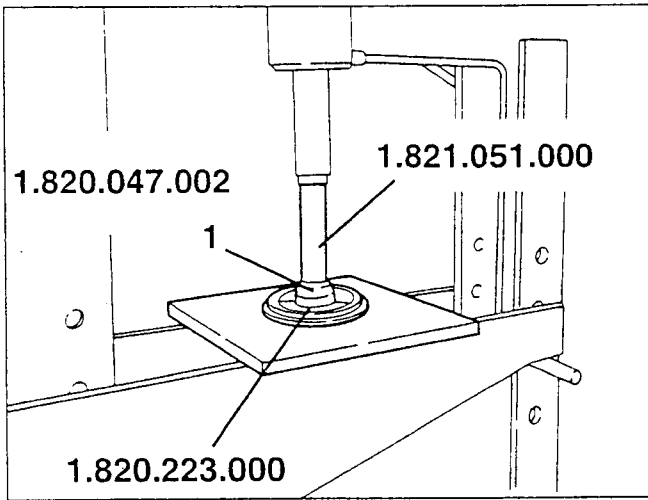


1. Working at the press, using support no. 1.821.149.000 and puller tool no. 1.821.045.000 remove the outer bearing race from the upright.



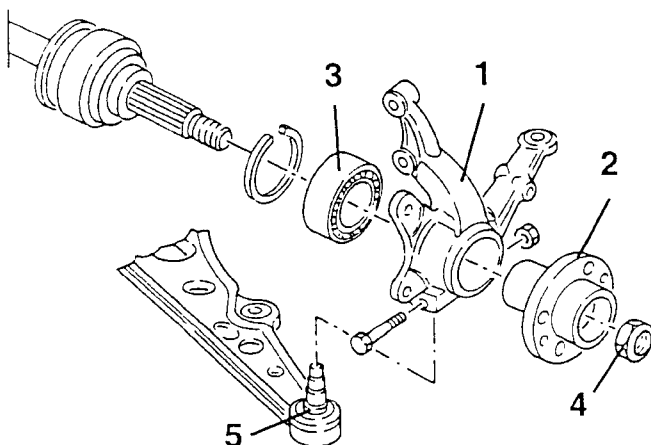
- Using a suitable tool move away the bearing inner race from the contact surface of the wheel hub.

1. Working at the press and using plate no. 1.820.047.002, half rings no. 1.820.223.000 and puller tool no. 1.821.051.000, withdraw the bearing inner race from the wheel hub.



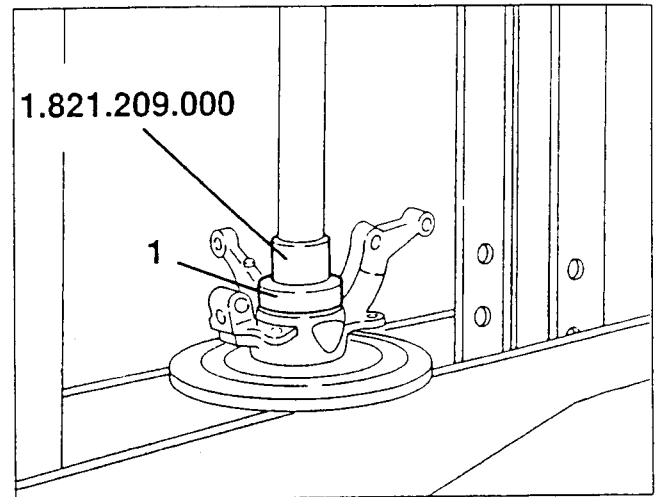
### CHECKS AND INSPECTIONS

1. Check the wheel upright inner surface for signs of seizing, and that the arms reveal no signs of damage, bumps, distortions or traces of breakage, in which case the upright must be replaced.
2. Check the surfaces of the wheel hub for damage or clear signs of bumps or traces of breakage, in which case, the wheel hub must be replaced.
3. Check the conditions of the rolling bearing for cracks, seizure or jamming, if necessary replace the bearing.
4. Always, and in any case, change the constant velocity locking nut before re-assembly.
5. Check the conditions of the ball pin fastening the wheel upright to the wishbone for distortion, excessive wear, cracks, sticking, or signs of rust and, if necessary, replace the ball pin.

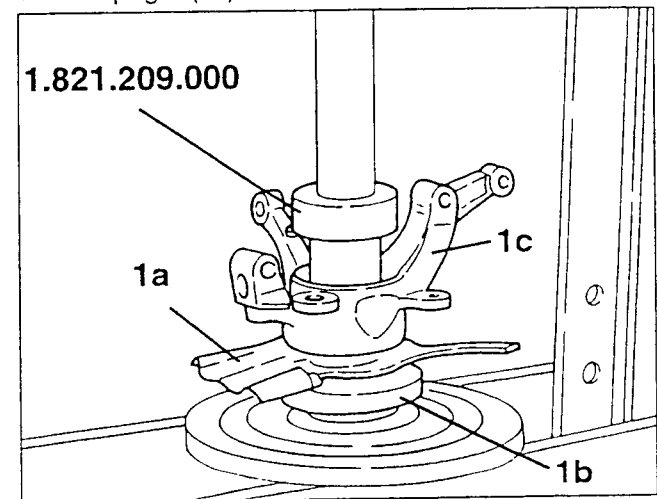


### RE-ASSEMBLY

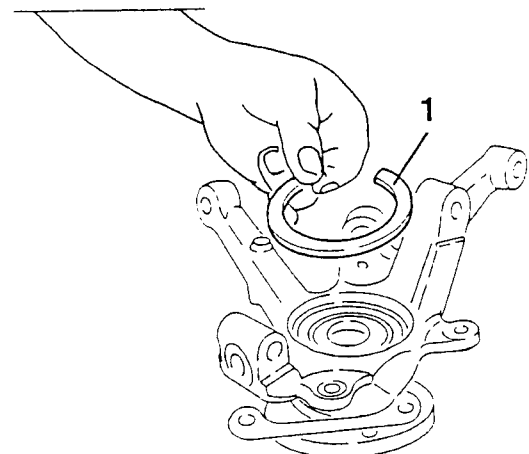
1. Working at the press and using installing tool no. 1.821.209.000 insert the bearing in the wheel upright.



1. Set the brake disk protection (1a) on the wheel hub (1b) then, working under the press using the installing tool no. 1.821.209.000 in the overturned position with respect to the previous step, insert the hub in the wheel upright (1c).



1. Assemble the bearing retainer clip in its housing on the wheel upright.



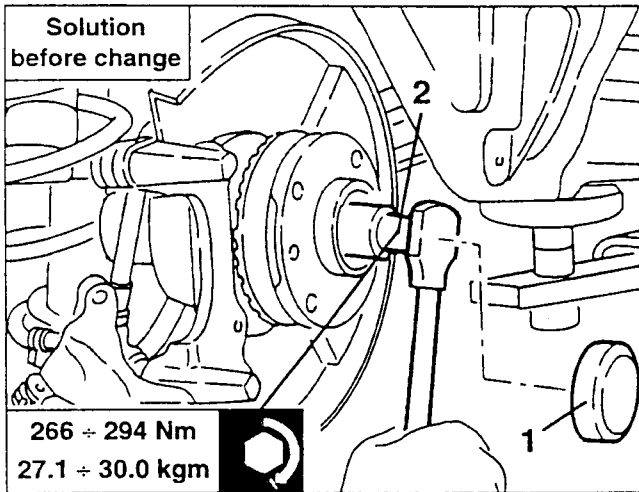
### REAR WHEEL HUB

#### REMOVING/REFITTING

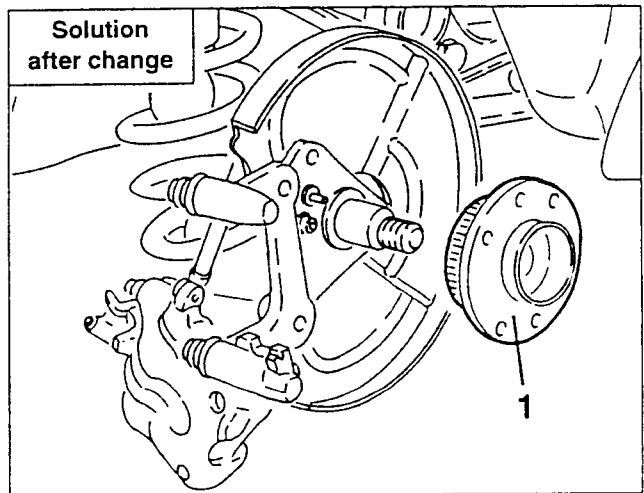
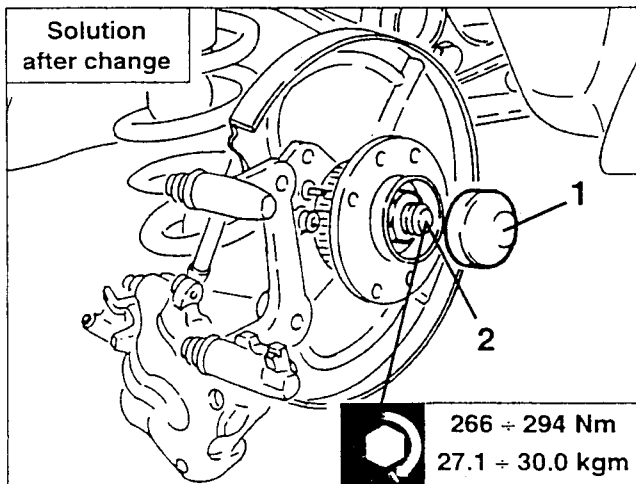
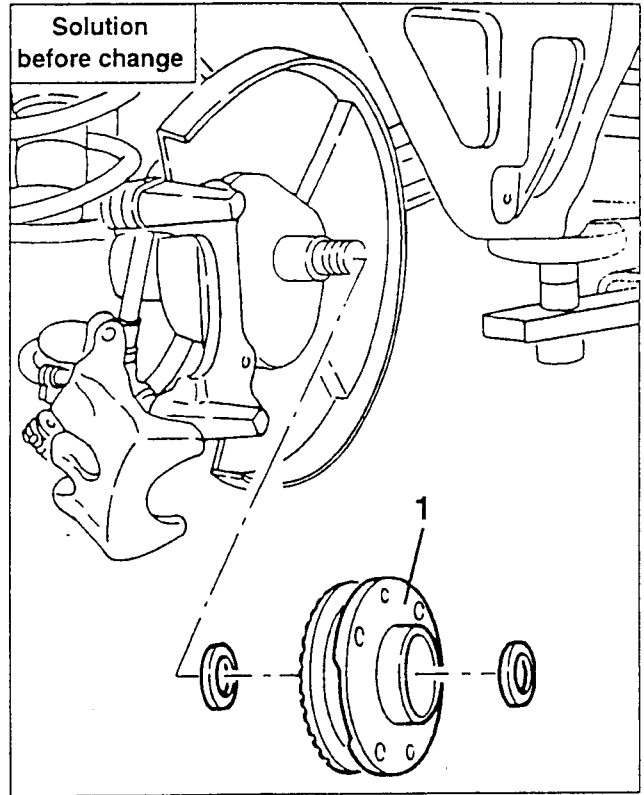
- Set the car on a lift.
- Remove the wheel on the side concerned.
- Remove the brake disk (see GROUP 33).

In the case of cars with rear drum brakes, remove the drums (see GROUP 33) and proceed as described below for cars with rear drum brakes.

1. Remove the dust guard of the rear steering knuckle.
2. Slacken the wheel hub fastening nut as illustrated.



1. Remove the wheel hub.



#### CHECKS AND INSPECTIONS

- Check the conditions of wear of the wheel bearing, keyed inside the hub. In the event of excessive play or noise, it is necessary to replace the hub complete.
- Check the conditions of wears of the spacer and, if necessary, change them.
- Replace the wheel hub fastening nut.

## WHEELS

The wheels (tyres and rims) installed are the most suited to the characteristics of the car and guarantee the highest degree of safety and comfort under all normal driving conditions.

Before replacing rims or tyres check the table listing the permitted types.

Never alter the rim-tyre arrangement originally fitted on the vehicle.

## RIMS

Steel or alloy rims must be fitted using the specific studs for each type of rim.

Therefore, when steel rims are being replaced by alloy rims or vice-versa, it is absolutely necessary to use the specific studs for the type of wheel installed.

## TYRES

The tyres installed on the car are of the tubeless type. To maintain driving comfort, the highest degree of safety and prolong the life of the tyre, follow the instructions given below:

- Ensure that the wheels are balanced and that the front and rear vehicle trim is correct.
- Never insert tools of any kind between the rim and tyre.
- If the rim gets damaged, replace it.
- For balancing use counterweights specifically for tubeless tyres.
- Tyre pressure (including the spare) must be as specified.
- Inner tubes must not be used on tubeless tyres.

To allow even wear on the front and rear tyres the wheels should be swapped around every 10,000 + 15,000 km keeping them on the same side of the car to avoid switching the direction of rotation.

### CAUTION:

**Do not swap tyres between sides.**

Some types of tyres are fitted with wear indicators and must be replaced as soon as these indicators can be seen on the tread.

Periodically check that the wear on the tread is even. You are reminded that wear on the tread gradually increases the likelihood of aquaplaning on wet surfaces.

Knocking against pavements, holes in the road and obstacles of various types, lengthy driving on rough roads can cause lesions to the tyres which are not always easy to see.

They may cause deformation, swelling and cuts on the side of the tyre which are often invisible but which could cause sudden deflation or bursting of a tyre.

## TYRE PRESSURE AND WEAR

The correct tyre pressure does not only determine the life of the tyre but also affects safety as it influences the degree of road holding of the vehicle.

The pressure in each tyre, including the spare, must be checked at regular intervals and before long journeys. The tyres should be checked when cold; use a pressure gauge in accordance with the specified ratings.

Incorrect pressure results in abnormal wearing of the tyre.

### A. Normal pressure

A correct tyre pressure guarantees extended life and better performance as the tread works on its entire width resulting in more uniform wearing.

This situation also involves:

- improved roadholding of the car.
- smoother and more accurate steering.
- lower fuel consumption due to the decreased rolling resistance of the wheel.

### B. Insufficient pressure

A low tyre pressure results in uneven wear on the tread (greater on the sides) and overheating of the tyre that can cause the detachment of the parts of the tyre and damage to the casing. This damage may cause sudden deflation or bursting.

### C. Overinflation

Conversely, overinflation results in:

- Uneven wear of the tread, higher in the middle.
- Decreased comfort.
- Greater vulnerability to shocks.

## WHEEL BALANCING

Each wheel, complete with tyre has been statically and dynamically balanced in the factory. When the tyres are changed the wheels must be rebalanced to avoid instability, wearing of the steering components and uneven wear of the tyres.

### WARNING:

**Only original Alfa Romeo counterweights should be used when balancing wheels in light alloy.**

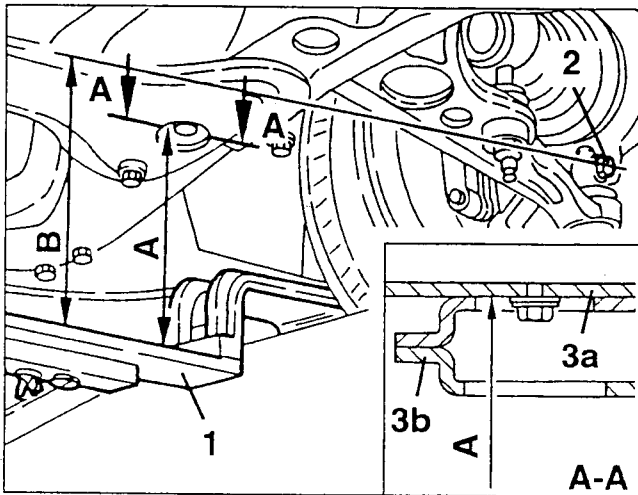
## CHECKING FRONT WHEEL ALIGNMENT

### PRELIMINARY OPERATIONS

- Inflate the tyre to the correct pressure.
- Place the vehicle on a vehicle lift.
- Set the car in the unladen condition (with fuel and fluids).
- Bounce the vehicle a few times to settle the suspension.

#### For Boxer versions only

1. Position the reference tool on the resting plane of the vehicle.
2. Using a surface gauge measure distance "B" between the resting plane of the vehicle and the centre of the screw securing the ball pin.
  - Using a millimeter rule measure the distance.
3. Using a surface gauge measure distance "A" between the resting plane of the vehicle and the lower surface of the chassis 3a and cross member 3b.
  - Using a millimeter rule measure the distance.



- Calculate the difference between "A" and "B" and check that it is within the specified limits.



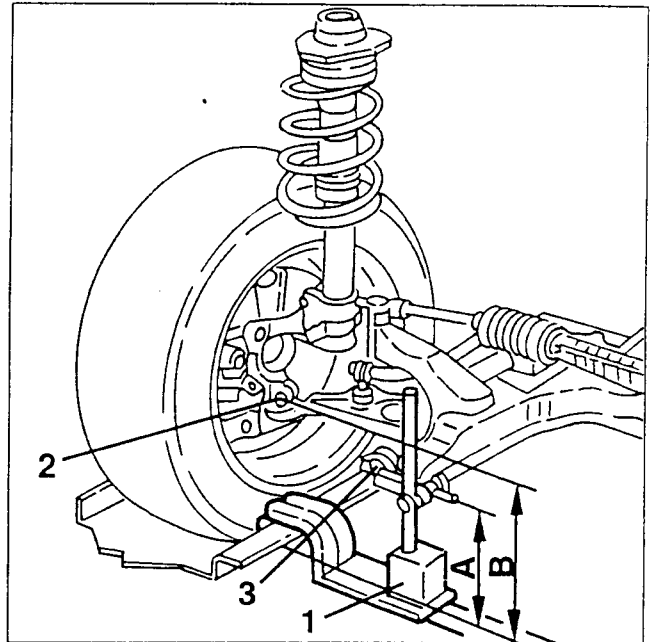
#### Front alignment B - A

40 ± 5 mm

#### For Turbodiesel and T. Spark 16V versions

1. Position the reference tool on the resting plane of the vehicle.

2. Using a surface gauge measure distance "B" between the resting plane of the vehicle and the centre of the screw securing the ball pin.
  - Using a millimeter rule measure the distance.
3. Using a surface gauge measure distance "A" between the resting plane of the vehicle and centre of the pin of the swinging arm.
  - Using a millimeter rule measure the distance.



- Calculate the difference between "A" and "B" and check that it is within the specified limits.



#### Front alignment B - A

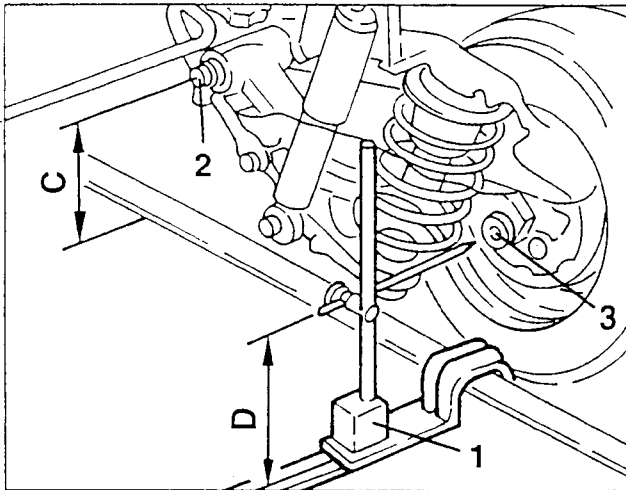
|                  |            |
|------------------|------------|
| Turbodiesel      |            |
| 1.4 T. Spark 16V | -13 ± 5 mm |
| 1.6 T. Spark 16V |            |
| 1.8 T. Spark 16V | -26 ± 5 mm |
| 2.0 T. Spark 16V |            |

## CHECKING REAR WHEEL ALIGNMENT

### PRELIMINARY OPERATIONS

- Inflate the tyres to the correct pressure.
- Place the vehicle on a vehicle lift.
- Set the car in the unladen condition (with fuel and fluids).
- Bounce the vehicle a few times to settle the suspension.

1. Position the reference tool on the resting plane of the vehicle.
2. Using a surface gauge measure the distance "C" between the vehicle's resting plane and the pivot of the rear swinging arm.  
- Using a millimeter rule measure the distance.
3. Using a surface gauge measure distance "B" between the resting plane of the vehicle and the centre of the rear wheel.  
- Using a millimeter rule measure the distance.



- Calculate the difference between "C" and "D" and check that it is within the specified limits.



### Rear alignment C - D

$7 \pm 5 \text{ mm (*)}$   
 $-2 \pm 5 \text{ mm}$

(\*): Specific for Boxer versions.

**NOTE:** If the alignment values are not within the specified limits replace both suspension springs.

## CHECKING CHARACTERISTIC ANGLES

### PRELIMINARY OPERATIONS

- Inflate the tyres to the correct pressure.
- Check that the eccentricity and orthogonality of the wheel rims do not exceed:
  - 1 mm for steel rims
  - 0.3 mm for alloy rims

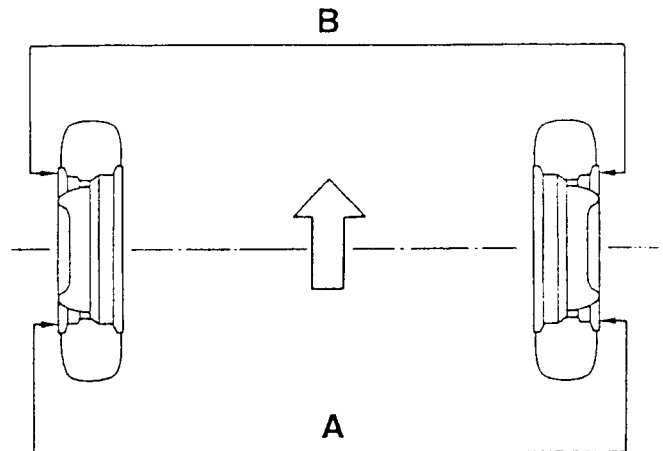
### CHECKING FRONT WHEEL TOE-IN AND TOE-OUT

- Using a suitable tool check that the toe-in and toe-out values are within the specified limits.



| Front wheel toe-in/toe-out A - B (*)                |                        |
|-----------------------------------------------------|------------------------|
| Boxer                                               | $3.5 \pm 1 \text{ mm}$ |
| Turbodiesel<br>1.4 T. Spark 16V<br>1.6 T. Spark 16V | $-1 \pm 1 \text{ mm}$  |
| 1.8 T. Spark 16V<br>2.0 T. Spark 16V                | $0 \pm 1 \text{ mm}$   |

(\*): Values measured unladen in running order (with specified fluids)



If the toe-in values differ from those specified, proceed as follows:

1. Loosen the attachments for the adjustment of the steering rods.

**WARNING:** Each time the front wheel toe-in is checked the bellows should also be checked to ensure that they rotate freely on the rod. If necessary pull them off and lubricate them with the specified grease.

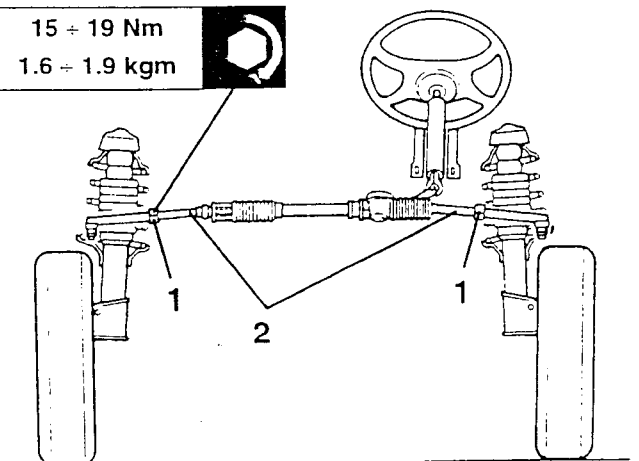
2. Rotate the rods until the specified value is reached without altering the position of the steering wheel.

**NOTE:** This adjustment must be carried out by operating on the rods of both wheels.

- Tighten the steering rod adjustment attachments to the specified torque.

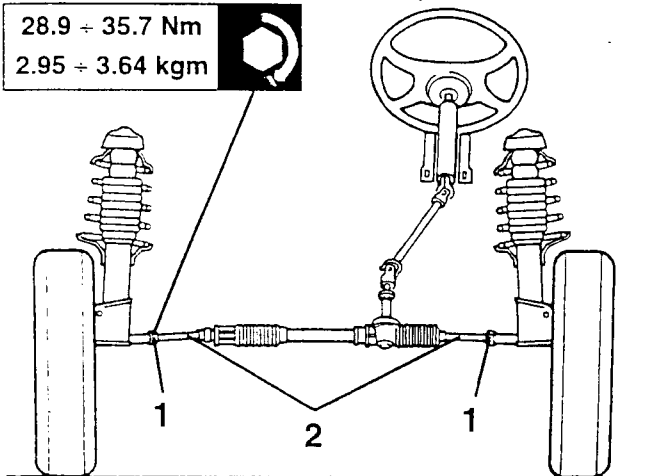
Specific for Boxer versions

$15 \div 19 \text{ Nm}$   
 $1.6 \div 1.9 \text{ kgm}$



Specific for Turbodiesel and T. Spark 16V versions

28.9 ÷ 35.7 Nm  
2.95 ÷ 3.64 kgm



## CHECKING REAR WHEEL TOE-IN

- Using a suitable tools check that the toe-in value (not adjustable) is within the specified limits.



| Rear wheel toe-in A - B (*)                         |            |
|-----------------------------------------------------|------------|
| Boxer                                               | 4 ± 2 mm   |
| Turbodiesel<br>1.4 T. Spark 16V<br>1.6 T. Spark 16V | 1 ± 1 mm   |
| 1.8 T. Spark 16V<br>2.0 T. Spark 16V                | 1.5 ± 1 mm |

(\*): Values measured unladen in running order (with specified fluids)

## CHECKING FRONT WHEEL CAMBER AND CASTER

- Check that the camber and caster angles (not adjustable) are within the specified limits.



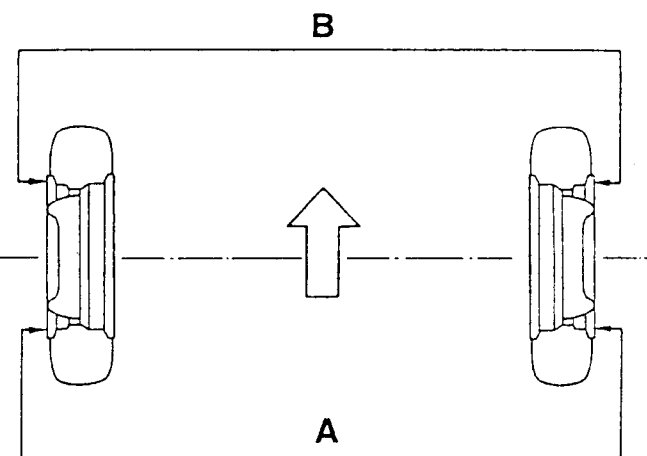
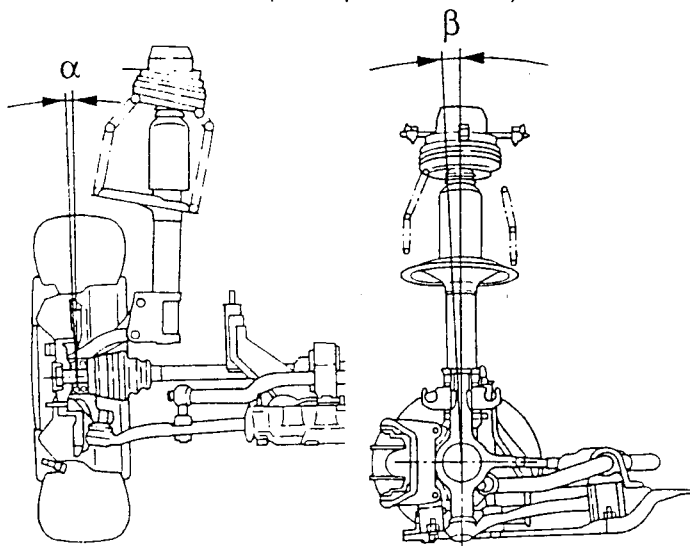
| Front wheel camber "α" (*)                          |              |
|-----------------------------------------------------|--------------|
| Boxer                                               | 0°10' ± 20'  |
| Turbodiesel<br>1.4 T. Spark 16V<br>1.6 T. Spark 16V | -1°10' ± 20' |
| 1.8 T. Spark 16V<br>2.0 T. Spark 16V                | -1°30' ± 20' |

(\*): Values measured unladen in running order (with specified fluids)



| Caster angle "β" (*) |  |
|----------------------|--|
| 3°20' ± 30'          |  |

(\*): Values measured unladen in running order (with specified fluids)



## CHECKING REAR WHEEL CAMBER

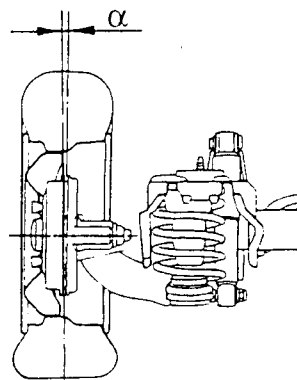
- Check that the camber angle (not adjustable) is within the specified limits.



| Rear wheel camber "α" (*) |  |
|---------------------------|--|
| -1° ± 15' (▲)             |  |
| -45' ± 15'                |  |

(\*): Values measured unladen in running order (with specified fluids)

(▲): Specific for Boxer versions



**NOTE:** If the values measured differ from the specified values body squaring should be checked (see GROUP 70).



SERVICE

**DIREZIONE POST-VENDITA**

SERVIZI ASSISTENZIALI

Viale Alfa Romeo 20020 Arese (MI)

Fiat Auto S.p.A.

Publication PA493000000000 - 3/94

Printed in Italy

no. 60494360

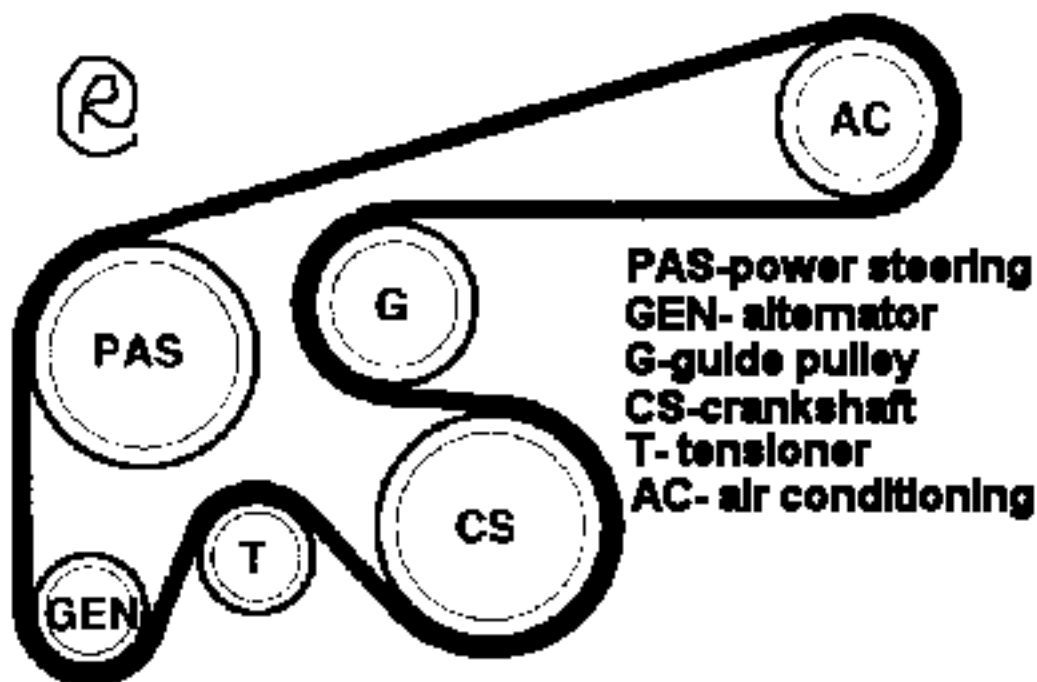
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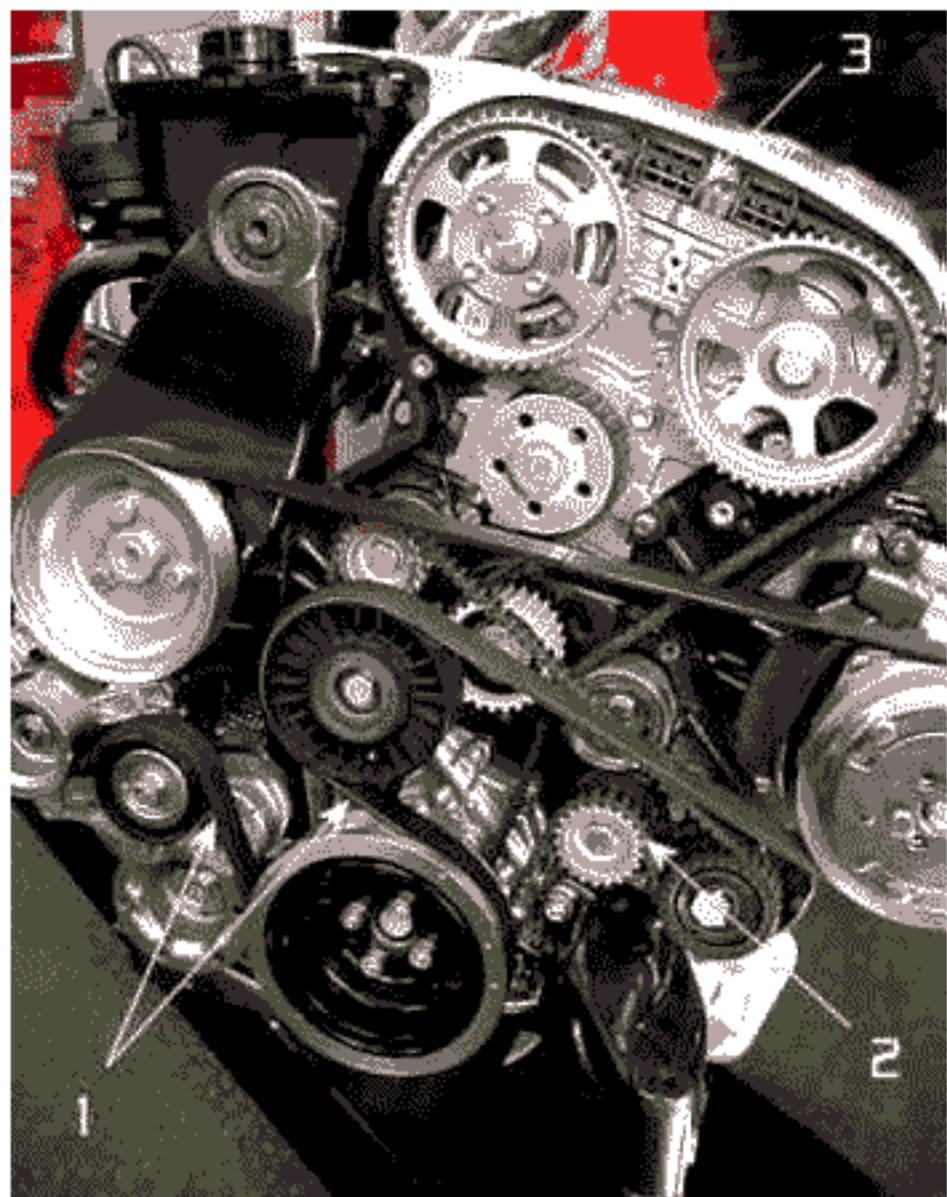
Printed in Italy by Tip. Bogliani - Torino







145/146 Twin Spark Serpentine belts



|              |                                                                                                                 |
|--------------|-----------------------------------------------------------------------------------------------------------------|
| Model:       | 33 Sport Wagon 1,3 +4x4 • 33 1,5 • 33 Sport Wagon 1,5ie +4x4<br>33 1,7 Cloverleaf • 33 1,7 Veloce • 33 1,7 i.e. |
| Year:        | 1986-94                                                                                                         |
| Engine Code: | 305.50, 305.58A, 307.32, 307.34, 307.36, 307.37, 307.46, 307.47, 307.50, 307.51                                 |



## Replacement Interval Guide

Alfa Romeo recommend check & replace if necessary every 12,000 miles and replacement every 48,000 miles.

*The previous use and service history of the vehicle must always be taken into account.*

*Refer to Timing Belt Replacement Intervals at the front of this manual.*

## Check For Engine Damage

**CAUTION:** This engine has been identified as an **INTERFERENCE** engine in which the possibility of valve-to-piston damage in the event of a timing belt failure is **MOST LIKELY** to occur.

*A compression check of all cylinders should be performed before removing the cylinder head.*

## Repair Times – hrs

### Remove & install:

|              |      |
|--------------|------|
| Both belts   | 1,35 |
| RH belt only | 1,05 |

## Special Tools

- None required.

## Special Precautions

- Disconnect battery earth lead.
- DO NOT turn crankshaft or camshaft when timing belt removed.
- Remove spark plugs to ease turning engine.
- Turn engine in normal direction of rotation (unless otherwise stated).
- DO NOT turn engine via camshaft or other sprockets.
- Observe all tightening torques.

## Removal

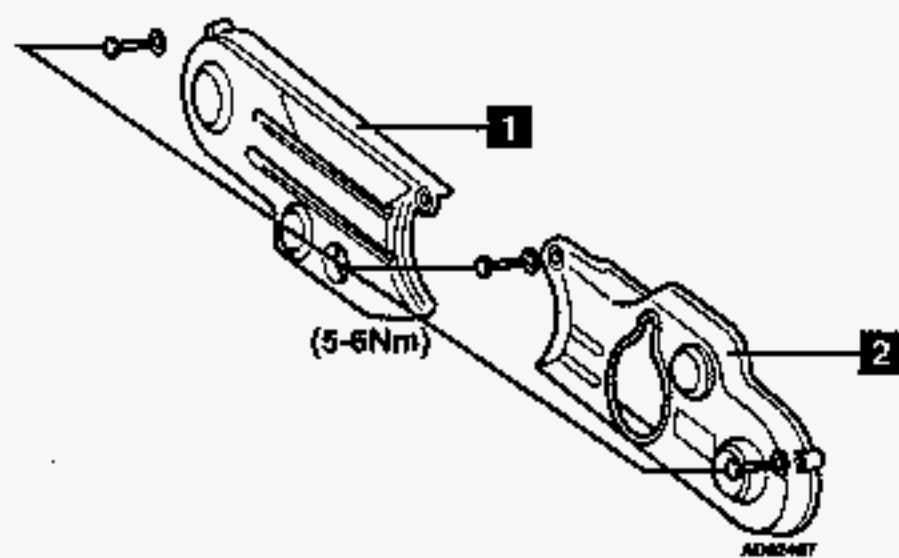
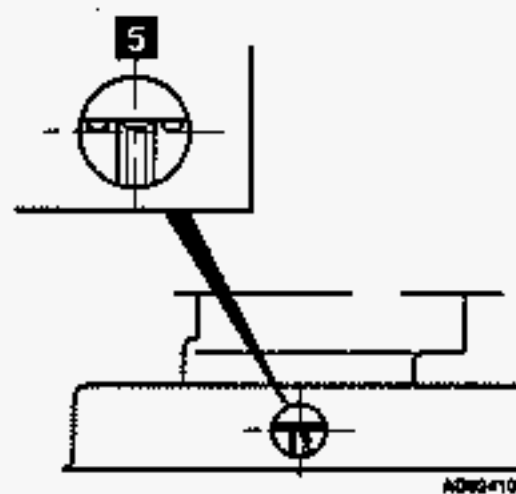
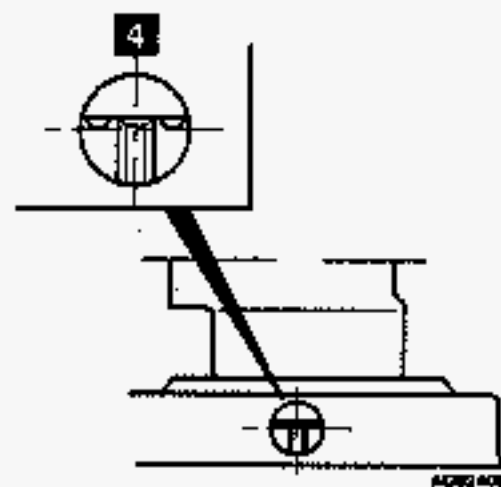
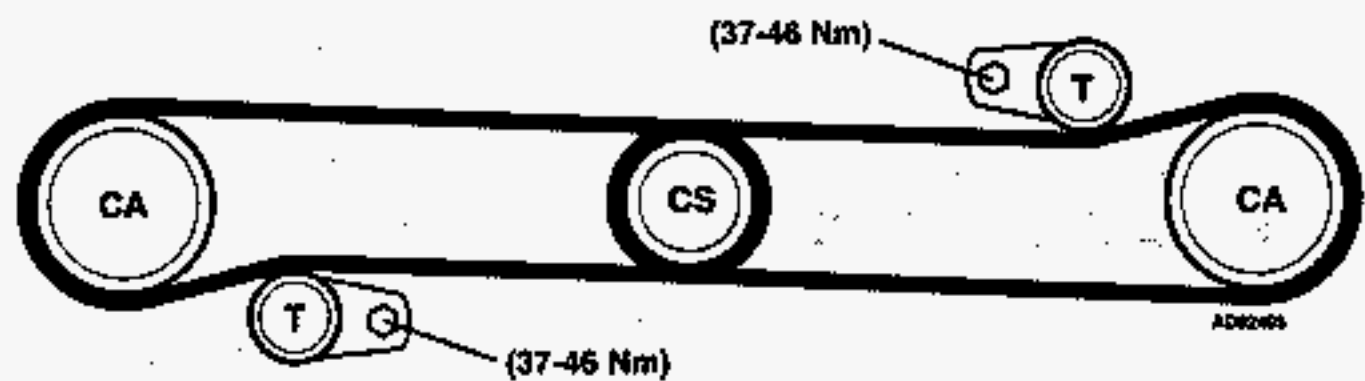
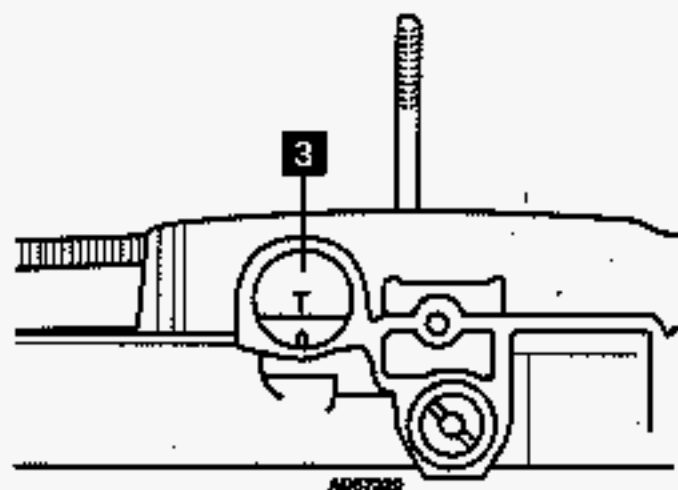
**NOTE:** Engine fitted with hydraulic tappets.

1. Remove:
  - Cooling fan.
  - Auxiliary drive belt.
  - Timing belt covers 1 & 2.
2. Turn crankshaft to TDC on No.1 cylinder. Ensure flywheel timing mark aligned 3. Ensure marks on camshafts in timing belt rear cover aligned 4 & 5.
3. Slacken RH tensioner nut. Move tensioner away from belt and lightly tighten nut.
4. Slacken LH tensioner nut. Move tensioner away from belt and lightly tighten nut.
5. Remove:
  - RH timing belt.
  - LH timing belt.

## Installation

1. If camshafts/crankshaft have been disturbed: Turn crankshaft 45° anti-clockwise from TDC mark to prevent piston/valve contact 1.
2. Turn LH camshaft until timing mark aligned 4.
3. Turn crankshaft clockwise until timing mark aligned 3.
4. Fit LH timing belt.
5. Slacken LH tensioner nut. Allow tensioner to operate and lightly tighten nut.
6. Turn crankshaft 45° anti-clockwise from TDC mark 3.
7. Turn RH camshaft until timing marks aligned 5.
8. Turn crankshaft until timing mark aligned 3.
9. Fit RH timing belt.
10. Slacken RH tensioner nut. Allow tensioner to operate and lightly tighten nut.
11. Turn crankshaft two turns clockwise to position RH cam lobes in neutral position.
12. Slacken RH tensioner nut, then tighten to 37-46 Nm.
13. Turn crankshaft one turn clockwise to position LH cam lobes in neutral position.
14. Slacken LH tensioner nut, then tighten to 37-46 Nm.
15. Turn crankshaft clockwise. Ensure timing marks aligned 3, 4 & 5.
16. Install components in reverse order of removal.
17. If tappet(s) are noisy: Allow engine to idle to ensure hydraulic tappets refill with oil.

Ⓐ



# ALFA ROMEO

Model: 33 1,7 16V  
Year: 1991-94  
Engine Code: 307-46, 307-47



## Replacement Interval Guide

Alfa Romeo recommend replacement every 48,000 miles.

*The previous use and service history of the vehicle must always be taken into account.*

*Refer to Timing Belt Replacement Intervals at the front of this manual.*

## Check For Engine Damage

**CAUTION:** This engine has been identified as an **INTERFERENCE** engine in which the possibility of valve-to-piston damage in the event of a timing belt failure is **MOST LIKELY** to occur.

*A compression check of all cylinders should be performed before removing the cylinder head.*

## Repair Times - hrs

### Remove & install:

|              |      |
|--------------|------|
| Both belts   | 1,50 |
| RH belt only | 1,20 |

## Special Tools

- None required.

## Special Precautions

- Disconnect battery earth lead.
- **DO NOT** turn crankshaft or camshaft when timing belt removed.
- Remove spark plugs to ease turning engine.
- Turn engine in normal direction of rotation (unless otherwise stated).
- **DO NOT** turn engine via camshaft or other sprockets.
- Observe all tightening torques.

## Removal

### 1. Remove:

- Cooling fan assembly.
- Spark plugs.
- Auxiliary drive belts.
- Water pump pulley ⑩.
- Timing belt covers ①.

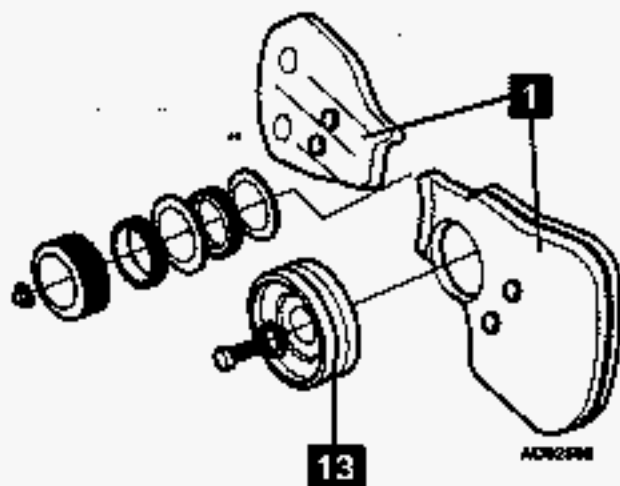
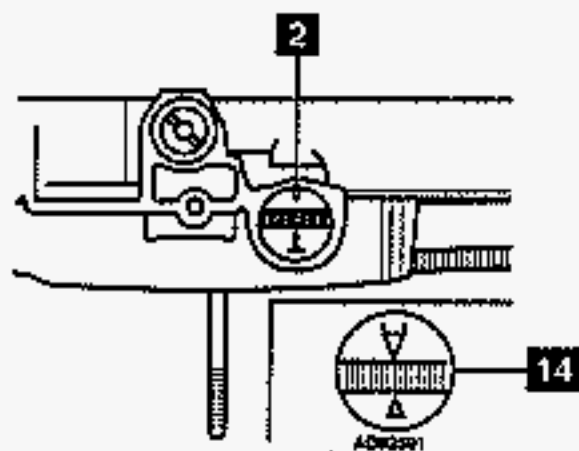
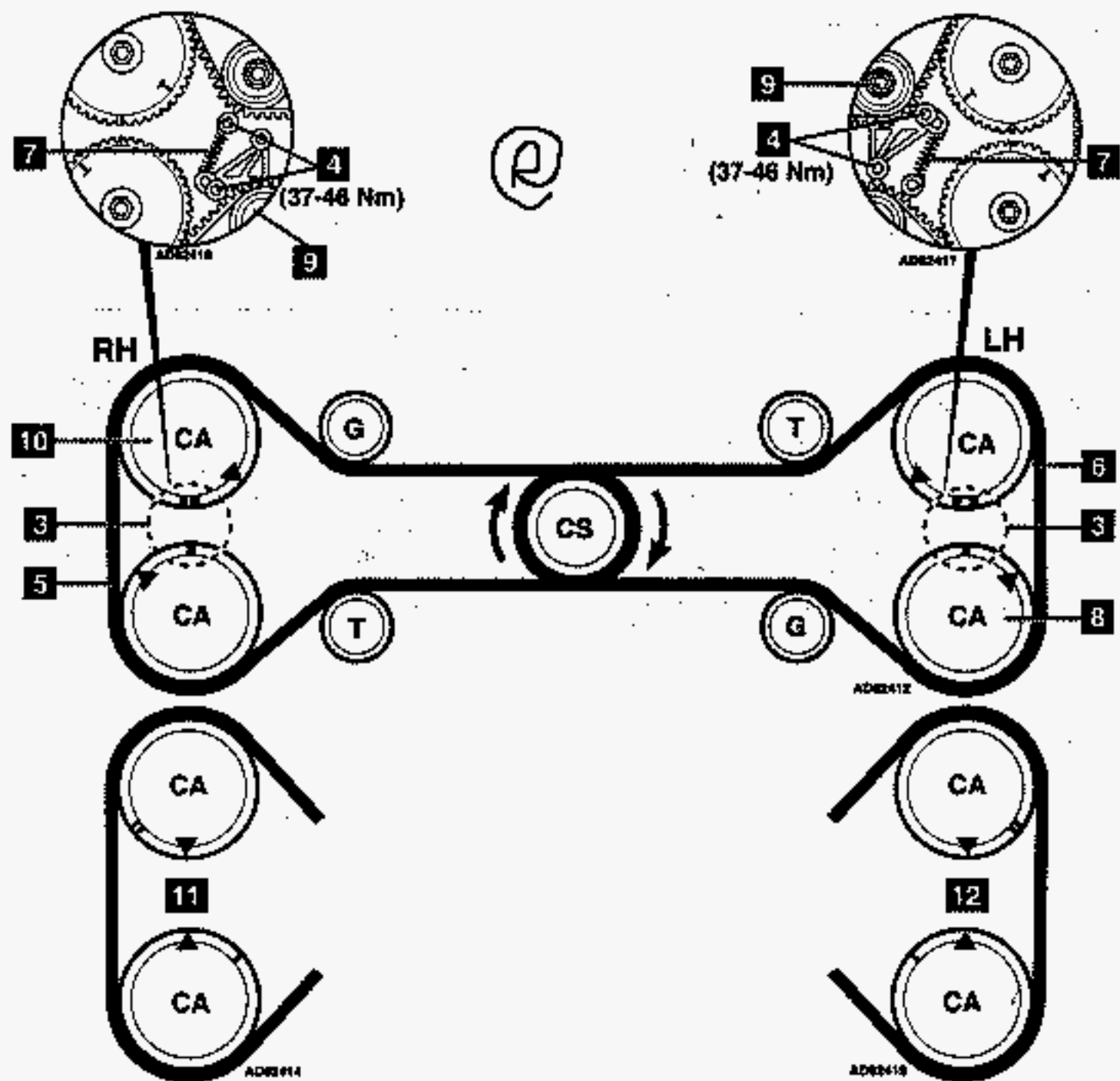
**NOTE:** Crankshaft damper does not need to be removed.

2. Turn crankshaft until flywheel timing mark and timing marks on camshafts aligned ② & ③.
3. Slacken RH tensioner nuts ④. Move tensioner away from belt and lightly tighten nuts.
4. Slacken LH tensioner nuts ④. Move tensioner away from belt and lightly tighten nuts.
5. Remove:
  - RH timing belt ⑤.
  - LH timing belt ⑥.

## Installation

**NOTE:** Check condition of tensioner springs ⑧ and free movement of tensioner bracket.

1. Ensure timing marks aligned ② & ③.
  2. Fit LH timing belt ⑥. Ensure belt is taut between crankshaft sprocket, guide pulley and exhaust camshaft sprocket ⑧.
  3. Slacken LH tensioner nuts ④. Allow tensioner to contact belt ⑥.
  4. Fit RH timing belt ⑤. Ensure belt is taut between crankshaft sprocket, guide pulley and inlet camshaft sprocket ⑩.
  5. Slacken RH tensioner nuts ④. Allow tensioner to contact belt ⑤.
  6. Turn crankshaft slowly two turns clockwise. Ensure timing belts do not slip.
  7. Ensure timing marks aligned ② & ③.
  8. Tighten LH tensioner nuts ④.
  9. Tighten RH tensioner nuts ④.
  10. Turn crankshaft slowly clockwise until neutral marks aligned ⑪, ⑫ & ⑬.
  11. Slacken LH tensioner nut, then tighten to 37-46 Nm ④.
  12. Slacken RH tensioner nut, then tighten to 37-46 Nm ④.
- NOTE:** Allow tensioners to operate by spring tension only.
13. Install components in reverse order of removal.



# ALFA ROMEO

Model: 145 1,3/1,6 8V • 146 1,3/1,6 8V  
Year: 1994-97  
Engine Code: AR 332.01, 335.01



## Replacement Interval Guide

Alfa Romeo recommend check & adjust every 48,000 miles and replacement every 72,000 miles.

*The previous use and service history of the vehicle must always be taken into account. Refer to Timing Belt Replacement Intervals at the front of this manual.*

## Check For Engine Damage

**CAUTION:** This engine has been identified as an INTERFERENCE engine in which the possibility of valve-to-piston damage in the event of a timing belt failure is MOST LIKELY to occur.

*A compression check of all cylinders should be performed before removing the cylinder head.*

## Repair Times – hrs

|                  |      |
|------------------|------|
| Check & adjust   | 0,90 |
| Remove & install | 1,35 |

## Special Tools

- None required.

## Special Precautions

- Disconnect battery earth lead.
- DO NOT turn crankshaft or camshaft when timing belt removed.
- Remove spark plugs to ease turning engine.
- Turn engine in normal direction of rotation (unless otherwise stated).
- DO NOT turn engine via camshaft or other sprockets.
- Observe all tightening torques.

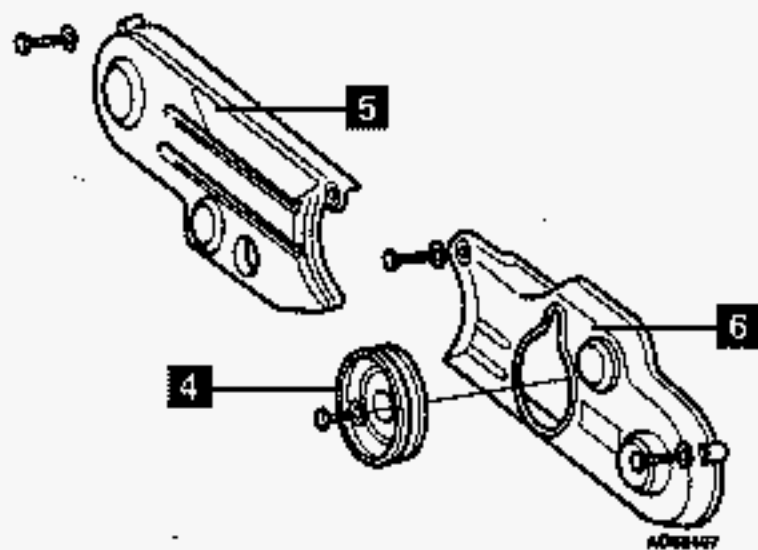
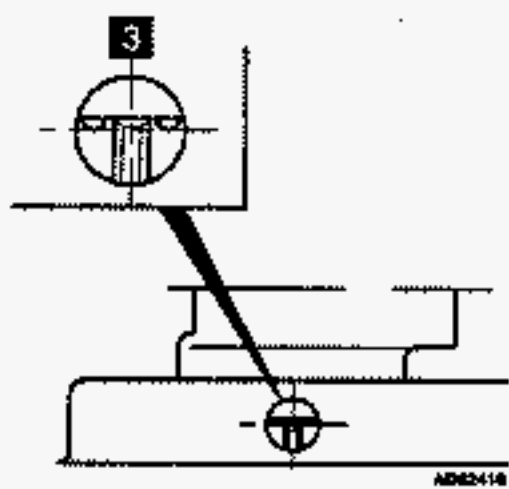
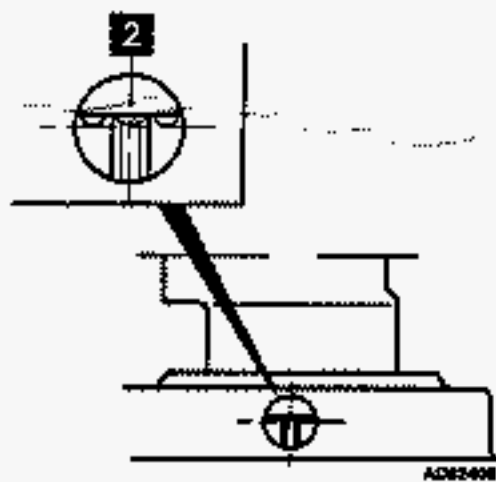
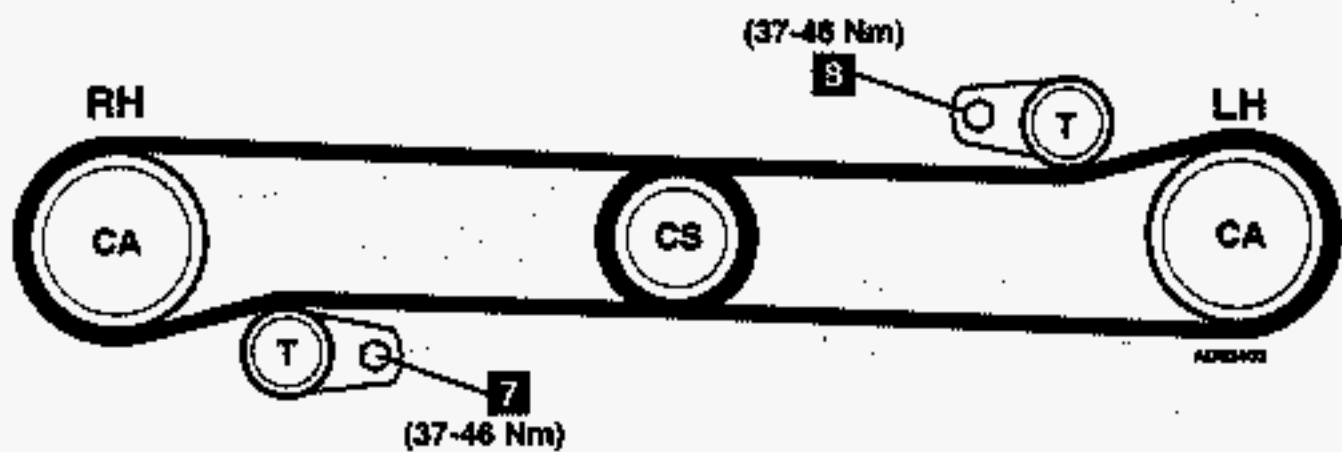
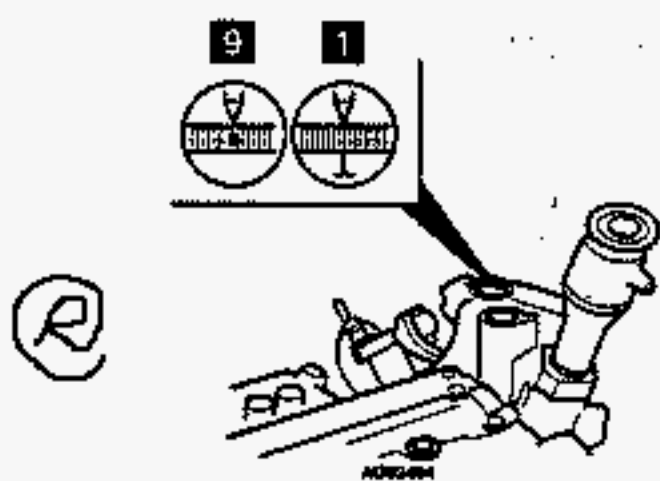
## Removal

1. Remove:
  - Cooling fan.
  - Air filter intake pipe.
  - Spark plugs.
2. Turn crankshaft clockwise until flywheel timing marks **1** and timing marks on camshafts aligned **2** & **3**.  
**NOTE:** Timing marks of camshafts aligned when sprocket tooth with half-circle marks either side visible through hole in timing belt rear cover **2** & **3**.
3. Remove:
  - Auxiliary drive belts.
  - Water pump pulley **4**.
  - Timing belt covers **5** & **6**.
4. Slacken RH tensioner nut **7**. Move tensioner away from belt and lightly tighten nut.

5. Remove RH timing belt.
6. Slacken LH tensioner nut **8**. Move tensioner away from belt and lightly tighten nut.
7. Remove LH timing belt.

## Installation

1. Ensure timing marks aligned **1**, **2** & **3**.
2. Fit LH timing belt in anti-clockwise direction, starting at crankshaft sprocket.
3. Slacken LH tensioner nut **8**. Allow tensioner to operate and lightly tighten nut.
4. Ensure timing marks aligned **1**, **2** & **3**.
5. Fit RH timing belt in anti-clockwise direction, starting at crankshaft sprocket. Ensure sprockets do not turn during this operation.
6. Slacken tensioner nut **7**. Allow tensioner to operate and lightly tighten nut.
7. Turn crankshaft clockwise several times. Align timing marks **1**, **2** & **3**.
8. Turn crankshaft 90° clockwise until flywheel mark aligned with arrow **4**.
9. Slacken RH tensioner nut, then tighten to 37-46 Nm **7**.
10. Turn crankshaft 360° clockwise until flywheel mark aligned **5**.
11. Slacken LH tensioner nut, then tighten to 37-46 Nm **8**.
12. Turn crankshaft clockwise. Ensure timing marks aligned **1**, **2** & **3**.
13. Install components in reverse order of removal.





# ALFA ROMEO

Model: 145/146 1,4/1,6/1,8 Twin Spark • 155 1,6/1,8 Twin Spark  
 156 1,6/1,8 Twin Spark • Spider/GTV 1,8 Twin Spark

Year: 1996-00

Engine Code: AR 322.01, 335.03, 671.06, 676.01



## Replacement Interval Guide

Alfa Romeo recommend check 145/146/155/Spider/GTV every 48,000 miles or 4 years.  
 Alfa Romeo recommend replacement every 72,000 miles or 6 years.  
*The previous use and service history of the vehicle must always be taken into account.*  
 Refer to Timing Belt Replacement Intervals at the front of this manual.

## Check For Engine Damage

**CAUTION:** This engine has been identified as an INTERFERENCE engine in which the possibility of valve-to-piston damage in the event of a timing belt failure is MOST LIKELY to occur.  
 A compression check of all cylinders should be performed before removing the cylinder head(s).

## Repair Times - hrs

|                        |      |
|------------------------|------|
| Check:                 |      |
| 145/146/155/Spider/GTV | 0,95 |
| Remove & install:      |      |
| 145/146                | 2,75 |
| 155                    | 2,75 |
| 156                    | 2,25 |
| Spider/GTV             | 2,75 |

## Special Tools

- Camshaft locking tools (1,4/1,6) - Alfa Romeo No.1.825.042.000.
- Camshaft locking tools (1,8) - Alfa Romeo No.1.825.041.000.
- Inlet camshaft holding tool - Alfa Romeo No.1.822.155.000.
- Exhaust camshaft holding tool - Alfa Romeo No.1.822.146.000.
- Timing belt tensioning tool - Alfa Romeo No.1.822.149.000.

## Special Precautions

- Disconnect battery earth lead.
- DO NOT turn crankshaft or camshaft when timing belt removed.
- Remove spark plugs to ease turning engine.
- Turn engine in normal direction of rotation (unless otherwise stated).
- DO NOT turn engine via camshaft or other sprockets.
- Observe all tightening torques.

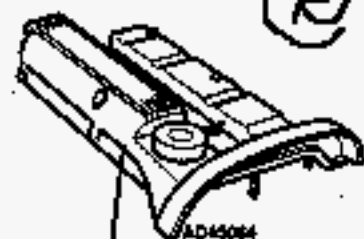
## Removal

1. Remove:
  - Auxiliary drive belt.
  - Auxiliary drive belt guide pulley 1.
  - Crankshaft pulley 2.
  - Timing belt upper cover 3.
  - Ignition coils.
  - Cylinder head cover 4.
  - Centre spark plug - cylinder No.1.
2. Insert dial gauge in No.1 cylinder centre plug hole 5.

3. Turn crankshaft slowly to TDC on No.1 cylinder. Use dial gauge.
4. Ensure marks on belt aligned with marks on sprockets 6 & 7.
5. Slacken timing belt tensioner nut 8.
6. Remove timing belt.

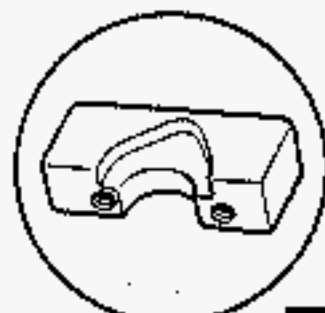
## Installation

1. Ensure crankshaft at TDC on No.1 cylinder. Use dial gauge 5.
2. Hold camshaft sprockets. Use tool Nos.1.822.155.000 and 1.822.146.000 9 & 10. Slacken bolt of each camshaft sprocket.
3. Remove No.3 inlet and exhaust camshaft bearing caps 11 & 12.  
**NOTE: Mark bearing caps before removal for identification.**
4. Fit locking tools in place of bearing caps 11 & 12. Tool Nos.1.825.041/042.000.  
**NOTE: Ensure locking tools aligned with respective cam profiles to prevent damage.**
5. Fit timing belt in following order:
  - Crankshaft sprocket.
  - Guide pulley.
  - Exhaust camshaft sprocket.
  - Inlet camshaft sprocket.
  - Tensioner pulley.
  - Water pump pulley.
6. Ensure marks on belt aligned with marks on sprockets 6 & 7.
7. Tension timing belt to maximum. Use tool No.1.822.149.000 13.
8. Tighten tensioner nut 8.
9. Hold camshaft sprockets. Use tool Nos.1.822.155.000 and 1.822.146.000 9 & 10.
10. Tighten bolt of each camshaft sprocket.
11. Remove dial gauge 5.
12. Remove locking tools 11 & 12.
13. Fit bearing caps in correct locations.
14. Lubricate camshaft bearing cap bolts. Tighten bolts to 13-16 Nm.
15. Turn crankshaft two turns clockwise to TDC on No.1 cylinder 5.
16. Ensure timing marks aligned 6 & 7.
17. Fit tensioning tool No.1.822.149.000 13.
18. Slacken tensioner nut 8.
19. Turn tensioner until pointer 14 aligned with hole 15.
20. Tighten tensioner nut to 21-26 Nm 8.
21. Turn crankshaft two turns clockwise to TDC on No.1 cylinder 5.
22. Ensure timing marks aligned 6 & 7.
23. Install components in reverse order of removal.
24. Tighten crankshaft pulley bolts to 24-29 Nm.



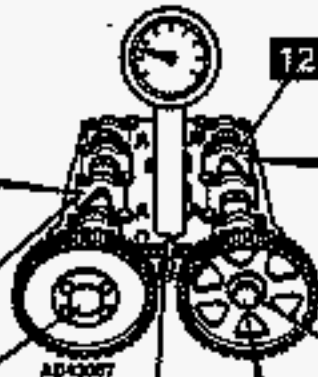
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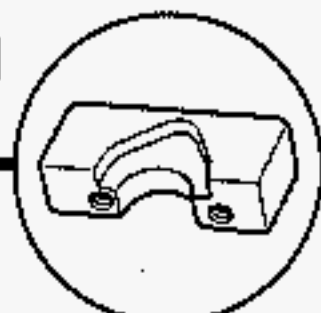
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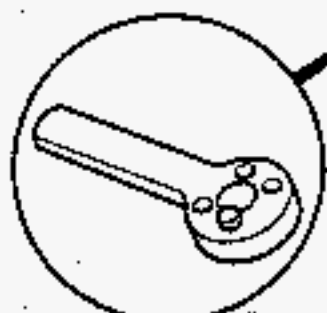
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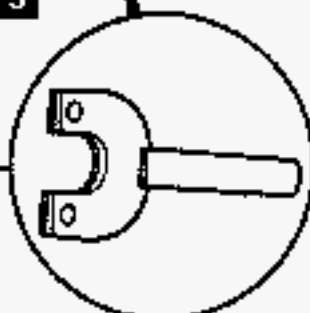
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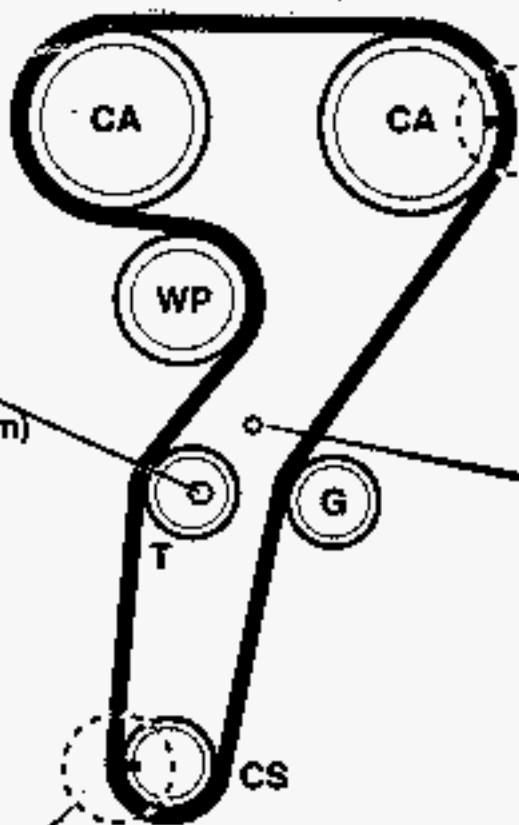
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CA

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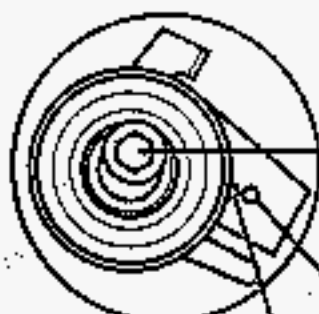
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8

(21-26 Nm)

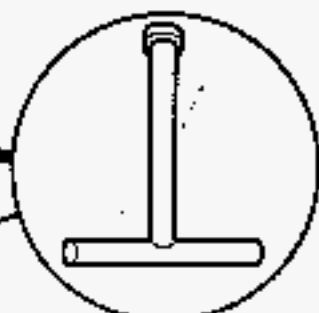
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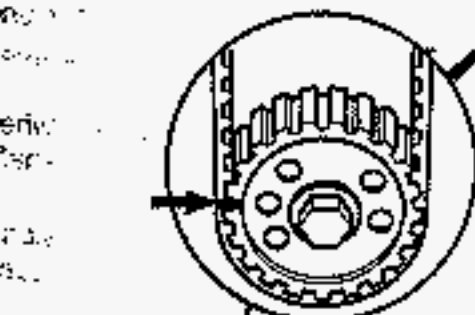


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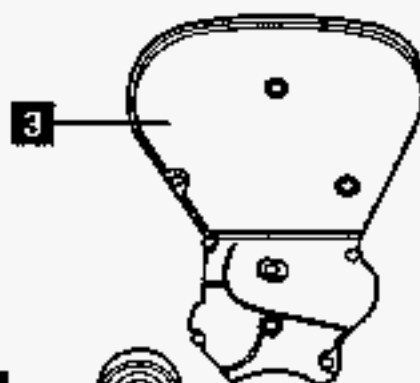


AD43063



AD43071

6



3

1

2

(24-29 Nm)

AD43060

AD11481

# ALFA ROMEO

Model: 145 1,7 16V • 146 1,7 16V  
Year: 1994-97  
Engine Code: 334.01



## Replacement Interval Guide

Alfa Romeo recommend check & adjust every 48,000 miles and replacement every 72,000 miles.

*The previous use and service history of the vehicle must always be taken into account. Refer to Timing Belt Replacement Intervals at the front of this manual.*

## Check For Engine Damage

**CAUTION:** This engine has been identified as an INTERFERENCE engine in which the possibility of valve-to-piston damage in the event of a timing belt failure is MOST LIKELY to occur.

*A compression check of all cylinders should be performed before removing the cylinder head.*

## Repair Times - hrs

|                               |        |
|-------------------------------|--------|
| Check & adjust (including AC) | 2,40   |
| Remove & install              | 1,50   |
| AC                            | + 0,95 |

## Special Tools

- None required.

## Special Precautions

- Disconnect battery earth lead.
- DO NOT turn crankshaft or camshaft when timing belt removed.
- Remove spark plugs to ease turning engine.
- Turn engine in normal direction of rotation (unless otherwise stated).
- DO NOT turn engine via camshaft or other sprockets.
- Observe all tightening torques.

## Removal

**NOTE:** On models fitted with air conditioning, specialist equipment will be required to drain/recharge AC system.

1. Drain AC system (if fitted).
2. Remove:
  - Radiator grille and bumper.
  - Bonnet release cable from lock.
  - Radiator upper crossmember.
  - Coolant hose from expansion tank.
3. Disconnect radiator hose from thermostat housing.
4. Disconnect electrical connections from cooling fans.
5. Disconnect AC condenser inlet/outlet hoses (if fitted).

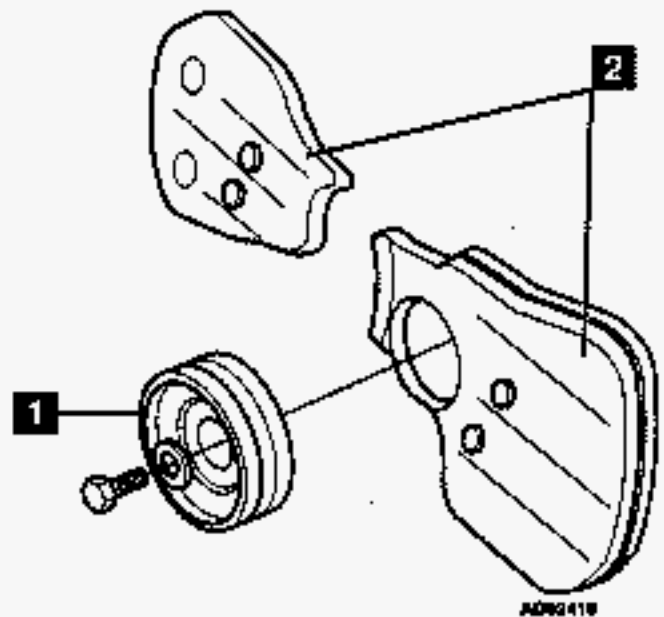
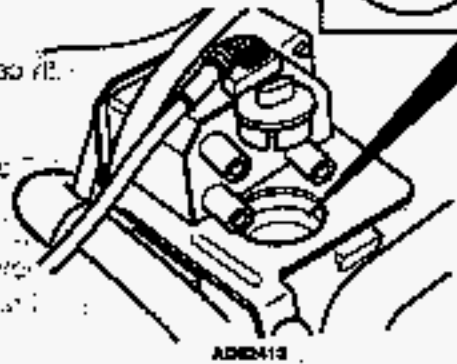
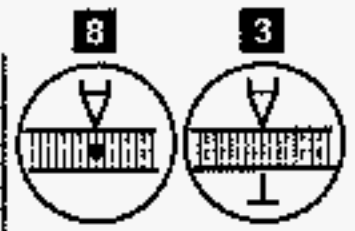
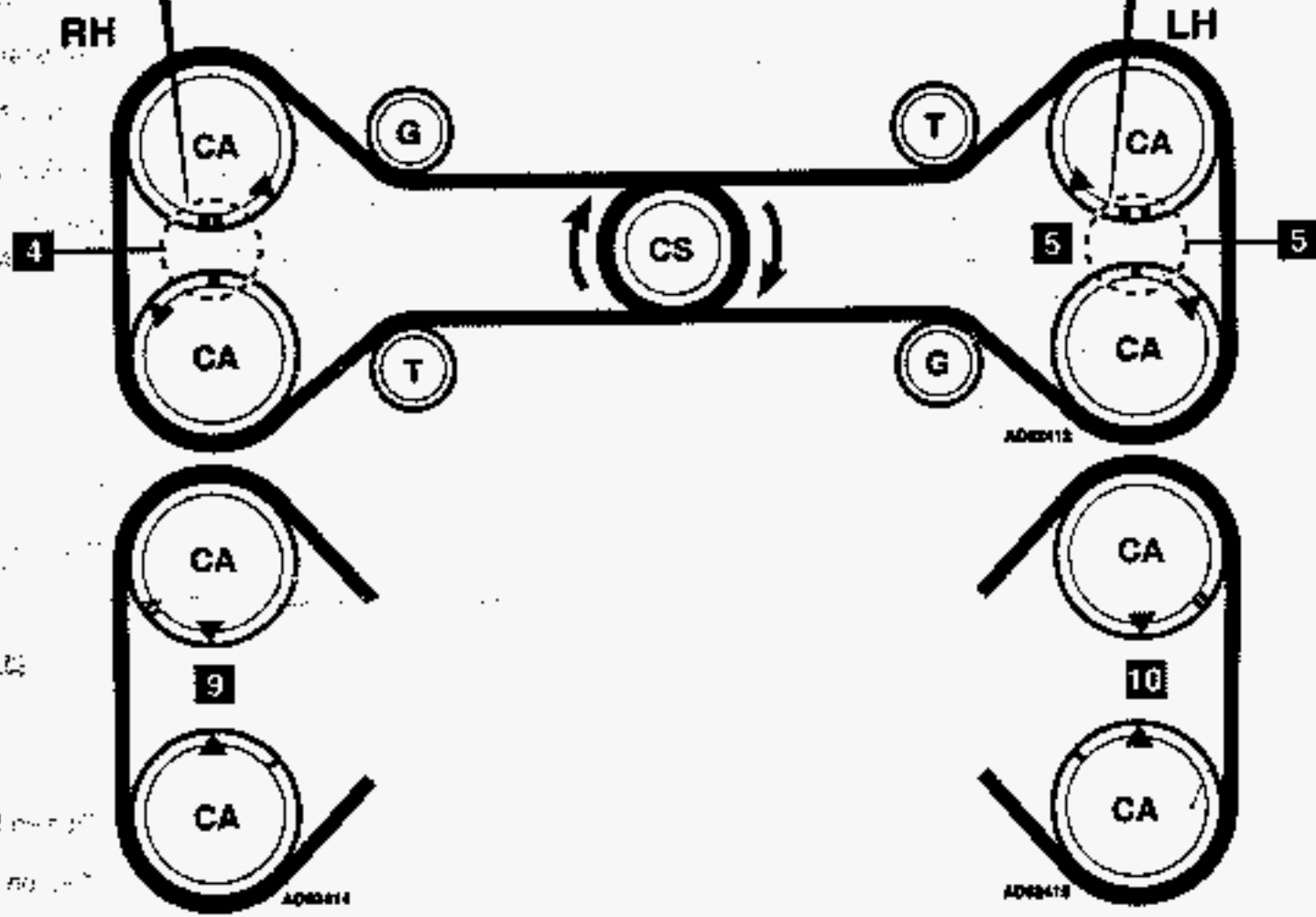
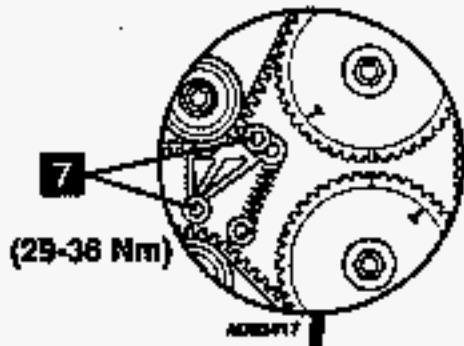
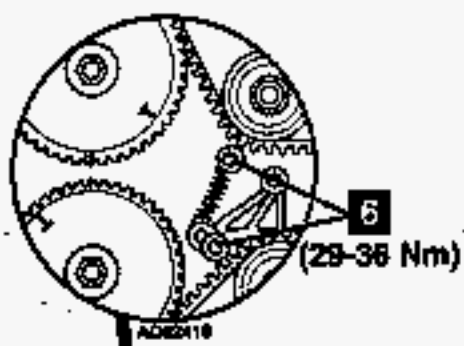
## 6. Remove:

- Radiator complete with fans (and condenser, if fitted).
  - Auxiliary drive belts.
  - Water pump pulley 1.
  - Timing belt covers 2.
  - Spark plugs.
7. Turn crankshaft clockwise until flywheel timing marks and timing marks on camshaft sprockets aligned 3, 4 & 5.
  8. Slacken RH tensioner nuts 6. Move tensioner away from belt and lightly tighten nuts.
  9. Remove RH timing belt.
  10. Slacken LH tensioner nuts 7. Move tensioner away from belt and lightly tighten nuts.
  11. Remove LH timing belt.

## Installation

1. Ensure timing marks aligned 3, 4 & 5.
2. Fit LH timing belt in anti-clockwise direction, starting at crankshaft sprocket. Ensure belt is taut between crankshaft sprocket, guide pulley and camshaft sprockets.
3. Slacken LH tensioner nuts 7. Allow tensioner to operate and lightly tighten nuts.
4. Ensure timing marks aligned 3, 4 & 5.
5. Fit RH timing belt in anti-clockwise direction, starting at crankshaft sprocket. Ensure belt is taut between crankshaft sprocket, guide pulley and camshaft sprockets.
6. Slacken RH tensioner nuts 6. Allow tensioner to operate and lightly tighten nuts.
7. Turn crankshaft several times clockwise to settle belts. Ensure timing marks aligned 3, 4 & 5.
8. Turn crankshaft 90° clockwise until flywheel mark and tensioning marks on RH camshaft sprockets aligned 3 & 4.
9. Slacken RH tensioner nuts 6. Allow tensioner to operate and tighten nuts. Tightening torque: 29-36 Nm.
10. Turn crankshaft 360° clockwise until flywheel mark and tensioning marks on LH camshaft sprockets aligned 3 & 4.
11. Slacken LH tensioner nuts 7. Allow tensioner to operate and tighten nuts. Tightening torque: 29-36 Nm.
12. Turn crankshaft several times clockwise. Ensure timing marks aligned 3, 4 & 5.
13. Install components in reverse order of removal.
14. Recharge AC system (if fitted).

(R)



# ALFA ROMEO

Model: 145/146 2,0 Twin Spark • 155 2,0 Twin Spark • 156 2,0 Twin Spark  
Spider/GTV 2,0 Twin Spark • Spider/GTV 2,0 16V

Year: 1995-00

Engine Code: AR 323.01, 672.04, 162.01



## Replacement Interval Guide

Alfa Romeo recommend check 145/146/155/Spider/GTV every 48,000 miles or 4 years.

Alfa Romeo recommend replacement every 72,000 miles or 6 years.

*The previous use and service history of the vehicle must always be taken into account.*

*Refer to Timing Belt Replacement Intervals at the front of this manual.*

## Check For Engine Damage

**CAUTION:** This engine has been identified as an INTERFERENCE engine in which the possibility of valve-to-piston damage in the event of a timing belt failure is MOST LIKELY to occur.

*A compression check of all cylinders should be performed before removing the cylinder head(s).*

## Repair Times – hrs

|                              |      |
|------------------------------|------|
| <b>Check:</b>                |      |
| 145/146/155/Spider/GTV       | 0,95 |
| <b>Remove &amp; install:</b> |      |
| 145/146/155                  | 2,90 |
| 156                          | 2,95 |
| Spider/GTV                   | 2,90 |

## Special Tools

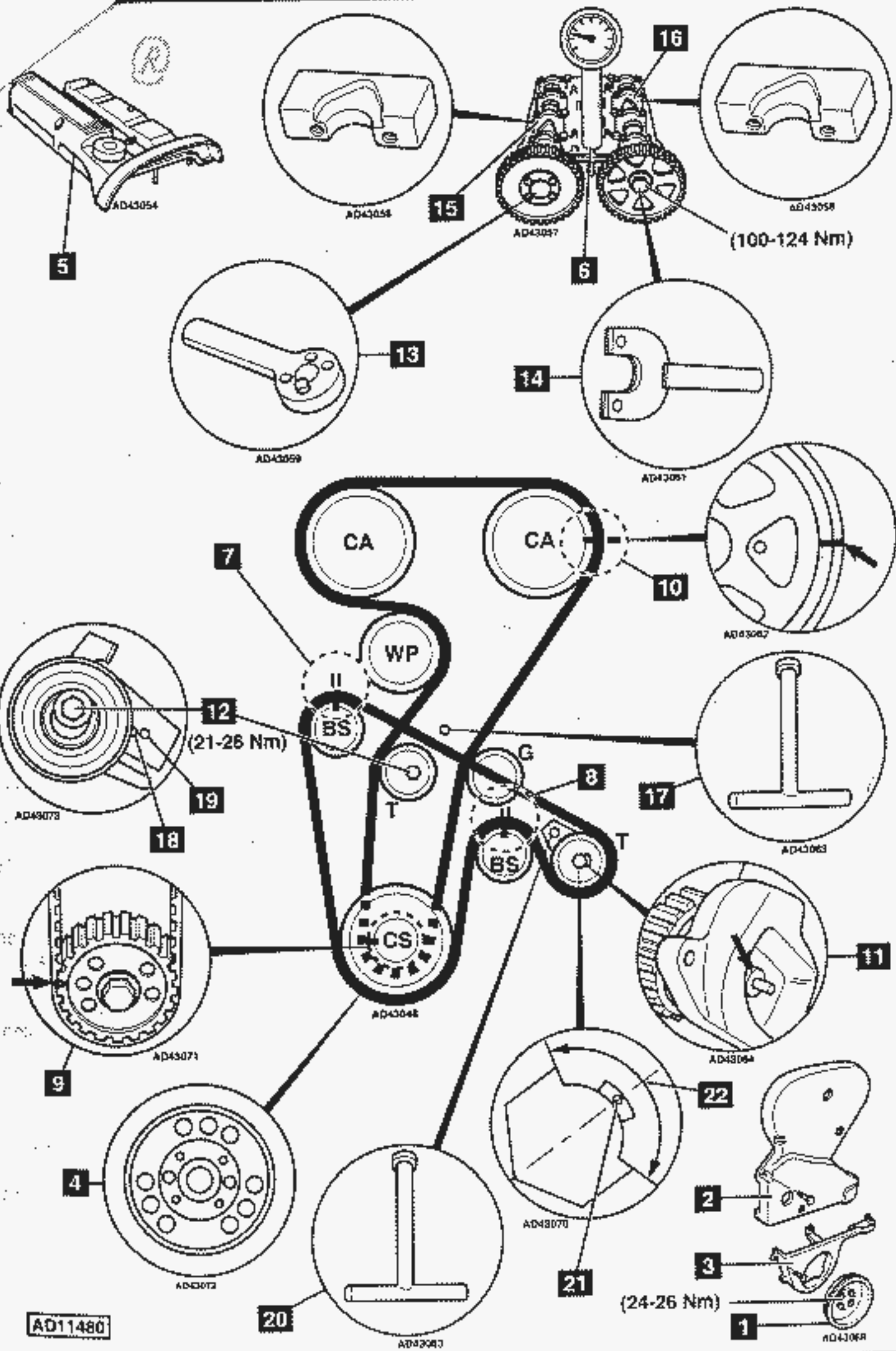
- Camshaft locking tools – Alfa Romeo No.1.825.041.000.
- Inlet camshaft holding tool – Alfa Romeo No.1.822.155.000.
- Exhaust camshaft holding tool – Alfa Romeo No.1.822.146.000.
- Timing belt tensioning tool – Alfa Romeo No.1.822.149.000.
- Balancer shaft belt tensioning tool – Alfa Romeo No.1.822.154.000.

## Removal

1. Remove:
  - Auxiliary drive belt.
  - Crankshaft pulley 1.
  - Timing belt upper cover 2.
  - Timing belt lower cover 3.
  - Ignition coils.
  - Cylinder head cover 4.
  - Centre spark plug – cylinder No.1.
2. Insert dial gauge in No.1 cylinder centre plug hole 5.
3. Turn crankshaft slowly to TDC on No.1 cylinder. Use dial gauge.
4. Ensure balancer shaft marks aligned 7 & 8.
5. Ensure marks on belt aligned with marks on sprockets 9 & 10.
6. Slacken balancer shaft belt tensioner nut 11.
7. Remove balancer shaft belt.
8. Remove balancer shaft belt sprocket from crankshaft 12.
9. Slacken timing belt tensioner nut 13.
10. Remove timing belt.

## Installation

1. Ensure crankshaft at TDC on No.1 cylinder. Use dial gauge 14.
2. Hold camshaft sprockets. Use tool Nos.1.822.155.000 and 1.822.146.000 15 & 16. Slacken bolt of each camshaft sprocket.
3. Remove No.3 inlet and exhaust camshaft bearing caps 17 & 18.  
**NOTE: Mark bearing caps before removal for identification.**
4. Fit locking tools in place of bearing caps 19 & 20. Tool No.1.825.041.000.  
**NOTE: Ensure locking tools aligned with respective cam profiles to prevent damage.**
5. Fit timing belt in following order:
  - Crankshaft sprocket.
  - Guide pulley.
  - Exhaust camshaft sprocket.
  - Inlet camshaft sprocket.
  - Tensioner pulley.
  - Water pump pulley.
6. Ensure marks on belt aligned with marks on sprockets 21 & 22.
7. Tension timing belt to maximum. Use tool No.1.822.149.000 23.
8. Tighten tensioner nut 24.
9. Hold camshaft sprockets. Use tool Nos.1.822.155.000 and 1.822.146.000 15 & 16.
10. Tighten bolt of each camshaft sprocket.
11. Remove dial gauge 14.
12. Remove locking tools 19 & 20.
13. Fit bearing caps in correct locations.
14. Lubricate camshaft bearing cap bolts. Tighten bolts to 13-16 Nm.
15. Turn crankshaft two turns clockwise to TDC on No.1 cylinder 14.
16. Fit tensioning tool No.1.822.149.000 23.
17. Slacken tensioner nut 24.
18. Turn tensioner until pointer 25 aligned with hole 26.
19. Tighten tensioner nut to 21-26 Nm 24.
20. Ensure crankshaft at TDC on No.1 cylinder 14.
21. Align balancer shaft timing marks 7 & 8.
22. Fit balancer shaft belt.
23. Fit tensioning tool No.1.822.154.000 23.
24. Turn tensioner until hole 25 is aligned with centre of tensioner 26.
25. Tighten tensioner nut 24.
26. Turn crankshaft two turns clockwise to TDC on No.1 cylinder 14.
27. Ensure timing marks aligned 7, 8, 9 & 10.
28. Install components in reverse order of removal.
29. Tighten crankshaft pulley bolts to 24-26 Nm.



AD11480

(24-26 Nm)

AD43068