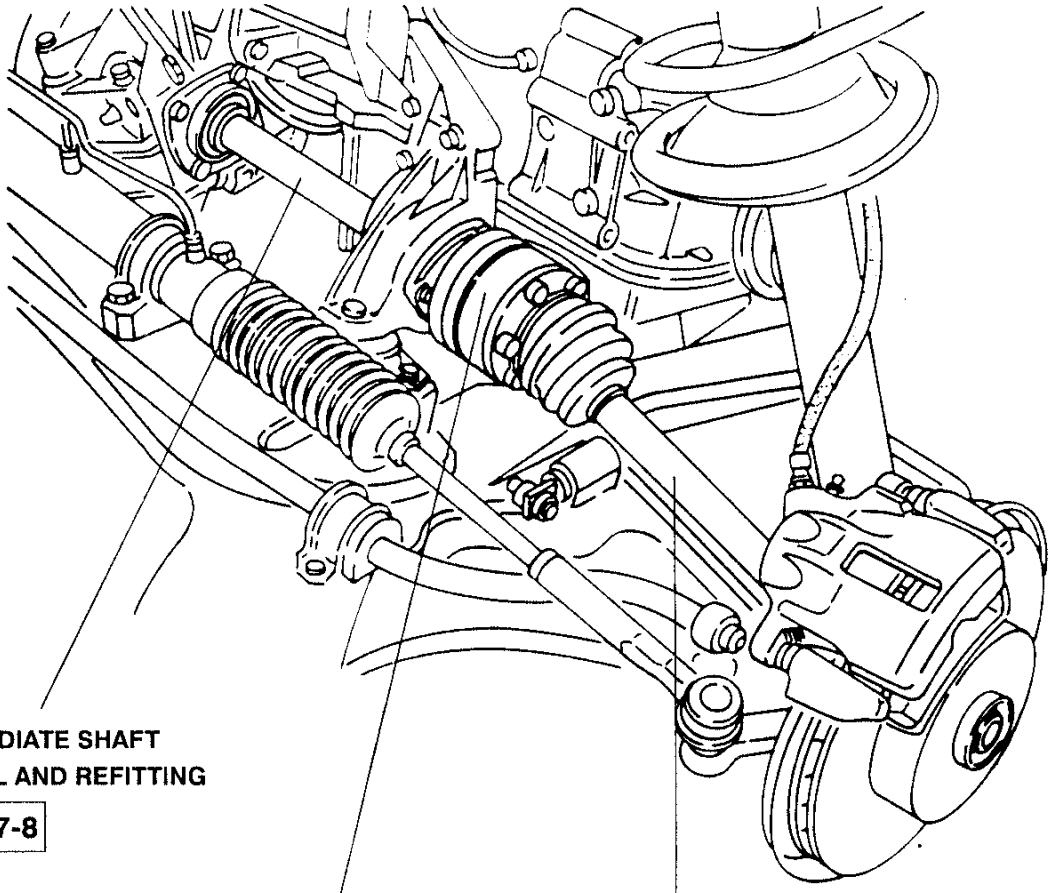
GROUP 17

AXLE SHAFTS

INDEX

ILLUSTRATED INDEX



INTERMEDIATE SHAFT
REMOVAL AND REFITTING
Page 17-8

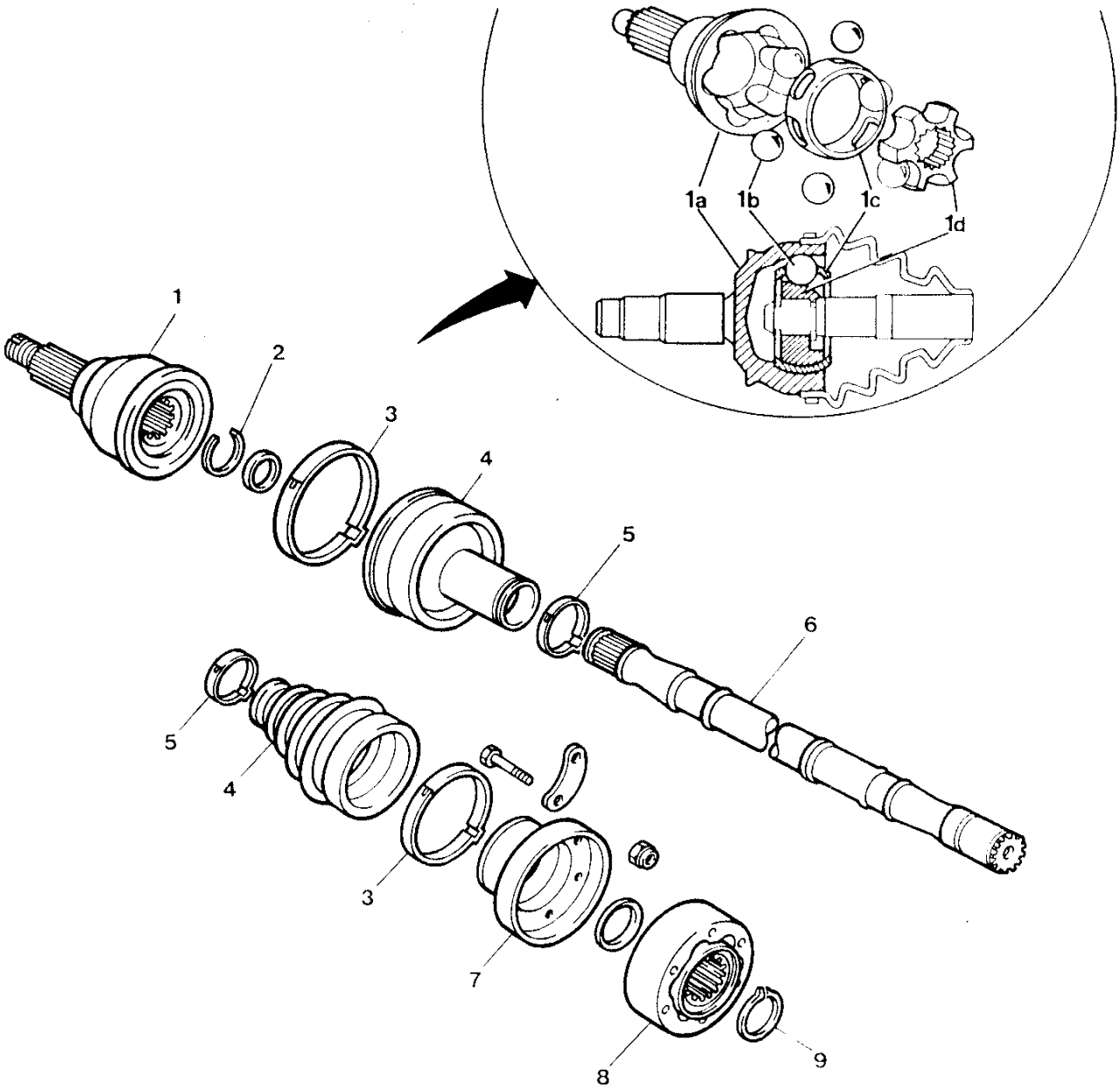
AXLE SHAFTS
REMOVAL AND REFITTING Page 17-5

CONSTANT SPEED JOINTS
DISASSEMBLY OF JOINT ON GEARBOX SIDE Page 17-9

AXLE SHAFTS

DESCRIPTION

The axle shafts,constant speed joints and the intermediate shaft form the assembly of the devices which transmits the movement from the gearbox to the drive wheels.



1. Constant speed joint - wheel side
2. Flexible ring
3. Retaining clamp
4. Cover
5. Retaining clamp
6. Axle shaft
7. Constant speed joint attachment flange
8. Constant speed joint - gearbox side
9. Flexible ring

The union of these devices, commonly called "transmission" when allied with the gearbox is composed of:

- Right and left-hand axle shafts;
- constant speed joints - gearbox and wheel sides;
- intermediate shaft.

The high resistance steel axle shafts (6), have grooved ends in order to permit coupling with the constant speed joints (1) and (8). The seating for the flexible rings (2) and (9) is to be found on the constant speed joint and secures the joints themselves.

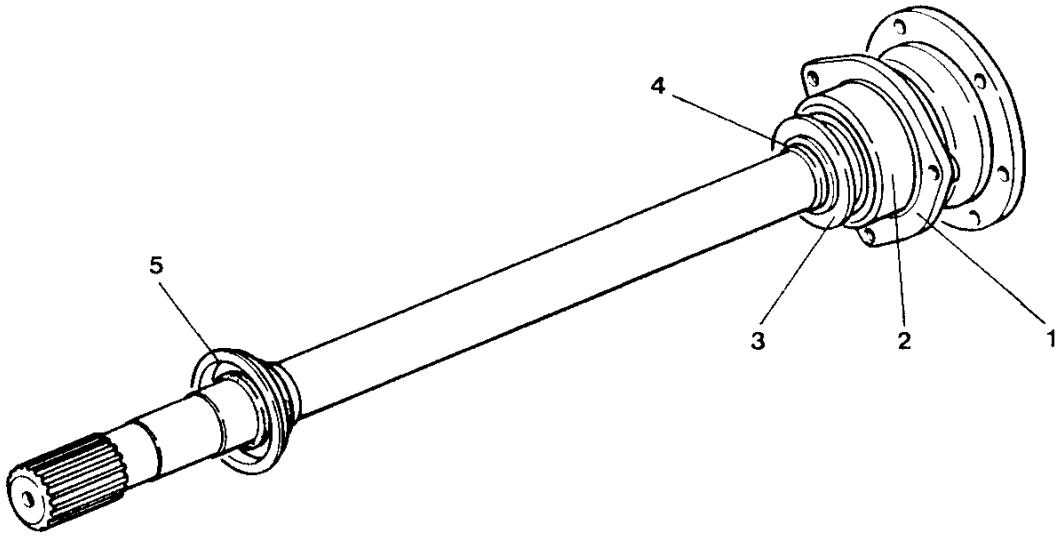
The constant speed joints are composed of an inner core (1d) called "drive", machined onto the input shaft, and by an outer shell (1a) called "driven", which forms the outgoing element of the shaft.

The inner core has six spherical grooves on its outer surface containing six balls (1b) kept in place by a cage (1c).

These balls are the parts which actually transmit the motion and are also located in other grooves on the inner surface of the shell.

The intermediate shaft also has a grooved end and like the axle shafts is made of high resistance steel. It connects, by way of a flange, the differential output with the right-hand axle shaft.

To limit the gap between the attachment points, the intermediate shaft is supported by a seating on the gearbox.

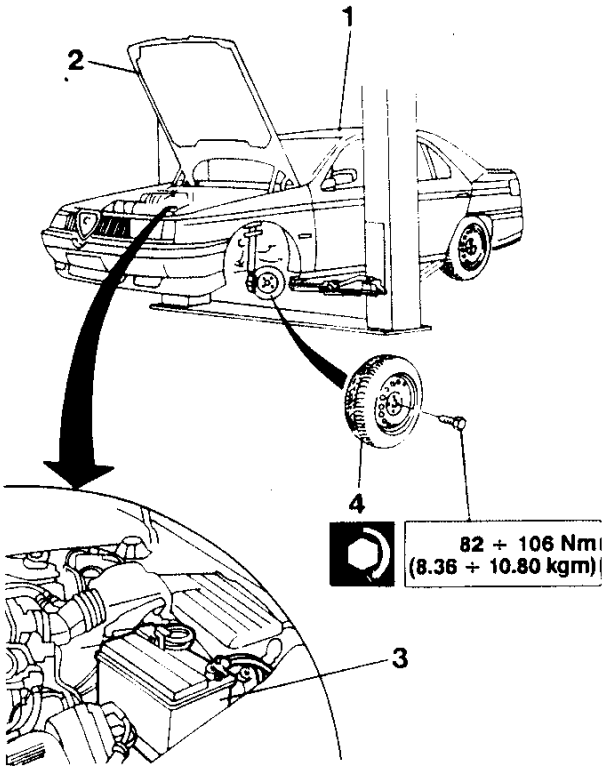


1. Bearing retaining plate
2. Ball bearing
3. Flexible washer
4. Flexible ring securing bearing
5. Bowl for bearing

REMOVAL AND REFITTING

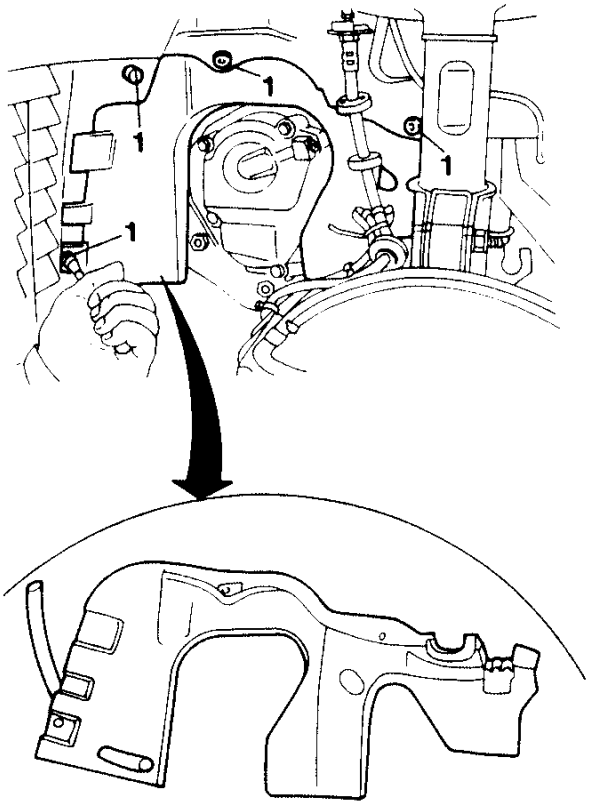
1. Set the vehicle on a lift.
2. Lift the bonnet.
3. Disconnect and remove the battery.
4. Remove the front wheels.

WARNING:
Protect the areas around the around the engine compartment with soft material in order to avoid accidentally damaging the bodywork.

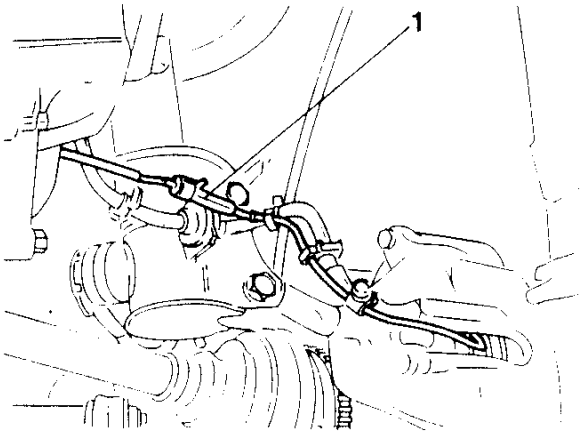


– Raise the vehicle.

1. Working through the left-hand wheelhousing, loosen the screws and remove the buttons securing the dustguard on the gearbox side.



1. Disconnect the connector from the brake pad wear sensor.

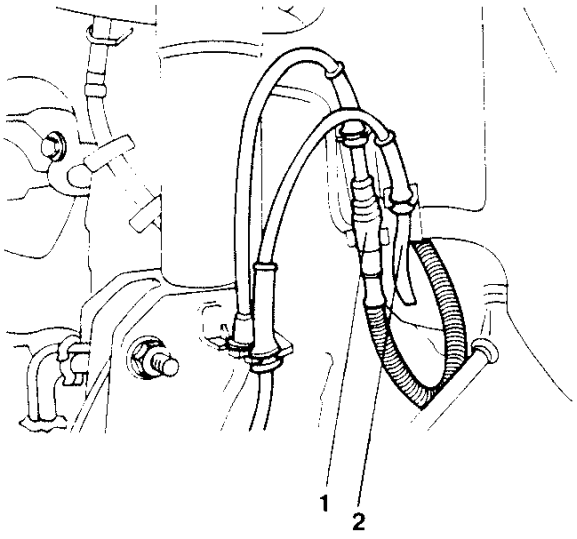


1. (only for vehicles equipped with controlled damping suspension):

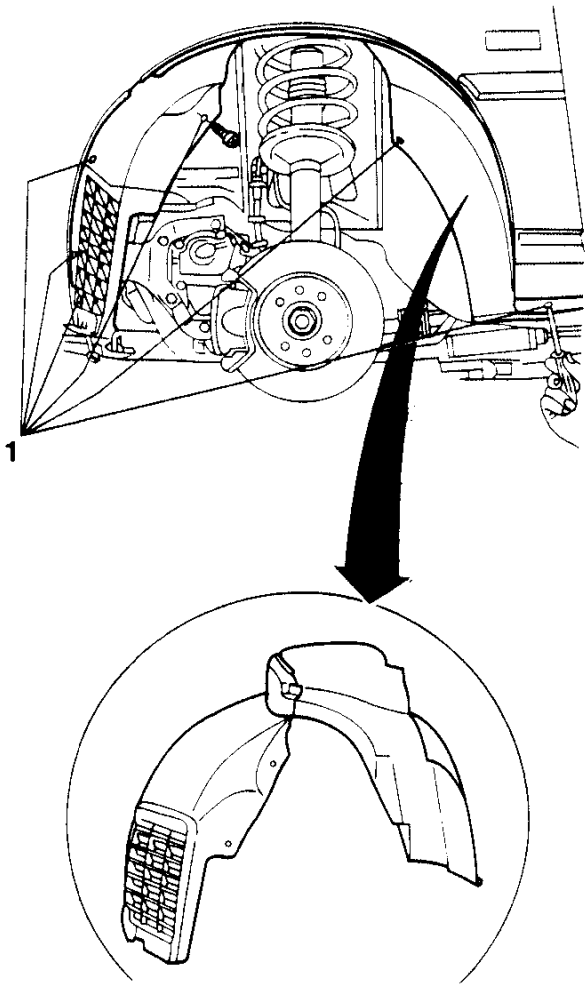
   - disconnect the connector from the controlled damping sensor.

2. (only for vehicles equipped with ABS):

   - Loosen the screw securing the ABS system wiring support bracket and move it to one side and secure it to the suspension.



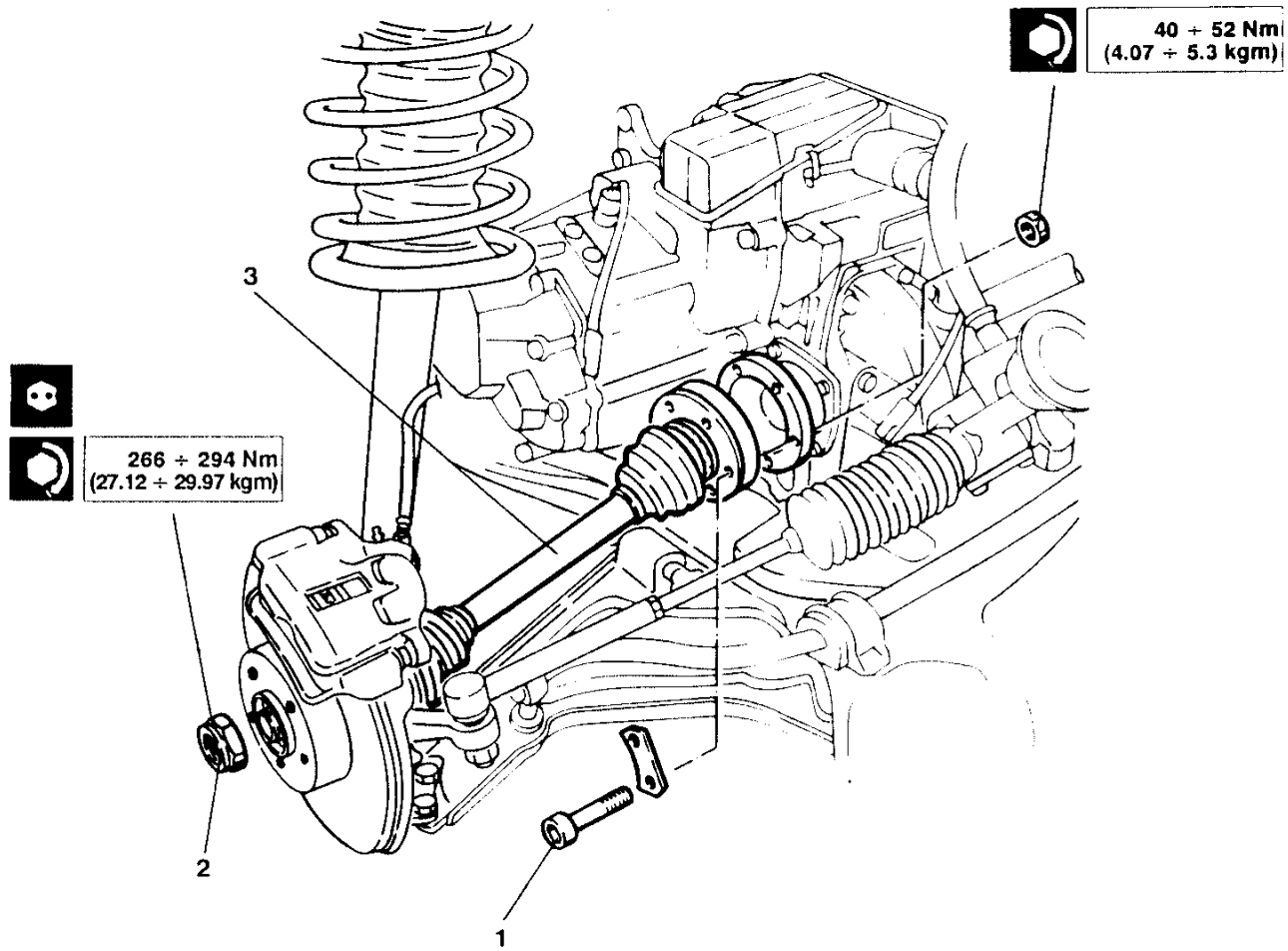
1. Loosen the screws and remove the plastic wheel-housing from the body.



1. Unscrew the six bolts and disconnect the left-hand constant speed joint from the differential flange. Remove the three safety plates.
2. Remove the caulking and unscrew the nut securing the wheel hub to the axle shaft

When refitting, caulk the new nut and tighten it to the correct torque.

3. Slide off the axle shaft and remove it.

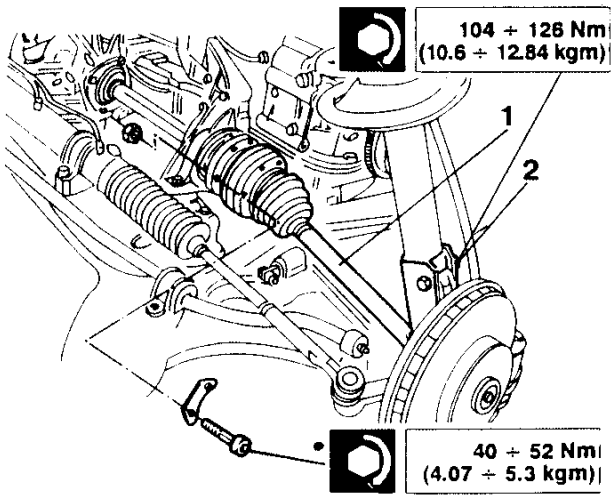


INTERMEDIATE SHAFT

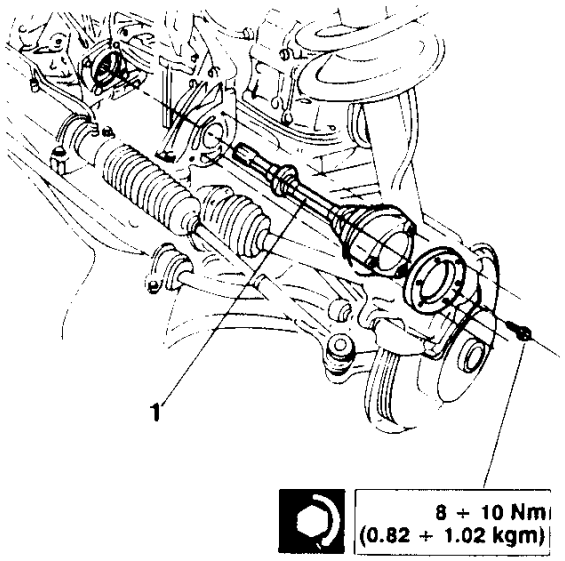
REMOVAL AND REFITTING

– Working from the right-hand side of the vehicle, operate as follows:

1. Unscrew the six bolts and disconnect the left-hand constant speed joint from the differential flange. Remove the safety plates.
2. Loosen the two bolts securing the wheel support to the suspension strut and remove the upper bolt.



1. Loosen the screws securing the flange of the intermediate shaft to the engine support and withdraw the shaft from the differential.



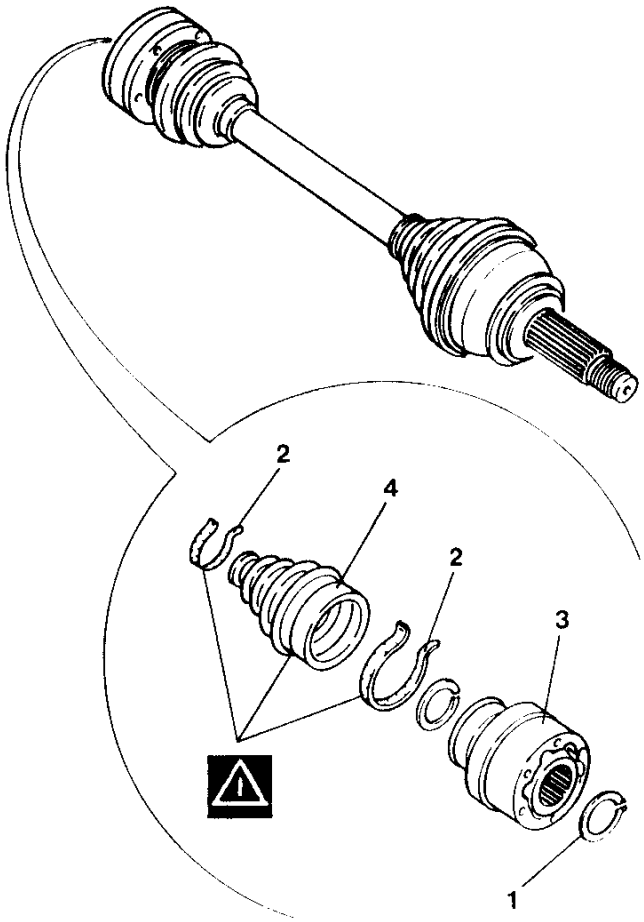
Refit by reversing the procedure followed for removal and tighten the previously removed screws and nuts to the correct torque.

CONSTANT SPEED JOINTS

DISASSEMBLY OF JOINT ON GEARBOX SIDE

1. Remove the snap ring.
2. Remove the bellows retaining clamps.
3. Slide the constant speed joint off the axle shaft.
4. Pull off the protective boot.

WARNING:
Substitute the boot and clamps when refitting.

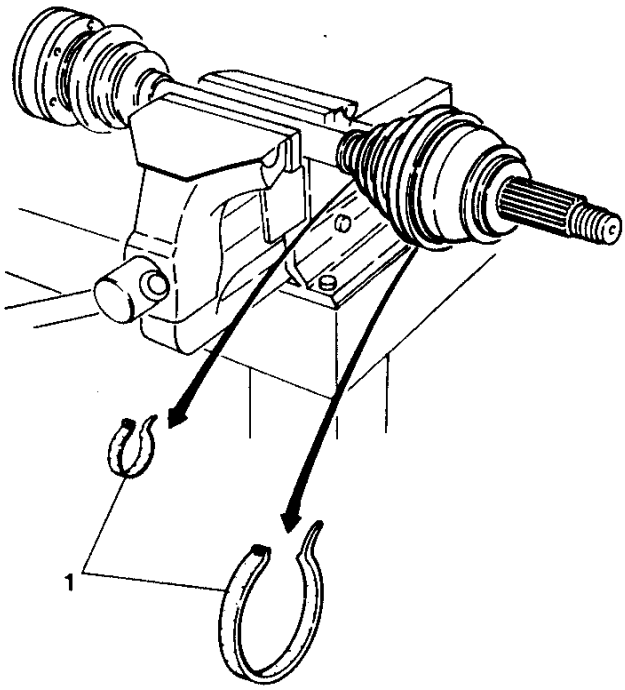


DISASSEMBLY OF JOINT ON WHEEL SIDE

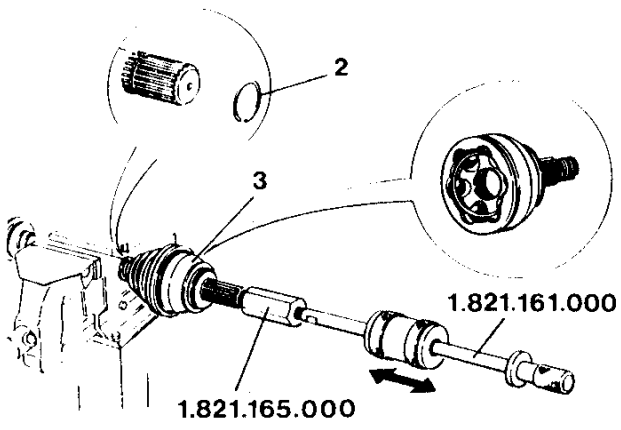
Lock the axle shaft in a vice and proceed as follows:

1. Remove the clamp securing the protective boot.

WARNING:
Substitute the boot and clamps when refitting.

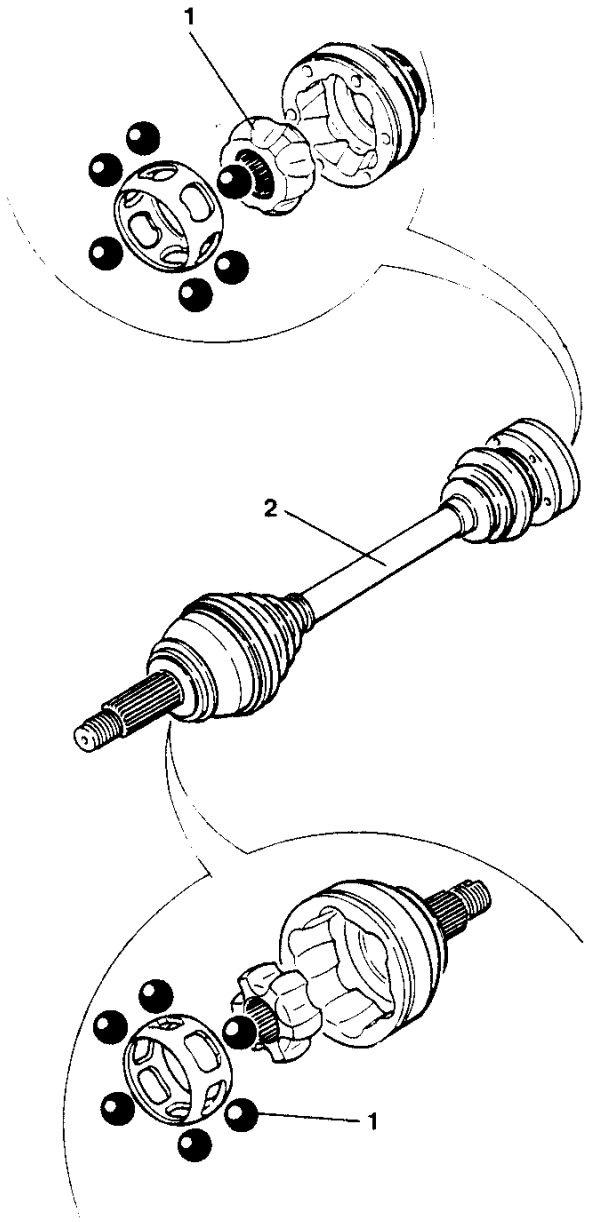


2. Remove the snap ring.
3. Using tools No. 1.821.165.000 and No. 1.821.161.000, remove the constant speed joint from the axle shaft.



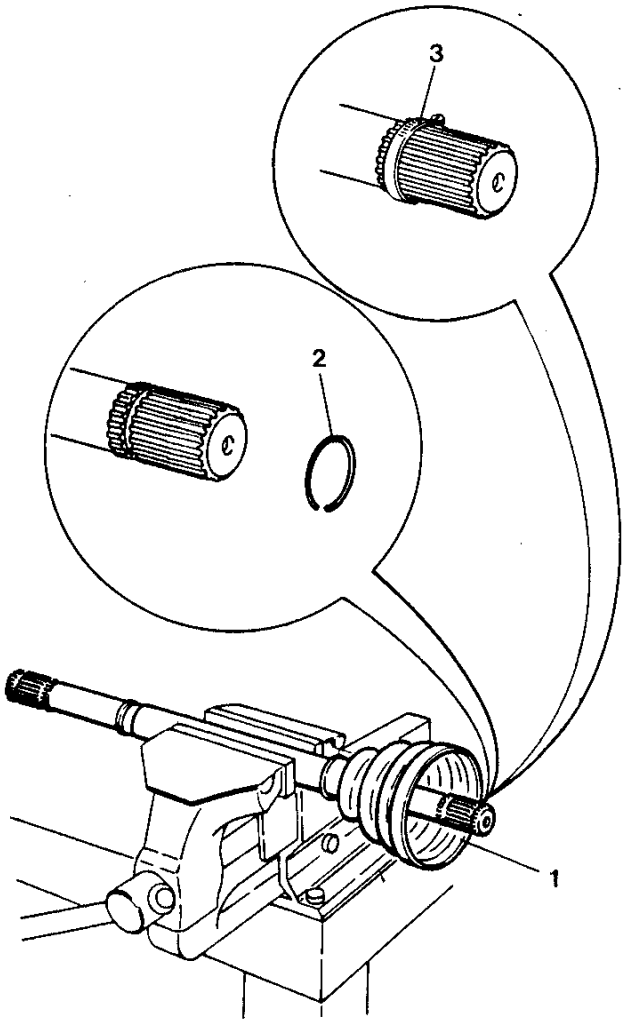
CHECKING AND ADJUSTMENT

1. Grease the components of the constant speed joint with petrol and check that the balls and seatings are not worn or cracked.
2. Check that the shaft is not deformed, cracked or worn.



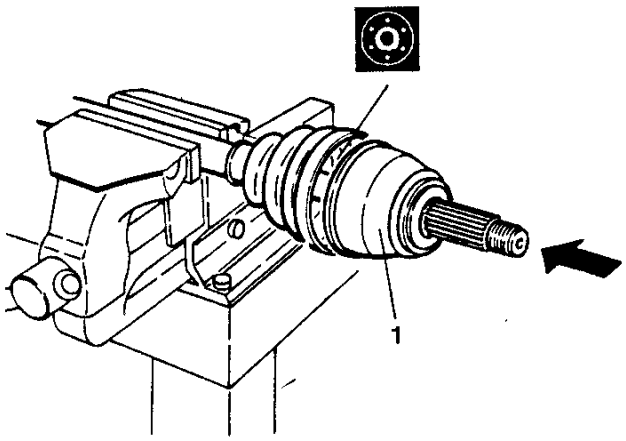
REFITTING THE JOINT ON THE WHEEL SIDE

1. Slide a new boot onto the axle shaft.
2. Position the snap ring in its seating.
3. Compress the snap ring using the securing clamp.

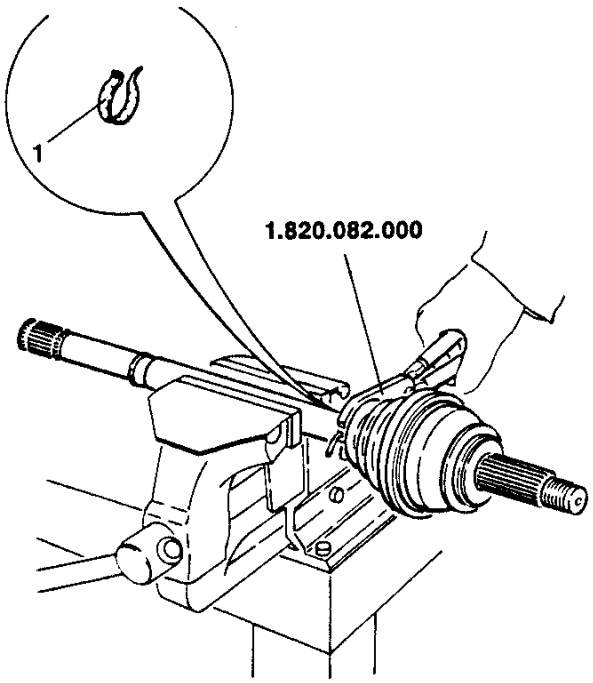


1. Position the constant speed joint on the axle shaft and using a soft mallet, drive it home.

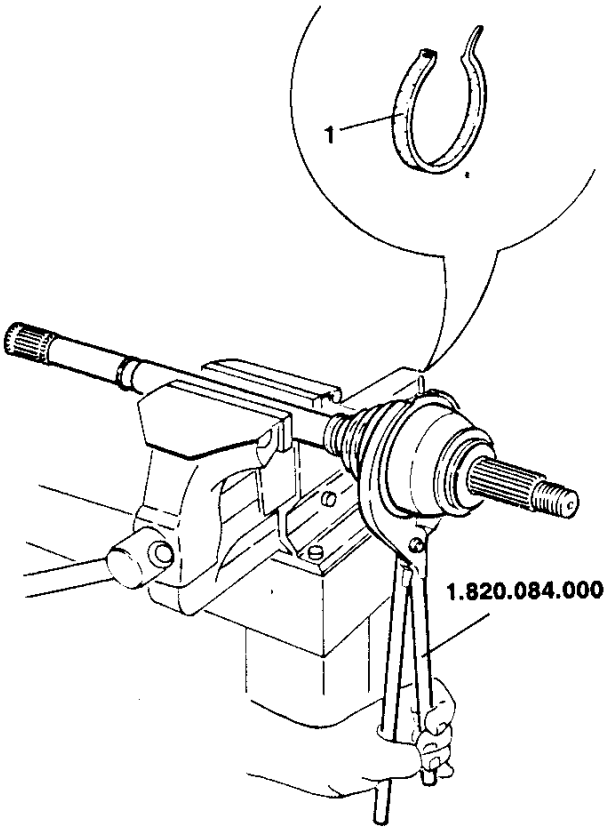
Fill the boot and grease the joint with about 120 g of the specified grease.



1. Using tool No. 1.820.082.000 slide the internal clamp on to secure the boot.



1. Using tool No. 1.820.084.000 slide the external clamp on to secure the boot.

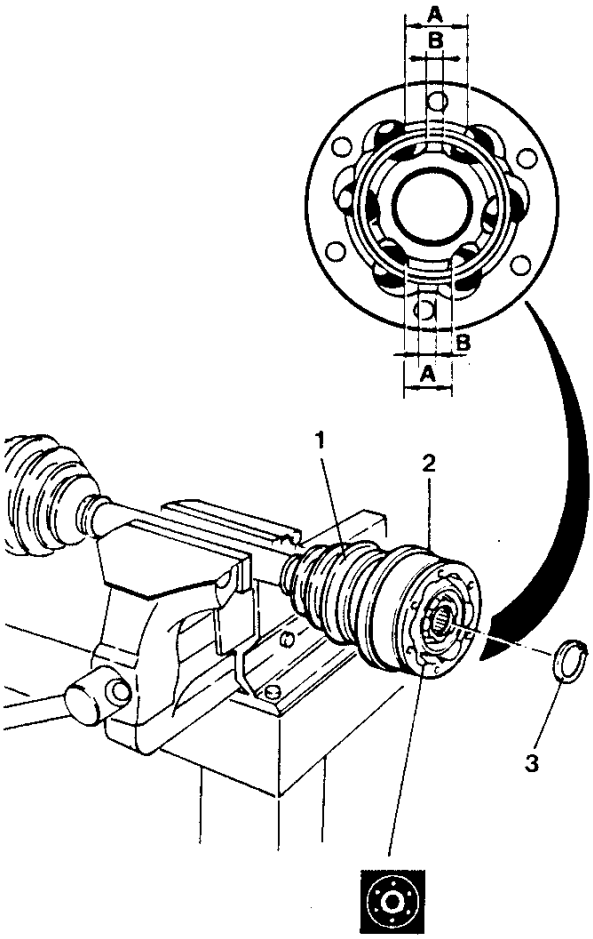


REFITTING THE JOINT ON THE GEARBOX SIDE

1. Slide a new protective boot onto the axle shaft.

WARNING:
Reassemble the components of the constant speed joint as shown if they have been previously removed:
A = Greatest distance between balls
B = Smallest distance between balls

Fill the boot and grease the joint with about 120 g of the specified grease.



2. Install the constant speed joint.
3. Install the snap ring.

TECHNICAL CHARACTERISTICS AND SPECIFICATIONS

GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

APPLICATION	TYPE	NAME
Axle shaft constant speed joints	GREASE	OPTIMOL-OLISTAMOLY 2LN 584 MOLYKOTE VN 2461/C TUTELA MRM2

TIGHTENING TORQUES

Description	kg·m	N·m
Axle shaft retaining screws	4.8 - 5.91	47 - 58
Intermediate axle shaft flange retaining screws	8.82 - 1.02	8.1 - 10
Nut securing axle shaft to wheel hub	36.29 - 40.77	356 - 400

SPECIFIC TOOLS

TOOL NUMBER	DESCRIPTION
1.820.082.000	Pliers for installing joint protection boot clamp
1.820.084.000	Pliers for installing joint protection boot clamp
1.821.165.000	Puller for constant speed joint
1.821.161.000	Mallet (use with No. 1.821.165.000)

FAULT DIAGNOSIS AND CORRECTIVE ACTION

SYMPTOMS AND ANAOMALIES	FAULT ISOLATION	TEST
CONSTANT NOISE DURING TRAVEL (EVEN WITH GEARBOX IN NEUTRAL)		A
KNOCKS DURING PICKUP AND SUDDEN CHANGES IN ENGINE TORQUE		B

CONSTANT NOISE DURING TRAVEL (EVEN WITH GEARBOX IN NEUTRAL)	TEST A

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
A1 CHECK INTERMEDIATE SHAFT – Check intermediate shaft for distortion or eccentricity	(OK) ▶ (OK) ▶	Carry out step A2 Replace intermediate shaft
A2 CHECK INTERMEDIATE SHAFT BEARING – Check intermediate shaft bearing for scoring or traces of overheating	(OK) ▶	Replace intermediate shaft

KNOCKS DURING PICKUP AND SUDDEN CHANGES IN ENGINE TORQUE	TEST B

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
B1 CHECK LUBRIFICATION – Check for presence of lubricating grease inside bellows and check bellows for damage	OK ▶ OK ▶	Carry out step B2 Adequately grease or replace bellows if necessary
B2 CHECK PLAY – Check for excessive play between housing and balls of the constant velocity joint	OK ▶	Replace constant velocity joint

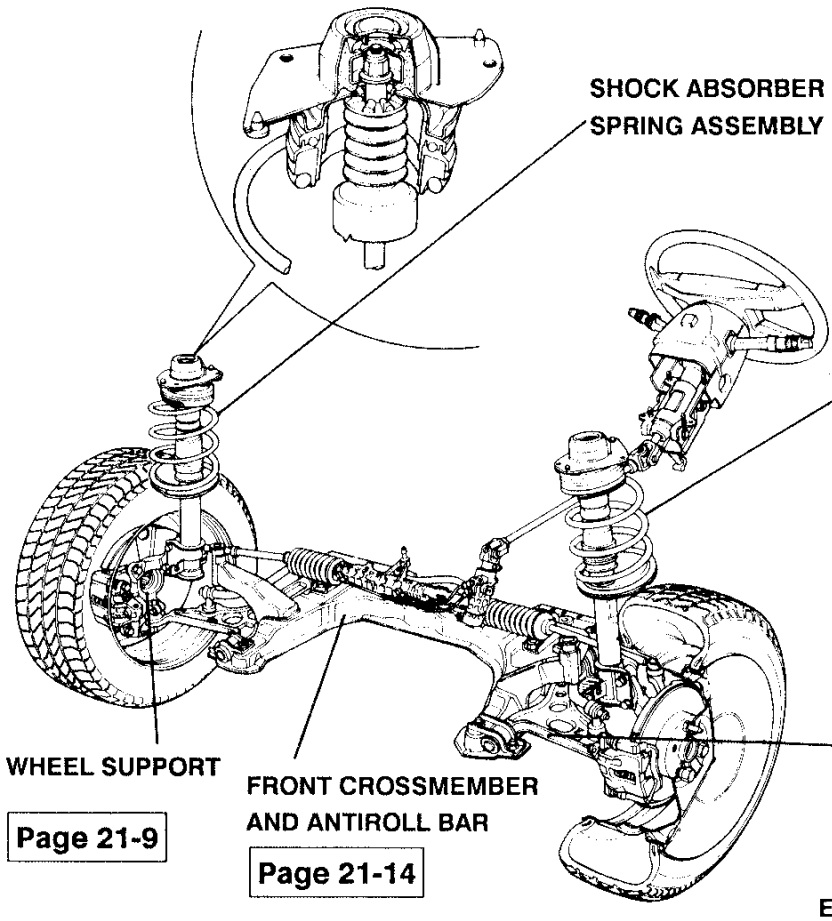
GROUP 21

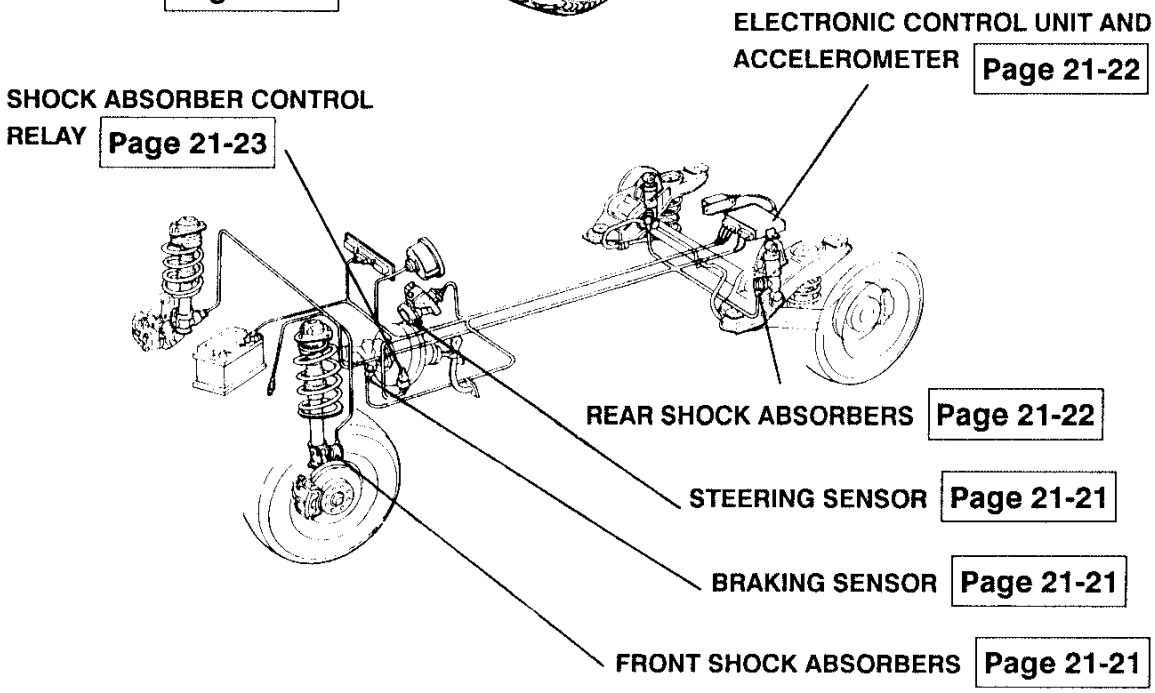
FRONT SUSPENSION

INDEX

(*) The data concerning the '95 versions are not available at time of going to press.

ILLUSTRATED INDEX

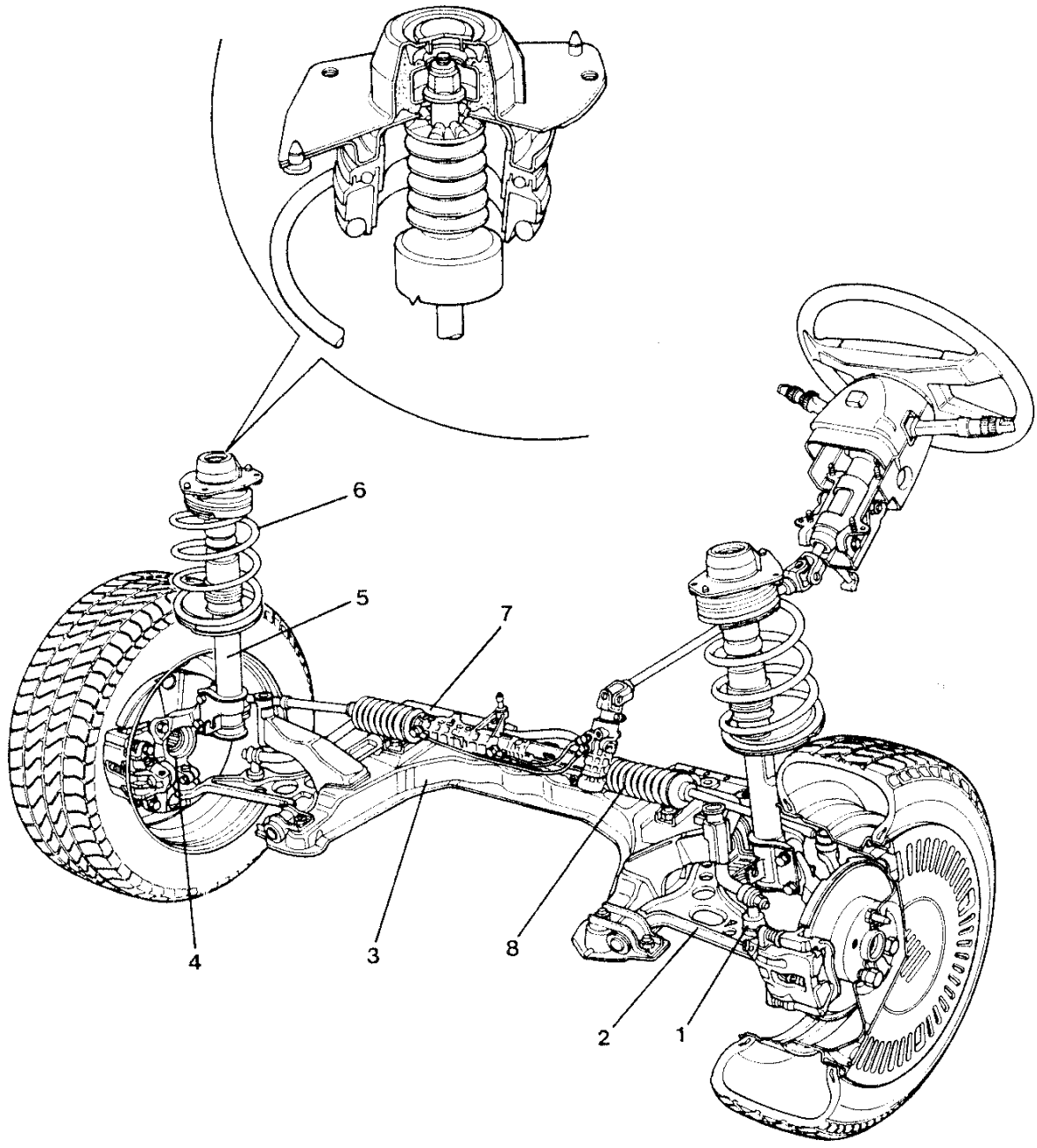




FRONT SUSPENSION

DESCRIPTION

The independent front wheel suspension is of the McPherson type with telescopic supports and negative reaction rod and is common to all the vehicles in the "167" range. For the models equipped with controlled damping suspension, variable "setting" shock absorbers have been adopted (see: CONTROLLED DAMPING SUSPENSION) though the overall structure of the assembly remains unaltered.



1. Swinging arm-antiroll bar connecting rod
2. Swinging arm
3. Front cross rail
4. Wheel support
5. Shock absorber
6. Helical spring
7. Antiroll bar
8. Steering box

The front suspension assembly can be broken down into the following main components:

- Front cross rail (3) , rigidly secured to the body, in addition to incorporating the supporting structure also supports the steering box (8) and the cast-iron swinging arms of the suspension (2).
- The telescopic supports which include the helical springs (6) and shock absorbers (5).
  The springs, offset and conical, make it possible to reduce the thrust on the shock absorber strut thus facilitating steering.
  This solution also makes it possible to eliminate any noise from the shock absorbers when the vehicle is in movement, which increases driving comfort.
  The telescopic supports, of new design, pressurized with intake valves of the lamellar type with reduced tollerance discs, make it possible to obtain excellent levels of comfort and silence over large obstacles though maintaining the necessary damping action.
- The cast-iron swinging arms (2), carry the spherical joints connected to the wheel support (4) and the silent-block with sheet metal framework for the attachment of the arms to the cross rail (3).
  The rotation of the arms on the silent-block confers high transversal rigidity and low longitudinal rigidity to the suspension. These operating conditions make it possible to:
  - improve vehicle behavior even under particularly critical road holding conditions;
  - improve driving comfort.

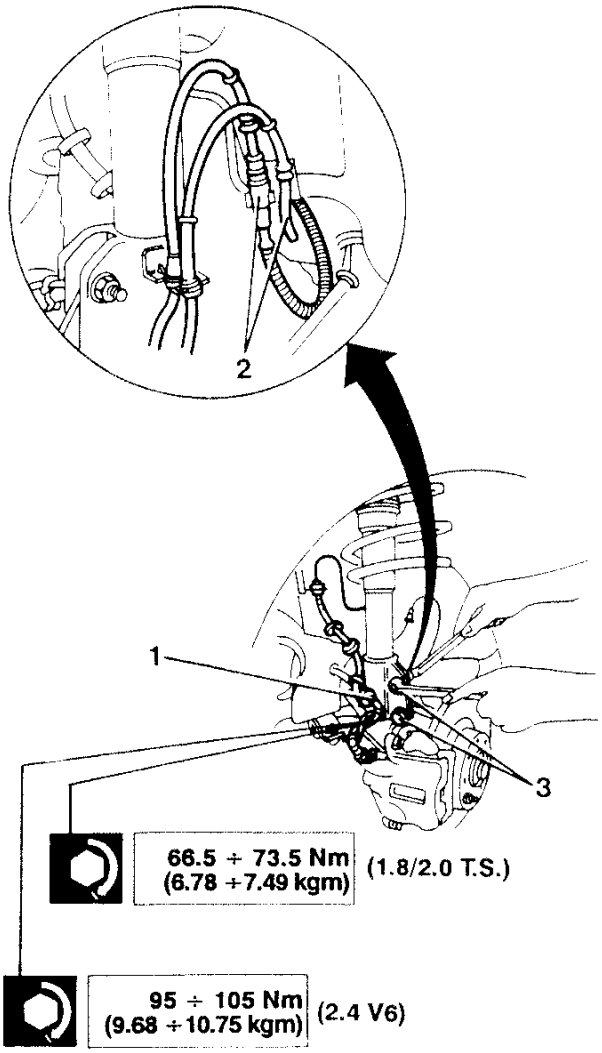
The antiroll bar, increasing the rigidity of the suspension on one side of the vehicle and lowering it on the other, serves to limit the transversal inclination of the car body. This makes it possible to increase the speed of the vehicle in a curve as it contrasts the rolling of the body provoked by the centrifugal forces produced as the speed of the vehicle increases.

SHOCK ABSORBER AND HELICAL SPRING ASSEMBLY

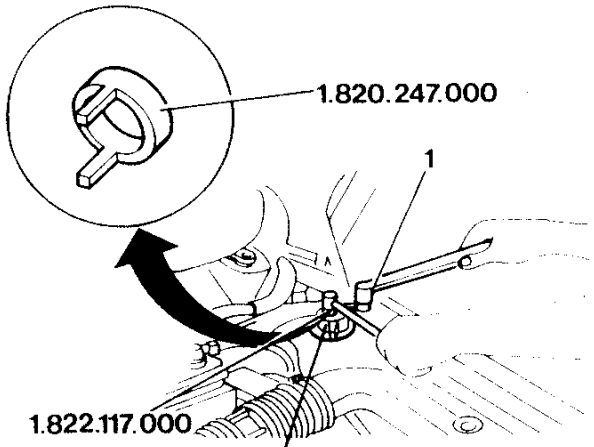
REMOVAL AND REFITTING

- Remove the front wheel.

1. Disconnect the brake hose retaining pad from the shock absorber strut.
2. (only for vehicles equipped with ABS and/or controlled damping suspension):
   - Disconnect and remove the connectors from the shock absorber guide.
3. Unscrew the two bolts securing the shock absorber guide to the wheel support.

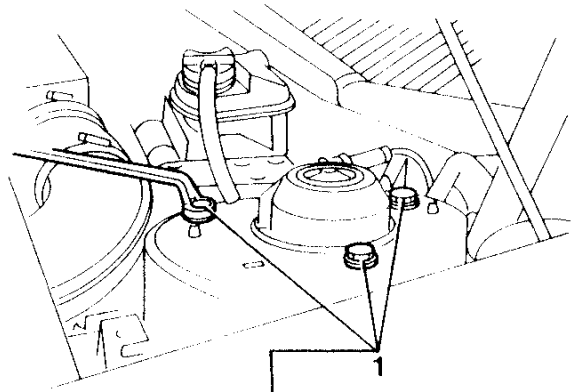


1. Using shock absorber strut retaining tool No.1.820.247.000, the extension for spanner No.1.822.117.000 and a 6 mm hexagonal box spanner, loosen the central spring retaining nut.



95 ÷ 105 Nm (9.68 ÷10.75 kgm)

1. Loosen the three screws securing the shock absorber to the dome and remove the shock absorber coil spring assembly.



34 ÷ 42 Nm (3.46 ÷4.28 kgm)

To refit reverse the procedure followed for removal and:

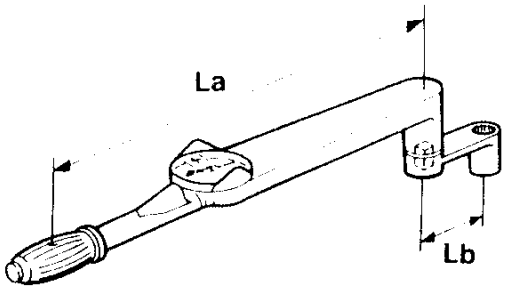
- Tighten the retaining screws to the correct torque.
- Position the shock absorber spring assembly and using shock absorber strut retaining tool No.1.820.247.000, the extension to spanner No.1.822.117.000 and a 6 mm hexagonal box spanner and tighten the central spring retaining nut to the specified torque.

NOTE: Using spanner No.1.822.117.000 and a dynamometer spanner the torque on the levering arm is varied; the correct torque therefore must be calculated by applying the following formula

$$\frac{La \times Cn}{La + Lb} = Cr$$

where:

La = Length of dynamomter spanner (in metres)
Lb = Length of spanner No. 1.822.117.000 (in metres)
Cn = Nominal torque (in Nm.)
Cr = Real tightening torque (in Nm.)



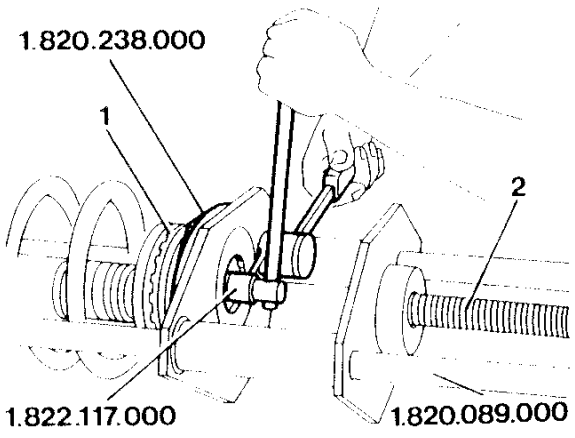
DISASSEMBLY AND REASSEMBLY

WARNING:
When replacing the shock absorbers it is necessary to follow these guidelines:

- **For vehicles with more than 20/25,000 km on the clock both shock absorbers on each axle must be replaced using parts of the same type.**
- **For vehicles which have not yet reached 20/25.000 km the shock absorbers can be replaced one at a time as long as the new one is of the same type as the old.**

1. Position the shock absorber coil spring assembly on tool No. 1.820.089.000 fitted with support plate No. 1.820.238.000 and using key No.1.822.117.000, completely unscrew the nut securing the spring.
2. Tighten the central screw of tool No.1.820.089.000, by two or three turns, compress the spring in order to allow removal of the previously loosened nut.

– Loosen the central screw and remove the spring and the shock absorber.



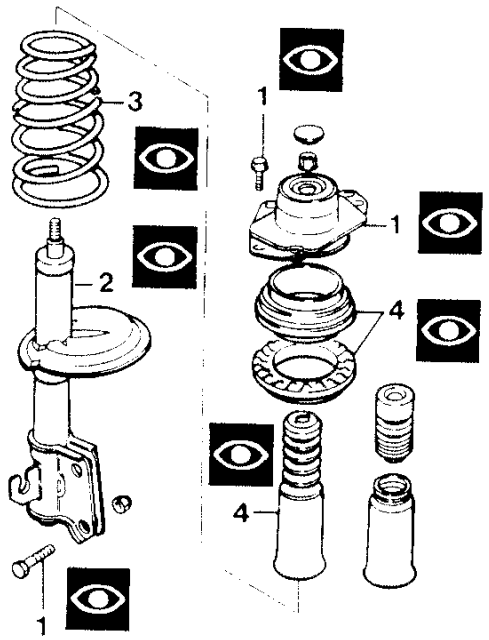
Refit by reversing the procedure followed for disassembly and only partially tighten the spring retaining nut.

CHECKS AND INSPECTIONS

1. Check that the components securing the shock absorber helical spring asssembly show no signs of abnormality which could affect the correct operation.
2. Check the state of the shock absorbers and ensure that they work well and are not leaking. If any anomaly is discovered replace the shock absorber.
3. Visually check that the springs are not cracked, deformed or faulty in any way.

NOTE: **The helical springs are divided in to categories and marked with coloured paint in order to facilitate 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.**

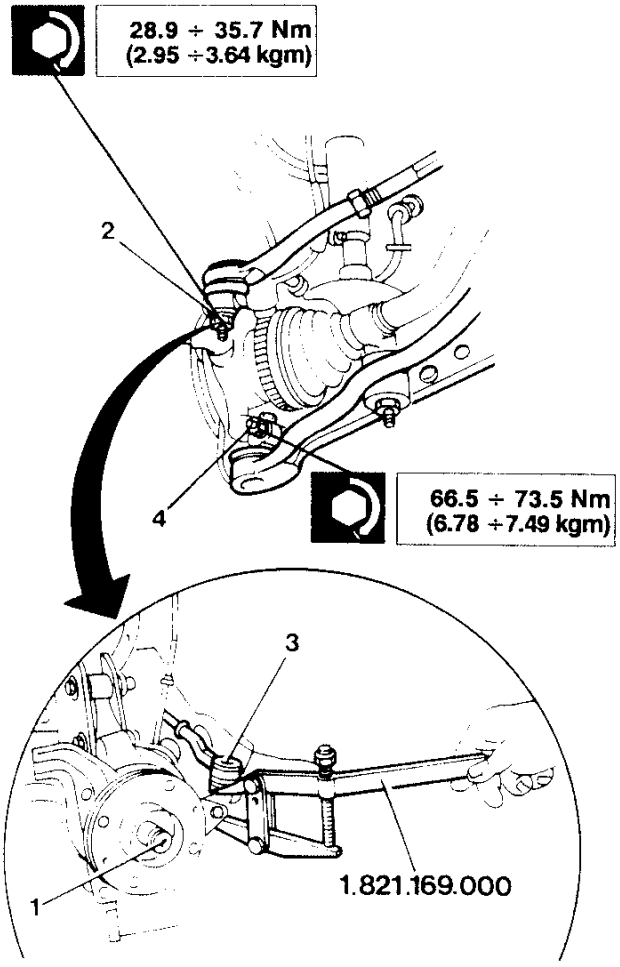
4. Check that the rubber elements are not damaged, deformed or obviously worn. If they are they must be replaced.



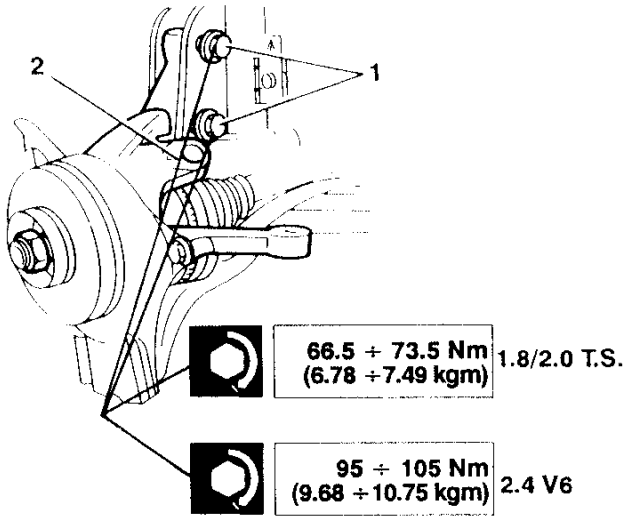
WHEEL SUPPORT

REMOVAL AND REFITTING

– Remove the wheel.
1. Caulk and unscrew the nut securing the wheel hub to the constant speed joint.
2. Detach the caliper without disconnecting the braking system hoses (see: GR. 22 - BRAKE HOSES).
3. Unscrew the nut securing the spherical joint connecting the side tie-rod to the wheel support.
4. Using tool No. 1.821.169.000, disconnect the sperical joint from the wheel support.
5. Unscrew the bolt connecting the swinging arm to the strut and withdraw it from the ball pivot.



1. Unscrew the two nuts securing the wheel support to the shock absorber strut.
2. Remove the wheel support/hub assembly together with the brake disc protection.

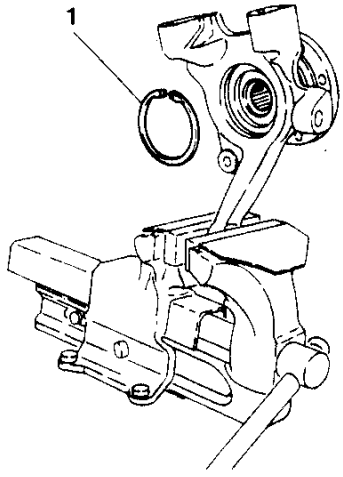


Refit by reversing the procedure followed for removal, tighten the nuts and screws to the correct torque and note the following:

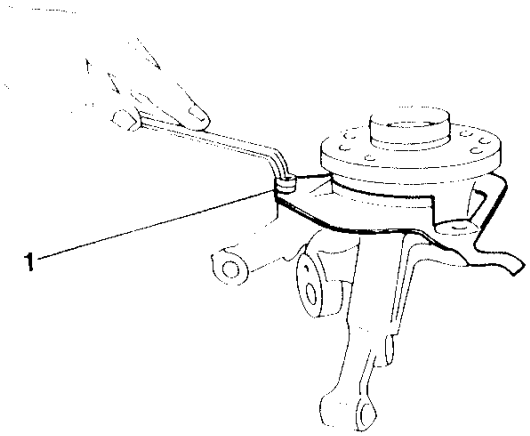
– To refit, always use a new nut to secure the wheel hub to the constant speed joint and, after tightening it to the correct torque, caulk it.

DISASSEMBLY

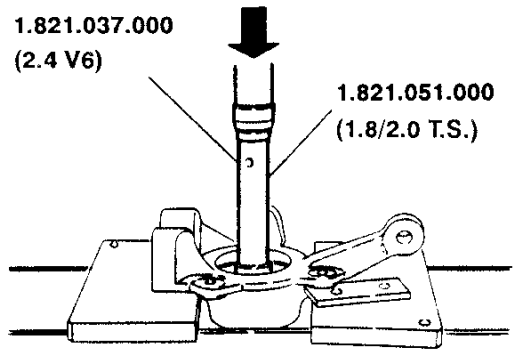
1. Lock the wheel hub/support assembly in a vice and remove the snap ring from the hub.

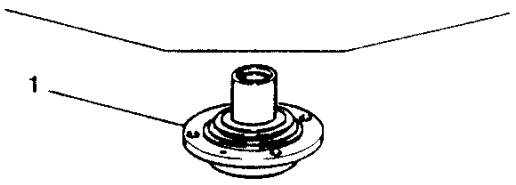


1. Loosen the screw securing the brake disc protection.

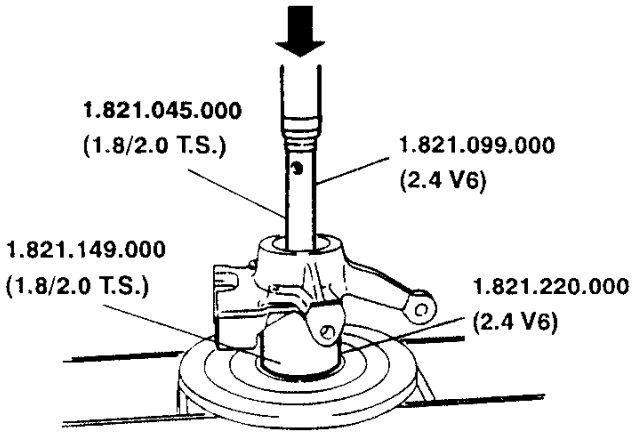


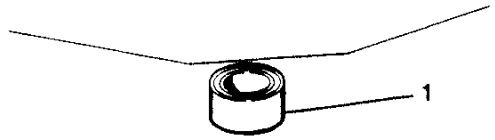
1. Using a press, withdraw the wheel hub from the support using:
   - (only for 1.8/2.0 T.S.) puller No. 1.821.051.000
   - (only for 2.4 V6) puller No. 1.821.037.000





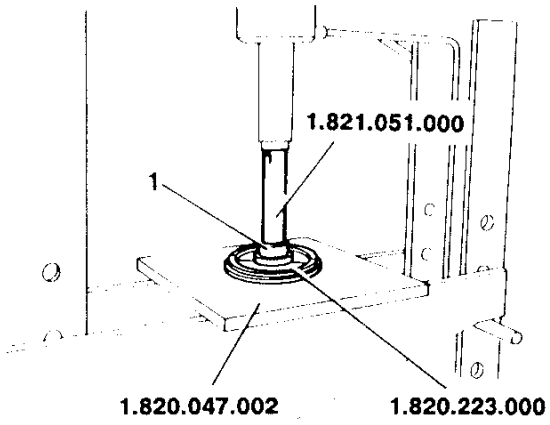
Using a press, withdraw the outer ring of the bearing from the support using:
- (only for 1.8/2.0 T.S.) support No. 1.821.149.000 e puller No. 1.821.045.000
- (only for 2.4 V6) the support shown in the illustration and puller No. 1.821.099.000





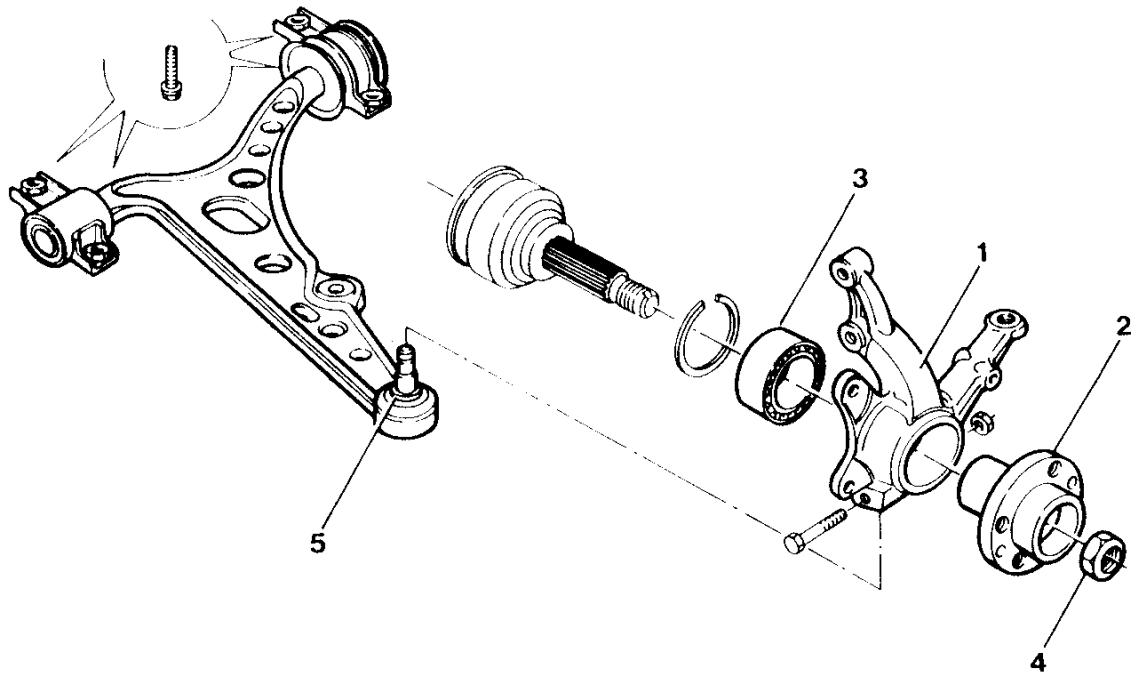
- Using a suitable tool withdraw the inner race of the bearing from the abutting end of the wheel hub.

1. Using a press and using plate No. 1.820.047.002, half-rings No. 1.820.223.000 and puller No. 1.821.051.000, withdraw the inner race from the wheel hub bearing.



CHECKS AND INSPECTIONS

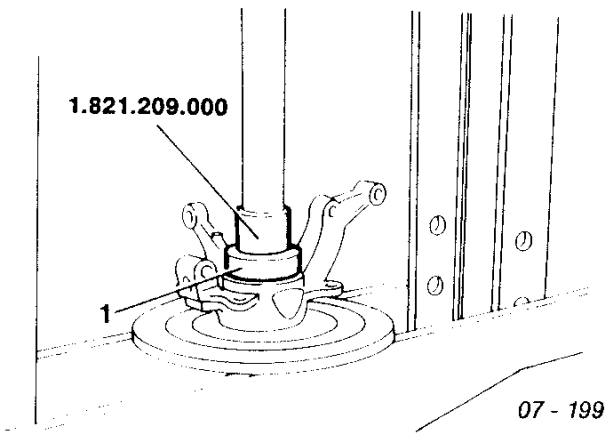
1. Check that the inner surfaces of the wheel support show no traces of seizing and that the arms are not damaged and show no signs of knocking, deformation or breakage. If any of these conditions are found, replace the support.
2. Check that the surfaces of the wheel hub and replace if they are damaged or broken.
3. Check the bearing for cracks, binding and seizing. Replace the bearing if necessary.
4. The nut securing the constant speed joint should always be substituted before refitting.
5. Check the condition of the ball pivot securing the wheel support to the swinging arm and ensure that it is not deformed, worn, cracked, seized or oxidized. If necessary replace the ball pivot.



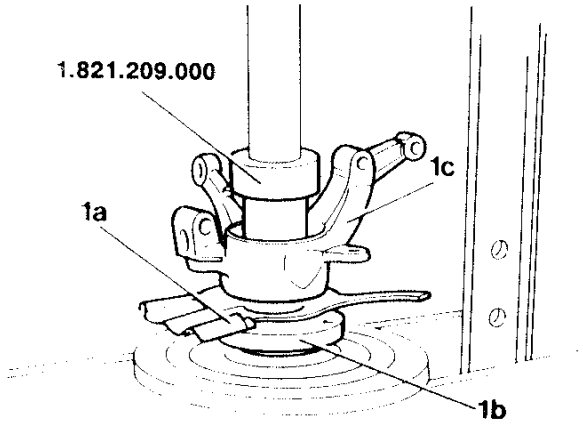
REFITTING

Only for 1.8/2.0 T.S. vehicle.

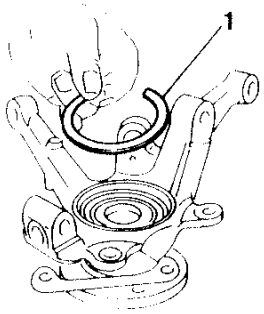
1. Using a press and inserting tool No. 1.821.209.000, insert the bearing into the wheel hub.



1. Place the brake disc protection (1a) on the wheel hub (1b) and using a press and using inserting tool No. 1.821.209.000 in an upside-down position in relation to the previous step, insert the hub into the wheel support (1c).

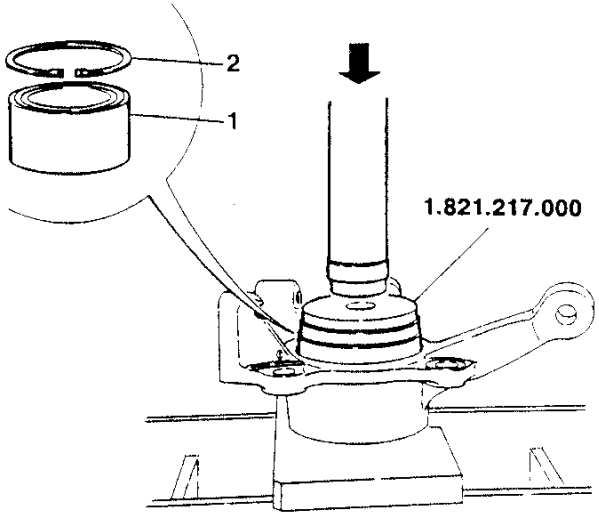


1. Install the bearing snap ring into its seating on the wheel support.

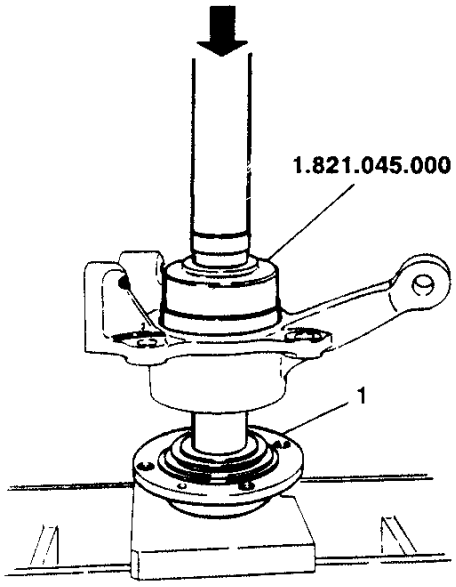


Only for 2.4 V6 vehicle.

1. Using a press and using inserting tool No. 1.821.217.000, insert the bearing into the wheel support.
2. Install the bearing snap ring into its seating on the wheel support.



1. Using a press and using inserting tool No. 1.821.045.000, insert the hub into the wheel support.

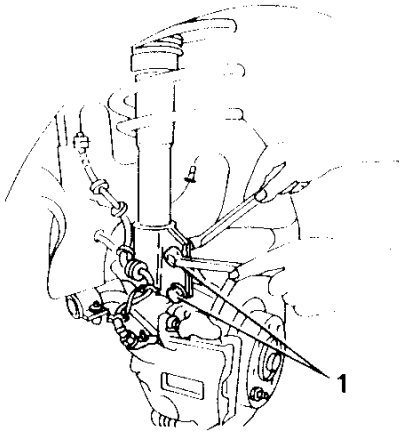


SWINGING ARM

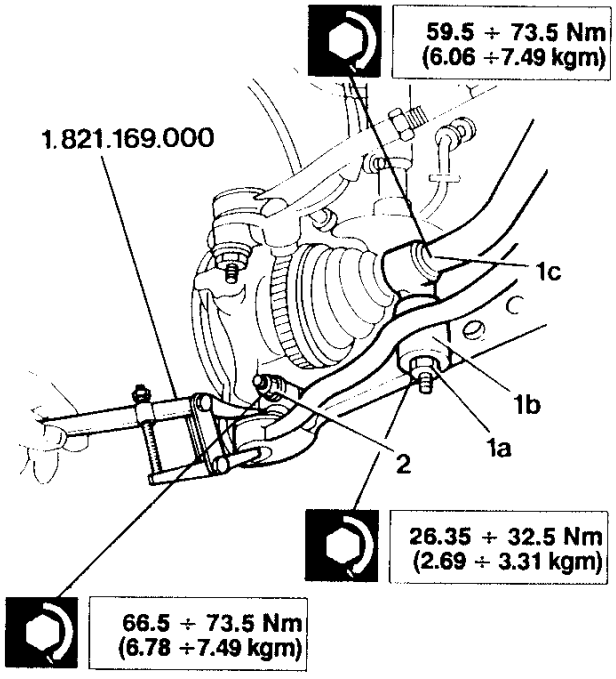
REMOVAL AND REFITTING

– Remove the front wheel.

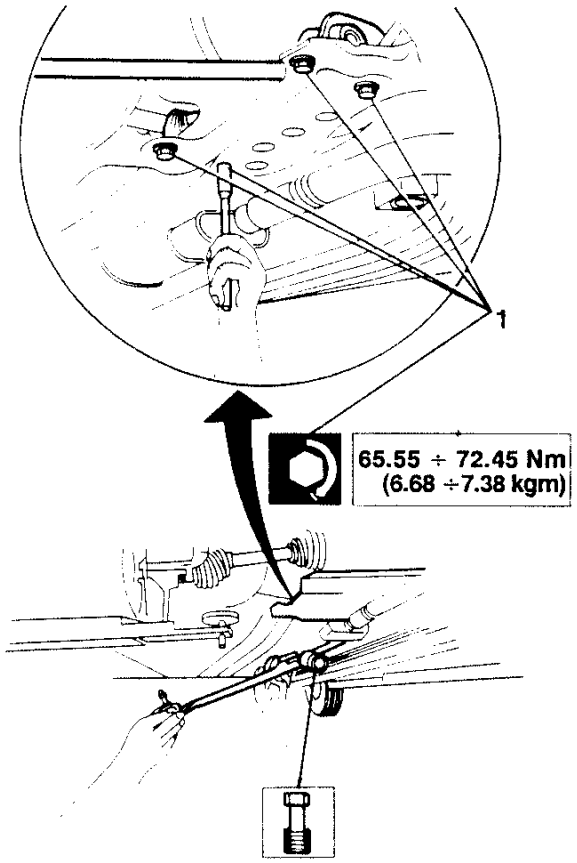
1. Unscrew the two bolts securing the wheel support to the shock absorber strut.



1. Unscrew the nut securing the rod to the swinging arm (1a) and remove it together with the rubber buffer (1b). Unscrew the nut securing the rod to the antiroll bar (1c), and remove the rod.
2. Unscrew the bolt securing the ball pin connecting the swinging arm and the wheel support and, using tool No. 1.821.169.000, disconnect the spherical joint from the swinging arm.



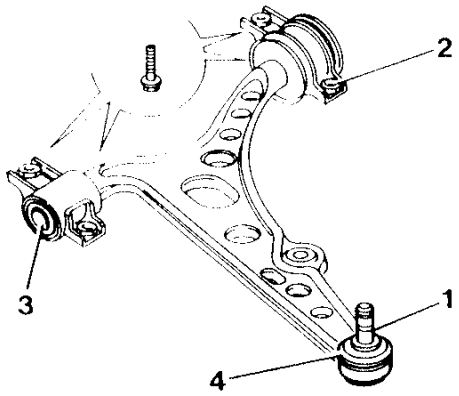
1. Loosen the screws securing the U bolts connecting the swinging arm to the front cross rail and remove the swinging arm.



Refit by reversing the procedure followed for removal, tightening the screws and nuts to the correct torque and using the specified grease, lubricate the flexible blocks of the U bolts connecting the swinging arm to the front cross rail.

CHECKS AND INSPECTIONS

1. Check the ball pivot (connecting the swinging arm to the wheel support) for damage and wear and replace if necessary.
2. Check the U bolts (connecting the swinging arm to the front cross rail) for damage and wear and replace if necessary.
3. Check the flexible bushings of the U bolts (connecting the swinging arm to the front cross rail) for damage and wear and replace if necessary.
4. Check the rubber bellows of the ball pivot (connecting the swinging arm to the wheel support) for damage and wear and replace if necessary.



FRONT CROSSMEMBER AND ANTIROLL BAR

REMOVAL AND REFITTING

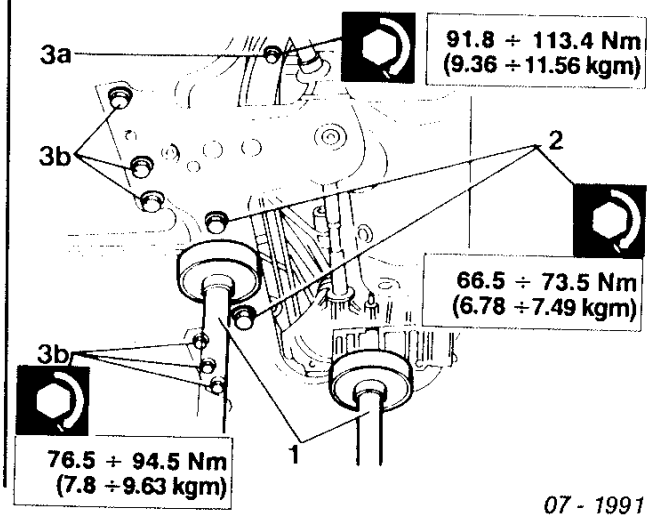
If it becomes necessary to replace the antiroll bar or the front cross rail, it will also be necessary to remove the entire cross rail as follows:

- Remove the forward section of the exhaust pipe (see: REPAIR MANUAL - ENGINES - GR. 04).
- Remove the bolts securing the swinging arm to the support (see: SWINGING ARM - Removal and refitting).
- Remove the central engine support (see: REPAIR MANUAL - ENGINES - GR. 01).

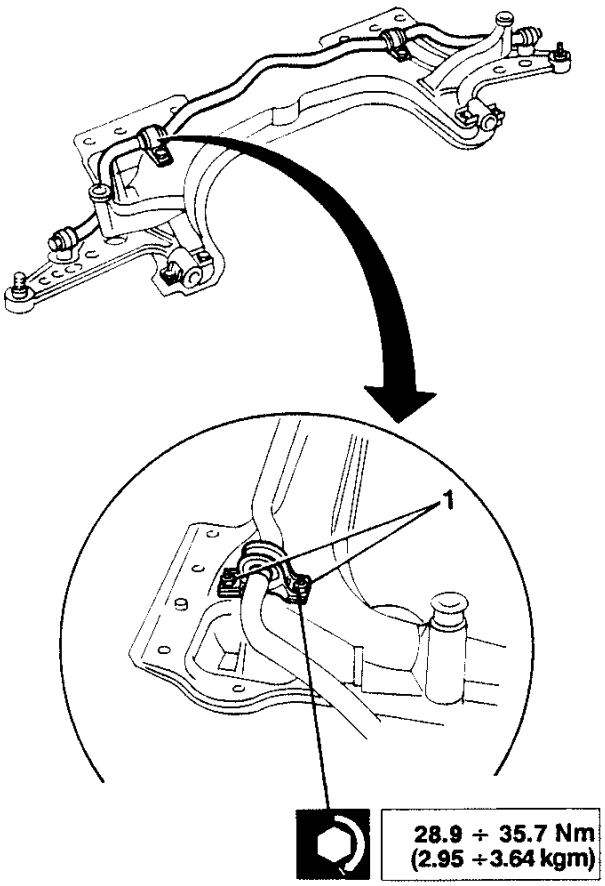
1. Using a hydraulic lift support the front cross rail.
2. Loosen the screws securing the steering box to the cross rail.

WARNING:
Operate with care when removing the front cross rail in order to avoid damaging the fuel delivery and return hoses located near the cross rail.

3. First loosen the two forward screws (3a) securing the cross rail to the body and then loosen the six rear screws (3b). Lower the lift and remove the front cross rail together with the antiroll bar.

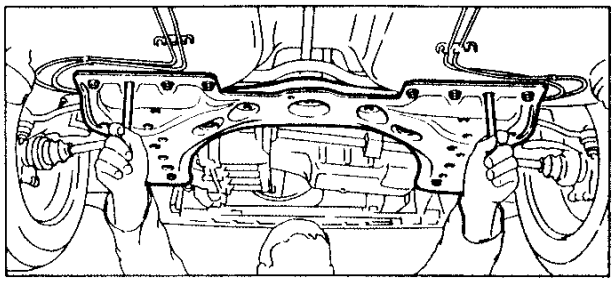


1. If necessary remove the antiroll bar by unscrewing the nuts securing the U bolts (supporting the bar) to the cross rail.
2. If necessary remove the swinging arms.



Refit by reversing the procedure followed for removal and tighten the screws and nuts to the correct torque. Observe the indications given at step six of the paragraph CHECKS AND INSPECTIONS and proceed as follows:

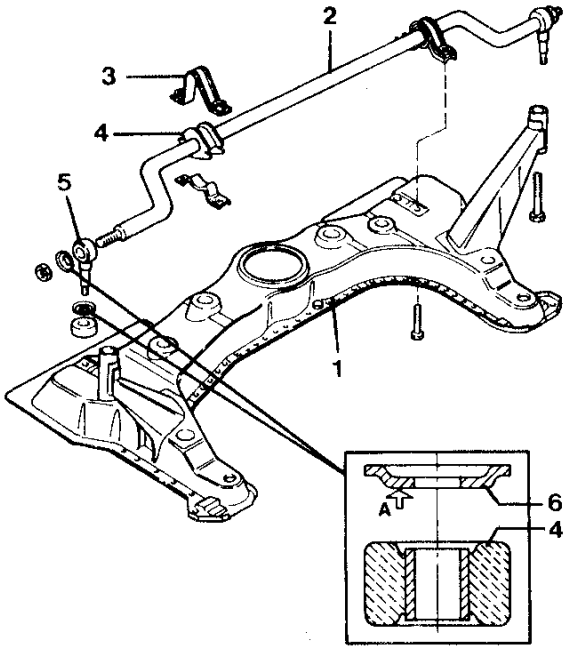
- When refitting the front cross rail it is necessary to secure it temporarily using two pins with a diameter of about 12 mm, to centre it using the holes on the body and then to secure definitively it by tightening the screws.



CHECKS AND INSPECTIONS

1. Visually check the cross rail ensuring that it shows no sign of cracking or deformation which may affect its operation. If any fault is discovered, replace the cross rail.
2. Visually check the bar for cracking and deformation and replace it if necessary.
3. Check the U bolts connecting the antiroll bar to the cross rail are not damaged, deformed or oxidized and replace them if necessary.
4. Check that the flexible blocks are not worn. Replace if necessary.
5. Check that the ball pins connecting the antiroll bar to the wheel support are not damaged, deformed or oxidized and replace them if necessary.

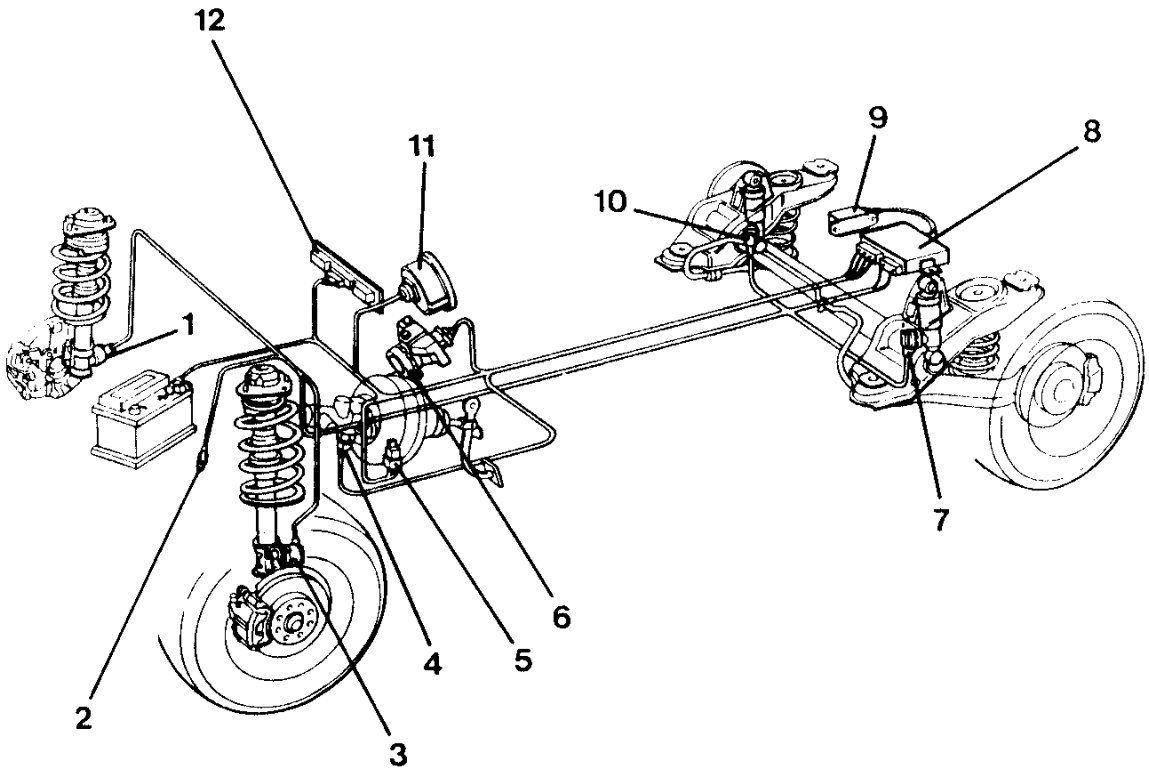
6. During refitting check that the washers are positioned with side A facing the flexible block as incorrect installation could negatively influence the life of the blocks.



CONTROLLED DAMPING SUSPENSION

DESCRIPTION

The electronically controlled front and rear suspension forms the most important part of the controlled damping suspension system (C.D.S) with which the top models in the 167 range are equipped. Therefore the theoretical description and diagnosis of the electronic components are dealt with in the ELECTRICAL AND ELECTRONIC DIAGNOSIS. The controlled damping suspension system is characterized by the possibility of adapting the setting of the shock absorbers to the widely differing driving conditions, guaranteeing the highest degree of comfort, road holding and safety in all situations.



1. Solenoid valve on front right-hand shock absorber
2. Speedometer sensor
3. Solenoid valve on front left-hand shock absorber
4. Braking system pressure sensor
5. Shock absorber solenoid valve control relay
6. Lever group with steering sensor incorporated
7. Solenoid valve on rear left-hand shock absorber
8. Electronic control unit
9. Vertical accelerometer
10. Solenoid on rear right-hand shock absorber
11. Speedometer sensor on instrument panel
12. Control panel

To be able to guarantee the greatest driving comfort, electronics has been employed to control the two parameters which have the greatest bearing on the efficiency of the suspension system:

- "flexibility" on which depend both the capacity of the suspension to absorb the irregularities of the ground and the vehicle trim in relation to its load. Flexibility is normally ensured by springs and in part by the flexible elements such as stabilizer bars, bushings, buffers etc.
- damping which reduces the elasticity of the springs forms the element on which any intervention must be made to gain "soft" or "hard" suspension. A high degree of suspension favours road holding while reduced damping ensures greater comfort.

In order to overcome the compromise between comfort and road holding, the vehicles in the 167 range, equipped with a controlled damping suspension system, can be characterized by the two different ways of intervening on the suspension system:

1. **"AUTO"condition**

From the two available conditions, the "AUTO" condition is the one which offers the greatest degree of functionality. It exploits both setting levels, switching from one to the other on the basis of the driving conditions. The "AUTO" condition, without detracting from the level of road holding, ensures a high degree of driving comfort. After the driver has pressed the relative button on the control panel, the system operates as follows:

- for speeds below 5 kph, the setting of the shock absorbers is kept to the greatest degree of rigidity in order to avoid an annoying rocking motion when driving off.
- for speeds between 5 kph and the town speed limits, the shock absorbers are set and maintained at the greatest level of comfort, in order to overcome the irregularities in the road surface which characterize urban driving.
- for speeds which are higher than the urban limits, the system is set to the greatest degree comfort but will automatically switch to the greater rigidity in the following situations:
  - sudden changes in direction,
  - tight mountain bends,
  - humps and irregularities which cause an excessive rocking of the vehicle body.

  When the conditions which caused the switch to the rigid setting have ended the system returns automatically to the soft setting.

  The system sensors (steering angle and rotation speed, vertical accelerometer, braking sensor, speedometer sensor) intervene according to the instantaneous speed of the vehicle in order to optimize driving safety.
- For high speeds, the system switches automatically and permanently to a particularly rigid setting of the shock absorbers which permits the maximum performance of the vehicle to be exploited under sports driving conditions with guaranteed safety.

2. **"SPORT" condition**

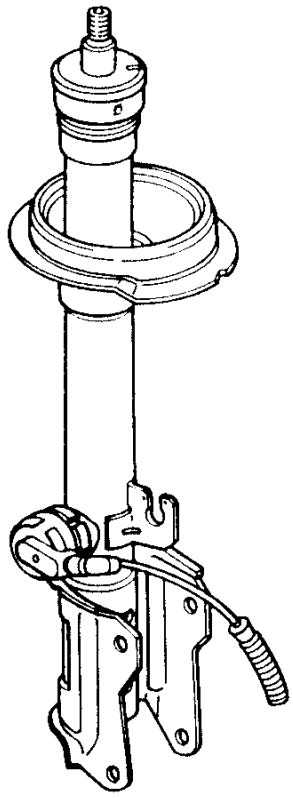
The "SPORT" condition maintains a rigid setting of the suspension system in order to confer to the vehicle a sports behavior.

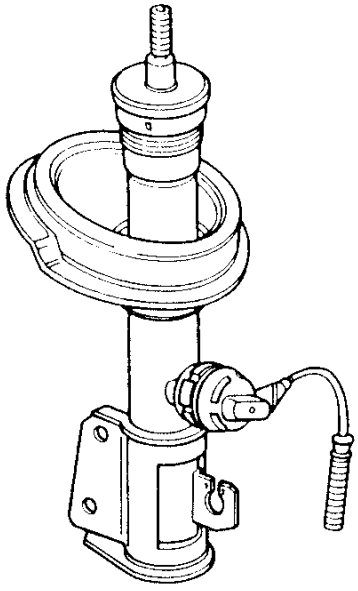
SYSTEM COMPONENTS

The controlled damping suspension system is composed of the following components listed below.

SPECIFIC SHOCK ABSORBERS

The four shock absorbers are oil dynamic, pressurized and are all equipped with an electromagnetically controlled regulation valve, fixed to the outer hose of the shock absorber. After an input by the control unit, each valve regulates the passage of the oil between the two chambers of the shock absorber, proportionally modifying the damping action. The reaction times of opening and closing of the valves are extremely short, around five milliseconds.

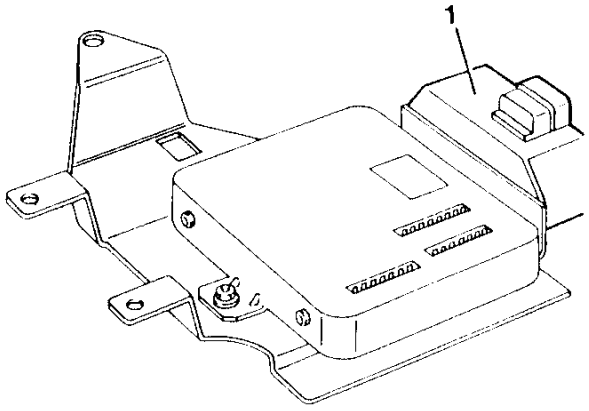




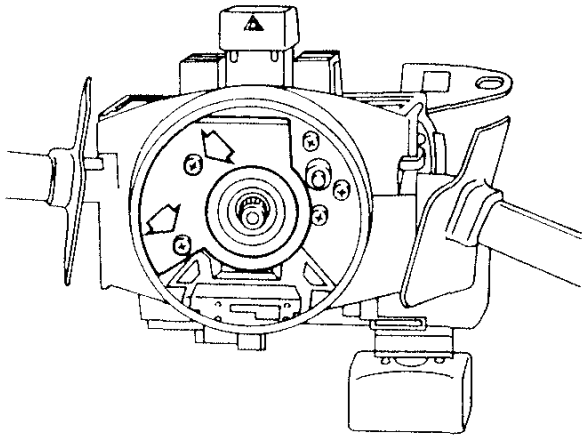
CONTROL SENSORS

The moment by moment adjustment of the shock absorbers is entrusted to the control unit which receives and processes the signals "read" from the sensors listed below.

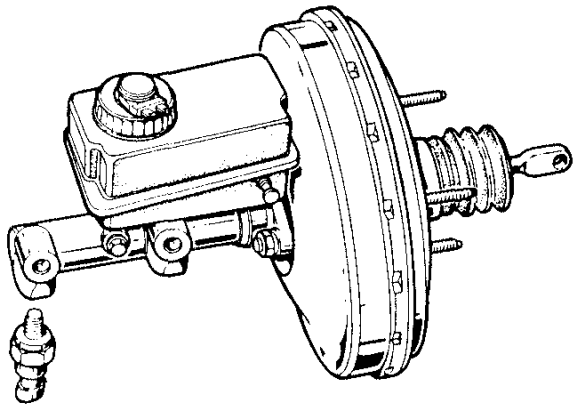
- Vertical acceleration sensor or accelerometer which, fixed to the control unit support and located under the cushion of the rear seat, detects the oscillations of the vehicle body.



- Steering column and steering wheel rotation speed sensor, integrated with the lever group and located under the steering wheel. This supplies the signals connected with the road conditions and style of driving used to tackle bends.



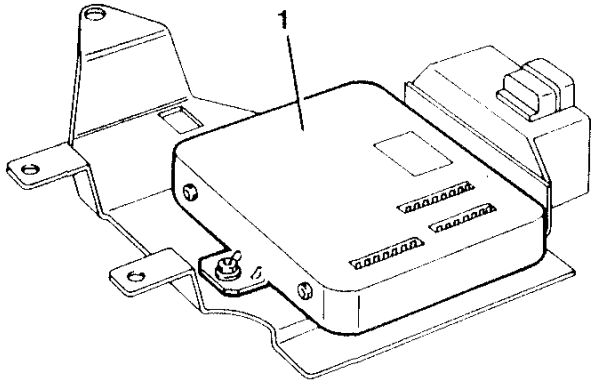
- Braking sensor located on the lower part of the brake pump. This detects particularly energetic braking conditions (pressures in the hydraulic brake circuit in excess of 10 bars) which may affect the trim of the vehicle and transforms them into an electrical signal.



- Speedometer sensor, located behind the instrument panel, constantly measures the speed of the vehicle.

ELECTRONIC CONTROL UNIT

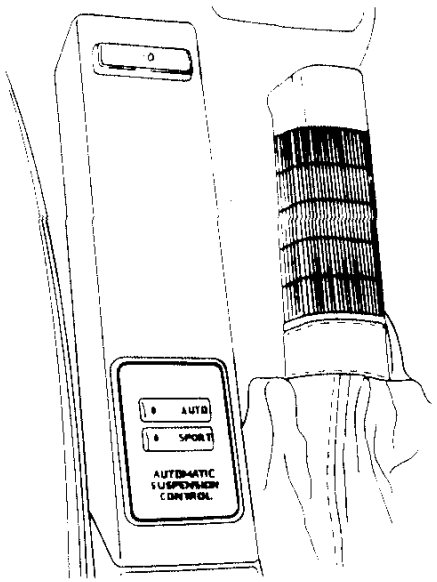
The control unit, located under the cushion of the rear seat, contains a microprocessor which receives the signals from the sensors listed above and processes them in accordance with a fixed logic. The resulting impulses are sent by the control unit to the solenoid valves located on the shock absorbers.



CONTROL PANEL

The control panel of the controlled damping suspension system, located under the heating-ventilation unit controls, is composed of two buttons/warning lamps which can be pressed by the driver in order to select the driving logic:

- automatic "AUTO": green warning light
- sport "SPORT": yellow/orange warning light

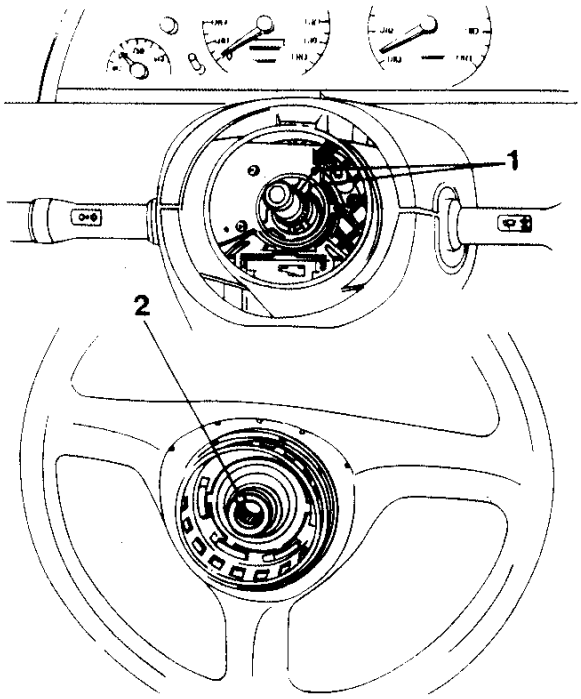


STEERING SENSOR

REMOVAL AND REFITTING

- Align the wheels.
- Remove the steering wheel (see: GR. 23).

1. Align the sensor with the reference mark indicated in the illustration.
2. Refit the steering wheel ensuring that the grooves on the hub are coupled with the sensor.



BRAKING SENSOR

REMOVAL AND REFITTING

- Remove and refit the braking sensor proceeding as described in the section dealing with the brake pump (see: GR. 22 - BRAKE PUMP - Removal and refitting).

Refit by reversing the procedure followed for removal tightening the nuts and screws to the correct torque.

CHECKS AND INSPECTIONS

- Visually check that the sensor is not physically damaged and that the elexctrical connections are intact. If necessary replace the sensor. For a operational check see: "ELECTRICAL AND ELECTRONIC DIAGNOSIS".

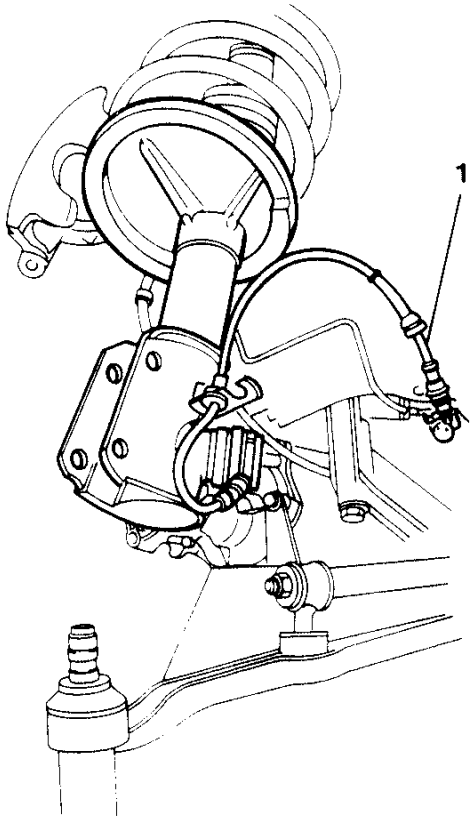
FRONT SHOCK ABSORBERS

REMOVAL AND REFITTING

NOTE: As no overhaulling is carried out in the service workshop, in the event of ananomaly the components must be removed and replaced with others of the same type (see: TECHNICAL CHARACTERISTICS AND SPECIFICATIONS).

1. Remove and refit the shock absorber as described for the traditional type of shock absorber (see: SHOCK ABSORBER AND HELICAL SPRING ASSEMBLY), and disconnect the solenoid valve-control unit electrical wiring connector.

Refit by reversing the procedure followed for removal and tighten the nuts and screws to the correct torque.



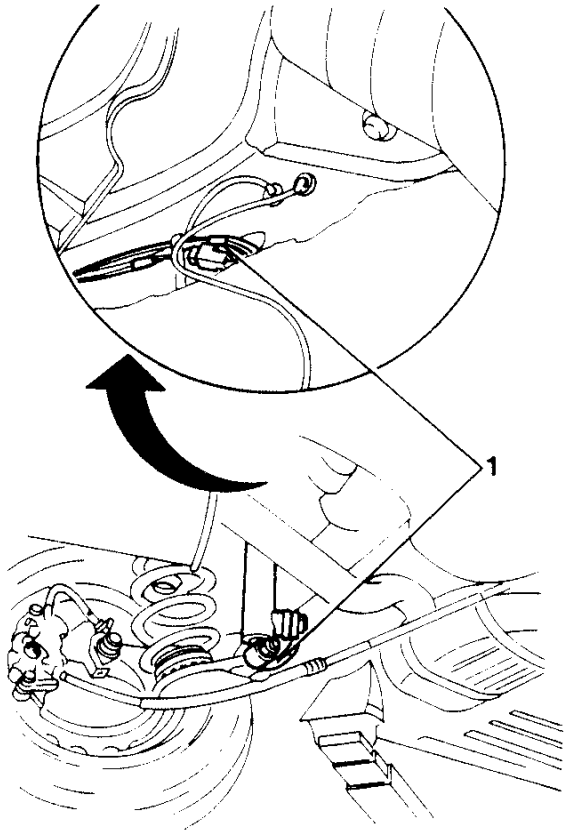
REAR SHOCK ABSORBERS

REMOVAL AND REFITTING

NOTE: **As no overhaulling is carried out in the service workshop, in the event of ananomaly thecomponents must be removed and replaced with another of the same type (see: TECHNICAL CHARACTERISTICS AND SPECIFICATIONS).**

1. Remove and refit the shock absorber as described for the traditional type of shock absorber (see: GR. 25 - SHOCK ABSORBER AND HELICAL SPRING ASSEMBLY), and disconnect the solenoid valve-control unit electrical wiring connector located under the rear seat (see: REPAIR MANUAL - TRIM - GR. 66 - REAR SEAT - Disassembly and reassembly).

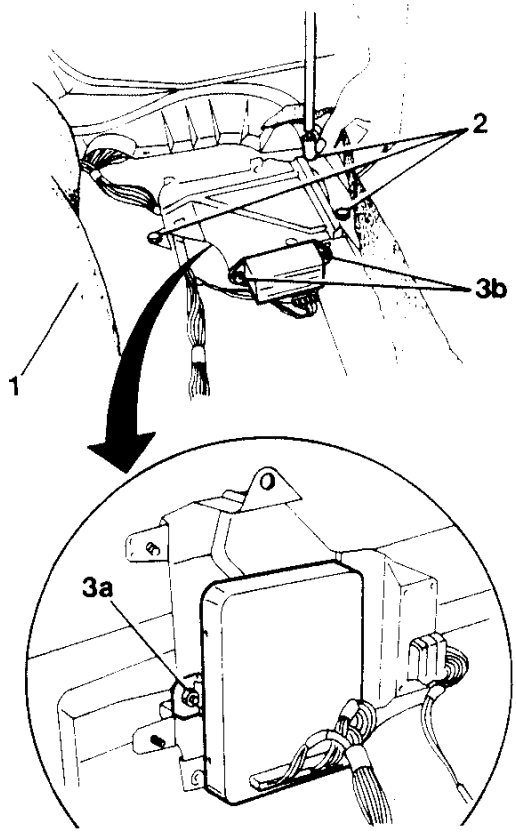
Refit by reversing the procedure followed for removal and tighten the nuts and screws to the correct torque.



ELECTRONIC CONTROL UNIT AND ACCELEROMETER

REMOVAL AND REFITTING

- Remove the rear seat (see: REPAIR MANUAL - GR. 66 - REAR SEATS - Disassembly and reassembly).
1. Lift the sound insulation.
2. Loosen the screws securing the control unit support bracket to the body.
3. Remove the control unit by loosening retaining screws (3a) and the screws securing the accelerometer (3b).



Refit by reversing the procedure followed for removal fully tightening the retaining nuts and screws.

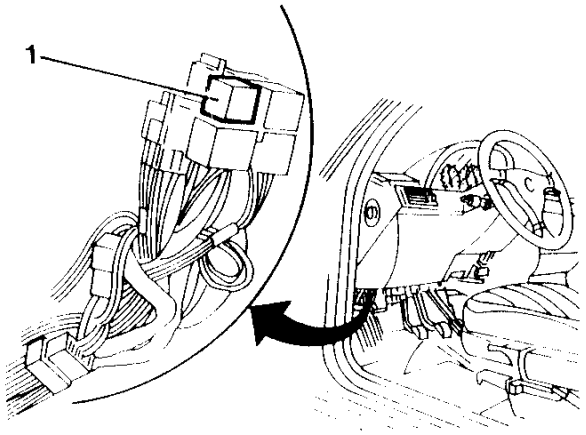
CHECKS AND INSPECTIONS

- Visually check that the control unit is not physically damaged and that the relative connectors and electrical wiring is intact. If necessary replace the damaged components. To check the functionality, refer to the section "ELECTRICAL AND ELECTRONIC DIAGNOSIS".

SHOCK ABSORBER CONTROL RELAY

REMOVAL AND REFITTING

1. To remove the relay located under the dashboard next to the bridging control unit, proceed as described for the other relays (see: REPAIR MANUAL - TRIM - GR. 40 - CONTROLLED DAMPING SUSPENSION SYSTEM CONTROL RELAY).



CHECKS AND INSPECTIONS

- Visually check the relay and the connecting pins for physical damage and if necessary replace the relay. To check the functionality refer to: "ELECTRICAL AND ELECTRONIC DIAGNOSIS".

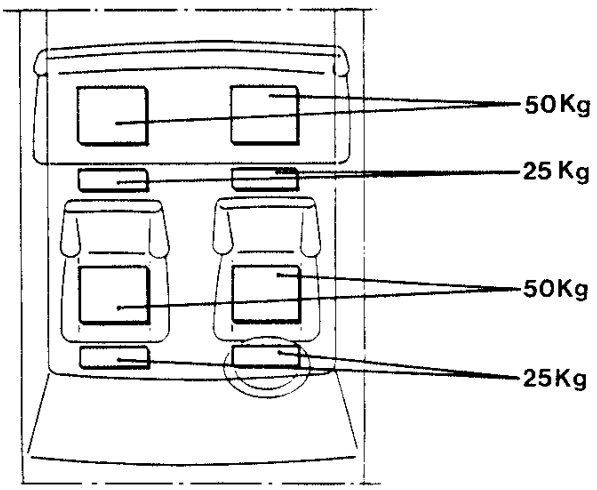
CHARACTERISTIC ANGLES

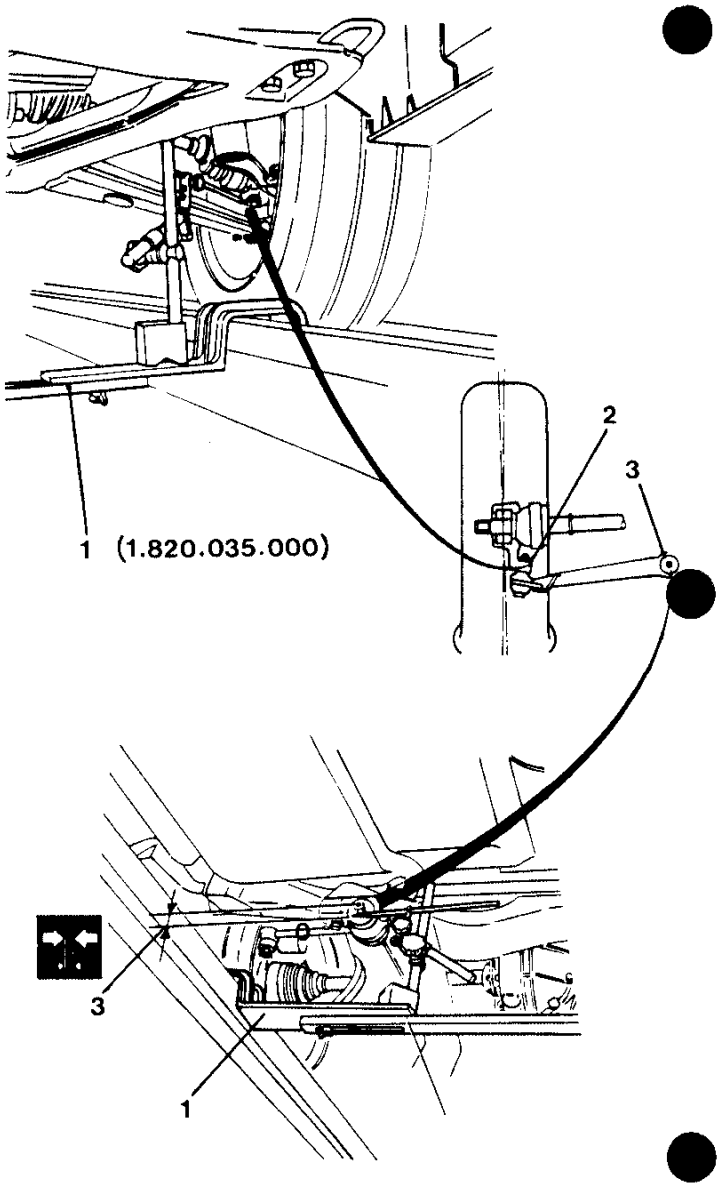
FRONT WHEEL ALIGNMENT

PRELIMINARY OPERATIONS

The wheel alignment should be checked after the following operations and checks have been carried out:

- inflate the tyres to the correct pressure (see GR. 28 - WHEELS AND TYRES).
- check that rim eccentricity and orthogonality do not exceed 3mm.
- check that there is no axial play on the wheel bearings.
- check that there there is no play between wheel support and ball pivot of the swinging arm.
- check that there is no play on the ball pivot of the steering tie-rod.
- place the vehicle on a lift.
- set the vehicle in static load condition (full tank + weight distributed as per figure).
- let the vehicle perform a few oscillations so that suspensions can be set.





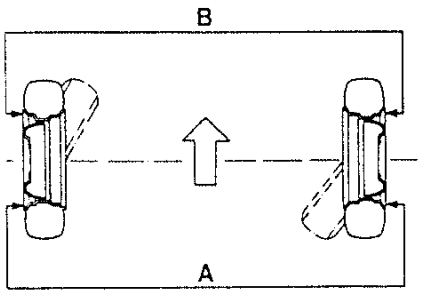
1. Place the reference ruler on vehicle resting plane.
2. Align the surface gauge tip to the upper plane where the swinging arm ball pivot attaches to wheel support.
3. Move the surface gauge and, by means of a ruler, measure the distance between the nut securing swinging arm to body and surface gauge tip.

– Check the measured distance against the values prescribed.

NOTE: **If the wheel alignment values are not within the values prescribed, replace both suspension springs.**

CHECKING TOE-IN AND TOE-OUT OF THE FRONT WHEELS

1. Using suitable apparatus, check that the toe-in/toe-out is as specified (see: TECHNICAL CHARACTERISTICS AND SPECIFICATIONS - Checking and adjustment).



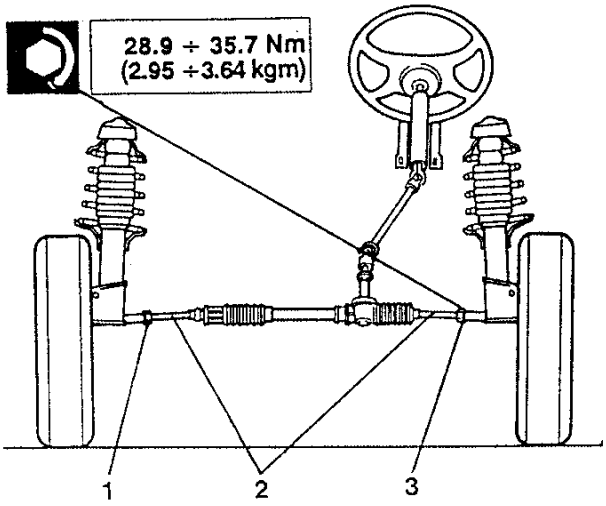
If the toe-in values are incorrect, proceed as follows:

WARNING:
Whenever the toe-in of the front wheels is checked the following instructions should be followed:
- **loosen the clamps of the bellows on the tie-rods.**
- **check that the bellows rotates freely and if necessary slide it off and lubricate with the specified grease.**
- **tighten the clamp after adjusting the toe-in and only after ensuring that it is positioned correctly.**

1. Loosen the side nuts on the lateral steering tie-rods.
2. Rotate the rods until the correct value is obtained without altering the position of the rungs of the steering wheel.

NOTE: **Adjustment must be carried by acting on the tie-rods of both wheels.**

3. Tighten the nuts securing the tie-rods to the correct torque.



CHECKING CAMBER AND CASTER ANGLES

– Check that the camber and caster angles (not adjustable) correspond to the specified values (see: SEE TECHNICAL CHARACTERISTICS AND SPECIFICATIONS - Checking and adjustment).

NOTE: **If the values measured prove to be incorrect, check the squaring of the body (see: REPAIR MANUAL - TRIM - GR. 49 - BODY SQUARING).**

TECHNICAL DATA AND SPECIFICATIONS

TECHNICAL DATA

COIL SPRINGS

SPECIFICATIONS		T.SPARK 1.8 (167A4A-167A4B-167A4C) T.SPARK 2.0 (167A2A)	T.SPARK 1.7 (167A4H-167A4G-167A4L) T.SPARK 1.8 (167A4E-167A4G-167A4M) T.SPARK 2.0 (167A2D)	
			Version with heater	Version with air conditioner
Inside diameter	(mm)	150	150	150
Outside diameter	(mm)	177.6	177.4	177.6
Wire diameter	(mm)	13.8	13.7	13.8
Number of turns		4.85	5.58	5.58
Direction		right-handed	right-handed	right-handed
Free length	(mm)	386.5	384	386.5

SPECIFICATIONS		2.5 V6 (167A1)	2.5 V6 (167A1C-167A1E)	
			Version with heater	Version with air conditioner
Inside diameter	(mm)	150	150	150
Outside diameter	(mm)	178	178	178.2
Wire diameter	(mm)	14	14	14.1
Number of turns		5.56	5.58	5.58
Direction		right-handed	right-handed	right-handed
Free length	(mm)	393	393	398

SHOCK ABSORBERS

Type		Telescopic hydraulic pressurized lamellar
Stroke	(mm)	167
Stem diameter	(mm)	22

ANTI-ROLL BAR

		'95 Versions	Other versions
Bar diameter	(mm)	22	23

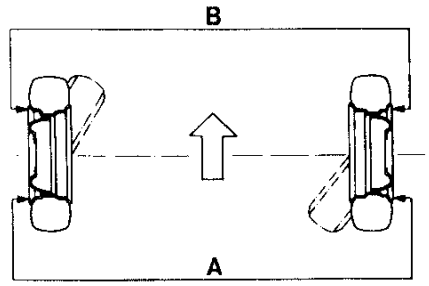
GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

APPLICATION	TYPE	DENOMINATION
Wishbone-bearing flexible supports	GREASE	GREASE MOLYKOTE 7544 G 54 TUTELA MR3
Steering track rods	GREASE	MOLYGUARD SYL113

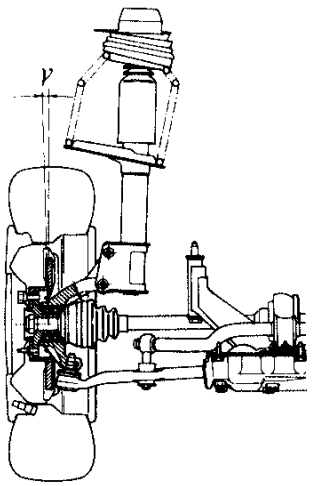
CHECKING AND ADJUSTMENT

SPRING CONTROL DATA

A-B	1.8 T.S./2.0 T.S./2.4 V6
	0 mm *

* Values measured on unladen vehicle with static load.

WHEEL CAMBER ANGLE

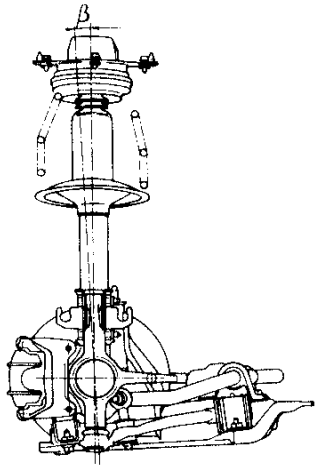


	1.8 T.S./2.0 T.S./2.4 V6
Front wheels	$\gamma = -20'$
Rear wheels	$0° \pm 20'$ $\gamma = -1°$

* (characteristics not adjustable)

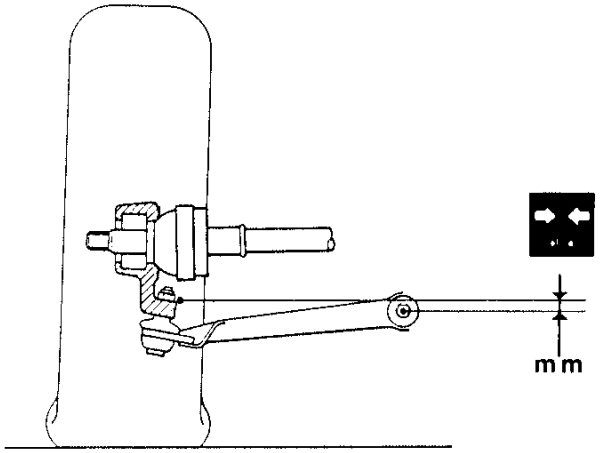
* Values measured with unladen vehicle with static load.

FRONT WHEEL CASTER ANGLE

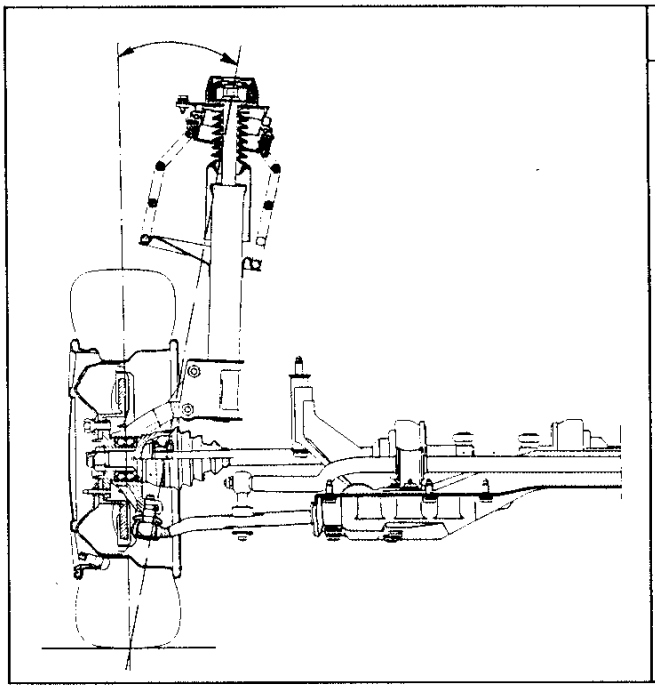
	1.8 T.S./2.0 T.S./2.4 V6
	3° 30'
	* (characteristics non adjustable)

* Values measured with unladen vehicle with static load.

ATTITUDE

A-B	1.8 T.S./2.0 T.S./2.4 V6		
	Front axle (mm) [in]	–33 [1 1/4]	
	Rear axle (mm) [in]	all (except 4x4)	–28 [1 1/8]
		4x4	–38 [1 1/2]

KING PIN ANGLE

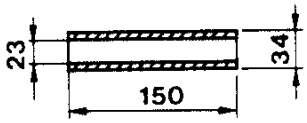


1.8 T.S./2.0 T.S./2.4 V6
11° 30'

TIGHTENING TORQUES

Description	N·m	kg·m
Hexagonal-head screw for front attachment of front crossmember to body	91.8 ÷ 113.4	9.36 ÷ 11.56
Hexagonal-head screw for rear attachment of front crossmember to body	76.5 ÷ 94.5	7.8 ÷ 9.63
Hexagonal-head screw for outer and rear front attachments securing swinging arm union connecting plate to the crossmember	65.55 ÷ 72.45	6.68 ÷ 7.38
Hexagonal-head screw for securing swinging arm union connecting plate inner front attachment to crossmember	65.55 ÷ 72.45	6.68 ÷ 7.38
Hexagon nut with flange for securing upper shock absorber attachment to anchor	65.55 ÷ 72.45	6.68 ÷ 7.38
Flanged hexagonal nut securing shock absorber upper part to anchor	95 ÷ 105	9.68 ÷ 10.76
Hexagonal-head screw for securing upper shock absorber anchor to body	34 ÷ 42	3.46 ÷ 4.28
Self-braking hexagon nut for securing shock absorber to support (only for 1.8 - 2.0 T.S.)	66.5 ÷ 73.5	6.78 ÷ 7.49
Self-locking hexagon nut for securing shock absorber to support (only for 2.4 - V6)	95 ÷ 105	9.68 ÷ 10.75
Self-locking hexagonal nut securing swinging arm spherical pin to support	66.5 ÷ 73.5	6.78 ÷ 7.49
Hexagonal-head screw for securing stabilizer bar support connecting plate to crossmember	28.9 ÷ 35.7	2.95 ÷ 3.64
Hexagon nut for securing stabilizing spacer bar end to rod	59.5 ÷ 73.5	6.06 ÷ 7.49
Hexagon nut for securing rod to front suspension arm	26.35 ÷ 32.5	2.69 ÷ 3.31
Hexagon nut for securing front wheel hub to stub axle	266 ÷ 294	27.12 ÷ 29.97
Rear/front wheel screw	73.1 ÷ 90.3	7.45 ÷ 9.20
Self-locking hexagonal nut securing steering wheel side tie-rod spherical pin to support	28.9 ÷ 35.7	2.95 ÷ 3.64
Hexagonal-head screw securing steering box to cross member	66.5 ÷ 73.5	6.78 ÷ 7.49
Hexagonal nut securing steering wheel side tie-rod	28.9 ÷ 35.7	2.95 ÷ 3.64

SPECIFIC TOOLS

TOOL NUMBER	DESCRIPTION
1.820.047.002	Plate for extracting front wheel hub bearing inner race (Use with 1.820.223.000 and 1.821.051.000)
1.820.089.000	Tool for compressing front suspension spring
1.820.223.000	Half rings for extracting inner race of front wheel hub bearing (Use with 1.820.047.002 and 1.821.051.000)
1.820.238.000	Plate for compressing front suspension spring (Use with1.820.089.000)
1.820.247.000	Tool for retaining front shock absorber strut
1.821.037.000	Puller for removing hub from wheel support (only for 2.4 V6)
1.821.045.000	Tool for: – extracting and inserting outer race of bearing from front wheel support (Use with 1.821.149.000 only for 1.8 - 2.0 T.S.) – inserting hub into front wheel support (only for 2.4 V6)
1.821.051.000	Tool for: – extracting wheel hub from support (only for 1.8/2.0 T.S.) – extracting inner race of front wheel hub bearing (Use with 1.820.047.002 and 1.820.223.000)
1.821.099.000	Puller for extracting bearing inner race from support
1.821.149.000	Support for extracting bearing outer race from front wheel support (Use with 1.821.045.000) (only for 1.8/2.0 T.S.)
1.821.209.000	Tool for inserting bearing and wheel hub into front wheel support
1.821.217.000	Tool for front wheel support bearing (only for 2.4 V6)
1.822.117.000	Wrench for loosening and tightening the nut securing front shock absorber
 (mm)	Support for extracting bearing outer race from front wheel support (only for 2.4 V6)

FAULT DIAGNOSIS AND CORRECTIVE INTERVENTION

PRELIMINARY CHECKS

CHECK TYRES

- Check that tyres are in good condition and that wear is equalized; check that the tyres are evenly worn across the tread.
- Check that the tyre pressure is correct (see: GR. 28).

ANOMALIES AND SYMPTOMS	CHECK	TEST REFERENCE
STEERING WHEEL KNOCKS, VIBRATIONS OR SHIMMY	– Knocking on the forecarriage when driving on rough roads (holes, hollows, asphalt rises, etc.) – Steering wheel shimmy while driving at high speed on straight roads	A
CONSTANT NOISE	– Constant noise from the forecarriage while driving on a straight and even road; the noise increases as the speed of the vehicle increases	B
ABNORMAL (OR UNEVEN) TYRE WEAR	See: GR. 28 - WHEELS & TYRES	C

CONTROLLED DAMPING SUSPENSION

ANOMALIES AND SYMPTOMS	CHECK	TEST REFERENCE
See: WIRING DIAGRAMS AND ELECTRICAL DIAGNOSIS		

DIAGNOSIS

ANOMALIES AND SYMPTOMS	CHECK	TEST REFERENCE
THE VEHICLE DRIFTS – When driving in a straight line the vehicle tends to drift to the left and/or right. **NOTA:** Drifting can be constant when vehicle pulls constantly to the left or to the right, in any running conditions. On the contrary, the vehicle may drift both to the right and left, if when accelerating it pulls to one side whereas, when decelerating, it pulls to the opposite side	CHECK TYRES FOR CORRECT INSTALLATION – Ensure that the D.O.T. marking on the tyre wall faces outwards (inflation valve side). VEHICLE TESTING PROCEDURE Perform testing on unloaded vehicle with fuel tank serviced to about half capacity, absence of wind on a straight and level road and at high speed. **CAUTION:** Obey the current road traffic laws. – Accelerate gradually but with continuity and then release the accelarator pedal – Maintain a constant speed and then paying due attention	**D** **NOTE:** If vehicle drifts only when braking, refer to "FAULT DIAGNOSIS AND CORRECTIVE ACTION" - GR. 22

STEERING WHEEL KNOCKS, VIBRATIONS OR SHIMMY	TEST A

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
A1 CHECK TYRES – Check tyres for correct pressure	OK ▶ OK ▶	Carry out step A2 Service tyres to correct pressure
A2 CHECK WHEELS – Check wheels for correct balancing – Also check for denting or distortion of the wheel rims	OK ▶ OK ▶	Carry out step A3 Balance wheels or replace rims
A3 CHECK POWER STEERING ATTACHMENTS – Check power steering to frame attachments for looseness	OK ▶ OK ▶	Carry out step A4 Tighten screws to prescribed torque
A4 CHECK SPHERICAL PINS – Check the spherical pins located at the ends of the side track rods for wear	OK ▶ OK ▶	Carry out step A5 Replace the spherical pins
A5 CHECK WISHBONES – Check wishbone rubber mounts for wear or damage	OK ▶ OK ▶	Carry out step A6 Replace rubber mounts

STEERING WHEEL KNOCKS, VIBRATIONS OR SHIMMY	TEST A

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
A6	CHECK STABILIZER		
– Check stabilizer rubber pads for wear or damage		OK ▶ OK ▶	Carry out step A7 Replace rubber pads
A7	CHECK SHOCK ABSORBERS		
– Check shock absorber attachments for correct torque – Also check efficiency of the shock absorbers		OK ▶ OK ▶	Carry out step A8 Tighten attachments or replace the affected shock absorber as required
A8	CHECK WHEEL HUB		
– Check bearing housing inside the wheel hub for distortion		OK ▶	Replace wheel hub and bearing if necessary

CONSTANT NOISE	TEST B

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
B1	CHECK TYRES		
– Check tyres for correct pressure		OK ▶ OK ▶	Carry out step B2 Service tyres to correct pressure
B2	CHECK WHEEL BEARINGS		
– Check wheel hub inner bearing for wear or damage		OK ▶	Replace wheel hub bearing

ABNORMAL (OR UNEVEN) TYRE WEAR	TEST C

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
C1	CHECK TYRE WEAR		
– See: GR. 28 - WHEELS AND TYRES			

KNOCKING	TEST D

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
D1 CHECK UNDERBODY – Visually check the underbody for traces of accidental shocks, dents or distortion of the suspension arms	(OK) ▶ (OK) ▶	Carry out step A2 Repair or replace damaged parts
D2 CHECK WHEELS – Check that wheels rotate correctly and that rotation is not rough due to malfunction of brake calipers and/or pads	(OK) ▶ (OK) ▶	Carry out step A3 Repair or replace worn or damaged parts (see: GR. 22)
D3 ATTITUDE CHECKS – Check front attitude – Check rear attitude	(OK) ▶ (OK) ▶	Eseguire step A4 Replace both suspension springs on the same axle
D4 CHECK RUBBER BUSHINGS AND PAD – Check spherical pins and rubber supports of front suspension control arm for damage – Check rubber bushings on rear suspension longitudinal and cross rods for damage	(OK) ▶ (OK) ▶	Carry out step A5 Replace defective part

THE VEHICLE DRIFTS (continued)	TEST G

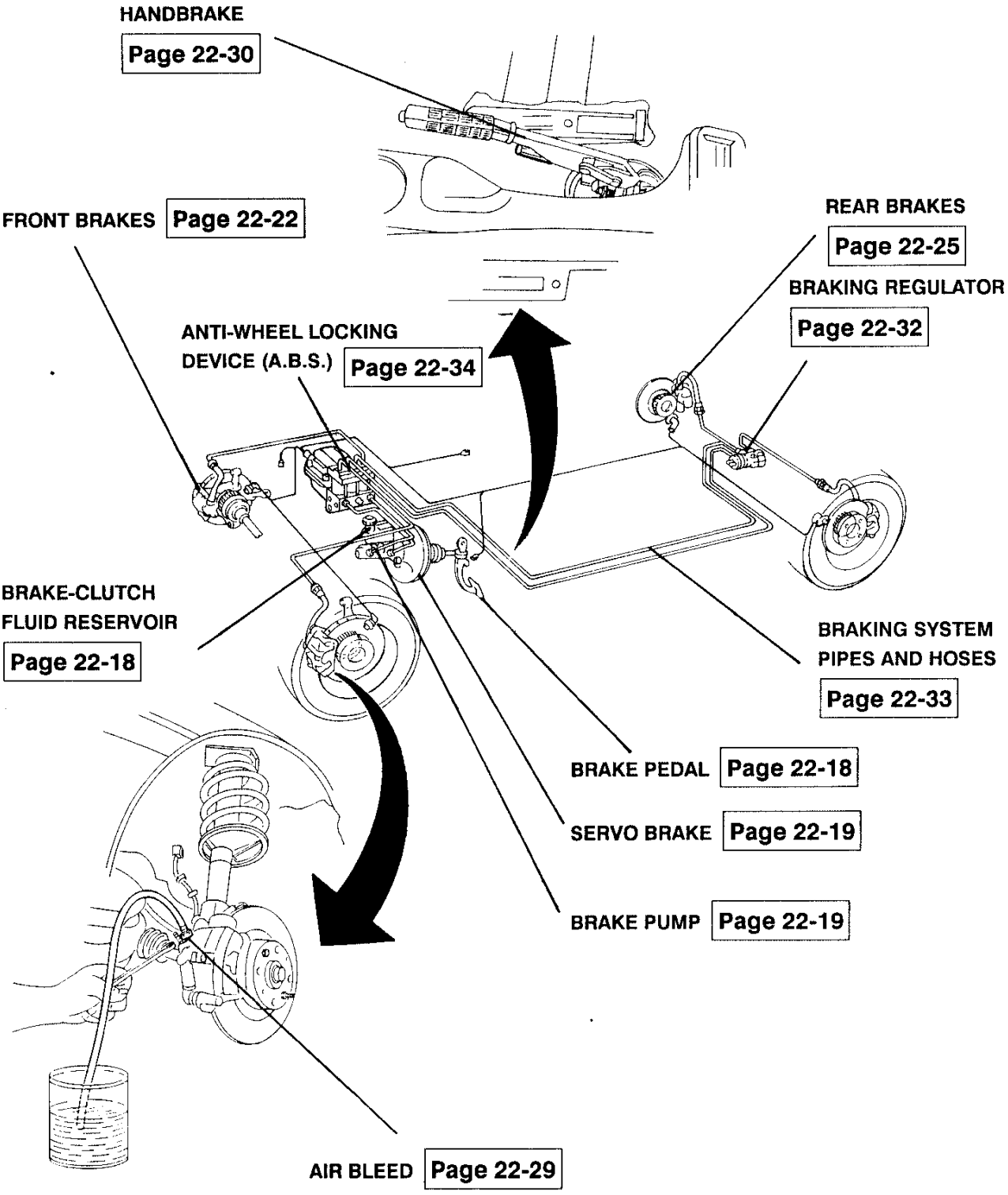
PASSO PROVA		RISULTATO	AZIONE CORRETTIVA
G5	CHECK WHEEL ALIGNMENT		
– Check alignment of front wheels – Check alignment of rear wheels		(OK) ▶ (OK) ▶	Carry out step A6 Adjust wheel alignment to correct value
G6	CHECK CHARACTERISTIC ANGLES OF WHEELS		
– Check camber and caster angles of front wheels – Check camber angle of rear wheels			

GROUP 22

FRONT AND REAR BRAKES

INDEX

ILLUSTRATED INDEX



FRONT AND REAR BRAKES

DESCRIPTION

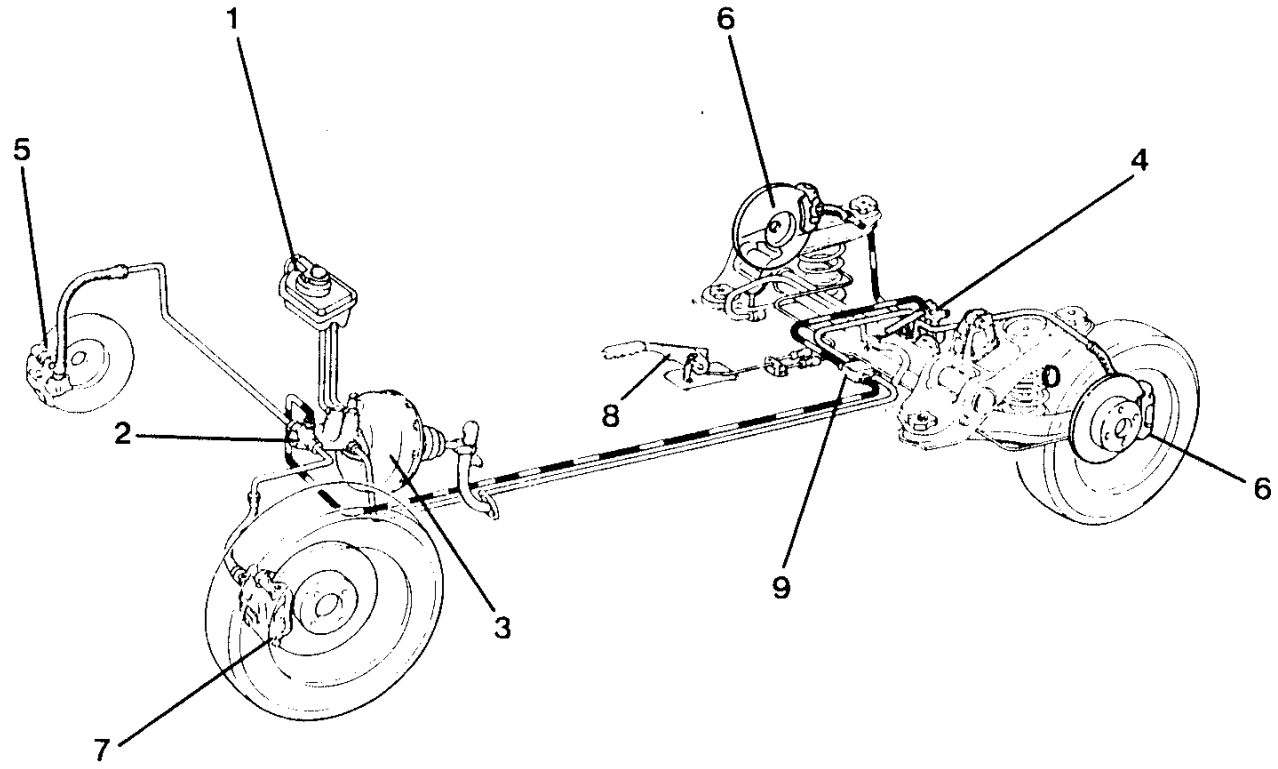
The braking system normally adopted for the vehicles in the 167 range is of the hydraulic control type with dual, diagonally connected circuit with servobrake, front and rear disc brakes with braking regulator. For the top models, and as an optional for other models, the system can be equipped with the BOSCH 2E ABS system (Anti Blocking System).

For four-wheel drive models a second generation 4 channel BOSCH 2S ABS system has been adopted.

HYDRAULICALLY CONTROLLED BRAKING SYSTEM

The system is of the traditional type and is basically composed of the following components:

1. Brake fluid reservoir (shared with the hydraulic clutch control system)
2. Two-stage pump
3. Vacuum servo brake
4. Braking regulator
5. Front disc brakes
6. Rear disc brakes
7. Floating type brake calipers
8. Mechanical type handbrake
9. Four-way distributor



This solution, of the traditional type is obtained by employing a series of devices aimed at:

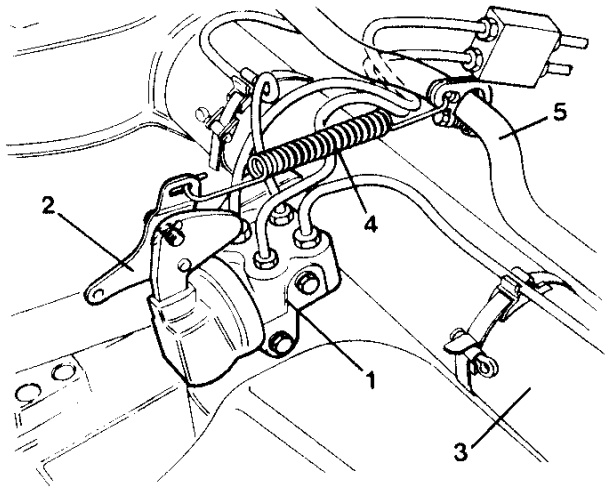
a. respecting the current laws regarding the problems of environmental pollution.
b. reducing the temperature of the brake fluid in order to avoid altering its chemical/physical properties.
c. guaranteeing for any event or malfunction, an adequate braking force suitable to the characteristics of the vehicle.

- The problem of environmental pollution has been faced by adopting brake pads of an ecological material (without asbestos) in the same way as for the friction gasket of the clutch.
- The GIRLING floating type brake calipers with guides protected by a hood, only act on one side of the disc and as a result, the heat produced during braking is greatly reduced. Consequently the temperature of the brake fluid is also greatly reduced in comparison to the traditional solutions.
- The use of the two-stage pump and of the two diagonal braking circuits permits 50 per cent of the braking force to be conserved in the event of a malfunction in the circuit or seizing of a piston.

BRAKING REGULATOR

The braking system is equipped with a braking regulation device (1) which, fixed to a bracket (2) integrated with the the rear axle (3) and connected by a spring (4) to the stabilizing bar (5), regulates the pressure of the brake fluid which powers the rear brakes on the basis of the loading on the rear axle of the vehicle.

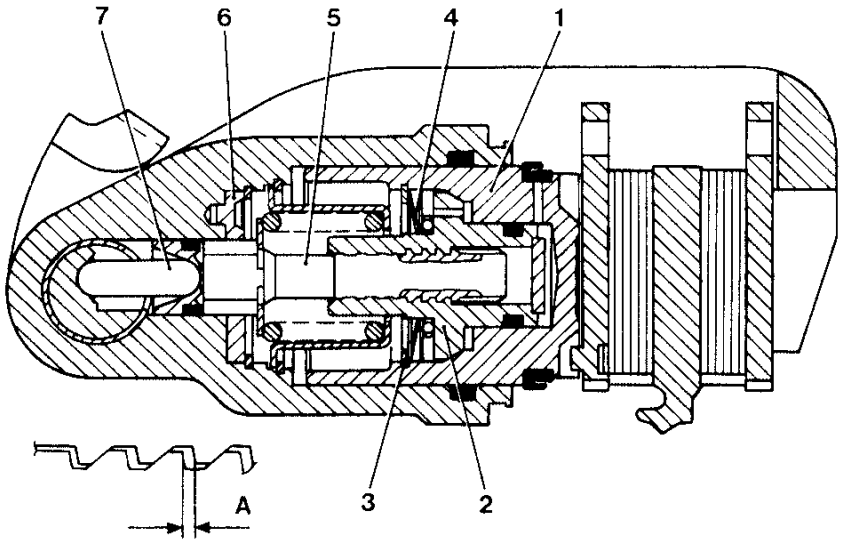
This moment-by-moment regulation, carried out by measuring the distance between the rear wheel axle and the body, prevents the rear wheels from locking when, braking being even, the loading on the rear axle is reduced therefore provoking a reduction in the adherence between wheels and ground.



AUTOMATIC REGULATION DEVICE

This device, contained in the rear brake caliper cylinder permits the automatic adjustment of the distance between the brake disc and the brake pad.
It is composed of a nut-screw (2) which can rotate on the shaft (5) only in the direction of advancement due to the action of a cup-spring (4).

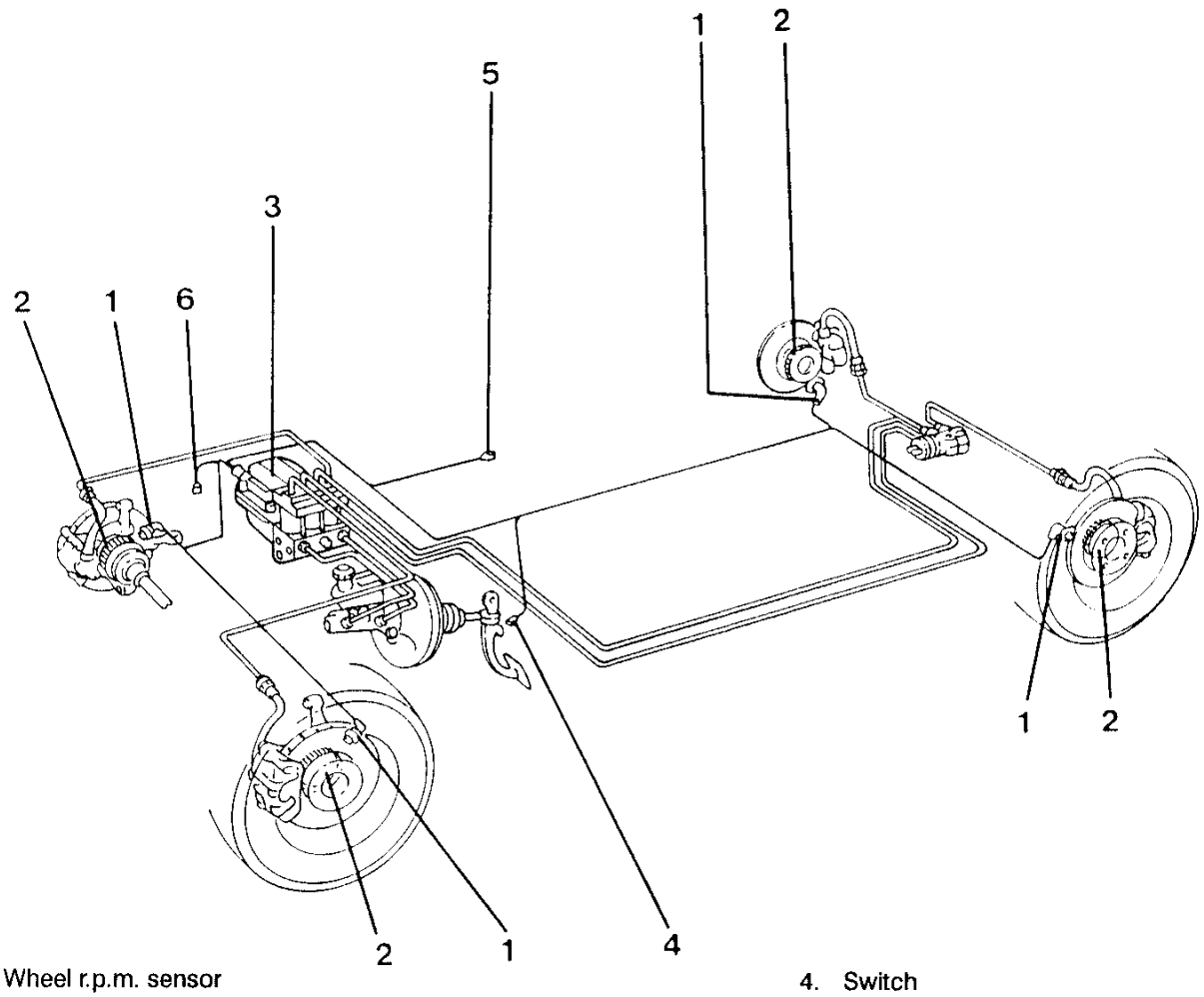
The shaft (5) cannot rotate as it is fixed to the body of the brake caliper by the safety lock (6).
There is a four-principle threaded coupling between the shaft and the nut-screw, with a preset clearance (A).
During braking the control cylinder (1), pushed by hydraulic pressure, moves towards the brake pad with the nut-screw (2) as it is fixed to the cylinder itself by the safety ring (3) and the cup-spring (4).



1. Piston
2. Nut-screw
3. Safety ring
4. Cup spring
5. Shaft
6. Safety lock
7. Rod

If the brake pads are excessively worn, the axial clearance (A), even if recovered, is not sufficient to absorb the stroke of the control piston (1) on its own.
The nut-screw (2) backs off momentarily from its point of contact with the piston (1) but the intervention of the cup-spring (4) rotates the nut-screw (2) on the shaft (5) until it establishes contact with the control piston (1).
When the handbrake is operated, the mechanical force is transmitted from the control lever to the rod (7) and then, by way of the shaft-nut-screw coupling, reaches the control piston (1) and then on to the brake pads without causing either the nut- screw or the piston to rotate. The piston has an obligatory engagement system which fixes it to the brake pad during braking.

HYDRAULIC BRAKING SYSTEM WITH BOSCH 2E A.B.S. (Anti Blocking System)



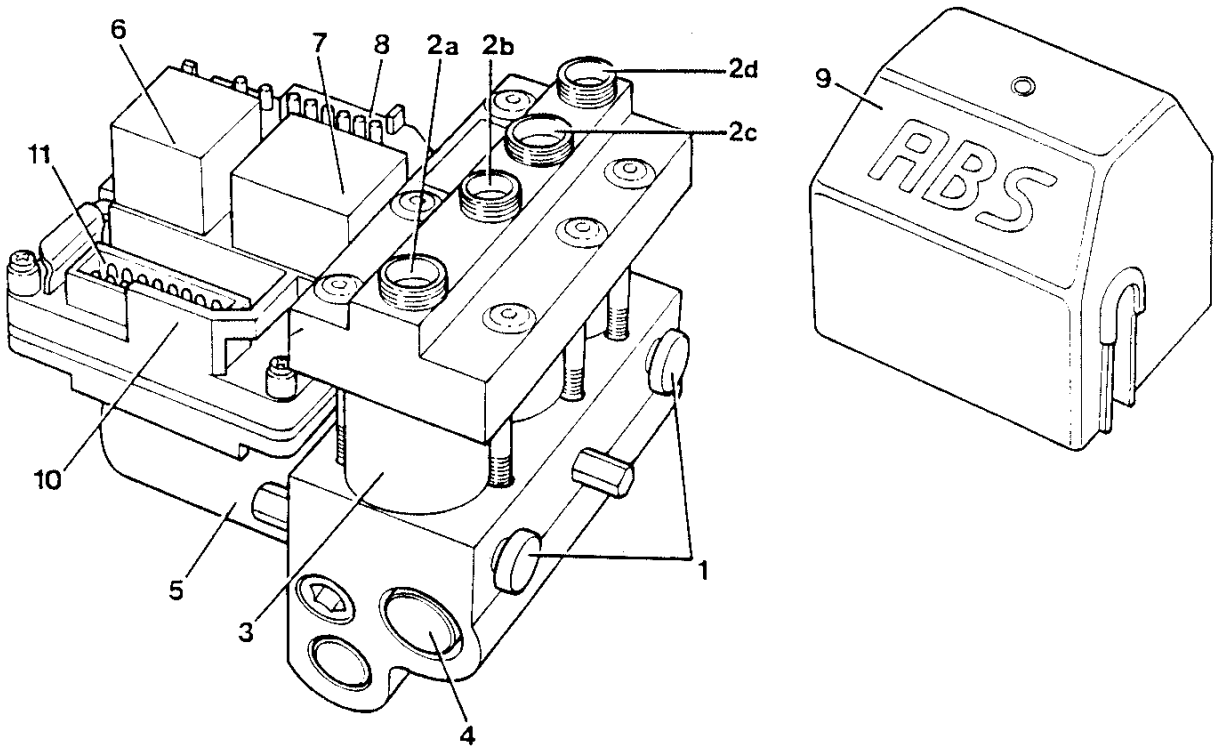
1. Wheel r.p.m. sensor
2. Phonic wheels
3. Hydraulic/electronic control unit
4. Switch
6. Warning lamp
7. Alfa Tester socket

The braking system, optional for the 1.8 and 2.0 T.S. models and standard on the 2.5 V6, is equipped with the BOSCH 2E ABS wheel lock prevention system.

The system, integrated with the traditional hydraulic braking system, can be broken down into the following main parts:

- A control unit (3) which, in relation to the other types of anti wheel-locking systems, combines an electronic control unit and a hydraulic control unit into one, thus governing the necessary electronics as well as the system itself;
- a socket (6) for diagnosis using the Alfa Tester;
- four sensors (1), integrated with the fixed part of the suspension and coupled with the same number of phonic wheels (2);
- a switch (4), located on the brake pedal for the activation of the stop lights;
- a warning lamp (5) on the instrument panel which signals any malfunctions in the ABS system.

ELECTROHYDRAULIC/ELECTRONIC CONTROL UNIT



1. Connections between hydraulic unit and brake pump
2. Connections between hydraulic unit and hoses:
   a) front left caliper (VL)
   b) rear right caliper (HR)
   c) rear left caliper (HL)
   d) front right caliper (VR)
3. Solenoid valves
4. Sequential hydraulic valve
5. Electric recovery pump
6. Electric pump control relay
7. Safety relay and solenoid valve power supply
8. Multiple connection
9. Cover
10. Electronic control unit
11. 15 pole connection for electronic control unit

The control unit, located in the engine compartment near the servo brake, is connected by the connections (1) to the brake pump and by connections (2) to the hoses of the braking system as shown in the previous diagram. With the exception of relays (6) and (7), the assembly cannot be overhauled and must be replaced if a defect arises. To replace the relays and the multipoint socket (8) it is necessary to remove the cover (9) after having unscrewed the retaining screws. From the sensors coupled with the phonic wheels, the control unit receives information relative to the rotational speed of the wheels and processes it generating control signals which make it possible to vary the pressure of the brake fluid in the cylinders of the calipers.

Depending on the behavior of the wheels, the electrohydraulic assembly varies the pressure of the brake fluid on the brake calipers following three distinct operational phases, described in detail in the paragraph "OPERATING PRINCIPLES OF THE ABS SYSTEM".

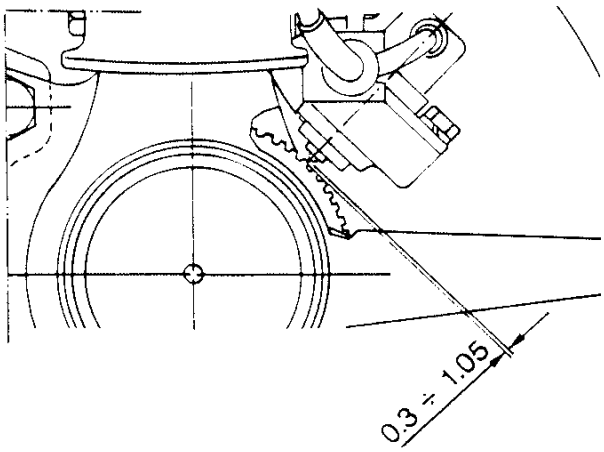
WHEEL R.P.M. SENSORS

The sensors designed to detect the number of revolutions of the wheels of the vehicle supply the control unit with the necessary continuity, all the information necessary for the control unit to correctly pilot the operation of the hydraulic system.

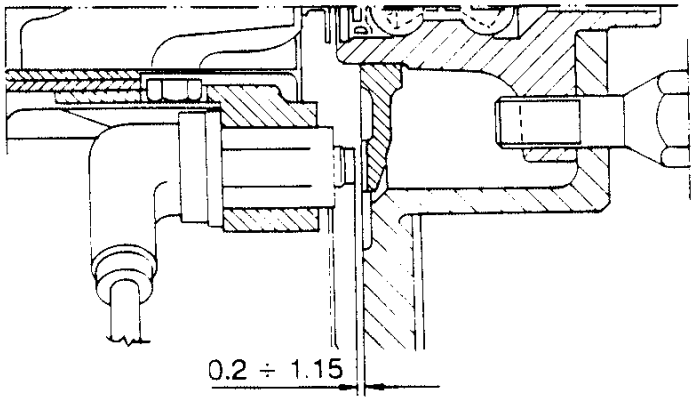
The sensors measure the speed of travel, acceleration, deceleration and wheel slip and are of the inductance type, installed in their seatings located on the front wheel supports and on the rear brake caliper support plate. As their position cannot be adjusted by shims if the air-gap differs from the specified values:

- Front wheel air-gap = 0.3 - 1.05 mm
- Rear wheel air-gap = 0.2 - 1.15 mm

it is necessary to replace them.



Front wheels

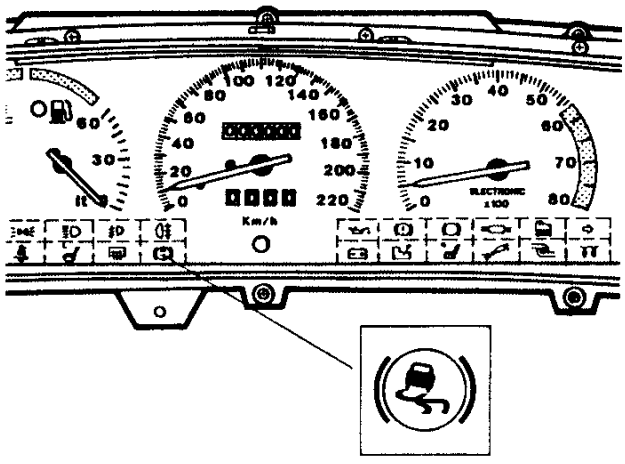


Rear wheels

The lines of magnetic flux are closed by the teeth of the phonic wheel coupled with the sensor and rotate with the wheel. The passage from full to empty, due to the presence or lack of the tooth, determines a variation 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.

MALFUNCTION WARNING LIGHT

When the ignition switch is turned to the MARCIA position, the malfunction warning light will come on and as soon as the engine is started it will go out again. The engine running signal reaches the control unit from the alternator. The ABS device cuts in at about 3 kph and at about 6 kph the device performs the test cycle which excludes the wheel revolution sensors.

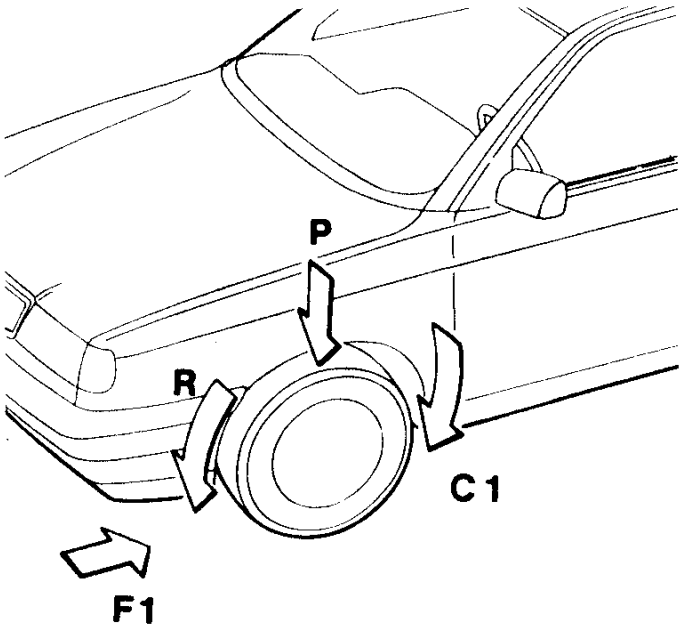


If the response from the components of the device is positive, the warning light will stay out. If the response is negative, the warning light will come on and the device will cut-out automatically leaving the traditional braking system to slow the vehicle. In this situation the warning light will flash on and off.

OPERATING PRINCIPLES OF THE ABS SYSTEM

Generally with motor cars, we are used to exerting pressure on the brake pedal in relation to the required degree of braking. Normally, when the road surface is dry and clean no problems arise as a great pressure can be exerted before the wheels begin to slip.

If the asphalt or the condition of the tyres is not perfect we instinctively leave a greater distance to allow for braking as the stopping distance is lengthened due to the physical problems of adherence and as it becomes more difficult to judge the correct braking pressure. If an unexpected situation arises (e.g. bumpy road, slippery roads, panic braking) it would be very difficult to control the vehicle and consequently the stopping distance would be lengthened and consequently the risk of losing control would be increased. This all arises because the wheel slips during braking and the tyre cannot therefore absorb the lateral forces acting on it. During braking the peripheral speed of the wheel tends to diminish faster than that of the vehicle. If the wheel locks and the vehicle is still moving the difference between these two speeds is at a maximum. This difference in speed is termed "**creeping**" or, to express the difference between the two speeds in percentage form, "**skid coefficient**".



Forces acting on the wheels during braking

C_1 braking torque
F_1 braking force
P - weight acting on tyre
R - rolling radius of tyre

Therefore:

- Creeping (skidding) 0% = if the wheel is free to roll
- Creeping (skidding) 100% = if the wheel is locked and the vehicle is still moving

During braking, friction increases greatly due to the low skid coefficient values and then decreases as the wheel slows down too much in relation to the speed of the vehicle. The greatest braking efficiency has therefore, skid coefficient values between 5% and 15% with a maximum value of 20% depending on the conditions of the tyres and road surface. The ABS system regulates braking pressure so that the skid coefficient is kept within optimal limits. This ensures that the maximum degree of friction is employed to brake the vehicle and that the vehicle stops in the shortest distance possible permitted by the road surface and the condition of the tyres.

DESCRIPTION OF THE ABS DEVICE

The electrohydraulic control unit, after receiving signals from the electronic control unit, varies the pressure of the brake fluid on the brake calipers in three phases:

1. Pressure increase phase
2. Pressure decrease phase
3. Constant pressure phase

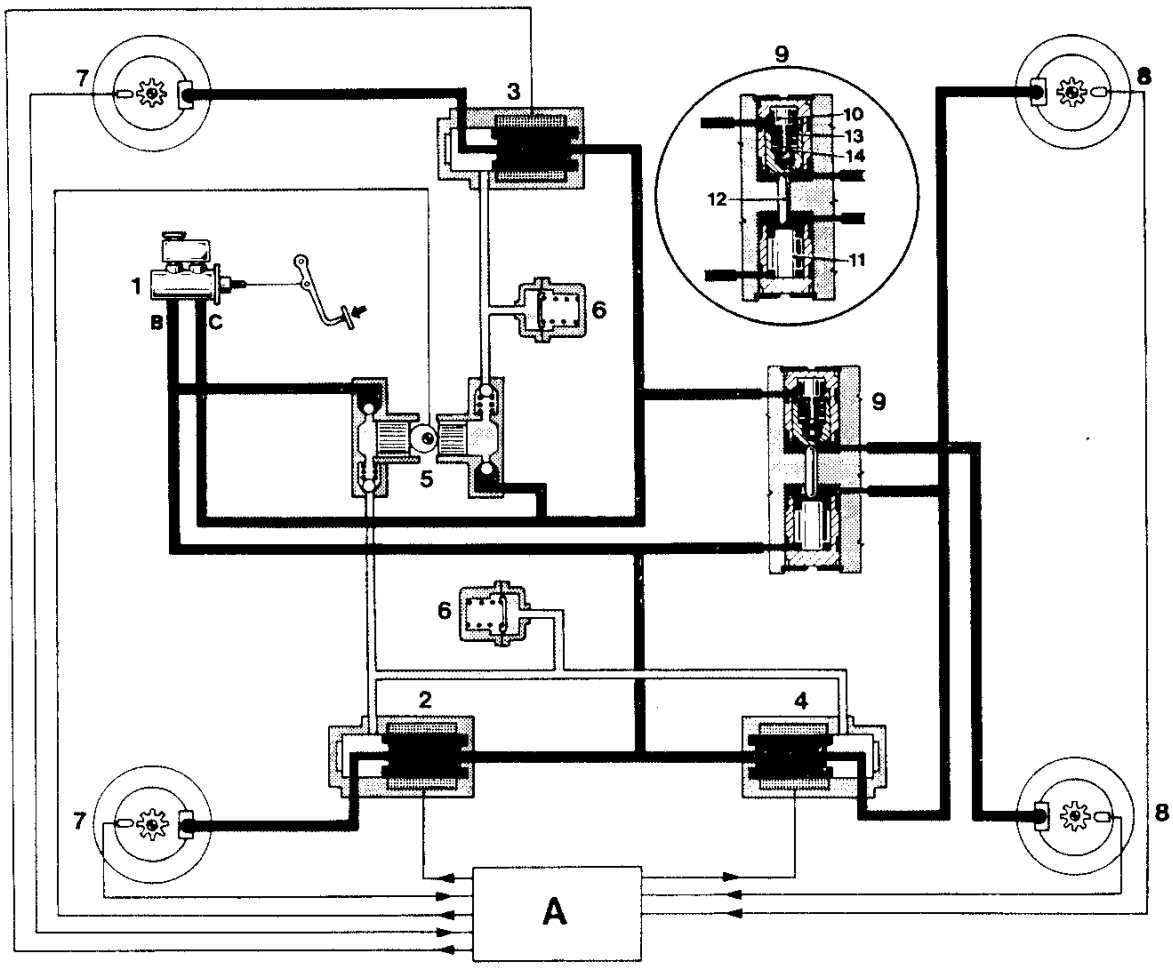
Pressure increase phase

In this phase the solenoid valves of the electrohydraulic control unit are not activated and the pressure in the calipers originates from the pressure exerted by the driver when pressing the brake pedal.

The pressure of the brake fluid in output from the brake pump hose (B) reaches the front left-hand and rear right-hand wheels through the solenoid valves (2) and (4) and from hose (C) to the front right-hand and rear left-hand wheels through solenoid valve (3) and sequential valve (9).

The pressure of the brake fluid crosses the sequential valve (9) as the piston (10), pushed by the spring (13) holds the valve (14) in the open position. The 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 decelerate in relation to the vehicle (skidding increases). If one rear wheel locks it is picked up by the relative sensor and the control unit reduces the pressure.



A. Electronic control unit
B. Brake pump output hose
C. Brake pump output 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. Sequential hydraulic valve
10. Piston
11. Piston
12. Rigid rod connecting the pistons
13. Spring
14. Valve

Pressure decrease phase

The electronic control unit measures the locking tendency of the wheel and the ABS device intervenes.

The solenoid valve (4) is activated by a 5 Amp (approx.) current and the connection between the brake pump and the rear right-hand brake caliper is interrupted 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 rear right-hand brake caliper and in the piston chamber (11) connected to it, decreases.

The subtracted brake fluid is once again put into circulation in the main circuit through the recovery pump (5).

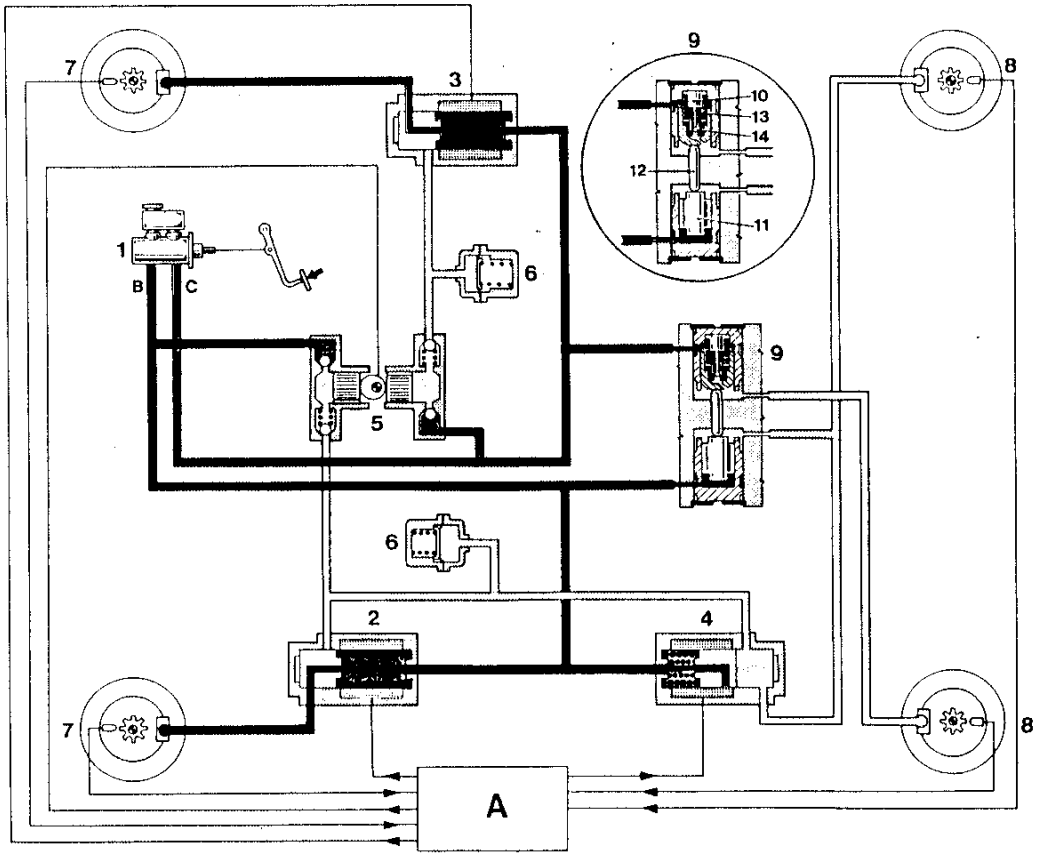
This is the origin of the hydraulic pulsations which can be perceived by the driver through the brake pedal.

The accumulator (6), stores the part of the brake fluid subtracted from the brake calipers and at the same time acts as a dashpot chamber for the pressure peaks inherent in the recovery phase.

The inequality between the the forces acting on the piston (11) causes it and the rod (12) to move. The rod, moved by piston (10) moves the piston (11) causing valve (14) to close.

For this reason a progressive reduction in pressure is obtained in the rear left-hand brake caliper provoked by the increase in volume in the piston chamber (10).

The equilibrium of the forces acting on pistons (10) and (11) will be reached when the braking pressure in the rear brake calipers are equal in value.



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10. Piston
11. Piston
12. Rigid rod connecting pistons
13. Spring
14. Valve

Continuous pressure phase

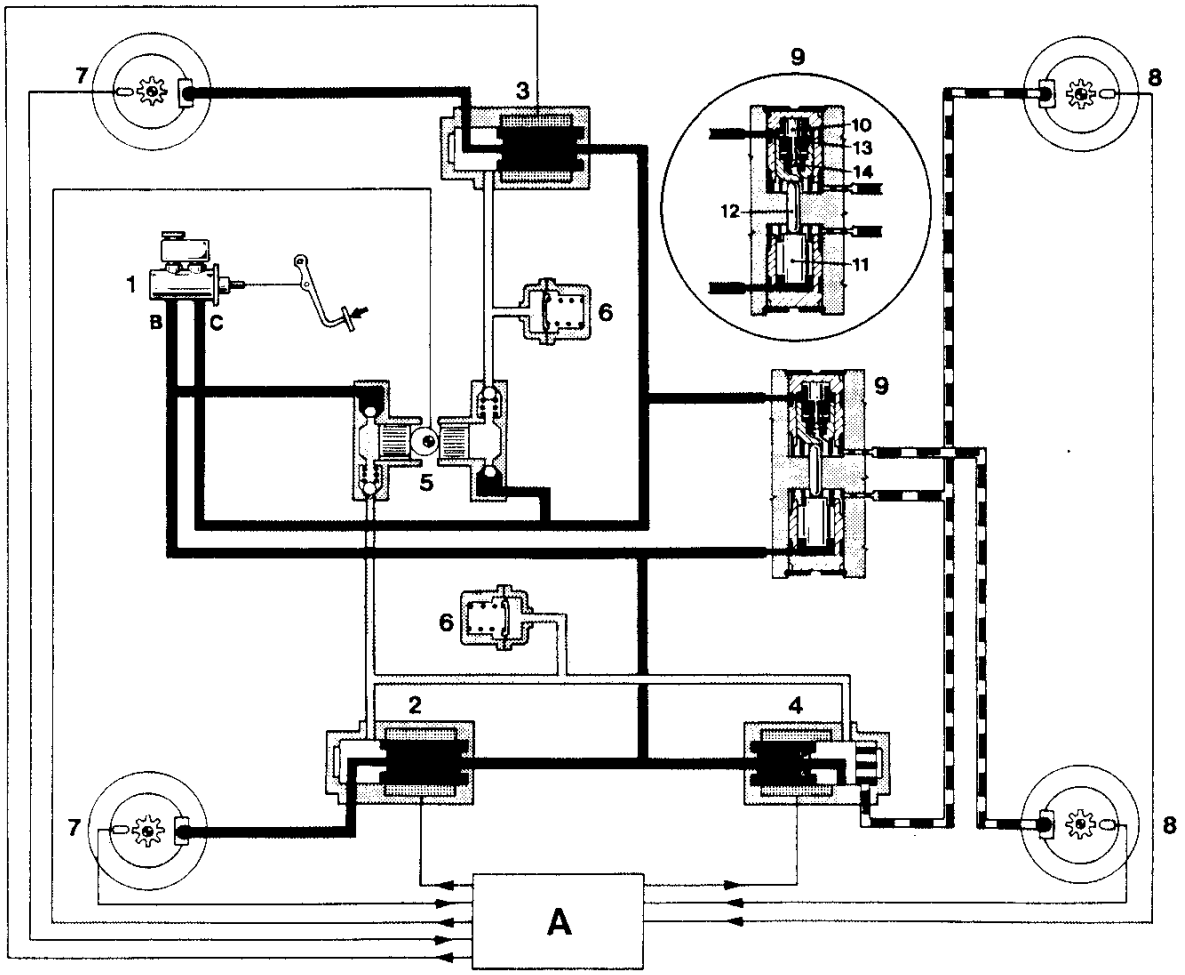
In this phase the there is an increase in both the speed and acceleration of the wheels.

The solenoid valve (4) is activated by a current of about 2 Amps. The connection between the brake pump and the rear brake calipers is still interrupted (hold position). The pressure on the rear brake calipers increases slightly as a result of the movement of the solenoid valve, and is then kept at a constant value.

The braking force continues even if the speed of the wheels nears that of the vehicle.

Once the permitted threshold value has been reached it is then necessary to increase the braking force again.

This cycle is repeated down to a speed of approxmately 6 kph when the ABS system cuts itself off to permit the vehicle to come to a halt.



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9. Sequential hydraulic valve
10. Piston
11. Piston
12. Rigid rod connecting the pistons
13. Spring
14. Valve

BRAKING REGULATOR

This is fixed to the half-shell of the rear axle and differs from the traditional type in its system of operation.

Operation

The load acting on the arms of the suspension is measured by the spring (2) which transforms the variations in force applied on the regulator.

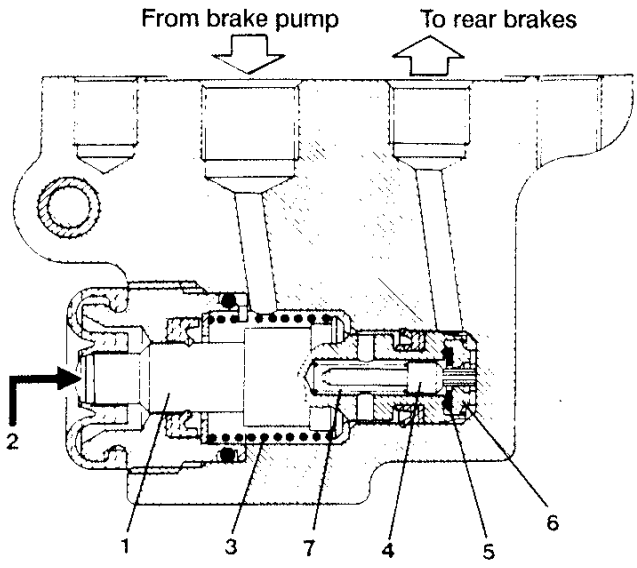
During braking, the oil originating from the brake pump enters the regulator, crosses it and moves on to the rear brakes with a pressure which, acting on the grooved plate (6), causes a thrust in the opposite direction to that acting on the operating piston (1).

The operating piston (1) is held in the stop limit position by the combined action of springs (2) and (3), one of which is external and one internal.

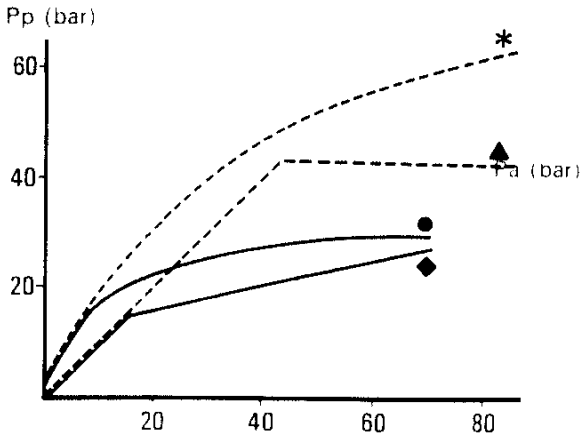
When the thrust acting on the grooved plate (6) exceeds that of the opposing force, the operating piston (1) moves towards the left thus interrupting the connection between the brake pump and the rear calipers, causing a jump in pressure at a preset ratio of 0.30.

During operation of the ABS device, when the braking action decreases and the pressure in the rear part of the regulator, acting through the grooving on the inner piston (4) overcomes the reaction of the spring (7), the piston (4) is moved to the left in order to equalize the pressure inside the regulator and keep the pressure peaks constant at the preset ratio of 0.30.

The braking regulator which is functionally integrated with the two sections of the braking circuit (see: BRAKING SYSTEM - DESCRIPTION), continues to operate even if the pressure on one of the two sections is decreased due to breakage of a hose or connection etc.)



1. Operating piston
2. Force exerted by the outer spring on the operating piston
3. Internal spring
4. Internal piston
5. Seal ring
6. Grooved plate
7. Spring for inner piston (4)



Curve characteristics of the pressure separation between front and rear brakes actuated by the braking regulator

Pa Braking pressure exerted on the front axle

Pp Braking pressure exerted on the rear axle

* Ideal curve with fully loaded vehicle

Real curve with fully loaded vehicle

Ideal curve with driver only

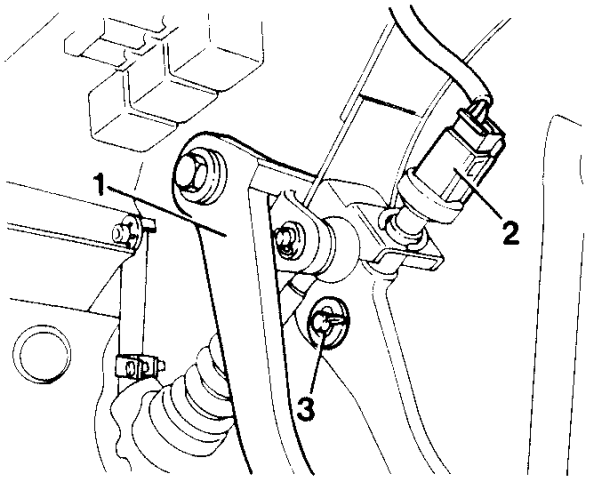
Real curve with driver only

BRAKE PEDAL

REMOVAL AND REFITTING

1. Remove the clutch pedal (see: GR. 12 - CLUTCH - REMOVAL AND REFITTING OF CLUTCH PEDAL).
2. Disconnect the wiring from the stoplight switch.
3. Withdraw the pin connecting the brake pedal to the brake pump control fork and remove the pedal.

Refit by reversing the procedure followed for removal and referring to GR. 12 - REMOVAL AND REFITTING CLUTCH PEDAL.



CLUTCH-BRAKE FLUID RESERVOIR

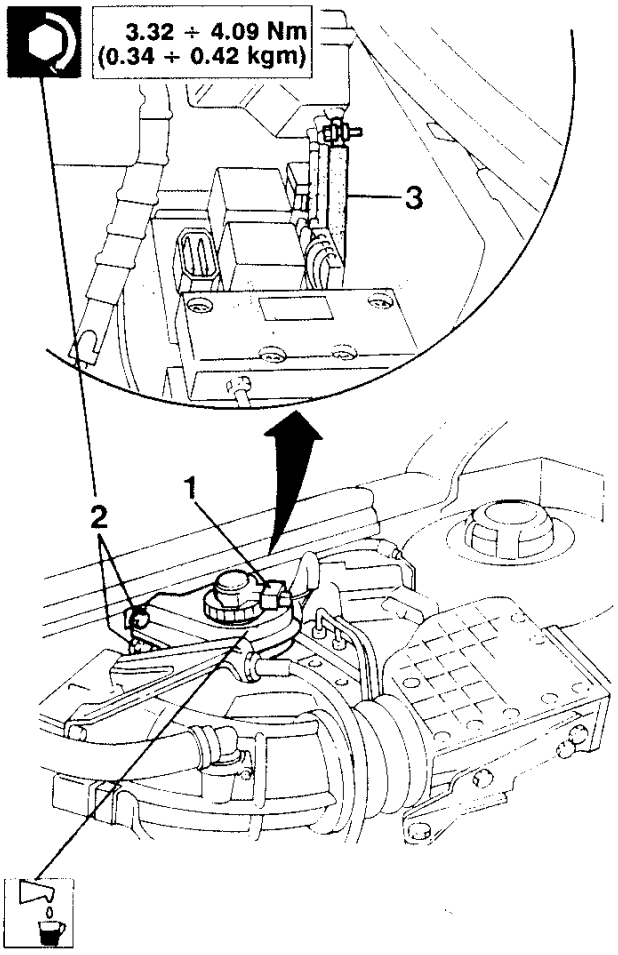
REMOVAL AND REFITTING

- Empty the clutch-brake fluid reservoir using a syringe.

1. Disconnect the connector of the low fluid level indicator.
2. Loosen the two screws securing the reservoir.
3. Disconnect the two brake pump delivery hoses and remove the reservoir.

Refit by reversing the procedure followed for removal and:

- tighten the screws securing the tank to the correct torque;
- bleed the air from the braking system (see: AIR BLEED);
- after bleeding restore the brake-clutch fluid to the correct level in the reservoir.



BRAKE PUMP

REMOVAL AND REFITTING

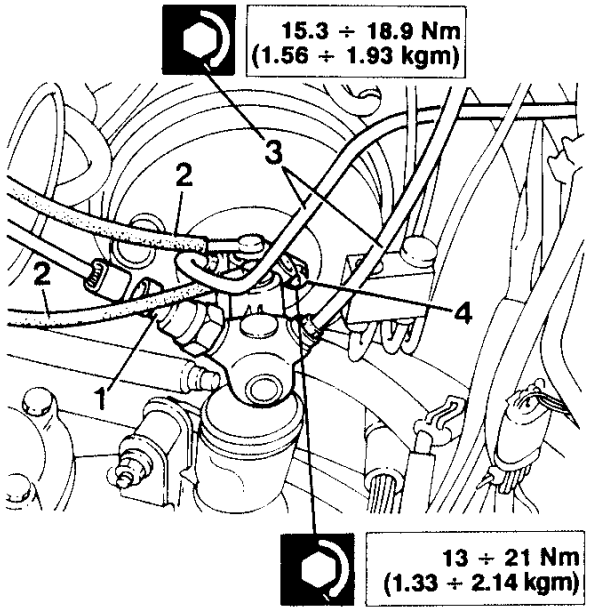
- Remove the battery and the battery support (see: REPAIR MANUAL - ENGINES - GR. 05).
- Empty the brake fluid reservoir with a syringe.

NOTE: **For models equipped with an air conditioning system, cut the band holding the hoses and move the hoses in order to facilitate removal of the brake pump.**

1. Only for models equipped with a controlled damping suspension system, disconnect the sensor connector located on the brake pump.
2. Disconnect the brake pump delivery hoses.
3. Disconnect the delivery pipe connection from the brake pump.
4. Unscrew the nuts and remove the brake pump.

Refit by reversing the procedure followed for removal and:

- tighten the pipes and the nuts securing the pump to the correct torque;
- bleed the air from the braking system (See: AIR BLEED);
- after bleeding restore the brake-clutch fluid to the correct level in the reservoir.



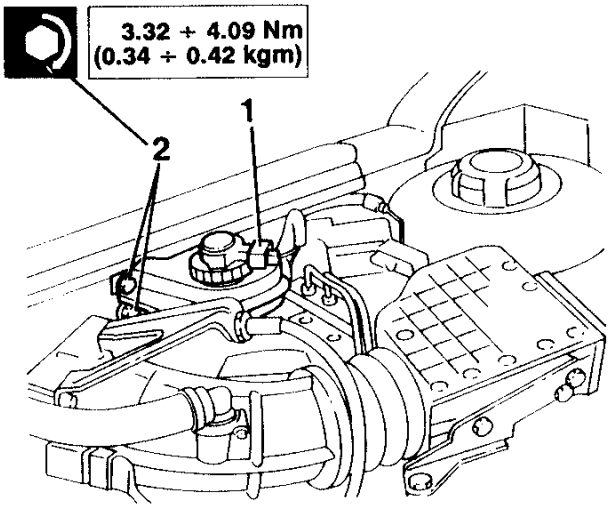
SERVO BRAKE

REMOVAL AND REFITTING

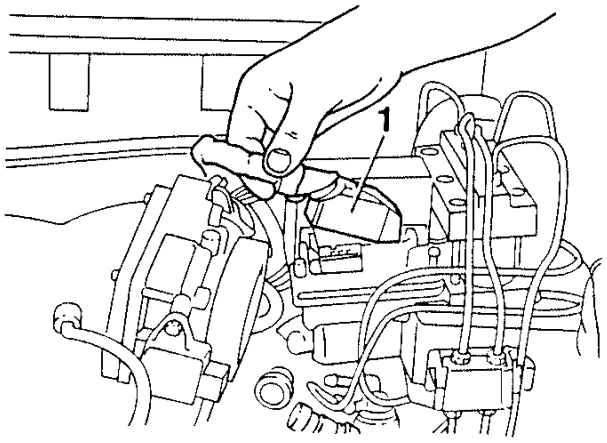
Working in the engine compartment, proceed as follows.

- Empty the brake fluid reservoir using a syringe.
- Remove the battery and the battery support (see: REPAIR MANUAL - ENGINES - GR. 05).
- Remove the air-flow meter (See: REPAIR MANUAL - ENGINES - GR. 04).

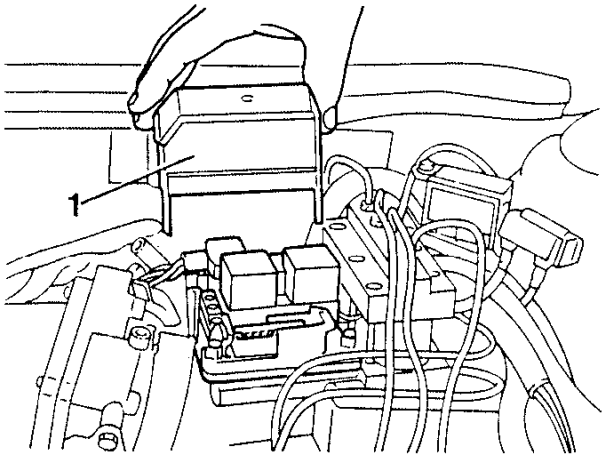
1. Disconnect the connector from the brake and clutch fluid level indicator device.
2. Loosen the two screws securing the brake and clutch fluid reservoir and move the reservoir.



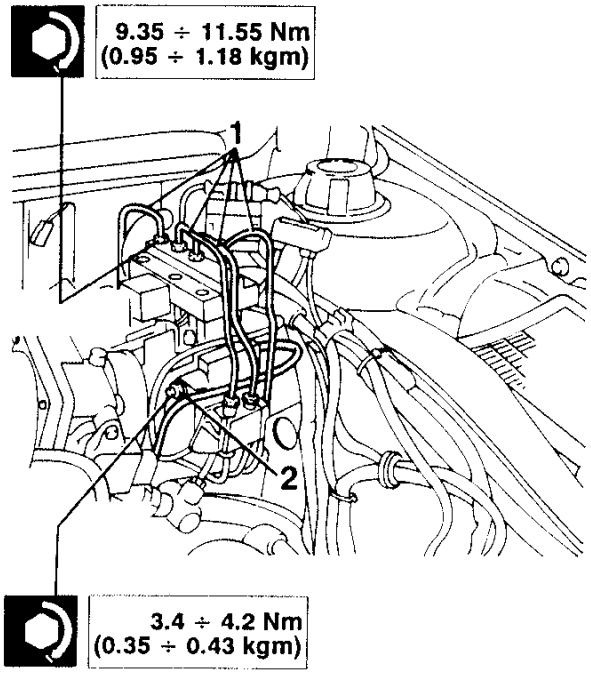
1. Disconnect the power supply wiring comb from the ABS control unit.



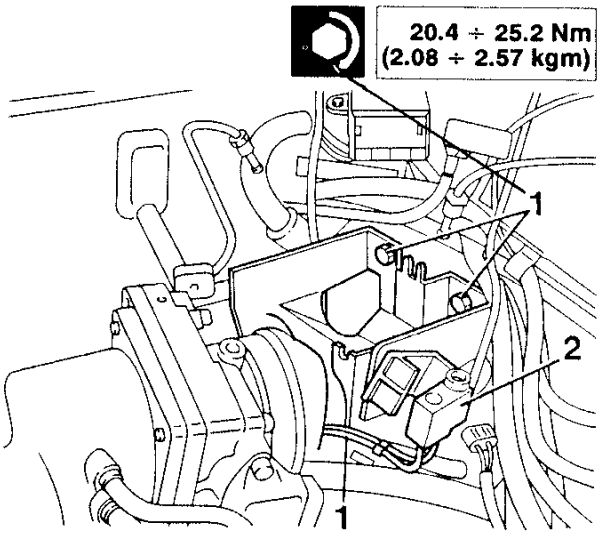
1. Loosen the screw securing the cover of the electronic control unit and remove the four-pin connector.



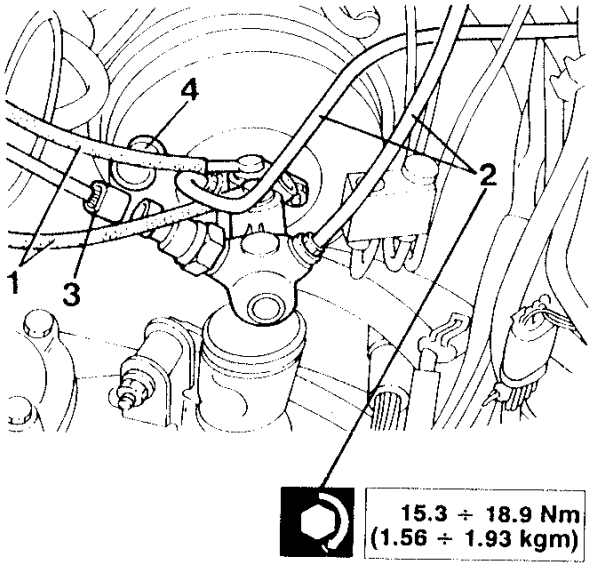
1. Disconnect the hydraulic unions from the ABS hydraulic unit and from the four-way distributor.
2. Loosen the three screws securing the hydraulic unit to the support and remove the support.



1. Loosen the three screws securing the ABS hydraulic unit support to the body.
2. Free the four-way distributor from its seating on the ABS hydraulic unit support and remove the support.

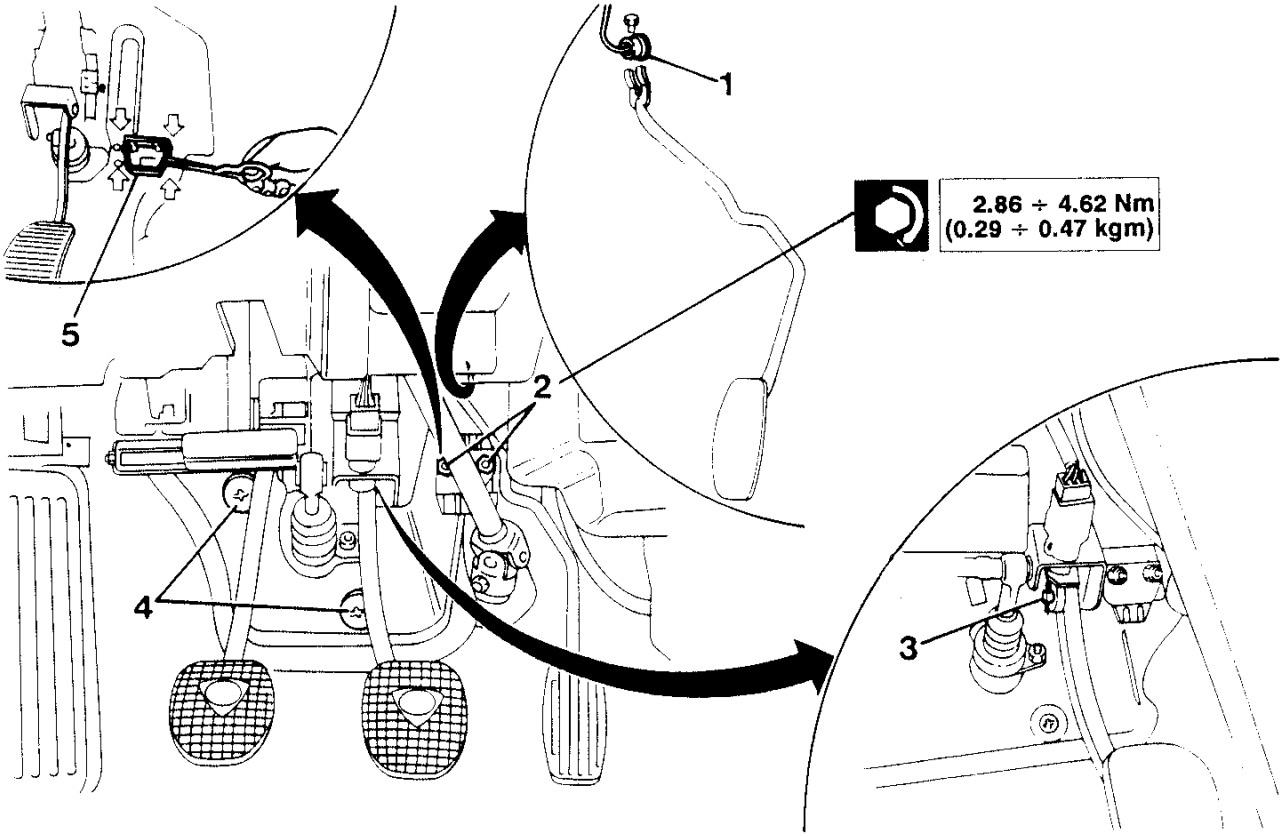


1. Disconnect the supply hoses from the brake pump.
2. Remove the delivery pipes from the brake pump.
3. Only for models equipped with controlled damping suspension -disconnect the braking sensor wiring.
4. Remove the servo brake vacuum intake hose.

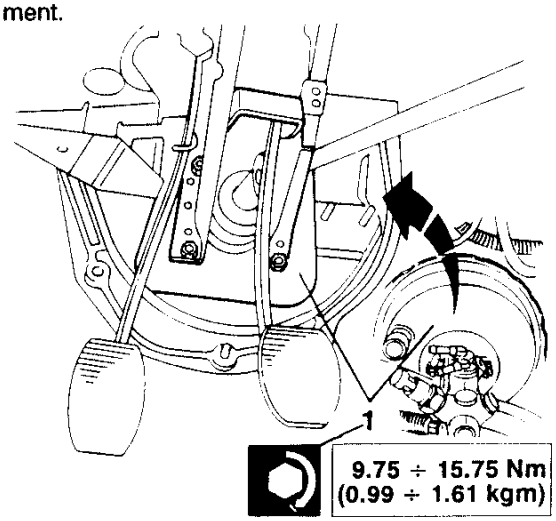


Operating from inside the passenger compartment, proceed as follows.

1. Free the accelerator cable from the accelerator pedal.
2. Loosen the two screws and remove the accelerator pedal.
3. Withdraw the cotter pin from the servo brake pin connecting plug and brake pedal. Remove the plug.
4. Remove the buttons securing the soundproofing plate.
5. Cut the soundproofing plate at the points indicated by the arrows in the diagram and remove the plate.



1. Unscrew the four nuts securing the servo brake to the body and remove it from the engine compartment.

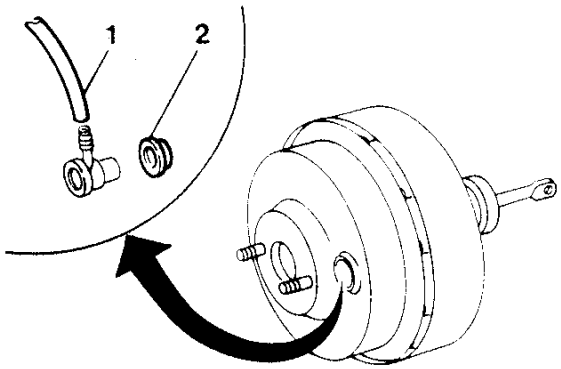


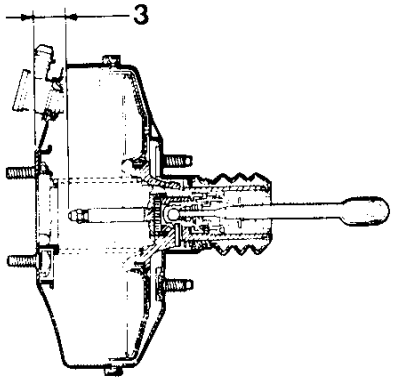
Refit by reversing the procedure followed for removal and:

- tighten the retaining screws and nuts to the specified torques;
- bleed the air from the braking system (see: AIR BLEED);
- after bleeding restore the brake-clutch fluid to the correct level in the reservoir.

CHECKS AND INSPECTIONS

– Check that the servo brake is working correctly.
1. Check the hoses for damage.
2. Check that the check valve is working correctly.
3. Check that the setting of the servo brake is correct. In the rest position the tip of the adjustment screw must be below the level of the surface of the cover and at the value given in the section: TECHNICAL CHARACTERISTICS AND SPECIFICATIONS.

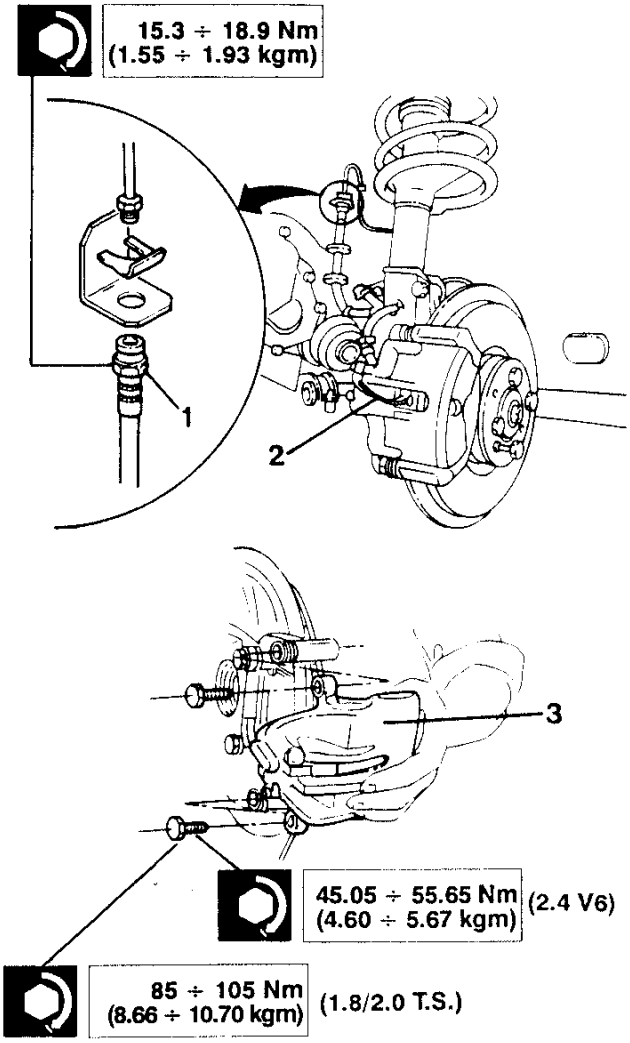




FRONT BRAKES

REMOVAL AND REFITTING

– Remove the wheel from the appropriate side.
1. Disconnect the connection and hose from the side panel.
2. Disconnect the brake pad wear sensor wiring connector.
3. Remove the two screws and remove the brake caliper.

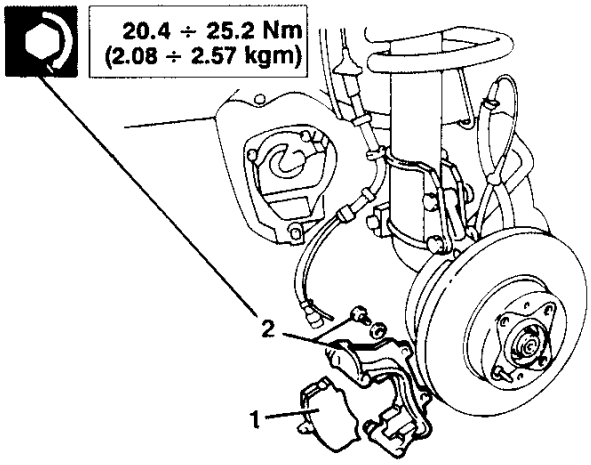


WARNING:
- **When refitting, substitute the screws securing the brake caliper body.**
- **When refitting check that the rubber boots protecting the threads of the retaining pins are not damaged. If they are, replace them.**

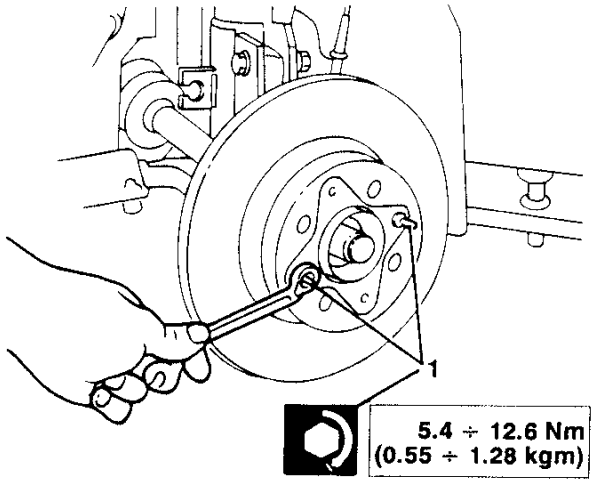
1. Remove the brake pads.

NOTE: **When refitting the brake pad and wear sensor must installed on the inner side of the disc (caliper piston side). Also check that the exhaust, located on the external part of the brake pad, is positioned to the rear of the direction of travel.**

2. Loosen the two screws and remove the brake caliper support bracket.



1. Loosen the two screws and remove the spacer and brake disc.

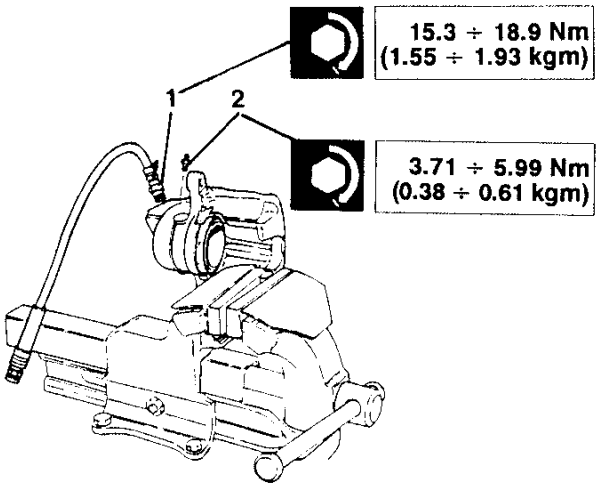


Refit by reversing the procedure followed for removal and tighten the screws and supply hoses to the correct torque.

When refitting bleed the air from the braking system (see: AIR BLEED).

DISASSEMBLY AND REASSEMBLY OF FRONT BRAKE CALIPER

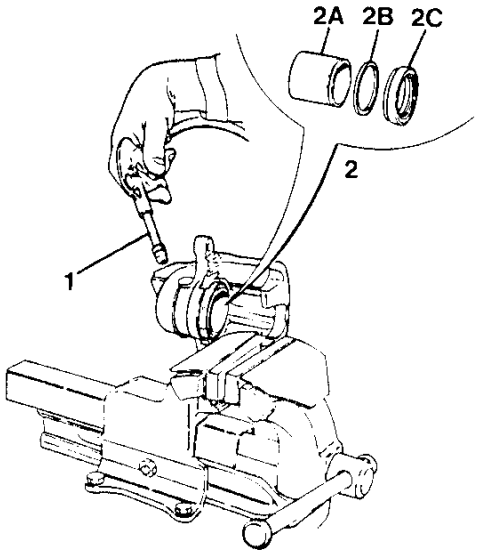
1. Disconnect the caliper hose connection.
2. Remove the drain screw.



1. Remove the piston by blowing a jet of compressed air into the brake fluid inlet hole.
2. Remove the piston (2A), gasket (2B), and protective boot (2C).

NOTE: **When refitting lubricate with the specified brake-clutch fluid.**

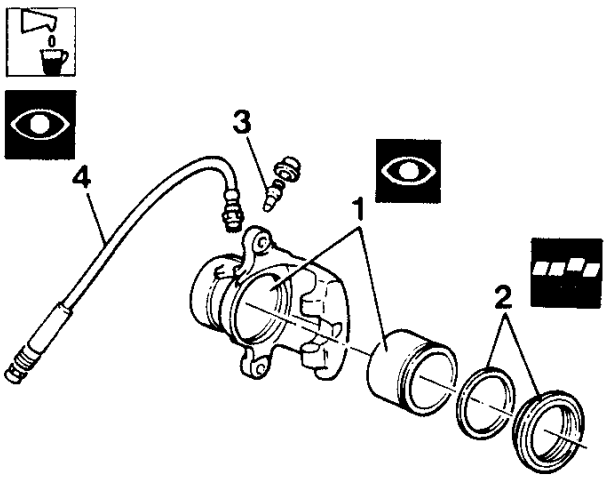
Refit by reversing the procedure followed for removal and tighten the drain screw and hose connection to the specified torque.

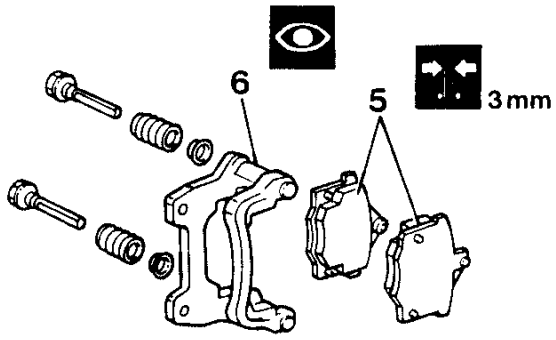


CHECKS AND INSPECTIONS

Brake calipers and brake pads

1. The piston and caliper body must not show signs of abrasion or seizing and both piston and caliper should be replaced if either of these defects is encountered.
2. Always substitute the protective boot and gasket.
3. Ensure that the drain screw is not blocked.
4. Check that the hose is not swollen or cracked.
5. Replace the brake pads if the friction material is less than 3 mm thick.
6. Check that the brake caliper support is not cracked or deformed.



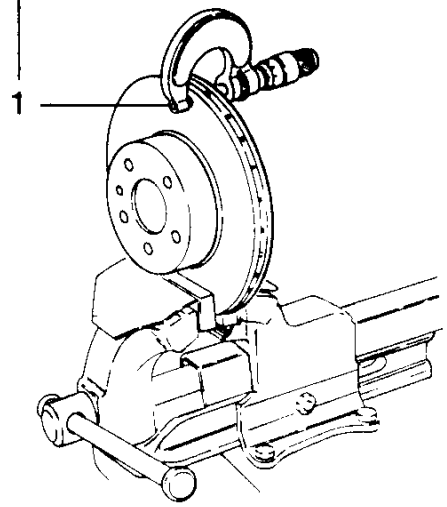


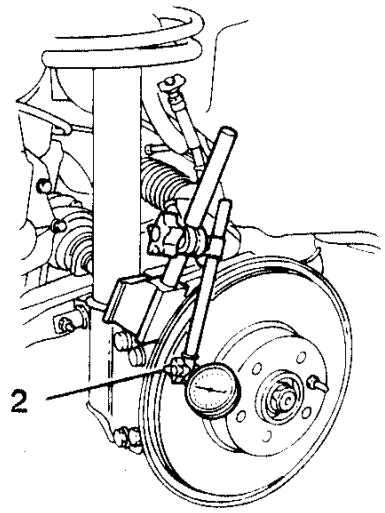
Brake discs

1. Check the thickness of the discs and ensure that the working surfaces are not deeply scratched or porous. Grind if necessary, respecting the specified tollerances given in the section TECHNICAL CHARACTERISTICS AND SPECIFICATIONS.
2. If only one brake pad is replaced check that the oscillation of the disc in relation to the rotational axis is within the specified limits (0.15 mm max.).

NOTE: The value must be measured 2 mm from the external diameter of the disc.

	WEAR LIMIT (mm)	GRINDING LIMIT (mm)
1.8 T.S.	18.2	19.2
2.0 T.S.		
2.4 V6	19.2	21.2





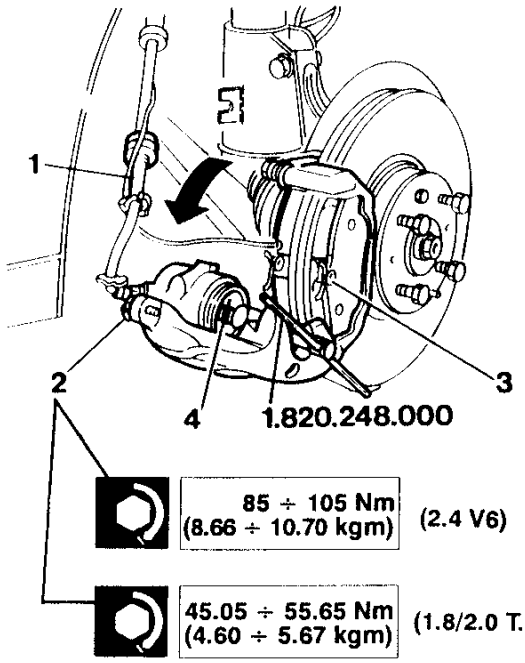
SUBSTITUTING THE FRONT BRAKE PADS

– Remove the front wheel.
1. Disconnect the brake pad wear sensor connector.
2. Loosen the upper screw securing the brake caliper and rotate it as shown in the illustration.
3. Substitute the brake pads.

NOTE: **The brake pad and wear sensor must installed on the inner side of the disc (caliper piston side). Also check that the exhaust, located on the external part of the brake pad, is positioned to the rear of the direction of travel.**

4. When refitting the brake caliper adjust the position of the piston using tool No. 1.820.248.000.

WARNING:
When refitting substitute the screw previously removed from the caliper body and tighten to the correct torque.

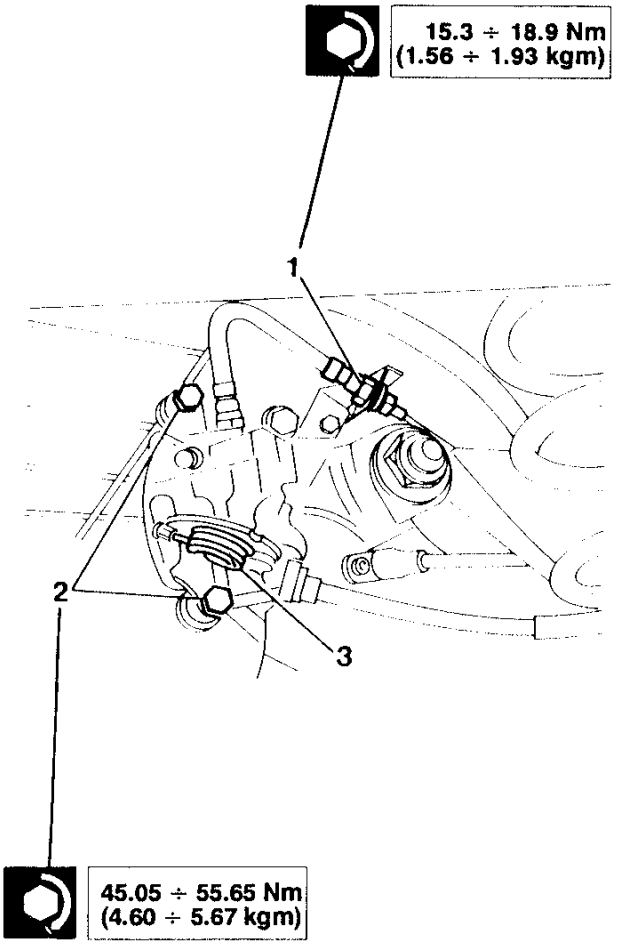


REAR BRAKES

REMOVAL AND REFITTING

– Remove the wheel from the appropriate side.
1. Disconnect hose connection.
2. Loosen the two screws securing the brake caliper body and remove the brake caliper.
3. Disconnect the handbrake control cable from the brake caliper.

WARNING:
- **When refitting substitute the screws securing the caliper body.**
- **When refitting check that the rubber boots are not damaged. If they are they must be replaced.**



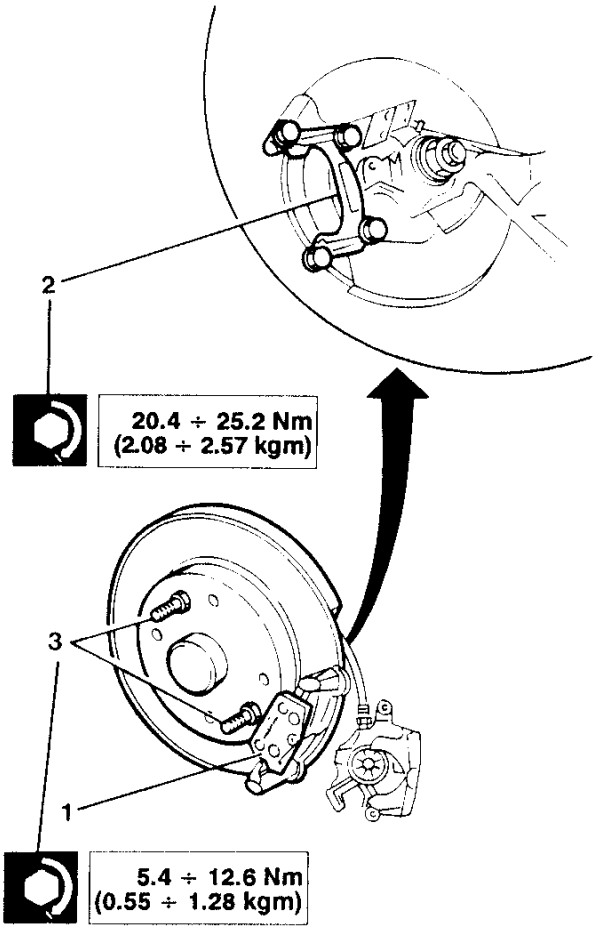
1. Remove the brake pads.

NOTE: The rear brake pads have no particular direction of installation.

2. Loosen the screws and remove the brake caliper support bracket.
3. Loosen the two screws and detach the brake disc.

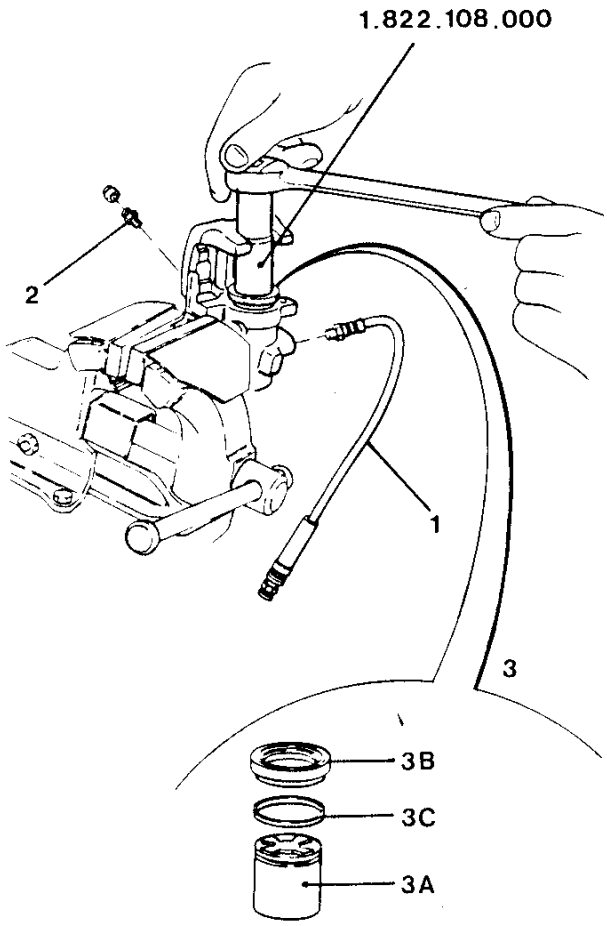
Refit by reversing the procedure followed for removal and tighten the retaining screws to the correct torque.

When refitting bleed the air from the braking system (see: AIR BLEED).



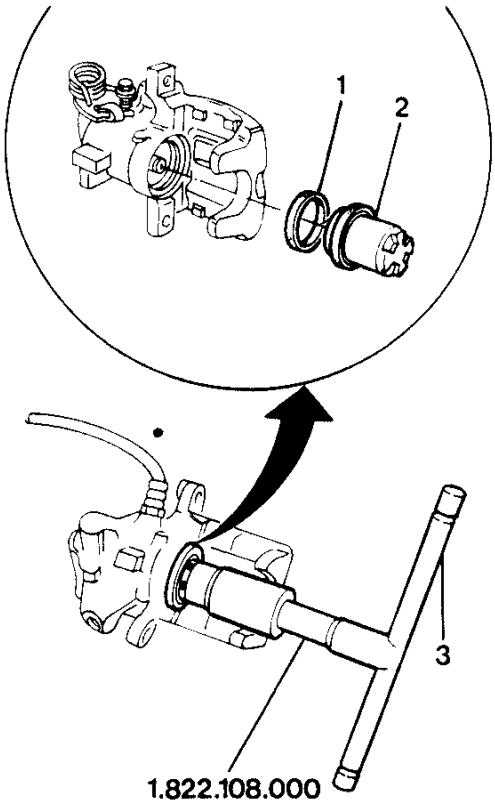
DISASSEMBLING THE REAR BRAKE CALIPER

1. Disconnect the hose connection from the caliper.
2. Remove the drain screw.
3. Disassemble the piston (using tool No. 1.822.108.000) (3A), the protective boot (3B) and the seal ring (3C).

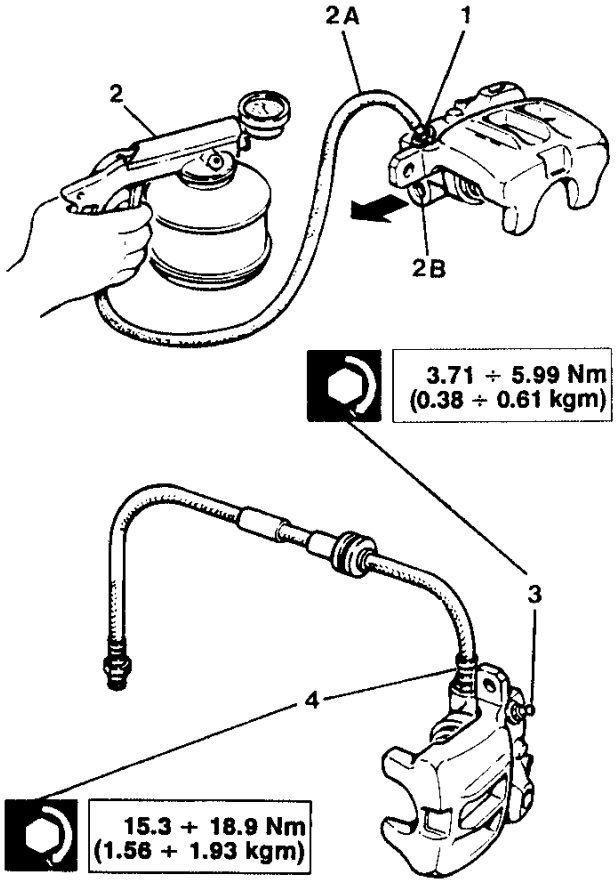


REFITTING THE REAR BRAKE CALIPER

1. Install the seal ring on the caliper body.
2. Position the protective boot on the rear part of the piston.
3. Install the piston and adjust the position using tool No. 1.822.108.000.



1. Partially tighten the drain screw.
2. Fill the brake caliper (2A) with the specified brake fluid until the fluid coming out of the hole (2B) of the hose connection contains no bubbles.
3. Tighten the drain screw to the correct torque.
4. Install the hose and tighten the connection to the correct torque.

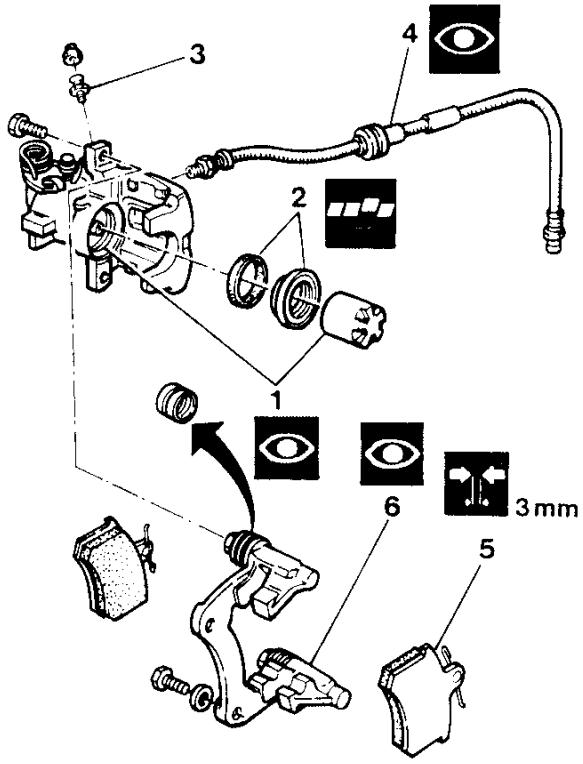


CHECKS AND INSPECTIONS

Brake caliper and brake pads

1. The piston and caliper body must not show signs of abrasion or seizing and both piston and caliper should be replaced if either of these defects is encountered.
2. Always substitute the protective boot and gasket.
3. Ensure that the drain screw is not blocked.
4. Check that the hose is not swolen or cracked.
5. Replace the brake pads if the friction material is less than 3 mm thick.
6. Check that the brake caliper support is not cracked or deformed.

– If the handbrake cable automatic adjustment device is not working correctly replace the entire brake caliper.

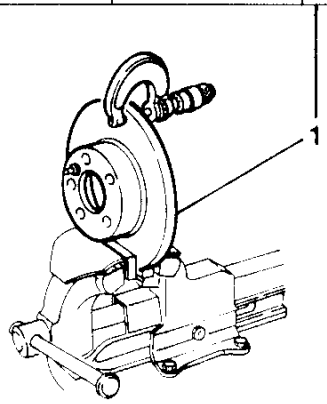


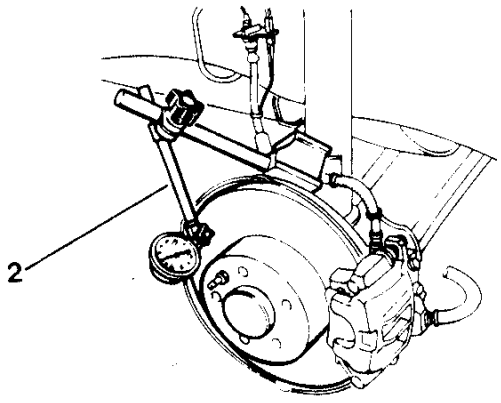
Brake disc

1. Check the thickness of the Discs and ensure that the working surfaces are not deeply scratched or porous. Grind if necessary, respecting the specified tollerances given in the section TECHNICAL CHARACTERISTICS AND SPECIFICATIONS.
2. If only one brake pad is replaced, check that the oscillation of the disc in relation to the rotational axis is within the specified limits (0.15 mm max).

NOTE: The value must be measured 2 mm from the external diameter of the disc.

	WEAR LIMIT	GRINDING LIMIT
1.8 T.S.	9.2	10.2
2.0 T.S.		
2.4 V6		





SUBSTITUTING THE REAR BRAKE PADS

– Remove the rear wheel.

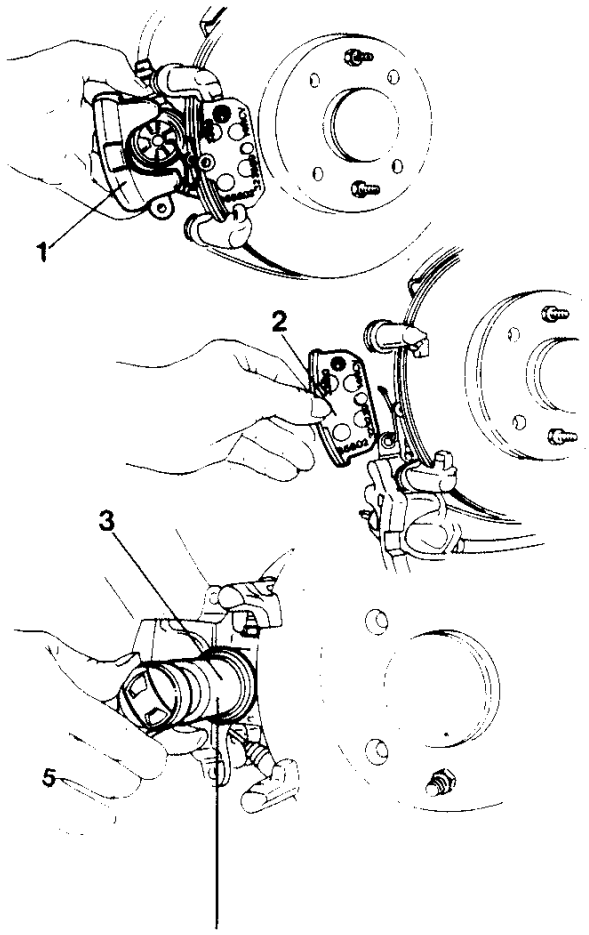
1. Loosen the two screws securing the caliper body and move it in order to facilitate the substitution of the pads.

NOTE: **When refitting substitute the screws securing the caliper body and tighten to the correct torque.**

2. Substitute the brake pads.

NOTE: **The rear brake pads have no particular direction of installation.**

3. Using tool No. 1.822.108.000 back-off the piston in order to facilitate the refitting of the caliper and install the caliper.



1.822.108.000

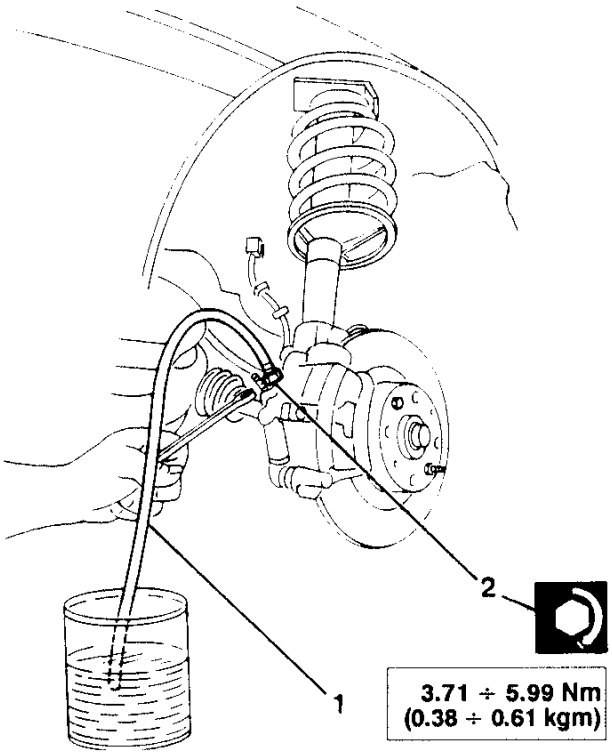
AIR BLEED

– Fill the brake-clutch fluid reservoir up to the MAX mark with the specified fluid.

– If necessary remove the wheel from the appropriate side.

1. Slide a hose onto the drain screw and submerge the end of the hose in a container full of the specified fluid.
2. Loosen the drain screw and repeatedly depress the brake pedal (waiting a few seconds between each depression). When bubble-free liquid begins to come out of the hose, fully depress the brake pedal and tighten the drain screw to the correct torque.

NOTE: **Each wheel must be bled separately.**



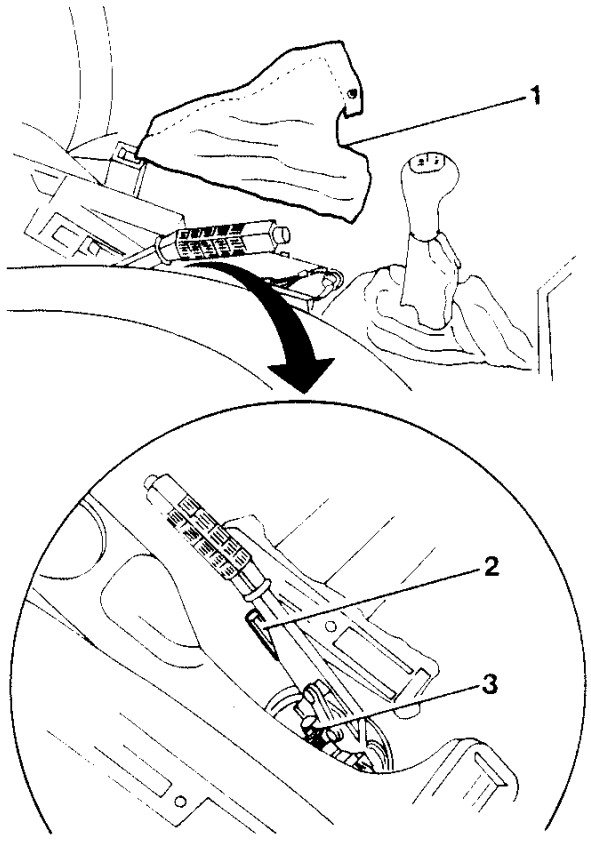
WARNING:

- **During the bleeding operation check that the level of fluid does not fall below the minimum mark.**
- **Do not re-use the fluid resulting from the bleeding operation.**
- **Prevent the fluid from coming into contact with painted surfaces.**

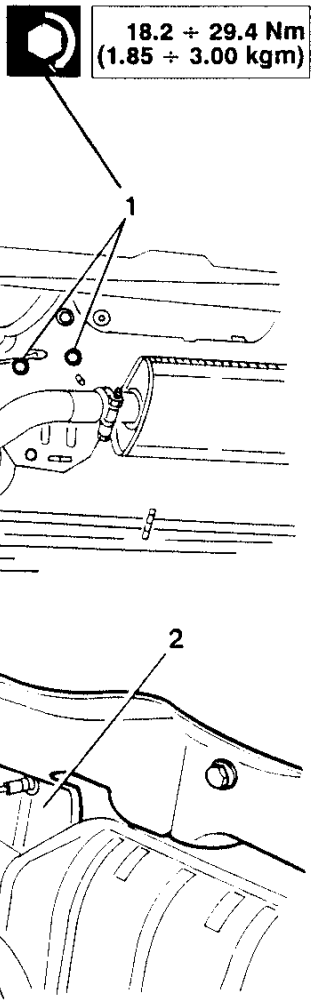
HANDBRAKE

REMOVING AND REFITTING THE HANDBRAKE LEVER

1. Remove the leather trim from the handbrake lever.
- Remove the trim from the tunnel (see: REPAIR MANUAL - TRIM - GR. 66 - Central tunnel console).
2. Completely unscrew the adjustment nut from the handbrake lever and free the control cable.
3. Disconnect the electrical connector from the handbrake switch.



- Raise the vehicle.
1. Loosen the two screws and remove the handbrake lever from the passenger compartment together with the bracket.
2. (Only for vehicles with a catalytic exhaust system):
   - loosen the screws securing the heat shielding and move the shielding until access can be gained to the two screws of the handbrake lever.

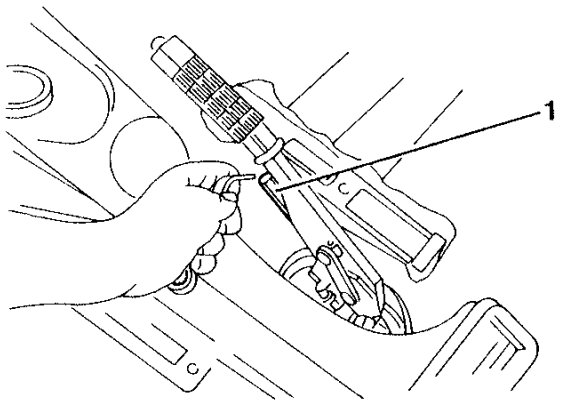


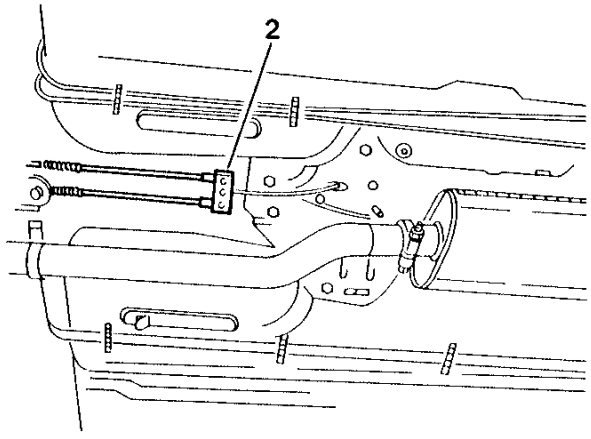
Refit by reversing the procedure followed for removal and tighten the retaining screws to the correct torque.

REMOVING AND REFITTING THE CONTROL CABLES

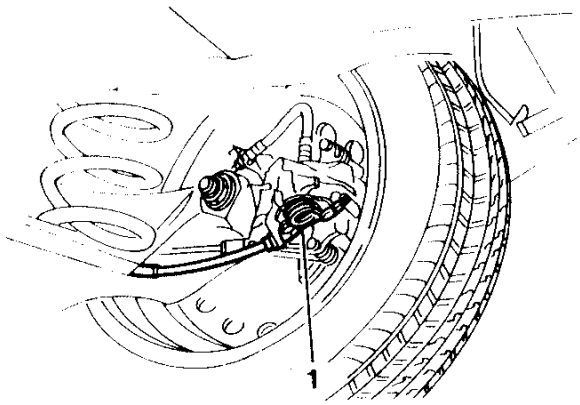
- Remove the central console (see: REPAIR MANUAL - TRIM - GR. 66).

1. Loosen the adjustment nut on the handbrake lever.
2. Disconnect the cables from the bracket.

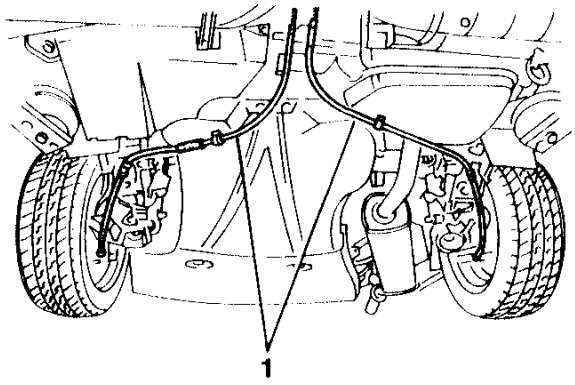




1. Disconnect the cables from the rear brake calipers.



1. Disconnect and remove the cables from the fittings located in the underbody.



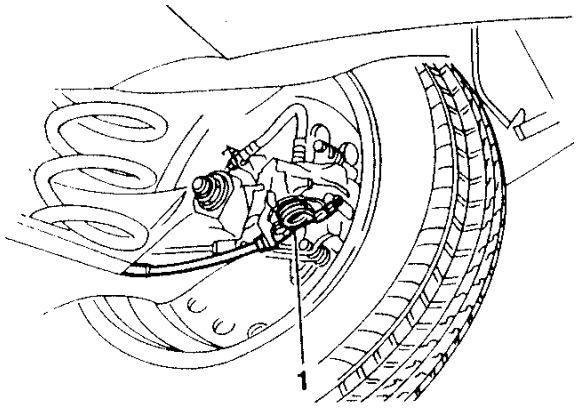
Refit by reversing the procedure followed for removal.

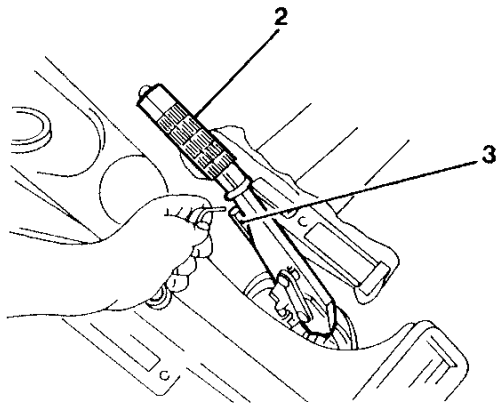
NOTE: After refitting adjust the handbrake cable travel.

ADJUSTING THE CONTROL CABLE

The handbrake must only be adjusted after the brake pads, control cable or brake caliper has been replaced as the recovery distance, which varies with wear, is automatic.

- Remove the leather trim from the handbrake lever.
1. With the handbrake cables disconnected from the rear calipers, depress the brake pedal at least ten times with force.
- Attach the handbrake cables to the calipers.
2. Adjust the handbrake lever to the third detent on the sector gear.
3. Using a spanner tighten the adjustment nut until a braking force is applied to the rear wheels.





NOTE: With the lever in the rest position, check that the wheels rotate freely.

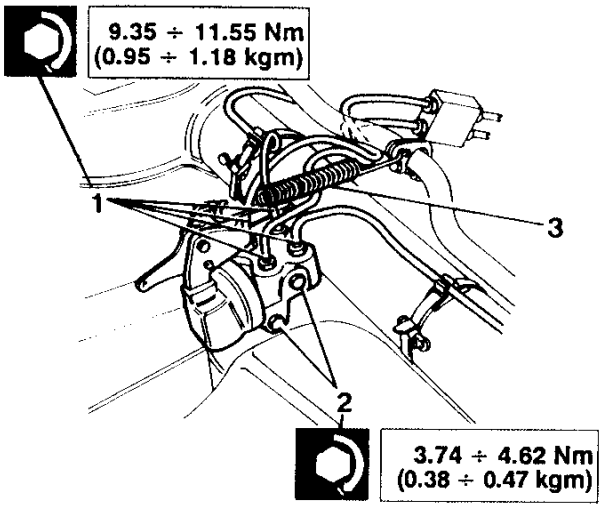
BRAKING REGULATOR

REMOVAL AND REFITTING

1. Disconnect the pipe connections.
2. Remove the screws securing the regulator.
3. Disconnect the spring and remove the regulator.

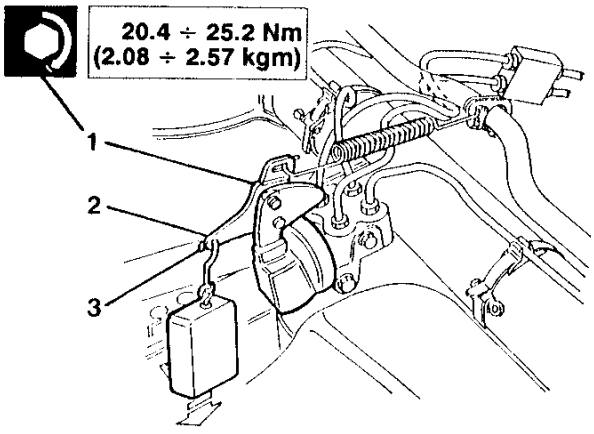
Refit by reversing the procedure followed for removal and tighten the regulator retaining screws to the correct torque.

When refitting bleed the air from the braking system (see: AIR BLEED).



ADJUSTMENT

- Ensure that the vehicle is fit to travel i.e. full fuel tank, engine coolant, spare tyre and accessories.
- Place the vehicle on a level surface with the wheels on the ground in order to settle the suspension.
1. Loosen the screw securing the bracket.
2. Attach a 5 ± 0.5 kg weight to the hook.
3. Keeping the bracket in this position, lock the retaining screw to the correct torque.

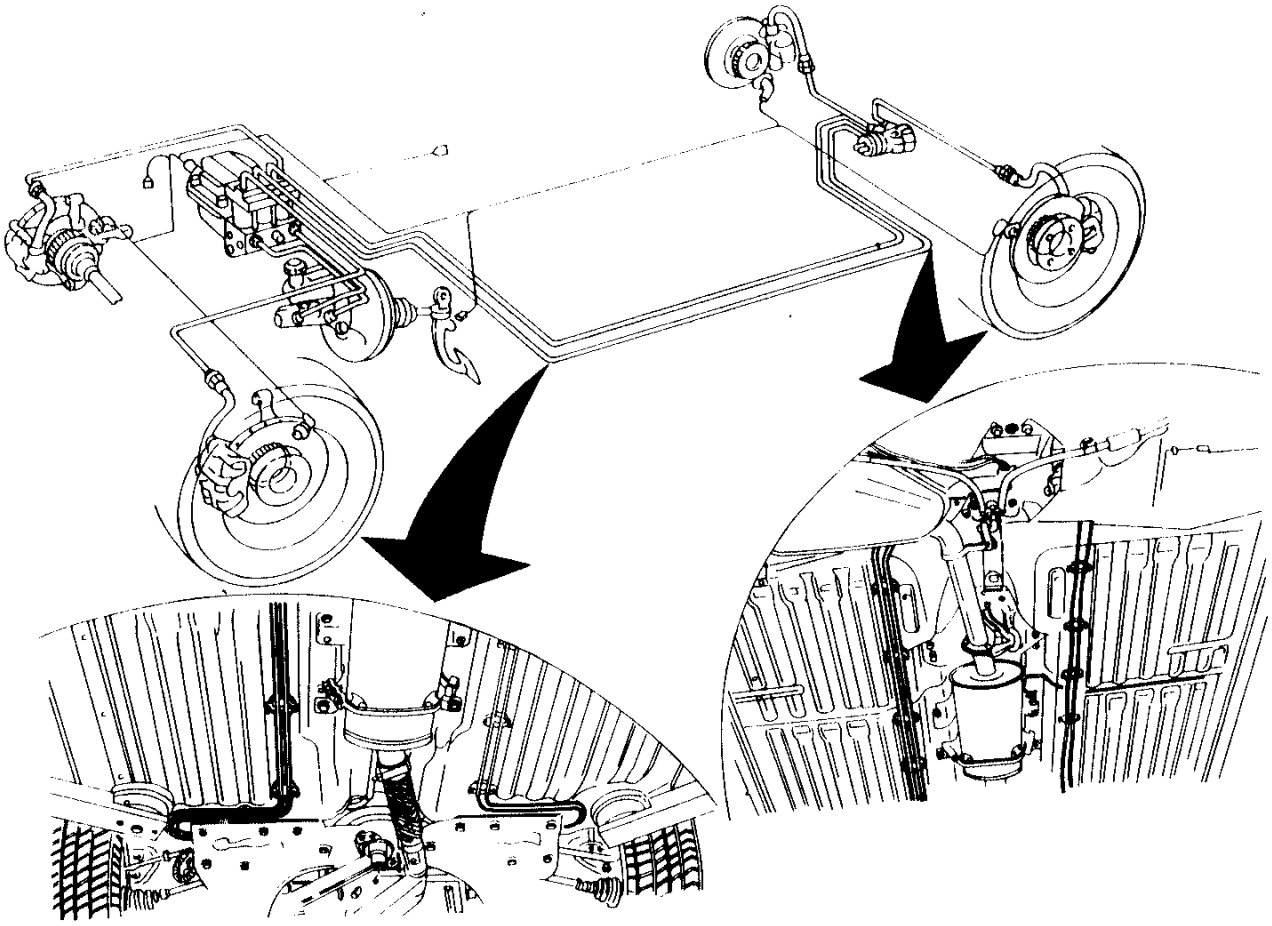


BRAKING SYSTEM PIPES AND HOSES

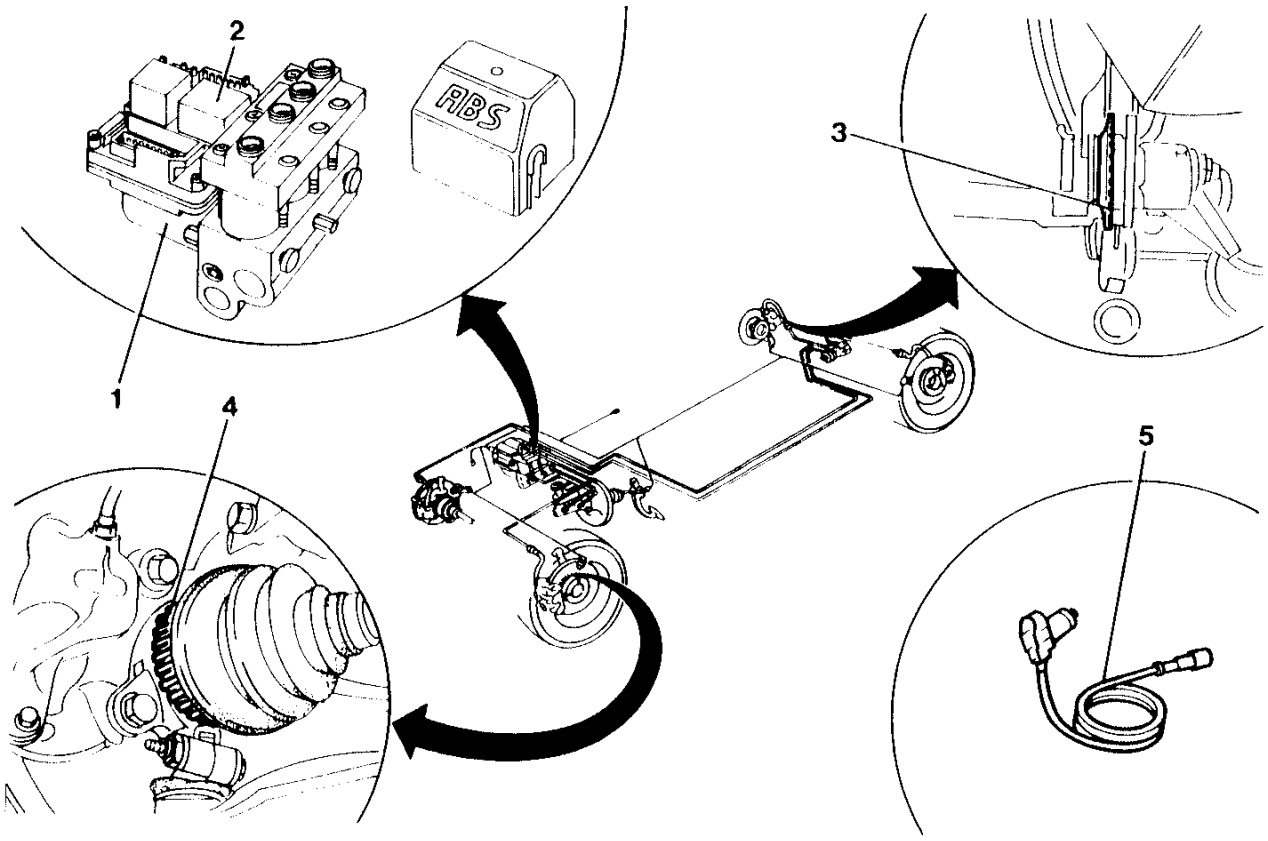
CHECKS AND INSPECTIONS

- Check that the pipes and hoses are not swollen, cracked or corroded and that they are not leaking.
- When replacing the hoses and pipes, drain the brake-clutch fluid reservoir with a syringe and plug the ends of the hoses/pipes so that no foreign matter can enter.
- When refitting fill the brake-clutch fluid reservoir and bleed the air from the braking system (see: AIR BLEED).

WARNING:
The pipes must not be bent for twisted.



ANTI-WHEEL LOCKING DEVICE (A.B.S.)



1. Hydraulic-electronic unit
2. Relay
3. Rear phonic wheel
4. Front phonic wheel
5. Induction sensor

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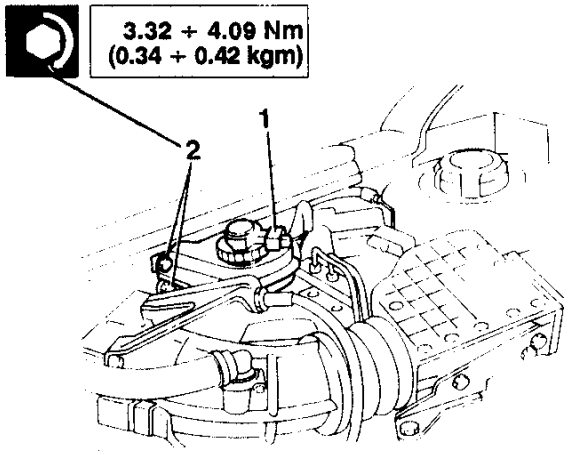
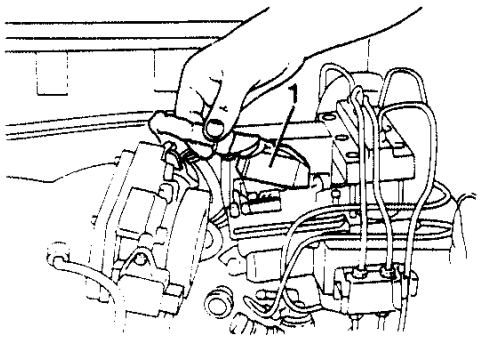
REMOVING AND REFITTING HYDRAULIC-ELECTRONIC UNIT

- Disconnect and remove the battery and support (see: REPAIR MANUAL - ENGINES - GR. 05).
- Remove the air-flow meter (see: REPAIR MANUAL - ENGINES - GR. 04 - Removal and refitting air-flow meter).
- Empty the brake-clutch fluid reservoir.

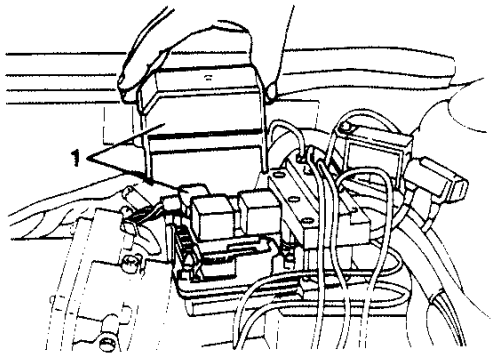
1. Disconnect the connector from the brake-clutch fluid level sensor.
2. Loosen the two screws securing the brake-clutch fluid reservoir and move the reservoir.



1. Remove the electric wiring comb from the control unit.



1. Loosen the screw securing cover of the electronic control unit and remove the four-pin connector.

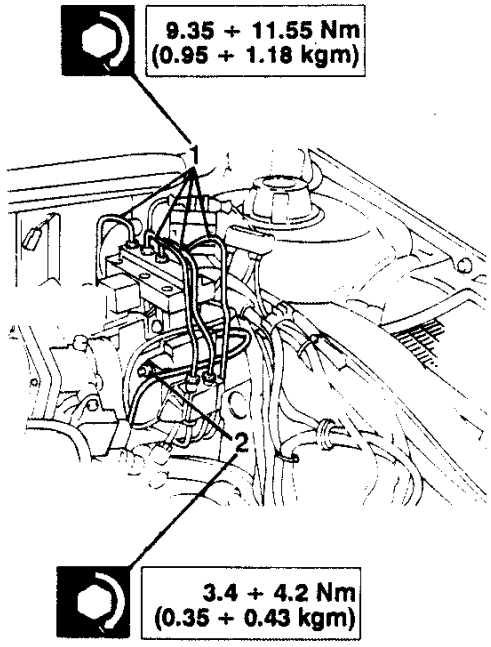


1. Disconnect the hydraulic connections from the hydraulic- electronic unit and from the four-way distributor.
2. Unscrew the three screws of the unit support and remove the support.

Refit by reversing the procedure followed for removal and tighten the pipe connections to the correct torque.

When refitting bleed the air from the braking system (see: AIR BLEED).

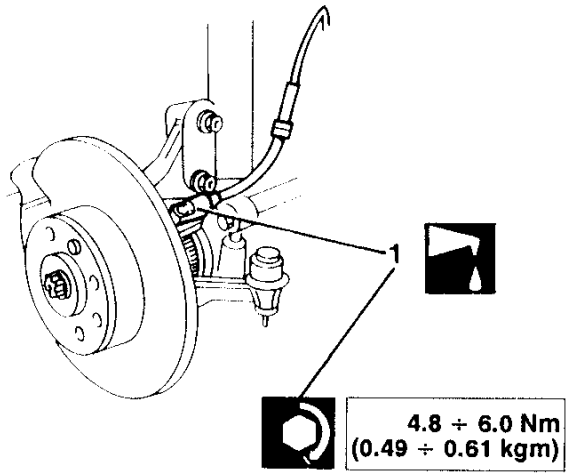
After bleeding the air, restore the correct level of brake-clutch fluid in the tank.



REMOVING AND REFITTING THE FRONT WHEEL INDUCTION SENSOR

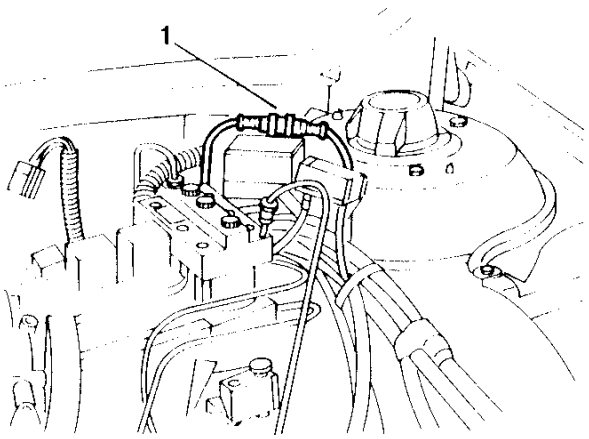
– Remove the wheel.

1. Loosen the screw securing the sensor.



1. Disconnect the electrical connector located near the shock absorber dome and remove the sensor and wiring after disconnecting it from the clips on the body.

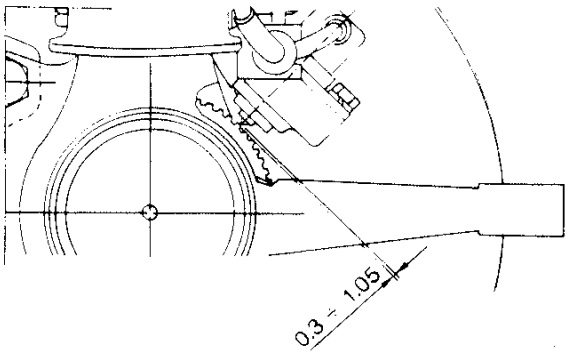
Refit by reversing the procedure followed for removal and tighten the screws securing the sensor to the correct torque.



CHECKING AIR GAP BETWEEN THE FRONT WHEEL R.P.M. SENSOR AND TEETH OF THE PHONIC WHEEL

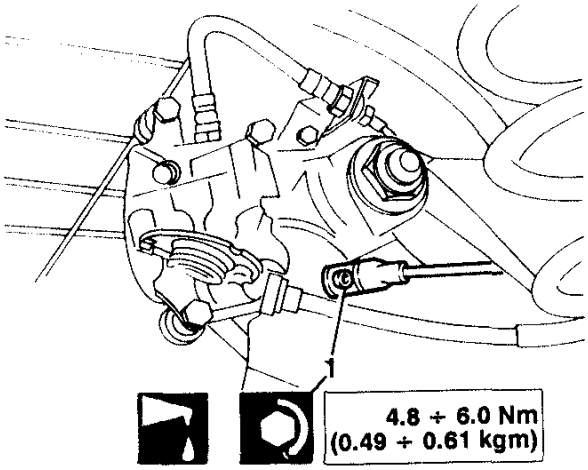
– Using a feeler gauge, check the air gap between the r.p.m. sensor and the phonic wheel on the constant speed joint.

WARNING:
The air gap cannot be adjusted as no shims are supplied for this purpose. Check the sensor and the teeth of the phonic wheel for damage if the air gap value does not correspond to the specified tollerance.



REMOVING AND REFITTING THE REAR WHEEL INDUCTION SENSOR

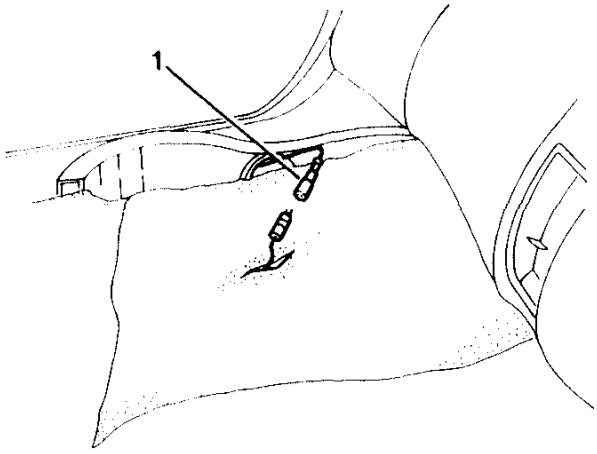
1. Loosen the screw securing the sensor.



– Remove the rear seat (see: REPAIR MANUAL - TRIM - GR. 66 - Removal and refitting of rear seat).

1. Disconnect the electrical connector located on the rear floor panel and remove the sensor.

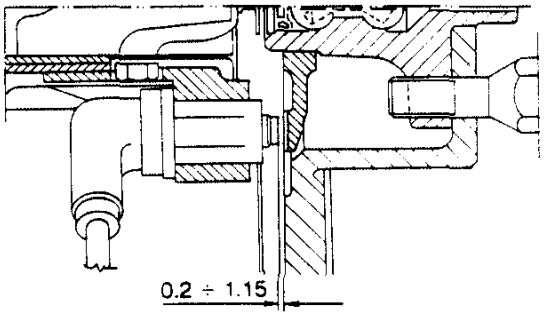
Refit by reversing the procedure followed for removal and tighten the screw securing the sensor to the correct torque.



CHECKING AIR GAP BETWEEN THE REAR WHEEL R.P.M. SENSOR AND TEETH OF THE PHONIC WHEEL

Using an appropriate feeler gauge check the air gap between the r.p.m. sensor and phonic wheel on the constant speed joint.

WARNING:
The air gap cannot be adjusted as no shims are supplied for this purpose. Check the sensor and the teeth of the phonic wheel for damage if the air gap value does not correspond to the specified tollerance.



TECHNICAL CHARACTERISTICS AND SPECIFICATIONS

TECHNICAL SPECIFICATIONS

MASTER CYLINDER

Model	Type	Diameter	Stroke
1.8 T.S.	ISOVAC	13/16" (20.6 mm)	9/16" (14 + 14 mm)
2.0 T.S.		7/8" (22.23 mm)	5/8" (16 + 16 mm)
2.4 V6		15/16" (23.8 mm)	

SERVO BRAKE

Model	Type	Diameter of operating cylinder
1.8 T.S.	ISOVAC	8" (20.32 cm)
2.0 T.S.		7" + 8" (17.78 + 20.32 cm)
2.4 V6		

FRONT BRAKE CALIPERS

Model	Type	Piston diameter (mm)	Brake pad area (cm^2)	Brake pad nominal thickness (mm)
1.8 T.S. - 2.0 T.S.	ALTECNA	48	35.8	17 ±0.3
2.4 V6	GIRLING	54	50	18.3 ±0.2

REAR BRAKE CALIPERS

Model	Type	Piston diameter (mm)	Brake pad area (cm^2)	Brake pad nominal thickness (mm)
1.8 T.S. - 2.0 T.S.	GIRLING	34	21	$14\ ^{-0}_{+0.4}$
2.4 V6				

GENERAL SPECIFICATIONS

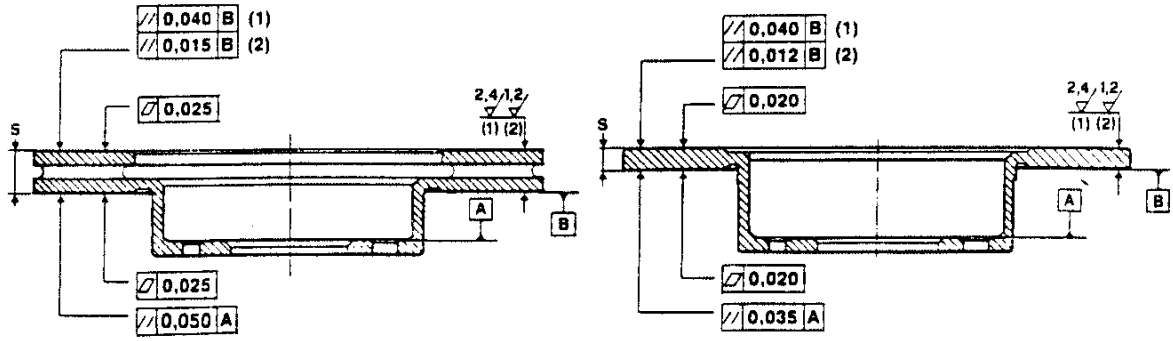
FLUIDS AND LUBRICANTS

APPLICATION	TYPE	NAME
Pedal joints and bushes	GREASE	SHELL RETINAX G.
Brake/clutch hydraulic system refill	FLUID Class: DOT 4 SAE J170 3F	TUTELA DOT 4 ALFA ROMEO BRAKE FLUID SUPER DOT 4
Seat for anti-lock front/rear wheel inductive sensor	GREASE	FIAT GRAS/IX (Norm. 9.55580)

CHECKS AND ADJUSTMENTS

BRAKE DISK		FRONT		REAR	
		1.8 T.S. - 2.0 T.S.	2.4 V6	1.8 T.S. - 2.0 T.S.	2.4 V6
Diameter	(mm)	257	284	240	
Limit operating thickness	(mm)	18.2	20.2	9.2	
Minimum thickness after grinding	(mm)	19.2	21.2	10.2	
Nominal thickness	(mm)	20.2	22.2	11.2	

BRAKE DISK GRINDING DIMENSIONS

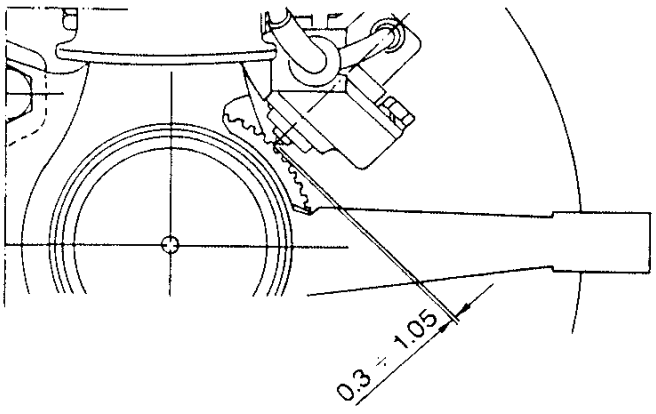


1. Radial
2. Circumferential

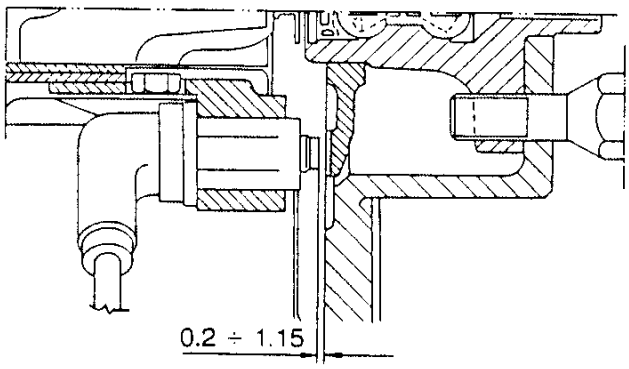
BRAKE PAD	FRONT	REAR
Limit operating thickness	All models	
	3 mm	3 mm

ADJUSTMENT OF AIR GAP BETWEEN INDUCTIVE SENSORS AND PHONIC WHEELS

Front wheels



Rear wheels



TIGHTENING TORQUES

Description	N·m	kg·m
Connection for pipe fitting on master cylinder	15.3 ÷ 18.9	1.55 ÷ 1.93
Nut securing master cylinder	13 ÷ 21	1.33 ÷ 2.14
Nut securing servo brake to pedal support	9.75 ÷ 15.75	0.99 ÷ 1.61
Nut securing accelerator pedal to pedal support	2.86 ÷ 4.62	0.29 ÷ 0.47
Columns (screws) securing front and rear wheels	73.1 ÷ 90.3	7.45 ÷ 9.20
Screw securing front brake calipers	45.05 ÷ 55.65	4.60 ÷ 5.67
Screw securing front brake calipers (2.4 V6)	85 ÷ 105	8.66 ÷ 10.70
Screw securing front brake caliper support bracket	20.4 ÷ 25.2	2.08 ÷ 2.57
Screw with centering pin for securing front and rear brake disks	5.4 ÷ 12.6	0.55 ÷ 1.28
Screw securing front and rear brake disks	5.4 ÷ 12.6	0.55 ÷ 1.28
Bleeder screw on brake calipers	3.71 ÷ 5.99	0.38 ÷ 0.61
Fitting connecting hose to brake calipers	15.3 ÷ 18.9	1.55 ÷ 1.93
Screw securing rear brake calipers	45.05 ÷ 55.65	4.60 ÷ 5.67
Screw securing rear brake calipers support bracket	20.4 ÷ 25.2	2.08 ÷ 2.57
Connection between hoses and pipes	15.3 ÷ 18.9	1.55 ÷ 1.93
Screw securing braking regulator to rear crossmember	3.74 ÷ 4.62	0.38 ÷ 0.47
Screw for braking regulator control lever	20.4 ÷ 25.2	2.08 ÷ 2.57
Fitting connecting pipe on braking regulator and 4-way distributor	9.35 ÷ 11.55	0.95 ÷ 1.18
Screw securing handbrake to body	18.2 ÷ 29.4	1.86 ÷ 3.00
Screw securing clutch-brake fluid reservoir to body	3.32 ÷ 4.05	0.34 ÷ 0.42
Nut securing hydraulic control unit to bracket	3.4 ÷ 4.2	0.35 ÷ 0.43
Screw securing control unit support bracket to body	20.4 ÷ 25.2	2.08 ÷ 2.57
Screw securing front and rear wheel inductive sensor	4.8 ÷ 6.0	0.49 ÷ 0.61

SPECIFIC TOOLS

TOOL NUMBER	DESCRIPTION
1.820.248.000	Tool for backing off front brake piston
1.822.108.000	Tool for backing off rear brake piston

FAULT DIAGNOSIS AND CORRECTIVE ACTION

PRELIMINARY CHECKS:

- Check tyre inflation pressure and wear
- Check wheel attitude and characteristic angles
- Check that brake fluid is of the prescribed type

ANOMALIES AND SYMPTOMS	CHECK	TEST REFERENCE
EXCESSIVE PEDAL TRAVEL	when pedal is depressed, travel is longer than normal	A
DAMPENED PEDAL TRAVEL	When pedal is depressed, damping is experienced at the end of travel; braking action is reduced	B
STIFFENING OF PEDAL TRAVEL	Pedal travel becomes stiff during normal brake use	C
INSUFFICIENT BRAKING POWER	Braking is not proportional to the force applied to the pedal	D
VEHICLE DRIFTS DURING BRAKING	The vehicle pulls to one side (right or left) during braking	E
VIBRATIONS DURING BRAKING	Vibrations are felt in the passenger compartment during braking	F
BRAKES THAT SQUEAK OR CREAK	Squeaking or creaking coming from pad-to -disk contact area is heard during braking	G
JAMMING OF REAR BRAKES	Rear brakes jam when brakes are actuated	H
INEFFICIENT HANDBRAKE	Rear wheels are not locked when handbrake is applied	I
REAR BRAKES REMAIN LOCKED WHEN HANDBRAKE IS RELEASED		L

DIAGNOSTIC

EXCESSIVE PEDAL TRAVEL	TEST A

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
A1 VISUALLY CHECK FOR FLUID LEAKS – Check for fluid leaking from brake pump, brake regulator, lines and fittings of brake system	OK ▶ OK ▶	Carry out step A2 Tighten fittings or replace damaged parts
A2 CHECK FOR TRAPPED AIR – Check for presence of trapped air in hydraulic brake circuit	OK ▶ OK ▶	Carry out step A3 See TEST B
A3 CHECK SLACK ADJUSTER – Check slack adjuster of handbrake for proper operation	OK ▶	Replace affected rear brake caliper

DAMPENED PEDAL TRAVEL	TEST B

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
B1	CHECK FOR TRAPPED AIR		
– Check for air trapped in hydraulic brake circuit		OK ▶ OK ▶	Carry out step B2 Purge trapped air from circuit
B2	CHECK HOSES		
– Check that hoses are not bulged due to deterioration		OK ▶ OK ▶	Carry out step B3 Replace hoses and purge trapped air from circuit
B3	CHECK BRAKE CALIPERS		
– Check that seals of brake calipers are not worn		OK ▶ OK ▶	Carry out step B4 Replace affected brake caliper
B4	CHECK BRAKE FLUID		
– Check that the brake fluid is of the approved type and quantity		OK ▶	Replace with approved brake fluid and purge trapped air from circuit

STIFFENING OF PEDAL TRAVEL	TEST C

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
C1 CHECK NON-RETURN VALVE – Check that the non-return valve is not damaged	OK ▶ OK ▶	Carry out step C2 Substitute the non-return valve
C2 CHECK BRAKE CALIPERS – Check the vacuum line for damage (from servo-unit to intake manifold) Carry out step C3	OK ▶ OK ▶	Carry out step C3 Replace vacuum level
C3 CHECK FITTINGS AND CLAMPS – Check fittings and clamps of servo-unit vacuum line for damage	OK ▶	Replace defective parts. If fault persists replace servo-unit

INSUFFICIENT BRAKING	TEST D

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
D1 CHECK FOR AIR TRAPPED IN SYSTEM – Check for air trapped in hydraulic brake circuit	(OK) ▶ (OK) ▶	Carry out step D2 Purge trapped air from circuit
D2 CHECK SURFACE OF BRAKE PADS – Check for presence of grease, oil, mud or water on the surface of the brake pads	(OK) ▶ (OK) ▶	Carry out step D3 Clean and check pads; eliminate cause of trouble; replace pads if necessary
D3 CHECK DISCS AND PADS – Check discs and pads for wear or damage; check that pads are of approved type	(OK) ▶ (OK) ▶	Carry out step D4 Replace pads
D4 CHECK PEDAL TRAVEL – Check brake pedal for overtravel	(OK) ▶ (OK) ▶	Carry out step D5 See TEST A
D5 CHECK CALIPERS PISTON – Check callpers pistons for wear or seizing	(OK) ▶	Replace calipers

VEHICLE DRIFTS DURING BRAKING	TEST E

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
E1 CHECK TYRE PRESSURE – Check that tyres are inflated to the correct pressure	OK ▶ OK ▶	Carry out step E2 Service to correct pressure
E2 CHECK SURFACE OF BRAKE PADS – Check for presence of grease, oil, mud or water on the surface of the pads	OK ▶ OK ▶	Carry out step E3 Clean and check pads; eliminate causes of trouble; replace pads if necessary
E3 CHECK BRAKE PAD WEAR – Check pads installed on same axle for different wear	OK ▶ OK ▶	Carry out step E4 Replace pads and check calipers for proper operation; if necessary replace calipers
E4 CHECK DISCS – Check that discs are of same manufacturer and dimensions	OK ▶ OK ▶	Carry out step E5 Replace discs
E5 CHECK BRAKING REGULATOR – Check that braking regulator is serviceable and correctly adjusted	OK ▶ OK ▶	Carry out step E6 Replace braking corrector if necessary
E6 CHECK CHARACTERISTIC ANGLES – Check that characteristic angles of the wheels are correctly adjusted	OK ▶	Adjust characteristic angles of wheels (see: GR. 21)

VIBRATIONS DURING BRAKING	TEST F

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
F1 CHECK BRAKE DISCS – Check that brake discs are not buckled or rusty	OK ▶ OK ▶	Carry out step F2 Grind or replace affected disc as necessary
F2 CHECK OVERHEATING OF DISCS – Check discs for signs of overheating (due to excessive stress)	OK ▶	Replace pads; grind or replace discs as necessary

SQUEAKING OR CREAKING DURING BRAKING	TEST G

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
G1	CHECK SURFACE OF BRAKE PADS		
– Check the braking surfaces of the pads are not vitrified		(OK) ▶ (OK) ▶	Carry out step H2 Replace pads and check disc
G2	CHECK BRAKE PADS		
– Check that brake pads are of approved type		(OK) ▶	Replace with brake pads of approved type

JAMMING OF REAR BRAKES	TEST H

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
H1	CHECK BRAKING REGULATOR		
– Check braking regulator for correct operation		OK ▶	Replace braking regulator

INEFFICIENT HANDBRAKE	TEST I

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
I1 CHECK ADJUSTMENT – Check that adjusting nut is properly set	(OK) ▶ (OK) ▶	Carry out step I2 Re-adjust acting on nut located under handbrake I2
I2 CHECK CONTROL CABLE – Check control cable for damage or breakage	(OK) ▶ (OK) ▶	Carry out step I3 Replace control cable
I3 CHECK CABLE CONNECTION – Check cable connection for damage	(OK) ▶	Check and eliminate cause of trouble

REAR BRAKES REMAIN LOCKED WHEN HANDBRAKE IS RELEASED	TEST L

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
L1 CHECK CONTROL CABLE TRAVEL – Check return travel of cable for freedom of movement	(OK) ▶ (OK) ▶	Carry out step L2 Eliminate any inteference or replace control cable
L2 CHECK LEVER PUSHBUTTON – Check pushbutton for freedom of movement	(OK) ▶ (OK) ▶	Carry out step L3 Replace control cable
L3 CHECK CABLE CONNECTION – Check cable connection for damage	(OK) ▶	Disassemble and repair pushbutton; replace the lever if necessary

GROUP 23

STEERING

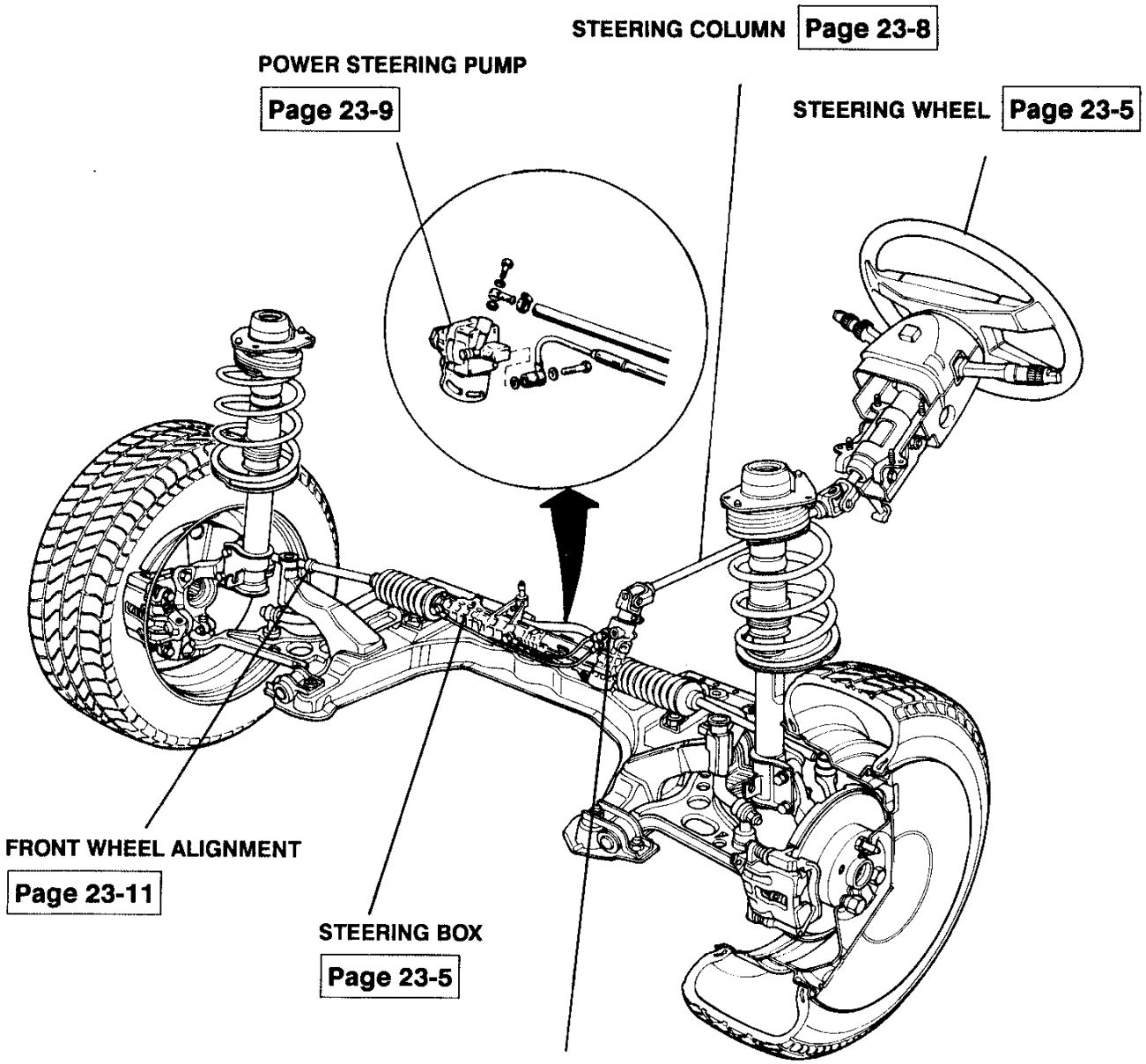
INDEX

GROUP 23

STEERING

INDEX

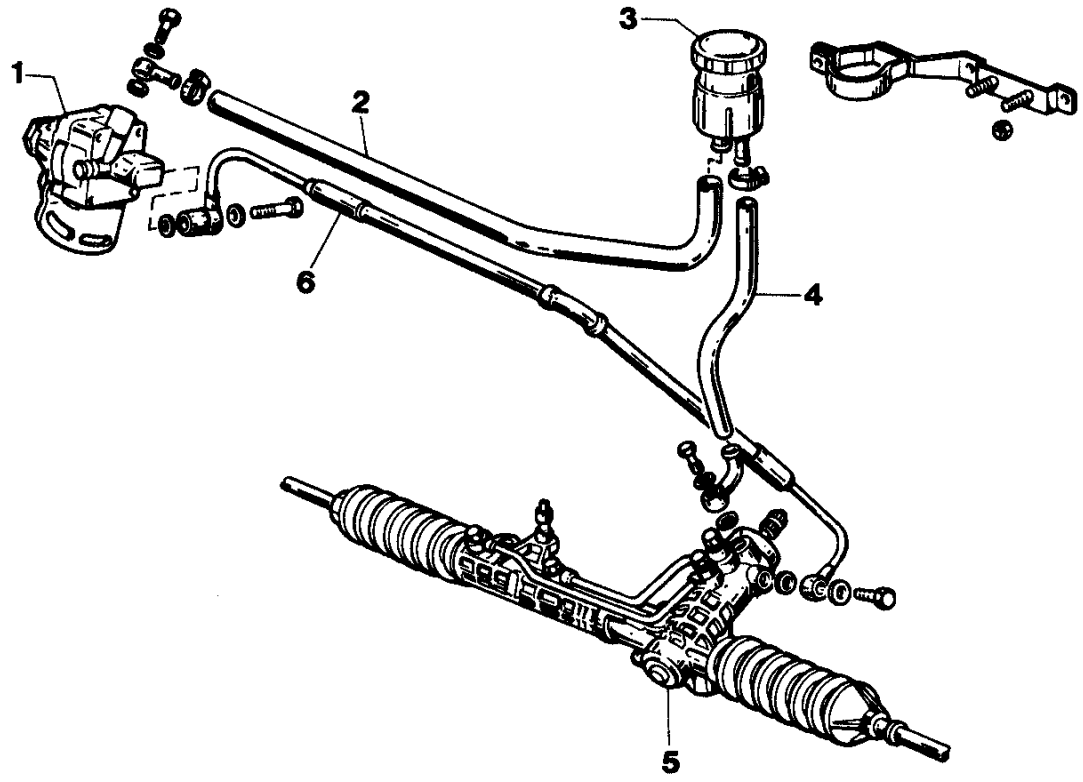
ILLUSTRATED INDEX



STEERING

DESCRIPTION

The power steering system fitted to all vehicles in the 167 range enables the effort required to turn the steering wheel to be reduced when maneuvering at low speeds and keeps the steering steady at high speeds. The composition of the steering column, articulated in two parts ensures greater passive safety in the event of a frontal impact. The system is composed of a pump (1) directly powered by the engine through a belt. The pump, drawing fluid from from the reservoir (3) (located in the engine compartment) through the delivery hose (2) sends it under pressure through hose (6) to the distribution valve located on the steering box (5). The distribution valve, connected by hose (4) to the reservoir permits the fluid to return in output from the operating cylinder to the reservoir itself.

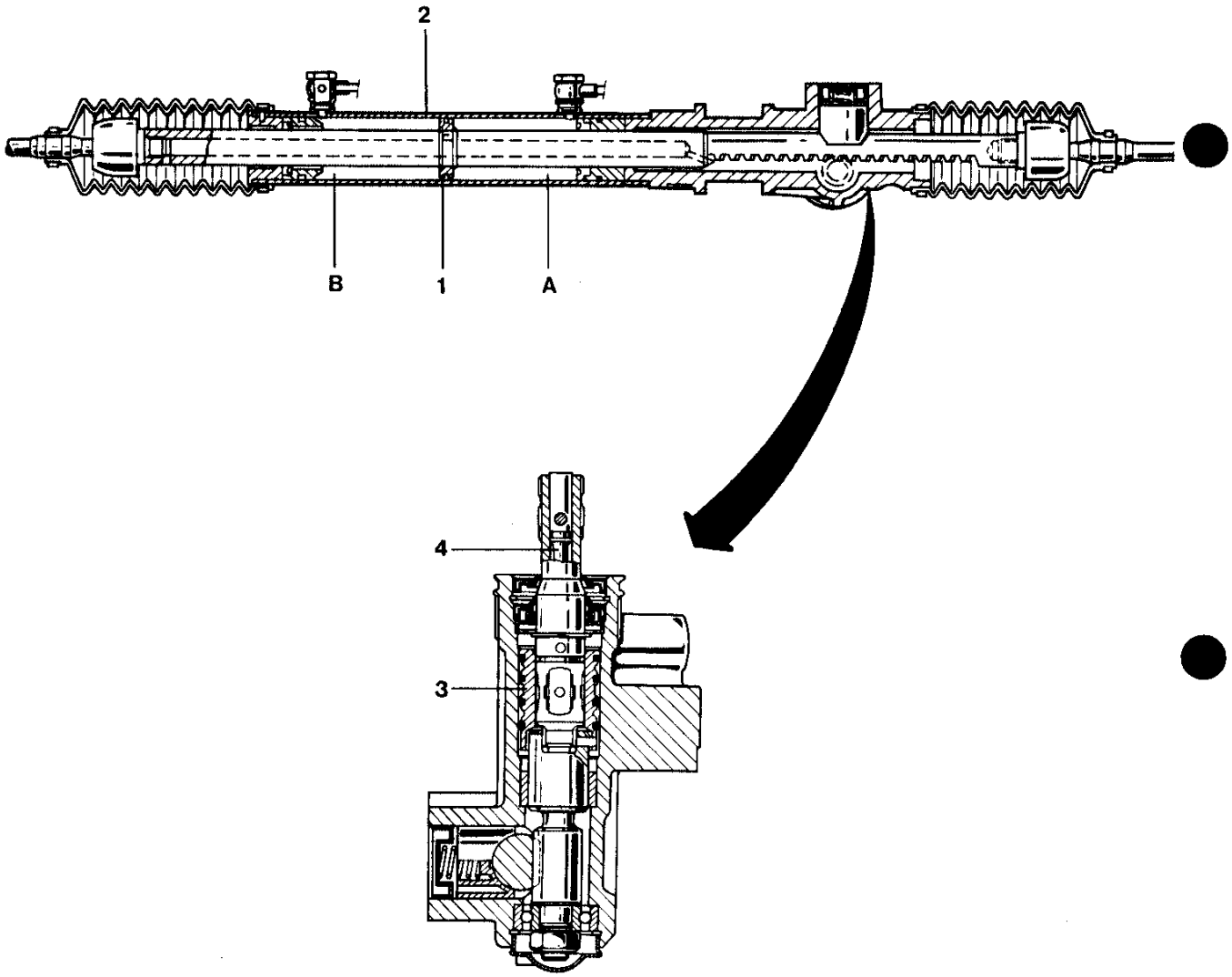


1. Pump
2. Hose carrying fluid to pump
3. Reservoir
4. Hose returning fluid to reservoir
5. Steering box
6. Hose carrying pressurized fluid

The steering box assembly is similar to the traditional mechanical rack steering box apart from the following:

- an operating cylinder (2) has been integrated with the steering box with a double action piston (1) machined onto the rack rod;
- a distribution valve (3) with relative ducts is located in the worm screw seating and is controlled by a torsion device (4) located at the tip of the worm screw.

Depending on the torsion transmitted by the steering wheel to the device, the fluid from the pump is sent to the reservoir or to one of the two chambers A or B of the operating cylinder. Force generated by the fluid pressure on the lateral surface of the piston determines its movement and hence of the rack.



1. Double action piston
2. Operating cylinder
3. Distribution valve
4. Torsion device

A. Right-hand chamber of the operating cylinder
B. Left-hand chamber of the operating cylinder

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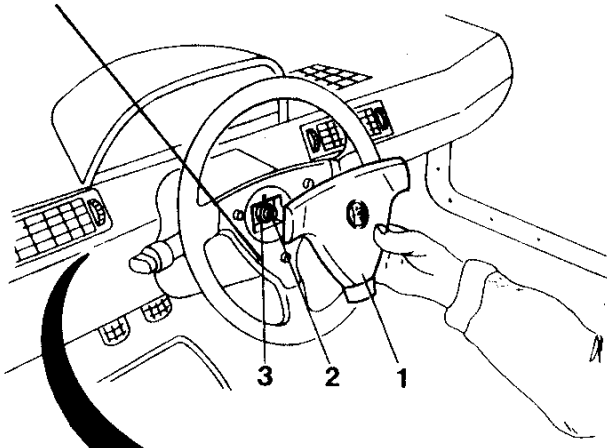
STEERING WHEEL

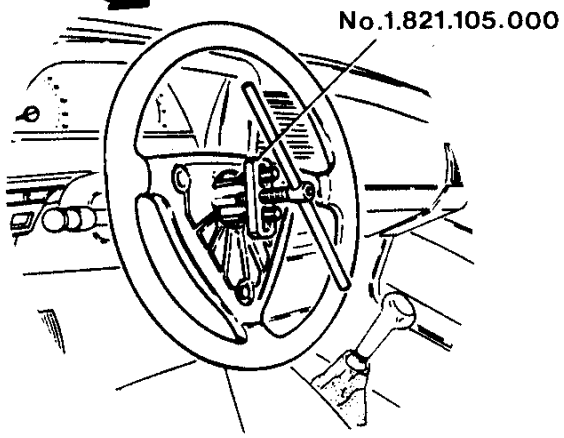
Removal and refitting

1. Using a screwdriver as a lever remove the horn button.
2. Disconnect the electrical wiring underneath.
3. Unscrew the nut securing the steering wheel.
4. Using tool No. 1.821.105.000 remove the steering wheel from the pin on the steering column.

Refit by reversing the procedure followed for removal and tighten the nut to the correct torque and position the steering wheel so that it is in the position shown in the illustration when the wheels are straight.

52.5 ÷ 42.5 Nm
(5.3 ÷ 4.4 kgm)

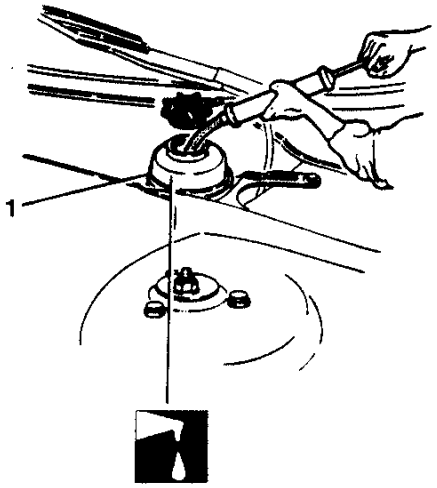




STEERING BOX

Removal and refitting

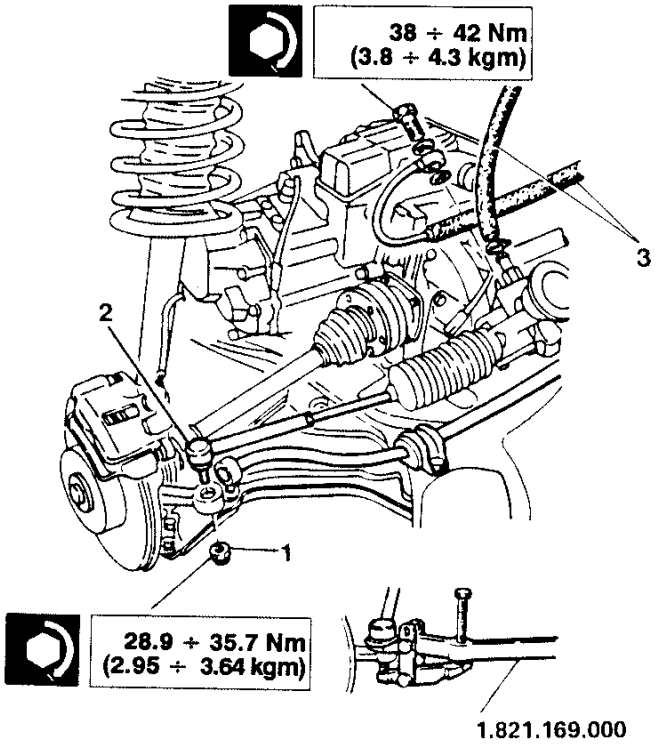
1. Using a syringe, empty the power steering fluid reservoir.



1. Unscrew the nut securing the tie-rod ball joint to the wheel hub.
2. Using tool No. 1.821.169.000 disconnect the ball joint from the hub.

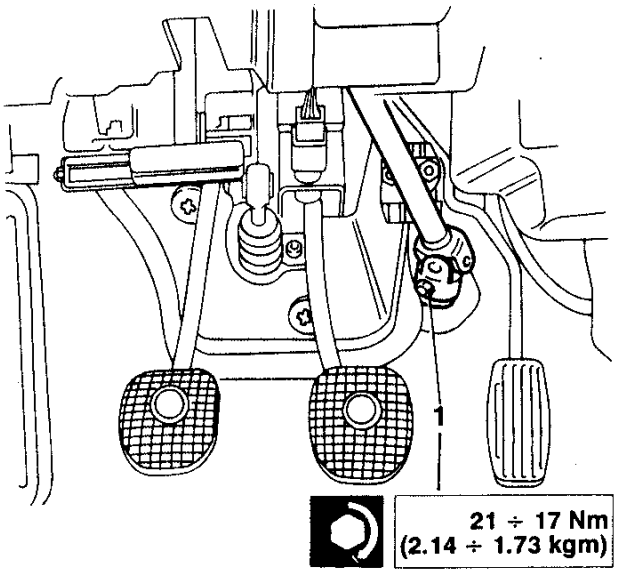
– Place a container under the vehicle.

3. Unscrew the connections from the delivery and return hoses connected to the steering box and let the fluid drain off for at least five minutes.

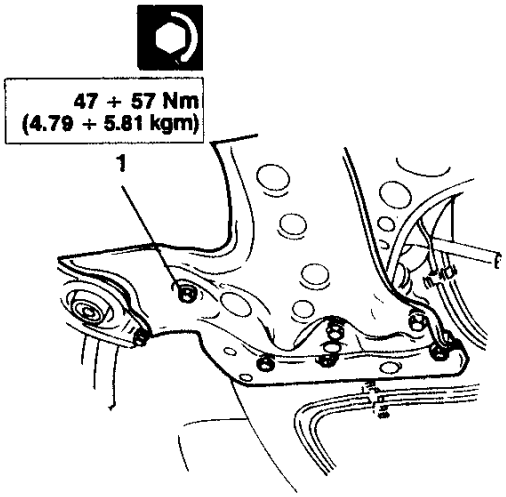


– (only for 1.8 - 2.0 T.S.) disconnect the speed engagement tie-rods (see: GR. 13 - GEARBOX OUTER LINKAGE).

1. Working from within the vehicle, unscrew the bolt securing the lower section of the steering column to the steering box pinion.



1. Loosen the two screws securing the steering box to the front crossmember.



– Remove the front crossmember (see: GR. 21 - FRONT CROSSMEMBER AND ANTIROLL BAR) and remove the steering box.

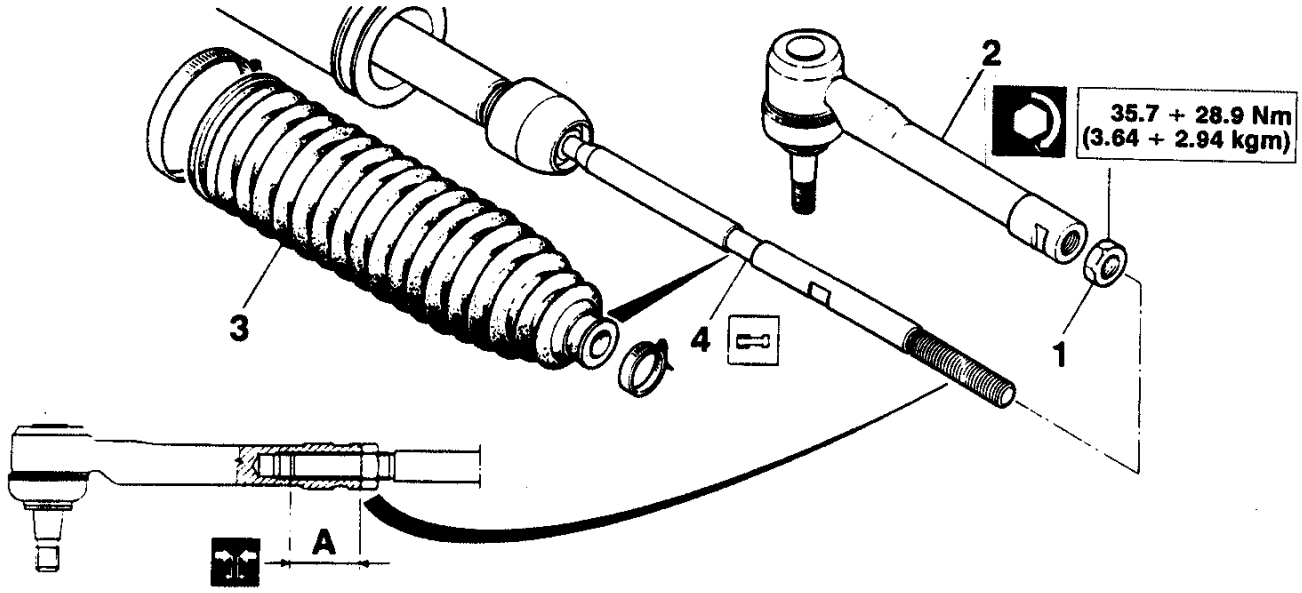
Refit by reversing the procedure followed for removal and tighten the nuts, screws and bolts to the correct torque. Ensure that the reservoir has been topped up with the specified fluid and check the sealing after connecting the hoses.

Disassembly and reassembly

1. Loosen the counternut securing the lateral tie-rod.

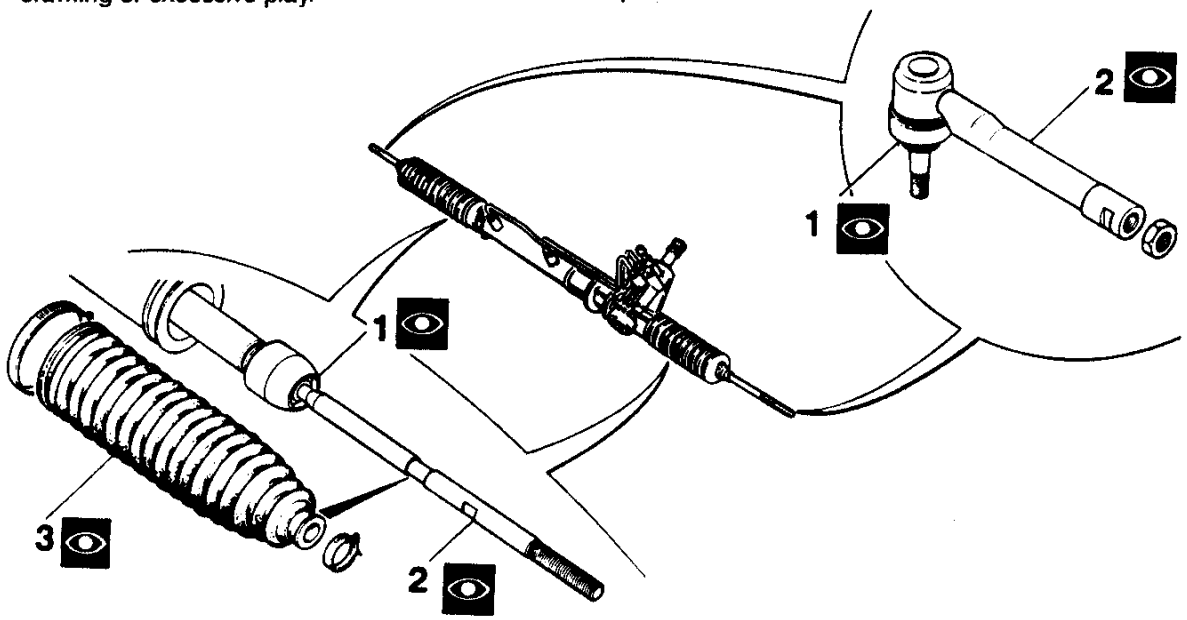
NOTE: Before proceeding to the next stage measure value "A" shown in the illustration in order to carry out the successive installation correctly.

2. Loosen the lateral tie-rod and remove it from the arm.
3. Loosen the clamps and remove the bellows.
4. Refit by tightening the counternut to the correct torque ensuring that the contact surfaces between the bellows and the shaft are lubricated with silicone grease. When the clamp is installed and closed to the second or third from last tooth, this will enable the lateral arm to rotate freely in the bellows.



Checks and inspections

1. Check that the ball joints are not damaged or worn and that they rotate freely in their seating without crawling or excessive play.
2. Check that the lateral tie-rods are not damaged or deformed.
3. Ensure that the rubber bellows is not damaged.

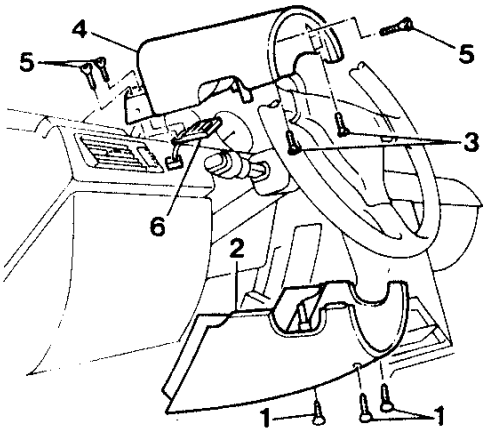


STEERING COLUMN

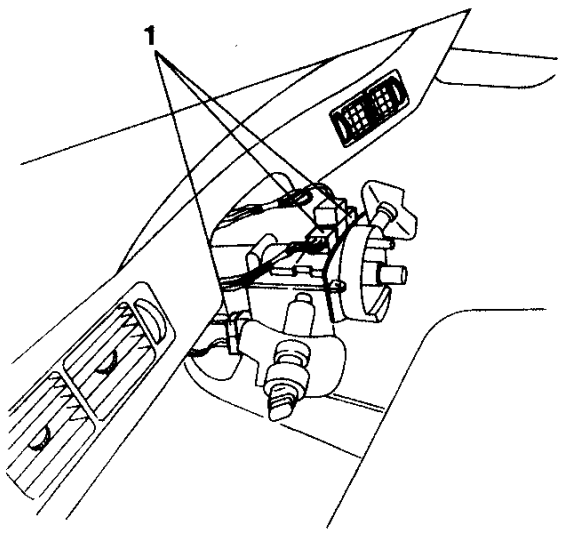
Removal and refitting

– Remove the steering wheel (see: STEERING WHEEL - Removal and refitting).

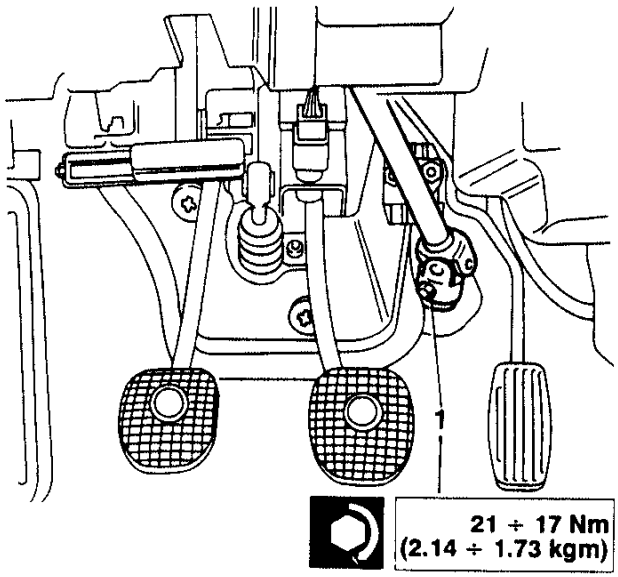
1. Loosen the three lower screws securing the lower steering column cover.
2. Remove the steering column cover.
3. Loosen the two screws securing the upper steering column cover.
4. Remove the upper steering column cover.
5. Loosen the three screws securing the rheostat to the steering column cover.
6. Remove the rheostat and disconnect the relative connector.



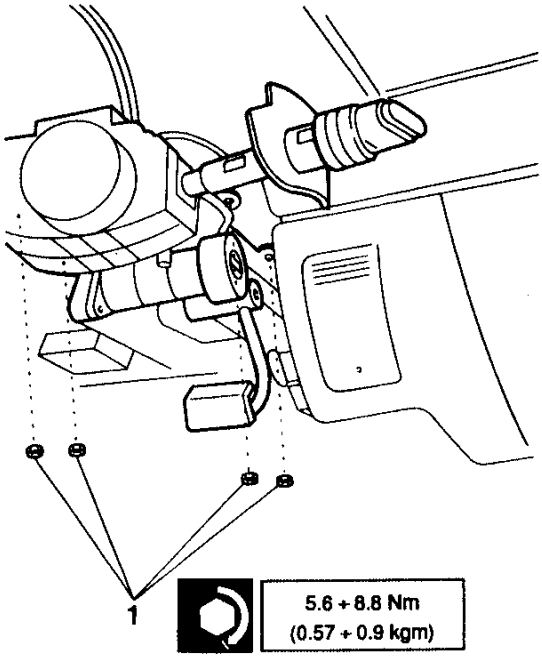
1. Disconnect the connectors from the hazard warning light switch and the ignition block and switch.



1. Loosen the bolt securing the lower section of the steering column to the steering box pinion.



1. Loosen the four nuts securing the steering column to the body and remove the column.

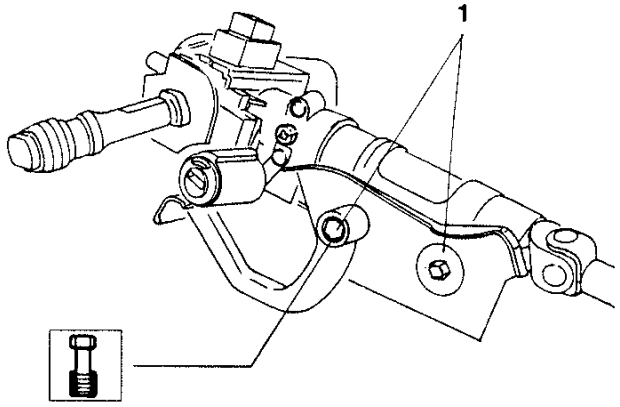


Refit by reversing the procedure followed for removal and tighten the nuts, screws and bolts to the correct torque. Ensure that the connectors are attached correctly.

Disassembly and reassembly

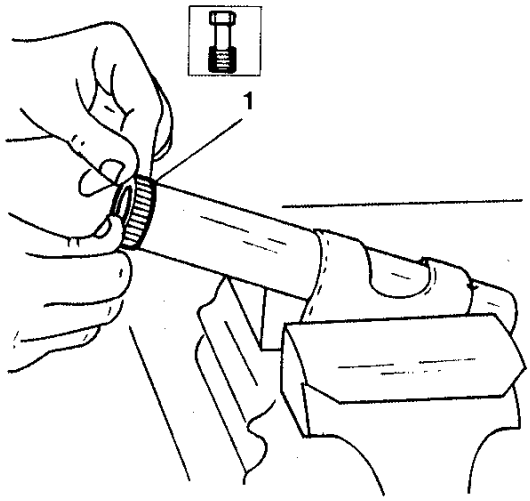
1. Using a vice, unscrew the nuts securing the steering height adjustment lever to the support and remove the lever and pins from the steering column.

25.2 ÷ 20.4 Nm (2.5 ÷ 2.1 kgm)



- Remove the stalk unit from the steering column (see: REPAIR MANUAL - BODY - GR. 40).

1. Straighten the caulking on the lower part of the support and withdraw the roller bearings.



Refit by reversing the procedure followed for removal and tighten the nuts, screws and bolts to the correct torque. Grease the steering height adjustment lever and the roller bearing seats on the steering column support using the specified grease.

Checks and inspections

- Check that there is no play between the the upper steering shaft and the relative bushings and that the shaft is centered correctly.
- Check that there is no excessive play on the crosses of the Cardan joints.
- Check that the teeth of the grooving are not damaged or excessively worn.

POWER STEERING PUMP

Removal and refitting

- Remove, refit and tighten the belt as indicated in the engine group (see: REPAIR MANUAL - ENGINES - GR. 01).

Checks and inspections

WARNING:
The power steering pump, like the steering box, cannot be disassembled into its component parts and should be sent to the manufacturer for overhauling.

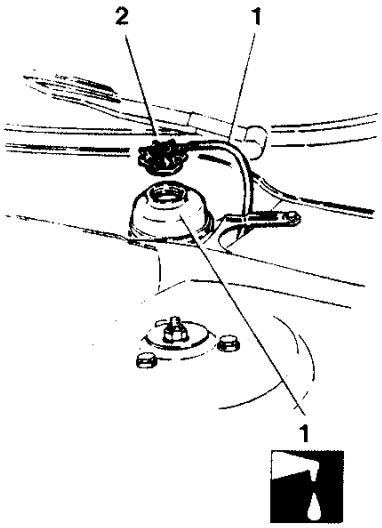
- Check the rolling torque of the steering wheel when the vehicle is stationary and the engine running. The torque must be between 0.6 daN with the engine at idle speed and 0.75 daN with the engine at maximum. If these limits are exceeded check the pressure in the system with the wheels completely turned. Insert a pressure gauge using a suitable "T" connection, on the pressurized fluid delivery hose coming from the pump and turn the steering wheel fully in one direction or the other. Further forcing the steering wheel the pressure indicated by the pressure gauge should rise to about 85 bars. If this does not happen either the fluid pump or the distribution valve of the steering box is not functioning correctly.

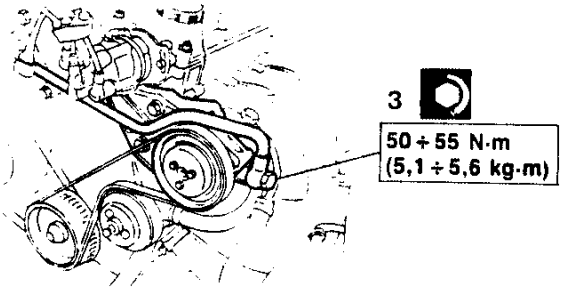
REFILLING HYDRAULIC SYSTEM AND AIR BLEED

1. Disconnect the reservoir breather pipe.
2. Remove the cap and refill the reservoir with the specified fluid.
3. Loosen the intake funnel on the pump until fluid begins to flow out and then tighten to the correct torque.

WARNING:
The power steering system is self-bleeding. The air bleed can be carried out by turning the steering wheel fully to the right and left with the engine running and the vehicle stationary. This operation must be carried out each time the hoses are disconnected and reconnected.

– With the engine running at idle speed, ensure that the reservoir does not empty. Turn the steering wheel fully to the right and to the left to bleed the system. Refill the reservoir to the maximum level mark.

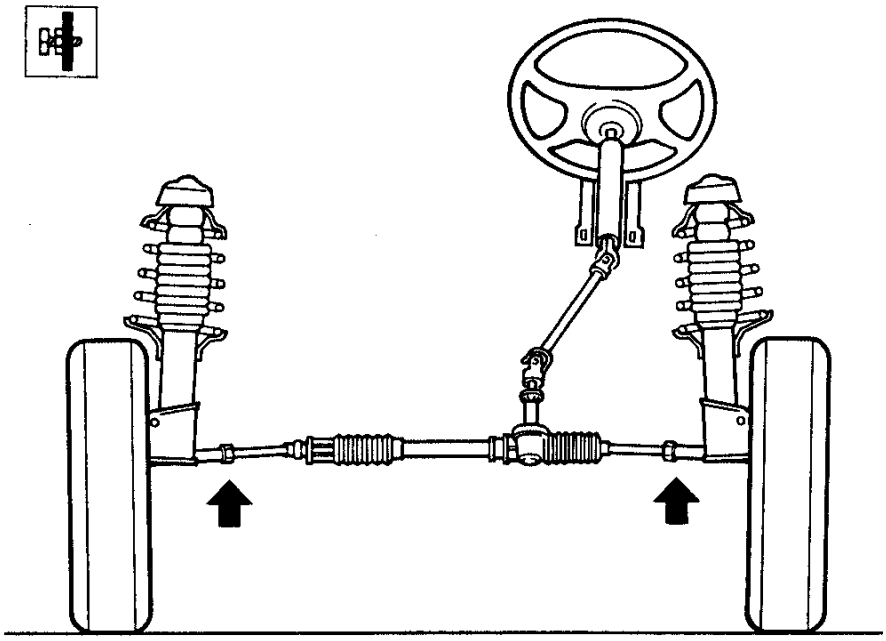




NOTE: A stiffening of the steering may be due to the sliding of the pump drive belt or to low fluid level. If the pump, cylinder or distribution valve ceases to work, the power steering system will operate as a simple mechanical steering box.

FRONT WHEEL ALIGNMENT

The front wheel alignment is carried out by loosening the nut securing the tie-rod and screwing or unscrewing the tie-rod itself, without altering the position of the steering wheel rungs, until the correct alignment is obtained (see: GR. 21 - TECHNICAL CHARACTERISTICS AND SPECIFICATIONS).



TECHNICAL CHARACTERISTICS AND SPECIFICATIONS

GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

APPLICATION	TYPE	NAME
Refilling power steering system	OIL	TUTELA GI/A
Steering wheel height adjustment lever	GREASE	TUTELA Jota 1X
Seatings of roller bushings on steering column support	GREASE	SPCA Spagraph ISECO Ergon Rubber Grease REINACH Sferal B2 AR

TIGHTENING TORQUES

Description	kg·m	N·m
Self-braking nut securing steering wheel to column	5.3 - 4.4	52.5 - 42.5
Self-braking nut securing steering tie-rod spherical pin to wheel support	2.95 - 3.64	28.9 - 35.7
Power steering fluid delivery and return hose connection funnel	3.8 - 4.3	38 - 42
Bolt securing steering column to power steering pinion	2.14 - 1.73	21 - 17
Screw securing steering box to front crossmember	4.79 - 5.81	47 - 57
Nut for securing lateral tie-rod	3.64 - 2.94	35.7 - 28.9
Nuts securing steering column to body	0.57 - 0.9	5.6 - 8.8
Nut securing adjustable guide	2.5 ÷ 2.1	25.2 - 20.4
Screw securing steering column to support	2.5 - 2.1	25.2 - 20.4
Funnel of fluid hose from reservoir to pump (on pump)	5.1 - 5.6	50 - 56

SPECIFIC TOOLS

TOOL NUMBER	DESCRIPTION
1.821.105.000	Puller for steering wheel
1.821.169.000	Puller for lateral tie-rod pin

FAULT DIAGNOSIS AND CORRECTIVE ACTION

PRELIMINARY CHECKS:

- Check tyre pressure and wear
- Check wheel attitude and characteristic angles
- Position vehicle on level, dry surface with engine at idle rpm

SYMPTOMS AND ANOMALIES	CHECK	TEST REFERENCE
LOW RESERVOIR LEVEL/LEAKS	Visible leaks are generally present in connection with the various components and hoses of the power steering system, resulting in a decrease in the level of fluid in the reservoir	A
GRADUAL STIFFENING OF THE STEERING ACTION	As the steering angle increases the steering action becomes stiffer	B
SUDDEN STIFFENING OF STEERING ACTION	Sudden stiffening of steering action during normal operation of steering	C
NOISE/KNOCKS DURING STEERING ACTION		D
CONTINUOUS NOISE		E
DAMAGED STEERING BOX BELLOWS		F
NOISY INTERMEDIATE STEERING SPINDLE		G
NOISY STEERING COLUMN		H
DIFFICULT SLIDING OR MISSED LOCKING OF STEERING COLUMN		I

DIAGNOSIS

LOW RESERVOIR FLUID LEVEL/LEAKS	TEST A

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
A1	CHECK STEERING BOX SEALING RINGS		
– Check steering box sealing rings for wear or damage		(OK) ▶ (OK) ▶	Carry out step A2 Replace steering box
A2	VISUAL CHECK FOR OIL LEAKS		
– Check for leaks from steering box, pump or reservoir		(OK) ▶ (OK) ▶	Carry out step A3 Tighten fittings to prescribed torque; replace fitting seals if necessary
A3	CHECK PUMP SEALING RINGS		
– Check pump shaft sealing rings for wear or damage		(OK) ▶	Replace power steering pump

GRADUAL STIFFENING OF STEERING ACTION	TEST B

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
B1 CHECK DISTRIBUTOR VALVE – Check distributor for damage and efficiency of seals	OK ▶ OK ▶	Carry out step B2 Replace steering box
B2 CHECK FOR OIL LEAKS – Check steering box for oil leakage	OK ▶ OK ▶	Carry out step B3 Replace steering box
B3 CHECK SYSTEM PRESSURE – Check that pump supply pressure does not fall below 49.7 psi (3.5 bars) with steering in neutral position	OK ▶ OK ▶	Carry out step B4 Replace power steering pump
B4 CHECK PUMP BELT – Check pump drive belt is not loose, damaged or broken	OK ▶	Restore belt to correct tension; replace belt if necessary

SUDDEN STIFFENING OF STEERING ACTION	TEST C

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
C1	CHECK HOSES	OK ▶	Replace affected hoses
– Check hoses for breakage			

NOISE/KNOCKING DURING STEERING OPERATION	TEST D

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
D1 CHECK OIL LEVEL – Check level of oil in circuit	OK ▶ OK ▶	Carry out step D2 Top-up oil to correct level
D2 CHECK FOR TRAPPED AIR IN THE SYSTEM – Check for presence of air in the system	OK ▶ OK ▶	Carry out step D3 Bleed system by rotating the steering wheel several times to end of travel in both directions; if noise is still present replace steering box
D3 CHECK RESERVOIR FILTER – Check reservoir filter for excessive dirt or obstruction	OK ▶ OK ▶	Carry out step D4 Replace reservoir
D4 CHECK ATTACHMENTS – Check steering component attaching screws for looseness	OK ▶ OK ▶	Carry out step D5 Tighten screws to prescribed torque
D5 CHECK RODS AND JOINTS – Check steering rods or spherical joints for damage or wear	OK ▶	Replace rods or joints

CONTINUOUS NOISE	TEST E

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
E1	CHECK PUMP		
– Disconnect belt from steering pump and note whether noise is still present		OK ▶	Replace pump

DAMAGED STEERING BOX BELLOWS	TEST F

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
F1	CHECK BELLOWS	OK ▶	Replace bellows
– Check steering box bellows for damage or aging			

NOISY INTERMEDIATE STEERING SPINDLE	TEST G

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
G1	CHECK UNIVERSAL JOINTS		
– Check intermediate steering spindle universal joint spiders for excessive play		OK ▶ OK ▶	Carry out step G2 Replace intermediate steering spindle
G2	CHECK SPLINED COUPLING		
– Check splined coupling of steering column and intermediate steering spindle for excessive play		OK ▶	Replace faulty parts

NOISY STEERING COLUMN	TEST H

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
H1 CHECK BEARINGS – Check steering column support bearings for wear or damage	OK ▶ OK ▶	Carry out step H2 Replace affected bearings
H2 CHECK STEERING COLUMN – Check steering column for interference with multiple switch shells	OK ▶ OK ▶	Carry out step H3 Correctly install multiple switch shells
H3 CHECK JOINT ATTACHMENTS – Check universal joint attachment nuts at ends of spindle for proper torque	OK ▶	Torque nuts to prescribed values

DIFFICULT SLIDING OR MISSED LOCKING OF STEERING COLUMN	TEST I

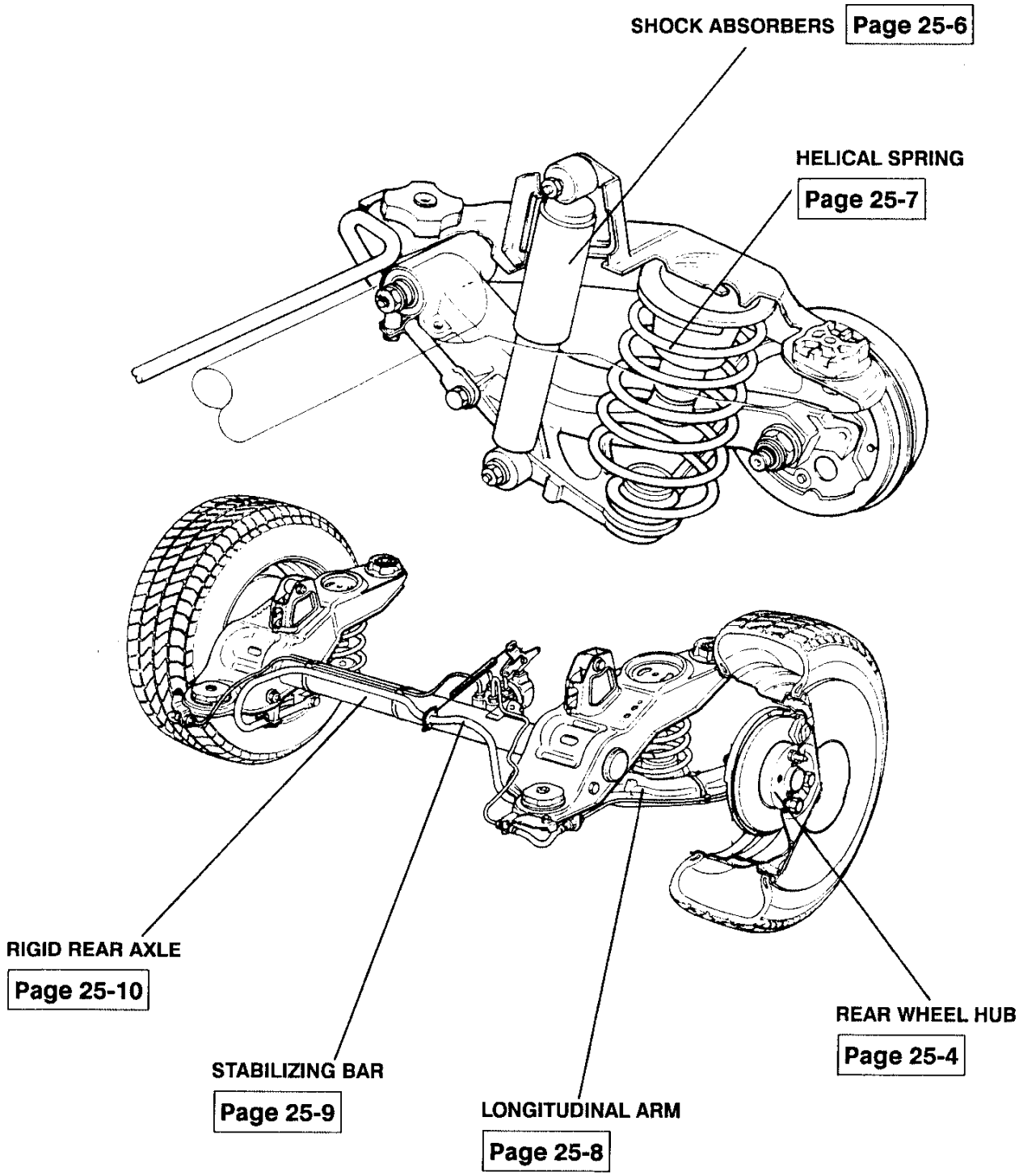
TEST PROCEDURE		RESULT	CORRECTIVE ACTION
I1	CHECK STEERING COLUMN SUPPORT ATTACHMENT		
– Check for excessive torque of steering column to car body attachment screw		OK ▶ OK ▶	Carry out step I2 Re-torque screw to correct value
I2	CHECK ADJUSTMENT LEVER ATTACHMENT		
– Check steering wheel axial adjustment lever attaching nut for excessive torque		OK ▶ OK ▶	Carry out step I3 Re-torque nut to correct value
I3	CHECK LUBRICATION OF SPLINED COUPLING		
– Check for proper lubrication of splined coupling of steering column and intermediate steering spindle		OK ▶	Lubricate splined coupling as required

GROUP 25

REAR SUSPENSION

INDEX

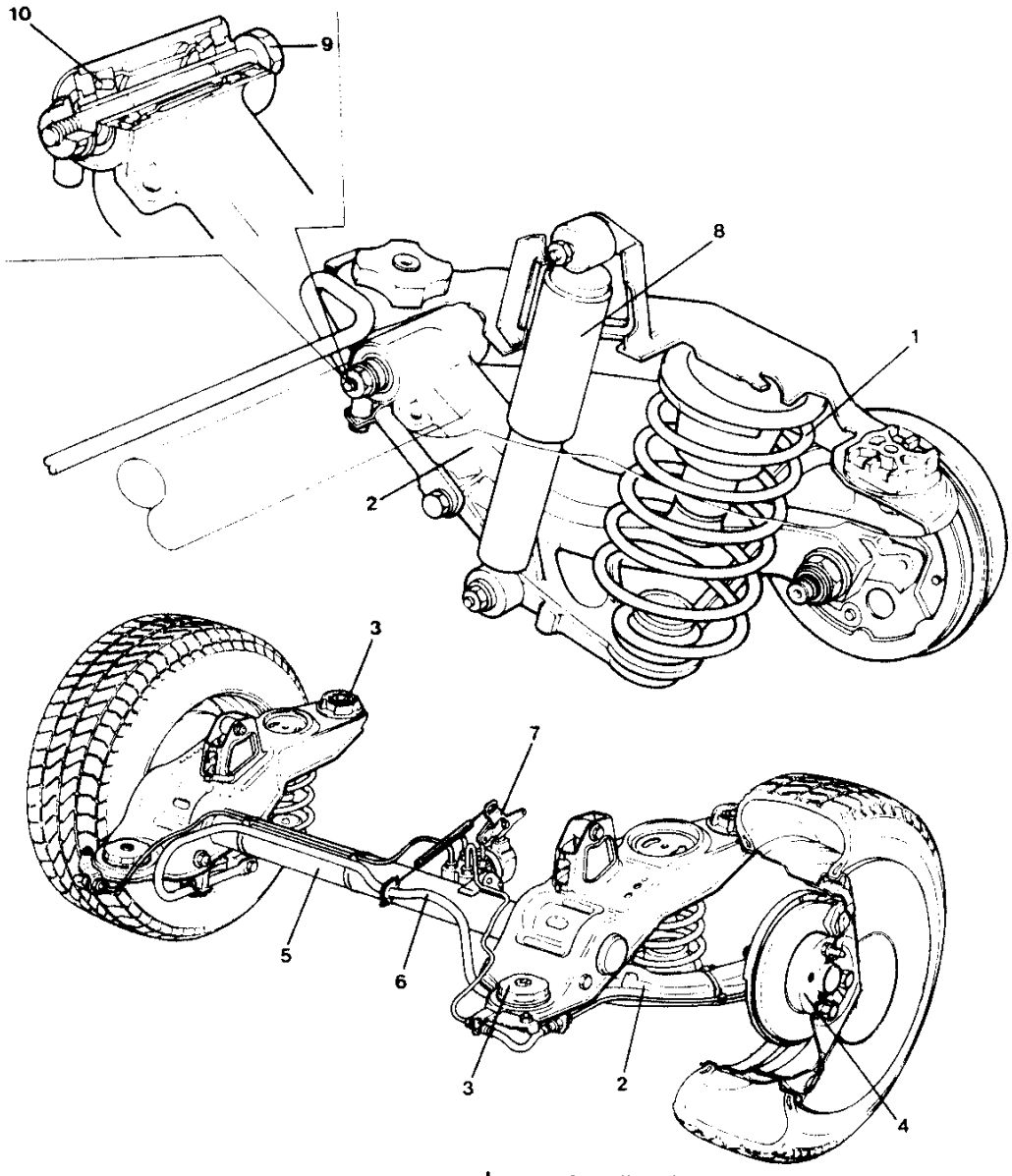
ILLUSTRATED INDEX



REAR SUSPENSION

DESCRIPTION

The rear suspension, of the independent wheel type with longitudinal swinging arms, has been significantly reduced in size enabling as a consequence, the adoption of a particularly low and wide luggage compartment. This type of suspension is common to all the vehicles in the 167 range. For the models equipped with controlled damping suspension, variable "setting" shock absorbers have been adopted (see: CONTROLLED DAMPING SUSPENSION) though the overall structure of the assembly remains unaltered.



1. Helical spring
2. Swinging arm
3. Flexible plug
4. Wheel hub
5. Rear rigid axle
6. Stabilizer bar
7. Braking regulator
8. Shock absorber
9. Screw securing swinging arm
10. Tapered roller bearings

The inherent problem with this type of suspension, is that the wheels vary their inclination in accordance with the rolling of the vehicle. This has been resolved by the integration of a stabilizing bar 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 secured to the body by flexible plugs (3).
- Swinging arms (2) integrated with the axle by screws (9) and hinged on the tapered roller bearings (10). They support the wheel hub (4) and the parts of the braking system.
- A stabilizing bar (6) which, connected to the swinging arms, limits the transversal inclination of the vehicle and by its own rotation also controls the operation of the braking distributor (7) which is also connected to it.
- Helical springs (1) which limit the thrust on the shock absorber strut.
- Shock absorbers (8) which are pressurized with lamellar intake valves and ensure a high degree of driving comfort.

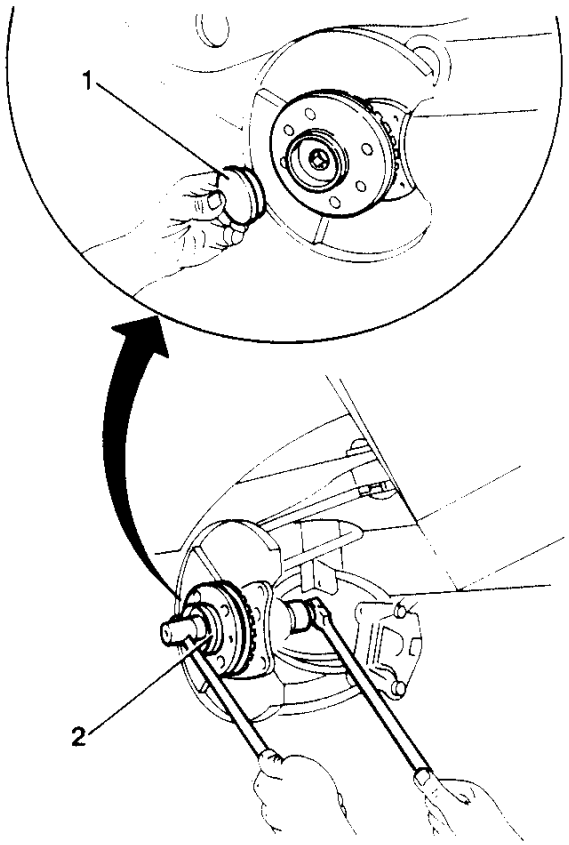
REAR WHEEL HUB

REMOVAL

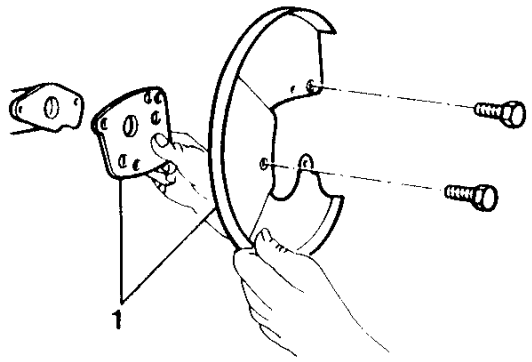
- Remove the rear wheel
- Remove the rear brakes together with calipers and discs (see: GR. 22 - REMOVING AND REFITTING REAR BRAKES)

1. Remove the dust guard from the rear spindle.
2. Unscrew the nut securing the spindle and remove the wheel hub and pin.

NOTE: For models equipped with an ABS system the wheel hub includes the phonic wheel.



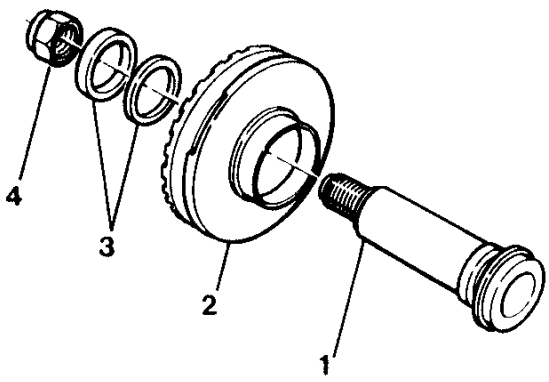
1. If necessary loosen the screws securing the brake disc protective sheet to the suspension arm and remove it together with the underlying stiffening plate.



CHECKS AND INSPECTIONS

WARNING:
The nut securing the spindle must be substituted when the pin is refitted.

1. Check the spindle for wear, cracks and deformation. Replace it if necessary.
2. Check that the wheel bearings machined onto the inside of the hub are not worn. If excessive play is found or the assembly is excessively noisy substitute the entire hub.
3. Check the spacers for wear and replace if necessary.
4. Substitute the nut securing the wheel hub.

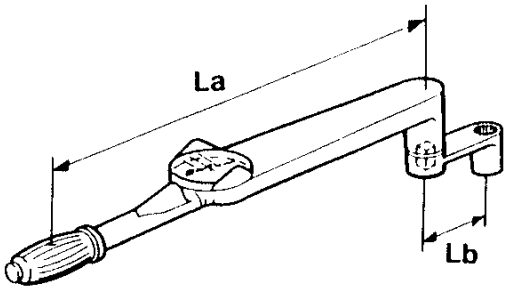


REFITTING

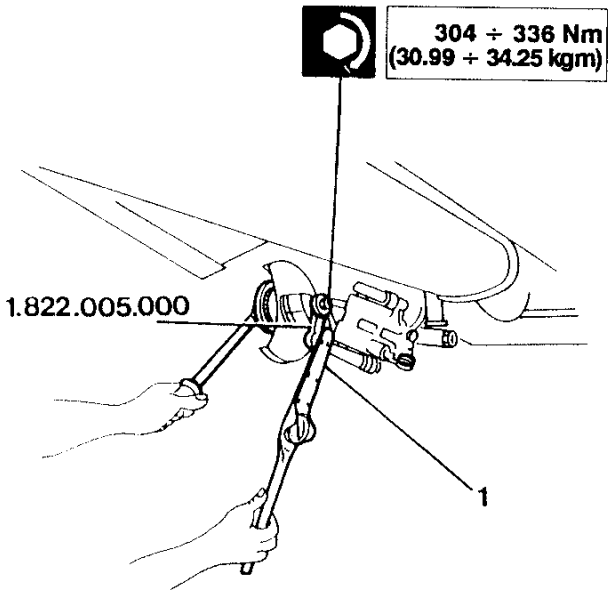
NOTE: Using spanner No.1.822.005.000 coupled with a dynamometer spanner, the tightening torque is altered and the real torque must be calculated by applying the following formula:

$$\frac{La \times Cn}{La + Lb} = Cr$$

where:
La = Length of the dynamometer spanner (in metres)
Lb = Length of spanner No. 1.822.005.000 (in metres)
Cn = Nominal torque (in Nm)
Cr = Real closing torque (in Nm)



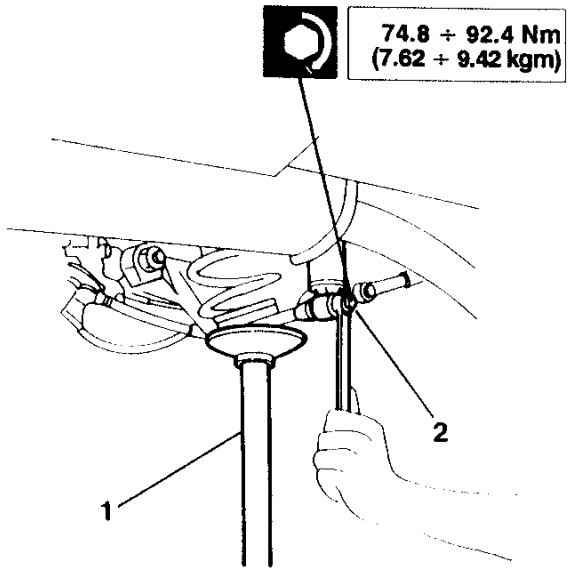
1. Refit by reversing the procedure followed for removal and using the spanner extension No. 1.822.005.000 together with a dynamometer spanner tighten the nut securing the wheel hub (taking the nominal torque into account) to the previously calculated real torque.



SHOCK ABSORBERS

REMOVAL AND REFITTING

– Remove the wheel.
1. Using a hydraulic jack placed under the longitudinal arm of the suspension, pre-load the spring.
2. Unscrew and remove the lower nut securing the shock absorber to the longitudinal arm of the suspension.

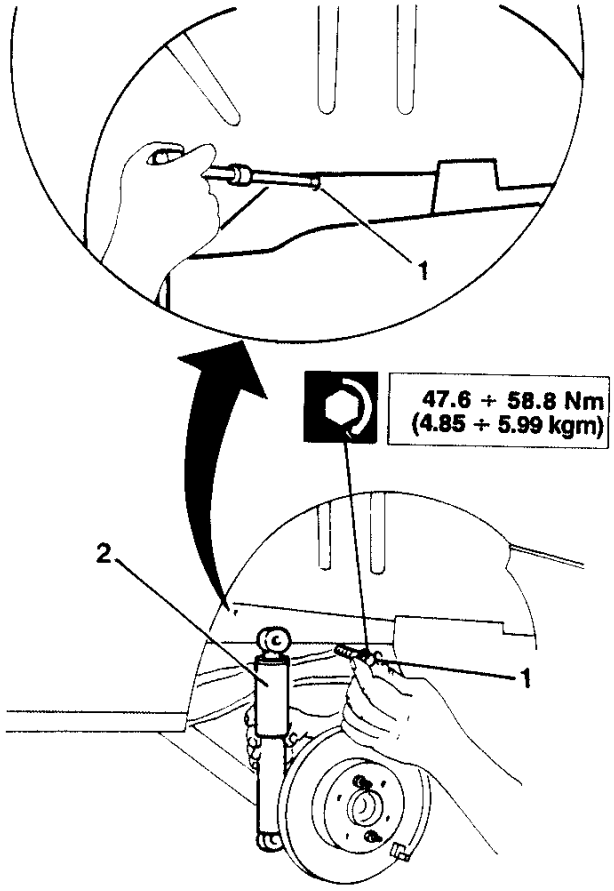


– Remove the protective cap covering the access hole containing the screw securing the shock absorber.

1. Working through the wheel arch unscrew through the hole in the body, the upper screw securing the shock absorber.

NOTE: **As the body is boxed around the area affected by the operation pay particular attention to avoid letting the screw fall inside the compartments.**

2. Remove the shock absorber.



Refit by reversing the procedure followed for removal and tighten the screw to the correct torque paying close attention in order to prevent the screw from falling into the boxed parts.

CHECKS AND INSPECTIONS

– Check that the shock absorbers are working correctly and are not leaking oil. If any faults are detected replace the shock absorber.

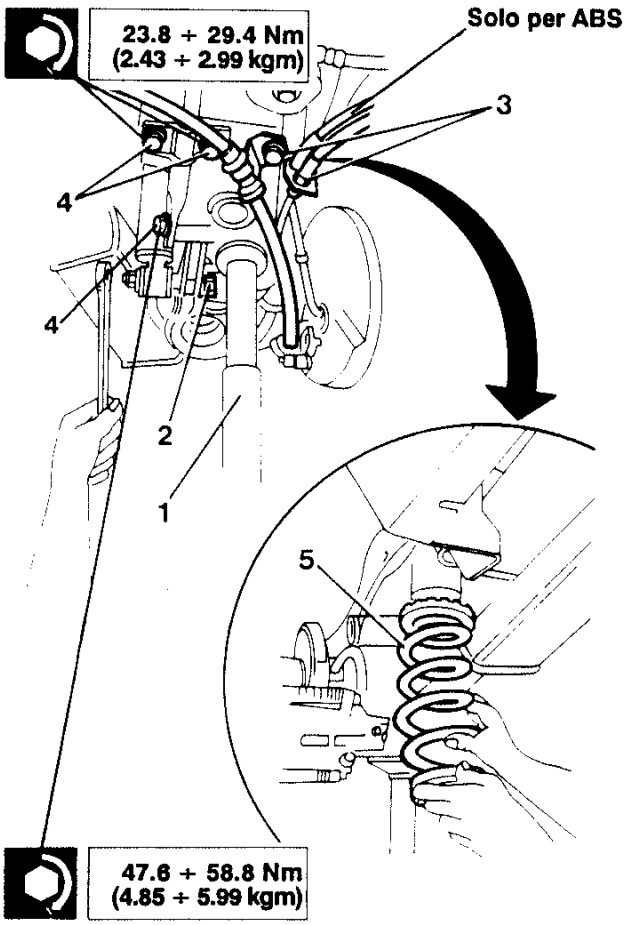
HELICAL SPRING

REMOVAL AND REFITTING

1. Using a hydraulic jack pre-load the suspension arm.
2. Remove the lower part of the shock absorber after unscrewing and removing the retaining nut.
3. Loosen the screws securing the brake lines and handbrake cable supporting brackets.

NOTE: **On models fitted with ABS, the brackets mentioned above also support the r.p.m. sensor wiring.**

4. Loosen the screws securing the stabilizing bar to the swinging arm so that the arm can be lowered.
5. Lower the hydraulic jack and remove the spring together with the stop-limit buffers underneath.



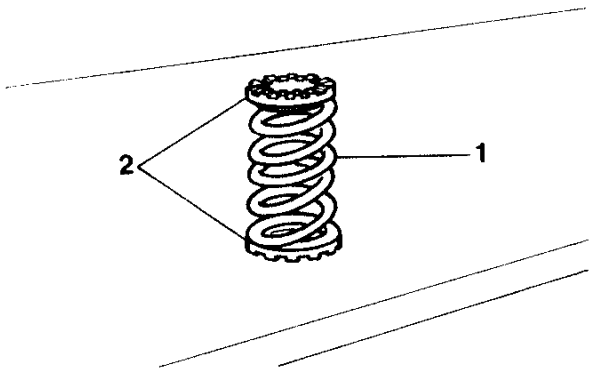
Refit by reversing the procedure followed for removal and tighten the screws to the correct torque.

CHECKS AND INSPECTIONS

1. Visually check that the springs are not cracked, deformed or generally defective.

NOTE: **The helical springs are divided into classes and marked with coloured paint. If one or both of the springs is removed check that the new spring(s) have the same colour code as the old ones.**

2. Check the rubber elements for damage. If they are deformed, obviously worn are in any way damaged they must be replaced.

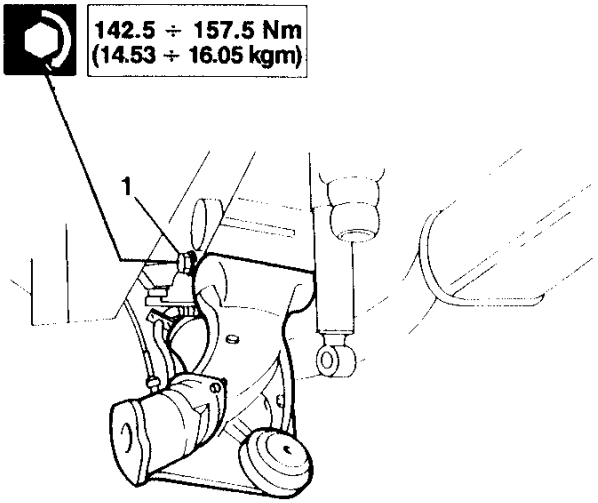


LONGITUDINAL ARM

REMOVAL AND REFITTING

- Remove the rear brakes (see: GR. 22 - REAR BRAKES - Removal and refitting).
- Remove the wheel hub (see: REAR WHEEL HUB - Removal and refitting).
- disconnect the shock absorber from the longitudinal arm by unscrewing the lower retaining nut (see: SHOCK ABSORBER - Removal and refitting).
- Remove the helical spring (see: HELICAL SPRING - Removal and refitting).

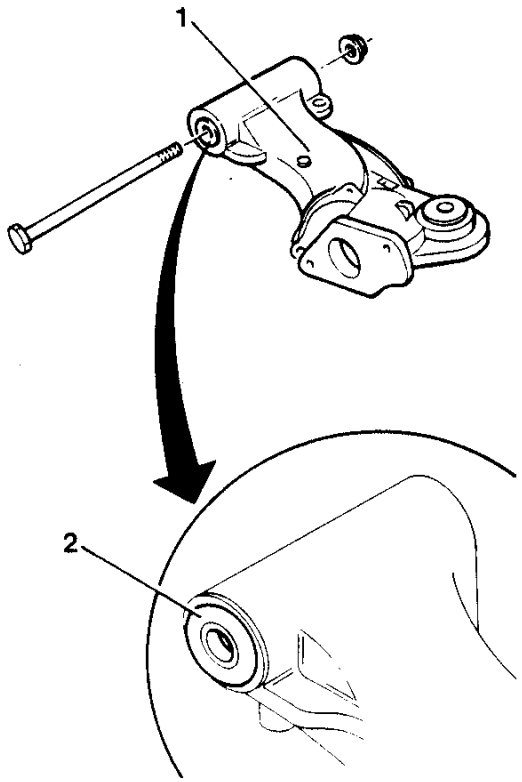
1. Unscrew the bolt securing the longitudinal arm to the rear axle and remove the arm.



Refit by reversing the procedure followed for removal and tighten the bolt securing the longitudinal arm to the correct torque. Take note of the indications given in the preceding paragraphs relative to the refitting operations.

CHECKS AND INSPECTIONS

1. Visually check that the longitudinal arm is not cracked, deformed or worn on the surfaces of the wheel side.
2. Check the state of the bearings and spacer. If there is excessive noise or play replace the swinging arm.

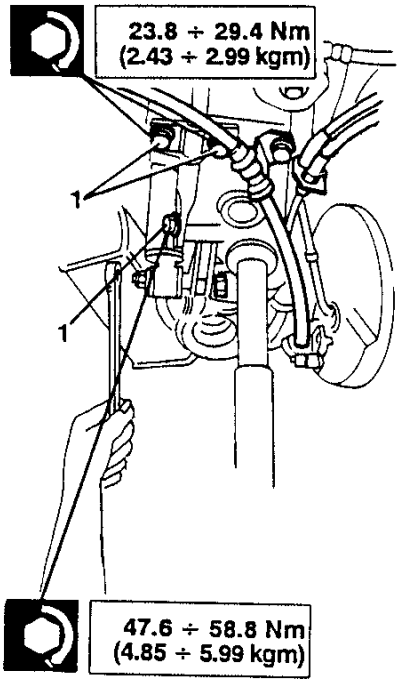


STABILIZING BAR

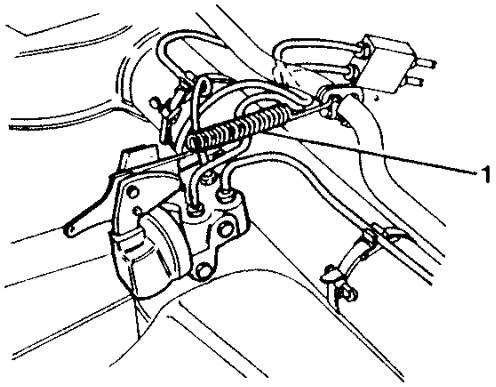
REMOVAL AND REFITTING

- Remove the rear section of the exhaust pipe (see: REPAIR MANUAL - ENGINES - GR. 04).
- Remove the fuel tank (see: REPAIR MANUAL - ENGINES - GR. 04).

1. Loosen the three screws securing the stabilizing bar to the longitudinal arm on both sides.



1. Disconnect the the spring operating the braking regulator from the stabilizing bar and remove the bar.



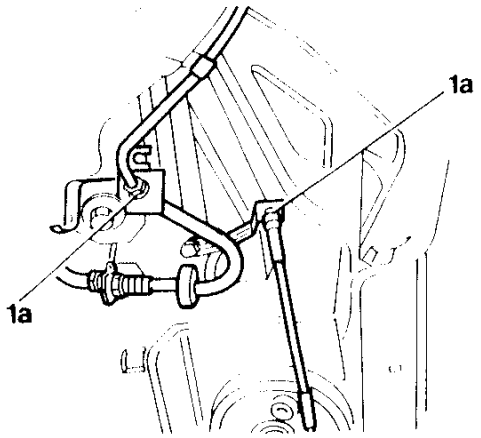
Refit by reversing the procedure followed for removal and tighten the screws to the correct torque. Take note of the information given previously regarding the specific techniques and devices to be used during the refitting operations and in particular adjust the braking regulator (see: GR. 22 - BRAKING REGULATOR - Adjustment).

RIGID REAR AXLE

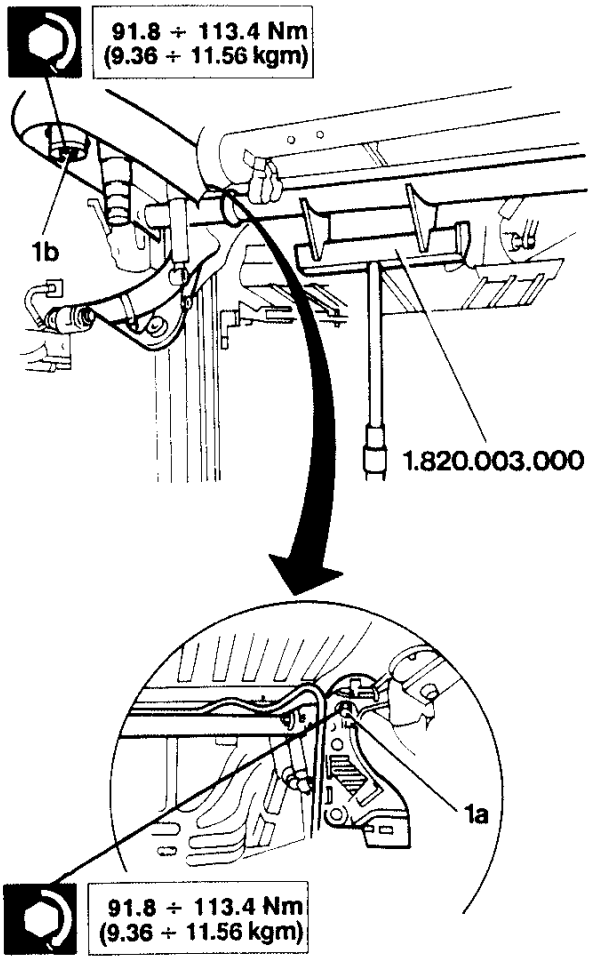
REMOVAL AND REFITTING

- Remove the rear section of the exhaust pipe (see: REPAIR MANUAL - ENGINES - GR. 04).
- Remove the fuel tank (see: REPAIR MANUAL - ENGINES - GR. 04).
- Disconnect the longitudinal arm by unscrewing the lower nut (see: SHOCK ABSORBER - Removal and refitting).
- Remove the helical spring (see: HELICAL SPRING - Removal and refitting).
- Disconnect the stabilizing bar from the longitudinal arm (see: HELICAL SPRING - Removal and refitting).

1. Disconnect the brake line support brackets (1a) (and for models fitted with ABS, the electrical wiring (1b) of the r.p.m. sensor) and move them to one side so that they do not obstruct the successive operations when removing the axle.



1. Place a hydraulic jack fitted with tool No. 1.820.003.000, under the rear axle and loosen the screws securing the front (1a) and rear (1b) flexible blocks to the body and, lowering the jack, remove the rigid rear axle.

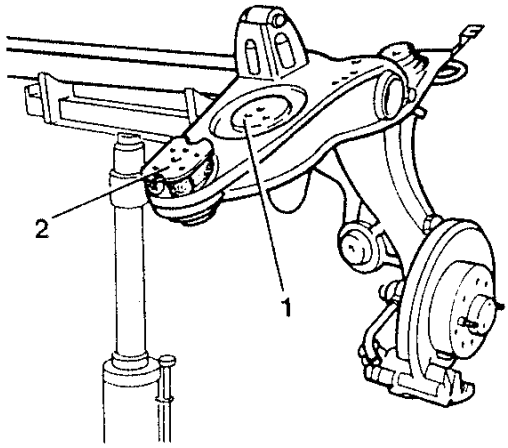


Refit by reversing the procedure followed for removal and tighten the screws securing the flexible blocks to the correct torque. Take note of the information given previously regarding the specific techniques and devices to be used during the refitting operations and in particular adjust the braking regulator (see: GR. 22 - ADJUSTMENT OF BRAKING REGULATOR).

CHECKS AND INSPECTIONS

1. Check that the rigid rear axle is not distorted or cracked and that there is no misalignment between the two lateral arms.
2. Check the condition of the stop-limit buffers.

– If any of the above faults are encountered substitute the entire axle.



TECHNICAL DATA AND SPECIFICATIONS

TECHNICAL DATA

Independent wheel suspensions, with longitudinal track rod arms, coil springs, hydraulic telescopic pressurized lamellar shock absorbers and stabilizer bar.

COIL SPRINGS

SPECIFICATIONS		All models
Inside diameter	(mm)	100
Outside diameter	(mm)	124.8
Wire diameter	(mm)	12.4
Number of turns		6.32
Direction		Right-handed
Free length	(mm)	305

SHOCK ABSORBERS

'95 Versions

Stroke	(mm)	160
Stem diameter	(mm)	11.5

Ather versions

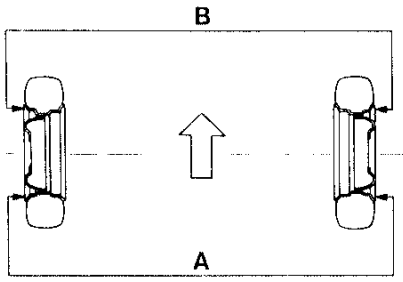
Stroke	(mm)	96.5
Outside diameter	(mm)	45.3

STABILIZER BAR

		'95 Versions	Other versions
Bar diameter	(mm)	17	19

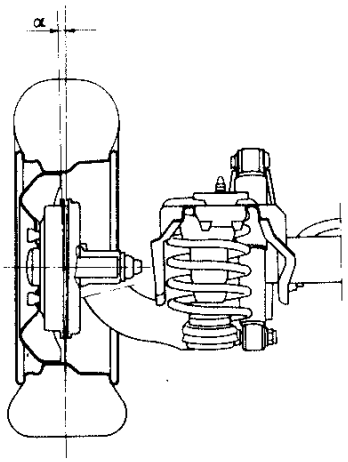
CHECKING AND ADJUSTMENT

SPRING CONTROL DATA

A-B	1.8 T.S./2.0 T.S./2.4 V6
	0.5 ± 2 mm * (characteristics not adjustable)

* Values measured with unladen vehicle in running order.

REAR WHEEL CAMBER ANGLE

	1.8 T.S./2.0 T.S./2.4 V6
	−1° ± 15' * (characteristics not adjustable)

* Values measured with unladen vehicle in running order.

TIGHTENING TORQUES

Description	N·m	kg·m
Hexagonal-head screw for securing front flexible anchor to body	91.8 ÷ 113.4	9.36 ÷ 11.56
Hexagonal-head screw for securing rear flexible anchor to body	91.8 ÷ 113.4	9.36 ÷ 11.56
Nut for screw securing rear suspension swinging arm to frame	142.5 ÷ 157.5	14.53 ÷ 16.05
Nut for screw securing lower shock absorber to suspension	74.8 ÷ 92.4	7.62 ÷ 9.42
Hexagonal-head screw for securing upper shock absorber to frame	47.6 ÷ 58.8	4.85 ÷ 5.99
Nut for stub-axle pin securing rear hub	304 ÷ 336	30.99 ÷ 34.25
Hexagonal-head screw for securing stabilizer bar to rear suspension arm	47.6 ÷ 58.8	4.85 ÷ 5.99
Hexagonal-head screw for securing stabilizer bar support connecting plate to rear suspension arm	23.8 ÷ 29.4	2.43 ÷ 2.99
Wheel screw (for versions with light alloy wheels)	83.3 ÷ 102.9	8.49 ÷ 10.49

SPECIFIC TOOLS

TOOL NUMBER	DESCRIPTION
1.820.003.000	Tool for removal/refitting rear axle
1.822.005.000	Spanner extension for tightening nut securing rear wheel hub

FAULT DIAGNOSIS AND CORRECTIVE ACTION

ANOMALIES AND SYMPTOMS	CHECK	TEST REFERENCE
KNOCKING	– Knocking on the rearcarriage while driving on rough roads (holes, hollows, asphalt rises, etc.)	A
CONSTANT NOISE	– Constant noise from rearcarriage while driving on a straight and even road; the noise increases as the speed of the vehicle increases.	B
VIBRATIONS	– Vibrations increase as vehicle speed increases	C

KNOCKING	TEST A

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
A1	CHECK SHOCK ABSORBERS		
– Check shock absorber attachments for correct torque – Also check the efficiency of the shock absorbers		OK ▶ OK ▶	Carry out step A2 Tighten attachments or replace affected shock absorber as required
A2	CHECK RUBBER BUSHINGS		
– Check longitudinal and cross beam rubber bushings for wear or damage		OK ▶ OK ▶	Carry out step A3 Replace rubber bushings
A3	CHECK WHEEL BEARINGS		
– Check wheel hub inner bearing for wear or damage		OK ▶	Replace wheel hub bearing

CONSTANT NOISE	TEST B

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
B1	CHECK TYRES		
– Check tyres for correct pressure		OK ▶ OK ▶	Carry out step B2 Service tyres to correct pressure
B2	CHECK WHEEL BEARINGS		
– Check wheel hub inner bearing for wear or damage		OK ▶	Replace wheel hub bearing

VIBRATIONS	TEST C

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
C1	CHECK WHEEL BALANCING		
– Check wheels for correct balancing		OK ▶ OK ▶	Carry out step C2 Balance wheels
C2	CHECK WHEEL RIMS		
– Check rims for dents or distortion		OK ▶	Replace flexible bushings

GROUP 28

WHEELS AND TYRES

INDEX

WHEELS AND TYRES

GENERALITIES

The wheels (rims and tyres) installed are the most suited to the characteristics of the vehicle 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. Do not vary the rim-tyre arrangement originally fitted to the vehicle.

RIMS

Rims in steel or alloy must be installed using the specific screws for each type of rim.
It is absolutely necessary to fit the specific screws for each type of rim installed when replacing steel rims with alloy rims and vice- versa.

TYRES

The tyres installed on the vehicle are of the tubeless type.
To maintain driving comfort, the highest degree of safety and prolong the life of the tyre proceed as follows:

- Ensure that the wheels are balanced and the vehicle trim is correct.
- Do not insert any tools between rim and tyre.
- If the rim gets damaged replace it.
- For balancing use counterweights specifically for tubeless tyres.
- Tyre pressure (including the spare tyre) must be as specified.
- Inner tubes must not be used on tubeless tyres.

To permit even tyre wear on the front and rear axles the wheels should be swapped round each 10,000 - 15,000 Km keeping the tyres on the same side of the vehicle to avoid switching the direction of rotation.

WARNING:
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 worn tread increases the probability of aquaplaning on wet surfaces.
Knocking against the pavement, holes in the road and obstacles of various types, lengthy driving on unmade roads can cause lesions to the tyres which are not always easy to see.
They may cause deformation, swelling and cuts on the sides of the tyres, often invisible, but which could cause sudden deflation of busrting of a tyre.

TYRE PRESSURE AND WEAR

The correct tyre pressure does not only determine the life of the tyre but also affects the safety as it influences the degree of road holding of the vehicle.
The pressure in each tyre, including the spare tyre, must be checked periodically and before long journeys.
The tyres should be checked when cold using a pressure gauge in accordance with the specified values.
Incorrect pressure results in abnormal wearing of the tyre.

A. Normal pressure
   A correct tyre pressure guarantees an extended tyre life and better performance as the tread uses its entire width resulting in a more uniform wearing.
   This situation also:
   - Improves the road holding of the vehicle.
   - Improves the smoothness and precision of the steering.
   - Lowers fuel consumption due to the decreases resistance on the tyres.

B. Insufficient pressure
A low tyre pressure results in an irregular wear pattern on the tread (greater on the sides) and causes the tyres to overheat which may cause the detachment of the elements of the tyres leadng to damage affecting the casing. This damage may cause the sudden deflation or bursting.

C. Overinflation
Overinflation results in:
- Irregular wear of the tread, higher in the middle.
- Decreased comfort.
- Greater vulnerability to shocks.

WHEEL BALANCING

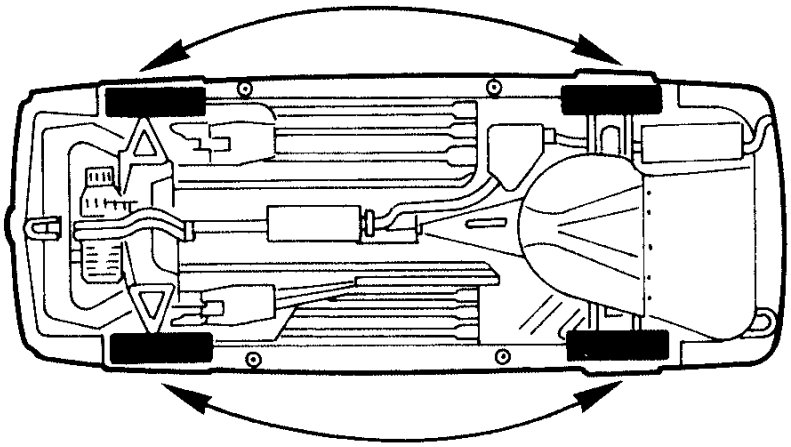
Each wheel has been statically and dynamically balanced in the factory. When the tyres are substituted the wheels must be rebalanced to avoid instability, wearing of the steering components and irregular wear on the tyres.

CAUTION:
Only original Alfa Romeo counterweights should be used when balancing wheels in light alloy.

TECHNICAL CHARACTERISTICS AND SPECIFICATIONS

GENERAL SPECIFICATIONS

TYRE ROTATION



FLUIDS AND LUBRICANTS

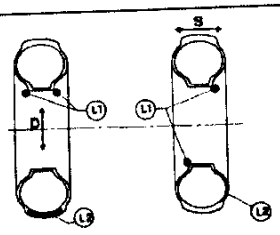
APPLICATION	TYPE	NAME
Tyre beads	FLUID	MILLOIL SC40/R MASCO 203SVA
		(*) (6 parts of water to one of fluid)

CHECKS AND ADJUSTMENTS

DYNAMIC BALANCING

Maximum permitted residual unbalance ..... 10 g

Balance weights ..... 70 g max. per side
..... (No more than two weights per side)



L1 = location of balance weights
D = tramp direction
S = Shimmy direction
L2 = Location of heavy area causing unbalance

NOTE:

- Install balance weights on inside edge of rim.
- Do not install more than two weights per side.
- Two types of weight are used: one for steel wheels and one for wheels in light alloy. Avoid using weights of different types on the same vehicle.
- After repairing a puncture ensure correct balancing of wheels and tyres.
- When replacing one or more tyres ensure that wheels are installed with the DOT marking facing outwards (in sight).

TIGHTENING TORQUES

PART	N · m	kg · m
Wheel screw (with metal rims)	73.1 ÷ 90.3	7.45 ÷ 9.20
Wheels screws (will alloy rims)	83.3 ÷ 102.9	8.49 ÷ 10.49

CHARACTERISTIC DATA

Dimensions

VEHICLE	RIM-TYRE DIMENSIONS	MAKE/TYPE	PRESSURES			
			REDUCED LOAD (2 PEOPLE)		FULLY LOADED	
			FRONT	REAR	FRONT	REAR
1.8 T.S.	6Jx14" - 185/60R14"82H	Pirelli/P4000 Michelin/MXV2 Good Year/NCT2	2.2	2.0	2.5	2.5
	OPTIONAL 6Jx14" - 195/60R14"85V	Pirelli/P4000 Michelin/MXV2 Good Year/NCT2				
2.0 T.S.	OPTIONAL FOR GERMANY 6Jx14" - 195/60R14"85V 6Jx15" - 195/55R15"84V	Pirelli/P4000E Michelin/MXV2 Good Year/NCT2	2.2	2.0	2.5	2.5
2.4 V6	6Jx15" - 195/55R15"84V	Pirelli/P4000E Michelin/MXV2 Good Year/GSD	2.5	2.3	2.8	2.5
	OPTIONAL 6Jx15" - 205/50R15"86V	Pirelli/P700Z Michelin/MXV2 Good Year/GSD				
ALL	SPARE WHEEL 4Jx15" - T115/70R15		4.2			

'95 VERSIONS

MODEL	RIM SIZE	TYRE SIZE	PRESSURES (Bar)			
			REDUCED LOAD (2 PERSONS)		FULL LOAD	
			FRONT	REAR	FRONT	REAR
T.SPARK 1.7 (167A4H) (167A4G) (167A4L)	6Jx14"	185/60 HR14	2.2	2.0	2.5	2.5
T.SPARK 1.8 (167A4E) (167A4M)	6Jx14"	185/60 HR14 195/60 VR14*	2.2	2.0	2.5	2.5
	6.5Jx15"	205/50 VR15	2.5	2.3	2.8	2.5
	7Jx16"*	205/45 ZR16	2.5	2.3	2.8	2.5
V6 (167A1E)	6.5Jx15"	205/50 VR15	2.5	2.3	2.8	2.5
	7Jx16*	205/45 ZR16	2.5	2.3	2.8	2.5
ALL	SPARE WHEEL (compact) 4Jx15" for steel rims 4BX15" for alloy rims	115/70 R15 90M	4.2			

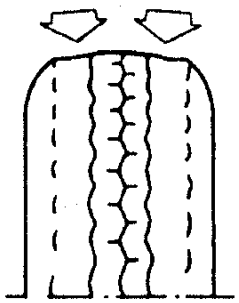
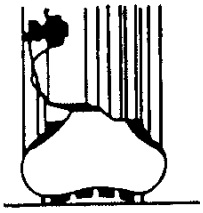
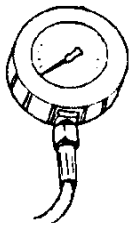
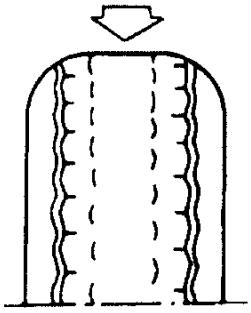
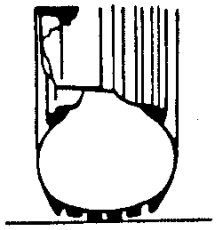
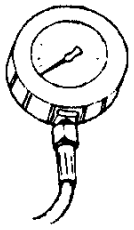
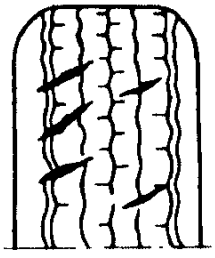
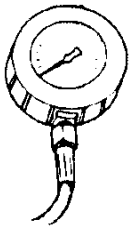
(*) Optional

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

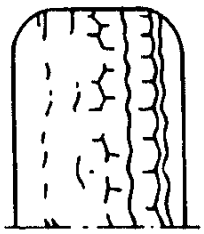
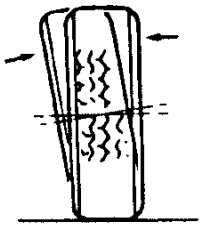
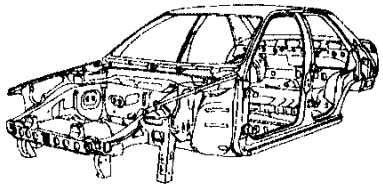
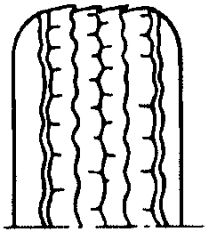
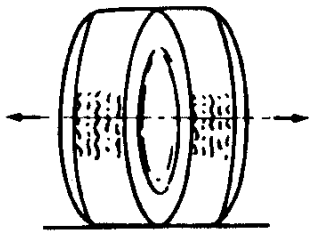
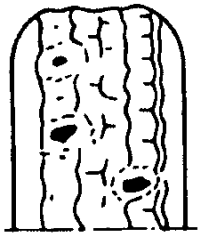
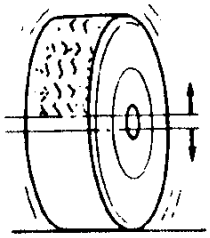
NOTE: To improve mating between the wheels and the car body the rims have a specific camber for each rim size. Therefore in addition to the correct rim and tyre match it is also necessary to check and maintain the camber of the rim.

RIM SIZE	RIM CAMBER
6JX14"	31.5 mm
6.5JX15"	37 mm
7JX16"	41 mm

TYRE WEAR

DEFECT	CAUSE	CORRECTIVE ACTION
RAPID SHOULDER WEAR 	 Pressure too low	 Service to correct pressure (cold) and replace both tyres of affected axle if necessary
RAPID WEAR OF CENTRE 	 Pressure too high	 Service to correct pressure (cold) and replace both tyres of affected axle if necessary
CRACKS IN TREAD 	 Pressure too low or tyres do not correspond to prescribed type	 Service to correct pressure (cold) and replace both tyres of affected axle if necessary

TYRE WEAR (cont.d)

DEFECT	CAUSE	CORRECTIVE ACTION
UNEVEN WEAR 	 Incorrect camber	 Check underbody for damage; if necessary replace both tyres of affected axle
FEATHERED WEAR 	 Incorrect toe-in	Service to correct toe-in value (see: GR. 21); replace both tyres of affected axle if necessary
WEAR SPOTS 	 Incorrect balancing or defective tyre	Correctly balance the wheel; if necessary replace both tyres of the affected axle