155

REPAIR MANUAL

MECHANICAL UNITS
BODY

155

REPAIR MANUAL

- **MECHANICAL UNITS**
- **BODY**

Alfa Romeo

PA4655CD000000

7-1991

UPDATE CARD

155

REPAIR MANUAL

- MECHANICAL UNITS
- BODY

UPDATE CARD			
UPDATE (DATE)	SECTION	PAGE	
		SUBSTITUTED	ADDED
1 (12/1994)	-	Division of manual	
1 (12/1994)	Introduction		VI
	Mechanical units (pages with PA4655C1000001)		
1 (12/1994)		13-91	
1 (12/1994)		13-92	
1 (12/1994)			13-92/1
1 (12/1994)			13-92/2
1 (12/1994)		21-1	
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DIVISION OF
"REPAIR MANUAL"

Models 155

The documentation published by the Alfa Romeo Assistance Service for the "155" vehicle is composed of the following publications:

155 REPAIR MANUAL
• VEHICLE CHARACTERISTICS AND MAINTENANCE

155 T.SPARK V6 - PA4655A1000000: GROUP 00
155 ⊠ - PA4655A24x4000: GROUP 00
155 TD - PA4655A3TD0000: GROUP 00
155 TD 2.5 - PA4655A4TD2500: GROUP 00
155 T. SPARK 16V - PA4655A516V000: GROUP 00

155 REPAIR MANUAL
• ENGINES

- PA4655B1000000: GROUPS 01, 04, 05, 07
  Engine 1995 cm^3 (code AR 67202)
  Engine 1773 cm^3 (code AR 67102)
  Engine 1749 cm^3 (code AR 67103)
- PA4655B2000000: GROUPS 01, 04, 05, 07
  Engine 2492 cm^3 (code AR 67301)

155 REPAIR MANUAL
• MECHANICAL UNITS
• BODY

- PA4655C1000000: MECHANICAL UNITS
- PA4655D1000000: Electrical components, Bodywork, Trim, Heating and Ventilation

155 REPAIR MANUAL
• ELECTRICAL & ELECTRONIC DIAGNOSIS

- PA4655E1000000: Wiring diagrams and Troubleshooting

continues →

155 REPAIR MANUAL
SUPPLEMENT FOR 155 ⊠
• ENGINES
• MECHANICAL UNITS
• BODY
• ELECTRICAL & ELECTRONIC DIAGNOSIS

- PA4736B14x4000: GROUPS 01, 04, 05, 07
  Engine 1995 cm^3 TURBO (code AR 67203)
- PA4736C14x4000: MECHANICAL UNITS
- PA4736D14x4000: Electrical components, Bodywork, Trim, Heating and Ventilation
- PA4736E14x4000: Wiring diagrams and Troubleshooting

155 REPAIR MANUAL
SUPPLEMENT FOR 155 TD
• ENGINES
• MECHANICAL UNITS
• BODY
• ELECTRICAL & ELECTRONIC DIAGNOSIS

- PA4805B1TD0000: GROUPS 01, 04, 05, 07
  Engine 1929 cm^3 TURBO DIESEL (code AR 67502)
- PA4805C1TD0000: MECHANICAL UNITS
- PA4805D1TD0000: Electrical components, Bodywork, Trim, Heating and Ventilation
- PA4805E1TD0000: Wiring diagrams and Troubleshooting

155 REPAIR MANUAL
SUPPLEMENT FOR 155 TD 2.5
• ENGINES
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• BODY
• ELECTRICAL & ELECTRONIC DIAGNOSIS

- PA4830B1TD2500: GROUPS 01, 04, 05, 07
  Engine 2.498 cm^3 TURBO DIESEL (code VM07B)
- PA4830C1TD2500: MECHANICAL UNITS
- PA4830D1TD2500: Electrical components, Bodywork, Trim, Heating and Ventilation
- PA4830E1TD2500: Wiring diagrams and Troubleshooting

155 REPAIR MANUAL
SUPPLEMENT FOR 155 T.SPARK 16V
• ENGINES
• MECHANICAL UNITS
• BODY
• ELECTRICAL & ELECTRONIC DIAGNOSIS

- PA4978B116V000: GROUPS 01, 04, 05, 07,
  Engine T.SPARK 16v
  (code AR 67204)
- PA4978C116V000: MECHANICAL UNITS
- PA4978D116V000: Electrical components, Bodywork, Trim, Heating and Ventilation
- PA4978E116V000: Wiring diagrams and Troubleshooting

INTRODUCTION

This publication provides the information necessary for the maintenance and repair operations regarding the 155 for the models listed in the "vehicle identification" table. The aim of this publication is to provide the Alfa Romeo Service staff with a tool which can be used to rapidly identify any faults and help to render the intervention precise and efficient.

The manual shows the procedures relative to the removal and refitting operations, disassembly and checks regarding the various groups which form the vehicle. The procedures are illustrated in detail as is the use of any necessary tools. A system of symbols combined with the basic technical data given to one side of each drawing facilitate a rapid and complete consultation of the manual.

Particular attention has been given to the fault diagnosis procedures which can be found at the end of each group. These combine with the irreplaceable experience of the operator and help to correctly identify and rectify the fault starting from the malfunction which the operator himself has detected and carrying out a series of tests on the system affected by the fault.

For the information relative to the vehicle's electrical system the "155 - Repair Manual - Electrical-Electronics Diagnosis" manual should be consulted.

All the information contained in this manual is accurate to the date of publication.

Alfa Romeo reserves the right to carry out any modifications to its products considered necessary without warning, though the technical information and up-dates regarding this manual will be promptly published.

How to use this manual

This manual is divided into chapters (GROUPS) relative to each of the assemblies which make up the vehicle.

To rapidly identify the group required, refer to the initial index.

Each group is accompanied by an analytic index and an illustrated index in order to facilitate the search for the required subject.

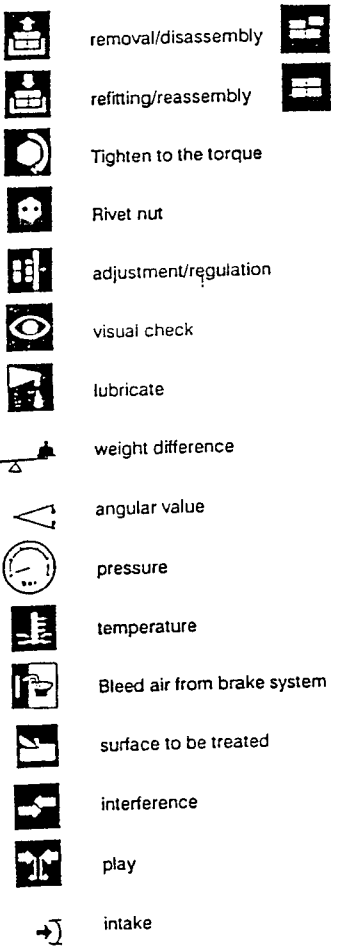
A brief description of the "removal/refitting", "disassembly/reassembly" and "checking and adjustment" procedures follows.

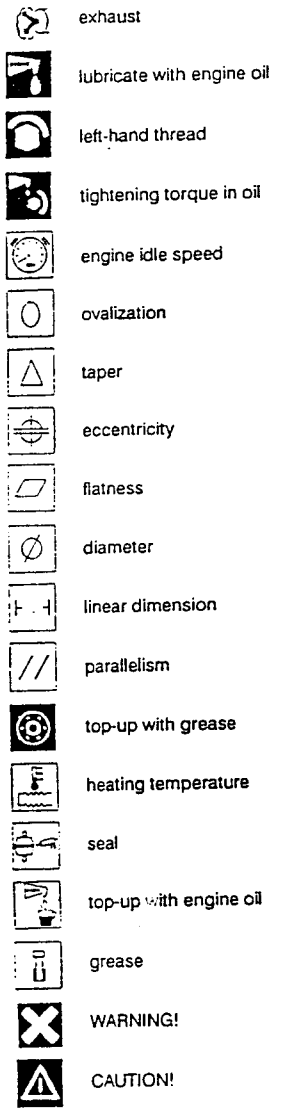
The procedures show the complete disassembly of the components and should be carried out alone only when strictly necessary. The "reassembly" and "refitting" procedures are normally a simple reversal of the "disassembly" and "removal" procedures and only the reassembly procedures which are significantly different are illustrated.
The technical data, specific tools and fault diagnosis procedures follow the procedures mentioned above.

Symbols

This manual employs a series of symbols in order for the main technical information provided to be easily located.

The list of the symbols follows.





Indications for the operators

All the operations must be carried out with the greatest care in order to avoid damaging vehicles and persons.

- For some procedures the use of the Alfa Romeo specific tools is indicated. The use of these tools is indispensable to the safety of the operation and to avoid damage to the parts involved in the procedure.
- To detach adhering parts, lightly tap with an aluminium or lead mallet; for parts in metal and a wooden or resin mallet for parts in light alloy.
- When disassembling check that the necessary parts have been marked.
- If necessary when refitting, lubricate the parts to prevent seizing or binding during the initial stages of operation.
- Using adhesive tape or clean rags, protect the parts which, after disassembly may allow dust or foreign particles to enter the engine.
- When refitting it is vital that the tightening torques and regulation settings are respected.
- During removal substitute the seal rings, oil seals, flexible washers, safety plates, self locking nuts and any other part showing signs of wear.
- Avoid marking the fittings inside the vehicle.

Assemblies or detached parts must only be replaced by original spare parts as only in this way can the suitability of the part and its perfect operation be guaranteed.

- CAUTION and WARNING indicate those procedures which must be carried out with particular care in order to prevent personal injury or damage to the vehicles.

WARNING:
is used when lack of care may cause personal injury.

CAUTION:
is used when lack of care may cause damage to the vehicle or parts of it.

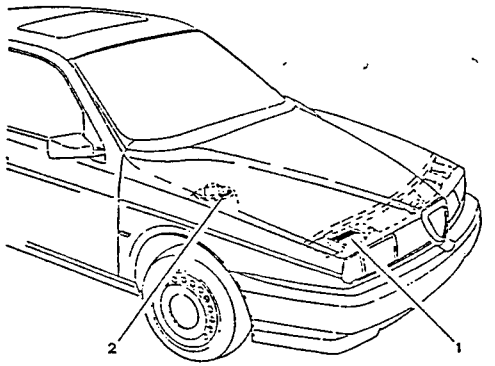
- Obey the current safety regulations regarding operation in the workshop. Where necessary specific precautions have been given in the manual in order to prevent dangerous situations from arising.

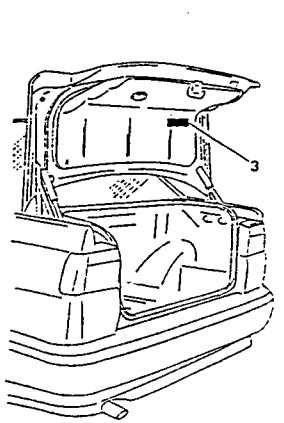
NOTE:
It is possible that some subjects have not been covered in time for publication.
In the indexes to the individual groups these subjects are indicated however and are accompanied by the words "Due for publication".
The Technical Assistance will provide documentation relative to these subjects in the form of up-date sheets or in "Technical Bulletins" which will promptly be sent to the Alfa Romeo Assistance Network.

NOTE:
It should be pointed out that inside this manual the "155" vehicle may also be indicated with the "167" vehicle code.

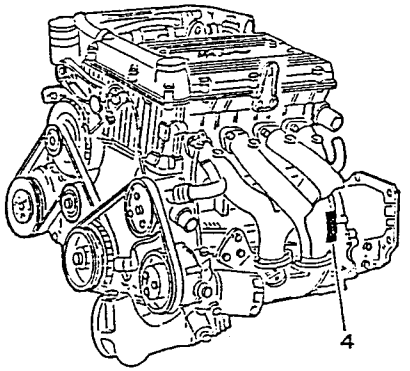
VEHICLE IDENTIFICATION

IDENTIFICATION LABELS

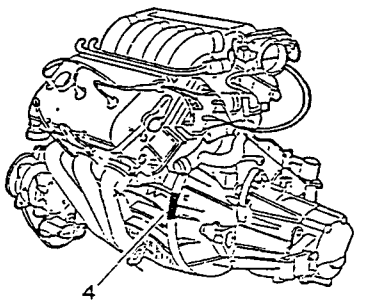




TWIN SPARK ENGINES



V6 ENGINE



1. Label carrying identification data
2. Body label
3. Body paint identification label
4. Engine label

MODEL IDENTIFICATION

Vehicle		155			
Model		T. SPARK 1.8	T. SPARK 1.8	T. SPARK 2.0	V6
Cylinder displacement		1.749 cm^3	1.773 cm^3	1.995 cm^3	2.492 cm^3
Trim level		4-door saloon			
Drive		LH + RH	LH + RH	LH + RH	LH + RH
Car model no.	on identification label	167A4B	167A4A	167A2A	167A1
	on upper part of RH side panel, engine compartment	167000	167000	167000	167000
Engine type and serial no.		AR67103 from 000001	AR67102 from 000001	AR67202 from 000001	AR67301 from 000001

NOTE: Inside the manual the various models are identified by the following wording:

- The "T. SPARK 1.8" and "T. SPARK 2.0" models are identified with "1.8 - 2.0 T.S.".

- The "V6" model is identified with "2.4 V6".

MODEL IDENTIFICATION ('95 Versions)

Vehicle		155					
Model		1.7 T. SPARK			1.8 T. SPARK		V6
Cylinder displacement		1.749 cm^3			1.773 cm^3		2.492 cm^3
Trim level		4-door saloon					
Drive		LH + RH			LH + RH		LH + RH
Car model no.	on identification label	167A4H	167A4G □	167A4L □	167A4E	167A4M □	167A1E
	on upper part of RH side panel, engine compartment	167000			167000		167000
Engine type and serial no.		AR 67105 from (*)	AR 67103 from (*)	AR 67105 from (*)	AR 67102 from (*)	AR 67202 from (*)	AR 67303 from (*)

(*) Engine no. not available at time of going to press
(□) Only for certain markets

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REPAIR MANUAL

• MECHANICAL UNITS

 GROUP 12 - CLUTCH

 GROUP 13 - GEARBOX - DIFFERENTIAL

 GROUP 17 - AXLE SHAFTS

 GROUP 21 - FRONT SUSPENSION

 GROUP 22 - FRONT AND REAR BRAKES

 GROUP 23 - STEERING

 GROUP 25 - REAR SUSPENSION

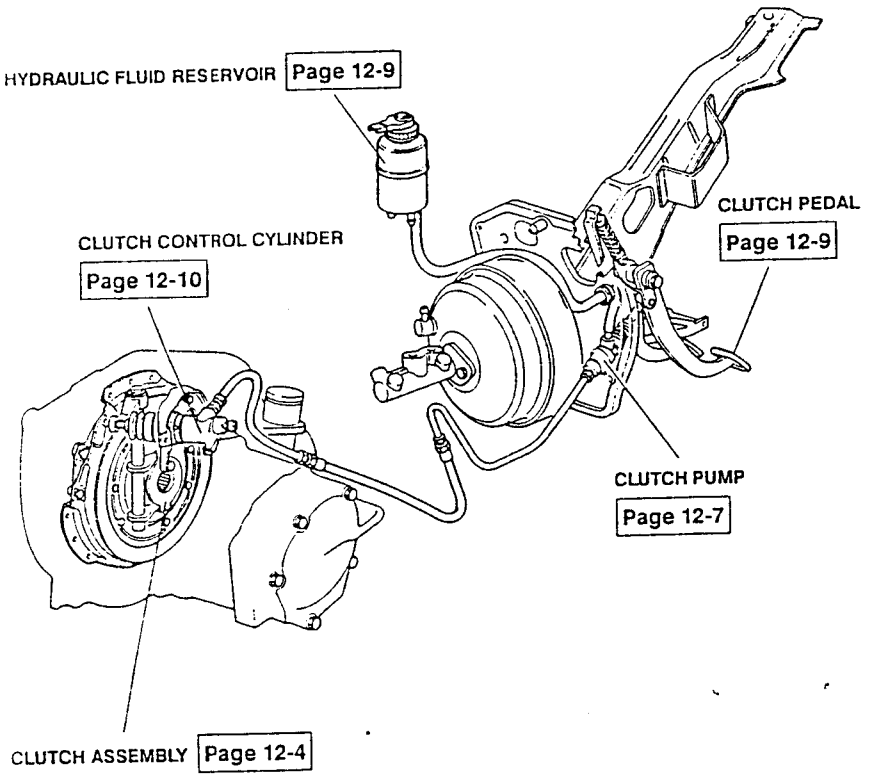
 GROUP 28 - WHEELS AND TYRES

GROUP 12

CLUTCH

INDEX

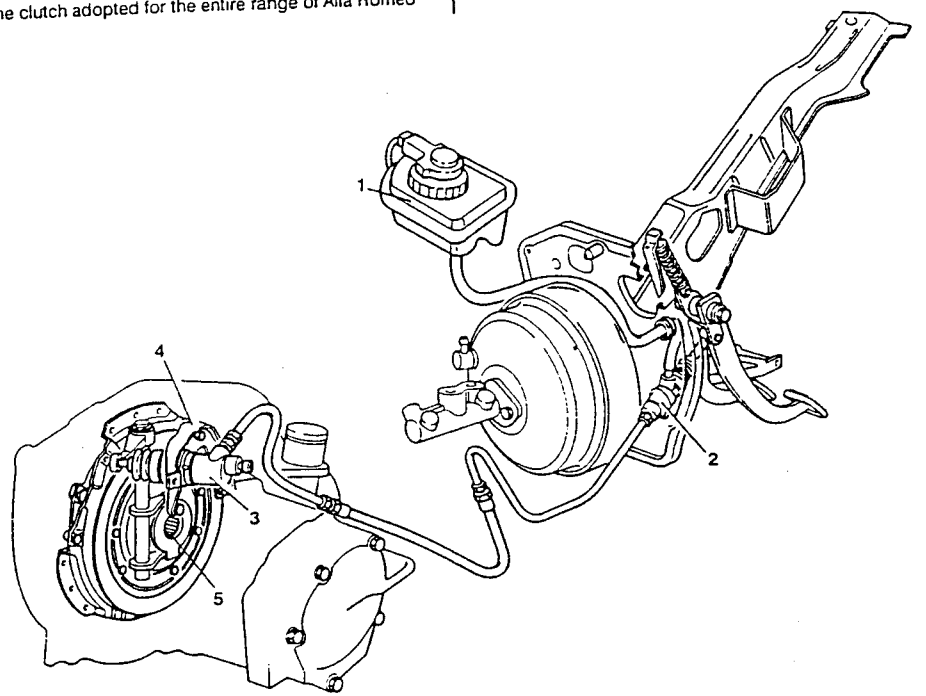
ILLUSTRATED INDEX



CLUTCH

DESCRIPTION

The clutch adopted for the entire range of Alfa Romeo 167 vehicles is of the dry monodisc type with a diaphragm pressure plate with springs.



This traditional solution is integrated with a series of devices aimed at:

1. respecting the current laws regarding the problem of environmental pollution;
2. reducing the pressure necessary to depress the clutch pedal;
3. containing the size of the assembly within acceptable values.

- The problem of pollution has been faced with the addition of friction gaskets and clutch plate employing ecological material (without asbestos) in the same way as for the brake pads.
- To reduce the effort required to depress the clutch pedal and to facilitate disengagement, a hydraulic disengagement device has been adopted on all the models in the "167" range.

This device is composed of a tank (1) shared with the braking system, a pump (2) secured to the pedal and a cylinder (3) fitted to the gear lever bell by way of a bracket (4) and thrust bearing (5).

The use of a hydraulic device makes it possible to:

- increase reliability in relation to the traditional, mechanical type solution;
- improve progression due to the damping of the hydraulic system during disengagement which avoids jerking particularly when the transmitted torque is high;
- greater operating precision as this device permits a constant adjustment to be made in the height of the clutch pedal;
- increase driving comfort, a result of the reduction in the level of vibrations transmitted to the engine due to the the damping effect of the oil.

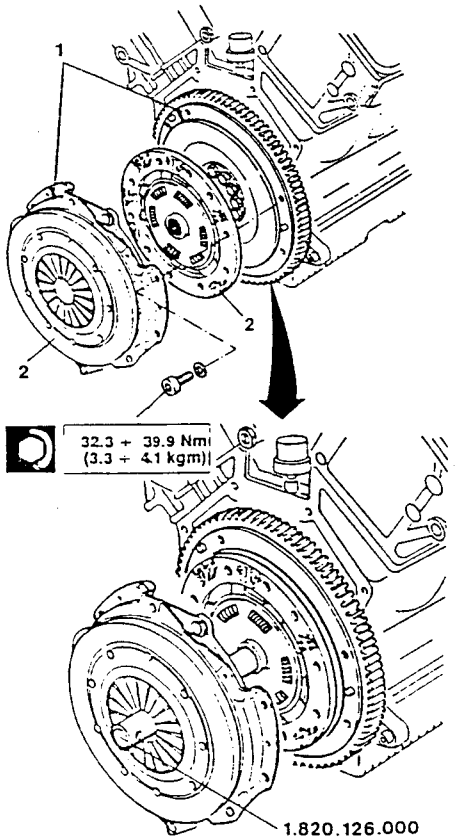
CLUTCH ASSEMBLY

REMOVAL AND REFITTING

- Remove the gearbox (see: GR. 13 - GEARBOX-DIFFERENTIAL - Removal and refitting).

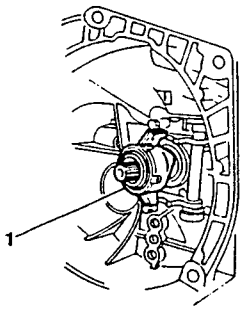
1. When replacing the driven gear, mark the relative position between the disk pressure plate and flywheel in order to facilitate refitting.
2. Loosen the six screws securing the pressure plate to the flywheel and remove the pressure plate together with the driven gear.

Refit by reversing the procedure followed for removal and using tool No. 1.820.126.000 to centre the clutch plate, tighten the pressure plate retaining screws to the specified torque.



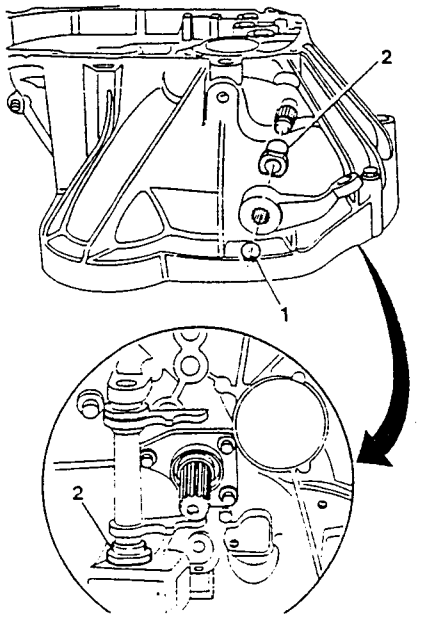
1. Withdraw the thrust bearing from its sleeve located in the gearlever bell.

When refitting the bearing it must not show signs of crawling or noise when rotating. If it does then it must be replaced.



- Only if necessary:

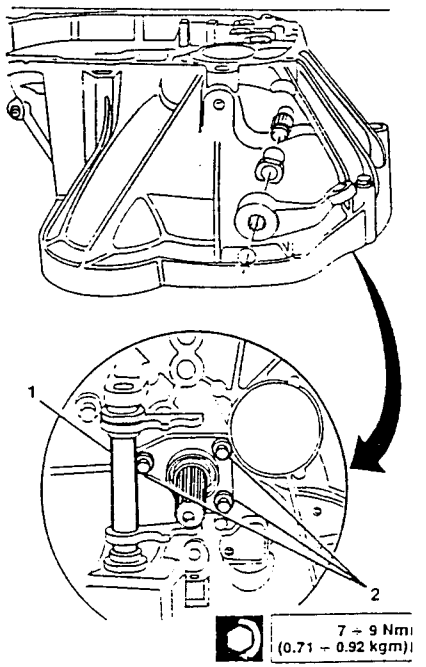
1. Remove the seeger ring and withdraw the clutch engagement control lever.
2. Remove the anti-slip bushing from the gearlever bell.



When refitting install a new bushing whenever there is excessive play on the pin.

1. Operating from inside the gearlever bell, withdraw the clutch engagement sleeve control pin and fork.
2. Loosen the screws and remove the thrust bearing sleeve.

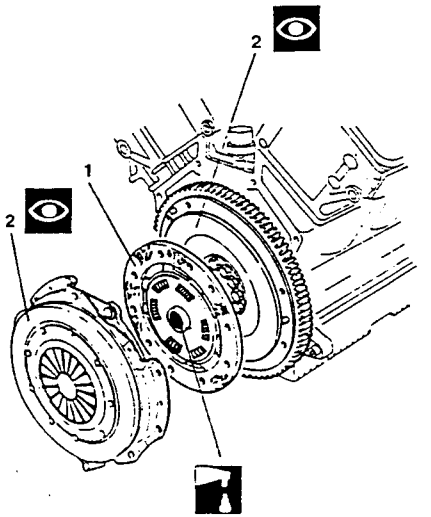
When refitting, grease the bushings and sleeve with the specified product. The sleeve and oil seal should be replaced whenever oil leaks are discovered.



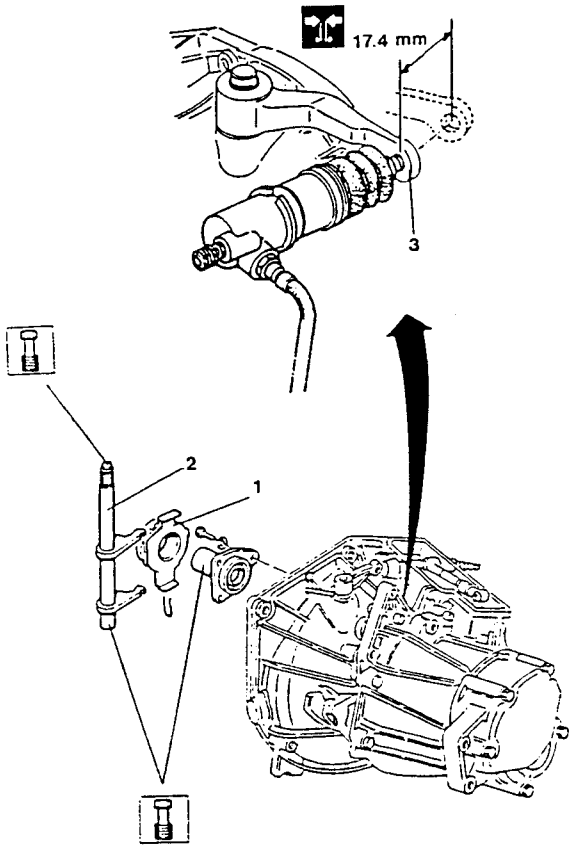
CHECKS AND INSPECTIONS

1. Check the clutch plate for uneven wear of the gaskets and their minimum thickness.
   Check for signs of burning or vitrification and the correct installation and integrity of the springs of the flexible coupling.
   Check the clutch plate hub for damage, freedom of movement and limited play on the power take-off shaft coupling.

2. Check the working surfaces of the flywheel and disc pressure plate for signs of overheating, irregular wear, nicks or parts missing. If necessary replace the disc pressure plate and/or grind the engine flywheel (see: REPAIR MANUAL - ENGINES - GR. 01).



1. Check the thrust bearing for noise, excessive play and freedom of movement in the sheath.
2. Check the fork for cracks, deformation, freedom of movement and excessive wear of the working surfaces.
3. Check that the disengagement stroke of the clutch control lever is 17.4 mm; if the stroke is below this figure, check the efficiency of the hydraulic circuit.



CLUTCH PUMP

REMOVAL AND REFITTING

Using a suitable tool clamp the oil delivery hose to prevent excessive oil spillage during removal.

1. Disconnect the oil delivery hose from the pump.
2. Remove the safety clip and withdraw the pin connecting the pump to the clutch pedal.
3. Loosen the nut securing the pump to the body.

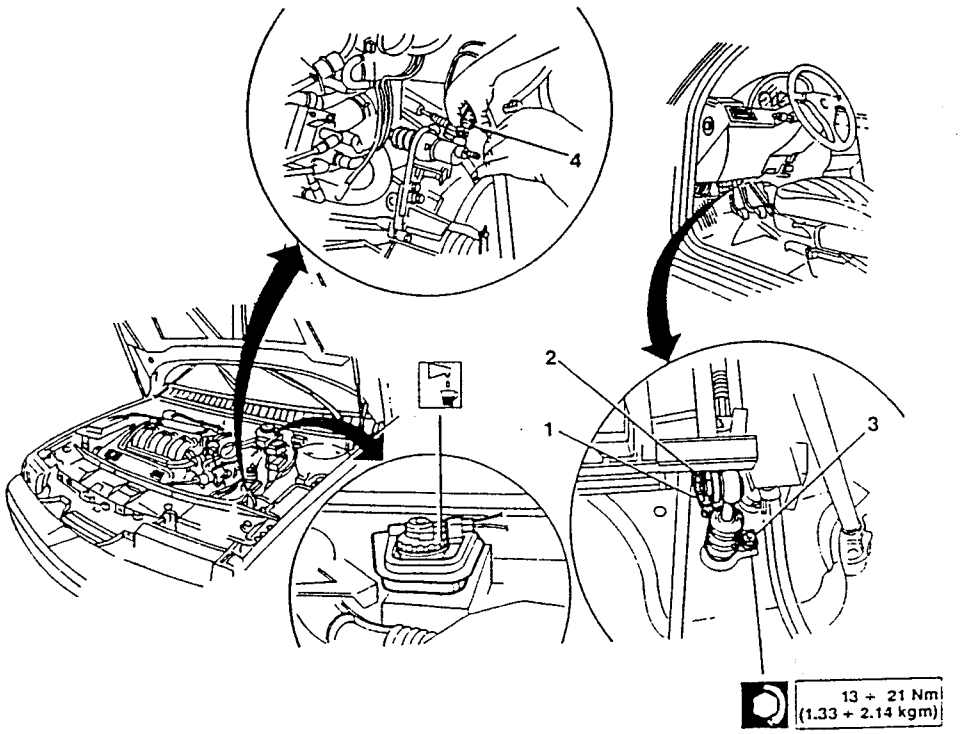
– Working in the engine compartment, proceed as follows:

4. Disconnect the flexible hose from the clutch control cylinder.

– Working from inside the vehicle, withdraw the pump together with the flexible hose carrying the oil to the cylinder.

Refit by reversing the procedure followed for removal and tightening the screw securing the clutch pump to the body to the correct torque.

When refitting the pump bleed air from the system (see: BLEEDING THE HYDRAULIC SYSTEM).

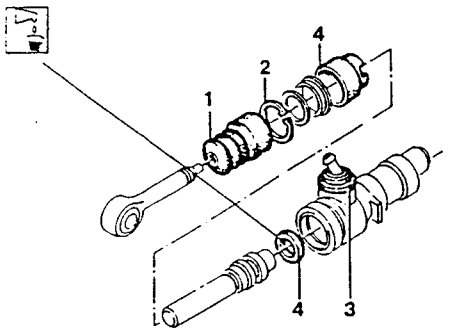


DISASSEMBLY AND REASSEMBLY

1. Pull off the protective boot from the clutch pump control rod.
2. Remove the spring ring from the clutch pump piston and withdraw the piston from the pump body.
3. Disassemble the gasket and connection located on the inlet of the hose arriving from the hydraulic fluid reservoir.
4. Remove the rubber seal rings.

When refitting install new rings after lubricating with the specified oil and replace the anti-friction gasket.

Refit by reversing the procedure followed for removal.



CHECKS AND INSPECTIONS

- Check that the piston and inner surface of the cylinder shows no sign of marking, scoring abrasion or rust.

  If traces of abrasion or seizing are found in the cylinder body, replace the pump assembly.

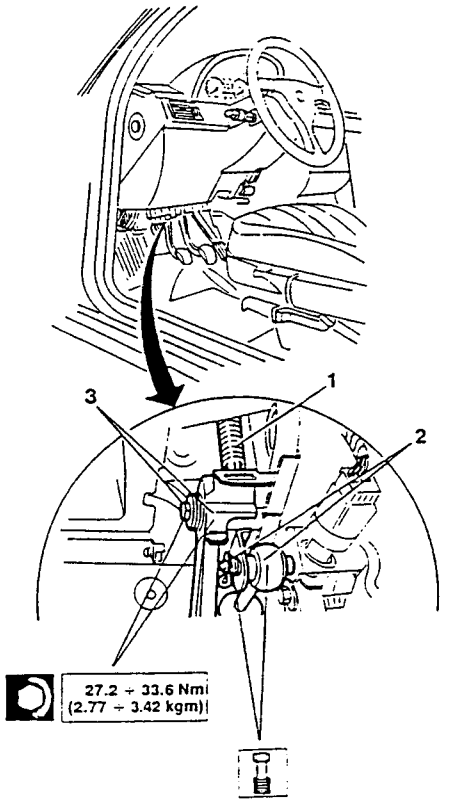
CLUTCH PEDAL

REMOVAL AND REFITTING

1. Disconnect the clutch pedal return spring.
2. Remove the cotter pin and withdraw the pin connecting the pump to the clutch pedal.
3. Loosen and remove the through screw on the clutch pedal together with the washers and spacers and then disconnect the clutch pedal.

Refit, by reversing the procedure followed for removal and tightening the through screw on the clutch pedal to the correct torque.

When refitting, grease the components securing the clutch pedal using the specified grease.



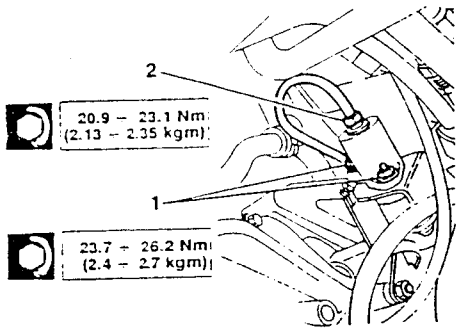
HYDRAULIC FLUID RESERVOIR

See: GR. 22 - CLUTCH AND BRAKE FLUID RESERVOIR.

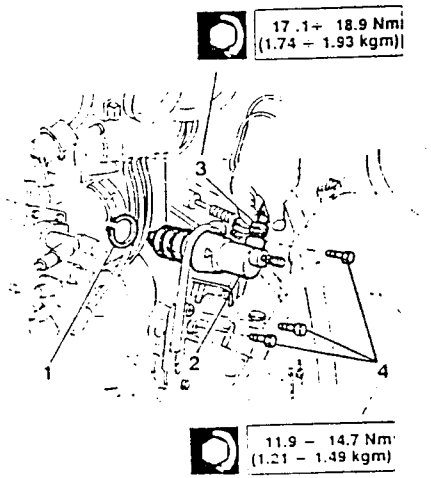
CLUTCH CONTROL CYLINDER

REMOVAL AND REFITTING

- Only for 1.8 - 2.0 T.S. models
1. Loosen the screws securing the cylinder to the support.
2. Loosen the connection securing the oil delivery hose to the cylinder and remove the cylinder.



- Only for 2.4 V6 models.
1. Remove snap ring.
2. Withdraw the clutch control cylinder from its bracket.
3. Disconnect the connection on the hose carrying hydraulic fluid to the cylinder and plug the hose.
4. If necessary unscrew and remove the screws securing the clutch control cylinder support bracket.



When refitting the cylinder bleed air from the system (see: BLEEDING THE HYDRAULIC SYSTEM).

Refit by reversing the procedure followed for removal and tighten the clutch control cylinder support bracket retaining screws to the correct torque.

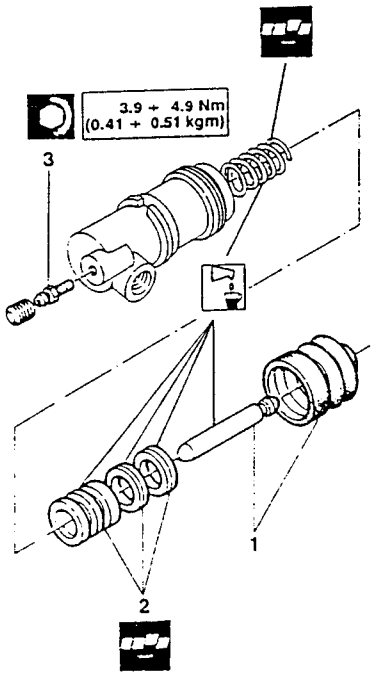
DISASSEMBLY AND REASSEMBLY

1. Pull off the rubber protection and remove it together with the control rod.
2. Using a jet of compressed air, remove the piston from the cylinder body.
3. If necessary remove the relief valve screw from the control cylinder body.

Lubricate the components in the cylinder with the correct oil before refitting.

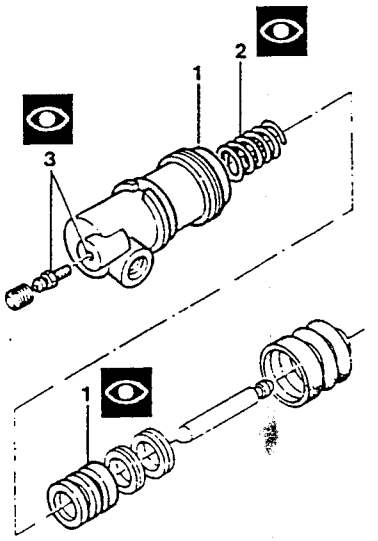
Refit by reversing the procedure followed for removal tightening the relief valve screw to the specified torque if previously removed.

- Substitute all seal rings when refitting.



CHECKS AND INSPECTIONS

1. Check that there are no signs of marking, scoring abrasion or rust inside the cylinder and on the piston. If signs of abrasion or seizing are detected on the cylinder body, replace the assembly.
2. Check the spring for damage.
3. Check that the relief hole is not blocked.

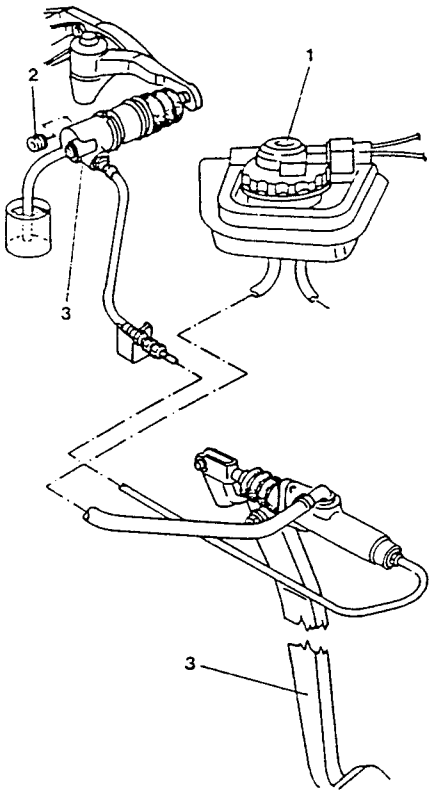


BLEEDING THE HYDRAULIC SYSTEM

WARNING:
Do not re-use the hydraulic fluid resulting from the bleeding operation.

1. Remove the cap on the clutch and brake fluid supply reservoir and if necessary top up to the correct level with the specified fluid.
2. Remove the protective cap from the relief screw on the cylinder and push a hose onto the screw. Put one end into a transparent container full of hydraulic fluid.
3. Simultaneously loosen the relief screw and fully depress the clutch pedal and allowing it to return slowly. Repeat the operation until all air trapped in the circuit has been eliminated. Then with the clutch pedal fully depressed, close the relief screw, remove the hose and install the protective cap.
   Top up the level of fluid in the reservoir and replace the cap.

- During bleeding the fluid in the reservoir must not fall below the "MIN" mark.
- Operate with care in order to prevent the hydraulic fluid from touching paintwork.
- After bleeding check that both the clutch and gears disengage and engage correctly.
  If necessary check the disengagement stroke on the clutch control lever.



TECHNICAL CHARACTERISTICS AND SPECIFICATIONS

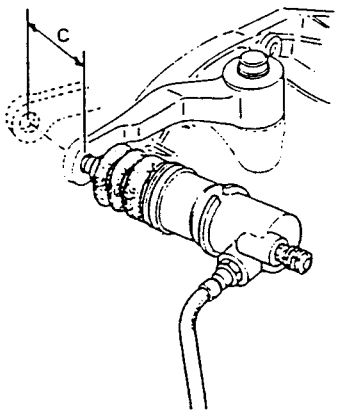
GENERAL INDICATIONS

FLUIDS AND LUBRICANTS

APPLICATION	TYPE	NAME
Clutch disk splined section	OIL	(MILLOIL OBTS250)
Thrust bearing seat and clutch control lever shaft rod	GREASE	TUTELA MR3
Pin connecting clutch pedal/pump	GREASE	SHELL RETINAX G
Lubrication of pump inner components and hydraulic system filling	FLUID Class: DOT 4 SAE J170 3F	ALFA ROMEO BRAKE FLUID SUPER DOT 4

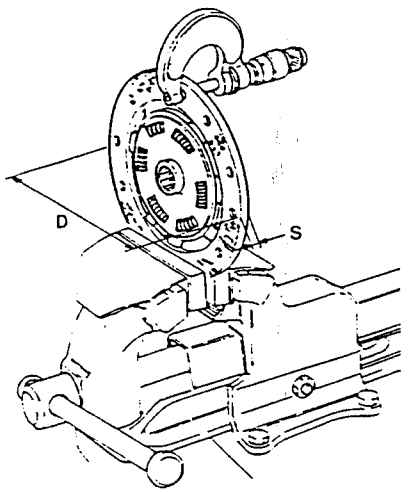
CHECKS AND ADJUSTMENTS

CLUTCH CONTROL LEVER



Clutch control lever disengagement travel ..... C = 17.4 mm

CLUTCH DISK



Clutch disk thickness ..... S = 7.1 ÷ 7.7 mm
Clutch disk diameter ... D = (2.4 V6) = 228.6 mm
..... (1.8 - 2.0 T.S.) = 215 mm

TIGHTENING TORQUES: 1.8 - 2.0 T.S.

Description	N·m	kg·m
Screw with unlosable washer securing clutch mechanism	32.3 ÷ 39.9	3.29 ÷ 4.07
Hexagon nut securing clutch cylinder to bracket	23.75 ÷ 26.25	2.42 ÷ 2.67
Hexagon nut securing bracket to compound screw	20.9 ÷ 23.1	2.13 ÷ 2.35
Union securing pipe to cylinder	17.1 ÷ 18.9	1.74 ÷ 1.92
Nut securing hoses to bracket	17.85 ÷ 22.05	1.82 ÷ 2.25
Union for clutch control/clutch pump hoses	17.1 ÷ 18.9	1.74 ÷ 1.92

TIGHTENING TORQUES: 2.4 V6

Description	N·m	kg·m
Allen screw securing clutch mechanism	17.85 ÷ 22.05	1.82 ÷ 2.25
Clutch control/clutch pump hose connection	17.1 ÷ 18.9	1.74 ÷ 1.92
Hexagonal head screw securing clutch cylinder bracket to gearbox	11.9 ÷ 14.7	1.21 ÷ 1.49

SPECIAL TOOLS

TOOL NUMBER	DESCRIPTION
1.820.126.000	Clutch disk centering spindle
1.821.215.000	Thrust bearing puller (only for clutch version with tie-rods)

FAULT DIAGNOSIS AND CORRECTIVE ACTION

SYMPTOMS AND ANOMALIES	FAULT ISOLATION	TEST
CLUTCH SLIPS During acceleration, engine revs increase without corresponding increase in vehicle speed	– Start engine – apply handbrake – depress clutch pedal and engage 4th gear – accelerate and release clutch pedal gradually; the vehicle does not move and the engine does not stop	A
CLUTCH DOES NOT DISENGAGE PROPERLY Sticking or noises are noted when changing down or when engaging reverse gear	– Start engine – depress clutch pedal and engage reverse gear after 4 or 5 seconds; noise is noted when changing gear	B
CLUTCH VIBRATES OR JERKS Clutch pedal vibrates when it is being released	– Start engine – depress and release clutch pedal; vehicle does not pull off smoothly but jerks or vibrates	C
NOISY CLUTCH	– Start engine – Depress and release clutch pedal; noise is noted during pedal actuation	D
EXCESSIVE PRESSURE REQUIRED TO ACTUATE CLUTCH PEDAL Clutch requires excessive pressure on the pedal	– Press clutch pedal using the applicable tool; pedal pressure is correct if applied pressure does not exceed the prescribed value	E

CLUTCH SLIPS	TEST A

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
A1 CHECK PEDAL – Check that clutch pedal returns to proper rest position when released	OK ▶ ~~OK~~ ▶	Carry out step A3 Carry out step A2
A2 CHECK CLUTCH CYLINDER – Check that clutch cylinder pin returns to proper rest position. Visually check that the exterior of cylinder body is not leaking oil through the piston inner seal	OK ▶ ~~OK~~ ▶	Carry out step A3 Replace clutch cylinder; if fault presists replace clutch pump
A3 CHECK CONTROL LEVER – Check that the clutch control lever disengagement travel is within prescribed limits	OK ▶ ~~OK~~ ▶	Carry out step A4 Overhaul clutch unit
A4 CHECK CLUTCH DISK – Check wear of clutch disk lining	OK ▶ ~~OK~~ ▶	Carry out step A5 Replace clutch disk

CLUTCH SLIPS (continued)	TEST A

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
A5 CHECK FOR CONTAMINATION BY OIL OR GREASE – Check for presence of oil or grease on the surfaces of the disk	OK ▶ ~~OK~~ ▶	Carry out step A6 Replace clutch disk and gearbox main shaft oil seal
A6 CHECK FLYWHEEL AND DISK PRESSURE PLATE – Check working surfaces of the flywheel and disk pressure plate for traces of overheating, uneven wear, nicks and removed material	~~OK~~ ▶	Replace disk pressure plate and/or reface the flywheel (see: REPAIR MANUAL - ENGINES - GR. 01)

CLUTCH DOES NOT DISENGAGE PROPERLY — TEST B

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
B1 CHECK FOR FLUID LEAKAGE – Visually check for fluid leakage from clutch actuating cylinder, pump or lines	(OK) ▶ (OK) ▶	Carry out step B2 Replace defective parts
B2 CHECK PUMP INTERNAL LEAKAGE – Slowly depress clutch pedal and at the same time check that fluid does not flow back into the reservoir – Start the engine, depress clutch pedal, engage first gear and hold the clutch pedal down; wait for about 30 seconds and check that the vehicle does not move	(OK) ▶ (OK) ▶	Carry out step B3 Replace clutch pump
B3 CHECK FOR TRAPPED AIR – Check for presence of trapped air in the hydraulic circuit by verifying that the clutch control lever disengagement travel is with the prescribed limits	(OK) ▶ (OK) ▶	Carry out step B4 Purge trapped air from the circuit
B4 CHECK SPLINED COUPLING – Check for dirt, rust or dents on splines of clutch disk hub and of gearbox main shaft	(OK) ▶ (OK) ▶	Carry out step B5 Remove any damage and clean the hub and mainshaft splines; replace clutch disk if necessary
B5 CHECK CLUTCH DISK – Check that the clutch disk is not distorted	(OK) ▶ (OK) ▶	Cary out step B6 Replace clutch disk
B6 CHECK DIAPHRAGM SPRING – Check that the disk pressure plate diaphragm spring is not damaged	(OK) ▶	Replace disk pressure plate

CLUTCH VIBRATES AND/OR JERKS — TEST C

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
C1 CHECK ENGINE MOUNTS – Check that the engine mounts are not loose or deteriorated (see group 00)	(OK) ▶ (OK) ▶	Carry out step C2 Tighten or replace affected mounts
C2 CHECK CLUTCH DISK – Check clutch disk lining for "vitrification" due to overheating, traces of oil or grease, distortion, wear or loose rivets. Check flexible couplings springs for damage	(OK) ▶ (OK) ▶	Carry out step C3 Replace clutch disk and, if necessary, gearbox main shaft oil seal
C3 CHECK FLYWHEEL AND DISK PRESSURE PLATE – Check working surfaces of flywheel and disk pressure plate for wear or distortion	(OK) ▶	Replace disk pressure plate and if necessary reface or replace flywheel (see: REPAIR MANUAL - ENGINES - GR. 01)

NOISY CLUTCH — TEST D

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
D1 CHECK THRUST BEARING – Check thrust bearing for wear or binding; check condition of mating surfaces of thrust bearing and disk pressure plate spring	(OK) ▶ (OK) ▶	Carry out step D2 Replace thrust bearing; replace disk pressure plate if necessary
D2 CHECK FORK – Check that the thrust bearing fork does not creak when moved	(OK) ▶	Check fork shaft bushings and replace if necessary

EXCESSIVE PRESSURE REQUIRED TO ACTUATE CLUTCH PEDAL — TEST E

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
E1 CHECK PEDAL SPRING – Check clutch booster mechanism spring for damage	(OK) ▶ (OK) ▶	Carry out step E2 Replace spring
E2 CHECK ACTUATING CYLINDER – Carry out step A2 of TEST A (see step A2)	(OK) ▶ (OK) ▶	Carry out step E3 (See step A2)
E3 CHECK CLUTCH UNIT – Check clutch unit for internal breakage and damage	(OK) ▶	Replace affected parts inside clutch unit

ALFA ROMEO 155

VOLUME 3
(MECHANICAL UNITS)

[SMS PART No Z6018]

THIS MANUAL CONTAINS THE FOLLOWING UPDATES

DESCRIPTION	PRINT No
MAIN MANUAL	4655***00000
SUPPLEMENT	4655***00001
SUPPLEMENT	4655***00002
SUPPLEMENT	4655***00003
SUPPLEMENT	4655***00004
SUPPLEMENT	4655***00005
SUPPLEMENT	4655***00006

GROUP 13

GEARBOX - DIFFERENTIAL

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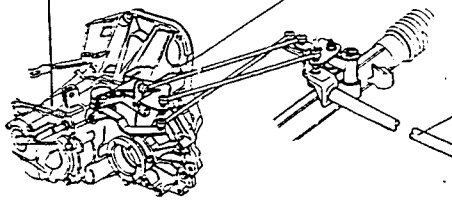
REASSEMBLY Page 13-34

GEARBOX 1.8 - 2.0 T.S.

DISASSEMBLY Page 13-42
CHECKS AND INSPECTIONS Page 13-54
REASSEMBLY Page 13-56



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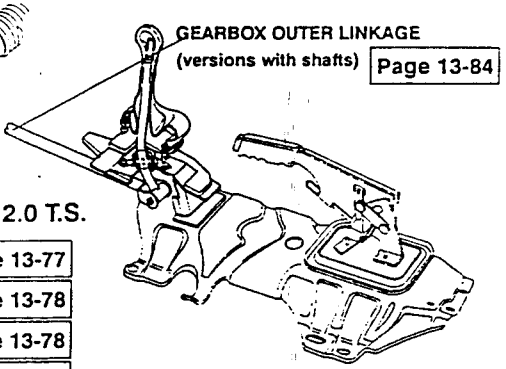

DIFFERENTIAL	2.4 V6	1.8 - 2.0 T.S.
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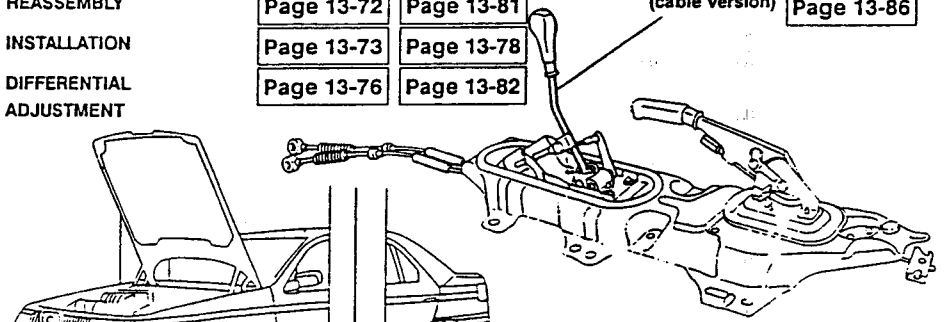

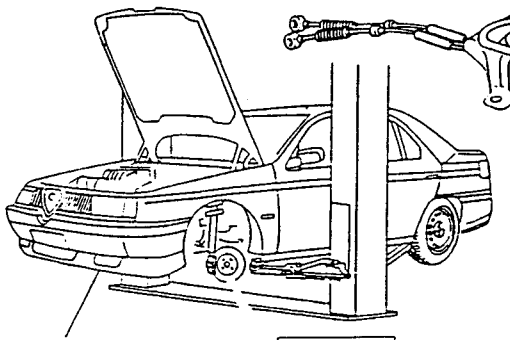

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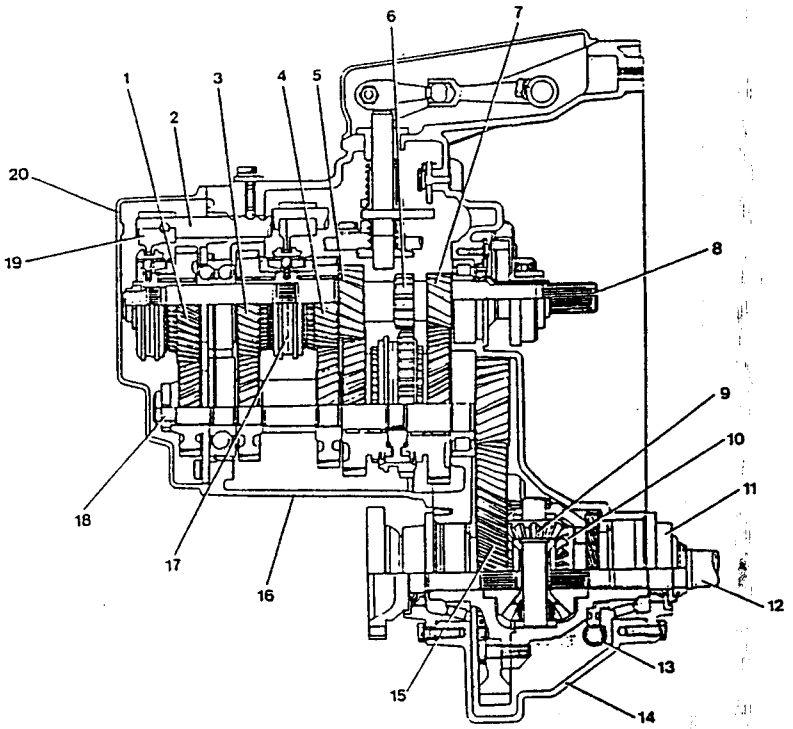
GEARBOX

DESCRIPTION

The gear box is of the transversal "cascade" type with five foward speeds, all synchronized, with perpetually driven gears and a final reduction cylindrical gear pair.

The gearbox is contained in the aluminium casing, whilst the 5th speed gear is contained in the rear cover. The gearbox is connected to the engine through the clutch cone. An oil dipstick, used to check the gearbox oil level (Min-Max), is located on the top of the gearbox on the differential side. To drain the oil, both from the differential side and the gearbox side, there are two drainage holes.



1. 5th speed drive gear
2. Speed engagement rod
3. 4th speed drive gear
4. 3rd speed drive gear
5. 2nd speed drive gear
6. Reverse speed drive gear
7. 1st speed drive gear
8. Main shaft
9. Side pinion
10. Crown wheel
11. Constant speed joint
12. Drive shaft
13. Odometer idle
14. Differential casing
15. Crown gear
16. Gearbox
17. Synchronizer
18. Layshaft
19. Engagement fork
20. Rear cover

Gearbox shape

The shape of the gearbox makes it possible to divide it into three distinct sections.

- The intermediate section forms the actual gearbox and contains and supports the main and lay shafts, the engagement forks and rods and the speed engagement control device.
- The rear section (rear cover) contains the driving and driven gears and the 5th speed engagement fork and the main and lay shaft rear bearings retaining plate.
- The front section (clutch cone) includes the clutch unit and thrust bearing and the relevant actuation system.

Main shaft

The gears for 1st, reverse and 2nd speeds have been machined directly onto the main shaft, while the gears for 3rd, 4th and 5th speeds and relevant synchrinizers are installed on bearings; in addition, the main shaft is supported by two ball bearings.

Lay shaft

1st and 2nd speed gears and relevant synchronizers are installed on the lay shaft with bearings whilst the 3rd, 4th and 5th speed gears are keyed to the shaft. The lay shaft is supported by two bearings; the bearing at the pinion end is of the roller type whilst the opposite one is of the ball type.

Gears and synchronizes

Gears for forward speeds are of the helical type with all speeds synchronized; reverse speed gears are of the straight toothing type.

A new feature of this gearbox concerns the 3rd, 4th and 5th speed gears and relevant synchronizers which have been installed on the main shaft to reduce the engagement loads during synchronization phase and noise produced by the gearbox during idle operation.

Unlike other gearboxes, the drive originating from the engine, when the gearbox is idling, is transmitted only to the gears of the 1st and 2nd speeds.

The reverse speed driven gear is machined onto the 1st - 2nd speed engagement sleeve.

The solution reduces the overall dimensions of the gears in the gearbox.

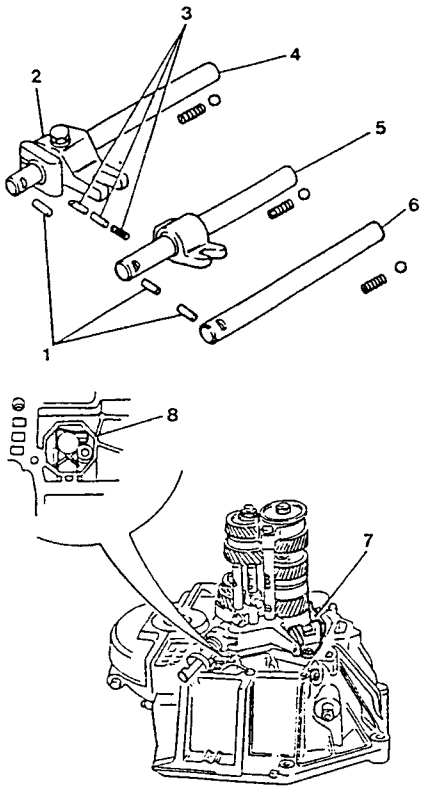
The idle gears are mounted on needle bearings that, reducing friction, minimize radial runout.

The synchronizers are of the tapered ring, Borg Warner type; they are identical for the 3rd, 4th and 5th speeds and smaller that those for the 1st and 2nd speeds installed on the transmission shaft, thus reducing the noise produced by the gears when in drive.

Safety devices

The gearbox is fitted with a number of safety devices.

- A first pawl device (1) prevents simultaneous engagement of two speeds whilst.
- A second device (3) (pawl-pin-spring) acts on rods (4) - (5) and (6) to maintain the reverse speed prong (2) in a safe position and prevent dangerous movements of the reverse speed fork (7), and consequent possibility of engaging reverse speed.
- A third device (8) consisting of a lever and a spring prevents inadvertent engagement of reverse speed when shifting from 5th to 4th speed..



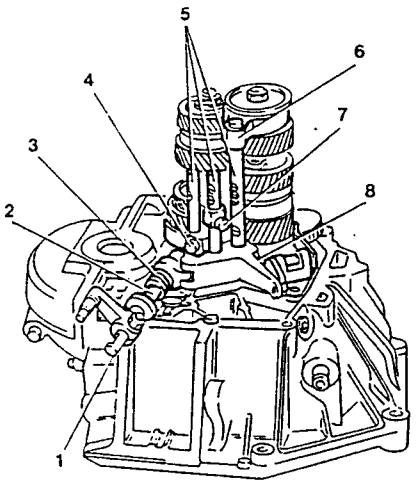
1. Safety pawl
2. Reverse speed prong
3. Reverse speed safety pawl
4. 5th and reverse speed rod
5. 3rd and 4th speed rod
6. 1st and 2nd speed rod
7. Reverse speed fork
8. Reverse speed engagement safety device

Controls and forks

To reduce friction and increase accuracy of gear engagement, the gearbox has been provided with a spherical control (1) which transmits movement to the selector prong (3) through a shaft (2).

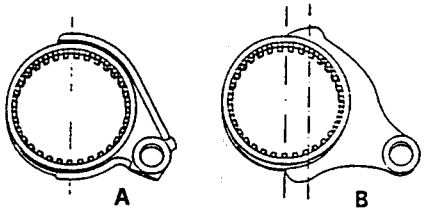
The selector prong actuates the sliding rods (5) carrying the synchronizer sleeve control forks (4, 6, 7, 8).

Therefore a fork (4) and relative rod provide for the engagement of 1st and 2nd speed, another (F) for the engagement of 3rd and 4th speed, another (7) for engagement of 5th speed and a final one (8) for engagement of reverse speed.



1. Spherical control
2. Shaft
3. Selector prong
4. 1st and 2nd speed engagement fork
5. Sliding rods
6. 5th speed engagement fork
7. 3rd and 4th speed engagement fork
8. Reverse gear engagement fork

An important characteristic of the forks (A) is that the thrust centre coincides with the centerline of the sleeve in order to prevent crawling during speed engagement. This coincidence is not present on forks of conventional gearboxes (B).

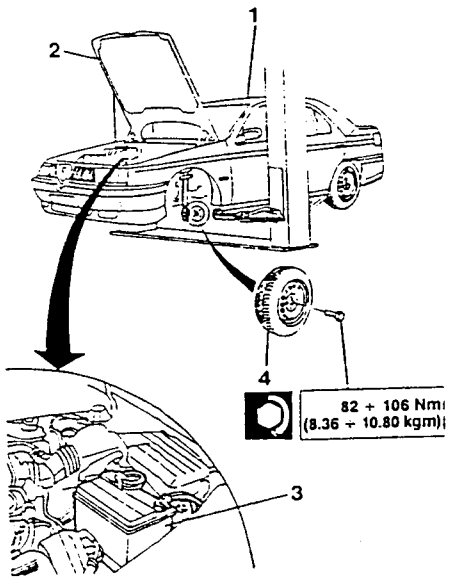


REMOVAL AND INSTALLATION

PRELIMINARY OPERATIONS

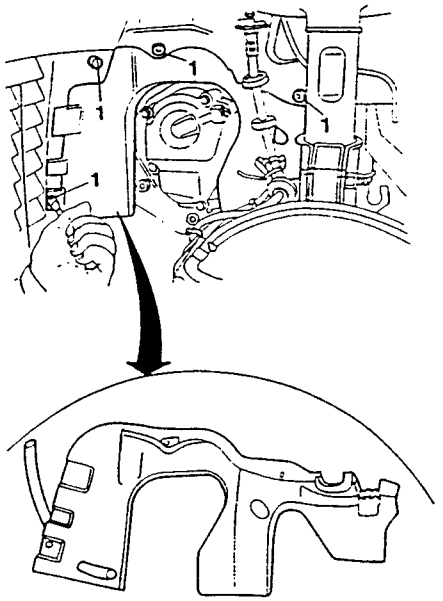
1. Place the vehicle on an auto lift.
2. Lift the bonnet.
3. Disconnect and remove the battery.
4. Remove the front wheels.

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

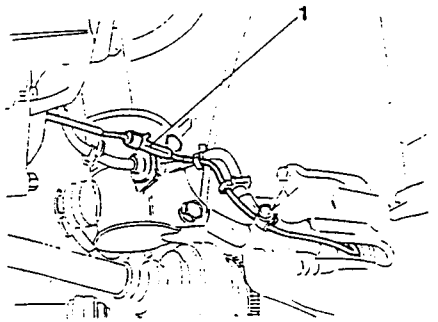


- Raise the vehicle.

1. Operating in the left wheelhousing compartment, unscrew the screws and remove the buttons securing the gearbox side dust guard.



1. Disconnect the brake pad wear sensor connector.

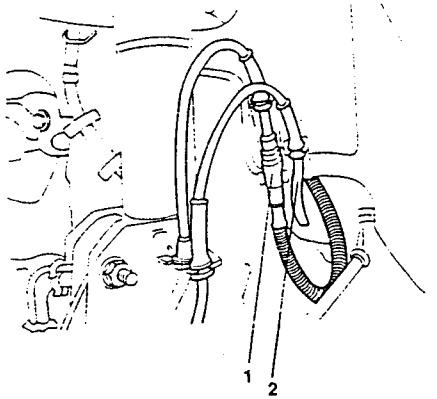


1. (only applicable to vehicles with controlled damping suspension):

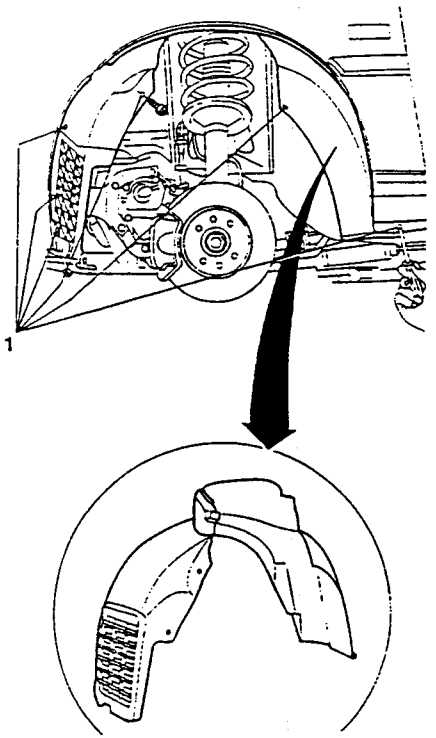
   - disconnect the controlled damping system sensor connector.

2. (only applicable to vehicles with ABS system):

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



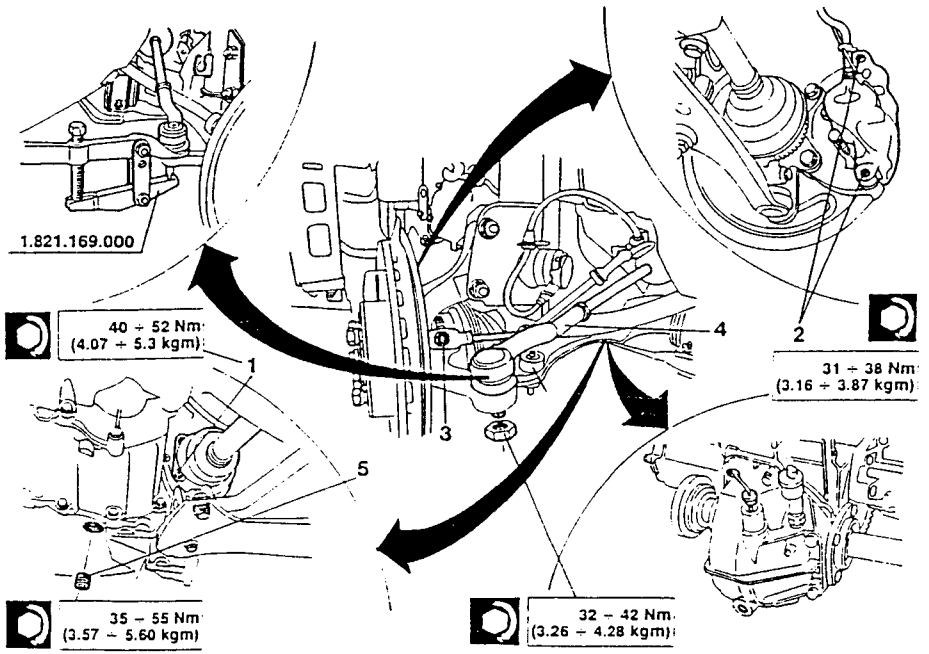
1. Unscrew the screws securing the plastic wheelhousing to the body and remove it.



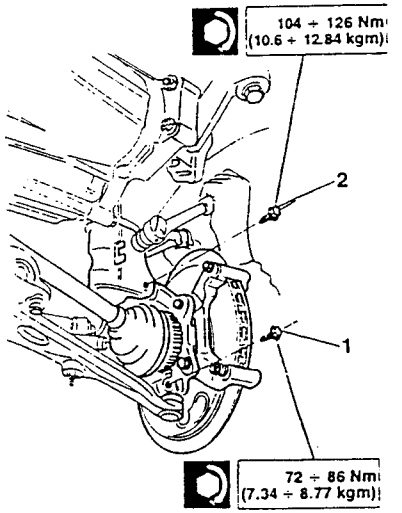
1. Unscrew the six bolts and disconnect the constant speed joint from the differential flange and removing the three safety plates.
2. Unscrew the two bolts securing the brake caliper and remove it together with the pads and arrange it in the upper part of the wheel housing.

CAUTION:
- **On installation replace the screws securing the brake caliper body.**
- **The brake pad and wear sensor must be installed on the inner side of the disc (brake caliper piston side); also check that the discharge duct on the outer part of the pad is placed to the rear of the direction of travel.**

3. (only for vehicles equipped with ABS):
   - unscrew the screws securing the ABS sensor and remove it.
4. Unscrew the nut securing the steering cross tie-rod spherical joint and withdraw it using tool-No. 1.821.169.000.
5. Unscrew the plug and drain the oil from the gearbox-differential. (Refill gearbox with the prescribed oil on installation)

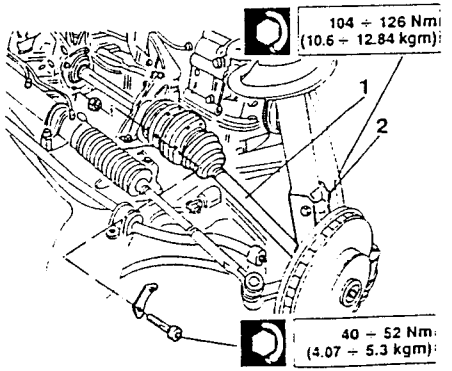


1. Unscrew and remove the bolt securing the wheel support to the spherical joint of the suspension arm.
2. Unscrew the two bolts securing the suspension stem to the wheel support and remove wheel hub, brake disc and drive shaft assembly.

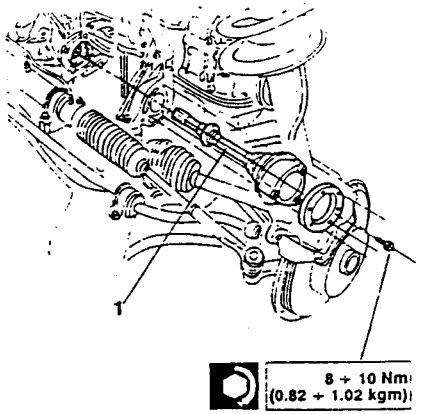


- Proceding from the right-hand side of the vehicle, operate as follows:

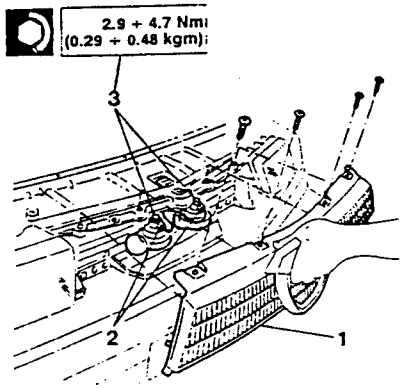
1. Unscrew the six bolts and disconnect the right-hand constant speed joint from the intermediate shaft and remove the three safety plates.
2. Loosen the two bolts securing the wheel support to the suspension stem and remove the upper one.



1. Unscrew the screws securing the intermediate shaft flange to the engine mounting and withdraw the shaft from the differential.

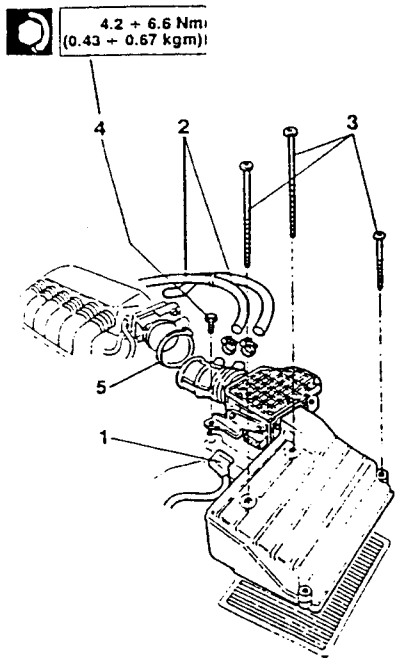


1. Unscrew the four screws and remove the front grill.
2. Disconnect the electrical wiring of the horns.
3. Unscrew the nuts securing the horns to the front cross member and remove the horns.

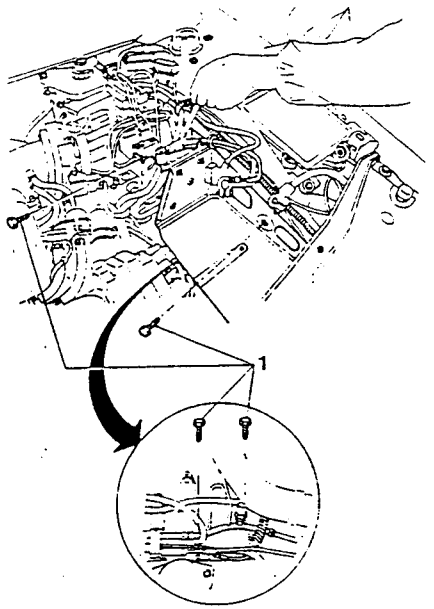


VARIATIONS FOR 2.4 V6 VEHICLES

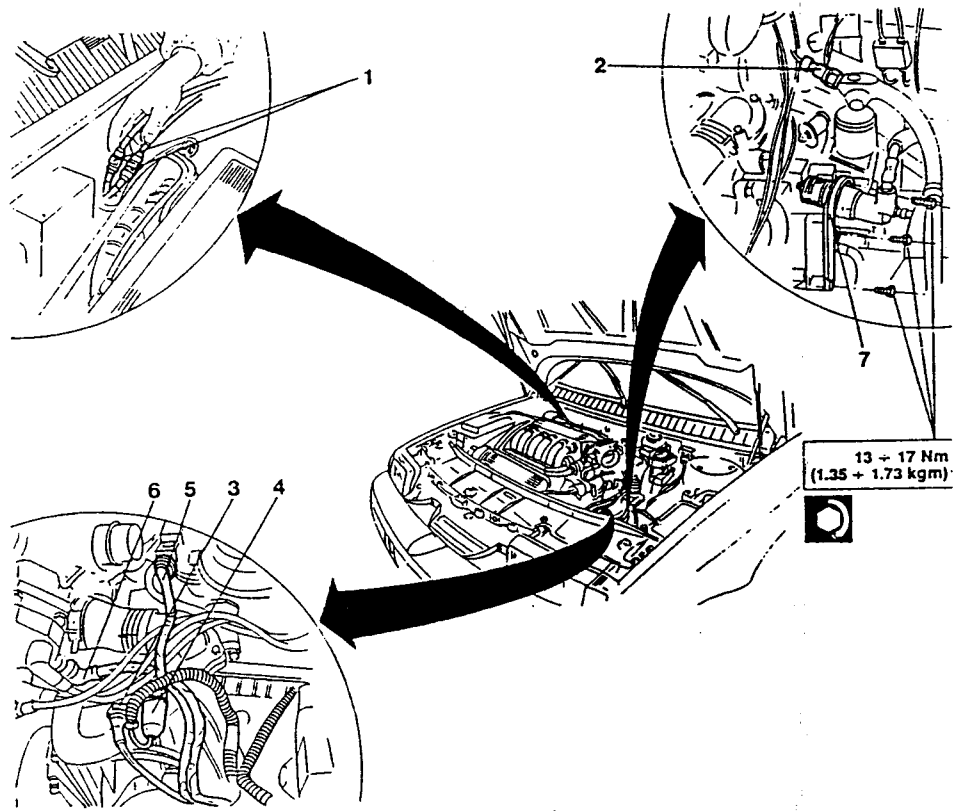
1. Disconnect the connector from the air flow meter.
2. Disconnect the oil vapour recirculation hose and the constant idle speed actuator hose.
3. Unscrew the screws securing the air cleaner cover.
4. Unscrew the screws securing the air flow meter square to the battery support.
5. Loosen the clamps securing the corrugated intake hose from the intake box side and remove the air cleaner cover and air flow meter assembly.



1. Unscrew the screws securing the battery support to the body and remove the support.



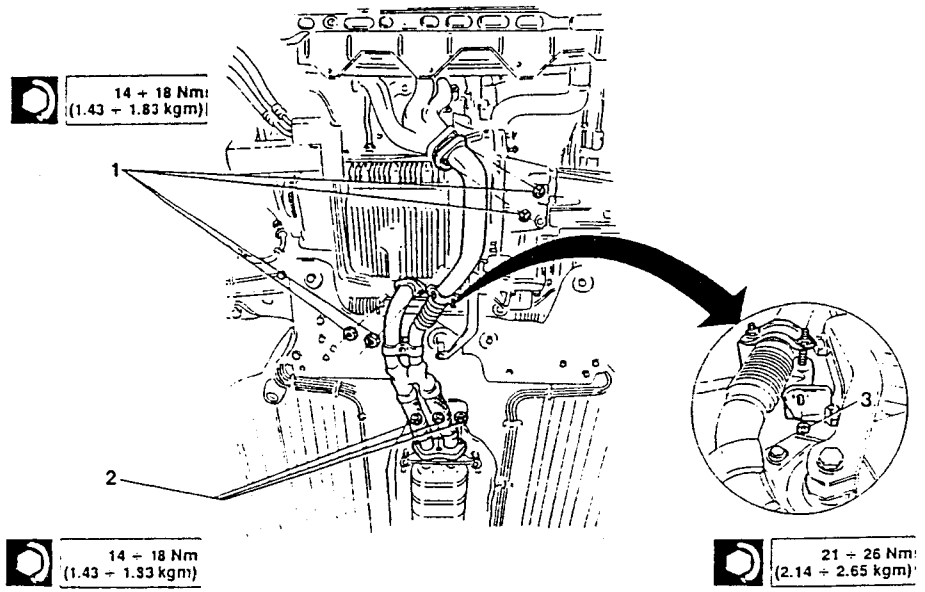
- Disconnect the connectors of the following devices:
1. (only for vehicles with catalyzed exhaust system):
   - two cables of the Lambda probe located near the service tank;
2. (only for vehicles with controlled damping suspension):
   - controlled damping system sensor on brake pump;
3. reverse gear switch.
4. water temperature sensor bulb, engine cooling system;
5. throttle valve switch (minimum-maximum);
6. ignition device.
7. Unscrew the three bolts and remove the clutch engagement cylinder bracket together with the earth lead. Secure the previously disconnected cylinder and relative wiring to the side panel.



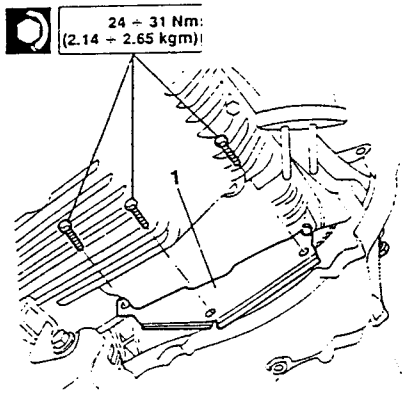
1. Unscrew the nuts securing the forward section of the exhaust pipe to the exhaust manifolds.
2. Unscrew the nuts securing the forward section of the exhaust pipe to the intermediate section.

CAUTION:
Pay particular attention when removing the forward section of the exhaust pipe in order to avoid damaging the wiring of the Lambda probe.

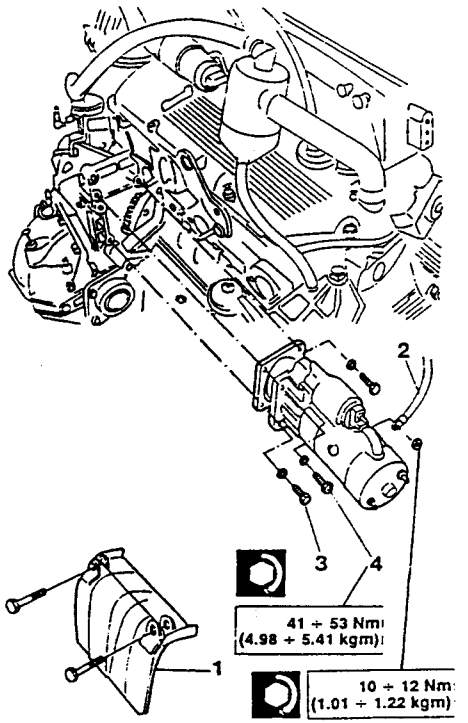
3. Unscrew the nut securing the exhaust pipe support bracket to the gearbox central support and remove the exhaust pipe.



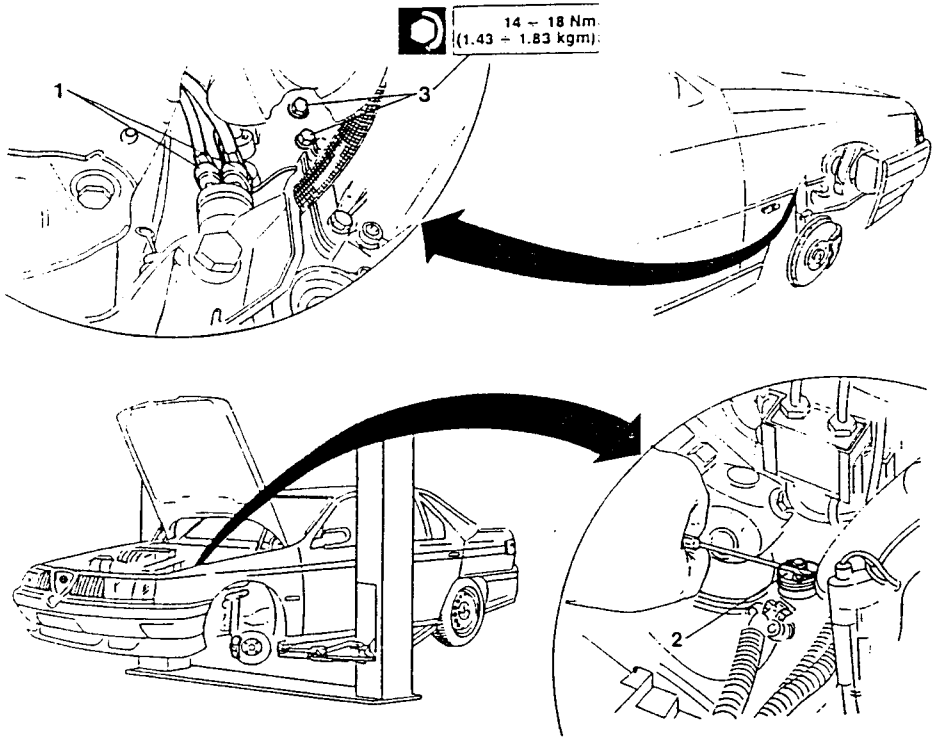
1. Unscrew the screws and remove the engine flywheel lower cover.



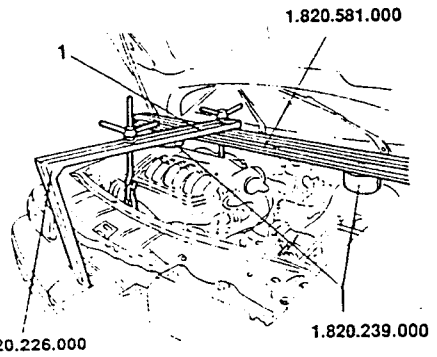
1. Unscrew the screws securing the starter motor protective heat shield and remove both parts of the shield.
2. Unscrew the nut securing the starter motor supply cable and disconnect the cable.
3. Unscrew the starter motor retaining screws.
4. Unscrew the engine-gearbox retaining bolt located under the starter motor.



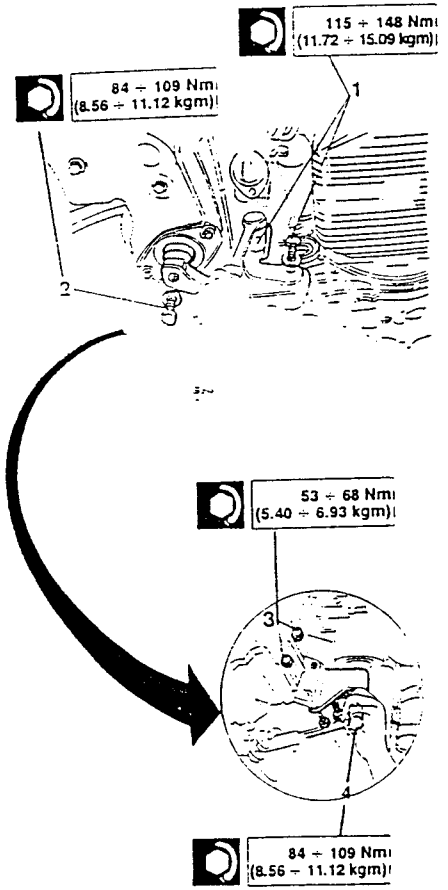
1. Disconnect the odometer sensor connector.
2. Disconnect the clips securing the gearbox control-cables to the speed engagement device.
3. Unscrew the three bolts securing the gearbox control cable reaction bracket and move it.



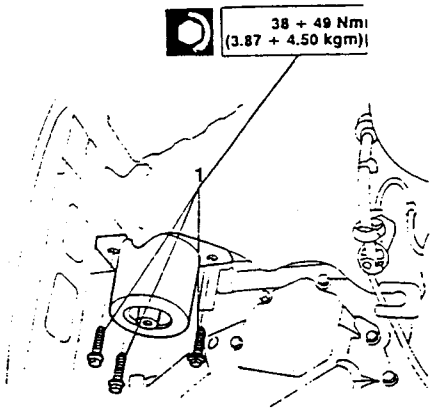
1. Position support Nos. 1.820.239.000, cross member No. 1.820.581.000 and engine support No. 1.820.226.000, and hook up the engine after having positioned suitable support hooks.



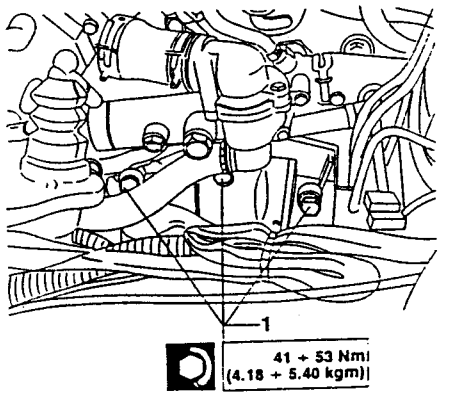
1. Unscrew the screws securing the engine central mounting bracket to the flexible pad and remove the bracket.
2. Unscrew the screws securing the engine central mounting bracket to the differential.
3. Unscrew the screws securing the front left engine mounting bracket to the gearbox.
4. Unscrew the screw securing the front left engine mounting bracket to the fleible block and remove the bracket.



1. Remove the three screws securing the front left engine mounting brackets to the body and remove the mounting.

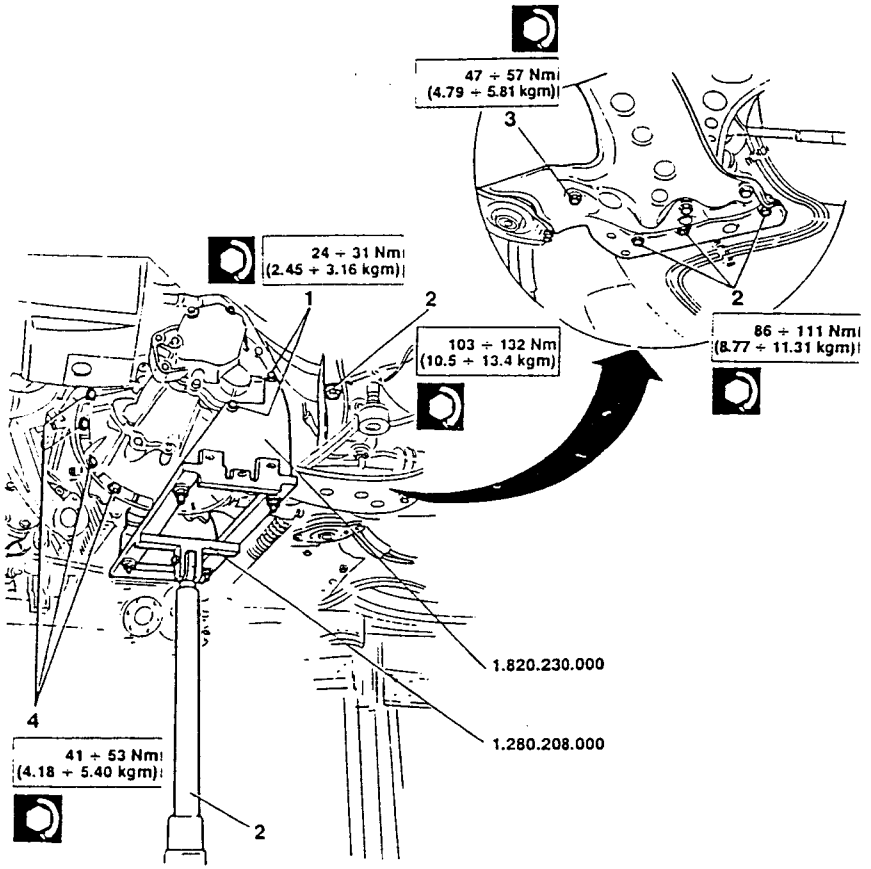


1. Operating inside the engine compartment, unscrew the three upper engine-gearbox retaining screws.



- Working underneath the vehicle proceed as follows:

1. Unscrew the two screws securing the gearbox cover and install brackets No. 1.820.230.000 and support No. 1.820.208.000.
2. Using a hydraulic lift, take the weight of the gearbox assembly and unscrew the screws securing the front suspension cross member to the body as indicated in the illustration.
3. Loosen the two central screws securing the cross member to the steering box.
4. Unscrew the screws securing the gear lever bell to the engine and disconnect the gearbox from the engine.

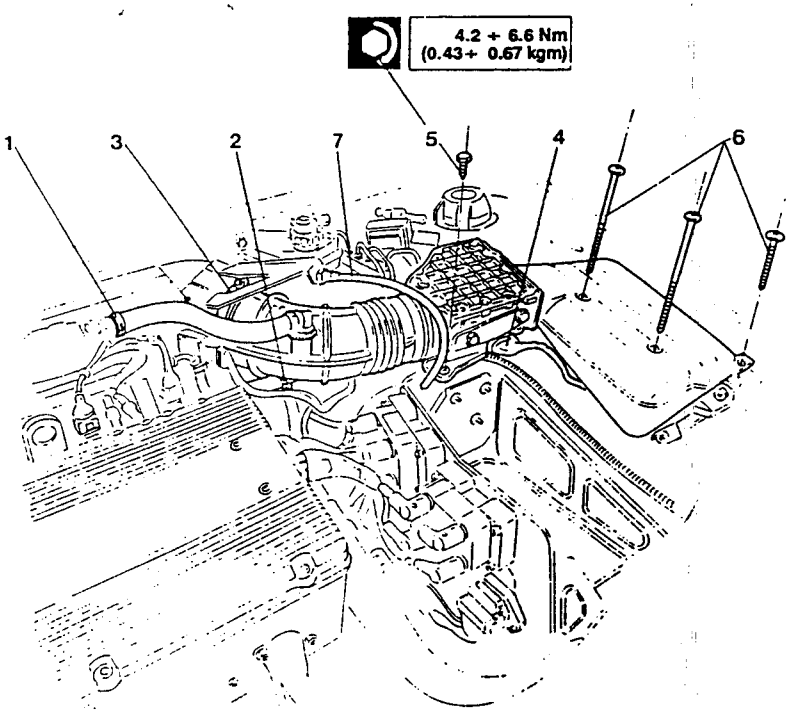


VARIATIONS FOR 1.8 - 2.0 T.S. VEHICLES

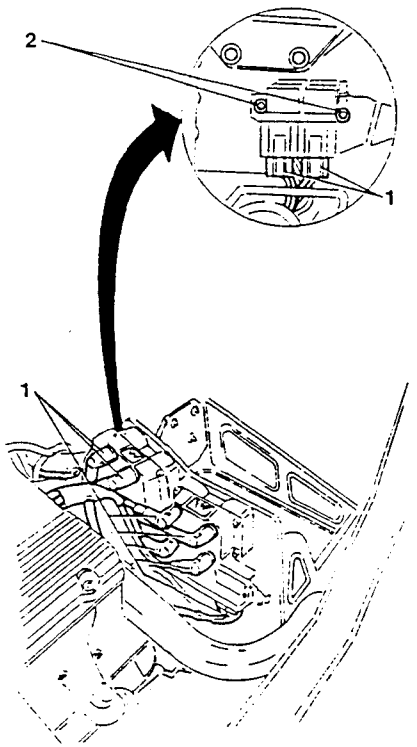
1. Loosen the clamps securing the oil vapour decanter hose and disconnect the hose.
2. Loosen the clamps holding the constant idle speed actuator hose and disconnect the hose.

- (only for vehicles with catalytic exhaust system): disconnect the connectors of the two cables of the Lambda probe located near the service tank.

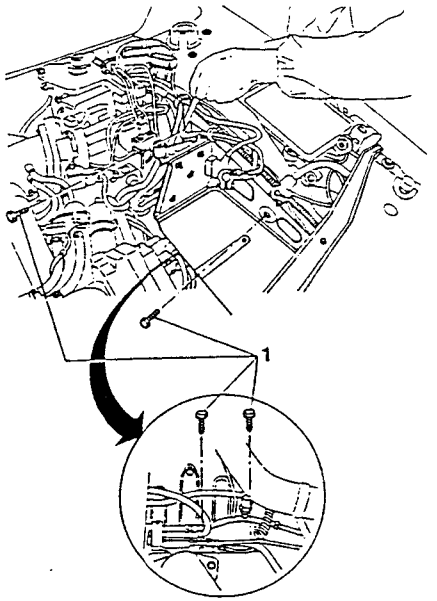
3. Loosen the clamps holding the suction manifold.
4. Disconnect the air flow meter connector.
5. Unscrew the screws of the air flow meter bracket.
6. Unscrew the three screws securing the intake box and remove it.
7. Free the accelerator cable and the positive cables of the battery from the anchor point on the battery holder.



1. Disconnect the ignition coil wiring and connectors located on the battery holder.
2. Unscrew the two screws securing the relay support bracket to the battery holder and remove it.

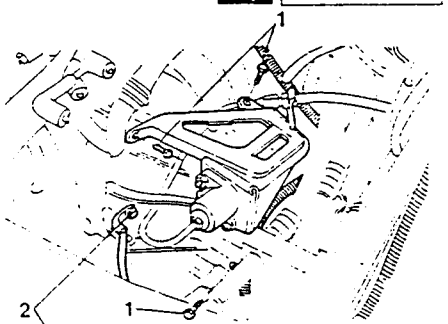


1. Unscrew the screws securing the battery holder to the body and remove the plate.



1. Unscrew the three screws securing the clutch engagement cylinder support bracket to the gear lever bell and remove the bracket and cylinder.
2. Unscrew the screw securing the earth lead to the gear lever bell and remove the cable.

20.9 ÷ 23.1 Nm (2.13 ÷ 2.35 kgm)



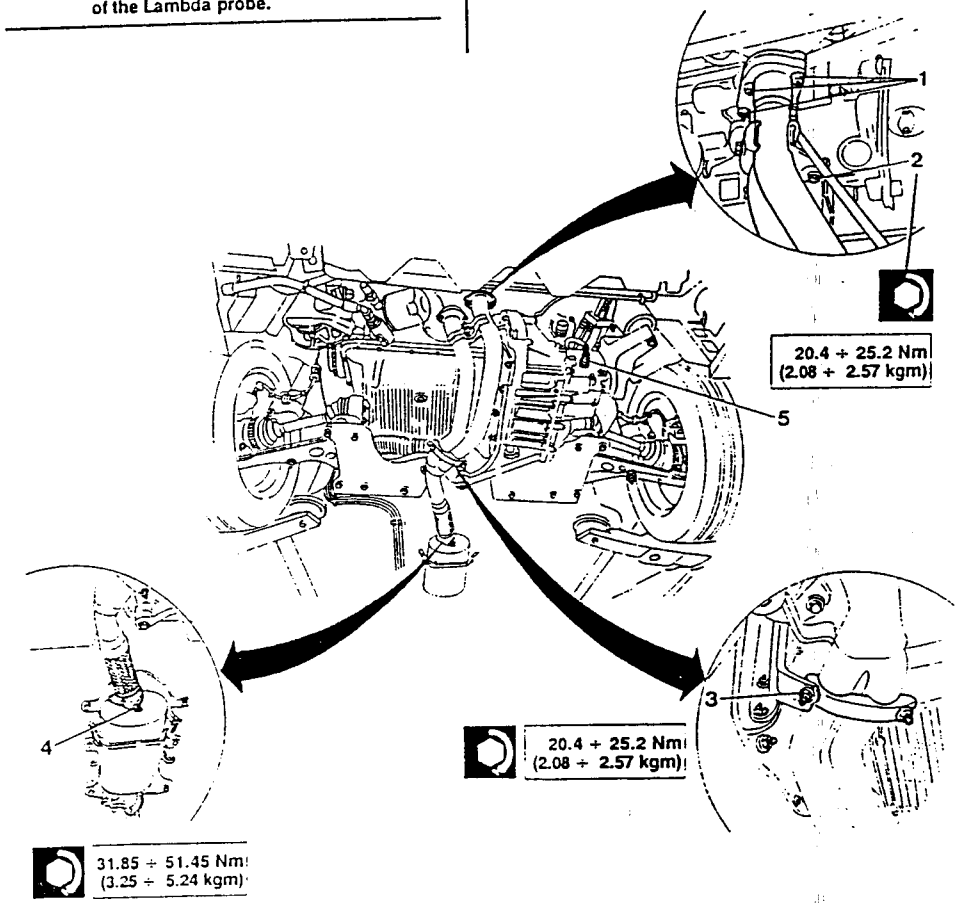
20.4 ÷ 25.2 Nm (2.08 ÷ 2.57 kgm)

– Raise the vehicle and proceed as follows:
1. Unscrew the nuts securing the exhaust pipes to the manifolds.
2. Unscrew the screws securing the exhaust pipe support bracket to the engine block.
3. Unscrew the nut securing the exhaust pipe support bracket to the central engine mounting.

CAUTION:
(only for vehicles with catalyzed exhaust system) Pay particular attention when removing the forward section of the exhaust pipe in order to avoid damaging the wiring of the Lambda probe.

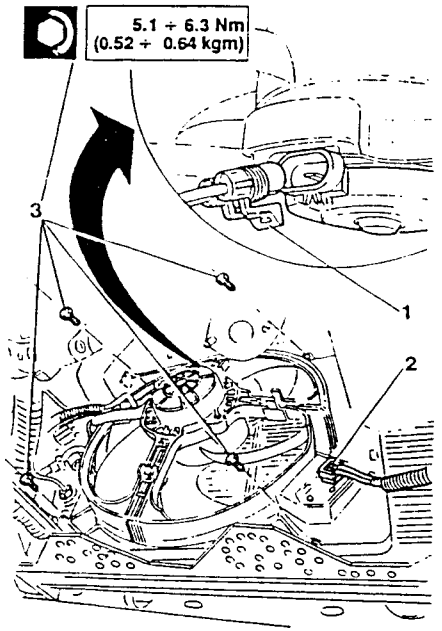
4. Unscrew the nut tightening the metal band connecting the forward and central sections of the exhaust pipe and remove the forward section.
5. Disconnect the reversing lamp wiring connector.

18 ÷ 19.95 Nm (1.83 ÷ 2.03 kgm)

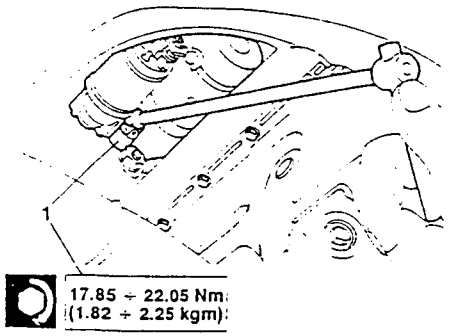


31.85 ÷ 51.45 Nm (3.25 ÷ 5.24 kgm)

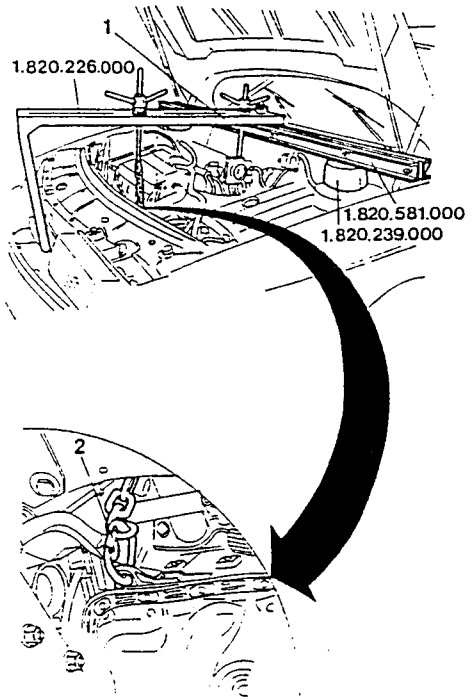
1. Disconnect the electric fan supply wiring connector.
2. Disconnect the electric fan additional resistance v..r-ing connector.
3. Unscrew the four screws securing the electric fan and remove it.



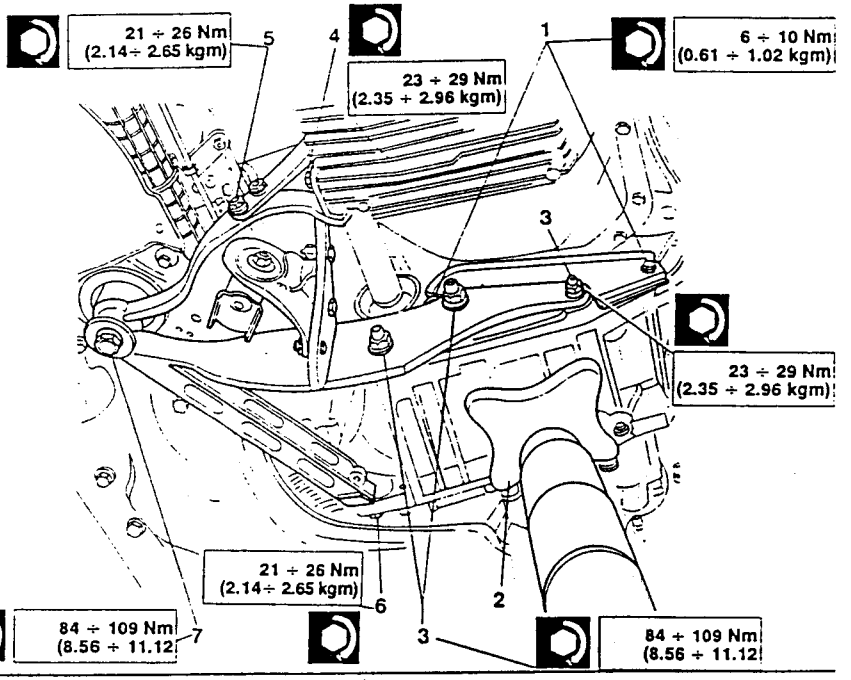
1. Unscrew the screws securing the starter motor to the gear lever bell.



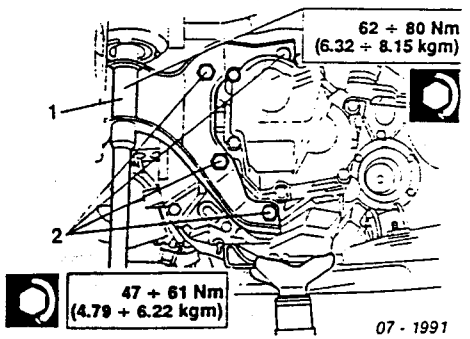
– Lower the vehicle and proceed as follows:
1. Position supports No. 1.820.239.000, cross member No. 1.820.581.000 and engine support No. 1.820.226.000.
2. Secure the engine to the cross member with suitable support rings.



– Raise the vehicle and proceed as follows:
1. Unscrew the screws securing the engine flywheel cover and remove the cover.
2. Take the weight of the gearbox with a hydraulic lift.
3. Unscrew the nuts securing the central engine support bracket to the gearbox.
4. Unscrew the screws securing the arm of the central engine support bracket to the engine block.
5. Unscrew the screws securing the arm of the central engine support bracket to the strut of the engine block.
6. Unscrew the screw securing the strut of the central engine support bracket to the gearbox.
7. Unscrew the screws securing the central engine support bracket to the flexible pad and remove the bracket.
8. Unscrew the screws securing the steering box to the cross member.
9. Unscrew the screws securing the cross member to the body and remove the cross member.

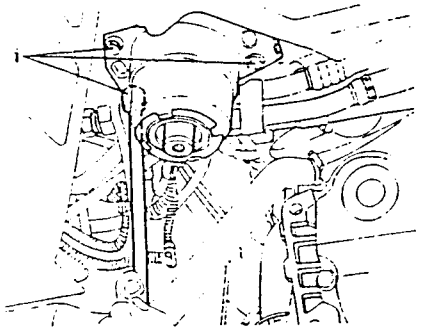


1. Unscrew the screws securing the gearbox support to the flexible pad.
2. Unscrew the screws securing the mensola to the gearbox and remove it.

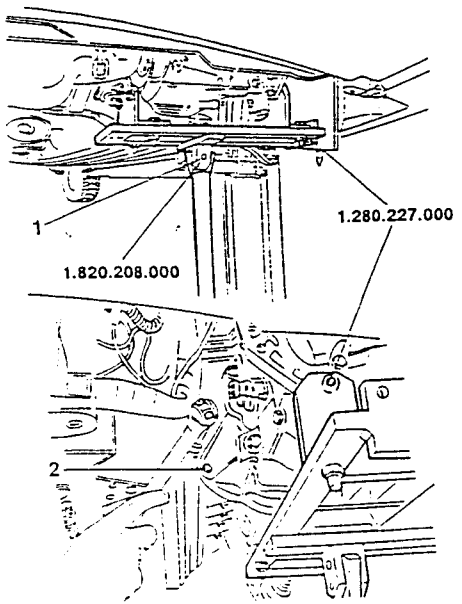


1. Unscrew and remove the flexible pad from the body.

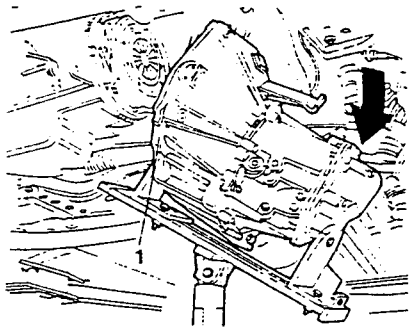
38 ÷ 49 Nm
(3.57 ÷ 4.99 kgm)



1. Set the gearbox support tool No. 1.820.208.000 with brackets 1.820.227.000 on a hydraulic jack and secure the gearbox as shown in the diagram.
2. Unscrew the engine-gearbox retaining screws.



1. Manoeuvre the gearbox - differential assembly in order to free it from the centering pins on the engine and to withdraw the clutch shaft from the driven disc. Lower the jack and remove the gearbox - differential group from the engine compartment.



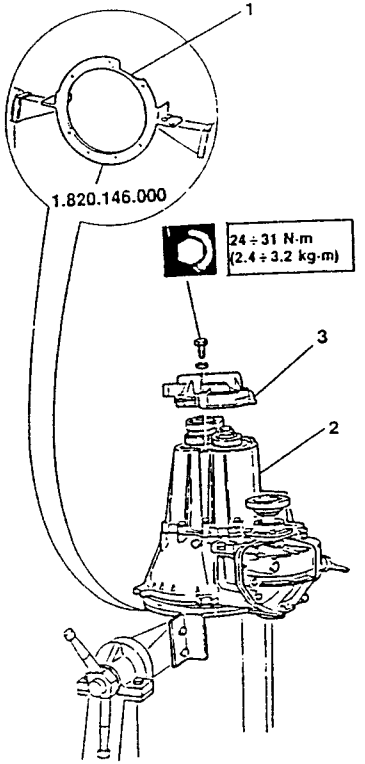
NOTE: Re-install the gearbox - differential assembly by reversing the sequence of operations described above. These procedures are also valid for vehicles and/ or versions equipped with special systems and/or devices.

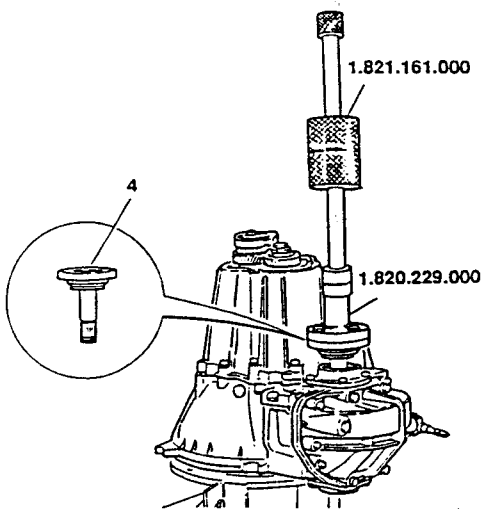
CAUTION:
After installing the gearbox - differential assembly, check and if necessary adjust the height of the clutch pedal (see: GR. 12).

DISASSEMBLY 2.4 V6

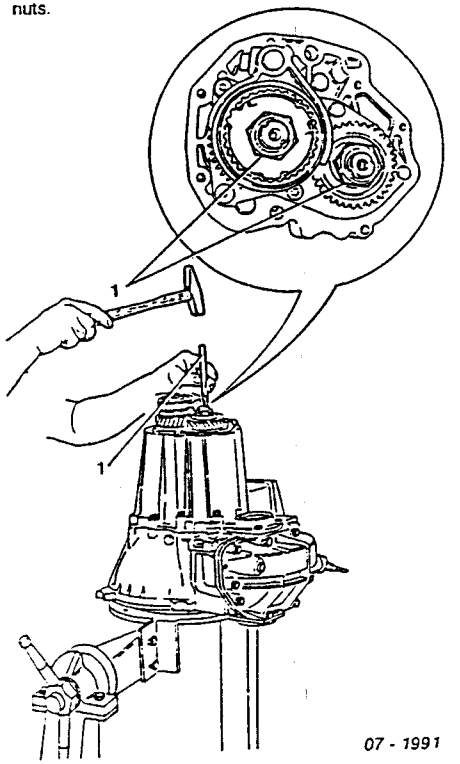
BENCH DISASSEMBLY

1. Fix support plate No. 1.820.146.000. to gearbox flange.
2. Install gearbox on rotary stand.
3. Remove rear cover.
4. Extract flange from differential using tools No. 1.821.161.000 and No. 1.820.229.000.

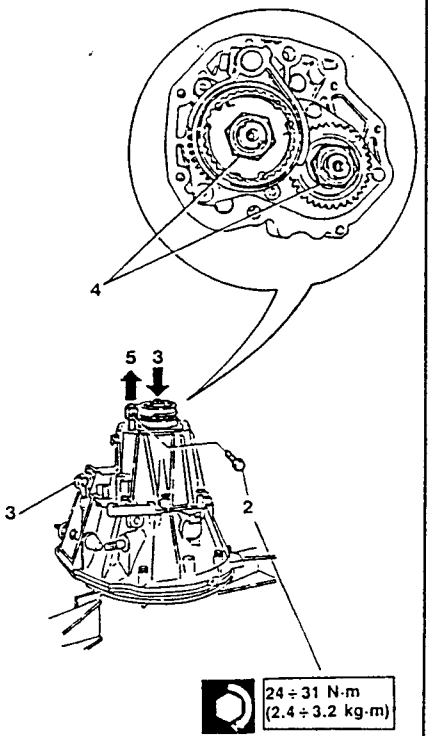




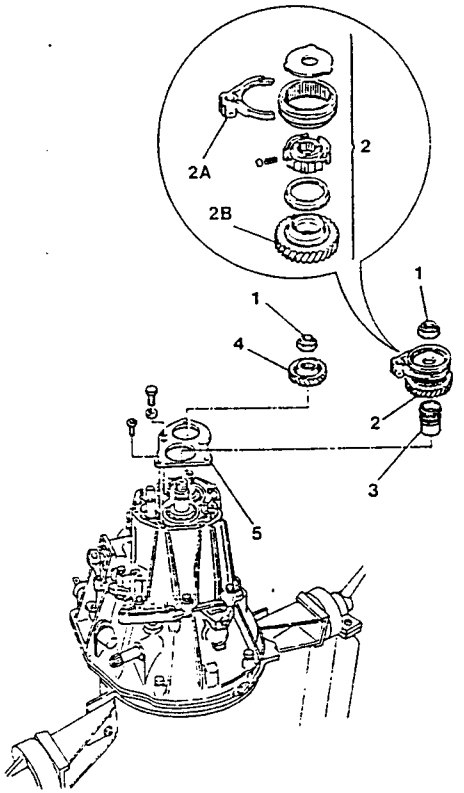
1. Straighten the caulking of main and lay shaft ring nuts.



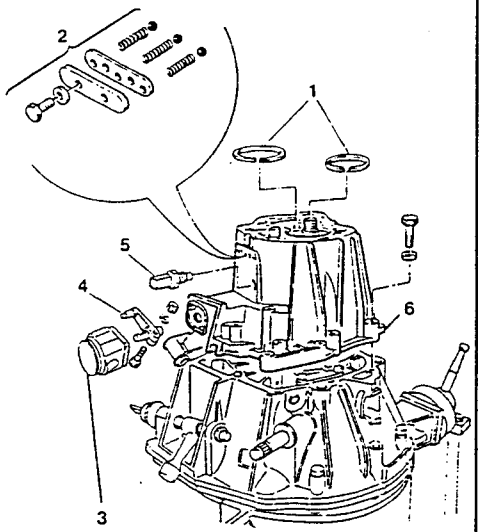
2. Remove the bolt securing 5th speed engagement fork to main shaft.
3. Lock gearbox shafts engaging 5th speed by hand (pressing the fork on main shaft) and engaging a speed using the selector lever.
4. Loosen the main and lay shaft ring nuts.
5. Return main shaft fork to idle position.



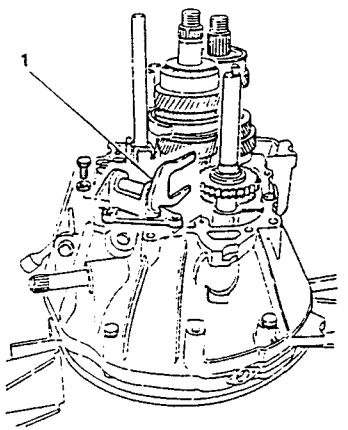
1. Remove the ring nuts securing main and lay shaft gears.
2. Withdraw hub-sleeve assembly with fork (2A) and drive gear (2B) with 5th speed synchronizer ring from main shaft.
3. Withdraw roller bearing and bushing of 5th speed gear from main shaft.
4. Withdraw 5th speed driven gear from layshaft.
5. Remove gearbox rear bearings retaining plate.



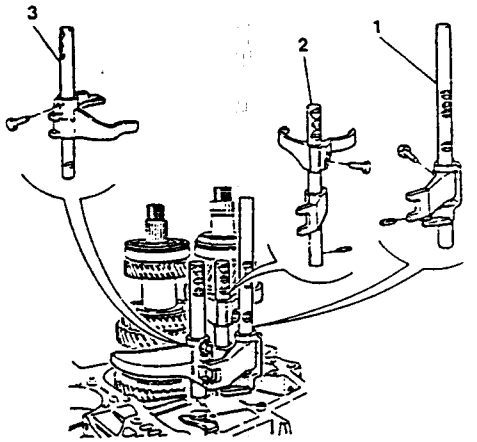
1. Remove flexible retaining rings securing gearbox rear bearings.
2. Remove retaining cover of speed control rod positioning balls and springs.
3. Remove the rubber protection.
4. Remove the speed engagement idler arm and relative support.
5. Remove the reversing light switch.
6. Remove gearbox casing by backing speed control shaft.



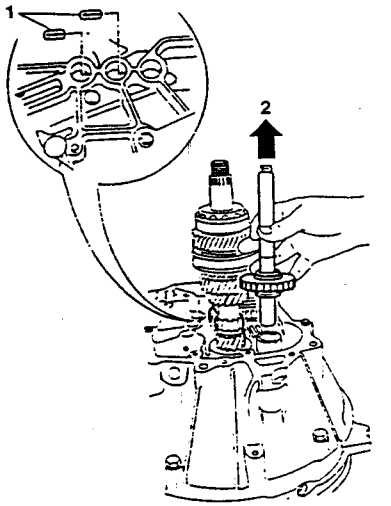
1. Remove reverse speed idle gear fork lever.



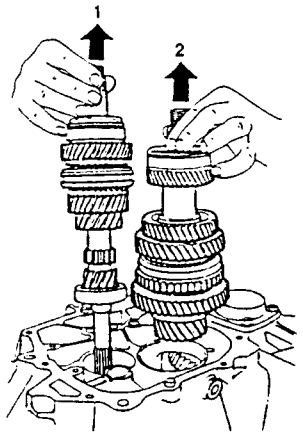
1. Remove the 5th and reverse speed rod.
2. Remove the 3rd and 4th speed rod and fork.
3. Remove the 1st and 2nd speed rod and fork.



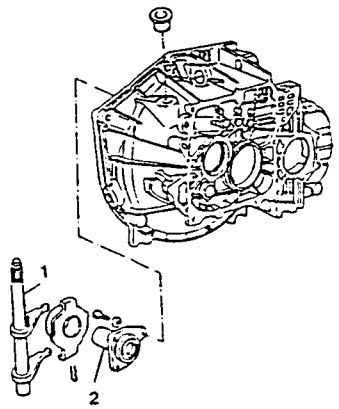
1. Remove safety pawls.
2. Remove reverse speed idle gear and shaft.



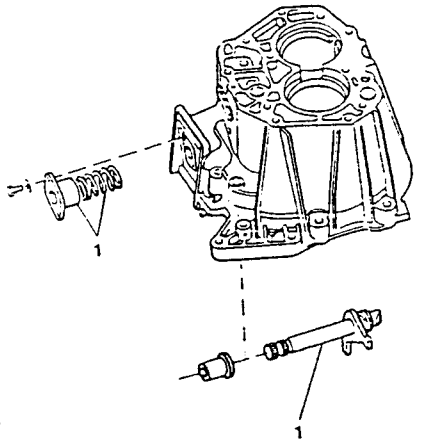
1. Remove the main shaft assembly.
2. Remove the lay shaft assembly.



1. Remove thrust bearing control shaft and fork.
2. Remove thrust bearing sleeve.

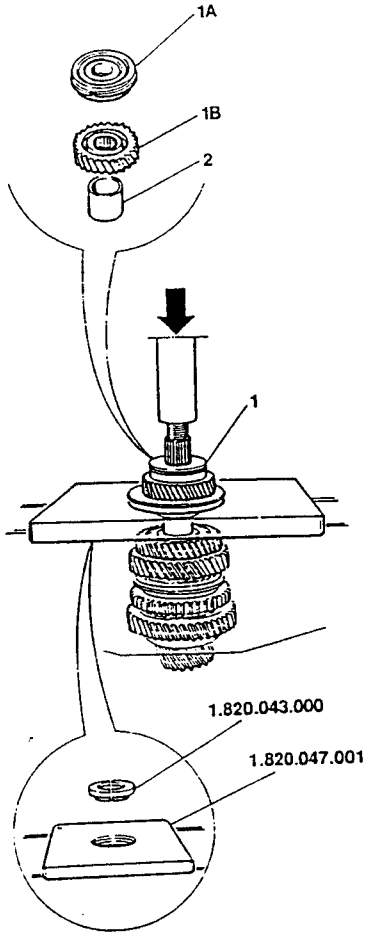


1. Remove complete speed control rod.

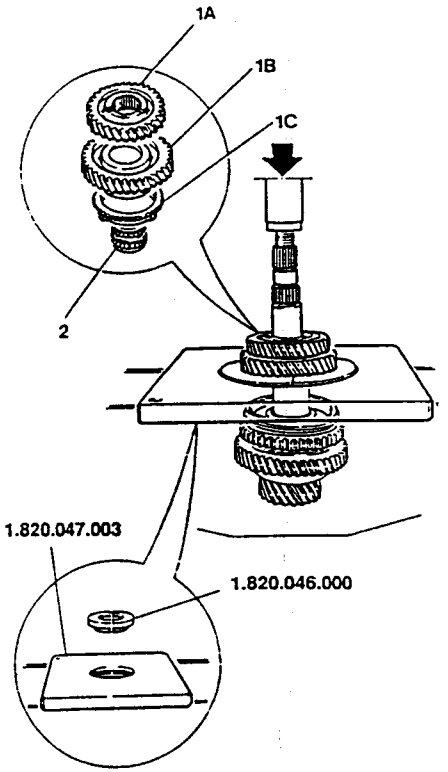


LAYSHAFT DISASSEMBLY

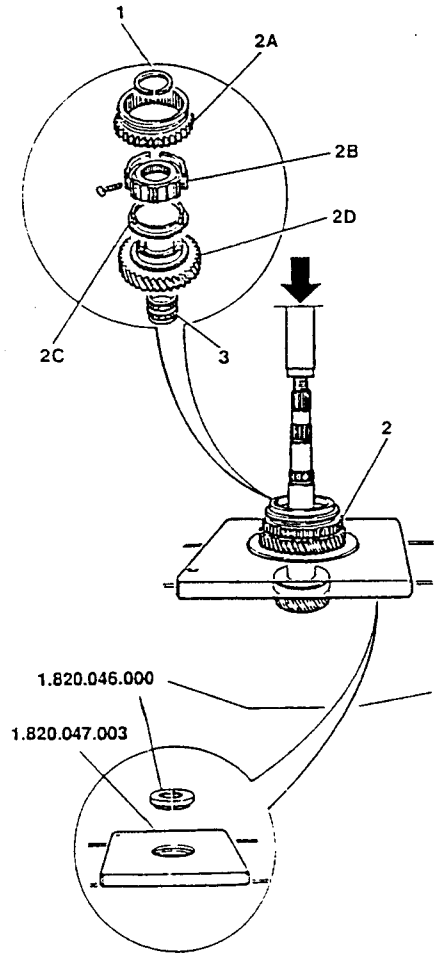
1. Using a press and suitable equipment, remove rear bearing (1A), and 4th speed driven gear (1B).
2. Withdraw spacer.



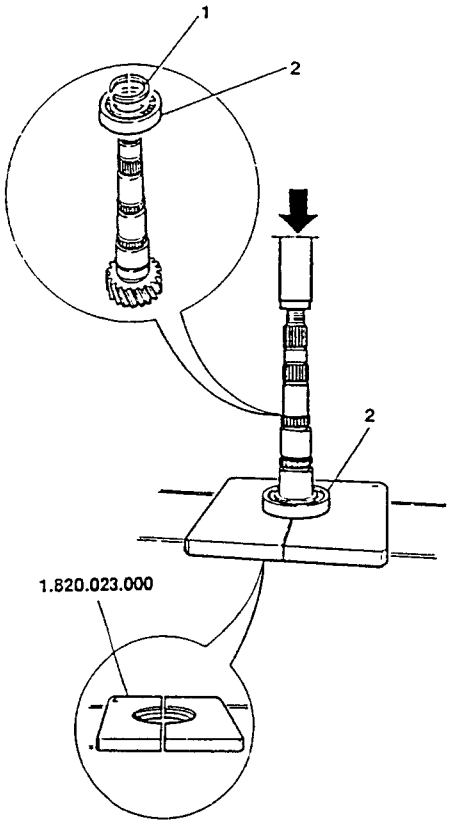
1. Using a press and suitable equipment, remove 2nd and 3rd driven gears (1A - 1B) and 2nd speed synchronizer ring (1C).
2. Withdraw bearing and rollers for 3rd speed driven gear



1. Remove flexible retaining ring securing 1st and 2nd speed engagement sliding hub.
2. Using a press and suitable equipment, remove 1st and 2nd speed engagement sliding sleeve and reverse gear (2A) hub (2B), 1st speed synchronizer ring (2C) and 1st speed driven gear (2D).
3. Withdraw 1st speed driven gear roller bearing.

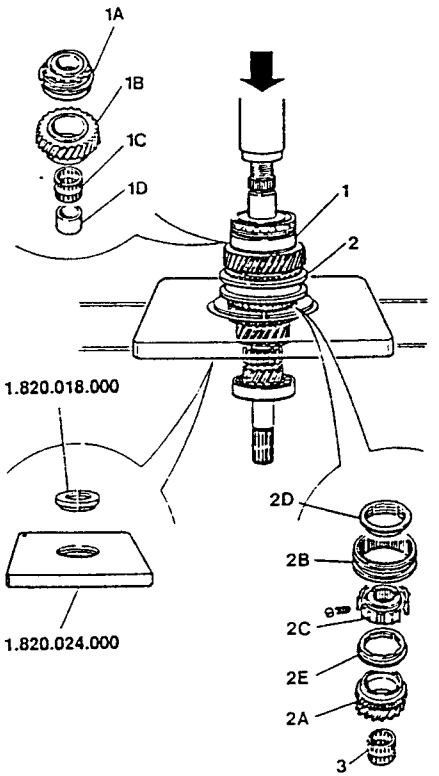


1. Remove flexible retaining ring securing front bearing.
2. Using a press and suitable equipment remove front bearing from transmission shaft.

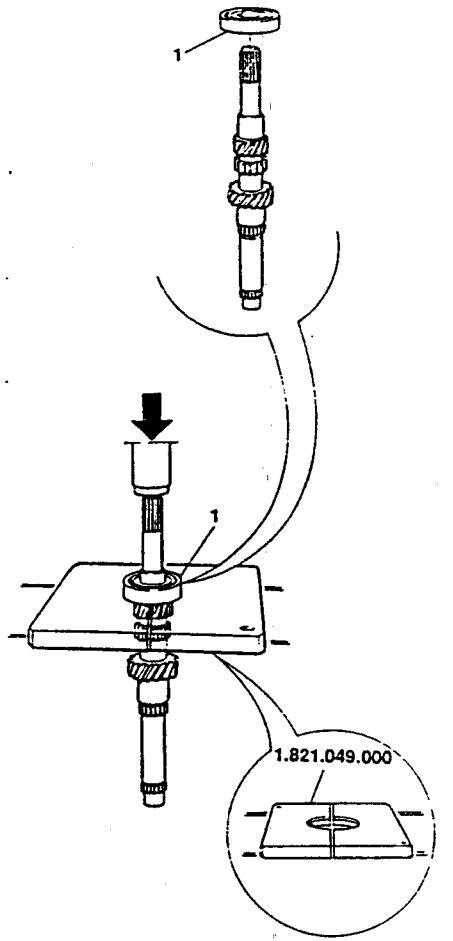


MAIN SHAFT DISASSEMBLY

1. Using a press and suitable equipment remove rear bearing (1A) and 4th speed drive gear assembly (1B) with relevant roller bearing (1C) and bushing (1D).
2. Withdraw 3rd speed drive gear (2A) and 3rd - 4th speed sliding sleeve assembly (2B) together with hub (2C) and 4th (2D) and 3rd (2E) speed synchronizer rings.
3. Withdraw 3rd speed drive gear roller bearing.



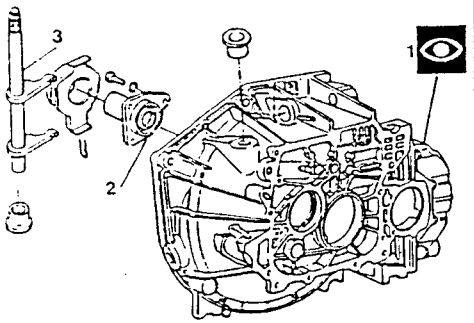
1. Using a press and suitable equipment remove front bearing from main shaft.

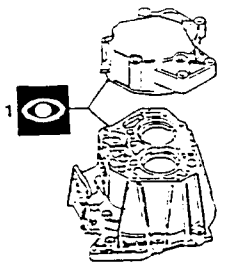


CHECKS AND INSPECTIONS 2.4 V6

GEARBOX SUPPORT - CENTRAL CASING - COVER

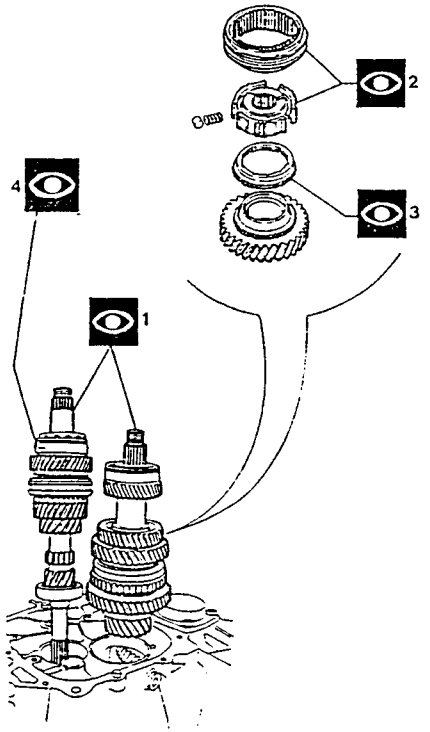
1. Check rods and bearing seats for cracks, wear or damage. Check that the contact surfaces are level (minor defects can be removed with a fine file).
2. Check for oil leaks; replace sleeve and seal assembly if necessary.
3. Check fork control shaft for excessive play; replace bushings if necessary.





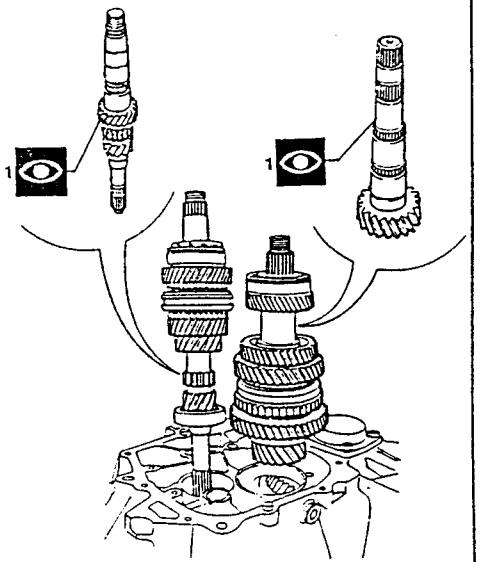
MAIN AND LAY SHAFTS

1. Check gear teeth for nicks or excessive wear and inner surfaces for seizing or abnormal wear.
2. Check hubs and sliding sleeves for nicks, freedom of movement, excessive play and seizing. Check sleeve inner teeth for excessive wear.
3. Check synchronizer rings for ovalization of inner surface.
4. Check rear bearing for scoring of outer race, inner ring and balls, signs of overheating or excessive wear.



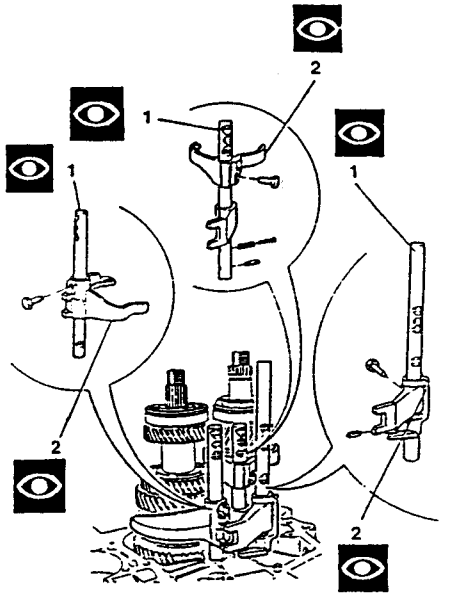
1. Check main and transmission shaft gears for nicks or excessive wear.

CAUTION:
- **When replacing main shaft (after high mileage) replace all layshaft gears.**
- **When replacing layshaft also replace differential ring gear.**



RODS AND FORKS

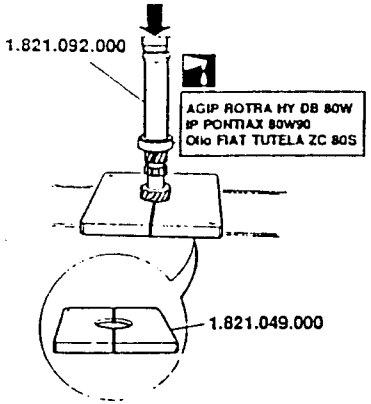
1. Check rods for distortion , wear and freedom of movement without excessive play.
2. Check forks for distortion or wear of surfaces mating the sliding sleeves.

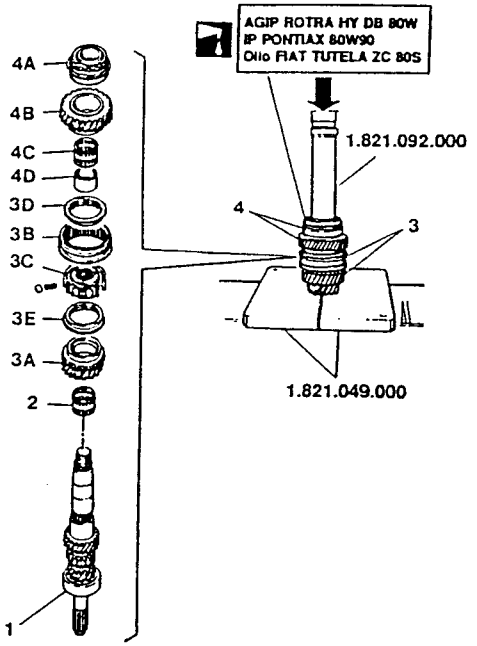


REASSEMBLY 2.4 V6

MAIN SHAFT REASSEMBLY

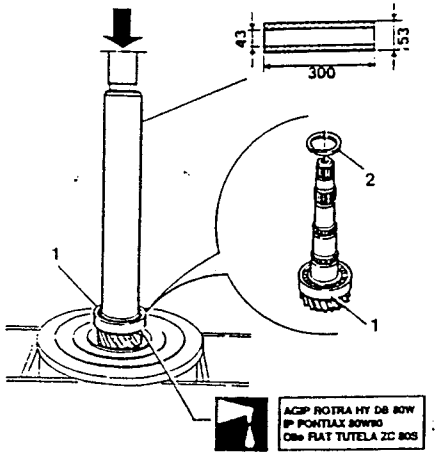
1. Using a press and suitable tool, install front bearing.
2. Install 3rd speed drive gear roller bearing.
3. Install 3rd speed drive gear (3A) and 3rd - 4th speed engagement sleeve assembly (3B) together with hub (3C) and 4th (3D) and 3rd (3E) speed synchronizer rings.
4. Install 4th speed drive gear (4B) with relative roller bearing (4C) and bushing (4D), then using a press and suitable tool, install the rear bearing (4A).



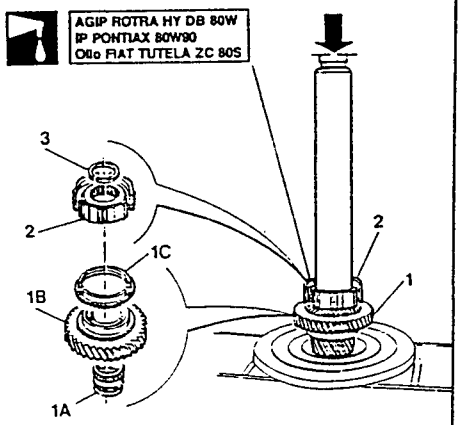


LAYSHAFT REASSEMBLY

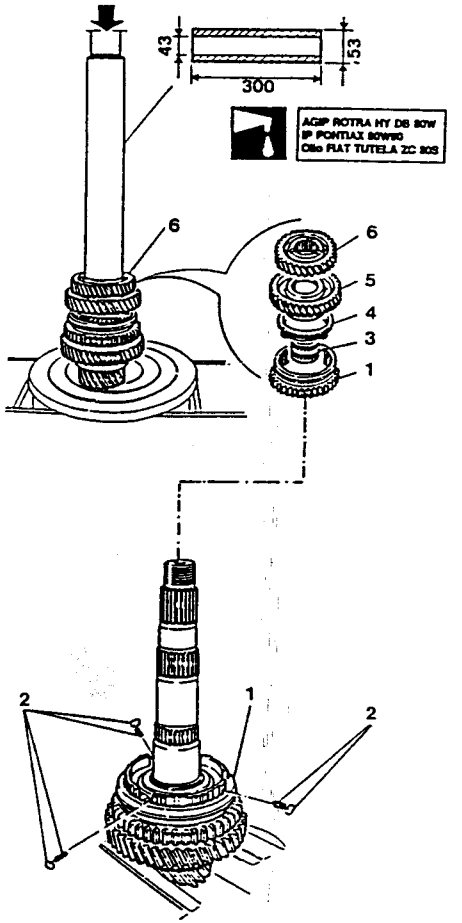
1. Using a press and suitable tool, install front bearing.
2. Install the flexible retaining ring securing bearing.



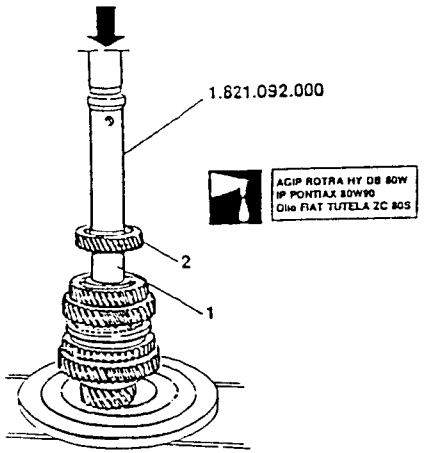
1. Install roller bearing (1A), 1st speed driven gear (1B), and 1st speed synchronizer ring (1C).
2. Using a press and suitable tool install 1st and 2nd speed sliding sleeve hub.
3. Install flexible retaining ring securing hub.



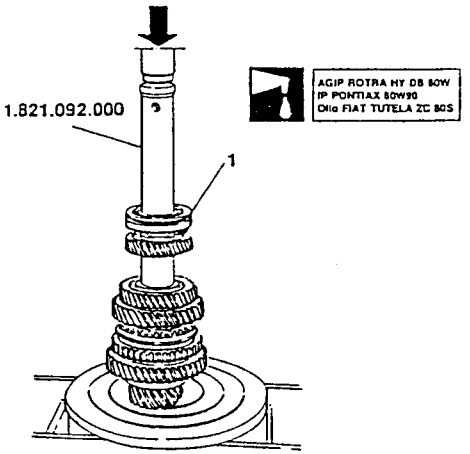
1. Install 1st and 2nd speed engagement sliding sleeve - reverse speed gear.
2. Insert springs and pins into hub.
3. Install 2nd speed driven gear roller bearing.
4. Install 2nd speed flexible synchronizer ring.
5. Install 2nd speed driven gear.
6. Using a press and suitable tool install 3rd speed driven gear.



1. Install spacer.
2. Using a press and suitable tool, install 4th speed driven gear.

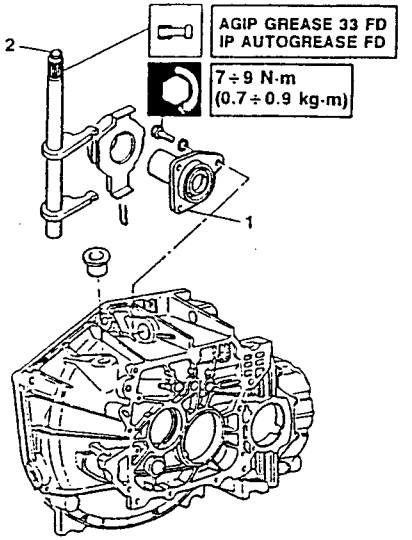


1. Using a press and suitable tool, install rear bearing.

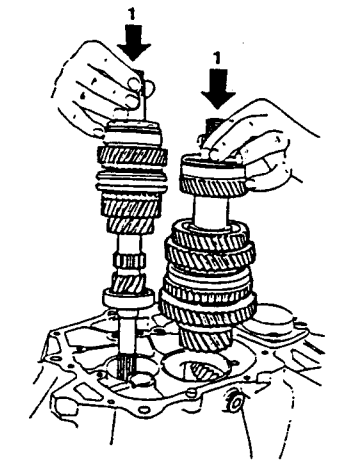


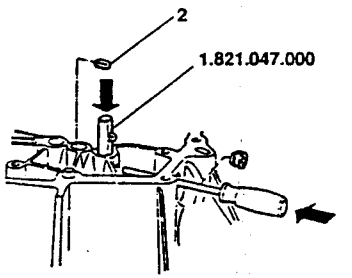
BENCH REASSEMBLY

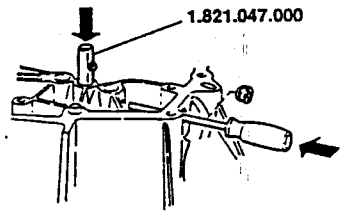
1. Install thrust bearing sleeve.
2. Install thrust bearing engagement rod and fork.



1. Insert main and lay shafts.
2. Insert safety pawls (use tool No. 1.821.047.000).

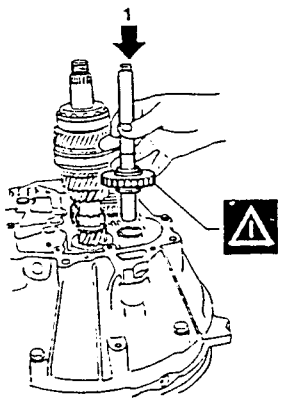






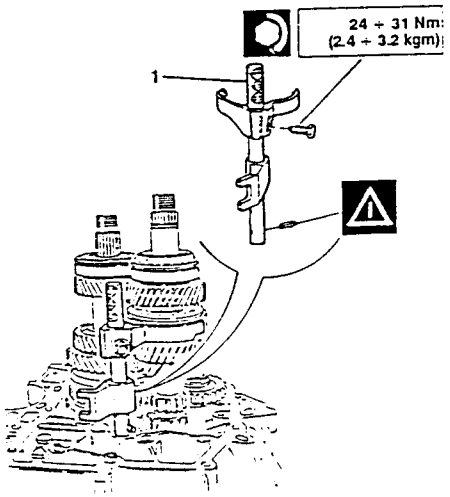
1. Install reverse speed shaft and idle gear.

CAUTION:
Ensure gear engagement toothing faces downwards.



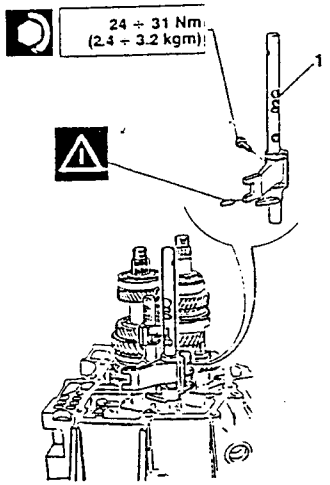
1. Install 3rd and 4th speed rod, fork and prong.

CAUTION:
Before installing rod, install safety pawl into rod.

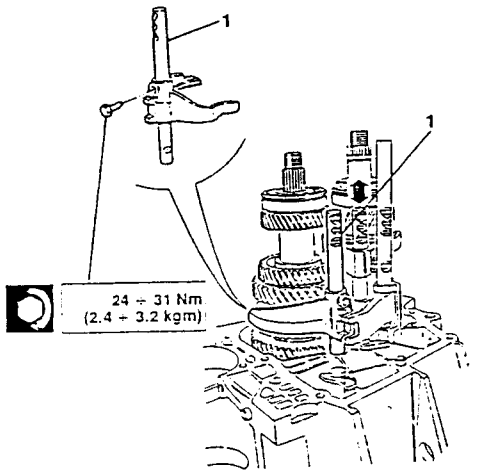


1. Install 5th and reverse speed rod and control prong.

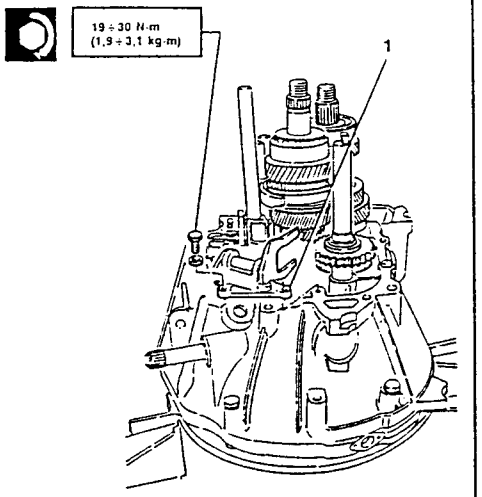
CAUTION:
Before installing prong, install safety pawl into prong.



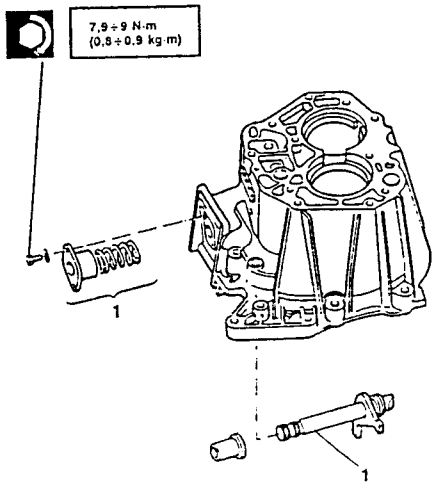
1. Install 1st and 2nd speed rod and fork. Move 3rd and 4th speed control rod to facilitate installation.



1. Install reverse speed idle gear fork lever.

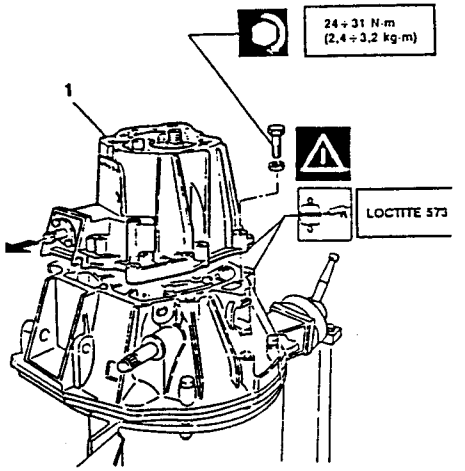


1. Install speed control shaft into cover without tightening retaining screws.

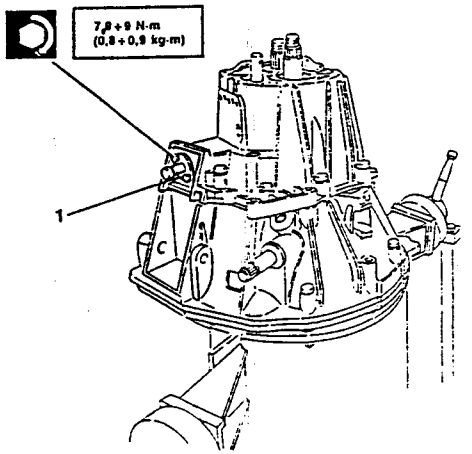


1. Install gearbox casing backing speed control shaft to facilitate engagement.

CAUTION:
Wipe contact surfaces with sealant.

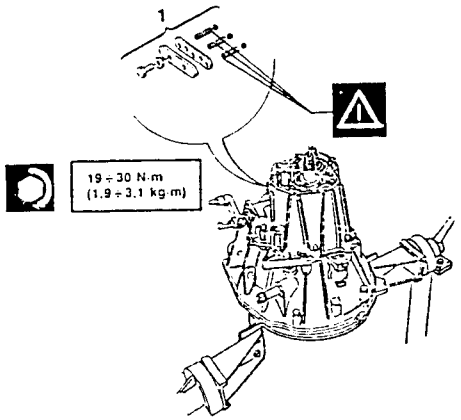


1. Tighten screws securing speed control shaft bushing.

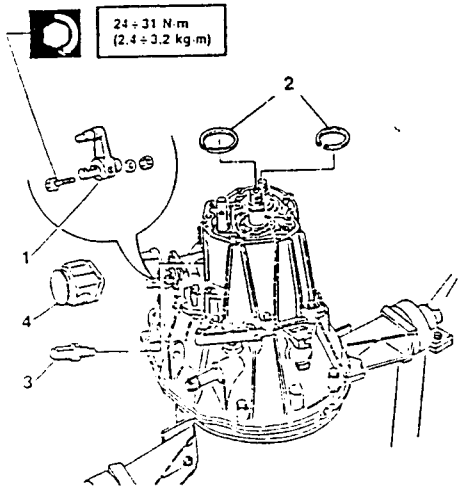


1. Install speed control rods, positioning balls and springs.

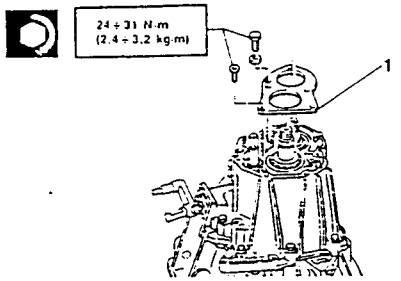
CAUTION:
Install spring made with wire of larger diameter on 5th and reverse speed control rod.



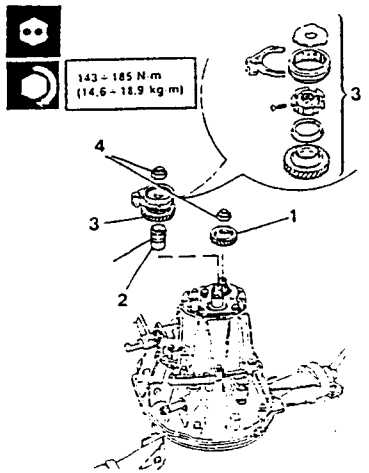
1. Install speed engagement idler arm and relative support.
2. Install flexible retaining rings securing bearings.
3. Install reversing light switch.
4. Install rubber protection.



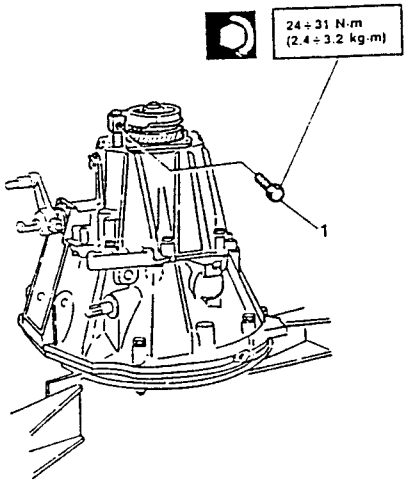
1. Install rear bearings retaining plate.



1. Install 5th speed driven gear onto layshaft.
2. Install 5th speed drive gear bushing and roller bearing onto main shaft.
3. Install 5th speed drive gear with synchronizer ring and hub-sliding sleeve assembly with fork and rollers and springs retaining flange.
4. Install ring nuts securing main and lay shaft gears. Perform caulking after tightening.



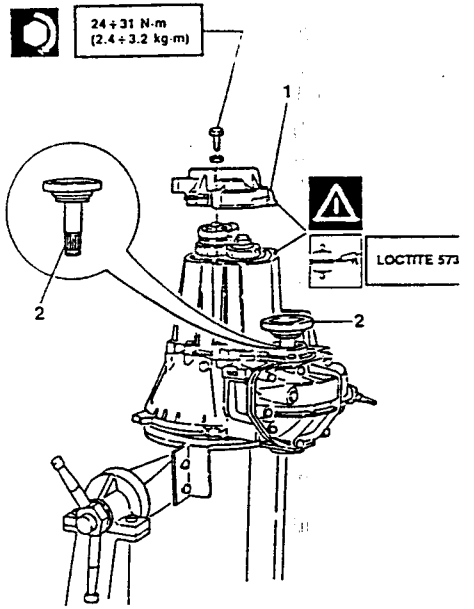
1. Install 5th speed engagement fork retaining screw.



1. Install rear cover.

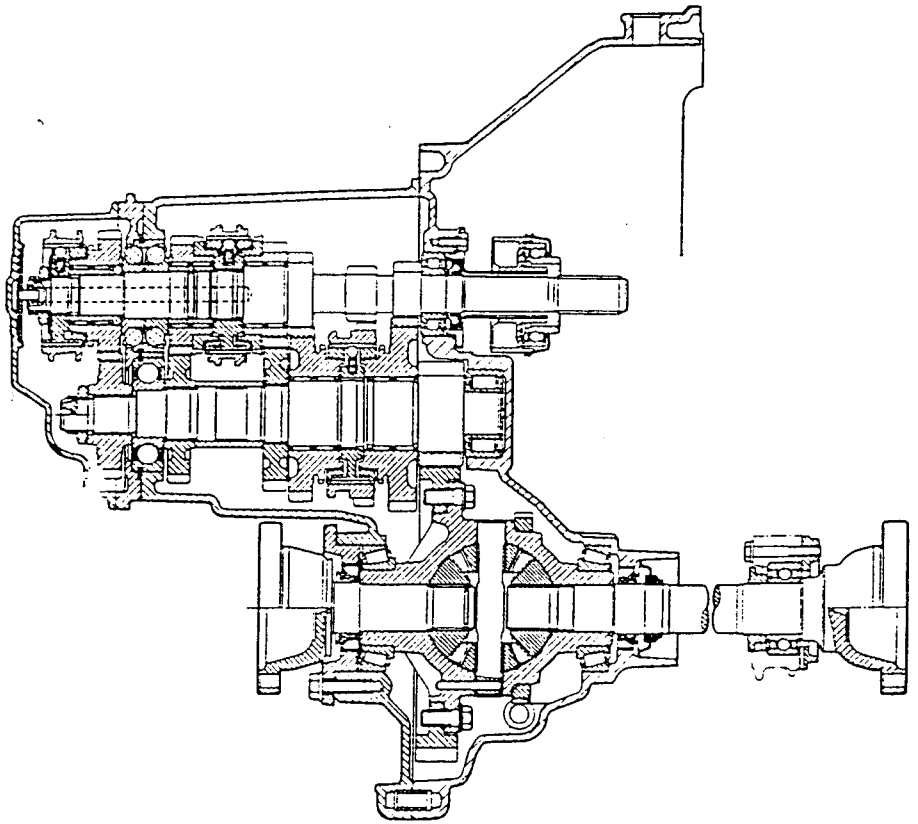
CAUTION:
Wipe contact surfaces with sealant.

2. Install flange.

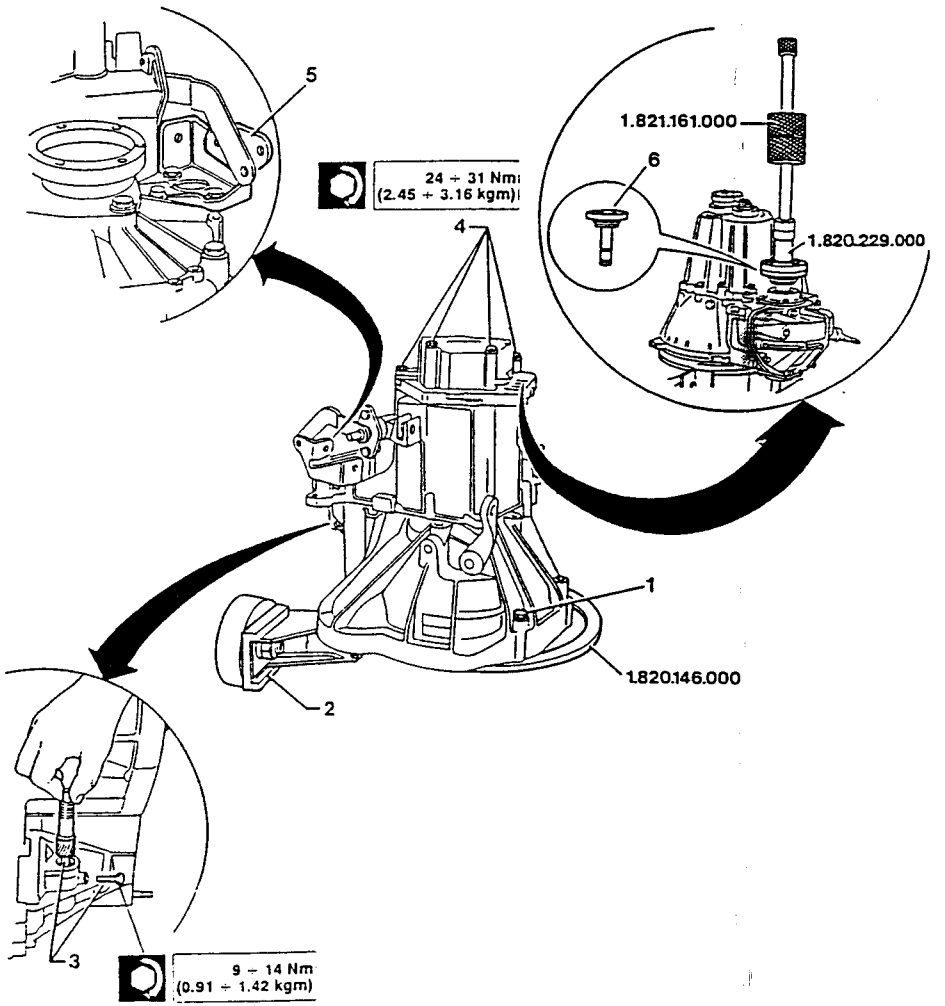


DISASSEMBLY 1.8 - 2.0 T.S.

BENCH DISASSEMBLY



1. Fix support plate No. 1.820.146.000 to the gearbox flange.
2. Place gearbox on a rotary stand.
3. Unscrew the retaining screw and remove the odometer idle gear.
4. Unscrew the six retaining screws and remove the rear cover.
5. Unscrew the retaining screws and remove the bracket supporting the speed engagement device.
6. Extract the flange from the differential using tool No. 1.821.161.000 and tool No. 1.820.229.000.

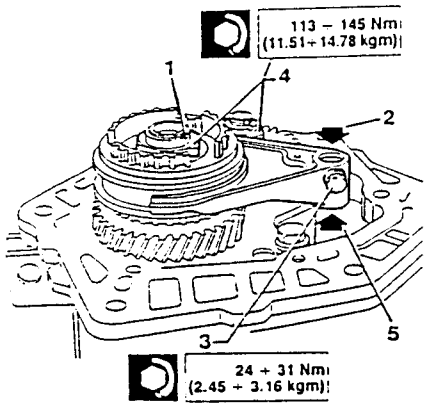


1. Straighten the caulking of the main and layshafyt ring nuts.
2. Lock the gearbox shafts by engaging 5th gear by hand (pressing the fork on the main shaft) and engaging a speed using the selector lever.

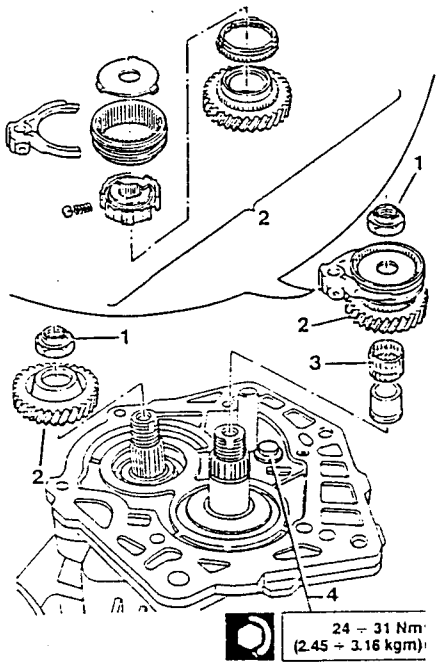
NOTE: **Engagement of two speeds at the same time leads to a locking of the gearbox shafts; this operation is necessary in order to unlock the nuts which hold the gears.**

3. Remove the bolt securing the 5th speed engagement fork to the main shaft.
4. Loosen the main and layshaft ring nuts.
5. Return the main shaft fork to the idle position.

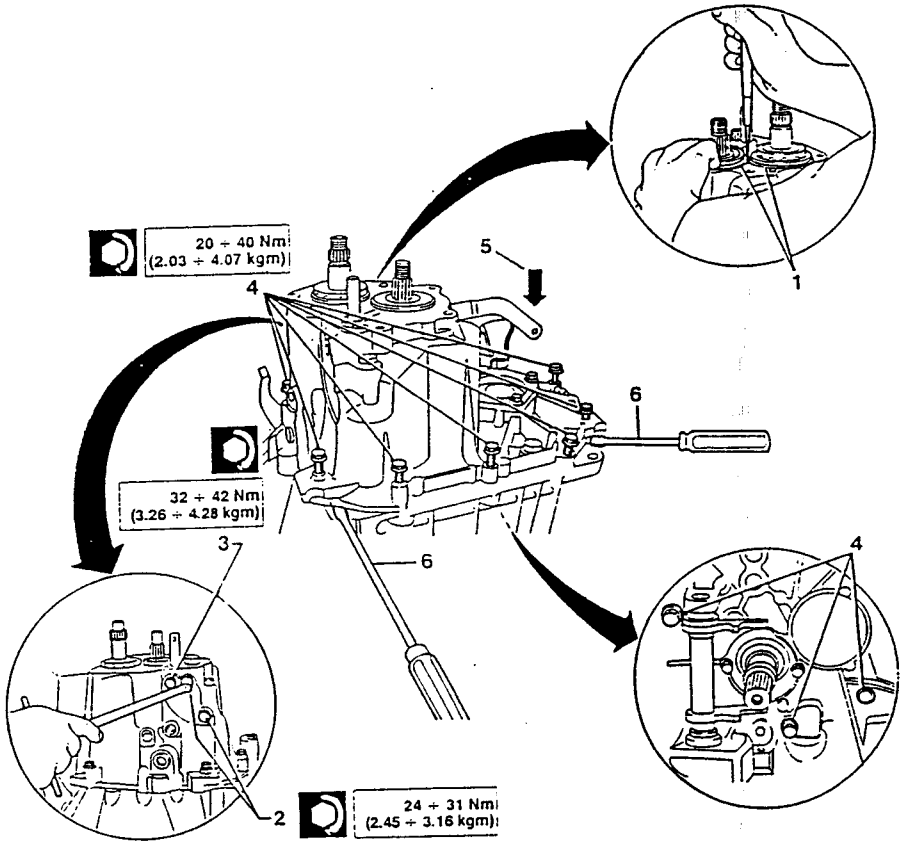
NOTE: **Returning the main shaft fork to the idle position is necessary to prevent the loss of the synchronizer rollers.**



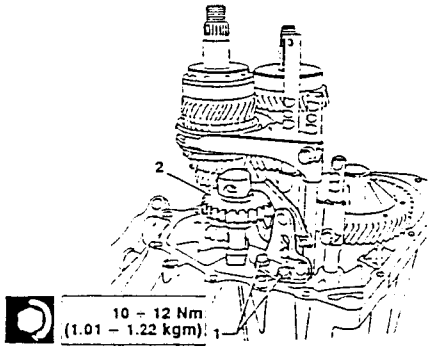
1. Remove the ring nuts securing the main and layshaft gears.
2. Remove the hub, fork and sleeve and 5th speed gears.
3. Witdraw the 5th speed drive gear roller bearing with the bushing.
4. Unscrew the bolt securing the rear bearings retaining plate to the gearbox and remove the plate.



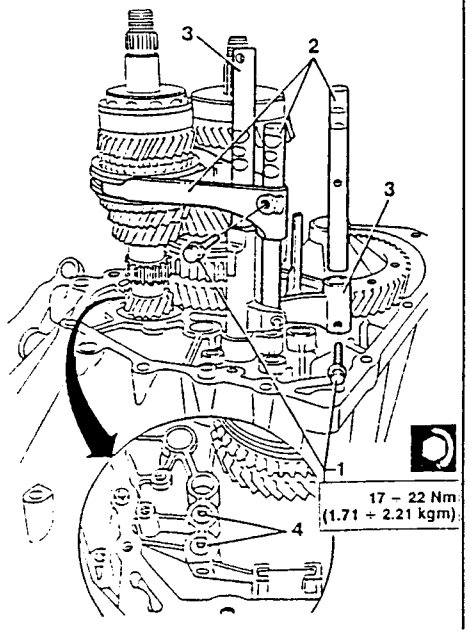
1. Remove the flexible retaining rings securing the rear bearings.
2. Remove the retaining caps and withdraw the speed control rod positioning springs and balls.
3. Unscrew the reverse speed shaft retaining screw.
4. Unscrew the thirteen screws (three of which are inside the support union) securing the gearbox to the engine-gearbox support union.
5. Push the clutch engagement control lever downward as indicated in the illustration.
6. Acting on the special lugs, lift the gearbox and remove it using two screw-drivers as levers.



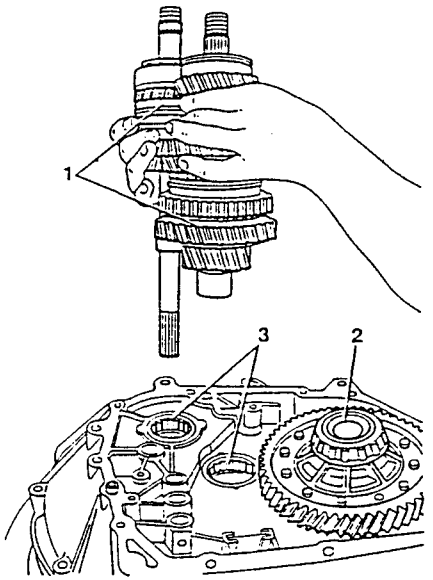
1. Unscrew the two retaining screws and remove the bracket supporting the reverse speed fork.
2. Remove the reverse speed idle gear and rod.



1. Unscrew the screws securing the 1st-2nd and 3rd-4th speed control forks.
2. Extract the following from their housings:
   1st-2nd speed control rod together with the relative fork and the 3rd-4th speed control rod.
3. Remove the 5th-reverse speed control rod and the 3rd-4th speed fork.
4. Remove the speed engagement safety pawls.



1. Withdraw the main and layshaft assemblies.
2. Remove the differential assembly.
3. Remove the main and layshaft front bearings from their seatings.

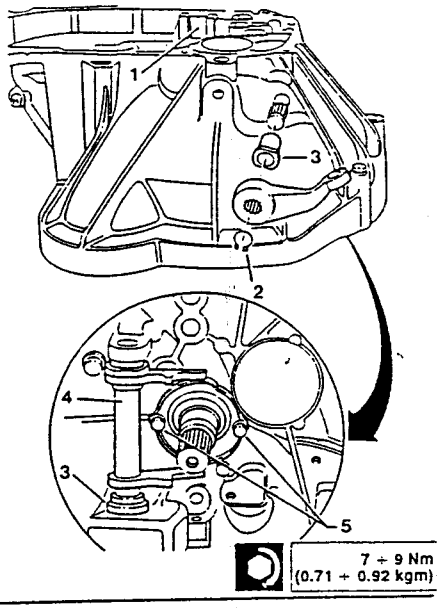


1. Remove the magnet and clean off any ferrous residues.
2. Remove the Seeger ring and withdraw the clutch engagement control lever.
3. Slide off and remove the anti-slip bushing from the engine-gearbox support union.

During reassembly install a new bush if there is excessive play in the pin.

4. Acting from inside the engine-gearbox support union, withdraw the clutch engagement sleeve control forked pin.
5. Unscrew the two screws and remove the thrust bearing sleeve.

During installation, replace the sleeve and seal if there are signs of oil leakage.

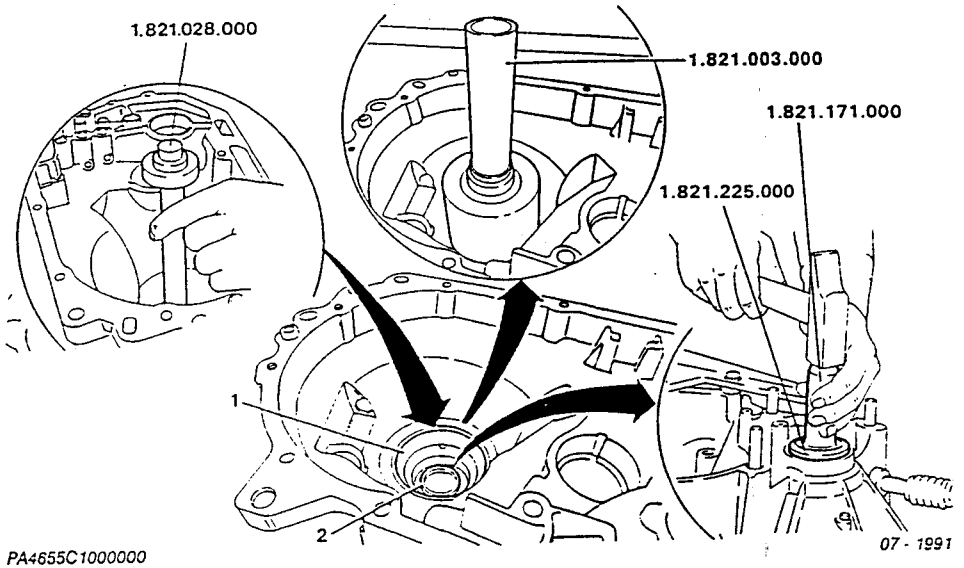


1. If necessary remove the outer race of the differential support roller bearing using tool No.1.821.003.000.

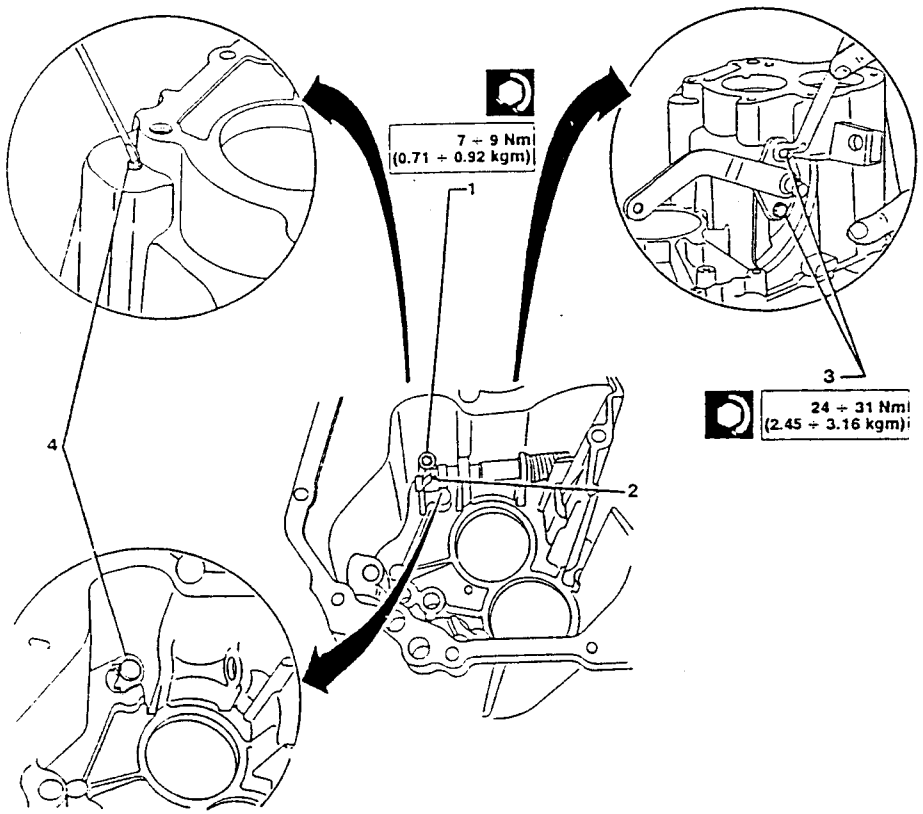
During installation introduce the new race using tool No. 1.821.028.000.

2. If necessary remove the differential casing oil seal on the engine side.

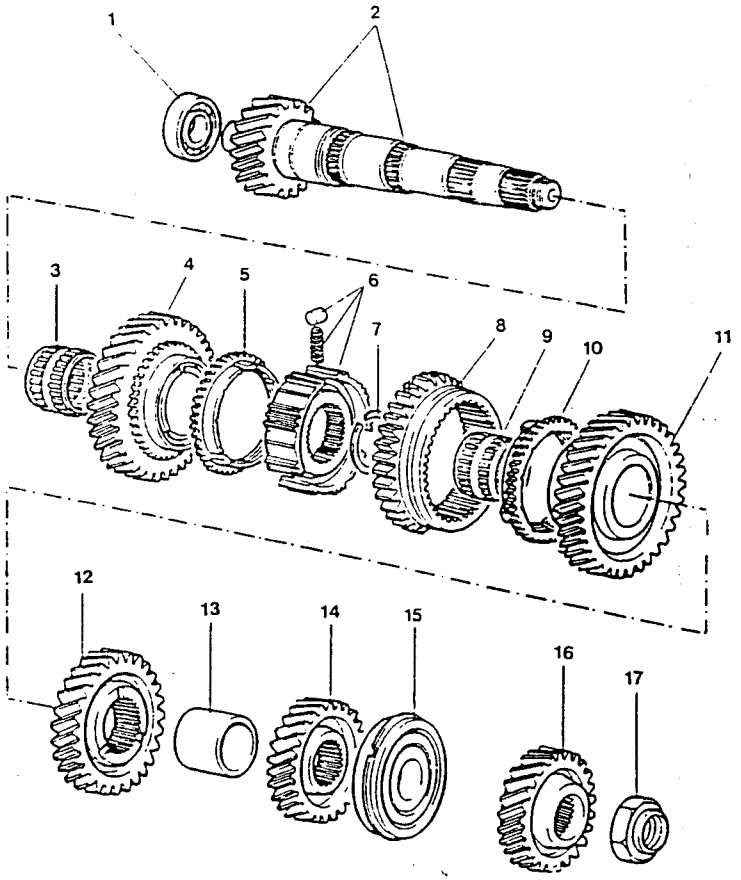
During reassembly insert a new oil seal using tools No. 1.821.171.000 and 1.821.225.000.



1. Unscrew the speed control prong retaining screws.
2. Withdraw the speed control prong retaining pin.
3. Unscrew the two screws securing the lever to the gearbox and remove the lever.
4. If necessary when removing the reverse speed engagement guide pin, first remove the external caulking and then withdraw the pin.

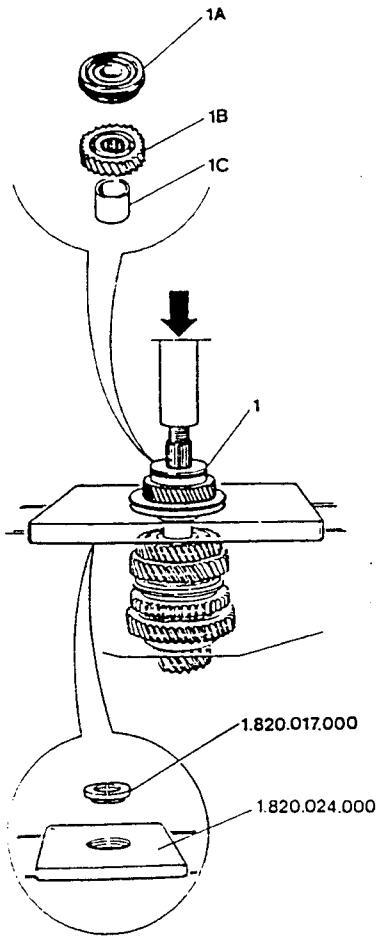


LAYSHAFT DISASSEMBLY

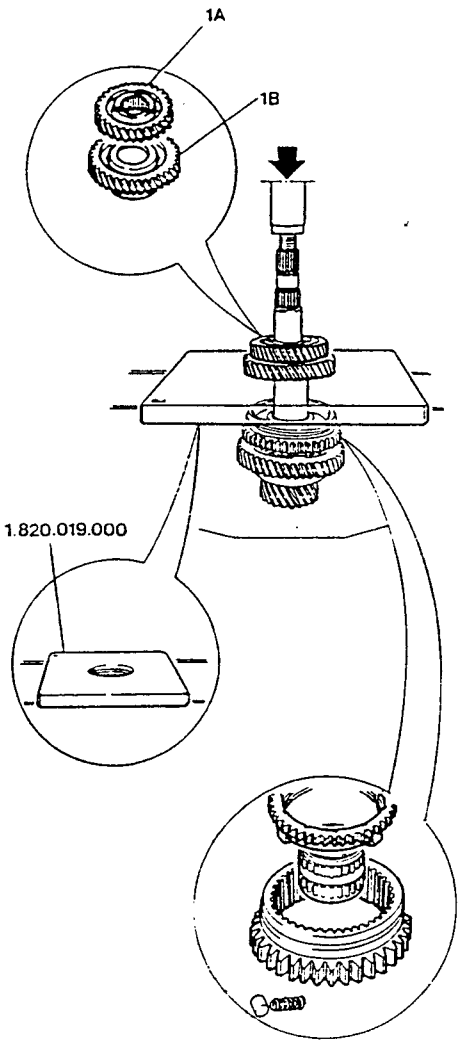


1. Layshaft front bearing.
2. Layshaft-pinion for taper for cylindrical crown gear
3. Roller bearing for 5th speed gear
4. 1st speed driven gear
5. 1st speed synchronizer ring
6. Hub complete with rollers and springs for 1st and 2nd speed engagement sliding sleeve
7. Flexible retaining ring
8. 1st and 2nd speed engaement sliding sleeve and reverse speed gear
9. 2nd speed gear roller bearing
10. 2nd speed synchronizer ring
11. 2nd speed driven gear
12. 3rd speed driven gear
13. Spacer between 3rd and 4th speed
14. 4th speed gear
15. Layshaft rear bearing
16. 5th speed driven gear
17. Layshaft gear locking nut

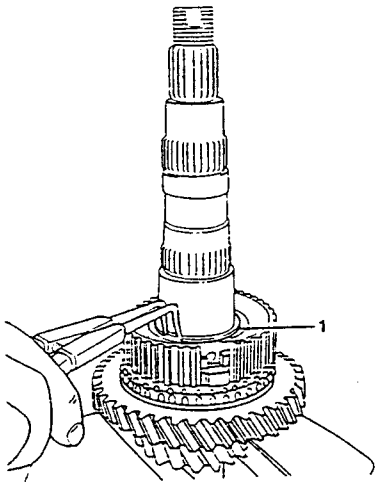
1. Using a hydraulic press, plate No. 1.820.024.000 and half rings No. 1.620.017.000, withdraw the 4th speed driven gear (1B) from the shaft together with the rear bearing (1A) and the spacer (1C).



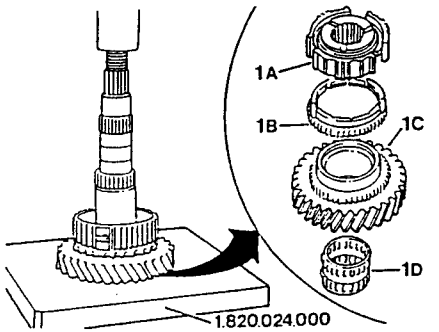
1. Using a hydraulic press and plate No. 1.820.019.000 withdraw the 2nd (1A) and 3rd (1B) speed driven gears and withdraw the 1st and 2nd speed engagement sliding sleeve (1C) together with springs and rollers (1D), 2nd speed synchronizer ring (1E) and the 2nd speed roller bearing (1F).



1. Remove the flexible hub-retaining ring.



1. Using a hydraulic press and plate No. 1.620.024.000 extract the complete hub (1A) of the, 1st and second speed sliding sleeve, 1st speed synchronizer ring (1B), 1st speed driven gear (1C) and withdraw the 1st speed gear roller bearing.



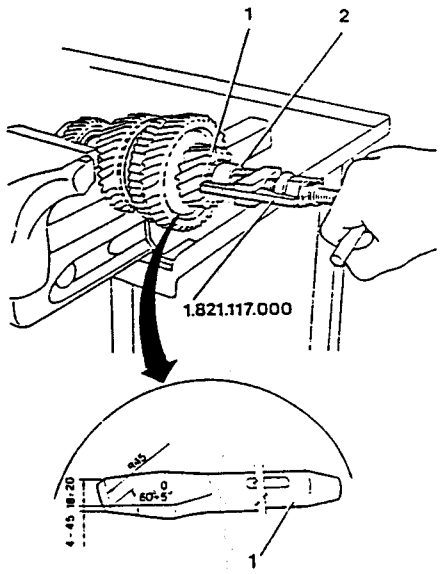
NOTE: **When replacing the layshaft front bearing remove the bearing inner race from the shaft as follows.**

1. Using a suitable tool slightly move the bearing race from the gear which is machined onto the shaft.

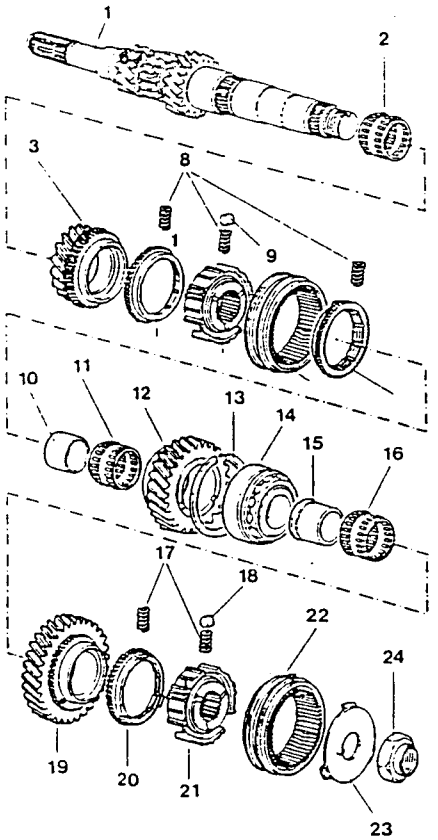
CAUTION:
Extreme caution should be used when operating with the chisel in order to avoid damaging the toothing and the shaft.

2. Using puller No. 1.821.117.000 remove the bearing race.

During installation, insert the new race using a hydraulic press and a generic flat base inserting tool.



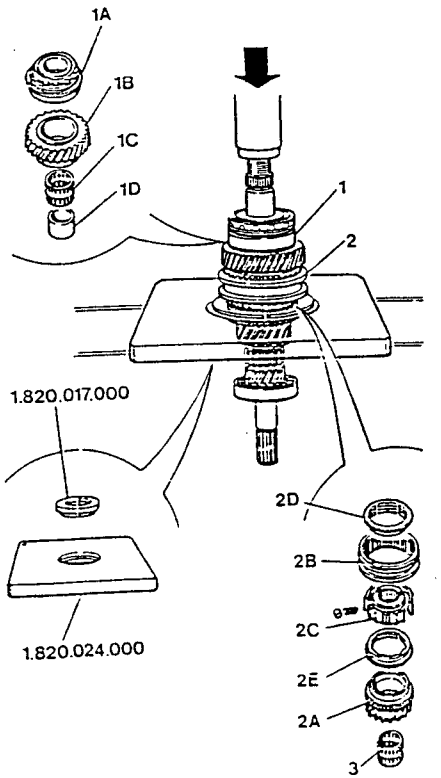
MAIN SHAFT DISASSEMBLY



1. Main shaft
2. 3rd speed gear roller bearing
3. 3rd speed drive gear
4. 3rd speed synchronizer ring
5. Hub for 3rd-4th speed sliding sleeve
6. 3rd-4th speed sliding sleeve
7. 4th speed synchronizer ring
8. Springs for 3rd-4th speed
9. Rollers for 3rd-4th speed hub
10. Bush for 4th speed drive gear
11. Roller bearing for 4th speed drive gear
12. 4th speed drive gear
13. Flexible ring
14. Rear bearing
15. Bush for 5th speed drive gear
16. Roller bearing for 5th speed drive gear
17. Springs for 5th speed hub
18. Rollers for 5th speed hub
19. 5th speed drive gear
20. 5th speed synchronizer ring
21. Hub for 5th speed engagement sliding sleeve
22. 5th speed engagement sliding sleeve
23. Flange securing 5th speed synchronizer rollers and springs
24. Nut securing gears to main shaft.

- Using a hydraulic press, plate No. 1.820.024.000 and half rings No. 1.820.017.000 disassemble as follows;

1. Withdraw the rear bearing (1A) and 4th speed drive gear (1B) assembly. Withdraw the roller bearing (1C) and bushing (1D) from the 4th speed drive gear.
2. Withdraw the 3rd speed drive gear (2A) and the 3rd and 4th speed engagement sliding sleeve (2B) assembly together with the hub (2C) and 4th speed (2D) and 3rd speed (2E) synchronizer rings.
3. Withdraw the 3rd speed drive gear roller bearing.



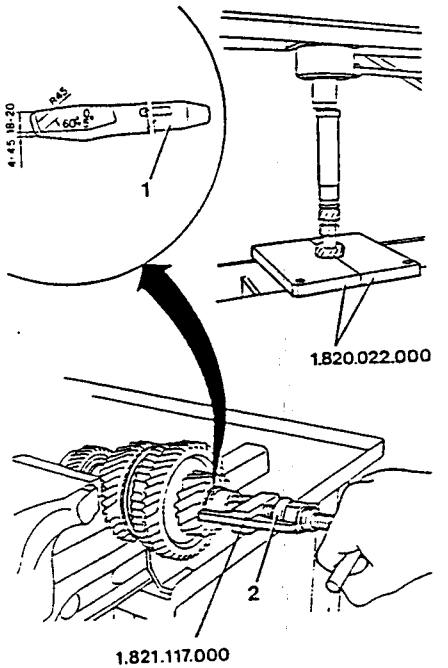
NOTE: **When replacing the main shaft front bearing, remove the bearing inner race from the shaft as follows.**

1. Using a suitable tool slightly move the bearing race from the gear which is machined onto the shaft.

CAUTION:
Extreme caution should be used in order to avoid damaging the toothing or the shaft.

2. Using universal puller No. 1.821.117.000, remove the bearing race.

During installation, using a hydraulic press, half plates No. 1.820.022.000 and a suitable inserting tool, re-install the inner race of the front bearing.

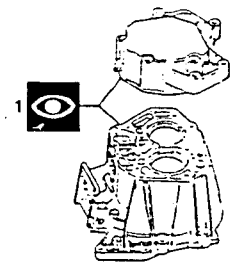


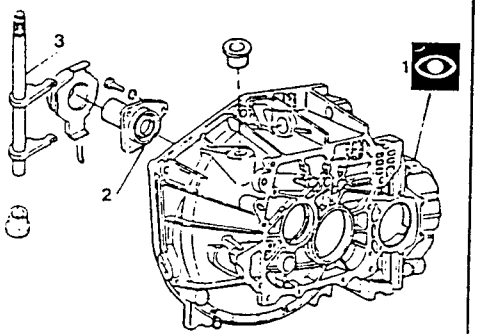
CHECKS AND INSPECTIONS

1.8 - 2.0 T.S.

GEARBOX SUPPORT - CENTRAL CASING - COVER

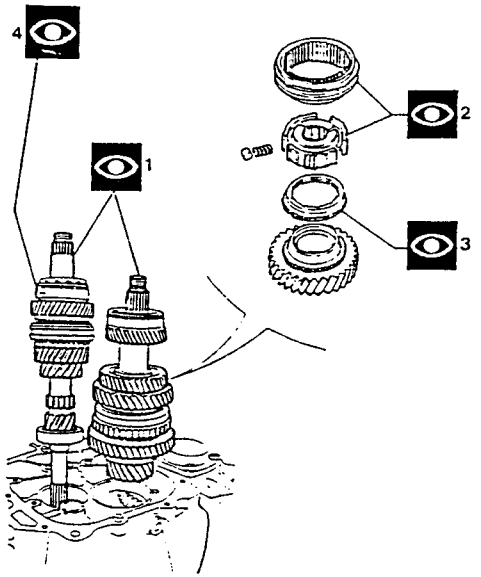
1. Check the rod and bearing seatings for cracks, wear or damage. Check that the contact surfaces are level (minor defects can be removed with a fine file).
2. Check for oil leaks; replace the sleeve and washer assembly if necessary.
3. Check the fork control shaft for excessive play; replace the bushings if necessary.





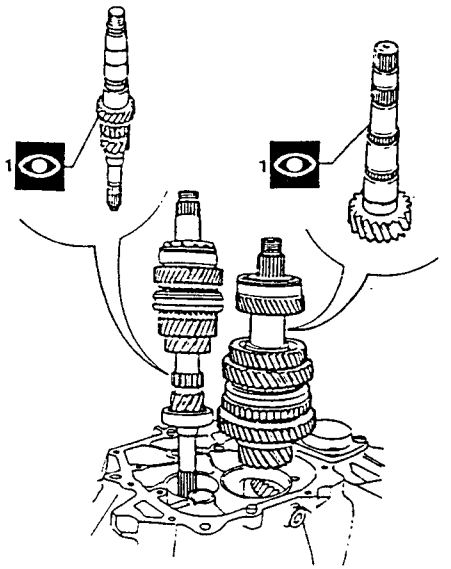
MAIN AND LAY SHAFTS

1. Check the gear teeth for nicks or excessive wear and inner surfaces for seizing or abnormal wear.
2. Check hubs and sliding sleeves for nicks, freedom of movement, excessive play and crawling. Check sleeve inner teeth for signs of excessive wear.
3. Check the synchronizer rings for signs of ovalization on the inner surfaces.
4. Check the rear bearings for scoring on the outer race, inner ring and balls, signs of overheating or excessive wear.



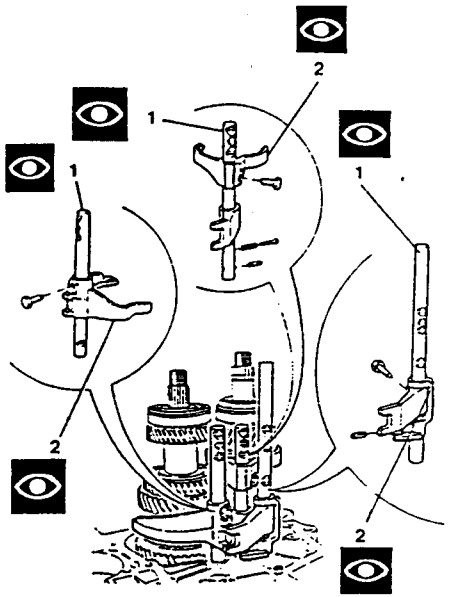
1. Check the main and layshaft gears for nicks or excessive wear.

CAUTION:
When replacing the main shaft (after high mileage), all the gears on the layshaft should also be replaced.
When replacing the layshaft, the differential ring gear should also be replaced.



RODS AND FORKS

1. Check the rods for distortion or wear, and freedom of movement without excessive play.
2. Check the forks for distortion or wear on the surfaces in contact with the sliding sleeve.



REASSEMBLY 1.8 - 2.0 T.S.

MAIN SHAFT REASSEMBLY

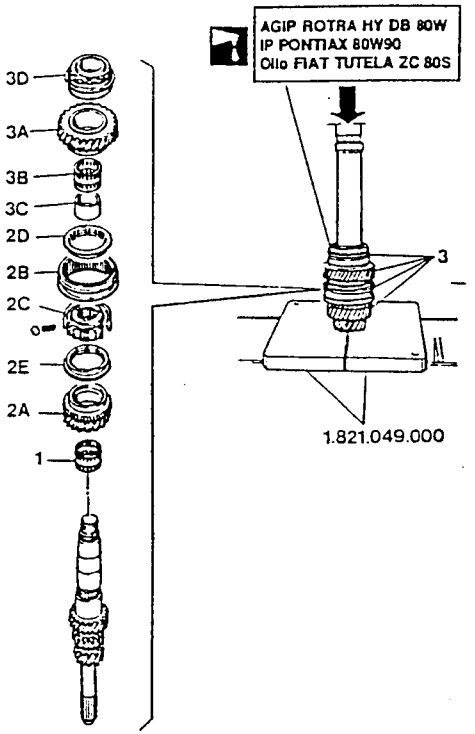
– Operating with the shaft suitably fitted in a vice or, where indicated, in a press, reassemble as follows;

Before installation lubricate all parts with the prescribed oil.

1. Install the 3rd speed drive gear roller bearing.
2. Install the 3rd speed drive gear (2A) and the 3rd and 4th speed sliding sleeve assembly (2B) togeter with hub (2C), 4th speed (2D) and 3rd speed (2E) synchronizer rings.

CAUTION:
In order to avoid losing the synchronizer rollers and springs, the sliding sleeve should be set in the idle position.

3. Using a press and half plate No. 1.821.049.000, install the 4th speed drive gear (3A) and relative roller bearing (3B) and bushing (3C). Using the inserting tool shown in the illustration, install the rear bearing (3D).

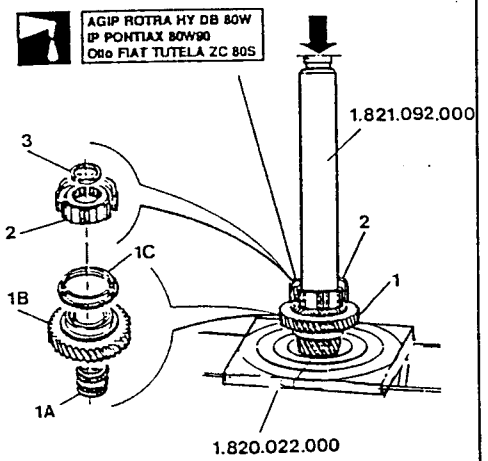


LAYSHAFT REASSEMBLY

– Operating with the shaft suitably fitted in a vice, or where indicated, in a press, reassemble as follows;

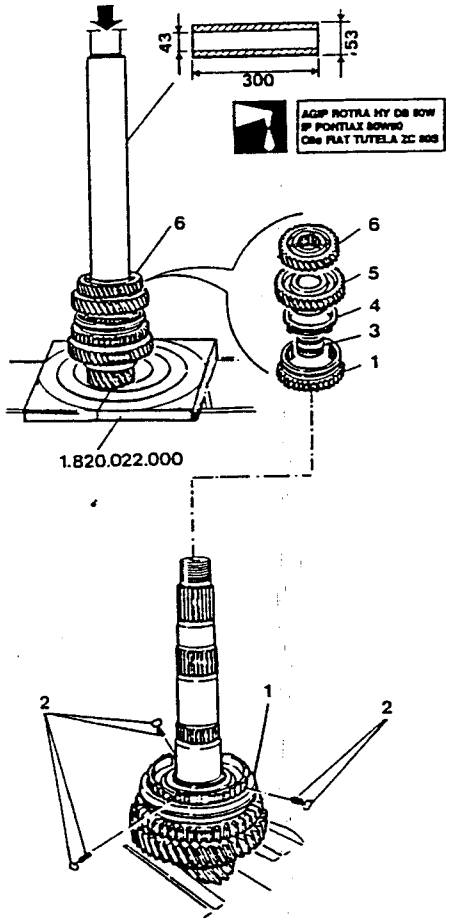
Before installation lubricate all parts with the prescribed oil.

1. Install the roller bearing (1A), the 1st speed driven gear (1B) and the 1st speed synchronizer ring (1C).
2. Using a press, half plates Nos. 1.820.022.000 and inserting tool No. 1.821.092.000, install the 1st and 2nd speed engagement sliding sleeve hub.
3. Install the flexible ring securing hub.

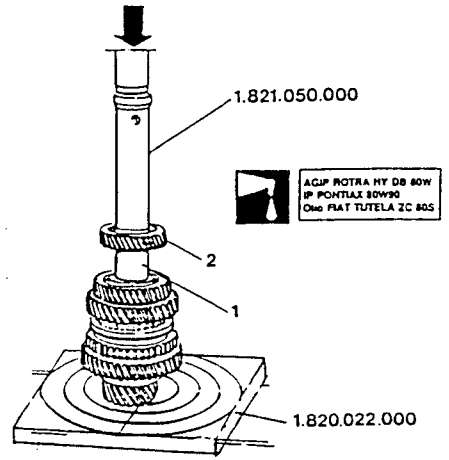


CAUTION:
In order to avoid losing the synchronizer rollers and springs, the sliding sleeve should be set in the idle position.

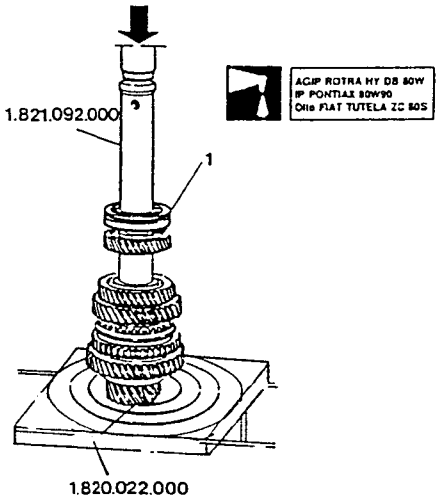
1. Install the 1st and 2nd speed - reverse speed gear engagement sliding sleeve.
2. Insert the springs and rollers in the hub.
3. Install the 2nd speed driven gear roller bearing.
4. Install the 2nd speed synchronizer ring.
5. Install the 2nd speed driven gear.
6. Using a press and suitable tool, install the 3rd speed driven gear.



1. Install the spacer.
2. Using a press, half plates No. 1.820.022.000 and inserting tool No. 1.821.092.000, install the 4th speed driven gear.

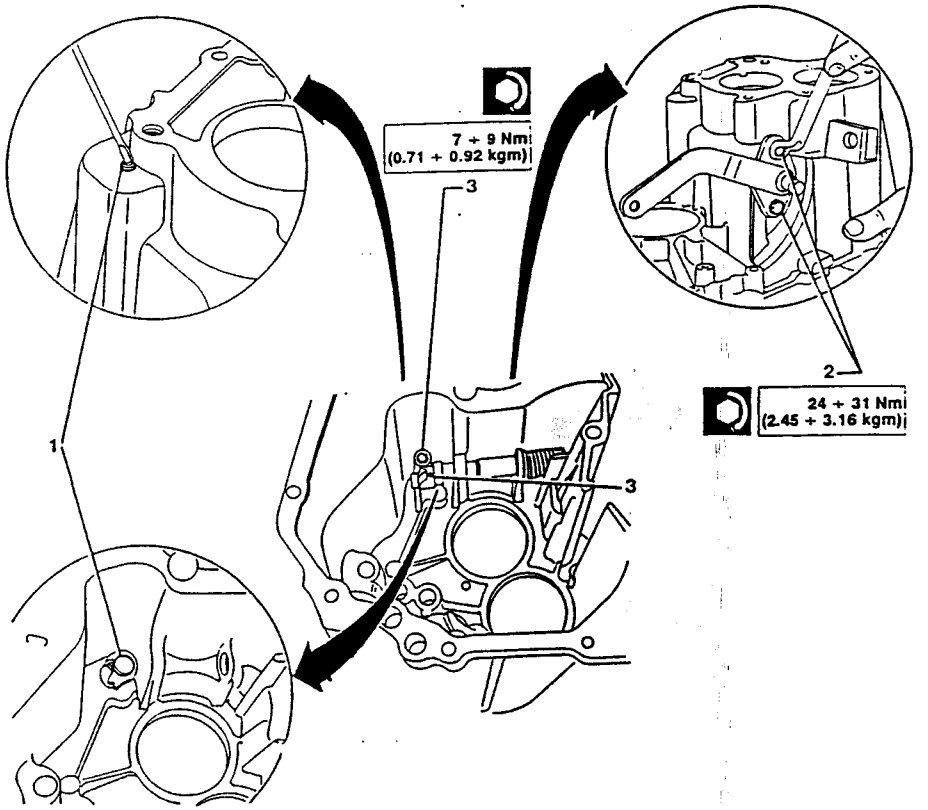


1. Using a press, half plates No. 1.820.022.000 and inserting tool No. 1.821.092.000, install the rear bearing.

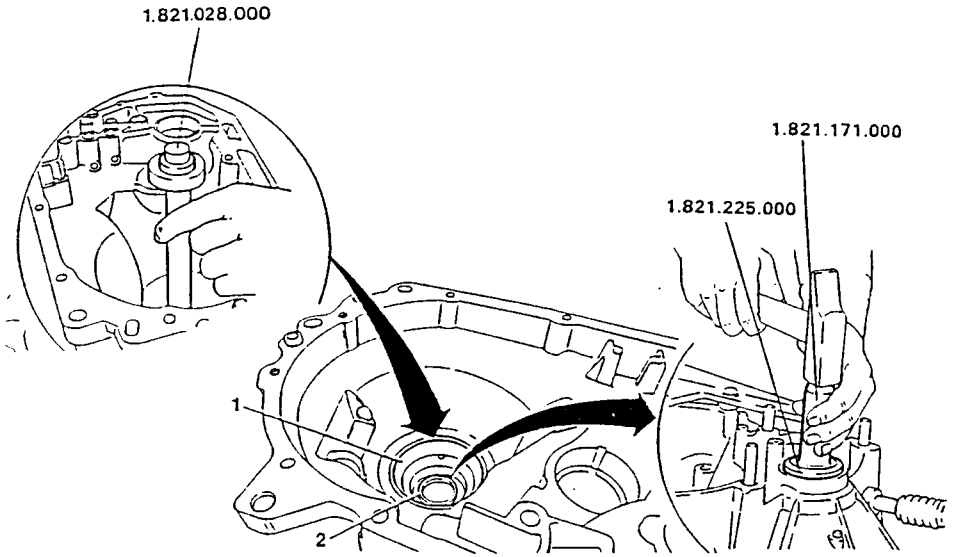


BENCH REASSEMBLY

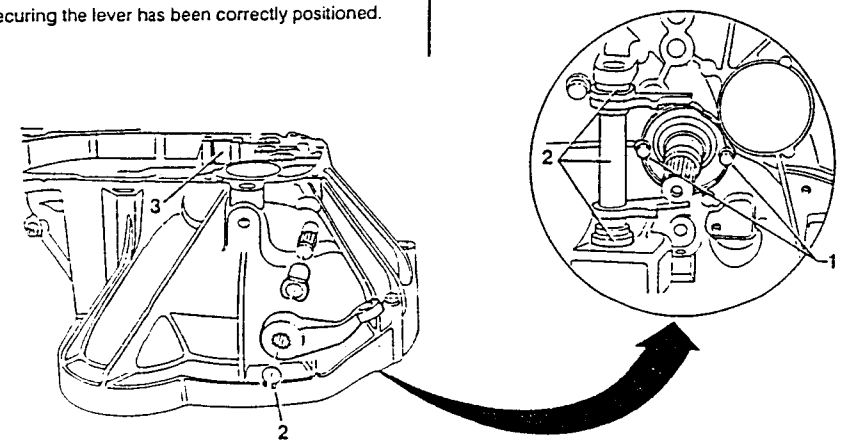
1. If previously removed, install a new guide pin for the engagement of reverse gear and caulk the outer tip.
2. Install the speed control lever, securing it to the gearbox using the two screws which should then be tighten to the prescribed torque.
3. Install the speed control prong by inserting the relative securing pin and tightening the screw to the prescribed torque.



1. If previously removed, install the new differential casing oil seal using tools No. 1.821.171.000 and No. 1.821.225.000.
2. If previously removed, insert the new outer race of the differential support roller bearing using tool No. 1.821.028.000.



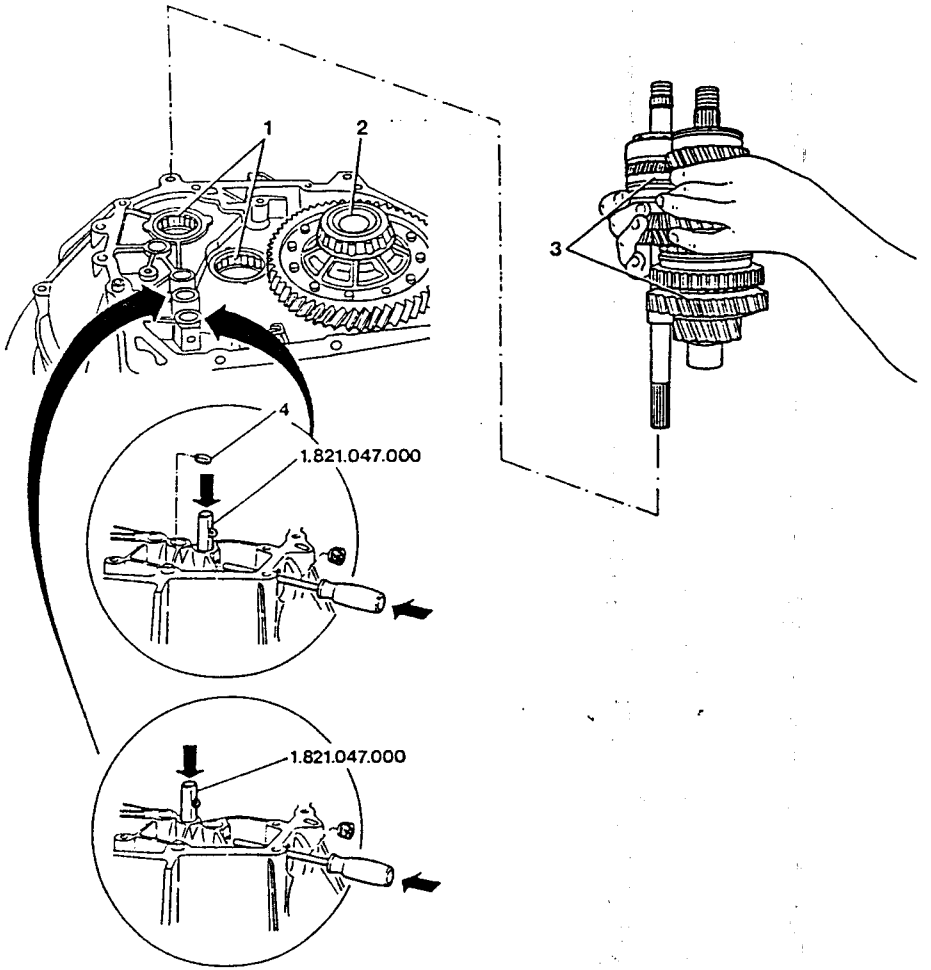
1. Install the thrust bearing sleeve and tihten the screws to the prescribed torque.
2. Install the pin and relative bushings, the thrust bearing engagement control fork, and the clutch engagement control lever, ensuring that the Seeger ring securing the lever has been correctly positioned.
3. Install the magnet



1. Install the main and lay shaft front bearings.

The bearings must be replaced if they show signs of scoring or excessive play or wear.

2. Install the differential assembly
3. Insert the main and lay shafts.
4. Insert the speed engagement safety pawls using tool No. 1.821.047.000.



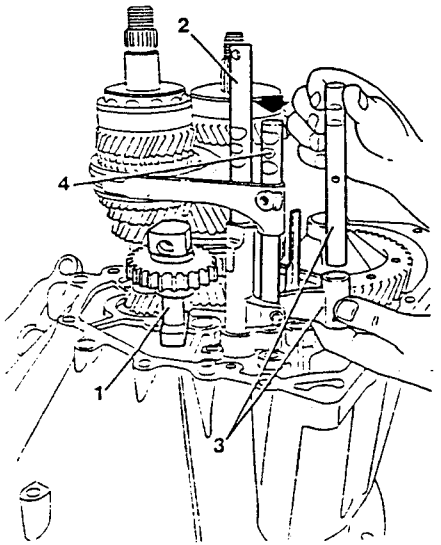
1. Install the reverse speed idle gear.

CAUTION:
Ensure that the gear engagement toothing faces downwards.

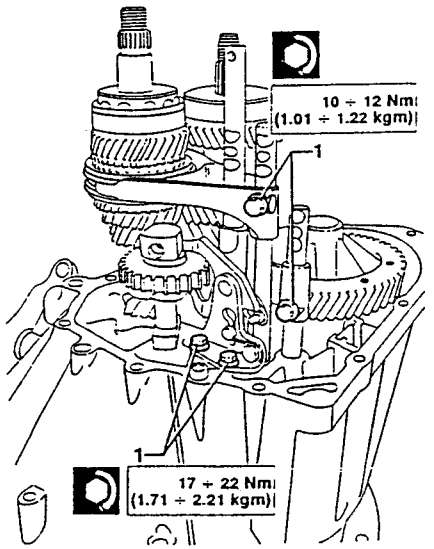
2. Install 5th and reverse speed control rod.
3. Position the 3rd and 4th speed fork and install the relative control rod.

CAUTION:
Position the safety pawl on the rod before installing the rod in its seating.

4. Install 1st and 2nd speed control rod and fork. To facilitate installation, move the 3rd and 4th speed control rod as shown in the illustration.



1. Tighten to the prescribed torque, the screws securing the gear control forks and bracket supporting the reverse speed fork. Move all forks to the idle position.

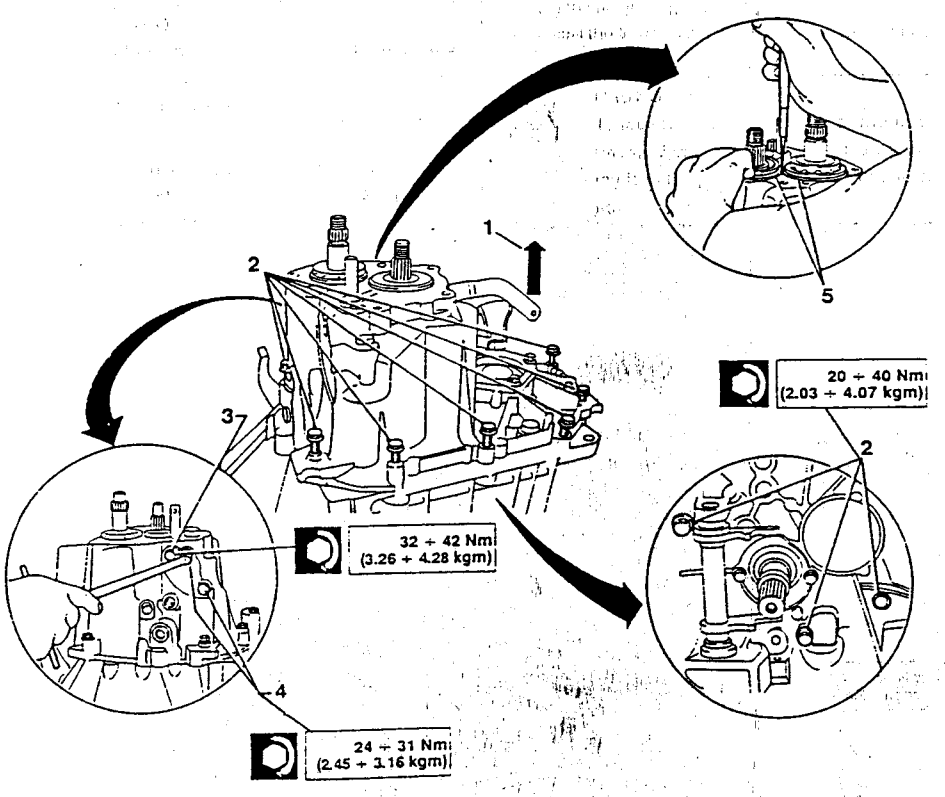


1. Holding up the gear selector lever, install the gearbox checking that the gear selector prong is inserted in the 3rd - 4th speed fork.

CAUTION:
Before installing the gearbox, wipe the contact surfaces with "LOCTITE 537" flat surface sealant.

2. Tighten the thirteen the screws to the prescribed torque, three of which are located inside the gearbox-engine support union.
3. Insert the speed control rod idle positioning balls and springs and tighten the caps to the prescribed torque.
4. Tighten to the prescribed torque, the screws securing the reverse speed shaft.
5. Install the flexible rings securing the rear bearings.

CAUTION:
To facilitate the installation of the flexible rings, adjust them so that the frontal opening is in the position shown in the illustration.



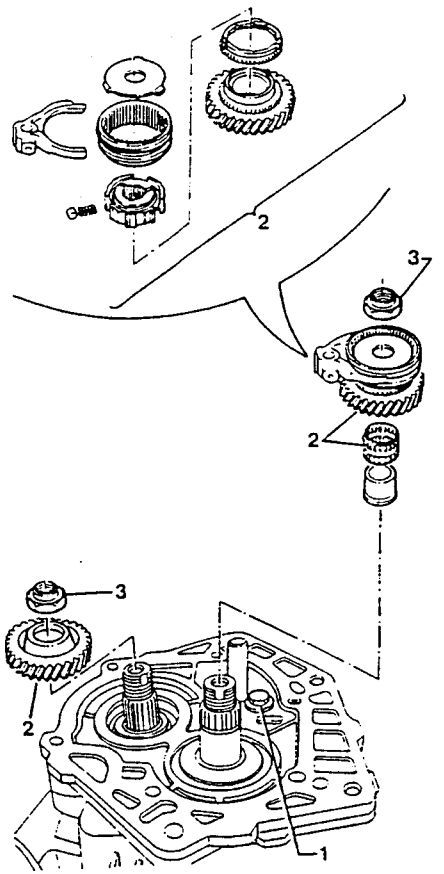
1. Tighten the rear bearings retaining plate screws to the prescribed torque.

CAUTION:
Before installing the gearbox, wipe the contact surfaces with "LOCTITE 573" flat surface sealant.

2. Position the hub, fork, sleeve and 5th speed gear on the main and lay shafts.

3. Tighten to the prescribed torque and then caulk the main and lay shaft locking ring nuts.

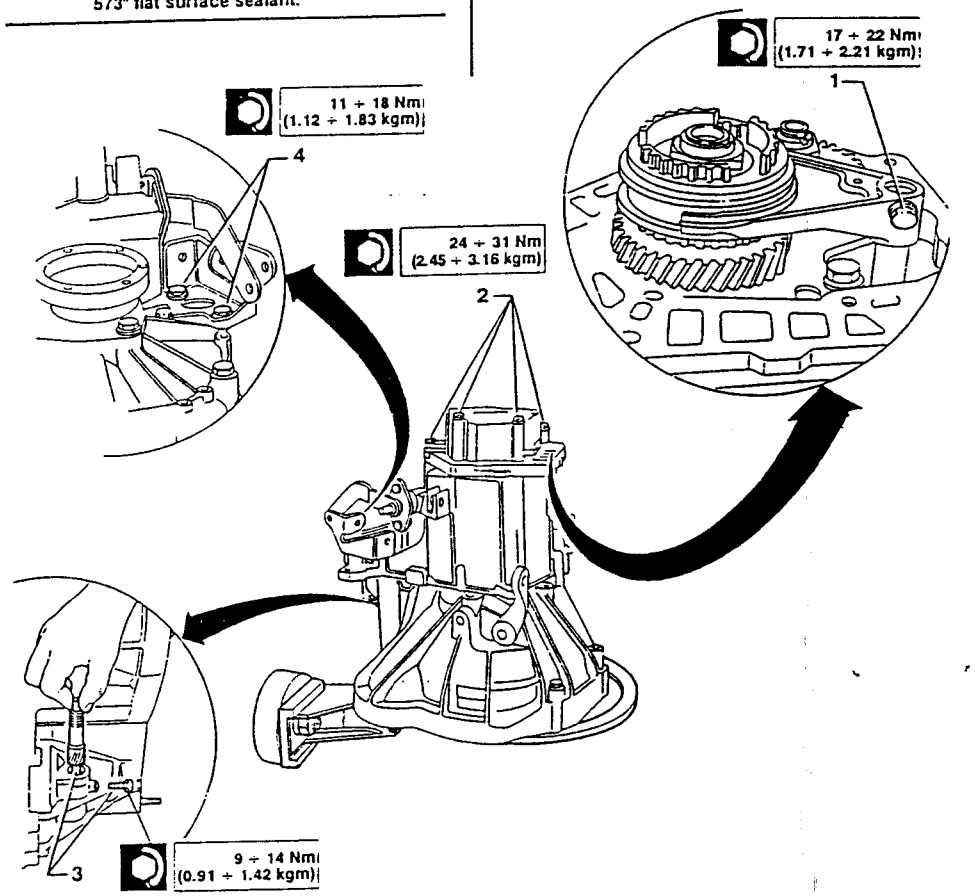
CAUTION:
The ring nuts securing the gears must be substituted each time they are removed.



1. Tighten the screws securing the 5th speed engagement fork to the main shaft.
2. Position the rear gearbox cover and tighten the retaining screws.

CAUTION:
Before installing the rear gearbox cover, wipe the contact surfaces with "LOCTITE 573" flat surface sealant.

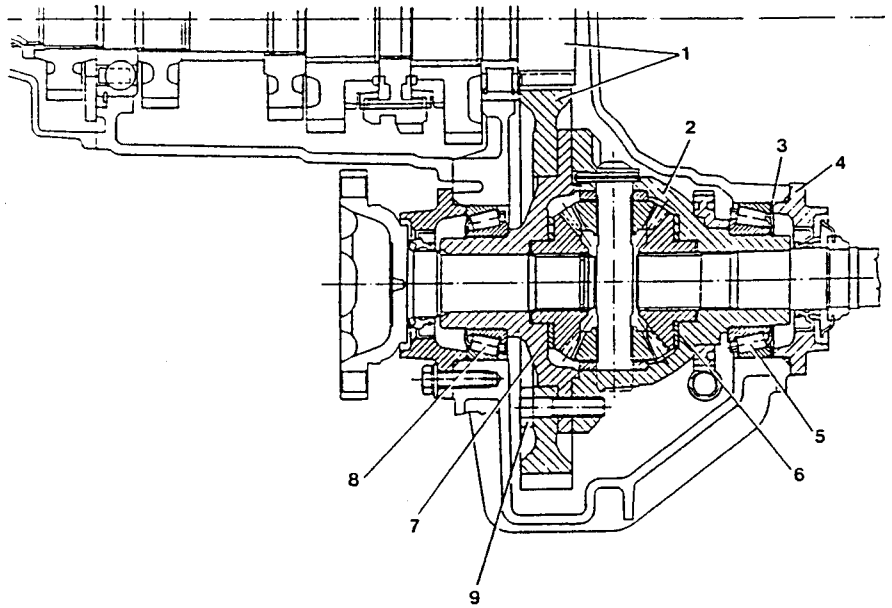
3. Install the odometer idling gear and tighten it to the prescribed torque.
4. Install the bracket supporting the gear engagement device and tighten the screws to the prescribed torque.



DIFFERENTIAL 2.4 V6

DESCRIPTION

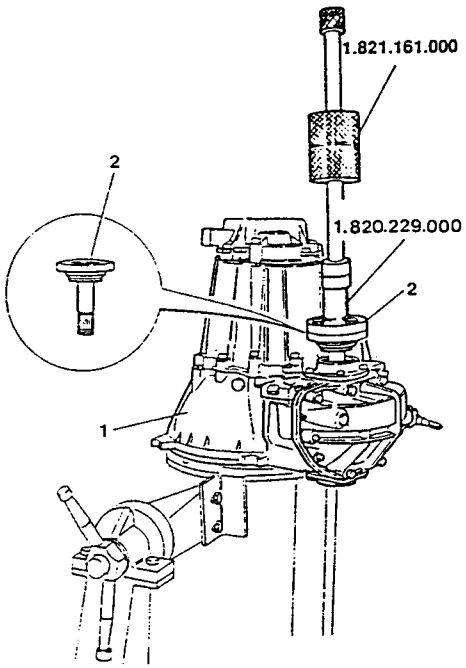
The differential consists of a reduction pair (1) and a differential casing (2) including crown wheels and side pinions. The differential casing is supported by two taper bearings (5 and 8) and is divided into two sections united by the same screws (9) securing the cylindrical crown gear. The odometer gear, made of teflon, is installed on the outer surface of the casing. The backlash between crown wheels and side pinions is determined using variable thickness rings (6 and 7) placed below the crown wheels. The pre-load adjustment system of the differential taper bearings is similar to that of other known groups, and is obtained using variable thickness rings (3) located below the relevant seal cover (4).



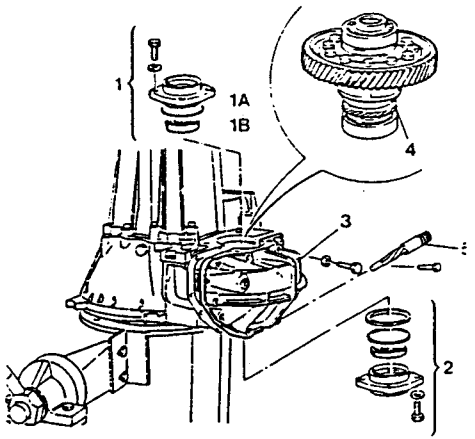
1. Cylindrical reduction pair
2. Differential casing
3. Ring
4. Seal cover
5. Taper bearing
6. Ring
7. Ring
8. Taper bearing
9. Differential casing half retaining screws

REMOVAL

1. Remove gearbox and place it on a suitable stand (see: GEARBOX BENCH DISASSEMBLY).
2. Withdraw flange from differential (using tool No. 1.821.161.000 and No. 1.821.229.000).

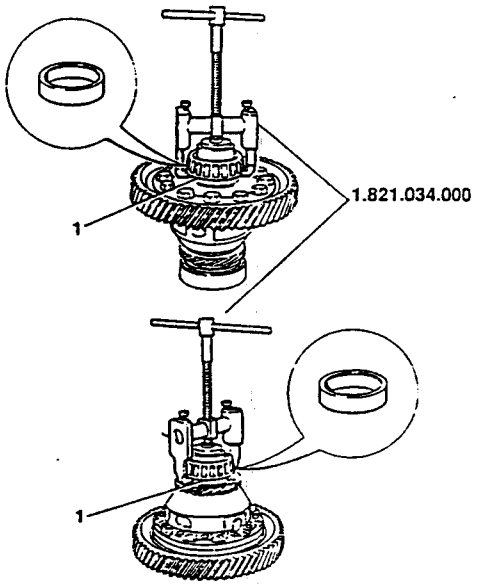


1. Remove differential casing seal cover - gearbox side with O- ring 1A and seal 1B.
2. Remove the differential casing seal cover - engine side, and shim ring 2A.
3. Remove differential cover.
4. Remove differential assembly.
5. Remove odometer driving-gear.

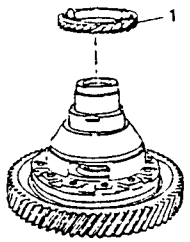


BENCH DISASSEMBLY

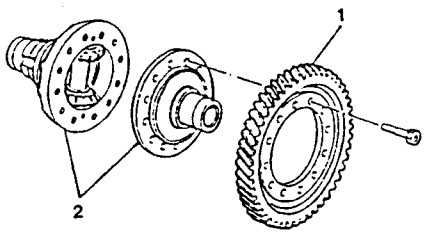
1. Extract the roller bearings using tool No. 1.821.034.000.



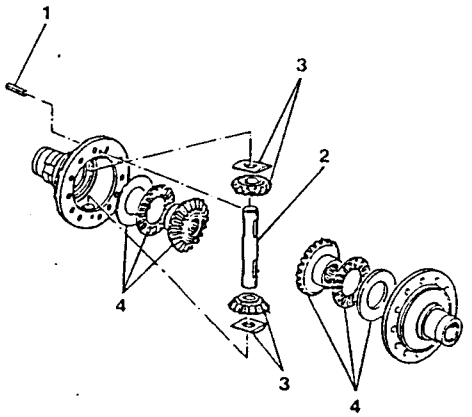
1. Remove odometer gear.



1. Remove differential casing crown gear.
2. Remove differential casing halves.



1. Remove the spring pin securing side pinion shaft.
2. Remove side pinion shaft from casing half.
3. Remove side pinions and relevant shoulder washers.
4. Remove crown wheels from casing halves together with roller cages and shim rings.



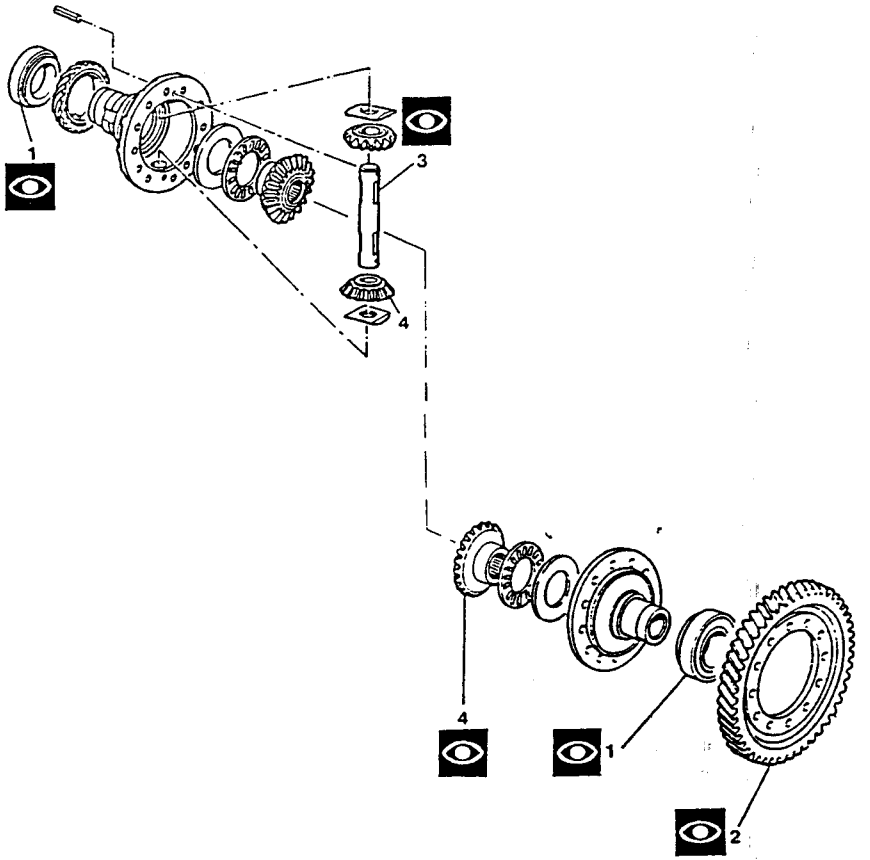
CHECKS AND INSPECTIONS

GEARING

1. Check bearing for scoring or traces of over heating or excessive wear.
2. Check crown gear for nicks or excessive wear.

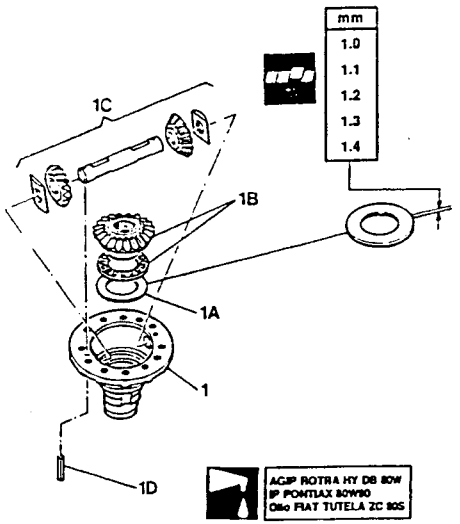
CAUTION:
When replacing crown gear (after high mileage) also replace gearbox layshaft.

3. Check side pinions shaft for seizing, wear or excessive play into casing half.
4. Check side pinions and crown wheels for nicks or wear of working surfaces.



CROWN WHEELS AND SIDE PINIONS BACKLASH CHECK

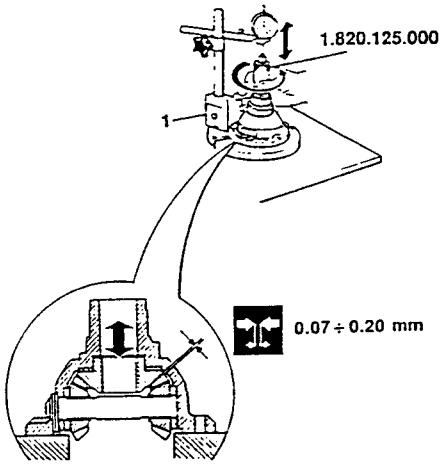
1. Install shim ring (1A), crown wheel (1B) and relevant roller cage, complete side pinion shaft (1C) and relative retaining pin (1D) into casing half.



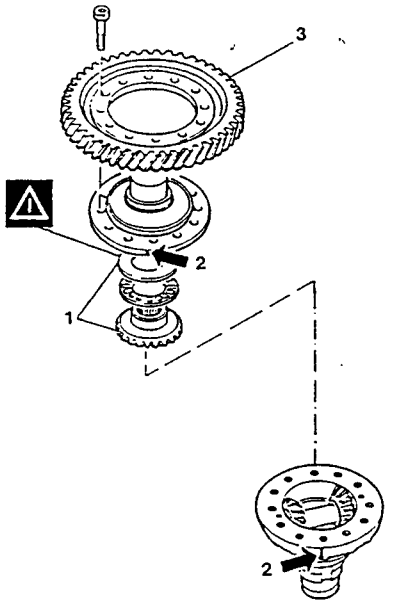
1. Insert tool No. 1.820.125.000 and install a magnetic base dial gauge with its probe contacting upper end of tool.
   Rotate and move tool axially; check that the average axial play is between 0.07 and 0.20 mm.

NOTE: **Check that the variation in axial play in one complete revolution of the tool is ≤ 0.10 mm (otherwise replace crown wheel and/or side pinions).**

If necessary, insert new shim rings of a suitable thickness.



1. Install second crown wheel and relevant roller cage (on new format differentials) and shim ring with thickness equal to that of previously installed ring.
2. Join the two casing halves aligning the reference notches.
3. Install crown gear and lock it momentarily.

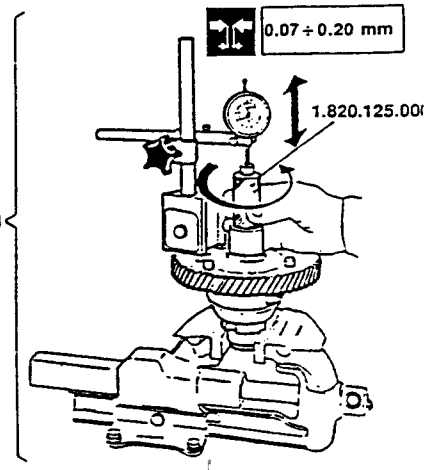


1. Insert tool No. 1.820.125.000 and install a magnetic base dial gauge with its probe contacting the upper end of the tool. Rotate and move the tool axially and check that the average axial play is between 0.07 and 0.20 mm.

If necessary insert new shim rings of suitable thickness.

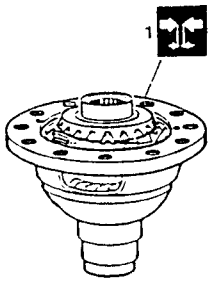
NOTE: **Check that the variation in axial play in one complete revlution of the tool is ≤ 0.10 mm (otherwise replace crown wheel).**

CAUTION:
Shim rings installed on crown wheels must be of the same thickness.

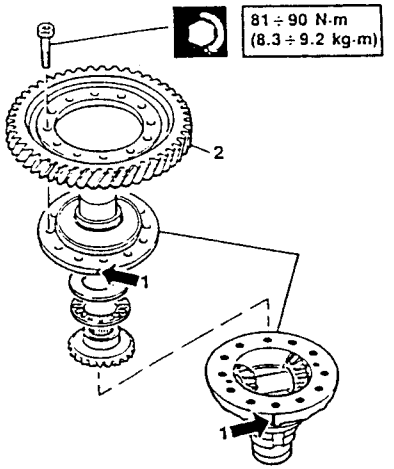


REASSEMBLY

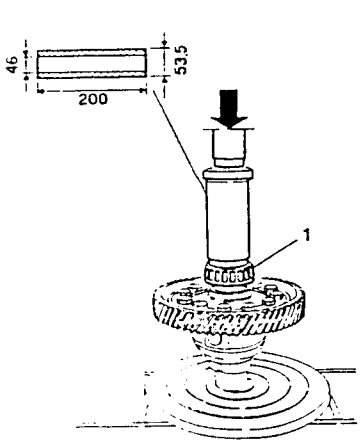
1. Carry out crown wheels and side pinions backlash checks before reassembly (see CHECKS AND INSPECTIONS).

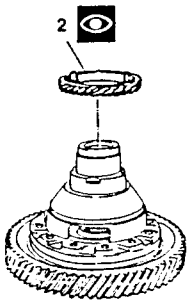


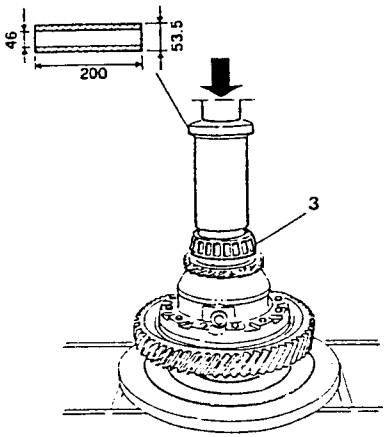
1. Join the two casing halves aligning the reference notches.
2. Install crown gear.



1. Using a press and suitable tool, install roller bearing.
2. Install odometer gear.
3. Using a press and suitable tool, install bearing.

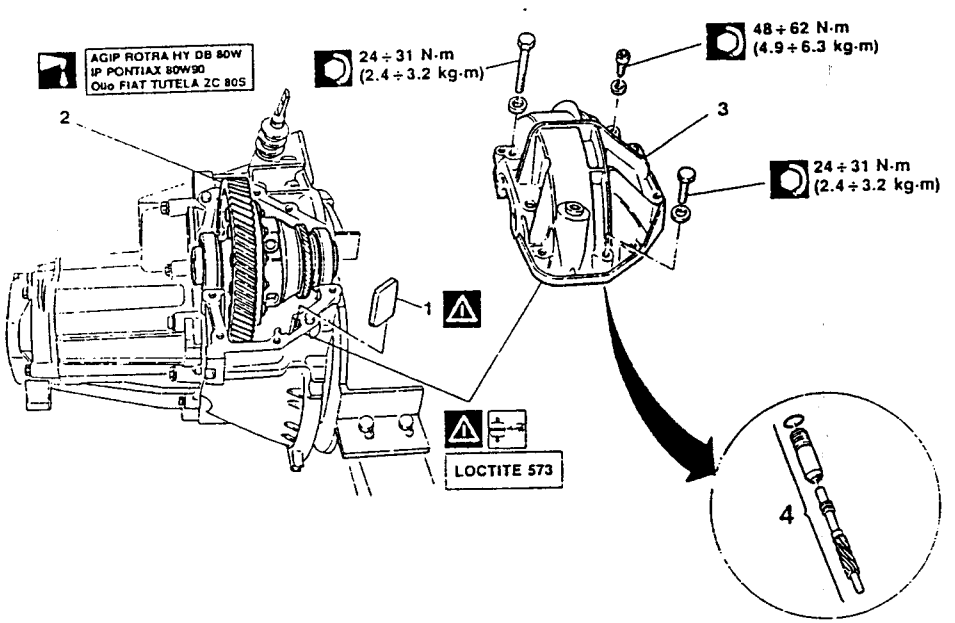




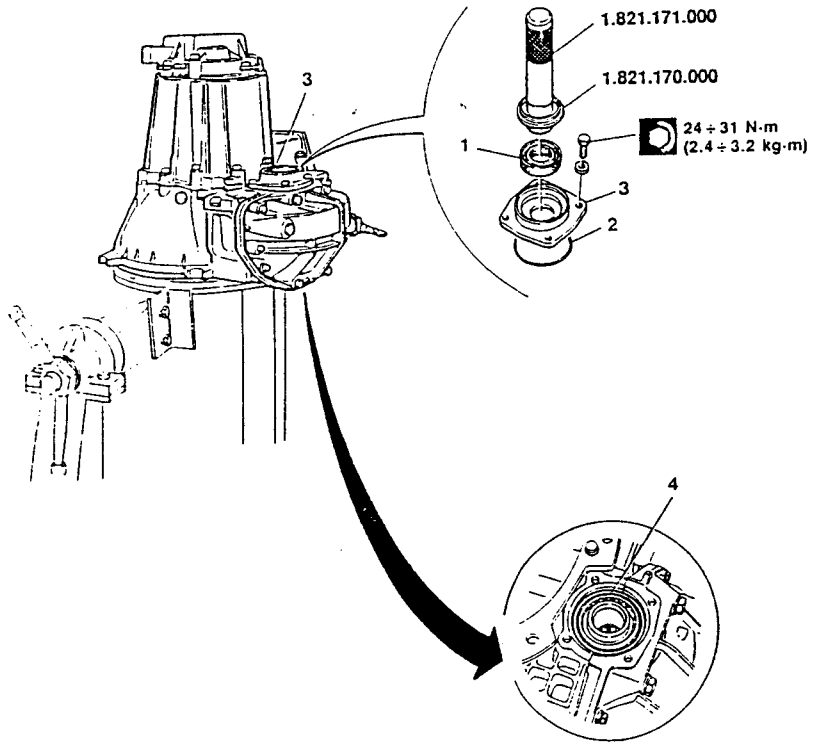


INSTALLATION

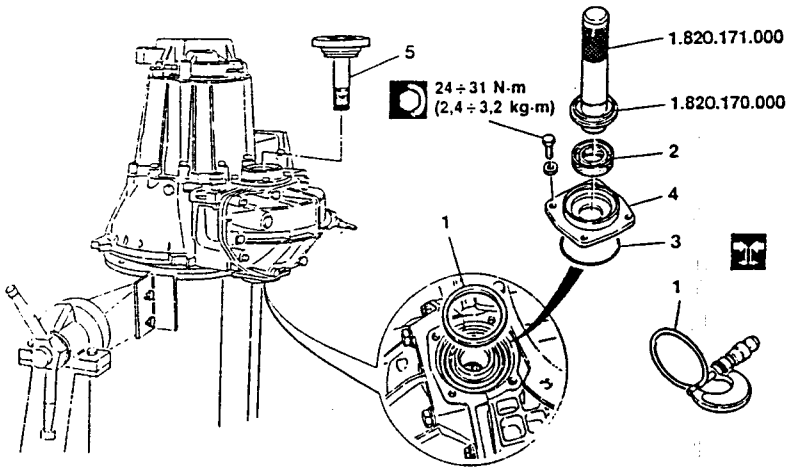
1. Insert magnet into its seating.
2. Insert differential assembly into gearbox.
3. Install cover (wipe contact surfaces with sealant).
4. Install odometer idle gear into differential cover.



1. Install oil seal into seal cover using specified tool.
2. Install O-ring on cover.
3. Install seal cover - gearbox side.
4. Settle outer race of roller bearing into seating - (engine side).

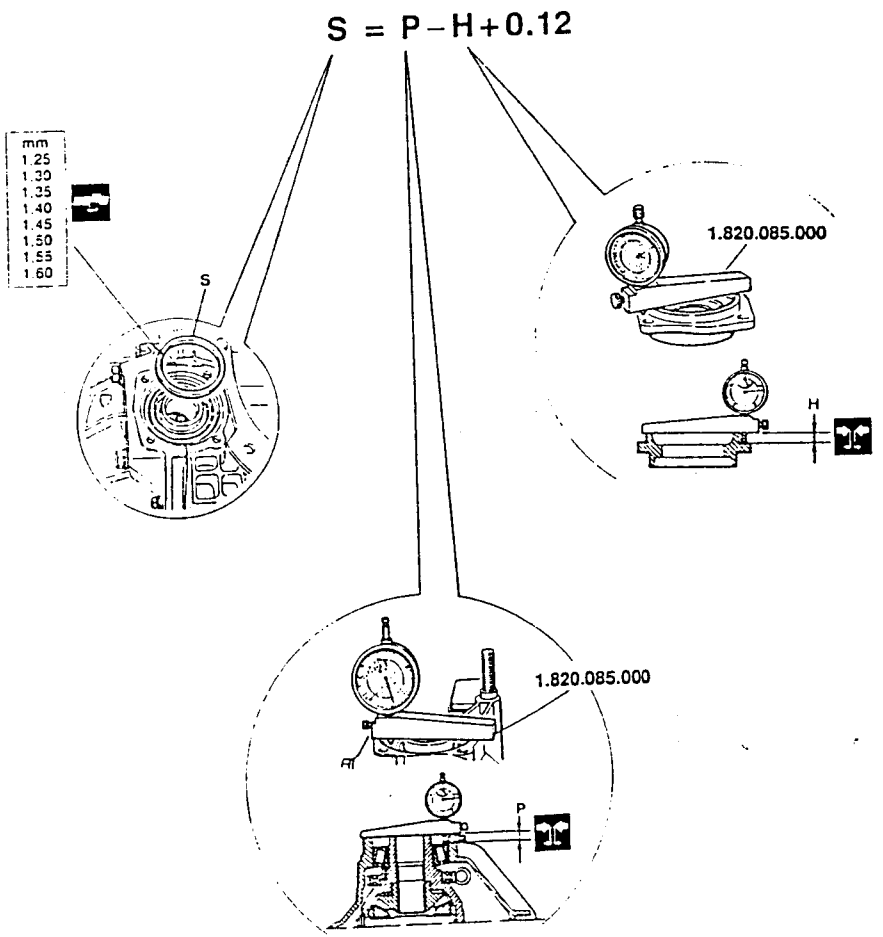


1. Install shim ring of suitable thickness (refer to DIFFERENTIAL ADJUSTMENT).
2. Install oil seal into cover using suitable tool.
3. Install O-ring on cover.
4. Install seal cover - engine side.
5. Install left axle securing flange.



DIFFERENTIAL ADJUSTMENT

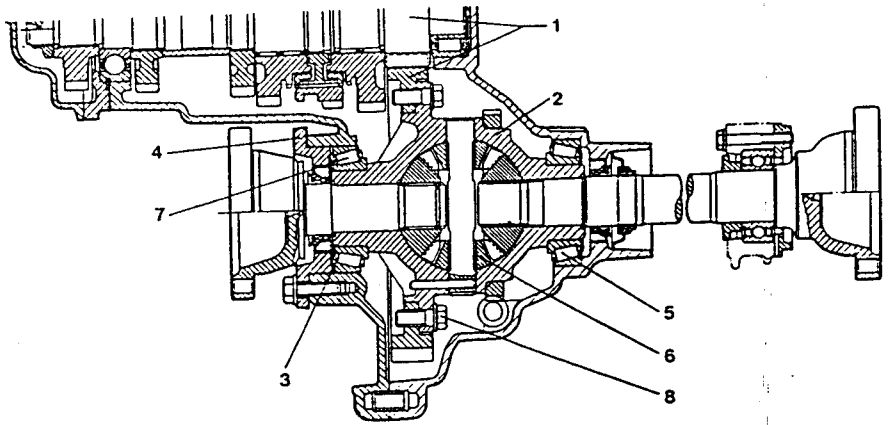
1. After the exact thickness of the shim ring has been determined, select thickness closest to determined value among spare shim rings.
2. If the determined thickness does not correspond to any of the available rings, or to the sum of thickness of two rings, install rings of next size up.



DIFFERENTIAL 1.8 - 2.0 T.S.

DESCRIPTION

The differential, consisting of a reduction pair (1) and a differential casing (2) including crown wheels and side pinions, is different from that of the 2.4 V6 vehicle in that the differential casing is a single piece.
The differential casing is fixed to the cylindrical crown gear by screws (8) and is supported by two tapered bearings (5 and 3).
The odometer idling control gear is connected to the outer surface of the casing.
The play between crown wheels and side pinions is pre-determined and cannot be adjusted as the crown wheels are installed in the casing without shims. Therefore the washers between the pinions and differential casing only serve to prevent slipping. On the other hand the pre-load adjustment system of the differential taper bearings is similar to that in use on other groups which are already known; in other words it employs variable thickness rings (3) which are placed below the relevant seal cover (4).



1. Reduction pair
2. Differential casing
3. Taper bearing
4. Seal cover
5. Taper bearing
6. Anti-slip washers
7. Taper bearing
8. Differential crown gear fixing screws.

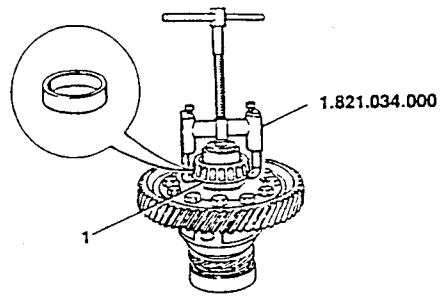
REMOVAL AND INSTALLATION

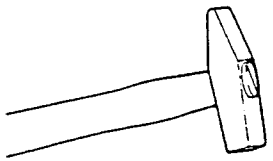
- Remove the gearbox and place it on a suitable stand. Disassemble up to the removal of the complete differential group (see: BENCH DISASSEMBLY 1.8 - 2.0 T.S.).

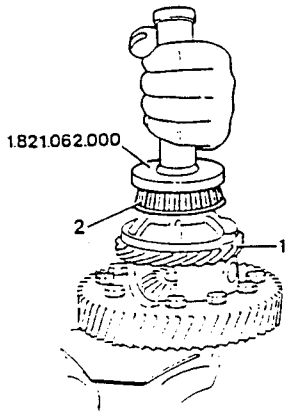
BENCH DISASSEMBLY

1. Using tool No. 1.821.034.000, remove the roller bearings.

During installation insert the bearings using tool No. 1.821.062.000.

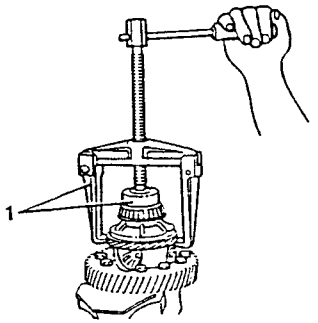




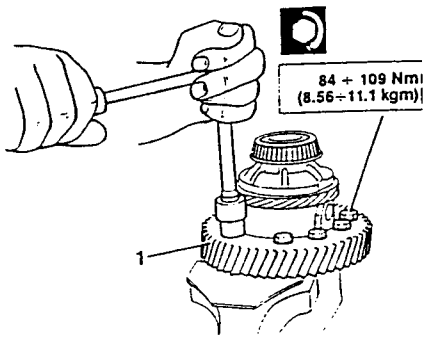


1. Using a reaction washer and a universal puller, remove the odometer idle control gear.

On installation, heat the gear in an oven to between 100° and 120°C and then insert.

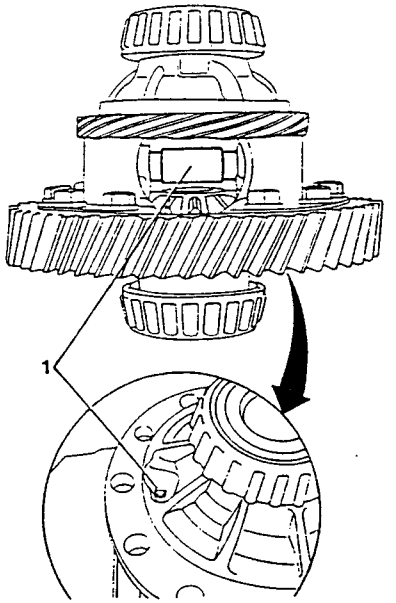


1. Mark the relative positions of the cylindrical crown gear and differential casing in order to be able to correctly position them during installation. Unscrew the screws securing the crown gear to the casing and remove the crown gear.

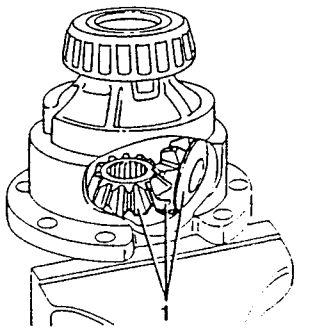


1. Using a suitable punch withdraw the side pinion shaft from the differential casing provoking the shearing of the flexible retaining pin.

During installation re-insert a suitable flexible retaining pin.



1. Withdraw the pinions, relative anti-slip washers and the crown wheels from the differential casing.



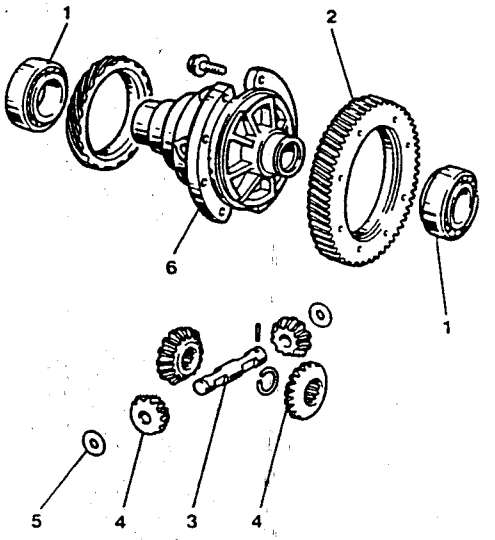
CHECKS AND INSPECTIONS

GEARING

1. Check the bearings for scoring, traces of overheating or excessive wear.
2. Check the ring gear for nicks or excessive wear.

CAUTION:
When replacing the ring gear (after high mileage), the gearbox layshaft should also be replaced.

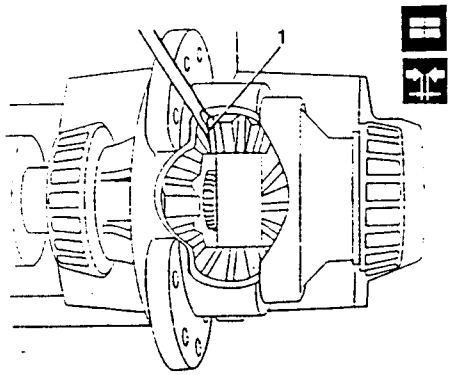
3. Check the pinion shaft for seizing, wear or excessive play into casing half.
4. Check side pinions and crown wheels for nicks or excessive wearing of the working surfaces.
5. Check the anti-slip washers located under the side pinions for nicks or signs of wearing of the working surfaces.
6. Check the differential casing for cracks or wearing of the working surfaces.



CHECKING PLAY BETWEEN SIDE PINIONS AND CROWN WHEELS

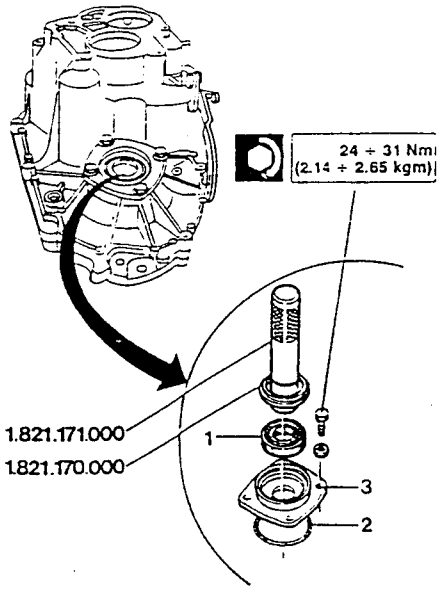
NOTE: **As the crown wheels are installed in the differential casing without shim rings, it is not possible to adjust the play between side pinions and crown wheels.**

1. After installing the differential casing, check the correct coupling of the crown wheels and side pinions with a screw-driver ensuring that during rotation of the assembly there is a slight resistance and no play.



REPLACING DIFFERENTIAL CASING OIL SEAL ON GEARBOX SIDE

- Remove the gearbox side differential casing seal cover with the seal ring and oil seal.
1. Using tools No. 1.821.171.000 and 1.821.170.000, install the new oil seal in the differential casing seal cover.
2. Install a new gasket on the cover.
3. Install the seal cover and tighten all the screws to the specified torque.

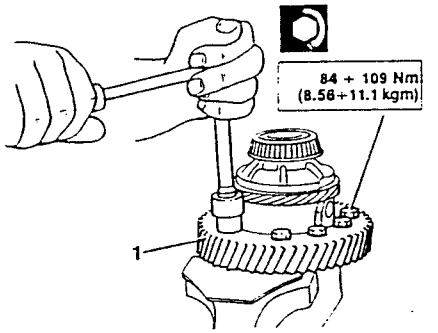


REPLACING DIFFERENTIAL CASING OIL SEAL ON ENGINE SIDE

The replacement of the engine side differential casing seal cover, due to the characteristics of the gearbox itself can be carried out in the workshop when overhaulling the gearbox (see: REASSEMBLY 1.8 - 2.0).

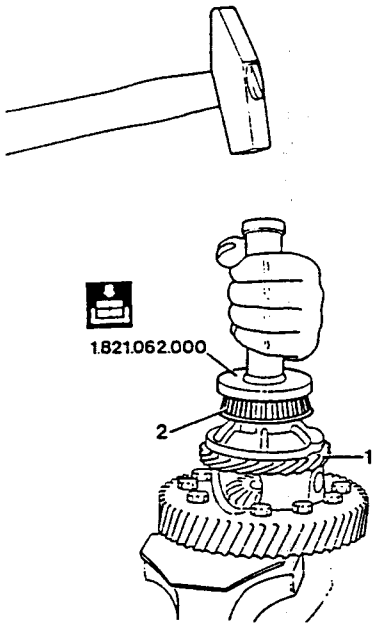
REASSEMBLY

1. Install the ring gear and tighten the screws to the prescribed torque.



1. Install the odometer idle control gear after gradually heating it from ambient temperature to approximately 100° - 120°C in an oven.

2. Using tool No. 1.821.062.000 install the differential casing support roller bearings.

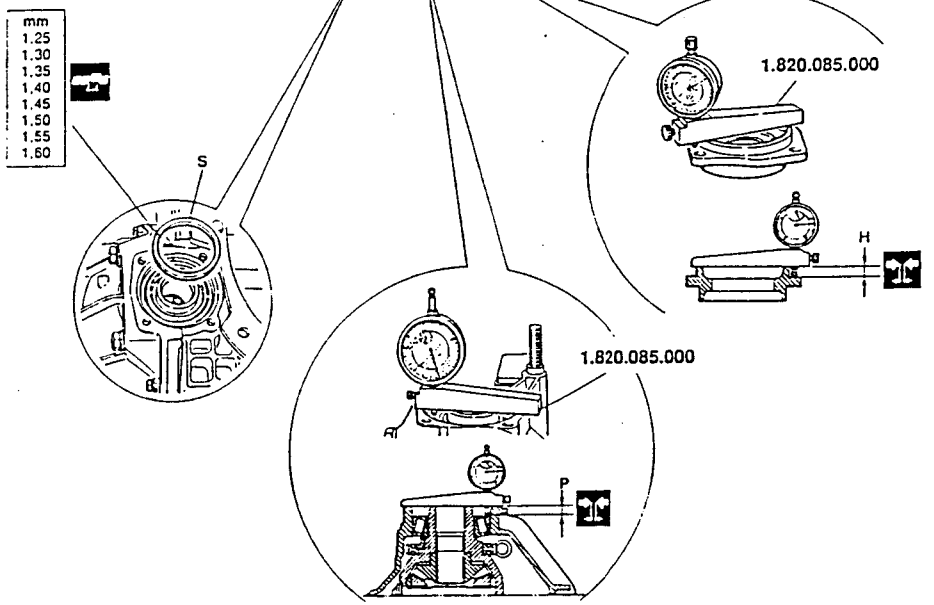


Install the differential assembly by reversing the procedures used for disassembly taking care to correctly determine the pre-load thickness of the bearings (see: DIFFERENTIAL ADJUSTMENT).

DIFFERENTIAL ADJUSTMENT

- Using a centesimal dial gauge and tool No. 1.820.085.000, measure the distance "P" between the resting plane of the seal cover and the outer ring of the roller bearing.
- Using a centesimal dial gauge and tool No. 1.820.085.000, measure height "H" of the seal cover.

$$S = P - H + 0.12$$



- Given that the fixed number 0.12 corresponds to the negative allowance prescribed for the settling and pre-loading of the bearings for the differential casing, determine value "S" of the thickness of the shim rings by applying the following formula:

$$S = P - H + 0.12$$

NOTE: **After the exact thickness of the shim ring has been obtained select a ring from among those supplied as spare parts which is as near as possible to this value.**

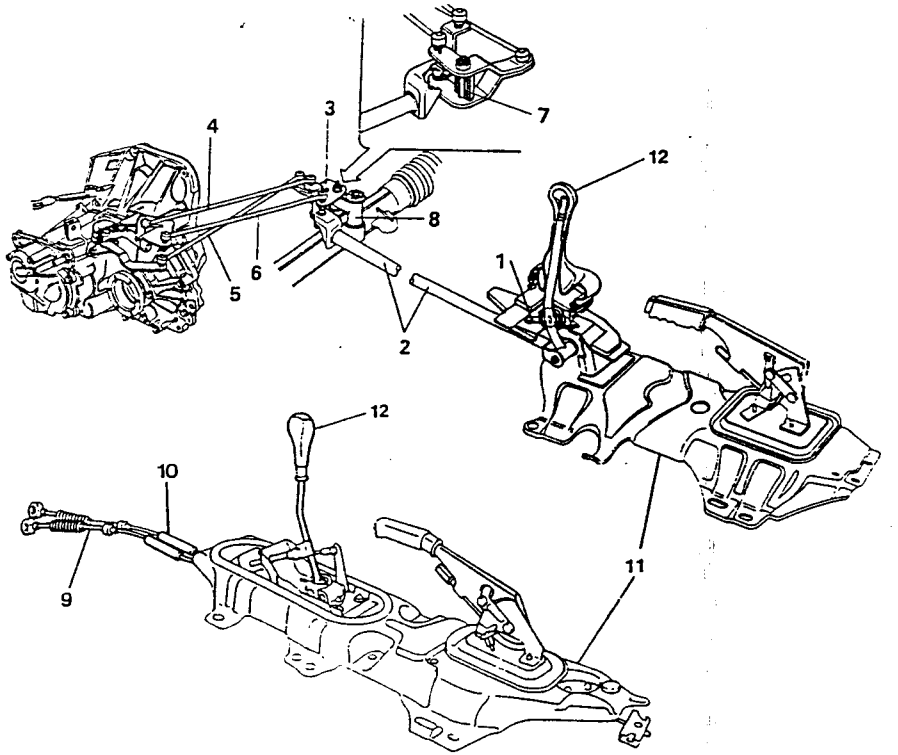
If the value obtained in this way does not correspond to one of the shim rings available, or to the sum of two rings, install the next thickness up.

NOTE: **Thicknesses "S" of the shim rings supplied as spare parts range from 1.70 to 2.60 mm increasing in steps of 0.05 mm.**

GEARBOX OUTER LINKAGE

DESCRIPTION

The gearbox outer linkage assembly can be divided into two types depending on the type of gearbox.
For gearboxes with a medium-low pick-up torque for 1.8 - 2.0 T.S. engines, the traditional system of shafts and rods is adopted. For gearboxes with high a pick-up torque for 2.4 V6 engines, a system of control cables has been introduced which, in addition to improving system maintenance, permits a notable reduction in vibration, and a consequent lowering of the noise level when compared to the traditional system. It also improves the characteristics of docility and precision of engagement.



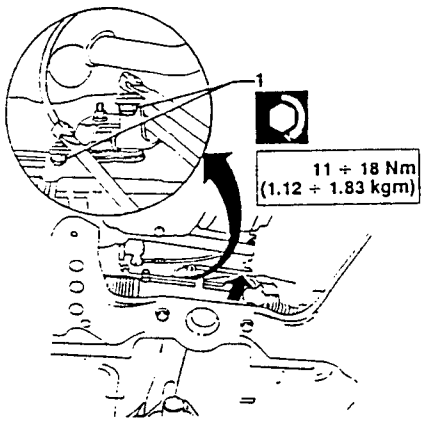
1. Speed selection lever support stand
2. Control rod
3. Speed selection and engagement rod return and support stand
4. Speed selection lever control rod
5. Speed engagement lever control rod
6. Reaction rod
7. Bearings
8. Pin retaining relay support and gear engagement and selection rod support
9. Speed selector cable
10. Speed engagement cable
11. Central support
12. Gear control lever

REMOVAL AND INSTALLATION (versions with shafts and rods)

- Operating underneath the vehicle, remove the front and central sections of the exhaust system (see: REPAIR MANUAL - ENGINES - GR. 04 - EXHAUST SYSTEM).

SPEED SELECTION AND CONTROL RODS

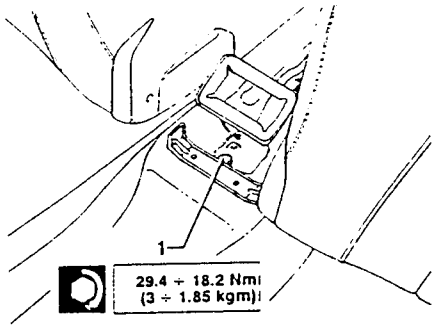
1. If necessary remove the speed selection and control rods by unscrewing the nuts securing the spherical joints at the ends of the rods and disconnect them from the relay support and from the gearbox speed selection and engagement devices.



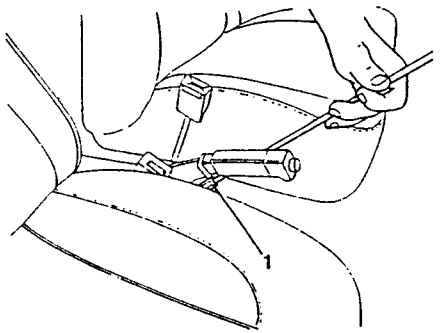
SPEED CONTROL LEVER - CENTRAL SUPPORT

- Operate as follows only if it is necessary to remove the central support together with the speed control lever.
- Working inside the vehicle remove the central console (see: REPAIR MANUAL - BODY - GR. 75 - CENTRAL CONSOLE).

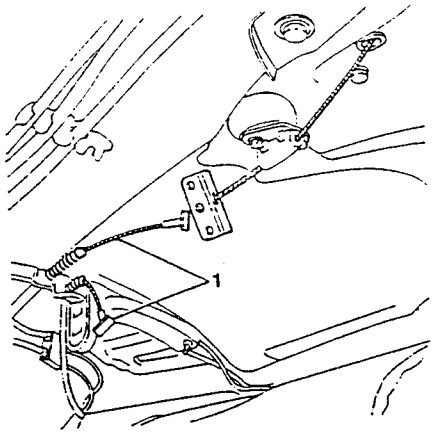
1. Unscrew the screw securing the central support to the body located near the rear air vent.



1. Unscrew the handbrake cable adjustment nut located under the lever.

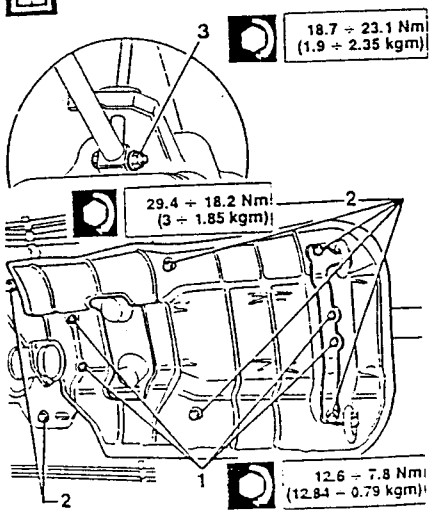


1. Operating under the vehicle, disconnect the handbrake drive tie-rods from the control bracket.



1. (only for vehicles with catalyzed exhaust system):
   - remove the heat shielding.
2. Unscrew the screws securing the central support to the body and lower the support.
3. Unscrew the bolt securing the lever to the speed control shaft and withdraw the central support together with the control lever.

Install by reversing the process employed for disassembly.

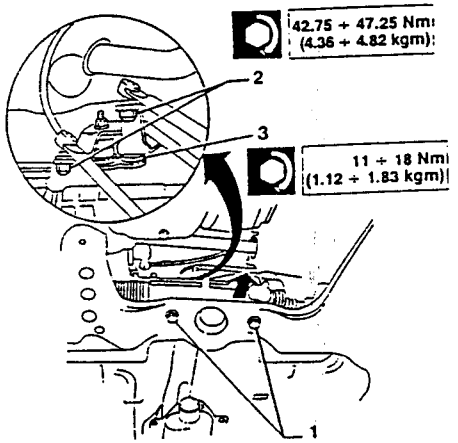


SPEED RODS RELAY SUPPORT

- If it is necessary to remove the speed selection and engagement rods relay, proceed as follows:

1. Unscrew the screws securing the steering box to the front cross member and move the box forwards.
2. Unscrew the nuts securing the spherical joints of the speed selection rods from the relay support.
3. Remove the rubber protection and the underlying clamp and withdraw the relay from the steering box pin.

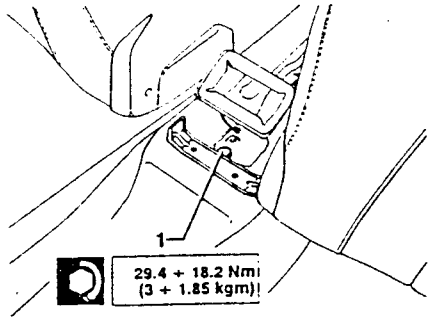
Install by reversing the process employed for disassembly.



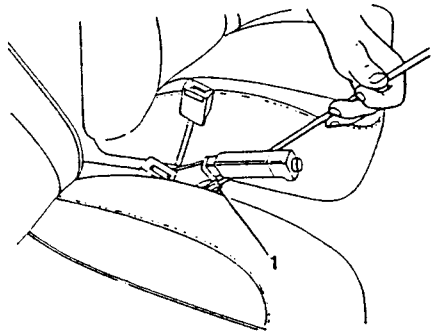
REMOVAL AND INSTALLATION (cable version)

- Operating inside the vehicle remove the central console (see: REPAIR MANUAL - BODY - GR. 75 - CENTRAL CONSOLE).

1. Unscrew the screws securing the central support to the body located near the rear air vent.

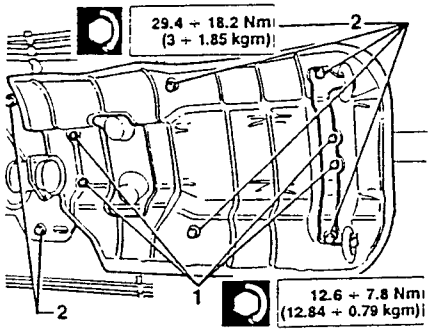


1. Unscrew the handbrake control cable adjustment nut located under the lever.

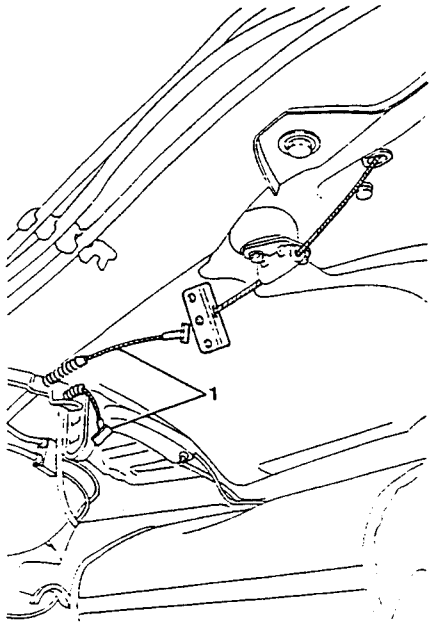


- Operating under the vehicle, remove the front and central sections of the exhaust system (see: REPAIR MANUAL - ENGINES - GR. 04 - EXHAUST SYSTEM).

1. (only for versions with catalyzed exhaust system):
   - remove the heat shielding.

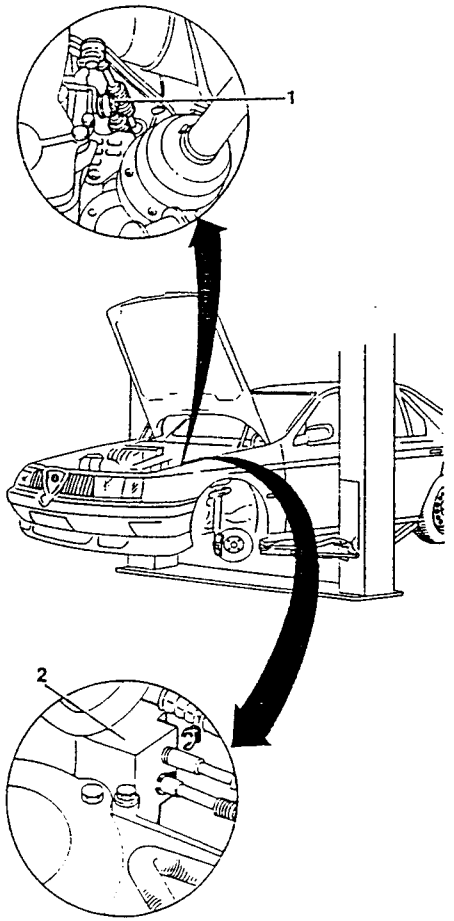


1. Disconnect the handbrake relay tie-rods from the control bracket.



- Operating in the engine compartment, remove the cover-air flow meter assembly (see: REMOVAL AND INSTALLATION).

1. Disconnect the clamps securing the gear control cables to the speed engagement device.
2. Remove the checking points securing the speed selection and engagement cables to the supporting bracket and withdraw the cables from the bracket and pulling them through from the underside of the vehicle.
3. Unscrew the screws securing the the central support to the body and remove them together with the cables.

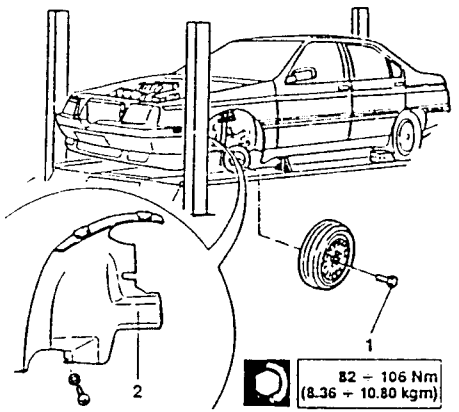


Install by reversing the procedure followed for disassembly taking care that the speed engagement and selection cables are correctly positioned on their relative devices.

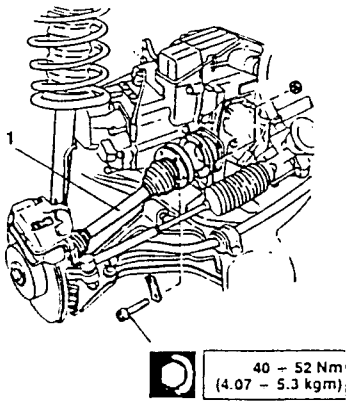
INTERVENTIONS CARRIED OUT ON THE VEHICLE

REPLACING DIFFERENTIAL CASING OIL SEAL ON GEARBOX SIDE (2.4 V6 - 1.8 - 2.0 T.S.)

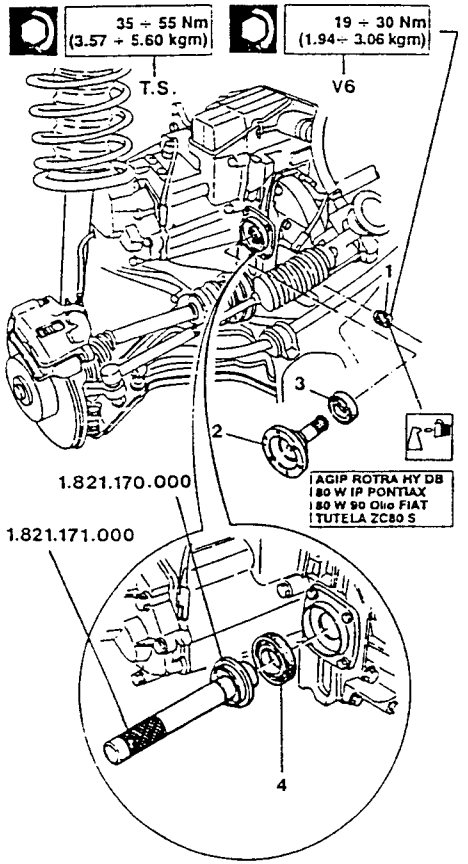
1. Unscrew the bolts and remove the front wheels.
2. Remove the gearbox side wheel housing.



1. Disconnect the left-hand halfshaft from the differential flange.



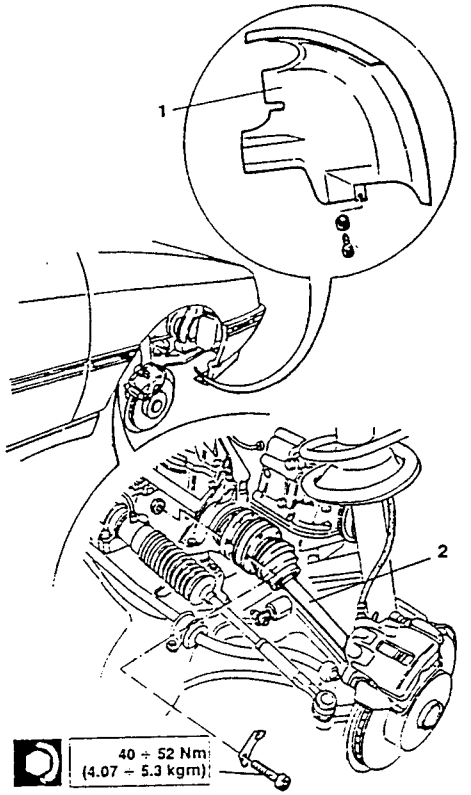
1. Unscrew the cap and drain off the oil.
2. Using tools No. 1.821.161.000 and 1.820.229.000, remove the flange from the differential.
3. Pull off the old oil seal.
4. Using tools No. 1.821.171.000 and 1.821.170.000, insert the new oil seal.



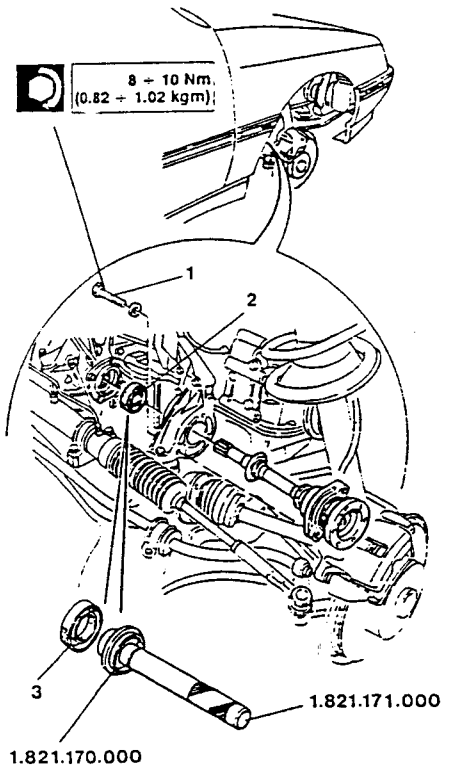
Refit by reversing the procedure followed for removal and tightening the screws to the specified torque.

REPLACING DIFFERENTIAL CASING OIL SEAL ON ENGINE SIDE (2.4 V6 model)

1. Remove the front wheel housing.
2. Disconnect the right-hand halfshaft from the intermediate shaft.



1. Remove the bolts securing the intermediate shaft flange and withdraw the shaft from the differential.
2. Pull off the old oil seal.
3. Using tools No. 1.821.170.000 and 1.821.171.000, insert the new oil seal.



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

REPLACING DIFFERENTIAL CASING OIL SEAL ON ENGINE SIDE (1.8 - 2.0 T.S. model)

Replacing the engine side differential casing oil seal, due to the construction characteristcs of the gearbox itself can only be carried out with the gearbox on the a bench in the overhaul workshp. (See: REASSEMBLY 1.8 - 2.0 T.S.).

TECHNICAL DATA AND SPECIFICATIONS

TECHNICAL DATA

GEARBOX RATIOS

Model	Axle ratio	Gear engaged	Gearbox ratio	Total ratio
1.8.T.S. (167A4C)	16/57 1 : 3.562	1	1 : 3.545	1 : 12.627
		2	1 : 2.267 ♦ 1 : 2.238	1 : 8.075 ♦ 1 : 7.972
		3	1 : 1.542	1 : 5.493
		4	1 : 1.156	1 : 4.118
		5	1 : 0.943	1 : 3.359
		RM	1 : 3.909	1 : 13.924
1.8T.S. (167A4B) 2.0.T.S. (167A2A)	17/57 1 : 3.353	1	1 : 3.545	1 : 11.886
		2	1 : 2.267 ♦ 1 : 2.238	1 : 7.601 ♦ 1 : 7.504
		3	1 : 1.542	1 : 5.170
		4	1 : 1.156	1 : 3.876
		5	1 : 0.943	1 : 3.162
		RM	1 : 3.909	1 : 13.107
2.4 V6 (167A1)	17/58 1 : 3.412	1	1 . 3.500	1 : 11.942
		2	1 : 2.173	1 : 7.425
		3	1 : 1.519	1 : 5.183
		4	1 : 1.156	1 : 3.944
		5	1 : 0.817	1 : 3.129
		RM	1 . 3.545	1 : 12.096

♦ Starting from random chassis no. 9700

Model	Axle ratio	Gear engaged	Gearbox ratio	Total ratio
T.SPARK 1.7 (167A4H)	16/57 1 : 3.563	1	1 . 3.545	1 : 12.631
		2	1 : 2.238	1 : 7.974
		3	1 : 1.541	1 : 5.491
		4	1 : 1.156	1 : 4.119
		5	1 : 0.942	1 : 3.356
		RM	1 : 3.909	1 : 13.928
T.SPARK 1.7 (167A4L)	18/57 1 : 3.167	1	1 : 3.909	1 . 12.380
		2	1 . 2.238	1 : 7.088
		3	1 : 1.440	1 : 4.560
		4	1 : 1.156	1 : 3.661
		5	1 : 0.875	1 : 2.771
		RM	1 : 3.909	1 : 12.380
T.SPARK 1.8 (167A4G)	16/57 1 : 3.563	1	1 : 3.545	1 : 12.631
		2	1 . 2.267	1 : 8.077
		3	1 : 1.541	1 . 5.491
		4	1 : 1.156	1 : 4.119
		5	1 : 0.942	1 . 3356
		RM	1 : 3.909	1 . 13.928
T.SPARK 2.0 (167A2D)	17/57 1 : 3.353	1	1 : 3.545	1 . 11.886
		2	1 . 2.267	1 : 7.601
		3	1 : 1.541	1 : 5.170
		4	1 : 1.156	1 : 3.876
		5	1 : 0.942	1 : 3.159
		RM	1 : 3.909	1 : 13.107
2.5V6 (167A1C)	17/58 1 : 3.412	1	1 : 3.500	1 : 11.932
		2	1 : 2.176	1 : 7.425
		3	1 : 1.524	1 : 5.200
		4	1 : 1.156	1 : 3.944
		5	1 : 0.917	1 : 3.129
		RM	1 : 3.545	1 : 12.096

VERSIONS '95

Model	Axle ratio	Gear engaged	Gearbox ratio	Total ratio
T.SPARK 1.7 (167A4H) (167A4G) T.SPARK 1.8 (167A4E)	16/57 1 . 3.562	1	1 . 3.545	1 : 12.627
		2	1 . 2.238	1 : 7.792
		3	1 : 1.520	1 : 5.414
		4	1 : 1.156	1 : 4.118
		5	1 : 0.946	1 : 3.370
		RM	1 : 3.909	1 : 13.924
T.SPARK 1.7 (167A4L) T.SPARK 1.8 (167A4M)	18/57 1 : 3.167	1	1 : 3. 909	1 : 12.380
		2	1 : 2.238	1 : 7.088
		3	1 : 1.444	1 : 4.573
		4	1 : 1.156	1 : 3.661
		5	1 : 0.872	1 : 2.762
		RM	1 : 3.909	1 : 12.380
2.5V6 (167A1E)	17/54 1 : 3.176	1	1 : 3.500	1 : 11.118
		2	1 : 2.235	1 : 7.099
		3	1 : 1.522	1 : 4.834
		4	1 : 1.156	1 : 3.672
		5	1 : 0.914	1 : 2.903
		RM	1 : 3.545	1 : 11.260

GENERAL INDICATIONS

FLUIDS AND LUBRICANTS

APPLICATION	TYPE	NAME
Gearbox/differential unit oil filling	OIL	AGIP ROTRA HY DB 80W IP PONTIAX 80W90 FIAT TUTELA ZC 80S oil
Clutch control fork bearing and thrust bearing seat	GREASE	AGIP GREASE 33 FD IP AUTOGREASE FD
Speed engagement control rod bushings and gear lever ball joint	GREASE	ISECO MOLIKOTE LONGTERM No. 2 FIAT GREASES/IX

SEALANTS AND SURFACE FIXING AGENTS

APPLICATION	TYPE	NAME
Rear cover and gearbox casing	HERMETIC	LOCTITE 573

CHECKS AND ADJUSTMENTS

DIFFERENTIAL - CROWN WHEEL/SIDE PINION BACKLASH

	2.4 V6
	0.07 - 0.20 mm

NOTE: Backlash between crown wheel and idle pinion is adjusted by using spare rings with a thickness ranging from 1.80 mm to 2.20 mm.

TIGHTENING TORQUES - 2.4 V6

GEARBOX - DIFFERENTIAL

Description	N·m	kg·m
Screw securing clutch disengagement sleeve support cover	7 - 9	0.71 - 0.92
Screw securing left and right side covers to casing	24 - 31	2.45 - 3.16
Screws securing gearbox casing to support	24 - 31	2.45 - 3.16
Screws securing rear cover to gearbox casing	24 - 31	2.45 - 3.16
Threaded plug for gearbox oil drainage	19 - 30	1.94 - 3.06
Screw securing differential cover to engine-gearbox support (length 55 mm)	24 - 31	2.45 - 3.16
Screw securing differential cover to engine-gearbox support (length 20 mm)	48 - 62	4.89 - 6.32
Screw retaining gearbox control rod spring	19 - 30	1.94 - 3.06
Ring nut locking main shaft gears	143 - 185	14.57 - 18.86
Ring nut locking drive shaft gears	143 - 185	14.57 - 18.86
Screw securing main shaft rear bearing retaining plate	24 - 31	2.45 - 3.16
Screw securing transmission shaft rear bearing retaining plate	24 - 31	2.45 - 3.16
Self-locking screw securing 1st and 2nd speed fork	24 - 31	2.45 - 3.16
Self locking screw securing 3rd and 4th speed prong	24 - 31	2.45 - 3.16
Self locking screw securing 3rd and 4th speed fork	24 - 31	2.45 - 3.16
Self locking screw securing reverse and 5th speed prong	24 - 31	2.45 - 3.16
Screw fixing complete reverse lever	24 - 31	2.45 - 3.16
Self locking screw securing 5th speed fork	24 - 31	2.45 - 3.16
Screw securing gearbox control shaft bushing to casing	7 - 9	0.71 - 0.92
Self-locking nut securing gear lever to internal shaft	24 - 31	2.45 - 3.16
Screw securing gear lever to outer shaft	24 - 31	2.45 - 3.16
Screw securing odometer support	8 - 12	0.82 - 1.22
Self-locking screw securing crown gear	81 - 90	8.26 - 9.17

Reversing light switch screw	20 - 40	2.04 - 4.08
Screws securing differential side coupling to flange	40 - 52	4.07 - 5.3
Screw securing axle shaft intermediate flange	8 - 10	0.82 - 1.02

ENGINE-GEARBOX SECURING DEVICES

Description	N·m	kg·m
Screw securing gearbox assembly support to engine	41 - 53	4.18 - 5.41
Screw securing flywheel cover to gearbox assembly support	6 - 10	0.61 - 1.02
Screw securing starter motor to gearbox assembly support	20 - 25	2.04 - 2.55
Nut securing supply cable to starter motor	10 - 12	1.01 - 1.22

GEARBOX OUTER LINKAGE

(Version with rods)

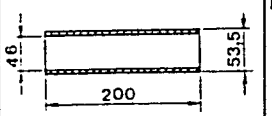
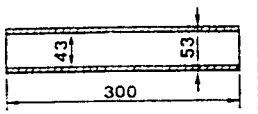
Description	N·m	kg·m
Screw securing rear flexible block to speed engagement reaction rod	4.5 - 7.1	0.45 - 0.72
Screw securing speed engagement lever ball-joint to complete support	5.6 - 7.3	0.57 - 0.74
Self-locking nut securing end of rod support to bracket on gearbox	5.6 - 7.3	0.57 - 0.74
Screw securing speed engagement reaction rod bracket to gearbox	10 - 12	1.01 - 1.22
Self-locking nut securing speed engagement tie-rod fork to gear lever	8.7 - 11.2	0.88 - 1.14
Screw securing speed engagement tie-rod to coupling	16 - 21	1.63 - 2.14
Screw securing coupling to gearbox output rod	19 - 25	1.93 - 2.54
Self-locking nut securing rod cover to body	4.6 - 7.2	0.46 - 0.73
Self-locking nut securing anti-vibration weight on gearbox reaction rod	12 - 16	1.22 - 1.63

(Version with cables)

Description	N·m	kg·m
Nut with self-locking flange securing gearbox reaction cables bracket to tunnel	7.1 - 9	0.72 - 0.92
Screw securing gearbox reaction cables to gearbox	14 - 18	1.43 - 1.83

SPECIAL TOOLS 2.4 V6

TOOL NUMBER	DESCRIPTION
1.820.018.000	half rings for: – extracting main shaft rear bearing – extracting main shaft 4th speed drive gear
1.820.023.000	Half plate for: – extracting layshaft front bearing
1.820.024.000	Half ring support plate (Use with 1.820.018.000)
1.820.043.000	Half rings for: – extracting layshaft 4th speed driven gear – extracting layshaft rear bearing
1.820.046.000	Half rings for: – extracting layshaft 2nd and 3rd speed driven gears – extracting layshaft 2nd speed synchronizer – extracting layshaft 1st speed driven gear sliding hub-sleeve
1.820.047.001	Half ring support plate (Use with 1.820.043.000)
1.820.047.003	Half ring support plate (Use with 1.820.046.000)
1.820.085.000	Tool for measuring thickness of differential casing bearing shim rings
1.820.125.000	Mandrel for checking differential axial play
1.820.146.000	Plate for supporting gearbox on rotary stand
1.820.208.000	Support for gearbox removal/installation (Use with 1.820.230.000)
1.820.226.000	Engine support (Use with 1.820.239.000 and 1.820.581.000)
1.820.229.000	Flange (Use with 1.821.161.000)
1.820.230.000	Bracket for gearbox removal/installation (Use with 1.820.208.000)
1.820.239.000	Supports for gearbox-engine stand (Use with 1.820.581.000 and 1.820.226.000)
1.820.581.000	Engine support horizontal cross member (Use with 1.820.239.000 and 1.820.226.000)
1.820.034.000	Differential bearing puller
1.821.047.000	Tool for inserting 1st, 3rd and 5th speed control rod safety pawls
1.821.049.000	Half plate for extracting/inserting main shaft rear and front bearings

TOOL NUMBER	DESCRIPTION
1.821.092.000	Inserting tool for: – main shaft rear and front bearings – layshaft rear bearing – layshaft 4th speed driven gear
1.821.161.000	Mallet for extracting differential flange (Use with 1.820.229.000)
1.821.169.000	Puller for steering lateral tie-rod pin
1.821.170.000	Key for inserting differential cover oil seal (Use with 1.821.171.000)
1.821.171.000	Hand grip (Use with 1.821.170.000)
 (mm)	Inserting tool for: – layshaft front bearing – layshaft 1st and 2nd speed engagement sliding sleeve-hub – layshaft 3rd speed driven gear
 (mm)	Inserting tool for differential bearings

TIGHTENING TORQUES - 1.8 T.S. - 2.0 T.S.

GEARBOX - DIFFERENTIAL

Description	N·m	kg·m
Nut securing spring inserting speed control rod	20 - 40	2.03 - 4.07
Screw securing gearbox plate and cover	24 - 31	2.45 - 3.16
Screw securing cover on gearbox coupling support to engine	10 - 12	1.01 - 1.22
Screw securing gearbox to engine junction support	24 - 31	2.45 - 3.16
Screw securing reverse speed shaft	32 - 42	3.26 - 4.28
Ring nut for main and lay shafts securing 5th speed gear	113 - 145	11.51 - 14.78
Screw securing speed control forks	17 - 22	1.71 - 2.21
Screw securing lever to speed selection and engagement control shaft	24 - 31	2.44 - 3.16
Screw securing support for reverse speed control lever	10 - 12	1.01 - 1.22
Screw securing speed control shaft bushing	10 - 12	1.01 - 1.22
Screw securing differential cylindrical crown gear	84 - 109	8.56 - 11.1
Screw securing differential casing retaining flange to gearbox	24 - 31	2.45 - 3.16
Screw securing speedometer support	9 - 14	0.91 - 1.42
Threaded magnetic tapered cap for gearbox oil drainage	35 - 55	3.56 - 5.6
Threaded tapered cap for introduction of gearbox oil	35 - 55	3.56 - 5.6
Screw securing right differential shaft support	7.8 - 12	0.79 - 1.22
Threaded tapered cap for 1st and 2nd speed rod seat on gearbox	15 - 24	1.52 - 2.45
Screw securing speed selection lever support	11 - 18	1.12 - 1.83
Screw securing differential side coupling to flange	40 - 52	4.07 - 5.3
Screw securing damping counterweight to axle shaft	5.6 - 8.8	0.57 - 0.89
Screw securing intermediate axle shaft	8 - 10	0.82 - 1.02
Reversing light switch screw	20 - 40	2.04 - 4.08

ENGINE - GEARBOX SECURING DEVICES

Description	N·m	kg·m
Nut for stud on gearbox support for gearbox-engine coupling	21 - 27	2.14 - 2.76
Screw with unlosable washer securing flywheel cover to gearbox junction support	6 - 10	0.61 - 1.01
Screw securing starter motor to gearbox coupling support	20 - 25	2.04 - 2.55
Screw securing gearbox coupling support to engine	20 - 25	2.04 - 2.55
Nut securing starter motor supply cable	10 - 12	1.01 - 1.22

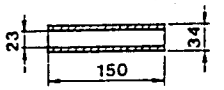
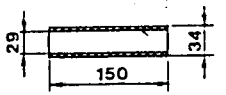
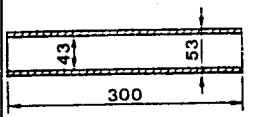
GEARBOX OUTER LINKAGE

Description	N·m	kg·m
Screw securing gear lever support to floor	5.6 - 8.8	2.03 - 4.07
Screw securing lower speed selection and engagement rod to gear lever	21 - 26	2.14 - 2.65
Self-locking nut for intermediate control retaining pin	11 - 18	1.12 - 1.83
Self-locking nut securing engagement tie-rod head to intermediate lever	11 - 18	1.12 - 1.83
Self-locking nut for screws securing selection intermediate control to gearbox	14 - 18	1.42 - 1.83

SPECIFIC TOOLS - 1.8 T.S. - 2.0 T.S.

GEARBOX - DIFFERENTIAL

TOOL NUMBER	DESCRIPTION
1.820.017.000	Half rings for: - extracting layshaft 4th speed driven gear - main shaft disassembly
1.820.019.000	Plate for extracting layshaft 2nd and 3rd speed driven gears
1.820.022.000	Half plates for inserting inner race of main shaft front bearing
1.820.024.000	- Half ring support plate (Use with 1.820.017.000) - Plate for extracting layshaft 1st speed driven gear
1.820.146.000	Plate supporting gearbox on rotary stand
1.820.208.000	Support for gearbox removal/installation (Use with 1.820.227.000)
1.820.226.000	Engine support (Use with 1.820.239.000 and 1.820.581.000)
1.820.227.000	Brackets for gearbox removal/installation (Use with 1.820.208.000)
1.820.229.000	Flange (Use with 1.821.161.000)
1.820.239.000	Supports for gearbox-engine stand (Use with 1.820.581.000 and 1.820.226.000)
1.820.581.000	Engine support horizontal cross member (use with 1.820.239.000 and 1.820.226.000)
1.821.003.000	Beater for withdrawing outer race of differential support bearing
1.821.028.000	Inserting tool for outer race of differential support bearing
1.821.034.000	Puller for differential bearings
1.821.047.000	Inserting tool for safety pawl 1st, 3rd and 5th speed control rods
1.821.049.000	Half plates for: inserting main shaft rear bearing
1.821.050.000	Inserting tool for 4th speed driven gear
1.821.062.000	Inserting tool for differential bearings
1.821.092.000	Inserting tool for 1st speed driven gear
1.821.117.000	Puller for dismantling inner race of main and layshaft front bearing

TOOL NUMBER	DESCRIPTION
1.821.161.000	Mallet for extracting differential flange (Use with 1.820.229.000)
1.821.169.000	Puller for side tie-rod pin of steering wheel
1.821.170.000	Inserting tool for gearbox side differential casing oil seal (Use with 1.821.171.000)
1.821.171.000	Grip (Use with 1.821.225.000)
1.821.225.000	Inserting tool for eingine side differential casing oil seal (Use with 1.821.171.000)
 (mm)	Inserting tool for: inner race of main shaft front bearing (Use with 1.820.022.000)
 (mm)	Inserting tool for: main and layshaft rear bearing (Use with 1.821.049.000)
 (mm)	Inserting tool for: layshaft 2nd and 3rd speed gears and synchronizer hub

FAULT DIAGNOSIS AND CORRECTIVE ACTION

SYMPTOMS AND ANOMALIES	FAULT ISOLATION	TEST
	When the origin of the noise has been identified and does not therefore originate from the engine, locate the anomalous group as indicated below: – Start the engine – The gearbox should be idling; in this state noises can be noted – Within reason vary the speed of the vehicle and engage different gears in order to locate the anomaly with precision – During these operations it may be difficult to engage the gears, or there may be excessive play in the gear control or a fault in the reverse gear electrical circuit	
NOISY GEARBOX/DIFFERENTIAL GROUP		A
NOISY GEARBOX WHEN IN NEUTRAL (STATIONARY VEHICLE)		B
CONSTANT NOISE DURING TRAVEL AND WITH GEARBOX IN NEUTRAL		C
SPECIFIC GEAR NOISE DURING ACCELERATION AND/OR DECELERATION		D
NOISE DURING ACCELERATION AND DECELERATION MOSTLY EXPERIENCED IN 4th OR 5th GEAR		E

FAULT DIAGNOSIS AND CORRECTIVE ACTION

SYMPTOMS AND ANOMALIES	FAULT ISOLATION	TEST
KNOCKS DURING PICK UP OR GEAR SPEED CHANGE		F
NOISE IN CURVES BOTH AT NORMAL GEAR SPEED AND IN NEUTRAL		G
NOISY REVERSE GEAR		H
BINDING OF GEARBOX CONTROL AND POSSIBLE NON-RETURN OF GEAR LEVER TO NEUTRAL		I
EXCESSIVE PLAY DURING GEAR SPEED CHANGE AND NOISE/VIBRATION OF GEAR LEVER		L
DIFFICULT OR NOISY (GRATING) ENGAGEMENT/DISENGAGEMENT OF GEAR SPEEDS		M
LOW SENSIBILITY DURING GEAR ENGAGEMENT		N

NOISY GEARBOX/DIFFERENTIAL — TEST A

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
A1 ENGINE OIL LEVEL CHECK – Check the oil level	(OK) ▶ (OK) ▶	Carry out step A2 Top-up oil to proper level
A2 OIL CHECK – Check that gearbox oil has the prescribed characteristics	(OK) ▶ (OK) ▶	Carry out step A3 Replace with prescribed oil
A3 CHECK FOR OIL LEAKS – Check that oil is not leaking from the oil seals of the differential support, top-up cap or drainage cap	(OK) ▶	Replace the oil seal rings or caps

NOISE DURING ENGINE IDLE (STATIONARY VEHICLE) — TEST B

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
B1 CONTROL IDLE SPEED – Check the engine idle rpm setting	(OK) ▶ (OK) ▶	Carry out step B2 Top-up oil to correct level
B2 CHECK OIL LEVEL – Check oil level	(OK) ▶	Top-up oil to correct level

CONTINUOUS NOISE DURING TRAVEL AND WHEN IDLING — TEST C

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
C1 CHECK BEARINGS – Check that the main and lay shaft bearings are not worn or damaged	OK ▶	Replace bearings and check seatings

SPECIFIC GEAR NOISE DURING ACCELERATION AND/OR DECELERATION — TEST D

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
D1 CHECK GEARS – Check that the gear teeth mating surfaces are not worn and are free from traces of meshing	OK ▶	Replace gears

NOISE DURING ACCELERATION AND DECELARATION EXPERIENCED MAINLY IN 4th OR 5th GEAR	TEST E

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
E1	CHECK SPUR GEAR PAIR		
– Check that the spur gear pair is not worn or damaged and that play is not excessive		(OK) ▶	Restore correct play or replace the spur gear pair

KNOCKING DURING PICKUP OR GEAR SPEED CHANGE	TEST F

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
F1	CHECK SPUR GEAR PAIR		
– Check the spur gear pair for wear, damage or excessive play		(OK) ▶ (OK) ▶	Carry out step F2 Restore correct play or replace spur gear pair if necessary
F2	CHECK CROWN GEAR ATTACHMENTS		
– Check that the crown gear attachments are are not loose		(OK) ▶ (OK) ▶	Carry out step F3 Tighten screws
F3	CHECK SPIDER PIN		
– Check that the spider pin and reltive seating on the differential casing are not worn		(OK) ▶ (OK) ▶	Carry out step F4 Replace differential unit
F4	CHECK PINION SHAFT		
– Check that the pinion shaft retaining nut is not loose		(OK) ▶ (OK) ▶	Carry out step F5 Tighten or replace nut

NOISE IN CURVES BOTH AT NORMAL GEAR SPEED AND IN NEUTRAL — TEST G

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
G1	CHECK GEAR TEETH		
– Check that the idle pinion and crown gear teeth are not worn or damaged and are free from traces of meshing		(OK) ▶	Replace differential unit

NOISY REVERSE GEAR — TEST H

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
H1	CHECK GEARS		
– Check that the reverse gears are not worn or damaged		(OK) ▶	Replace defective parts

BINDING OF GEARBOX CONTROLS AND POSSIBLE NON-RETURN OF GEAR LEVER TO NEUTRAL	TEST I

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
I1	CHECK GEARBOX LINKAGE		
– Check the gearbox linkage for binding or looseness		(OK) ▶ (OK) ▶	Carry out step I2 Tighten or replace the damaged parts
I2	CHECK LINKAGE LUBRICATION		
– Check that the gearbox linkage parts are sufficiently lubricated		(OK) ▶	Lubricate the parts as required

EXCESSIVE PLAY DURING GEAR SPEED CHANGE AND NOISE/VIBRATION OF GEAR LEVER	TEST L

TEST PROCEDURE		RESULT	CORRECTIVE ACTION
L1	CHECK LINKAGE PARTS		
– Check for wear of selector lever spherical unit, flexible joint bushings and the gear selection rod knuckle bushings		(OK) ▶	Check for proper torque and replace parts if necessary

DIFFICULT OR NOISY (GRATING) ENGAGEMENT/DISENGAGEMENT OF GEAR SPEEDS	TEST M

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
M1 CHECK GEARS – Check gear teeth for nicks and excessive wear and inner surfaces for signs of meshing	(OK) ▶ (OK) ▶	Carry out step M2 Replace defective gears
M2 CHECK HUBS AND SLIDING SLEEVES – Check hubs and sliding sleeves for nicks, excessive wear or play and freedom of movement	(OK) ▶ (OK) ▶	Carry out step M3 Replace the sliding sleeves
M3 CHECK SYNCHRONIZER RINGS – Check synchronizer rings for ovalization and inner surface wear	(OK) ▶ (OK) ▶	Carry out step M4 Substitute the synchronizer rings
M4 CHECK PAWL SPRINGS – Check sleeve hub pawl for damage	(OK) ▶	Replace the sliding sleeves

LOW SENSIBILITY DURING GEAR ENGAGEMENT	TEST N

TEST PROCEDURE	RESULT	CORRECTIVE ACTION
N1 CHECK FORK CONTROL RODS – Check bushings of fork control rods for wear or seizure	(OK) ▶ (OK) ▶	Carry out step N2 Replace worn parts
N2 CHECK PAWLS – Check pawls and relevant springs for damage	(OK) ▶ (OK) ▶	Carry out step N3 Replace defective parts
N3 CHECK RODS – Check rods for wear, distortion and freedom of movement	(OK) ▶ (OK) ▶	Carry out step N4 Replace rods
N4 CHECK SELECTOR FORK – Check selector fork for wear or damage	(OK) ▶	Replace selector

GROUP 17

AXLE SHAFTS

INDEX

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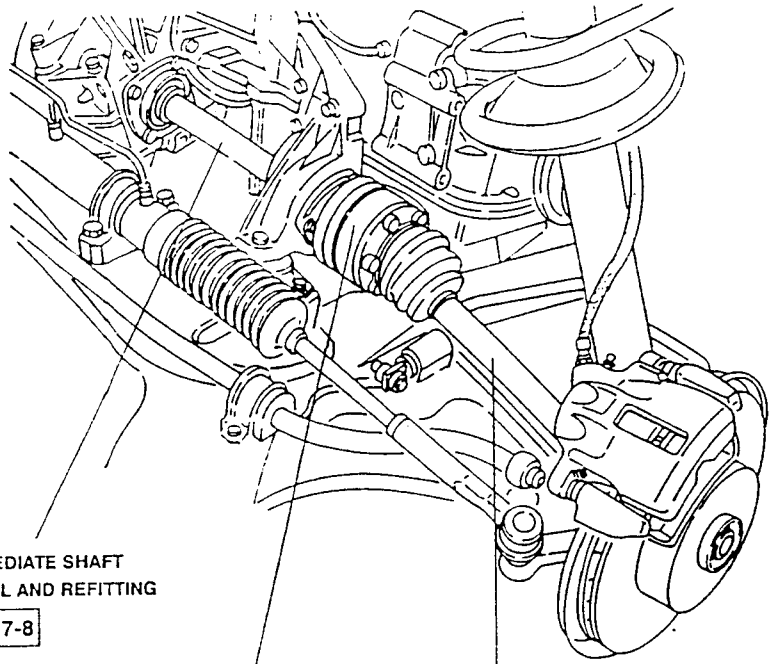

INTERMEDIATE SHAFT
REMOVAL AND REFITTING
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AXLE SHAFTS
REMOVAL AND REFITTING Page 17-5

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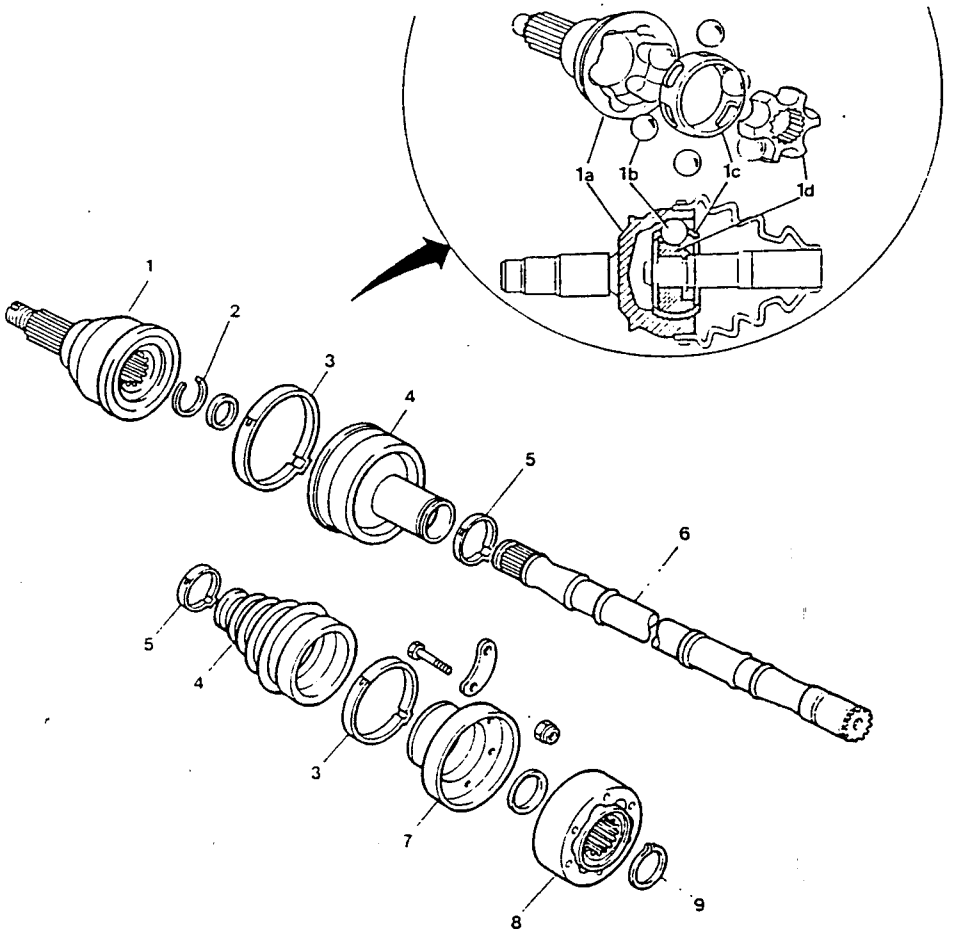
DISASSEMBLY OF JOINT ON GEARBOX SIDE Page 17-9

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.

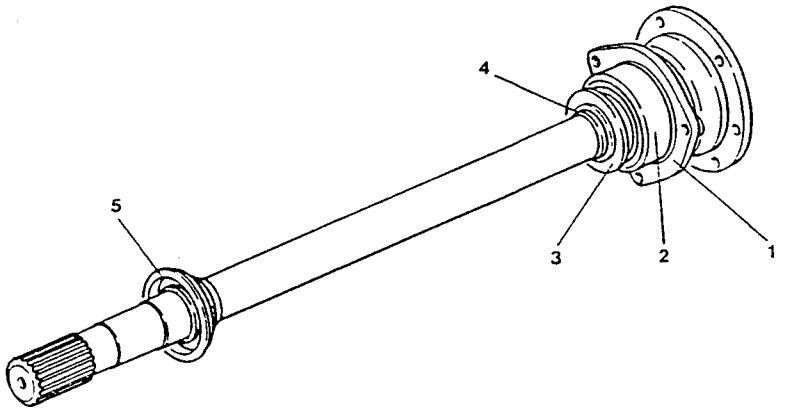
The constant speed joints are composed of an inner core (1d) called "drive", machined onto the input shaft, and by an outer shell (1a) called "driven", which forms the outgoing element of the shaft.

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.

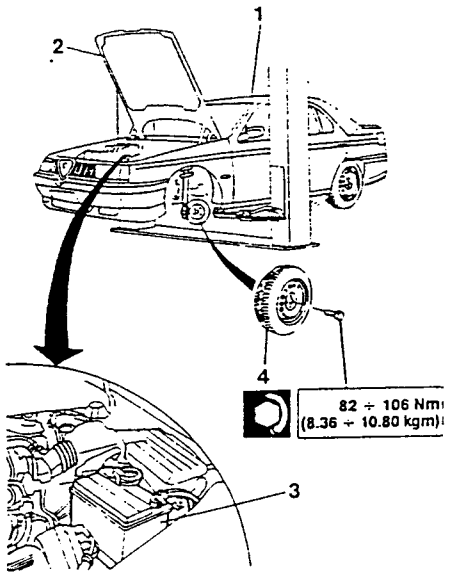


1. Bearing retaining plate
2. Ball bearing
3. Flexible washer
4. Flexible ring securing bearing
5. Bowl for bearing

REMOVAL AND REFITTING

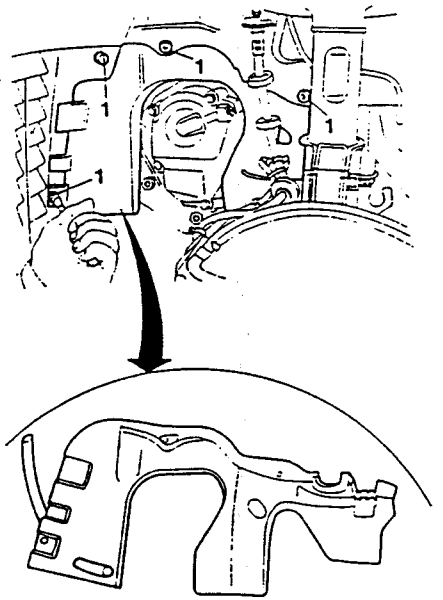
1. Set the vehicle on a lift.
2. Lift the bonnet.
3. Disconnect and remove the battery.
4. Remove the front wheels.

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

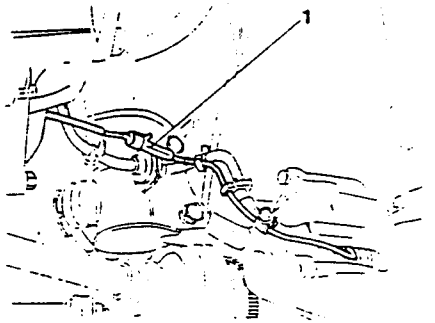


- Raise the vehicle.

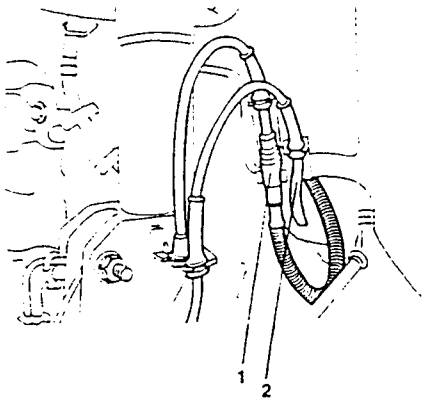
1. Working through the left-hand wheelhousing, loosen the screws and remove the buttons securing the dustguard on the gearbox side.



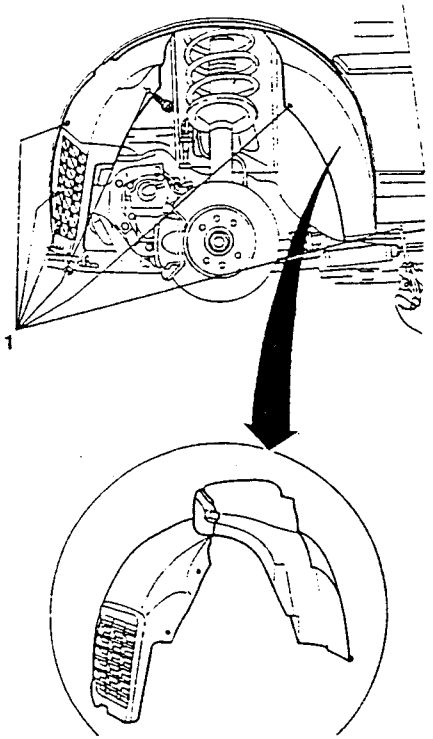
1. Disconnect the connector from the brake pad wear sensor.



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.



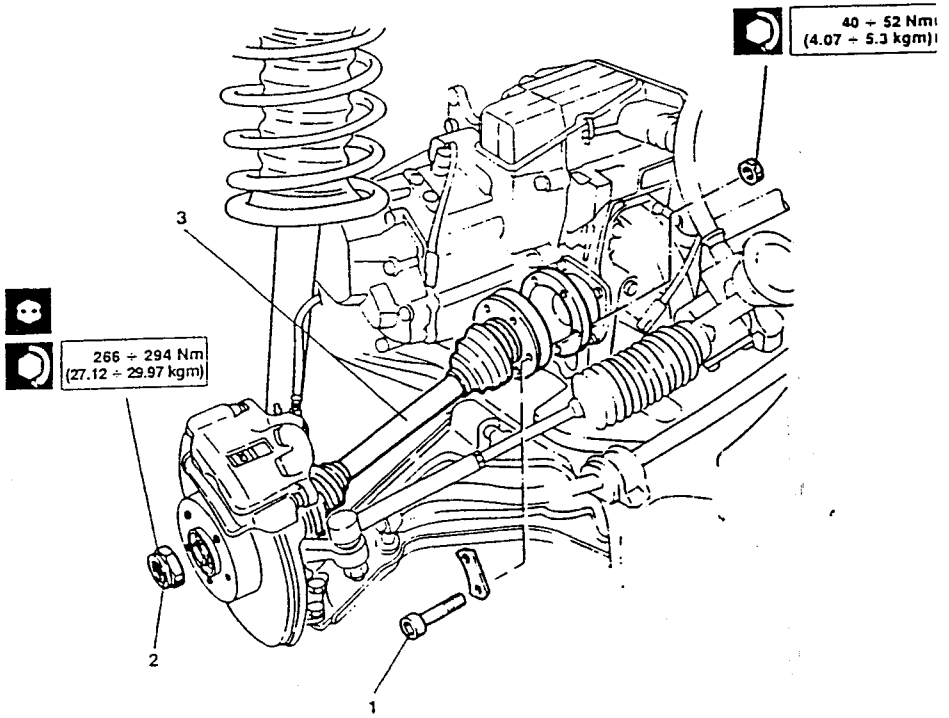
1. Loosen the screws and remove the plastic wheel-housing from the body.



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.

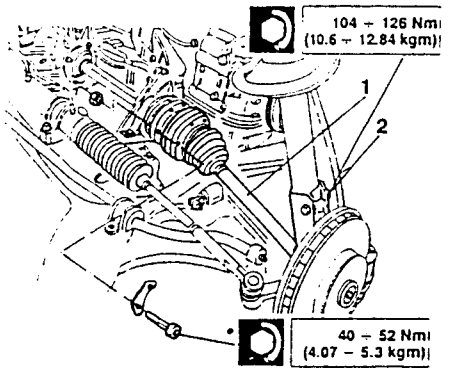


INTERMEDIATE SHAFT

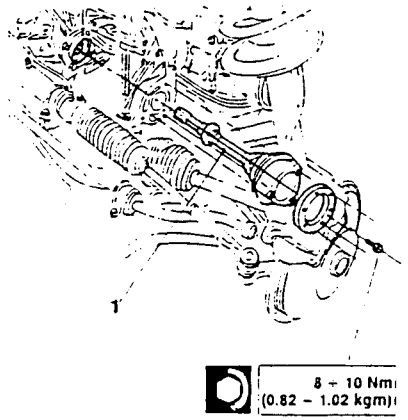
REMOVAL AND REFITTING

- 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.



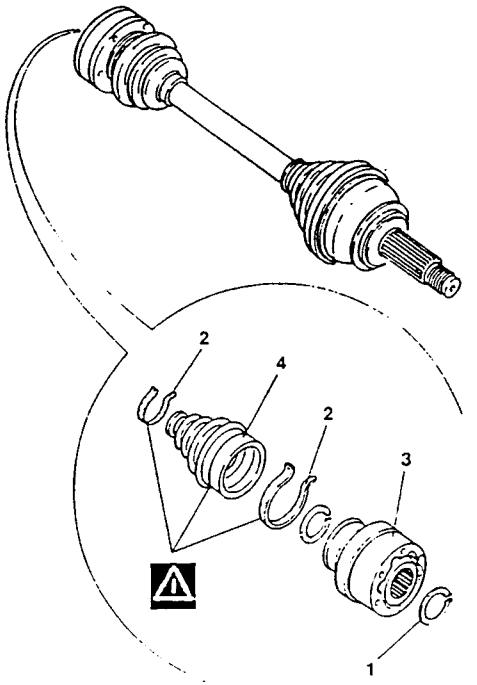
Refit by reversing the procedure followed for removal and tighten the previously removed screws and nuts to the correct torque.

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.

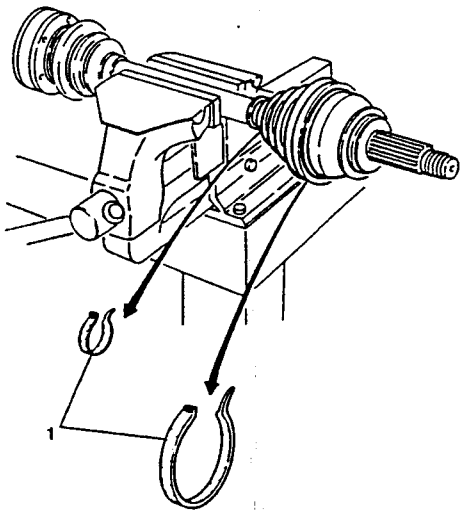


DISASSEMBLY OF JOINT ON WHEEL SIDE

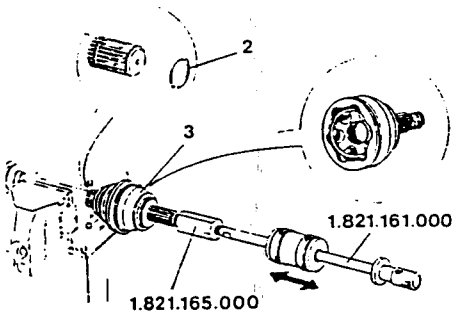
Lock the axle shaft in a vice and proceed as follows:

1. Remove the clamp securing the protective boot.

WARNING:
Substitute the boot and clamps when refitting.



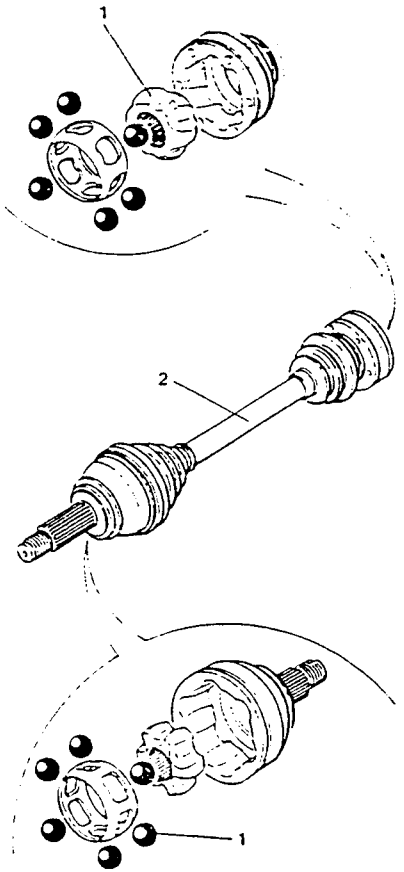
2. Remove the snap ring.
3. Using tools No. 1.821.165.000 and No. 1.821.161.000, remove the constant speed joint from the axle shaft.



CHECKING AND ADJUSTMENT

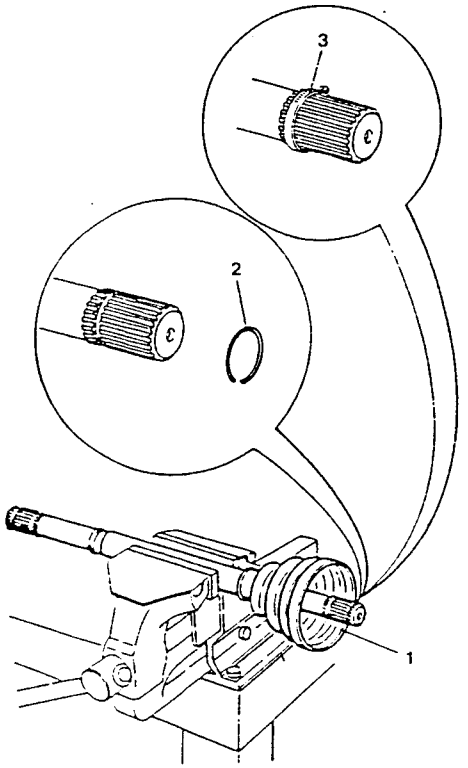
Grease the components of the constant speed joint with petrol and check that the balls and seatings are not worn or cracked.

2. Check that the shaft is not deformed, cracked or worn.



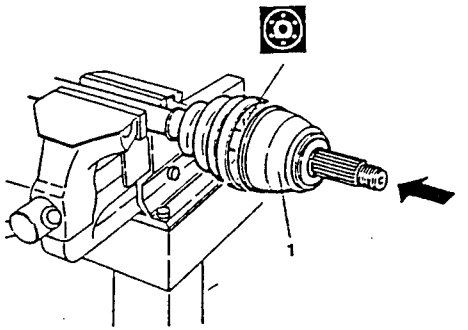
REFITTING THE JOINT ON THE WHEEL SIDE

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.

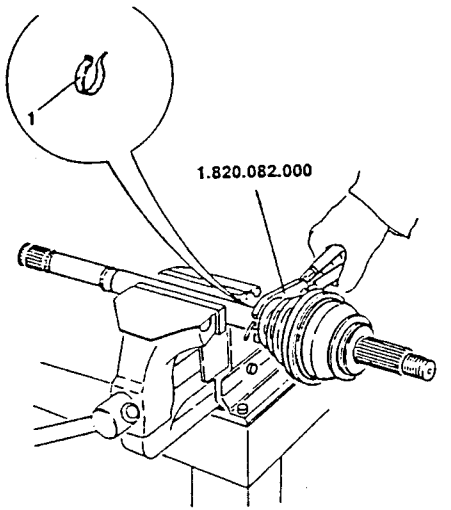


1. Position the constant speed joint on the axle shaft and using a soft mallet, drive it home.

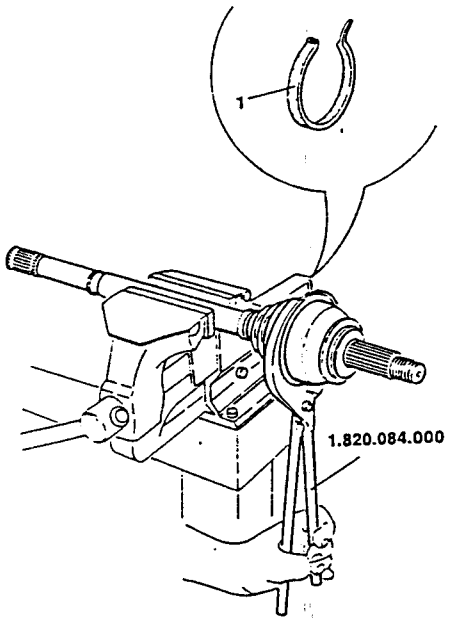
Fill the boot and grease the joint with about 120 g of the specified grease.



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.

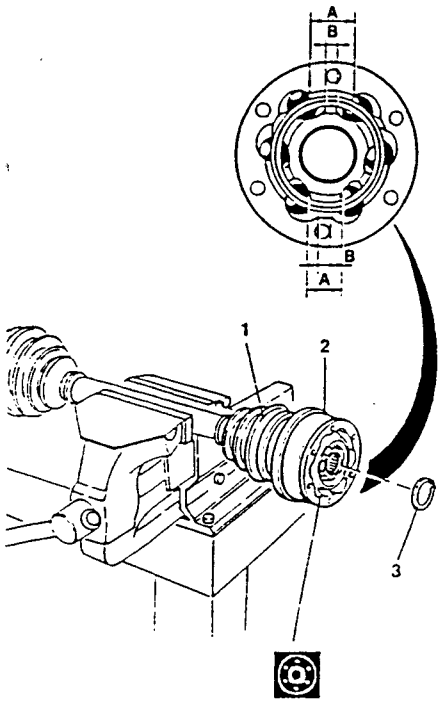


REFITTING THE JOINT ON THE GEARBOX SIDE

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

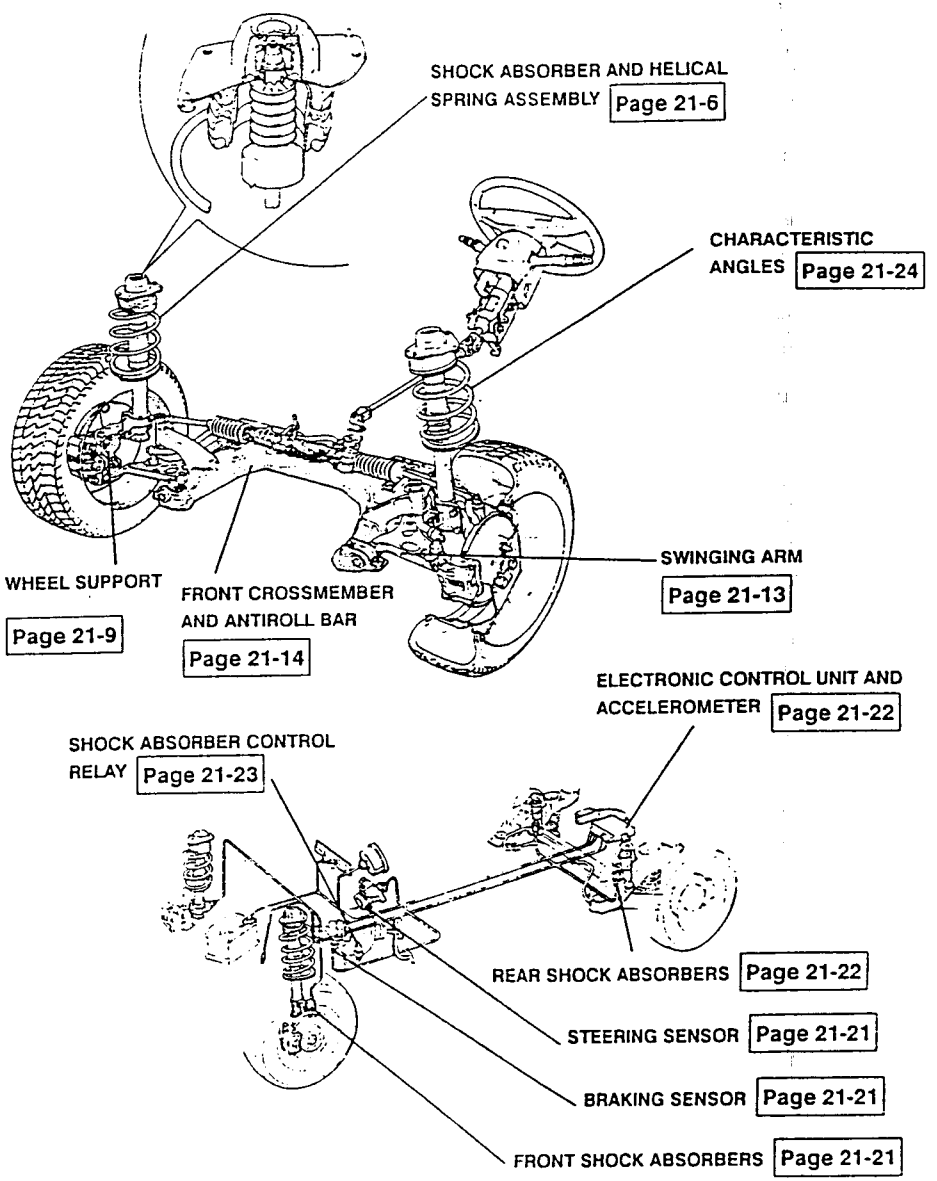
GROUP 21

FRONT SUSPENSION

INDEX

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

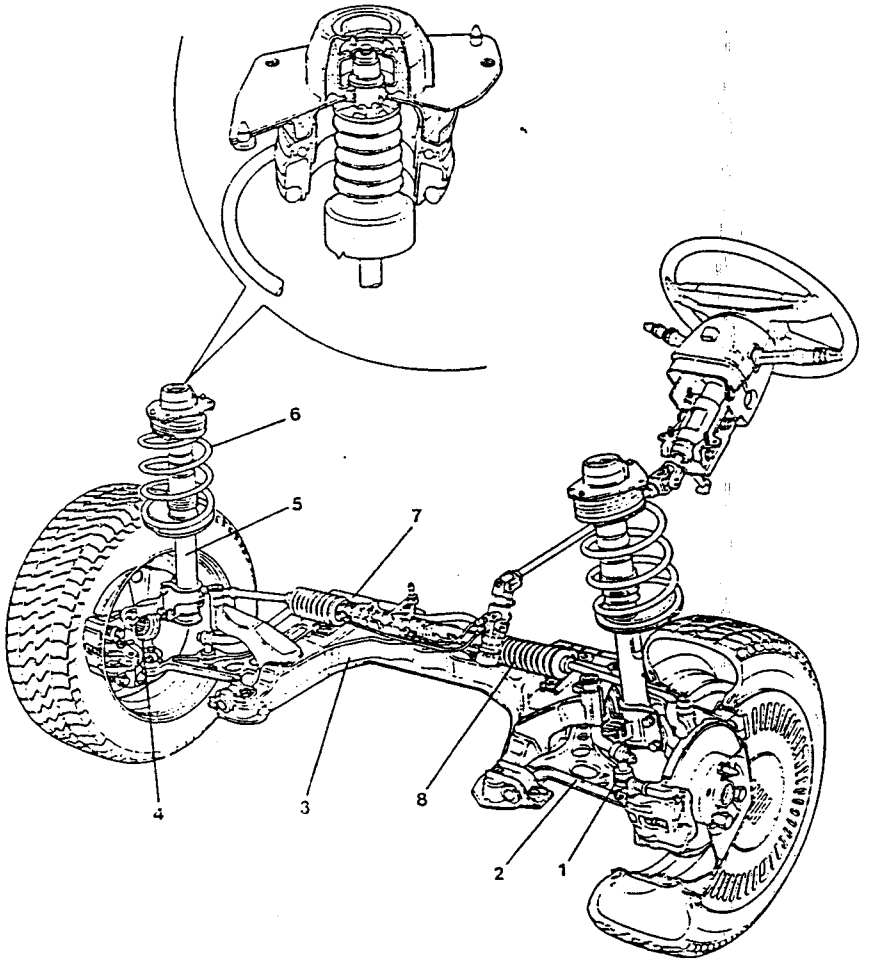
ILLUSTRATED INDEX



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.

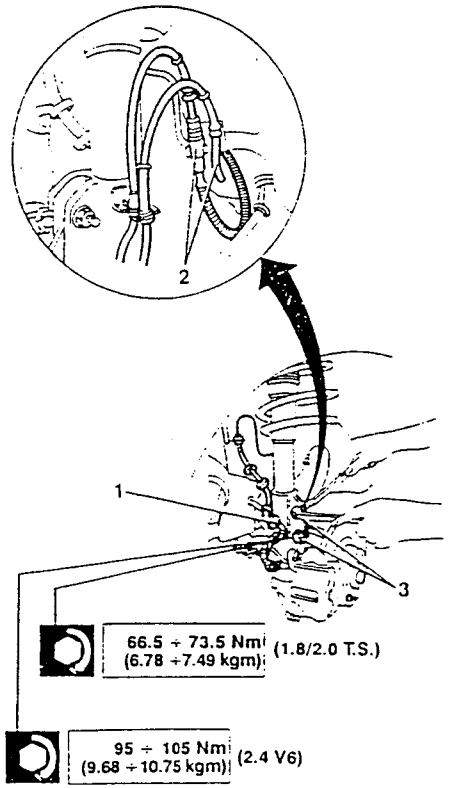
The antiroll bar, increasing the rigidity of the suspension on one side of the vehicle and lowering it on the other, serves to limit the transversal inclination of the car body. This makes it possible to increase the speed of the vehicle in a curve as it contrasts the rolling of the body provoked by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

SHOCK ABSORBER AND HELICAL SPRING ASSEMBLY

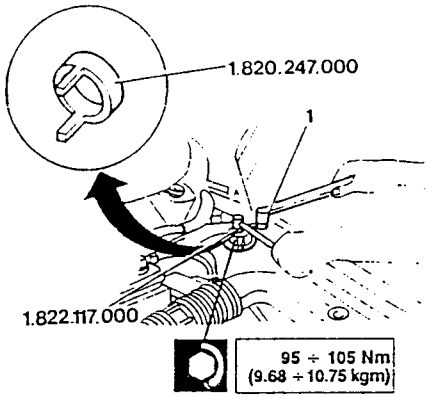
REMOVAL AND REFITTING

- Remove the front wheel.

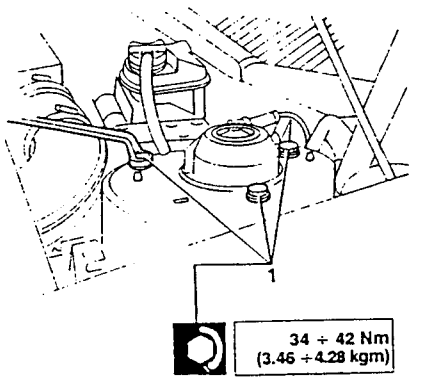
1. Disconnect the brake hose retaining pad from the shock absorber strut.
2. (only for vehicles equipped with ABS and/or controlled damping suspension):
   - Disconnect and remove the connectors from the shock absorber guide.
3. Unscrew the two bolts securing the shock absorber guide to the wheel support.



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.



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



To refit reverse the procedure followed for removal and:

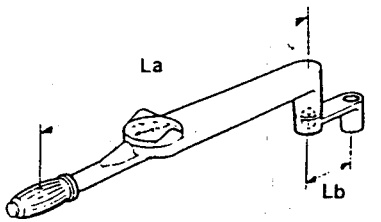
- Tighten the retaining screws to the correct torque.
- Position the shock absorber spring assembly and using shock absorber strut retaining tool No.1.820.247.000, the extension to spanner No.1.822.117.000 and a 6 mm hexagonal box spanner and tighten the central spring retaining nut to the specified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



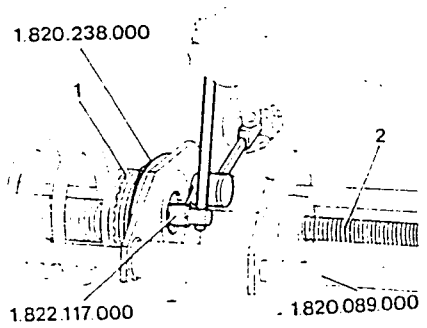
DISASSEMBLY AND REASSEMBLY

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.



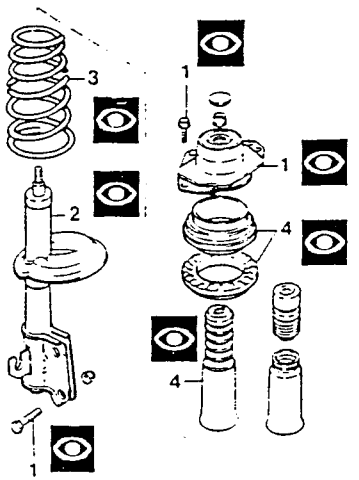
Refit by reversing the procedure followed for disassembly and only partially tighten the spring retaining nut.

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.**

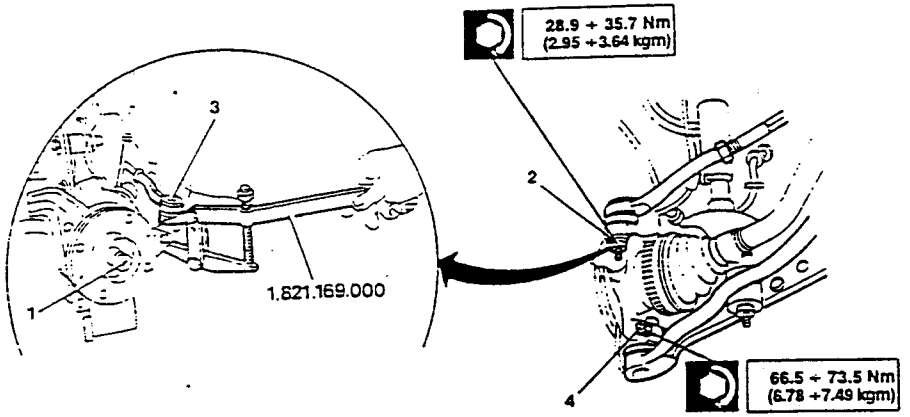
4. Check that the rubber elements are not damaged, deformed or obviously worn. If they are they must be replaced.



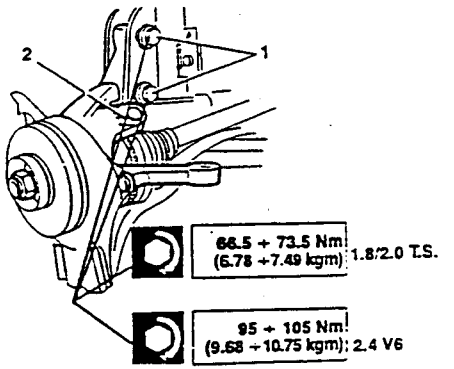
WHEEL STRUT

REMOVAL AND REFITTING

– Remove the wheel.
– Detach the entire caliper and move it to one side without disconnecting the brake lines (see GR. 22 - BRAKE LINES).
1. Caulk and loosen the nut securing the wheel hub to the half-shaft.
2. Unscrew the nut on the ball joint connecting the lateral steering tie-rod to the wheel strut.
3. Using tool N. 1.821.169.000, disconnect the ball joint from the wheel strut.
4. Unscrew the bolt connecting the swinging arm to the strut and free it from the spherical pin.



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

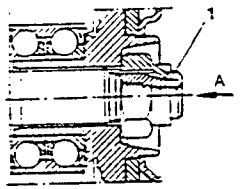


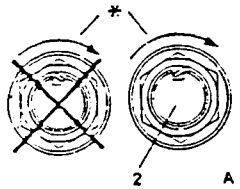
Refit by reversing the procedure followed for removal. Tighten the nuts and screws to the specified torque and follow the indications given below relative to the method of caulking the nut securing the wheel hubs and to the adjustment of the position of the wheel strut.

Caulking the nut securing the front wheel hubs

- Always use a new nut.
- Carefully clean the threaded tug on the half-shaft using a wire brush and then blow-off with compressed air.
- Clean the threads of the nut and tug using ethyl alcohol or heptane.
- Apply 3 - 4 drops of Loctite 270 adhesive to the thread of the tug.

1. Tighten the new nut to the specified torque within 5 minutes from the application of the adhesive.

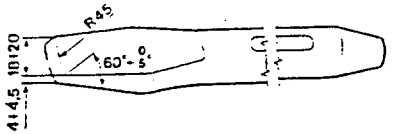




INCORRECT CORPECT

*) To tighten the nut

2. Using a chisel shaped as shown in the illustration below, caulk the collar of the nut.



Allow 150 minutes to pass before using the vehicle.

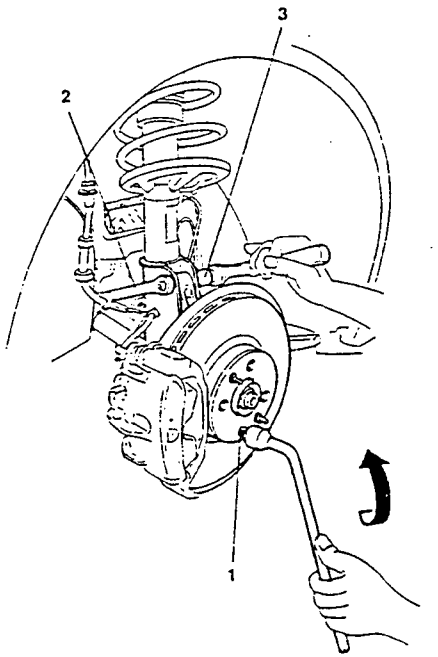
Adjusting the position of the front suspension support.

NOTE: **The operation described below should be carried out each time the two bolts securing the wheel strut to the shock absorber support are loosened or removed and completed by eliminating the play between the retaining screws and their holes in order to maintain the camber angle within the specified limits (See: TECHNICAL CHARACTERISTICS AND SPECIFICATIONS - CHECKS AND ADJUSTMENTS).**

- Position a suitable wooden rotation tool between the spring cap and body.

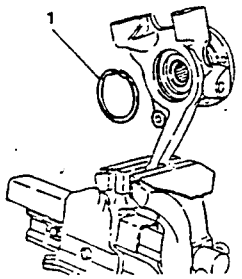
WARNING:
Ensure that the resting point of the rotation tool corresponds to the cap and not to the coils of the spring as this may cause involuntary movement and/or bending of the spring itself during the following operation.

1. Temporarily place one of the wheel nuts and using a spanner, act on the nut as shown in the illustration.
2. Secure a spanner so that the nut of the bolt is held firmly.
3. Tighten the screws on the bolts to the specified torque.

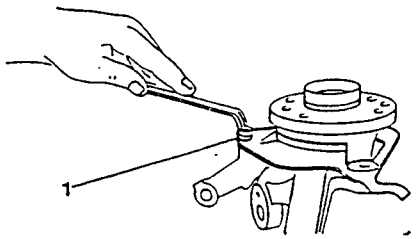


DISASSEMBLY

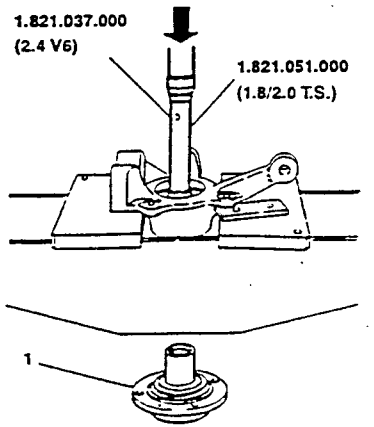
1. Lock the wheel support/hub assembly in a vice and remove the flexible ring securing the hub.



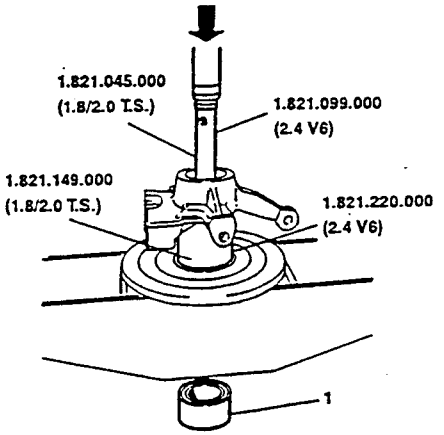
1. Loosen the screw securing the brake disk cover.



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

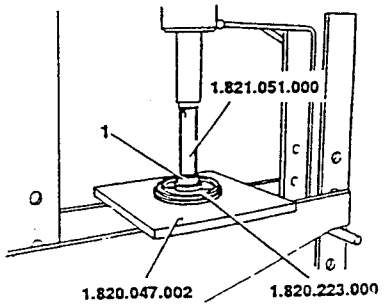


Working under a press withdraw the outer ring of the bearing from the support using:
- (for 1.8/2.0 T.S. only) support No. 1.821.149.000 and puller No. 1.821.045.000
- (for 2.4 V6 only) the support tool shown in the diagram and puller No. 1.821.099.000



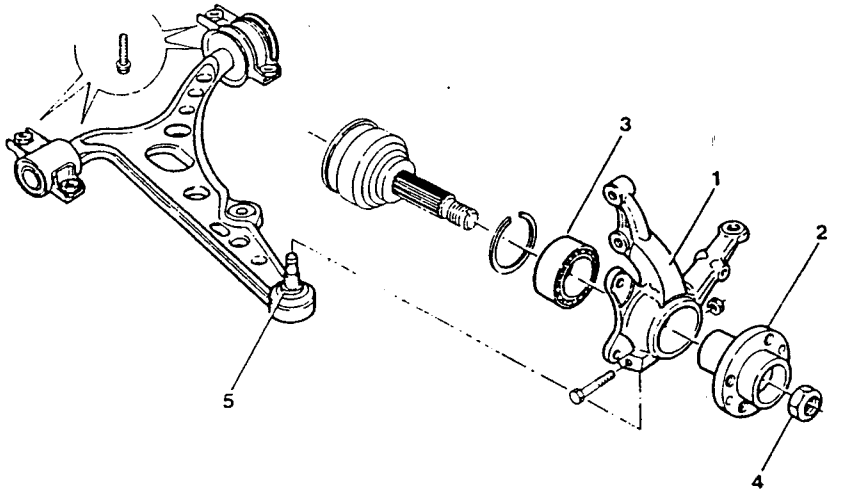
- Using a suitable tool move the inner race of the bearing away from the abutting end of the wheel hub.

1. Working under 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 of the bearing from the wheel hub.



CHECKS AND INSPECTIONS

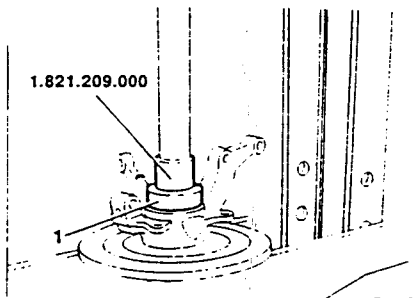
1. Check that the inner surfaces of the wheel support show no traces of seizing and that the arms are not damaged and show no signs of knocking, deformation or breakage. If any of these conditions are found, replace the support.
2. Check that the surfaces of the wheel hub and replace if they are damaged 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.



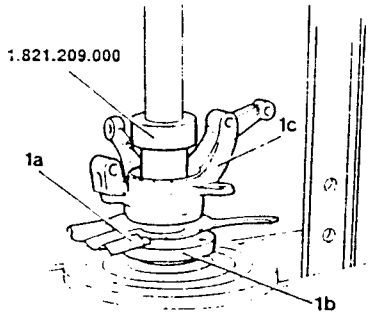
REFITTING

Only for 1.8/2.0 T.S. vehicle.

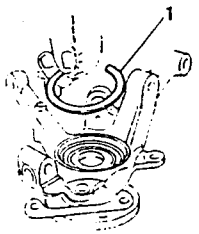
1. Using a press and inserting tool No. 1.821.209.000, insert the bearing into the wheel hub.



1. Place the brake disc protection (1a) on the wheel hub (1b) and using a press and using inserting tool No. 1.621.209.000 in an upside-down position in relation to the previous step, insert the hub into the wheel support (1c).

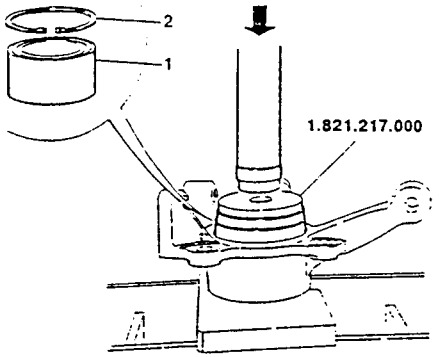


1. Install the bearing snap ring into its seating on the wheel support.

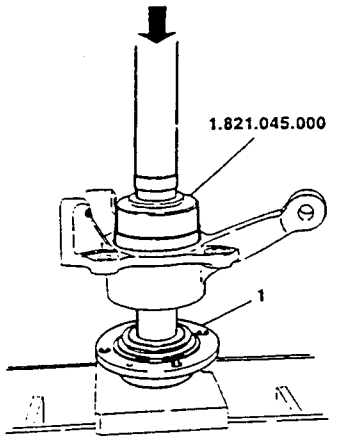


Only for 2.4 V6 vehicle.

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.

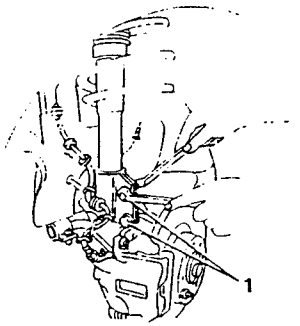


SWINGING ARM

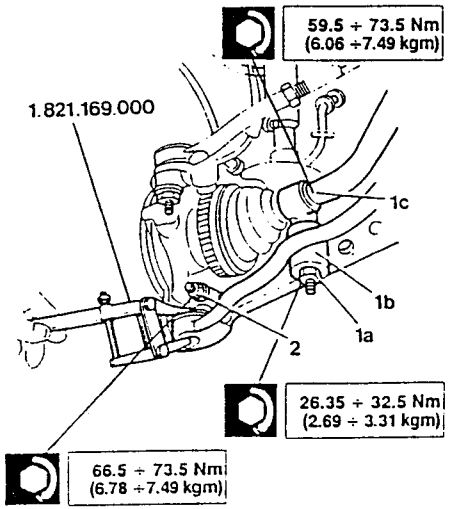
REMOVAL AND REFITTING

– Remove the front wheel.

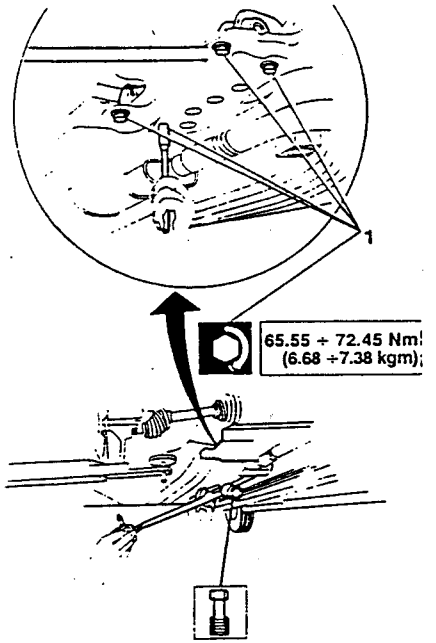
1. Unscrew the two bolts securing the wheel support to the shock absorber strut.



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.



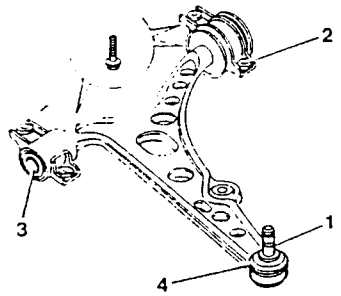
1. Loosen the screws securing the U bolts connecting the swinging arm to the front cross rail and remove the swinging arm.



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

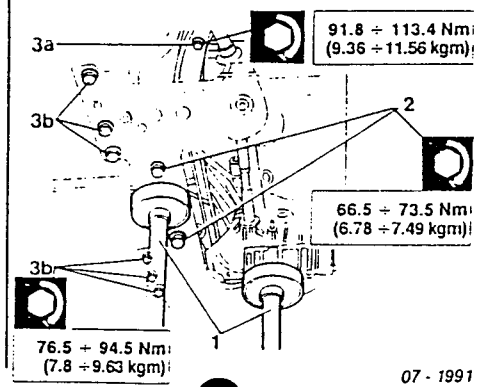
If it becomes necessary to replace the antiroll bar or the front cross rail, it will also be necessary to remove the entire cross rail as follows:

- 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).

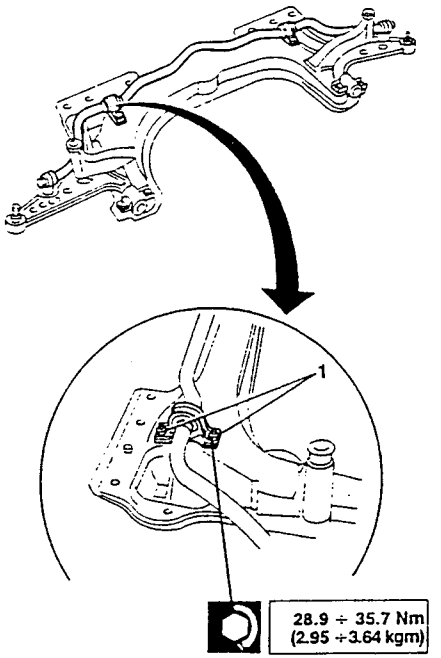
1. Using a hydraulic lift support the front cross rail.
2. Loosen the screws securing the steering box to the cross rail.

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.

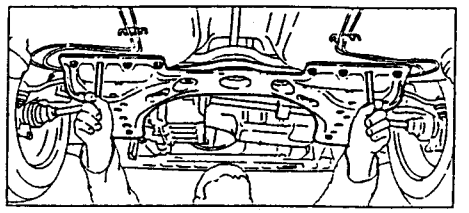


1. If necessary remove the antiroll bar by unscrewing the nuts securing the U bolts (supporting the bar) to the cross rail.
2. If necessary remove the swinging arms.



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:

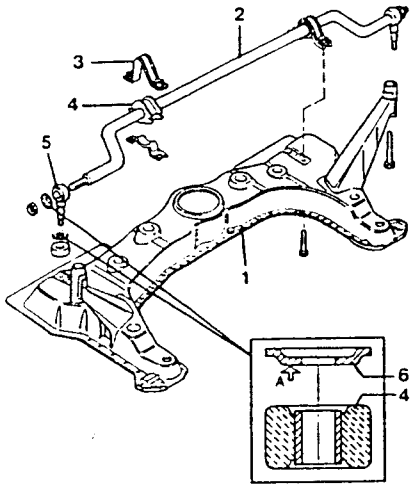
- When refitting the front cross rail it is necessary to secure it temporarily using two pins with a diameter of about 12 mm, to centre it using the holes on the body and then to secure definitively it by tightening the screws.



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.

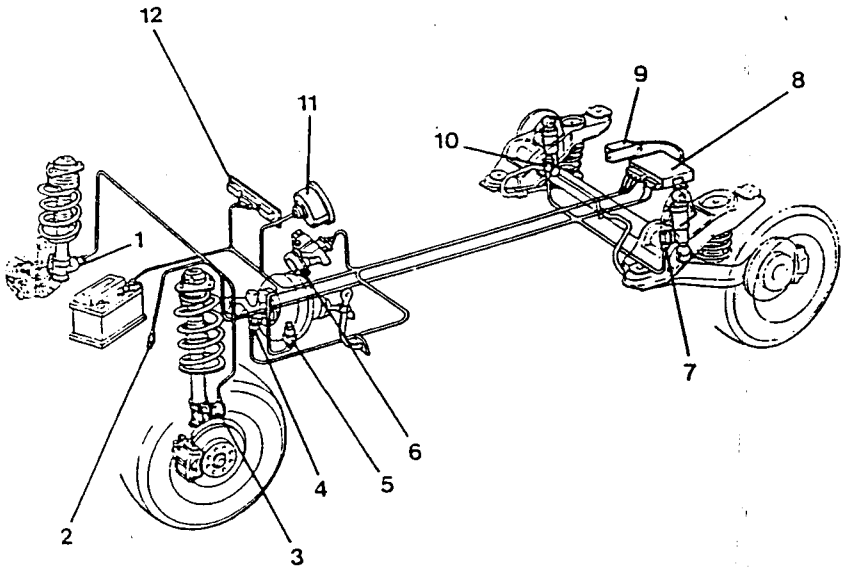
During refitting check that the washers are positioned with side A facing the flexible block as incorrect installation could negatively influence the life of the blocks.



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**

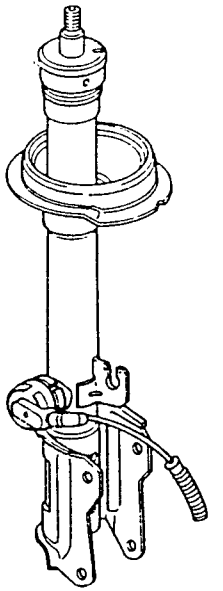
The "SPORT" condition maintains a rigid setting of the suspension system in order to confer to the vehicle a sports behavior.

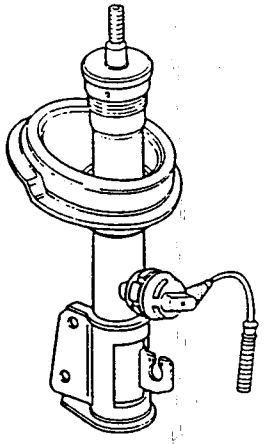
SYSTEM COMPONENTS

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.

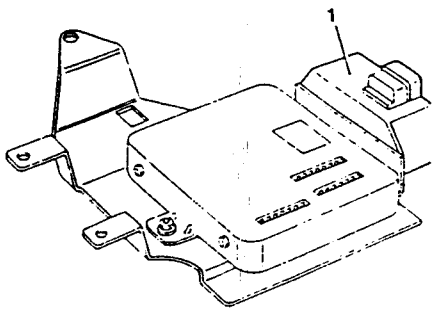




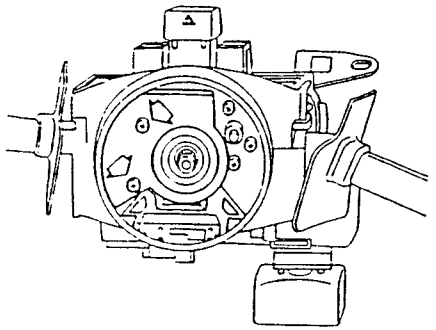
CONTROL SENSORS

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.

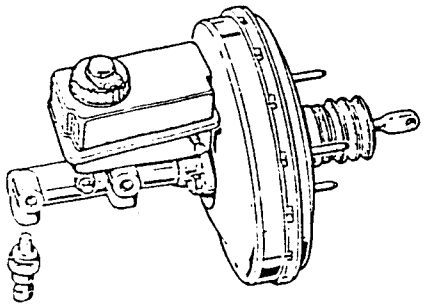
- Vertical acceleration sensor or accelerometer which, fixed to the control unit support and located under the cushion of the rear seat, detects the oscillations of the vehicle body.



- 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.



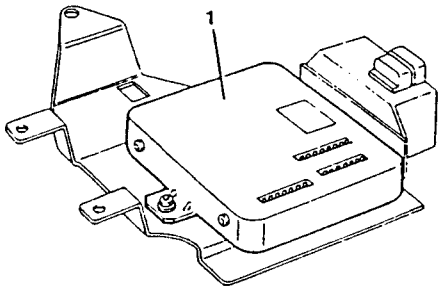
- Braking sensor located on the lower part of the brake pump. This detects particularly energetic braking conditions (pressures in the hydraulic brake circuit in excess of 10 bars) which may affect the trim of the vehicle and transforms them into an electrical signal.



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

ELECTRONIC CONTROL UNIT

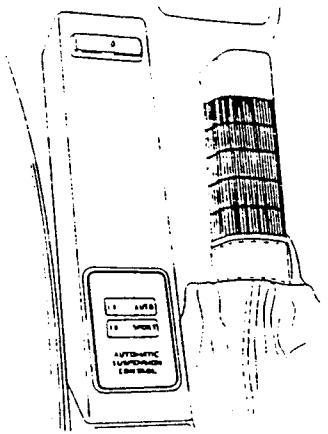
The control unit, located under the cushion of the rear seat, contains a microprocessor which receives the signals from the sensors listed above and processes them in accordance with a fixed logic. The resulting impulses are sent by the control unit to the solenoid valves located on the shock absorbers.



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

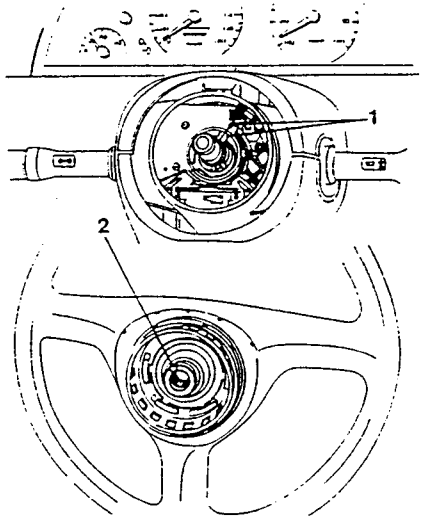


STEERING SENSOR

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".

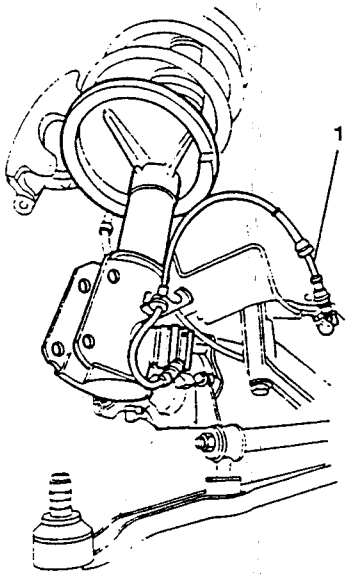
FRONT SHOCK ABSORBERS

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.



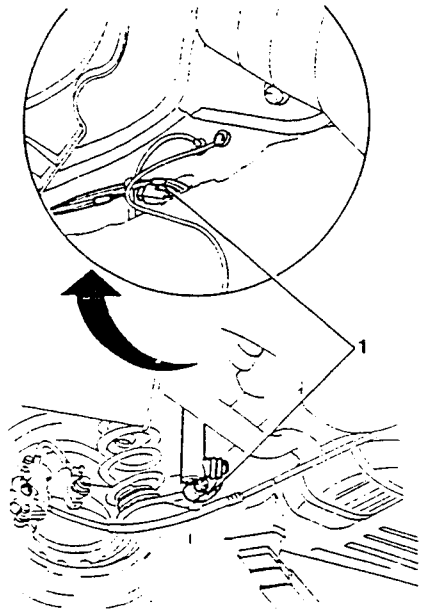
REAR SHOCK ABSORBERS

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.

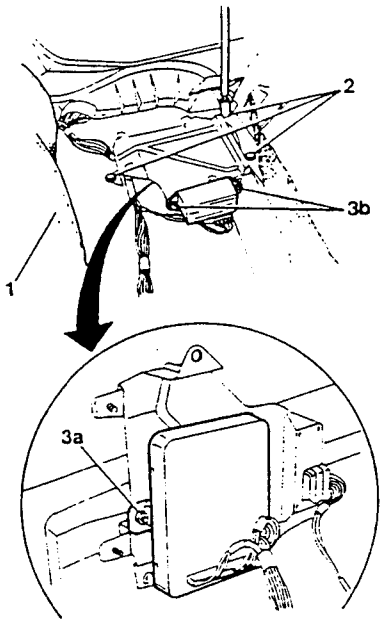


ELECTRONIC CONTROL UNIT AND ACCELEROMETER

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.

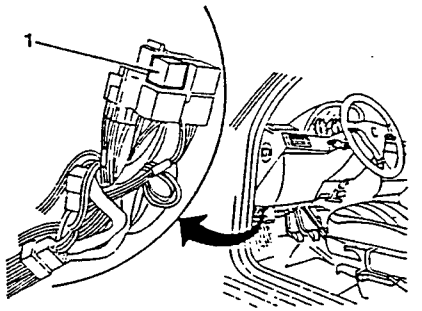
CHECKS AND INSPECTIONS

- Visually check the control unit, accelerometer and relative connectors and electrical wiring for physical damage. If necessary, replace the damaged components. To check the functionality refer to: "ELECTRICAL AND ELECTRONIC DIAGNOSIS".

SHOCK ABSORBER SOLENOID VALVE CONTROL RELAY

REMOVAL AND REFITTING

1. To remove the relay located under the instrument panel to one side of the branch control unit, proceed as indicated for the other relays (see: REPAIR INSTRUCTIONS - BODYWORK - GR. 40 - CONTROLLED DAMPING SUSPENSION SYSTEM CONTROL RELAY).



CHECKS AND INSPECTIONS

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

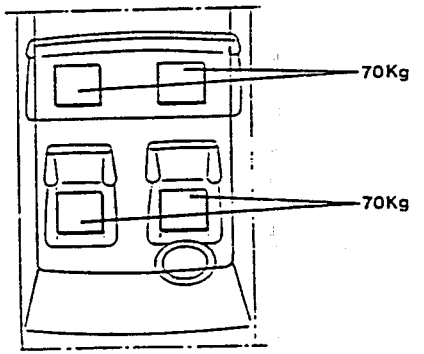
CHECKING TRIM AND CHARACTERISTIC ANGLES

CHECKING TRIM OF FRONT WHEELS

PRELIMINARY OPERATIONS

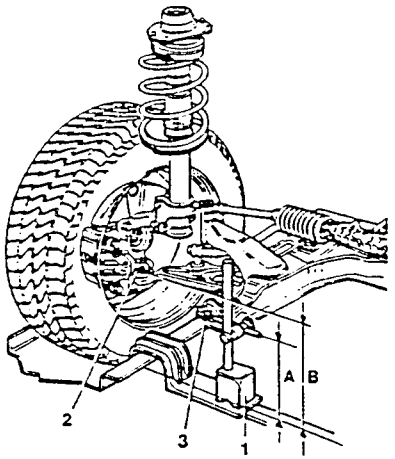
Wheel trim should be checked after the following operation and checks have been completed:

- tyres inflated to the specified pressure (see: REPAIR INSTRUCTIONS - BODYWORK - GR. 28 - WHEELS AND TYRES).
- Vehicle placed on a lift.
- Vehicle set in accordance with one of the following loading conditions:
  - empty (with specified refill quantities)
  - static load (specified refill quantities and weight distribution as shown).
- Rock the vehicle a few times to settle the suspension.



1. Position the reference tool on the resting plane of the vehicle.
2. Using a surface gauge measure distance "B" from the resting plane of the vehicle to the centre of the screw securing the spherical pin.
- Using a millimeter rule measure the distance.
3. Using the surface gauge measure the distance "A" between the resting plane of the vehicle and the centre of the pin of the swinging arm.
- Using a millimeter rule measure the distance.

- Calculate the difference between distance "B" and distance "A" and compare (see: TECHNICAL CHARACTERISTICS AND SPECIFICATIONS - CHECKS AND ADJUSTMENTS - FRONT TRIM) the resulting value with the secified values.



NOTE: **If the values are incorrect, replace both the suspension springs.**

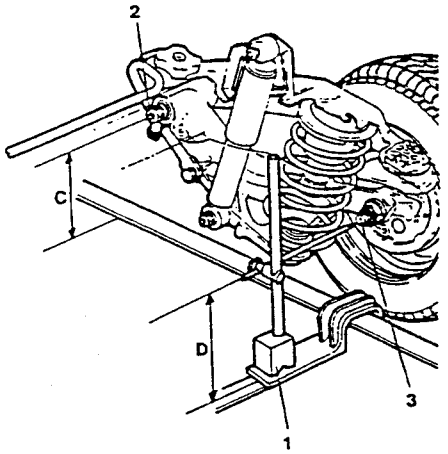
CHECKING REAR WHEEL TRIM

PRELIMINARY OPERATIONS

Wheel trim should be checked after the following operations and checks have been completed:

- tyres inflated to the specified pressure (see: REPAIR INSTRUCTIONS - BODYWORK - GR. 28 - WHEELS AND TYRES).
- Vehicle placed on a lift.
- Vehicle set in accordance with one of the following loading conditions:
  - running condition
  - static load (specified refill quantities and weight distribution as shown).
- Rock the vehicle a few times to settle the suspension.

1. Position the abutting tool on the resting plane of the vehicle.
2. Using a surface gauge measure distance "C" between the resting plane of the vehicle and the fulcrum of the rear swinging arm.
   - Using a millimeter rule measure the distance.
3. Using the surface gauge measure distance "D" between the resting surface of the vehicle and the rear wheel centre line.
   - Using a millimeter rule measure the distance.
   - Calculate the distance between the distance "C" and distance "D" and compare (see: TECHNICAL CHARACTERISTICS AND SPECIFICATIONS - CHECKS AND ADJUSTMENTS - REAR TRIM) the resulting value with the specified values.



NOTE: **If the values are incorrect, replace both the suspension springs.**

CHECKING CHARACTERISTIC ANGLES

The characteristic angles should be checked after the following operations and checks have been completed:

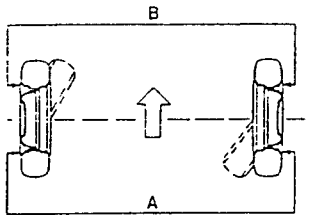
- tyres inflated to the specified pressure (see: REPAIR INSTRUCTIONS - BODYWORK - GR. 28 - WHEELS AND TYRES).
- check that eccentricity and orthogonality of the wheels does not exceed:
  - 1 mm for steel rims
  - 0.3 mm for alloy rims.
- check that there is no clearance between wheel support and articulated pin of swinging arm.
- check that there is no axial play on the wheel bearings.

- 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:

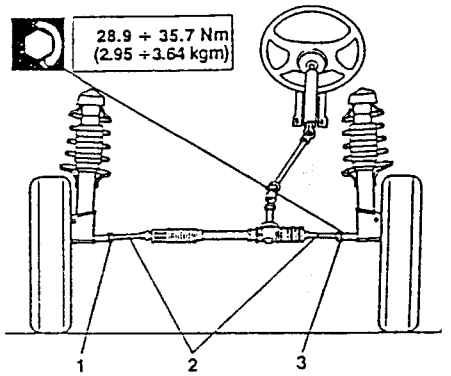
WARNING:
Whenever the toe-in of the front wheels is checked the following instructions should be followed:

- 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 CHARACTERISTICS AND SPECIFICATIONS

TECHNICAL CHARACTERISTICS

Independent wheel suspension of the MacPherson type with negative off-set and anti-roll bar with pressurized telescopic hydraulic shock absorbers of the blade type, transversal swinging arms and off- set springs.

HELICAL SPRINGS

CHARACTERISTICS		2.4 V6	1.8 T.S. 2.0 T.S.
Inner diameter	150 mm	150	150
Outer diameter	(mm)	178	177.6
Outher diameter	(mm)	14	13.8
Number of coils		5.56	4.85
Direction of coil		Right	
Free length	(mm)	393	386.5

SHOCK ABSORBERS

		Normal	C.D.S
Type: telescopic hydraulic pressurized blade type		BOGE	
Stroke	(mm)	167	
Diameter of strut	(mm)	22	
Controlled damping suspension solenoid valve power supply		(see: ELECTRICAL-ELECTRONIC DIAGNOSIS SECTION 31)	

ANTI-ROLL BAR

Diameter of bar	(mm)	23

GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

APPLICATION	TYPE	NAME
Swinging arm flexible supports	GREASE	GREASE MOLYKOTE 7544 PG 54 TUTELA MR3
Lateral steering tie-rods	GREASE	MOLYGUARD SYL113

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

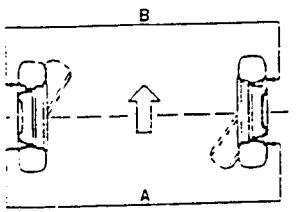
GENERAL SPECIFICATIONS

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

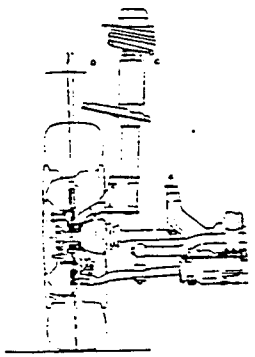
FRONT WHEEL TOE-OUT

A-B	1.8 T.S./2.0 T.S. 2.4 V6	2.0 T.B. 4x4
	1 ± 1 *	0.26 ± 1 *
	0 ± 1 •	0 ± 1 •

* Values measured when empty and in running order (with specified servicing)

• Values measured with vehicle with static load.

CAMBER ANGLE

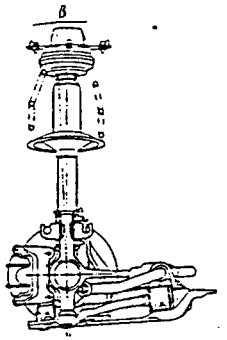
	1.8 T.S./2.0 T.S. 2.4 V6	2.0 T.B. 4x4
	γ = 0 ± 20' *	γ = −3' ± 20' *
	γ = −20' ± 20' •	γ = −21' ± 20' •
	♦ (specification not adjustable)	

* Values measured when empty and in running order (with specified servicing)

• Values measured with vehicle with static load.

♦ As the camber angles can be affected by the position of the wheel strut, ensure that it is in the correct position if the γ° values exceed those indicated (see WHEEL STRUT - Adjusting position of the front suspension support).

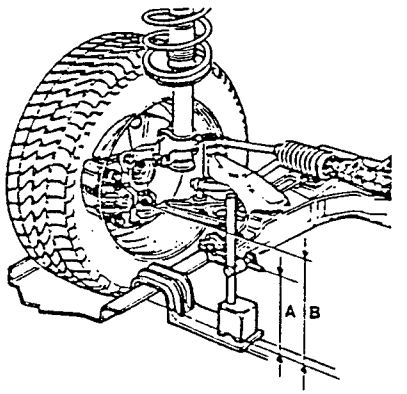
FRONT WHEEL CASTER ANGLE

	1.8 T.S.	2.0 T.S.	2.4 V6
	with power steering 3° 10' ± 30' * 3° 10' ± 30' •	3° 10' ± 30' * 3° 10' ± 30' •	3° 10' ± 30' * 3° 30' •
	mechanical steering 2° ± 30' * 2° 30' ± 30' •		
	(characteristics cannot be adjusted)		

* Values measured when empty in running condition (with specified refill quantities).

• Values measured with vehicle in static load condition.

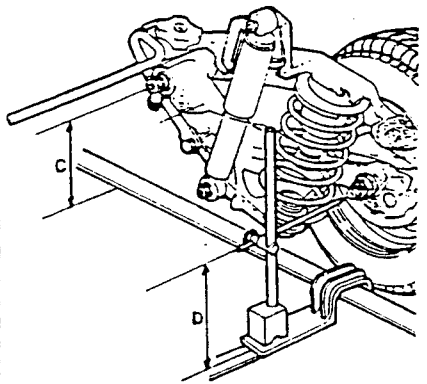
FRONT TRIM

B-A	1.8 T.S. (mm)	2.0 T.S. (mm)	2.4 V6 (mm)
	7.6 ± 7 *	7.6 ± 7 *	5 ± 7 *
	−21 ± 7 •	−21 ± 7 •	−21 ± 7 •

* Values measured when empty in running condition (with specified refill quantities).

• Values measured with vehicle in static load condition.

REAR TRIM

C-D 	1.8 T.S. (mm)	2.0 T.S. (mm)	2.4 V6 (mm)
	7.2 ± 7 • -28 ± 7 •	7.2 ± 7 • -28 ± 7 •	7.2 ± 7 • -28 ± 7 •

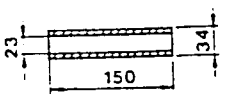
• Values measured when empty in running condition (with specified refill quantities).

• Values measured with vehicle in static load condition.

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 securing front and rear external attachments of swinging arm clevis to crossmember	65.55 ÷ 72.45	6.68 ÷ 7.38
Hexagonal head screw for fixing front inner swinging arm clevis to crossmember	65.55 ÷ 72.45	6.68 ÷ 7.38
Hexagonal head screw for fixing rear inner swinging arm clevis to crossmember	65.55 ÷ 72.45	6.68 ÷ 7.38
Hexagonal nut with flange for fixing upper shock absorber to block	95 ÷ 105	9.68 ÷ 10.76
Hexagonal head screw for fixing upper shock absorber block to body	34 ÷ 42	3.46 ÷ 4.28
Self-braking hexagonal nut for fixing shock absorber to support (only for 1.8 - 2.0 T.S.)	66.5 ÷ 73.5	6.78 ÷ 7.49
Self-braking hexagonal nut for fixing shock absorber to support (only for 2.4 - 6 V)	95 ÷ 105	9.68 ÷ 10.75
Self-braking hexagonal nut for fixing swinging arm spherical pin to support	66.5 ÷ 73.5	6.78 ÷ 7.49
Hexagonal head screw for fixing stabilizer bar support stand clevis to crossmember	28.9 ÷ 35.7	2.95 ÷ 3.64
Hexagonal nut for fixing end of stabilizer bar to rod	59.5 ÷ 73.5	6.06 ÷ 7.49
Hexagonal nut for fixing rod to front suspension arm	26.35 ÷ 32.5	2.69 ÷ 3.31
Hexagonal nut for fixing front wheel hub to stub axle	266 ÷ 294	27.12 ÷ 29.97
Front/rear wheel pillar	73.1 ÷ 90.3	7.45 ÷ 9.20
Self-braking hexagonal nut for fixing spherical lateral steering tie- rod pin to support	28.9 ÷ 35.7	2.95 ÷ 3.64
Hexagonal head screw for fixing steering box to crossmember	66.5 ÷ 73.5	6.78 ÷ 7.49
Hexagonal nut for fixing lateral steering 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
	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

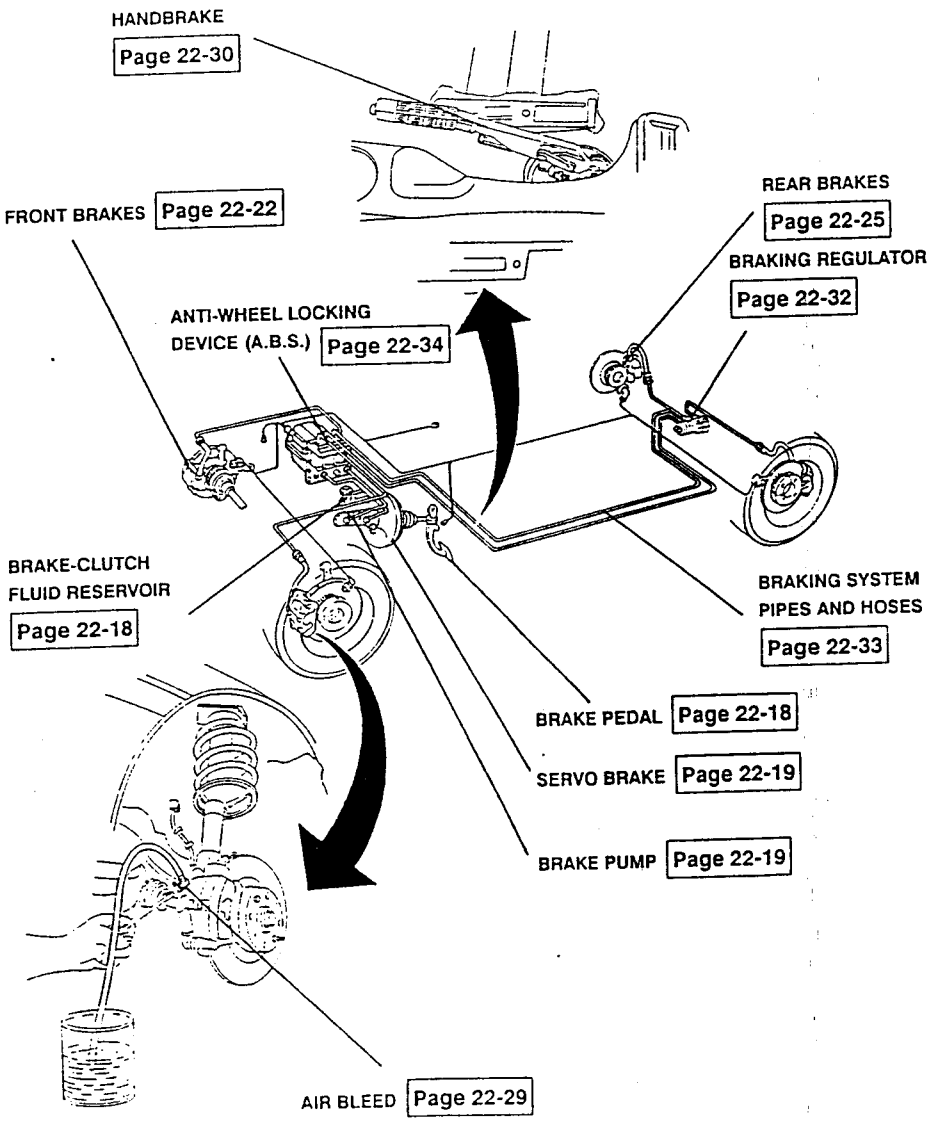
PASSO PROVA	RISULTATO	AZIONE CORRETTIVA
G5 CHECK WHEEL ALIGNMENT – Check alignment of front wheels – Check alignment of rear wheels	(OK) ▶ (OK) ▶	Carry out step A6 Adjust wheel alignment to correct value
G6 CHECK CHARACTERISTIC ANGLES OF WHEELS – Check camber and caster angles of front wheels – Check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

GROUP 22

FRONT AND REAR BRAKES

INDEX

ILLUSTRATED INDEX



FRONT AND REAR BRAKES

DESCRIPTION

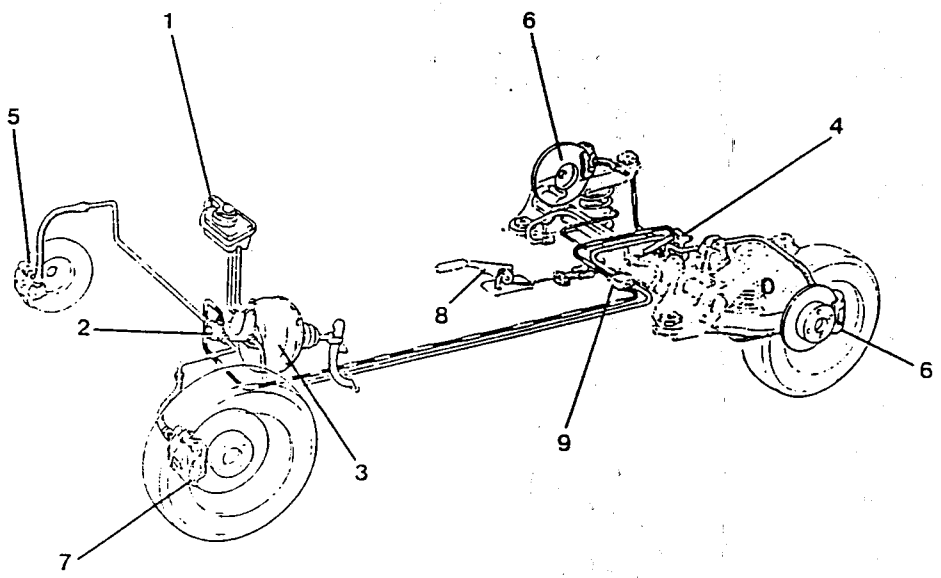
The braking system normally adopted for the vehicles in the 167 range is of the hydraulic control type with dual, diagonally connected circuit with servobrake, front and rear disc brakes with braking regulator. For the top models, and as an optional for other models, the system can be equipped with the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



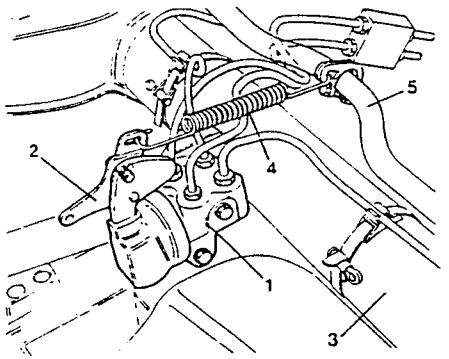
This solution, of the traditional type is obtained by employing a series of devices aimed at:

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.

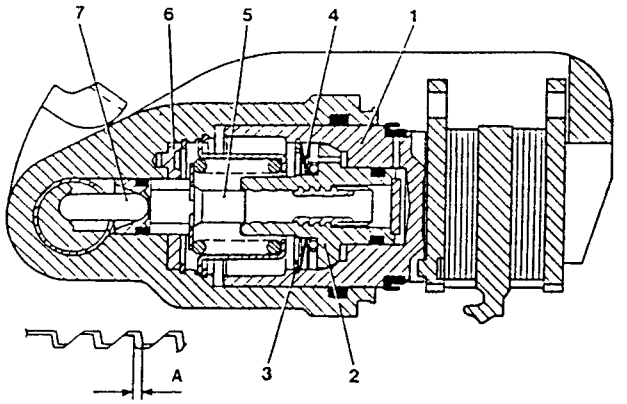
BRAKING REGULATOR

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

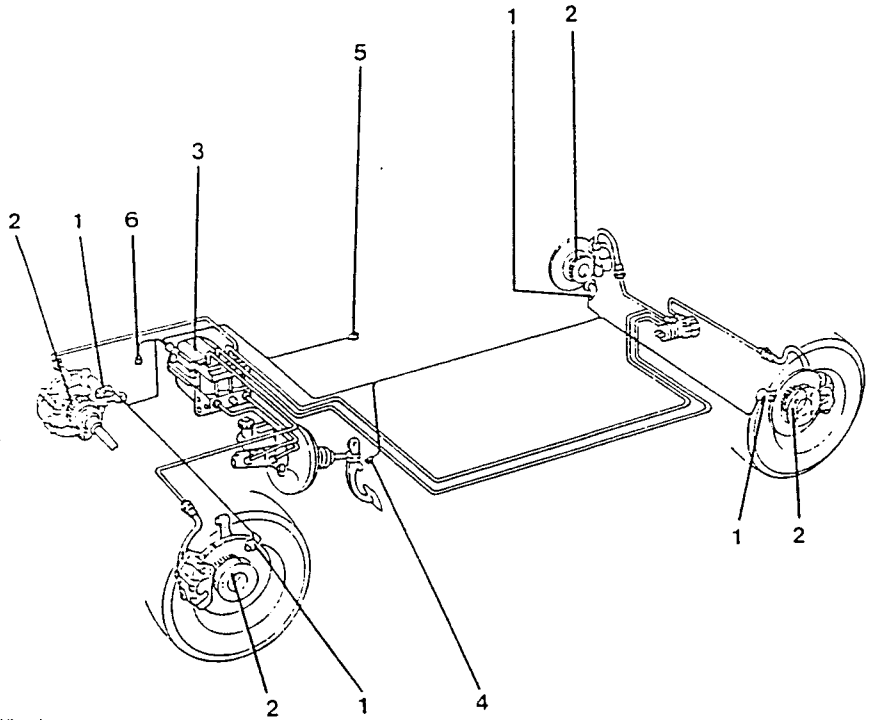
This device, contained in the rear brake caliper cylinder permits the automatic adjustment of the distance between the brake disc and the brake pad.
It is composed of a nut-screw (2) which can rotate on the shaft (5) only in the direction of advancement due to the action of a cup-spring (4).
The shaft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



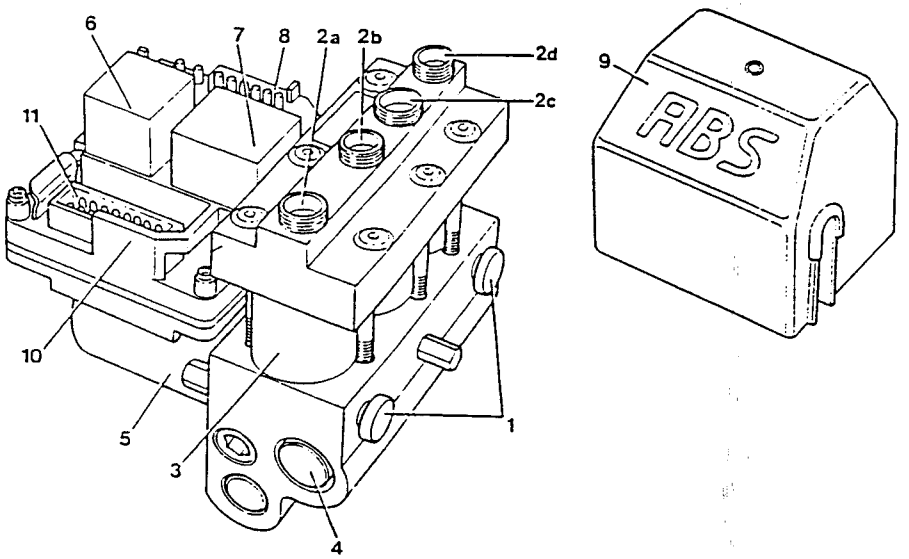
1. Wheel r.p.m. sensor
2. Phonic wheels
3. Hydraulic/electronic control unit
4. Switch
6. Warning lamp
7. Alfa Tester socket

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".

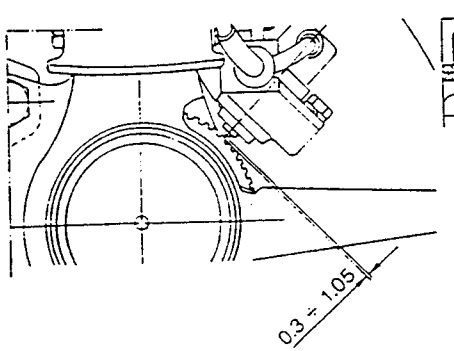
WHEEL R.P.M. SENSORS

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.

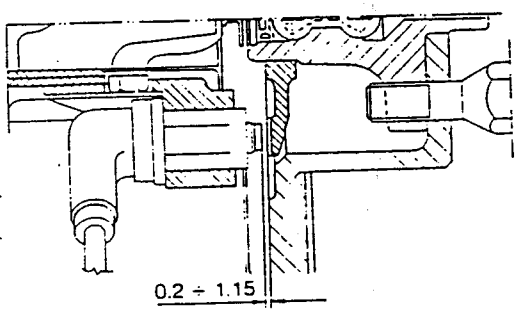
The sensors measure the speed of travel, acceleration, deceleration and wheel slip and are of the inductance type, installed in their seatings located on the front wheel supports and on the rear brake caliper support plate. As their position cannot be adjusted by shims if the air-gap differs from the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

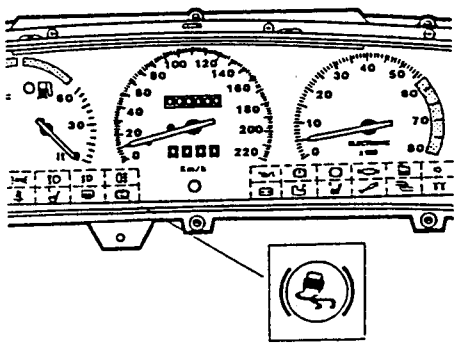


Rear wheels

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.

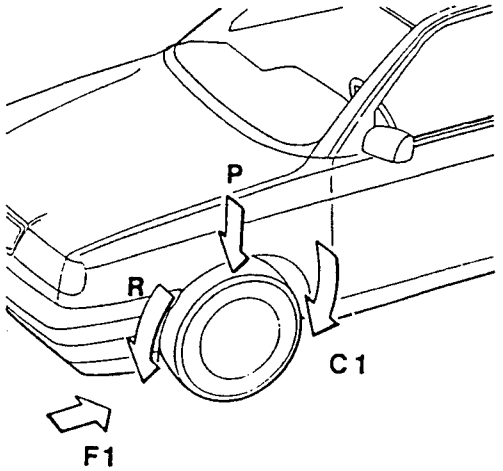


If the response from the components of the device is positive, the warning light will stay out. If the response is negative, the warning light will come on and the device will cut-out automatically leaving the traditional braking system to slow the vehicle. In this situation the warning light will flash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

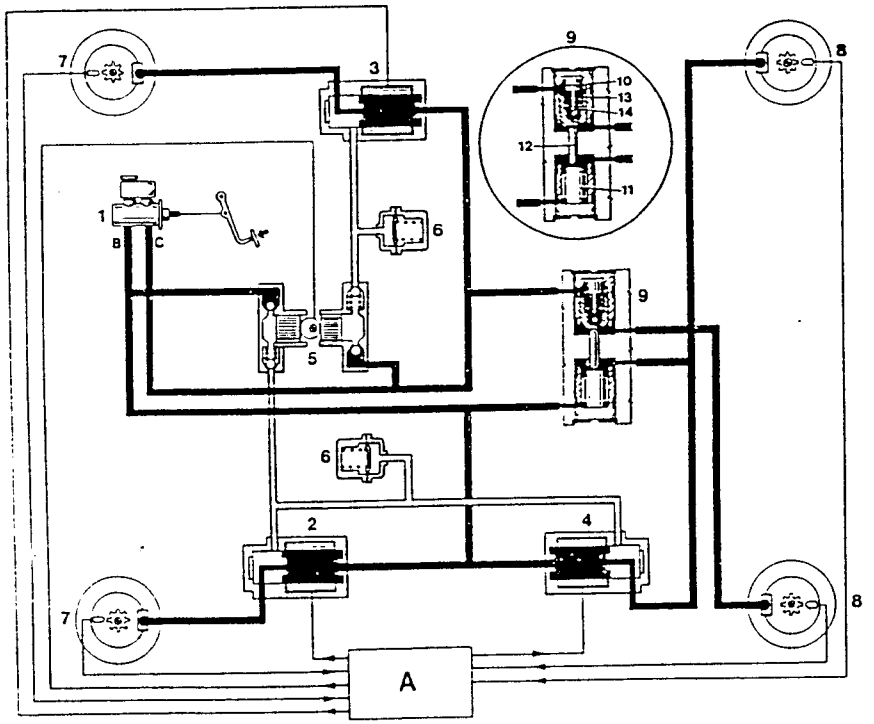
In this phase the solenoid valves of the electrohydraulic control unit are not activated and the pressure in the calipers originates from the pressure exerted by the driver when pressing the brake pedal.

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).

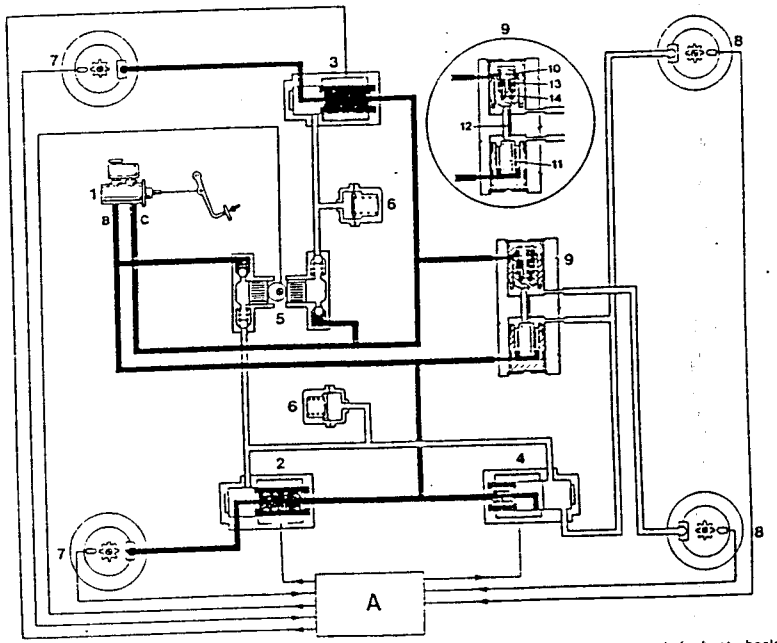
This is the origin of the hydraulic pulsations which can be perceived by the driver through the brake pedal.

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.



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 pistons
13. Spring
14. Valve

Continuous pressure phase

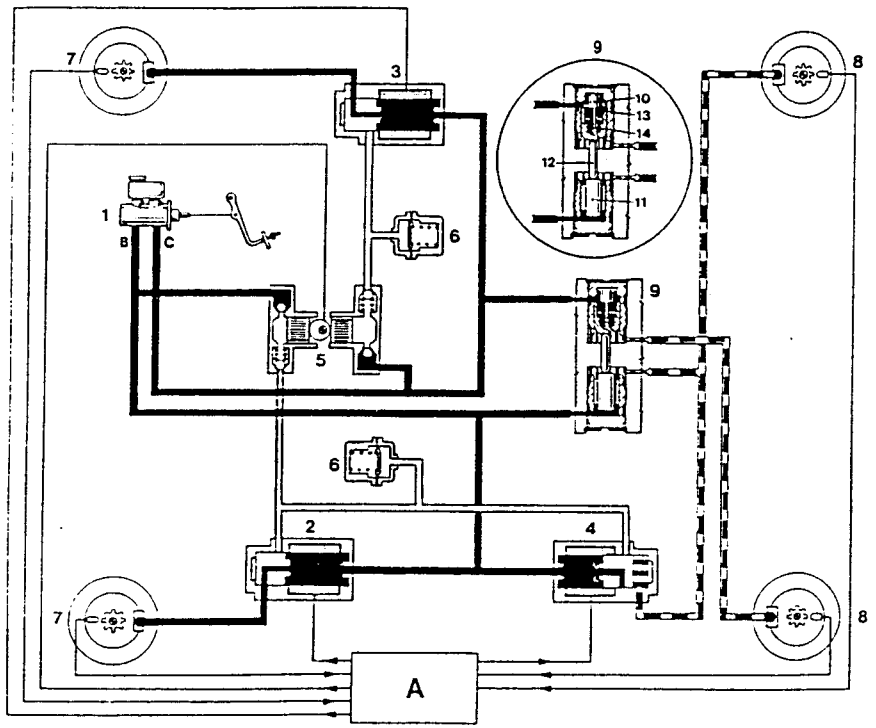
In this phase the there is an increase in both the speed and acceleration of the wheels.

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.



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

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.

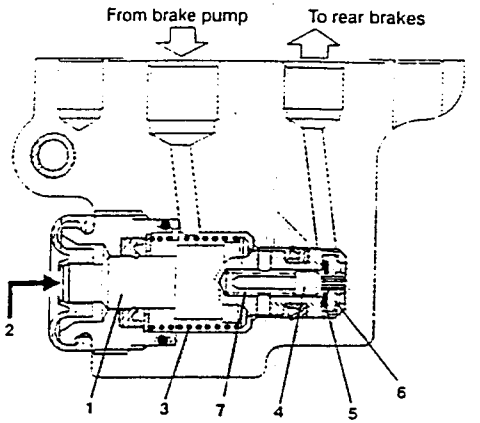
During braking, the oil originating from the brake pump enters the regulator, crosses it and moves on to the rear brakes with a pressure which, acting on the grooved plate (6), causes a thrust in the opposite direction to that acting on the operating piston (1).

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.

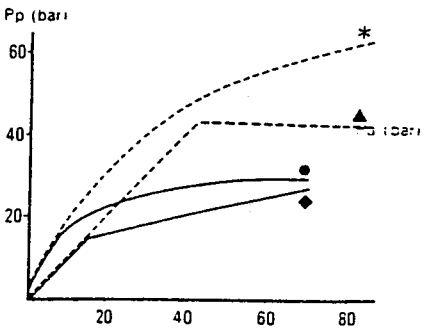
When the thrust acting on the grooved plate (6) exceeds that of the opposing force, the operating piston (1) moves towards the left thus interrupting the connection between the brake pump and the rear calipers, causing a jump in pressure at a preset ratio of 0.30.

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

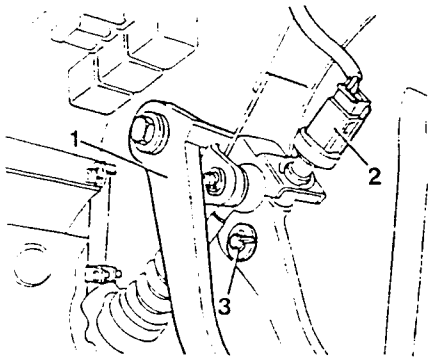
Pa Braking pressure exerted on the front axle
Pp Braking pressure exerted on the rear axle
* Ideal curve with fully loaded vehicle
Real curve with fully loaded vehicle
Ideal curve with driver only
Real curve with driver only

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.



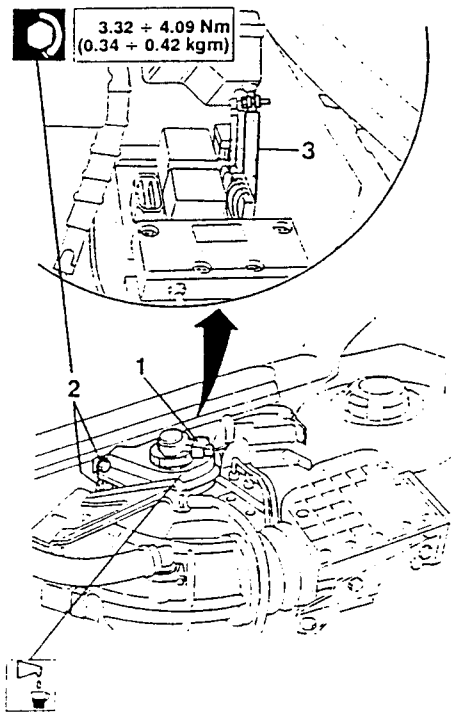
CLUTCH-BRAKE FLUID RESERVOIR

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

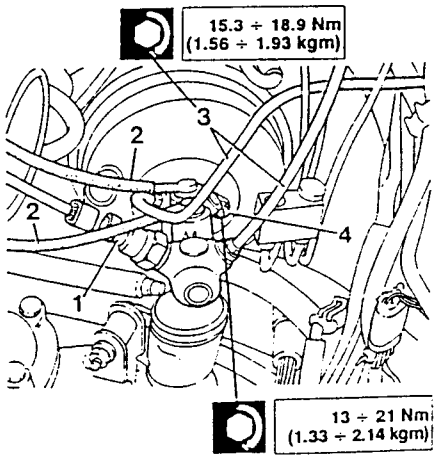
REMOVAL AND REFITTING

- 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.

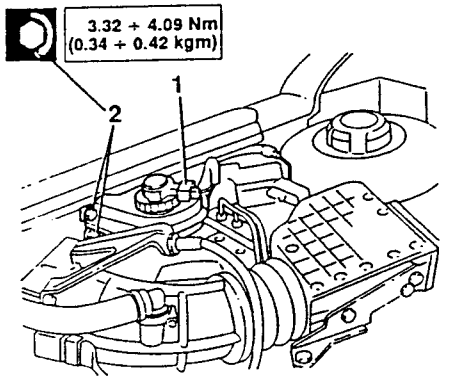


SERVO BRAKE

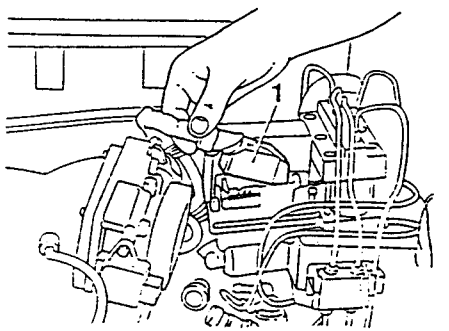
REMOVAL AND REFITTING

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)

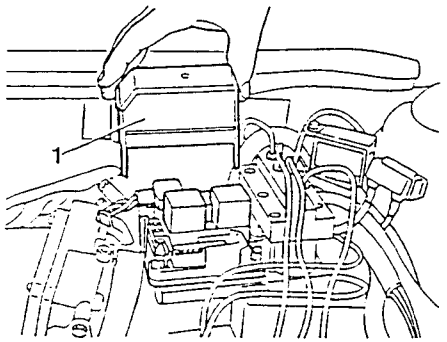
1. Disconnect the connector from the brake and clutch fluid level indicator device.
2. Loosen the two screws securing the brake and clutch fluid reservoir and move the reservoir.



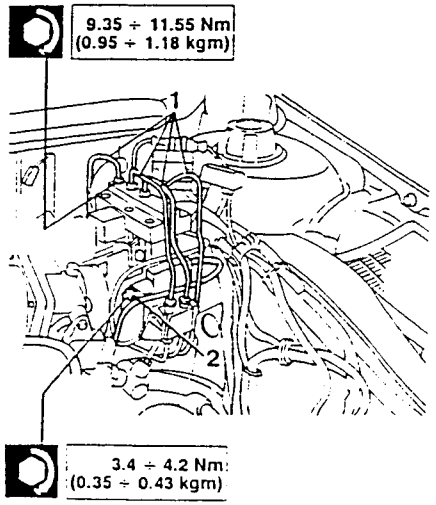
1. Disconnect the power supply wiring comb from the ABS control unit.



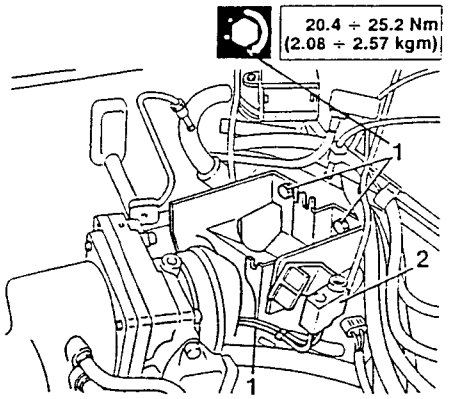
1. Loosen the screw securing the cover of the electronic control unit and remove the four-pin connector.



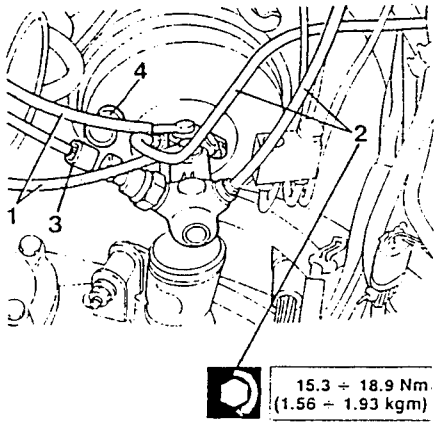
1. Disconnect the hydraulic unions from the ABS hydraulic unit and from the four-way distributor.
2. Loosen the three screws securing the hydraulic unit to the support and remove the support.



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.

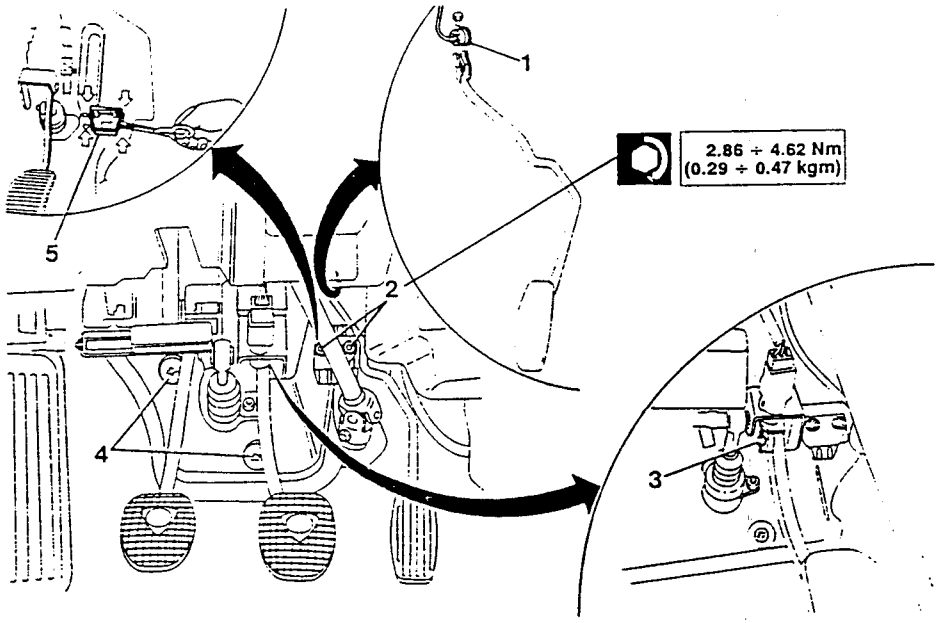


1. Disconnect the supply hoses from the brake pump.
2. Remove the delivery pipes from the brake pump.
3. Remove the servo brake vacuum intake hose.

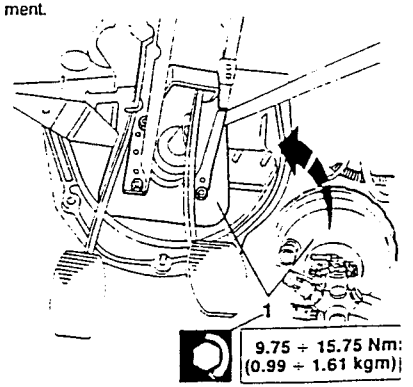


Operating from inside the passenger compartment, proceed as follows.

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.



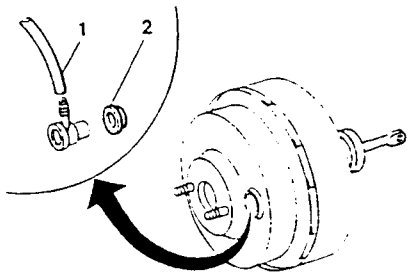
Refit by reversing the procedure followed for removal and:

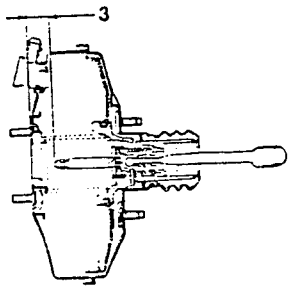
- tighten the retaining screws and nuts to the specified torques;
- bleed the air from the braking system (see: AIR BLEED);
- after bleeding restore the brake-clutch fluid to the correct level in the reservoir.

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.





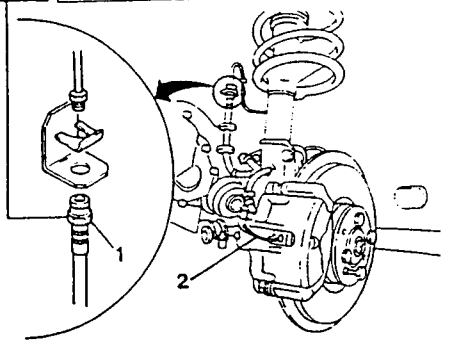
FRONT BRAKES

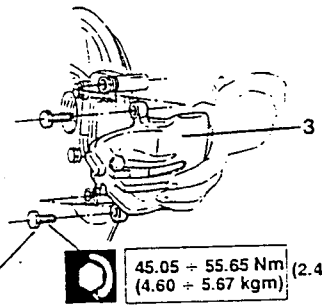
REMOVAL AND REFITTING

- 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.

15.3 ÷ 18.9 Nm (1.55 ÷ 1.93 kgm)





45.05 ÷ 55.65 Nm (4.60 ÷ 5.67 kgm) (2.4 V6)

85 ÷ 105 Nm (8.66 ÷ 10.70 kgm) (1.8/2.0 T.S.)

WARNING:

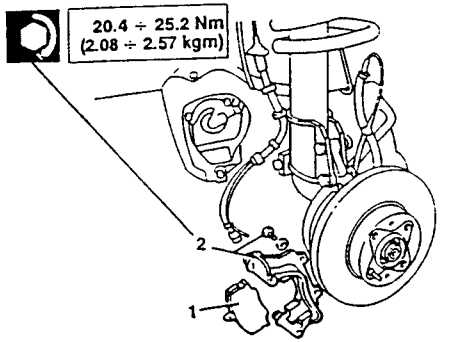
- **When refitting, substitute the screws securing the brake caliper body.**
- **When refitting check that the rubber boots protecting the threads of the retaining pins are not damaged. If they are, replace them.**

1. Remove the brake pads.

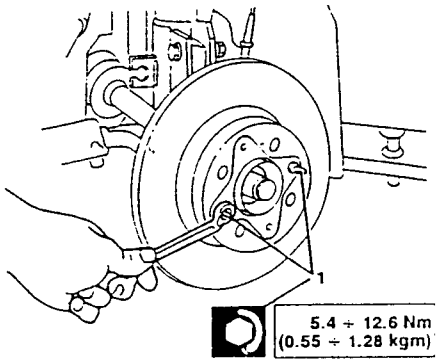
NOTE: **When refitting the brake pad and wear sensor must installed on the inner side of the disc (caliper piston side). Also check that the exhaust, located on the external part of the brake pad, is positioned to the rear of the direction of travel.**

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

20.4 ÷ 25.2 Nm (2.08 ÷ 2.57 kgm)



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



5.4 ÷ 12.6 Nm (0.55 ÷ 1.28 kgm)

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

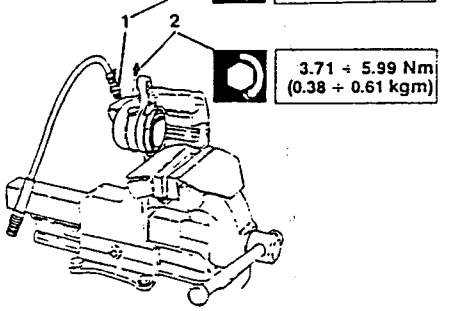
When refitting bleed the air from the braking system (see: AIR BLEED).

DISASSEMBLY AND REASSEMBLY OF FRONT BRAKE CALIPER

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

15.3 ÷ 18.9 Nm (1.55 ÷ 1.93 kgm)

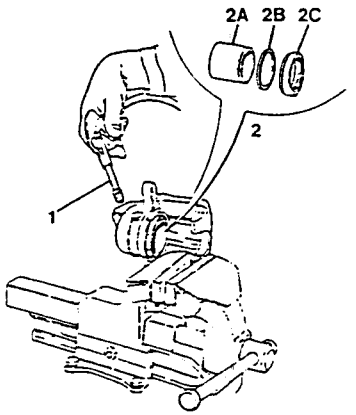
3.71 ÷ 5.99 Nm (0.38 ÷ 0.61 kgm)



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.**

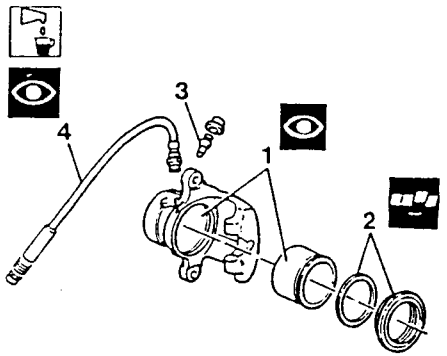
Refit by reversing the procedure followed for removal and tighten the drain screw and hose connection to the specified torque.

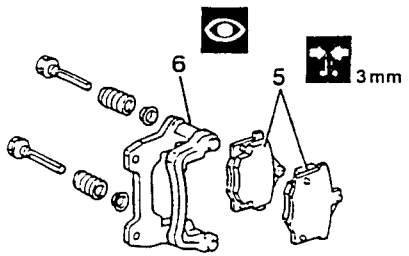


CHECKS AND INSPECTIONS

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.





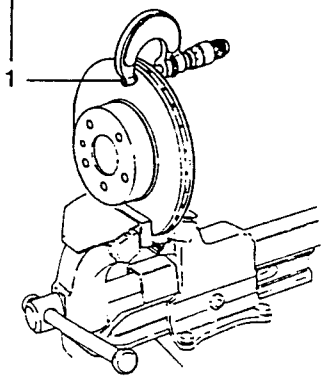
Brake discs

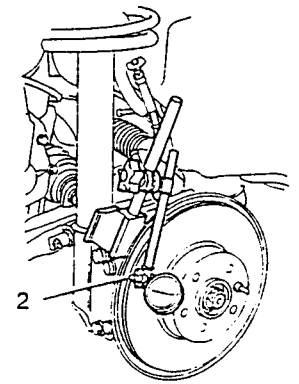
1. Check the thickness of the discs and ensure that the working surfaces are not deeply scratched or porous. Grind if necessary, respecting the specified tollerances given in the section TECHNICAL CHARACTERISTICS AND SPECIFICATIONS.

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





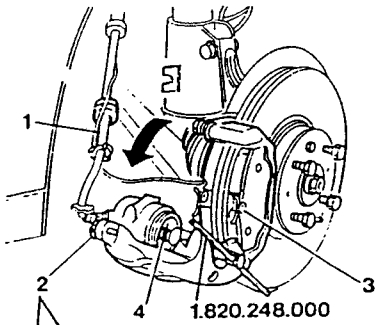
SUBSTITUTING THE FRONT BRAKE PADS

- 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.



85 ÷ 105 Nm (8.66 ÷ 10.70 kgm) (2.4 V6)

45.05 ÷ 55.65 Nm (4.60 ÷ 5.67 kgm) (1.8/2.0 T.S.)

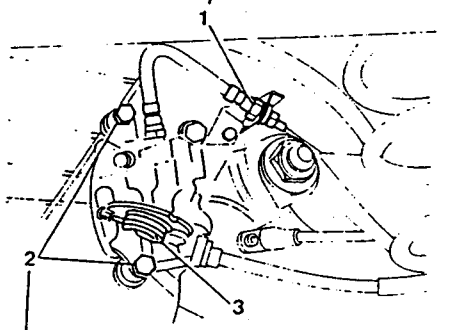
REAR BRAKES

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.**

15.3 ÷ 18.9 Nm (1.56 ÷ 1.93 kgm)



45.05 ÷ 55.65 Nm (4.60 ÷ 5.67 kgm)

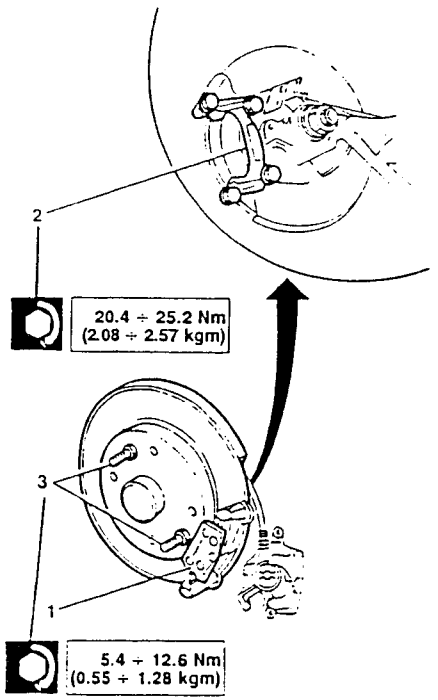
1. Remove the brake pads.

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.

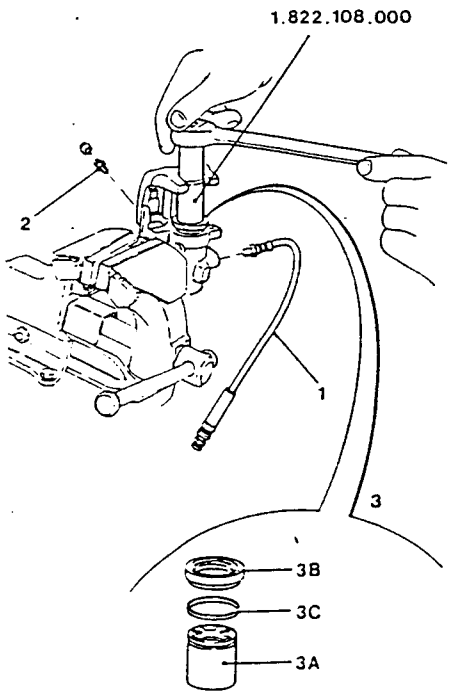
Refit by reversing the procedure followed for removal and tighten the retaining screws to the correct torque.

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



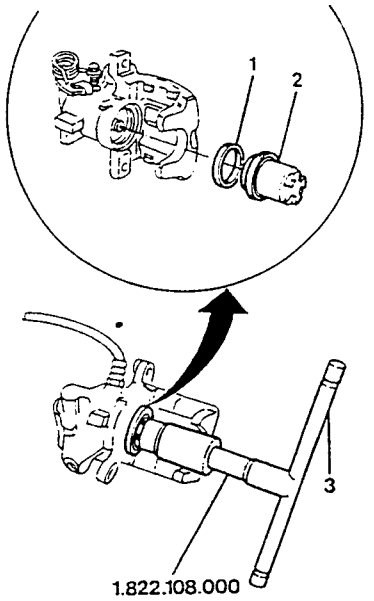
DISASSEMBLING THE REAR BRAKE CALIPER

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).

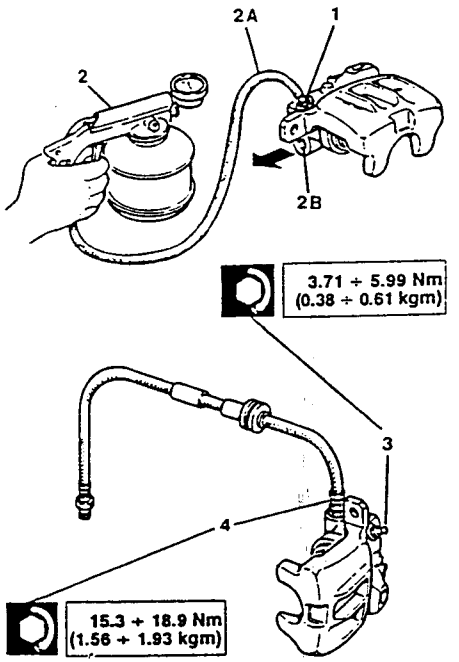


REFITTING THE REAR BRAKE CALIPER

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.

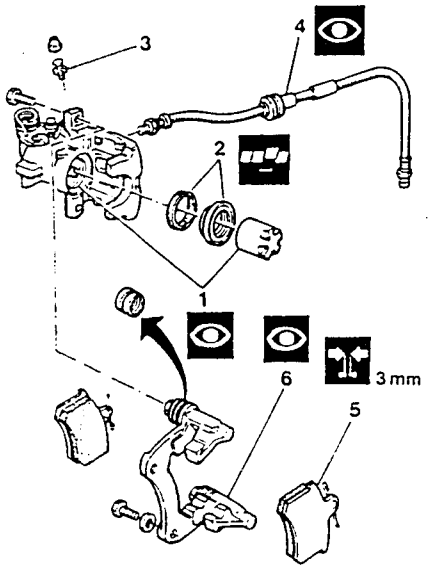


CHECKS AND INSPECTIONS

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.

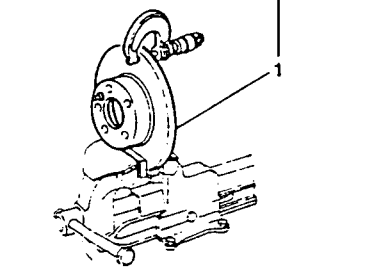


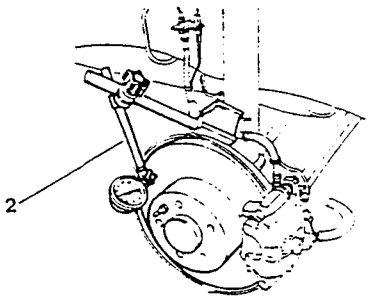
Brake disc

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		





REPLACING BRAKE PADS

– Remove the rear wheel.

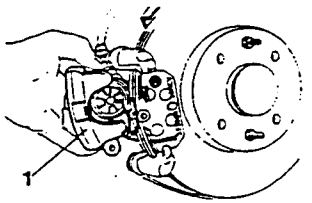
1. Loosen the two screws securing the caliper body and move the caliper in order to facilitate the replacement of the pads.

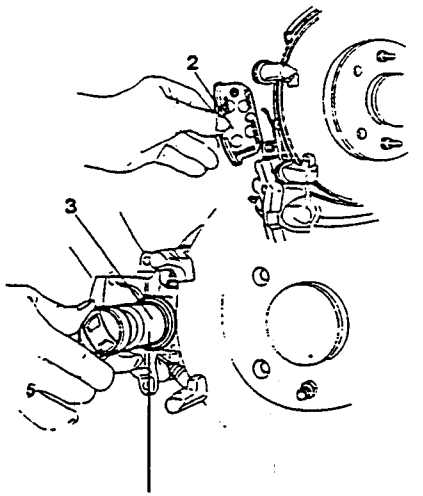
NOTE: **When refitting replace the screws securing the caliper body attachment and tighten them to the correct torque.**

2. Replace the brake pads.

NOTE: **The rear brake pads can be installed in either direction.**

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





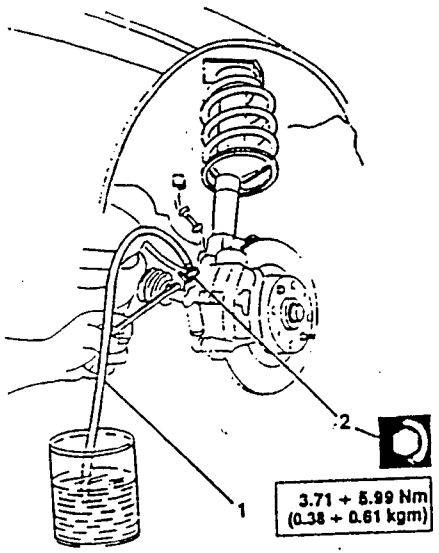
1.822.108.000

AIR BLEED

- Top up the brake clutch fluid reservoir to the MAX mark with the specified fluid.
- If necessary remove the wheel on which you are working.

1. Push the flexible hose onto the drain screw. Submerge one end of the hose in a container filled with the specified fluid.
2. Loosen the drain screw and repeatedly press the brake pedal (wait a few seconds each time) and when bubble-free fluid begins to drain into the container, fully depress the brake pedal and tighten the drain screw to the correct torque.

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



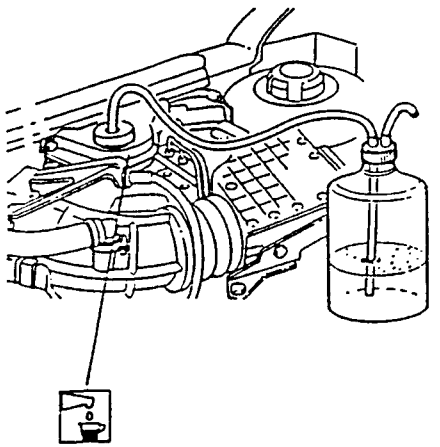
WARNING:
- **Ensure that the fluid level does not fall below the minimum when bleeding the system.**
- **Do not re-use the fluid drained off during the bleeding operations.**
- **Do not allow the fluid to come into contact with painted surfaces.**

BLEEDING THE ABS SYSTEM

The hydraulic unit is suplied already filled and bled.
When refilling the hydraulic circuit or carrying out and operations to it, it is necessary to proceed as described below.

PROCEDURE FOR BLEEDING

1. Using a suitable bleeding device applies to the brake fluid reservoir, carry out the bleeding operations in the following order:



1. Front left-hand wheel
2. Front right-hand wheel
3. Rear left-hand wheel
4. Rear right-hand wheel.

(see: AIR BLEED)

NOTE: **If the indicated procedure is not followed, air may penetrate the piston resulting in a longer brake pedal travel. In this case proceed as described in RECOVERY PROCEDURE IN THE EVENT OF AIR IN THE PISTON.**
Air may also penetrate the ABS hydraulic system which will make it impossible to carry out bleeding operations.

RECOVERY PROCEDURE IN THE EVENT OF AIR IN THE PISTON

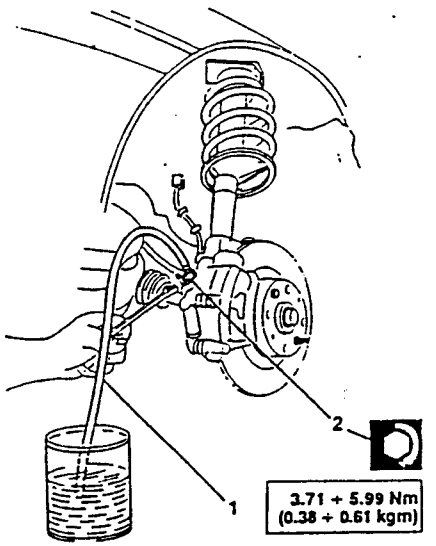
If air is present in the brake cylinder, after bleeding operations have been performed in the wrong order, proceed as follows:

- Repatedly and rapidly press the brake pedal and bleed in the following order:
  1. Rear right-hand wheel
  2. Front left-hand wheel
  3. Front left-hand wheel
  4. Rear right-hand wheel.

  (see: AIR BLEED)

WARNING
It will be necessary to reeat the operation 5 times for each wheel before passing on to the next.

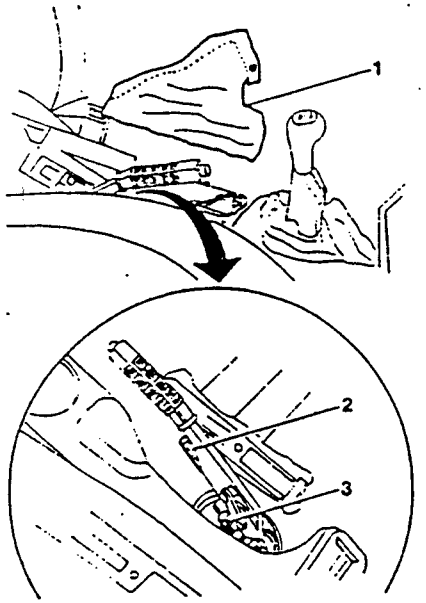
- Proceed with the normal bleeding procedure (see: AIR BLEED) following the order indicated:
  1. Front left-hand wheel
  2. Front right-hand wheel
  3. Rear left-hand wheel
  4. Front right-hand wheel.



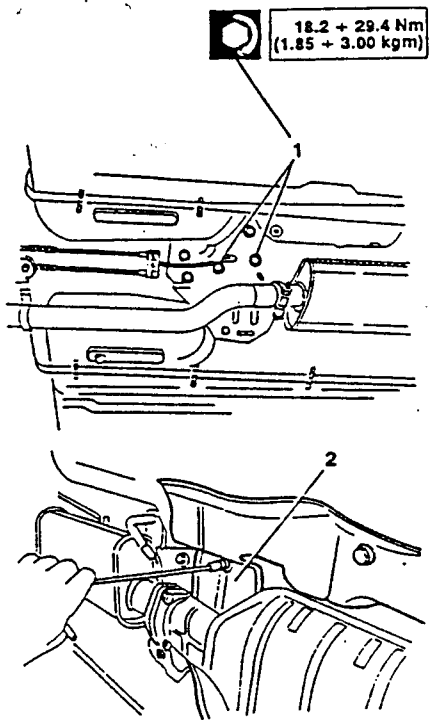
HANDBRAKE

REMOVING AND REFITTING THE HANDBRAKE LEVER

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



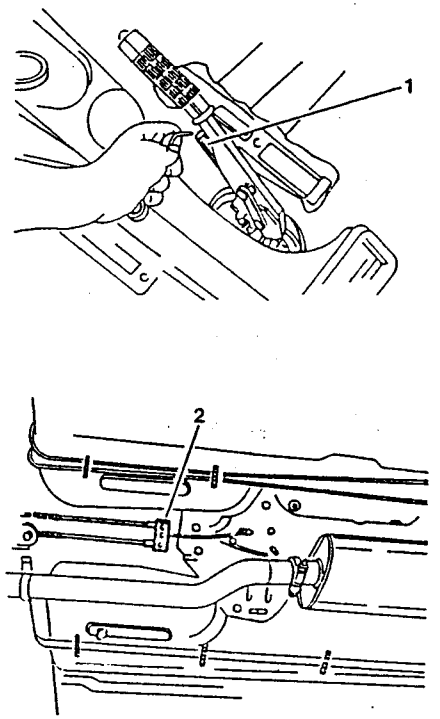
- Raise the vehicle.
1. Unscrew the two screws securing the handbrake lever and remove the lever together with the bracket.
2. (Only for versions with catalyzer):
   - unscrew the screws securing the heat shield until the two screws securing the handbrake lever can be reached.



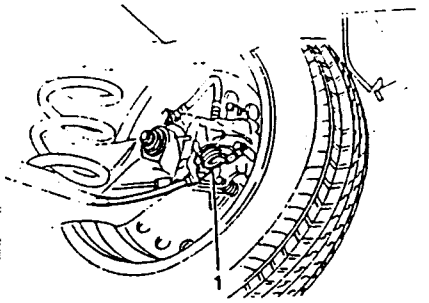
Refit by reversing the procedure followed for removal and tighten the retaining screws to the specified torque.

REMOVING AND REFITTING THE CONTROL CABLES

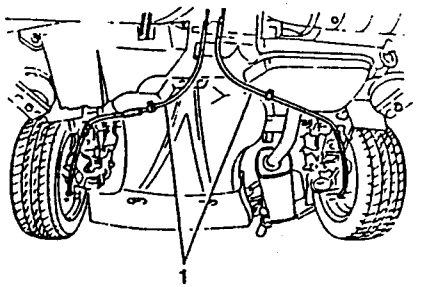
- Remove the central console (see: REPAIR MANUAL - TRIM - GR. 66).
1. Loosen the adjustment nut on the handbrake lever.
2. Disconnect the cables from the bracket.



1. Disconnect the cables from the rear brake calipers.



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



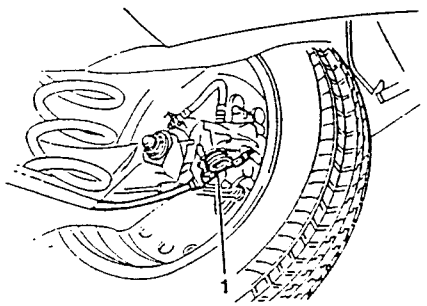
Refit by reversing the procedure followed for removal.

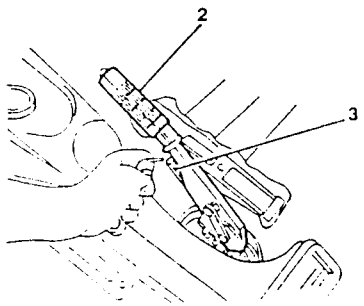
NOTE: **After refitting adjust the handbrake cable travel.**

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.

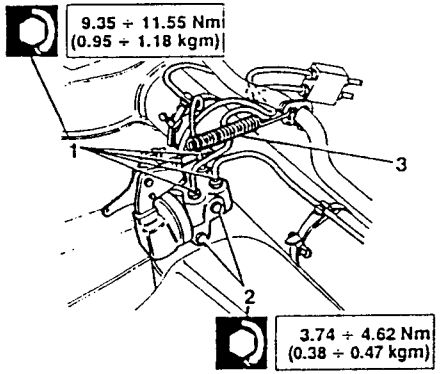
BRAKING REGULATOR

REMOVAL AND REFITTING

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

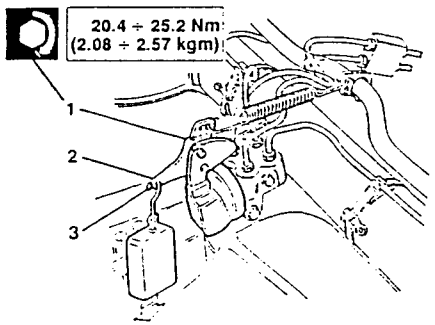
Refit by reversing the procedure followed for removal and tighten the regulator retaining screws to the correct torque.

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.

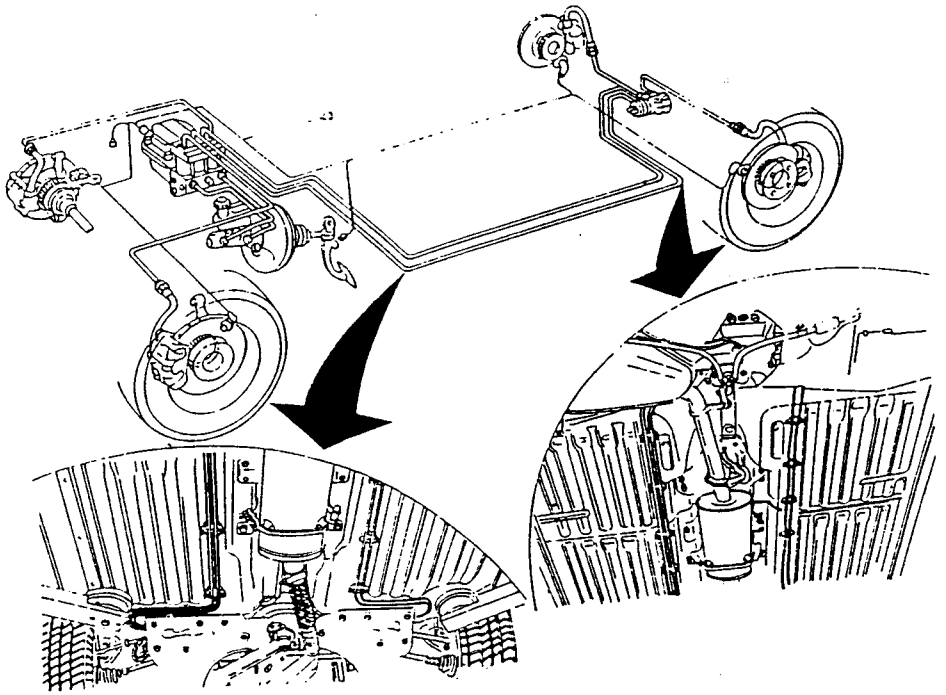


BRAKING SYSTEM PIPES AND HOSES

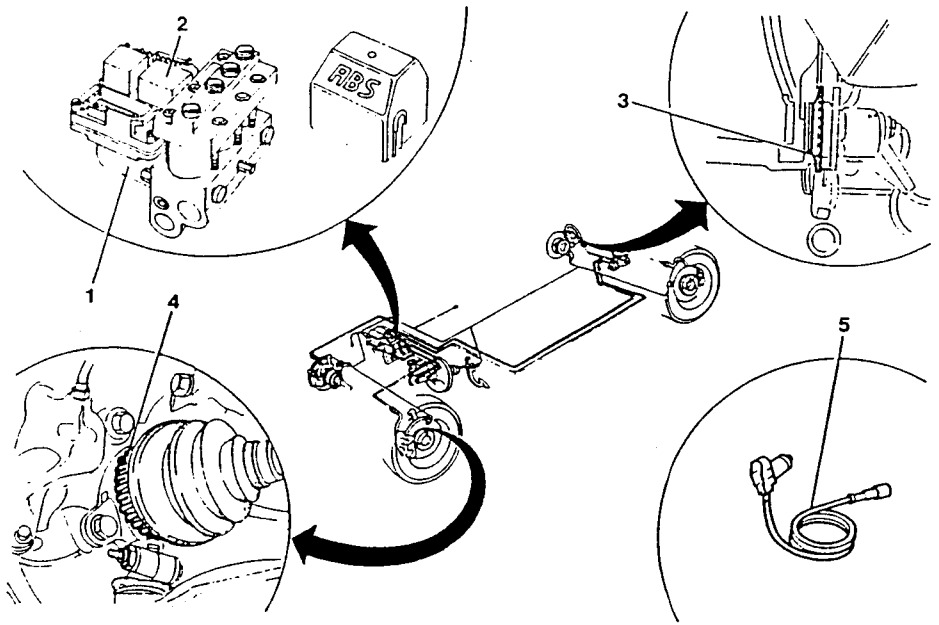
CHECKS AND INSPECTIONS

- 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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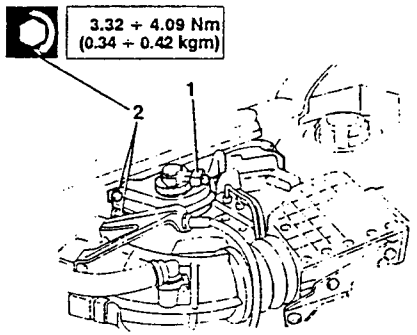
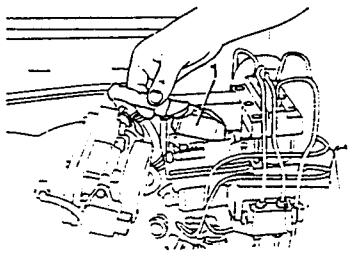
REMOVING AND REFITTING HYDRAULIC-ELECTRONIC UNIT

- 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.

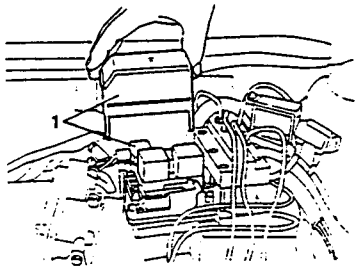
1. Disconnect the connector from the brake-clutch fluid level sensor.
2. Loosen the two screws securing the brake-clutch fluid reservoir and move the reservoir.



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



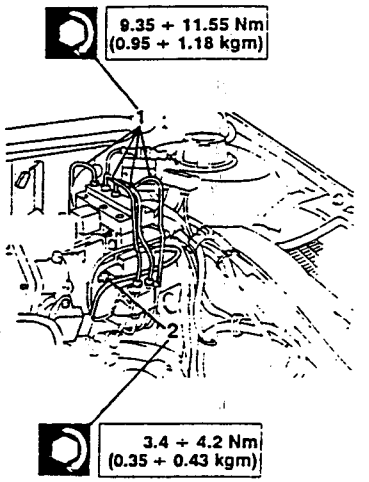
1. Loosen the screw securing cover of the electronic control unit and remove the four-pin connector.



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.



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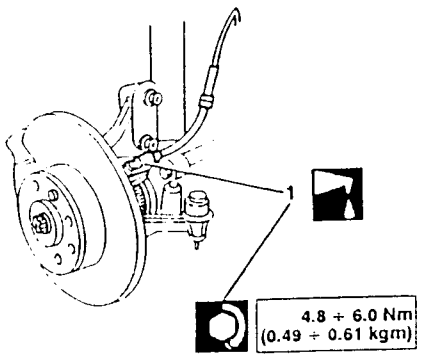
REMOVING AND REFITTING THE FRONT WHEEL INDUCTION SENSOR

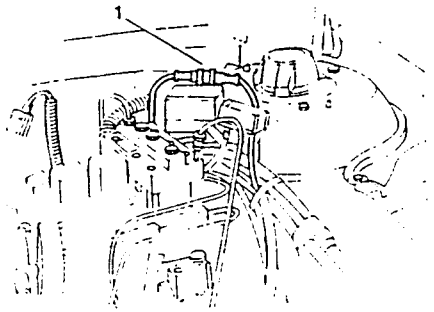
- Remove the wheel.

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.

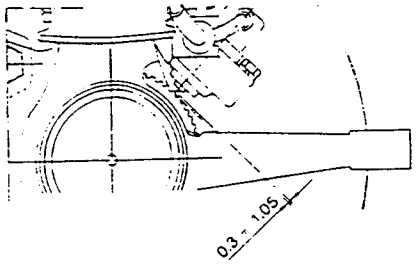
Refit by reversing the procedure followed for removal and tighten the screws securing the sensor to the correct torque.



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

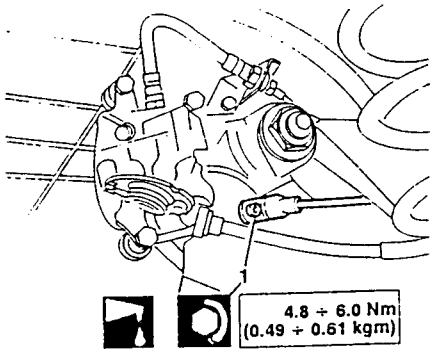
- Using a feeler gauge, check the air gap between the r.p.m. sensor and the phonic wheel on the constant speed joint.

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

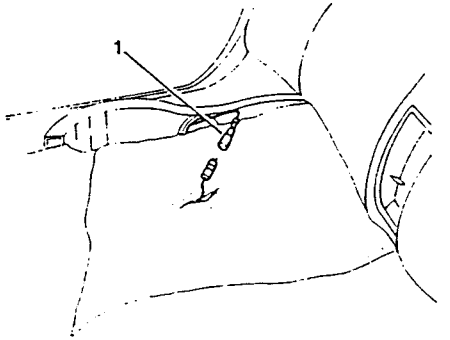
1. Loosen the screw securing the sensor.



- 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.

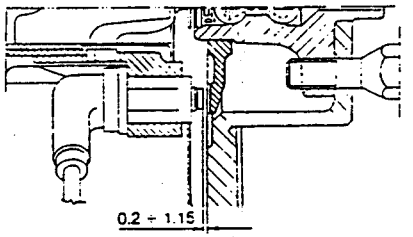
Refit by reversing the procedure followed for removal and tighten the screw securing the sensor to the correct torque.



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 $^{+0.4}_{-0.8}$
2.4 V6				

GENERAL SPECIFICATIONS

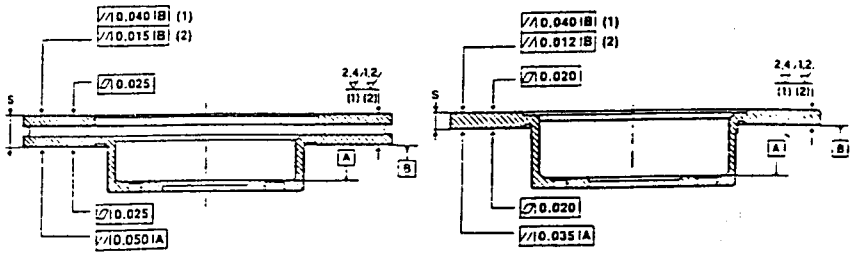
FLUIDS AND LUBRICANTS

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

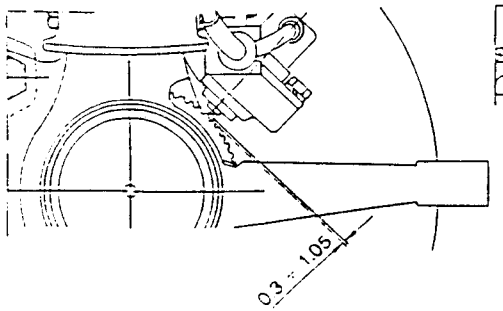


1. Radial
2. Circumferential

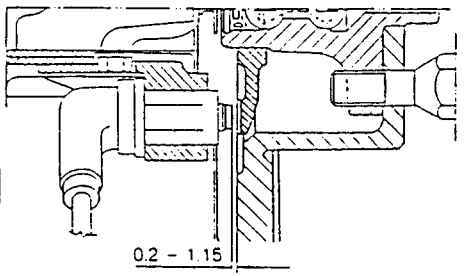
BRAKE PAD	FRONT	REAR
Limit operating thickness	All models	
	3 mm	3 mm

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 callpers	45.05 ÷ 55.65	4.60 ÷ 5.67
Screw securing front brake callpers (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 calipers pistons for wear or selzing	(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