155 4x4

REPAIR MANUAL

• MECHANICAL UNITS


GROUP 12 - CLUTCH


GROUP 13 - GEARBOX - TORQUE DISTRIBUTOR - CENTRAL DIFFERENTIAL


GROUP 15 - TRANSMISSION


GROUP 17 - AXLE SHAFTS


GROUP 18 - FOUR-WHEEL DRIVE REAR AXLE


GROUP 21 - FRONT SUSPENSION


GROUP 22 - FRONT AND REAR BRAKES


GROUP 23 - STEERING


GROUP 25 - REAR SUSPENSION


GROUP 28 - WHEELS AND TYRES

155 ◀ Refer to the corresponding Group in the "155 - REPAIR MANUAL" - PA4655C1000000

GROUP 12

CLUTCH

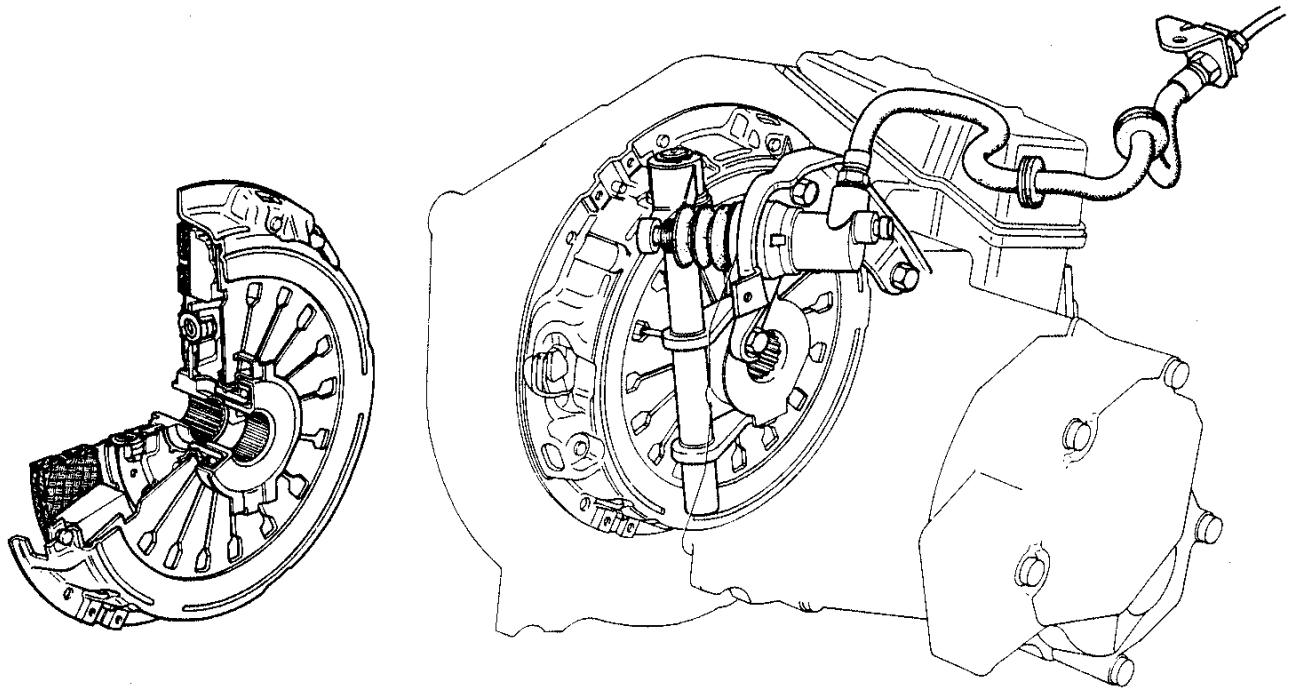
INDEX

For all parts not given here, refer to the corresponding Group in publication No. PA4655C1000000.

CLUTCH

DESCRIPTION

The clutch adopted for the four-wheel drive version in the 155 range is of the single dry disc type with hydraulic "pulled" action.



The hydraulically controlled single dry disc of the traditional type is fitted to reduce the effort required to depress the clutch pedal and is off the traction disengagement type. When the pedal is depressed the clutch is pulled by a thrust bearing of the hoooked type rather than pushed as in the traditional system. This type of clutch has been adopted because, having to transmit a high torque, the overall dimensions of the cluch would need to be increased in order to avoid variations in the action of the pedal.

CLUTCH PEDAL

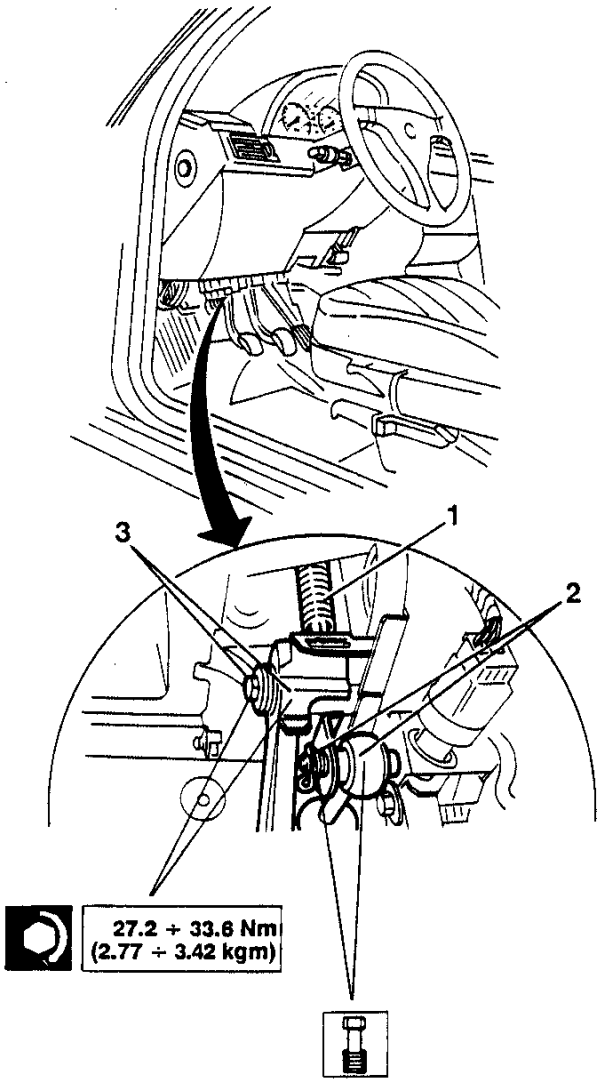
REMOVAL AND REFITTING

- Disconnect the wiring from the ABS system wiring located on the clutch pedal.

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.

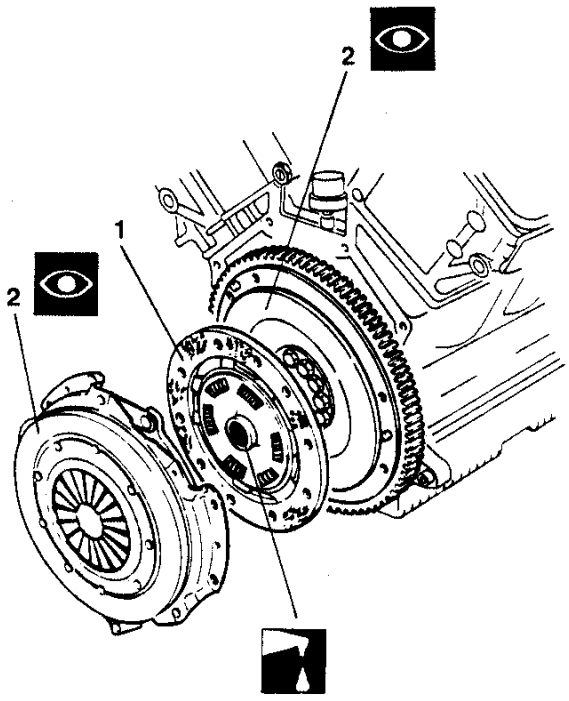
Refit, by reversing the procedure followed for removal and tightening the through screw on the clutch pedal to the correct torque.

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

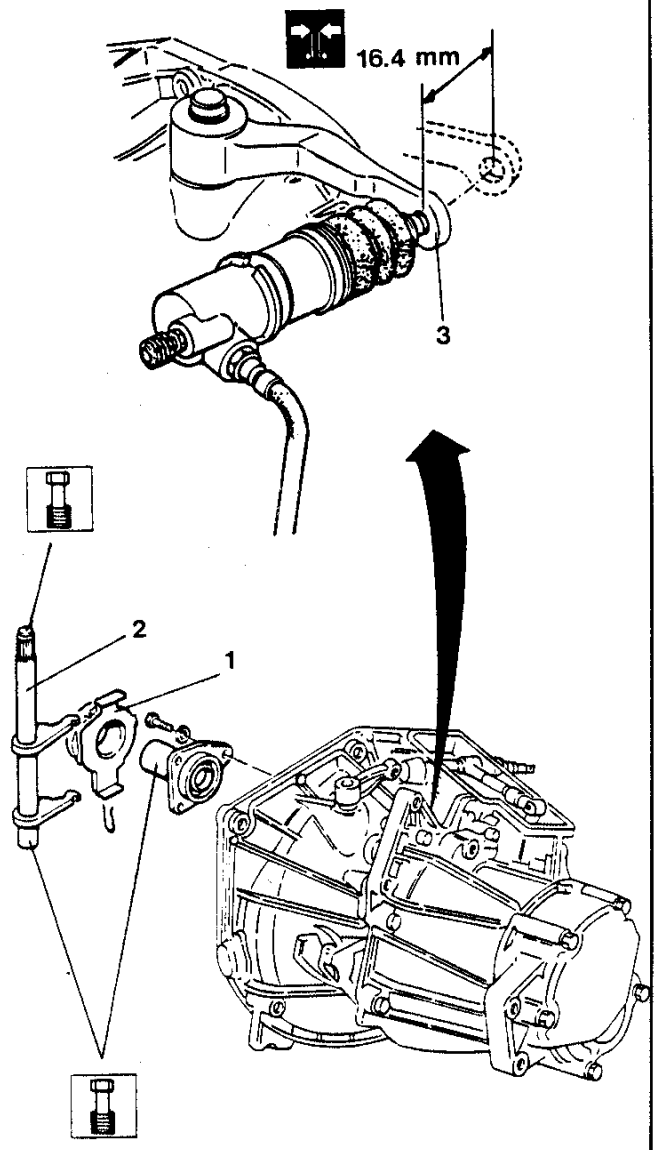


CHECKS AND INSPECTIONS

1. Check the clutch plate for even 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 16.4 mm; if the stroke is below this figure, check the efficiency of the hydraulic circuit.



TECHNICAL CHARACTERISTICS AND SPECIFICATIONS

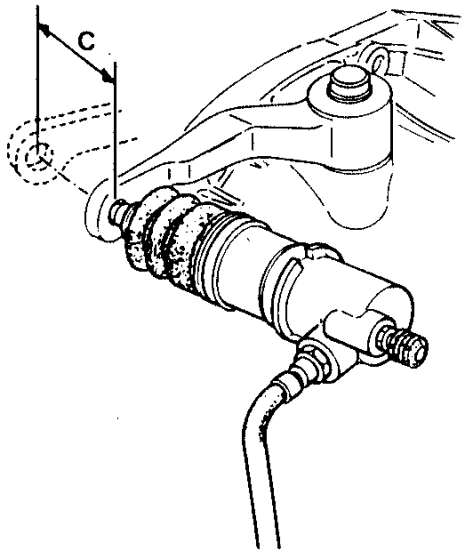
GENERAL INDICATIONS

FLUIDS AND LUBRICANTS

APPLICATION	TYPE	NAME
Thrust bearing seat and clutch control lever shaft rod	GREASE	TUTELA MR3
Clutch control cylinder pushrod		
Lubrication of pump inner components and hydraulic system filling	FLUID Class: DOT 4 SAE J170 3F	ALFA ROMEO BRAKE FLUID SUPER DOT 4

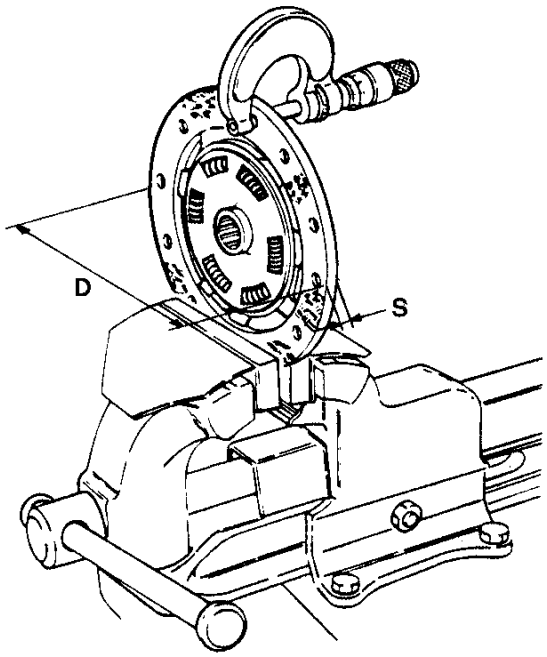
CHECKS AND ADJUSTMENTS

CLUTCH CONTROL LEVER



Clutch control lever disengagement travel .....C = 16.4 mm

CLUTCH DISK



Clutch disk thickness ..... S = 7.1 ÷ 7.7 mm
Clutch disk diameter .....D = 229 mm

TIGHTENING TORQUES

Description	N·m	kg·m
Cylindrical screw with hexagon for fixing clutch mechanism	17.85 - 22.05	1.82 - 2.25
Union for connection of pipe to hose - pump and cylinder sides	17.1 - 18.9	1.74 - 1.92
Hexagonal-head screw for securing intermediate anchoring bracket on clutch control hose	11.9 - 14.7	1.21 - 1.49
Hexagonal-head screw securing clutch control 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)

GROUP 13

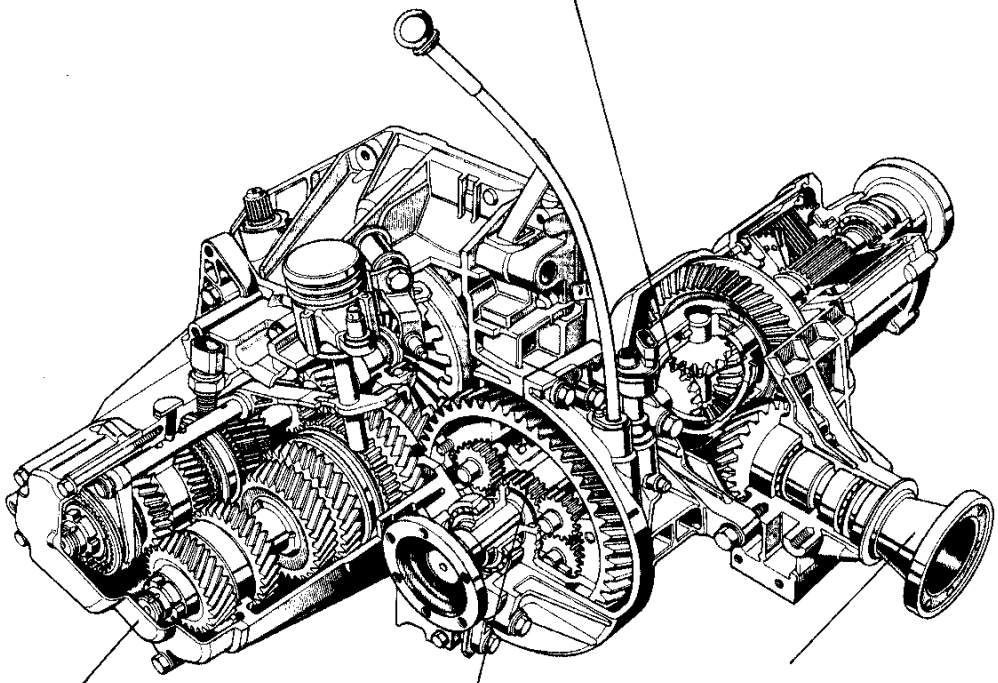
GEARBOX - TORQUE DISTRIBUTOR - CENTRAL DIFFERENTIAL

INDEX

ILLUSTRATED INDEX

ON VEHICLE OPERATIONS

DIFFERENTIAL AND TRANSMISSION



GEARBOX

TORQUE DISTRIBUTOR - CENTRAL DIFFERENTIAL

GEARBOX

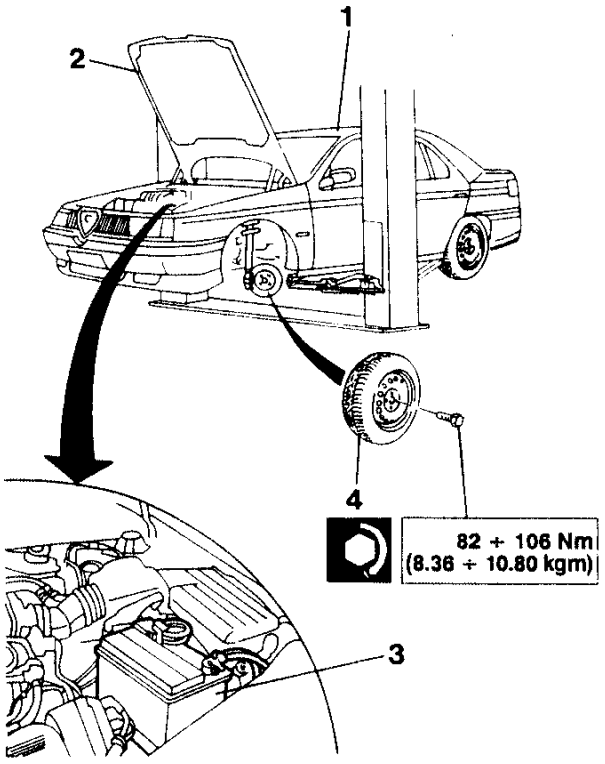
DESCRIPTION

See: PA4655C1000000 / REPAIR INSTRUCTIONS - MECHANICAL UNITS - GR. 13.

REMOVAL AND REFITTING

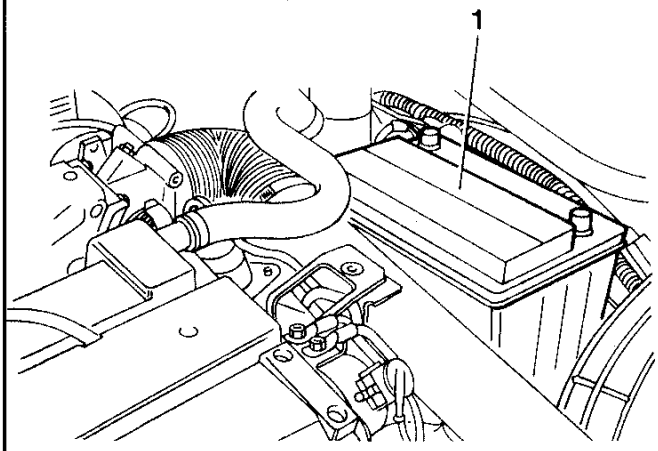
1. Place the vehicle on a lift.
2. Lift the bonnet.
3. Disconnect the battery.
4. Remove the front wheels.

WARNING:
Protect the areas around the engine compartment with soft material to prevent the bodywork from being accidentally damaged.

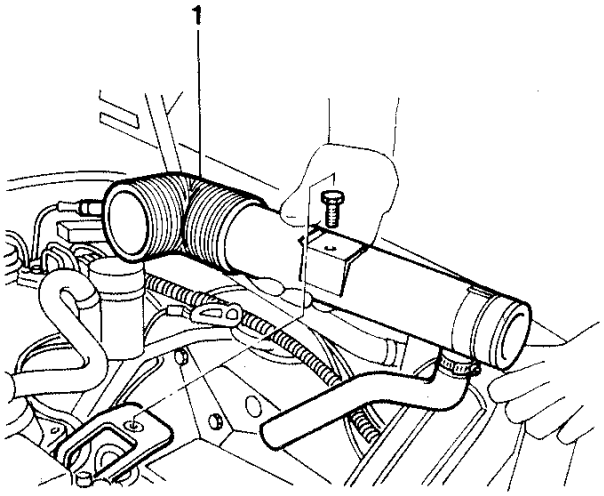


- Remove the complete front left-hand suspension (see: GR. 21).
- Remove the front suspension crossmember (see: GR. 21).
- With the vehicle on the ground perform the following operations:

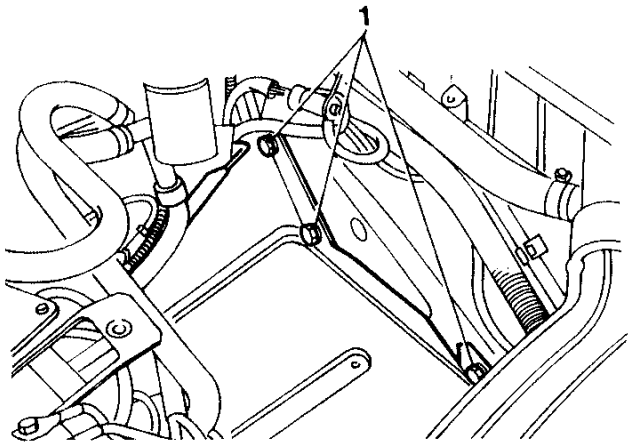
1. Remove the battery.



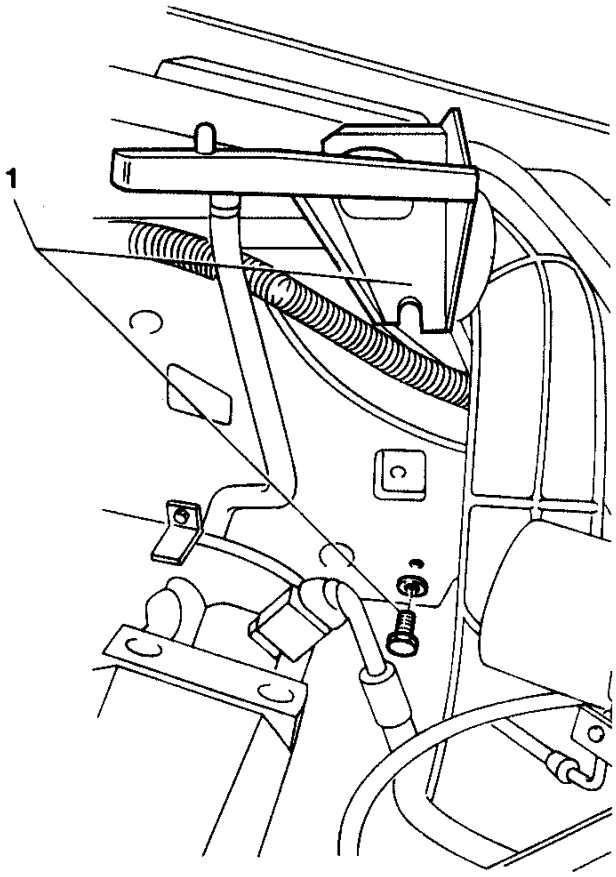
1. Loosen the retaining screw and after removing the air-air exchanger from the throttle body and idle speed adjustment solenoid valve, remove the connecting pipe.



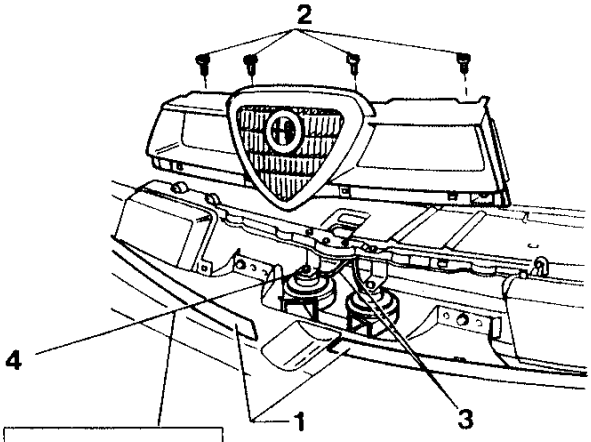
1. Loosen the upper screws securing the battery support.



1. Loosen the lower screw securing the battery support and remove the support.

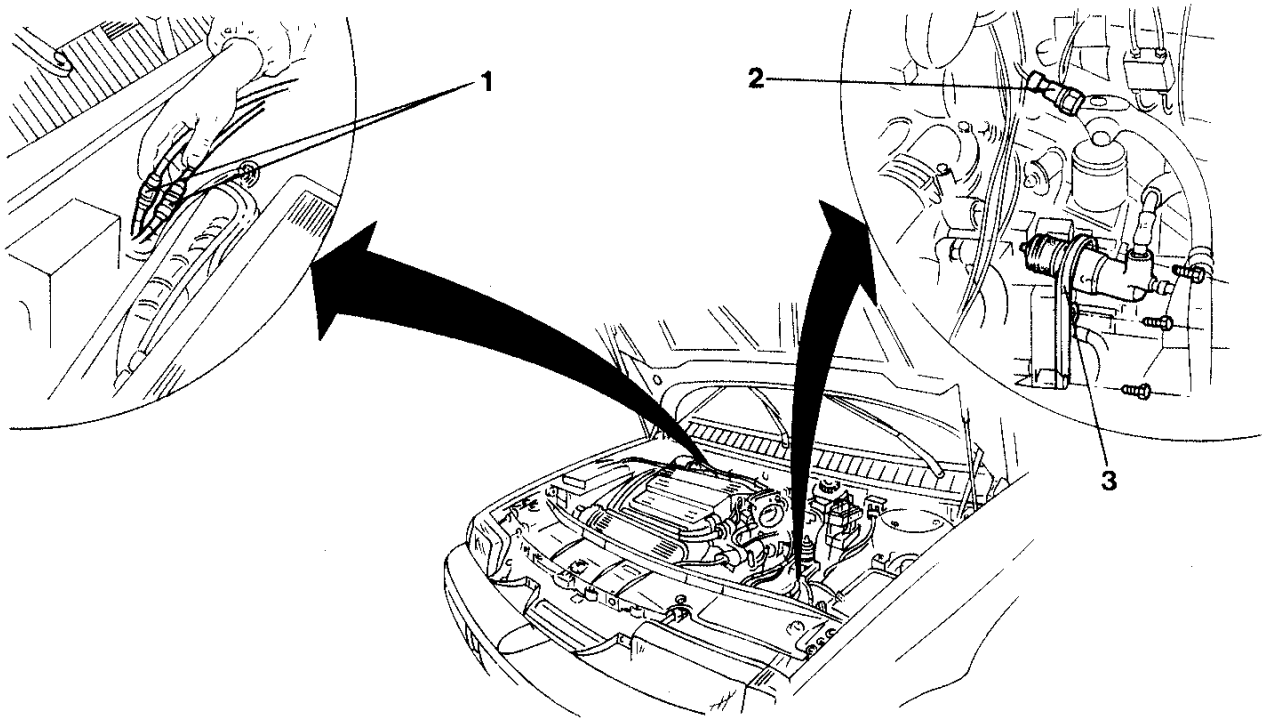


1. Remove the finishing trim by detaching the pins securing it to the grille.
2. Loosen the screws securing the grille to the body and remove the grille.
3. Disconnect the electrical wiring from the horns.
4. Loosen the retaining nuts and remove the horns from the front crossmember.



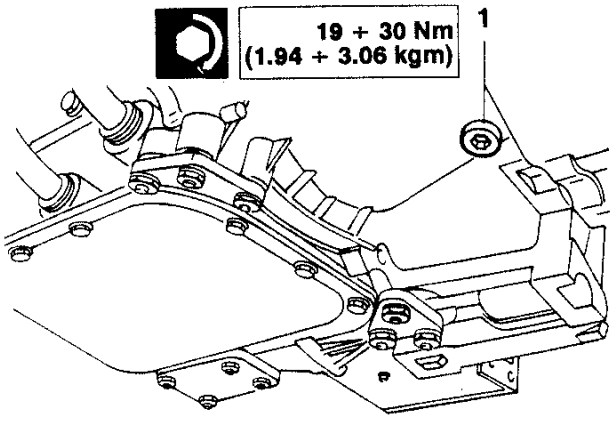
2.9 ÷ 4.7 Nm (0.29 ÷ 0.48 kgm)

1. (Only for vehicles with catalyzer):
   - Disconnect the two lambda probe cables located near the service tank.
2. (Only for vehicles with controlled damping suspension):
   - Disconnect the sensor from the controlled damping suspension system on the brake pump.
3. Loosen the screws securing the clutch cylinder bracket to the gearbox and remove the bracket together with the earth cable.

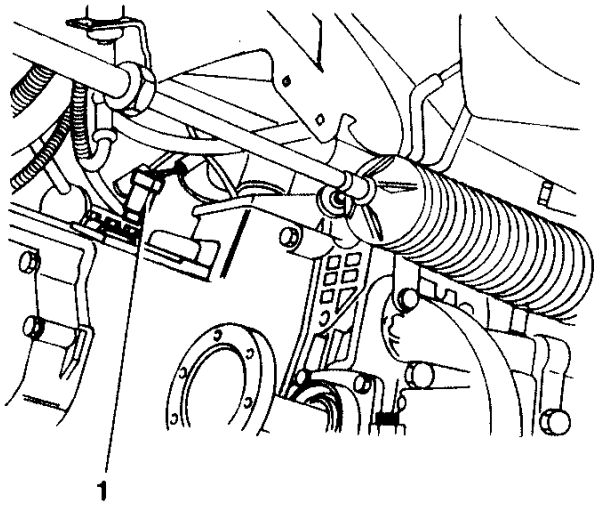


- Raise the vehicle and perform the following operations:

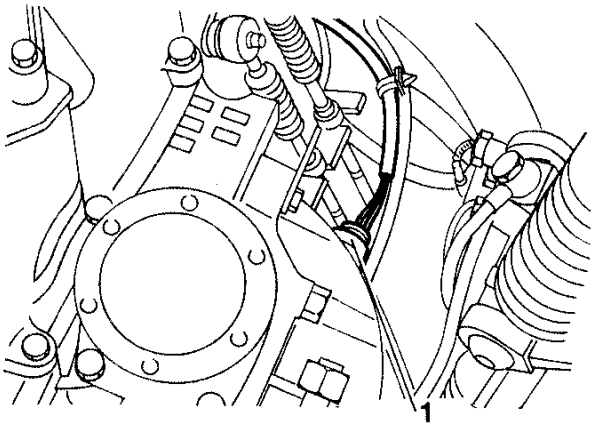
1. Unscrew the cap and drain the oil from the gearbox-differential.



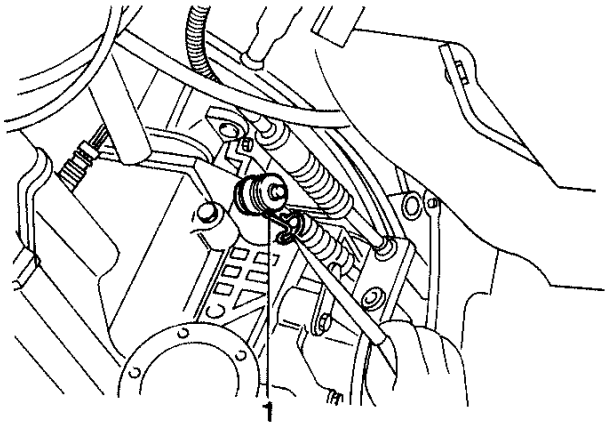
1. Disconnect the connector from the reversing light device.



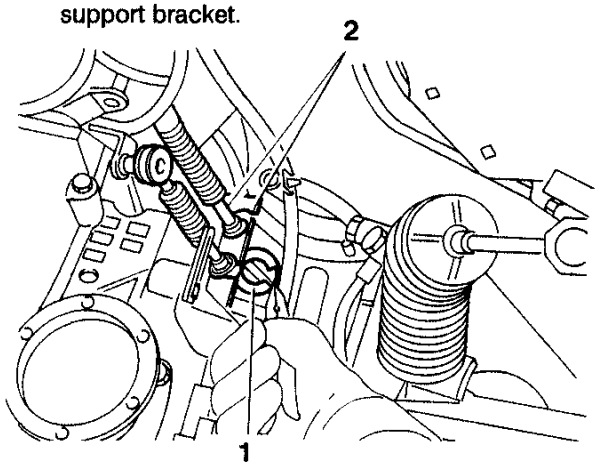
1. Disconnect the wiring from the odometer impumse generator and disconnect the wiring from the tube housing the dipstick.



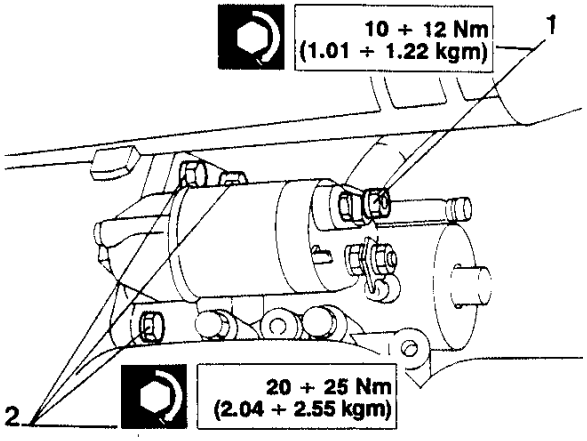
1. Disconnect the clips securing the gear selection and engagement control cables.



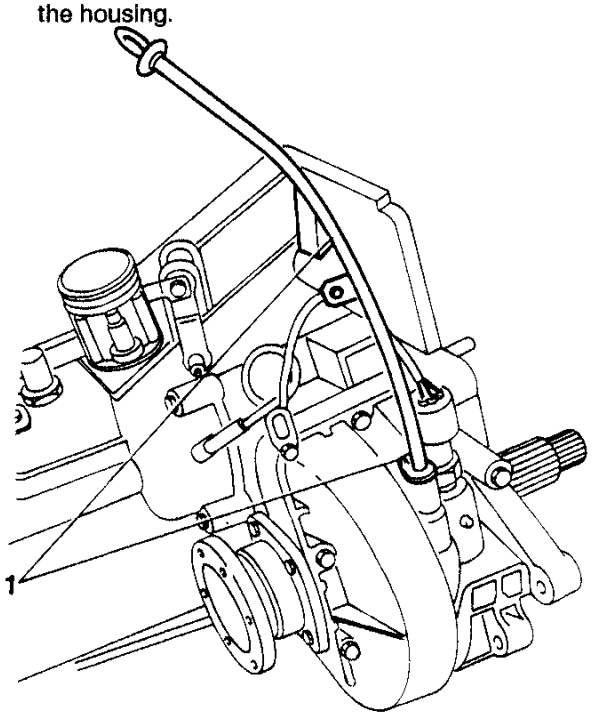
1. Remove the clamps securing the gear selection and engagement cables.
2. Disconnect the cables from the gear engagement and selection devices and withdraw them from the support bracket.



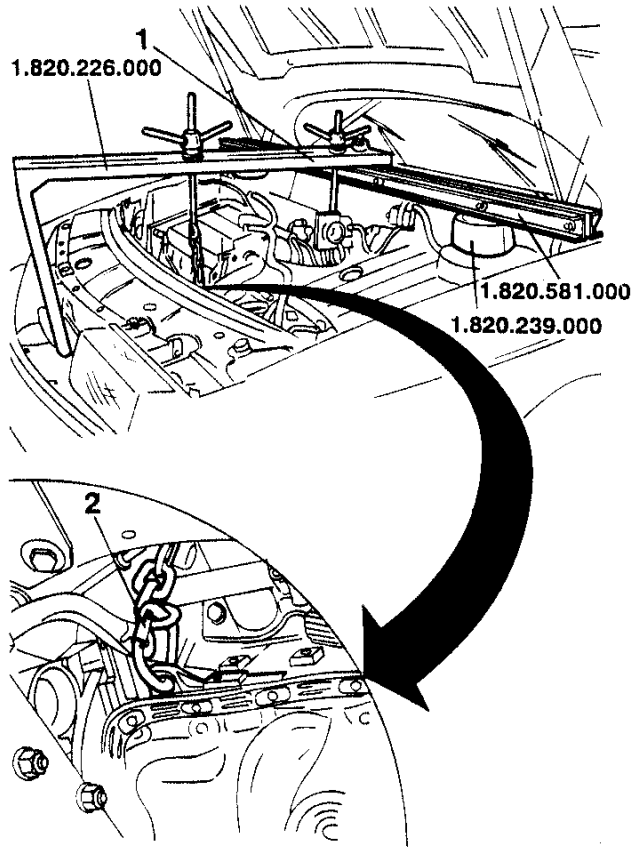
1. Loosen the nut securing starter motor supply cable and disconnect the cable.
2. Loosen the screws securing the starter motor to the gear lever bell and remove the starter motor.



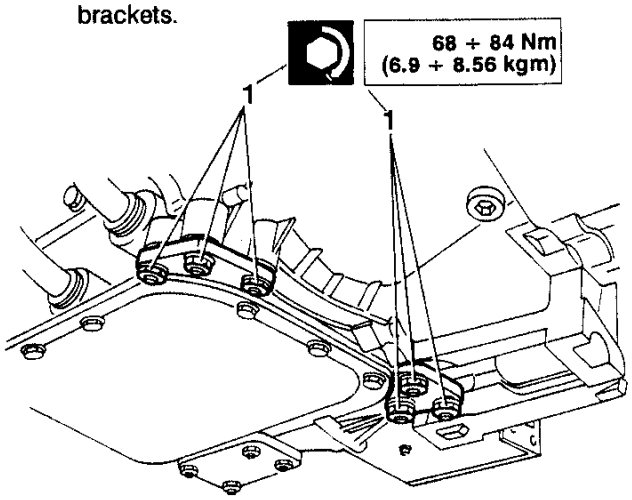
1. Loosen the screws securing the oil dipstick housing from the gear lever bell and distributor and remove the housing.



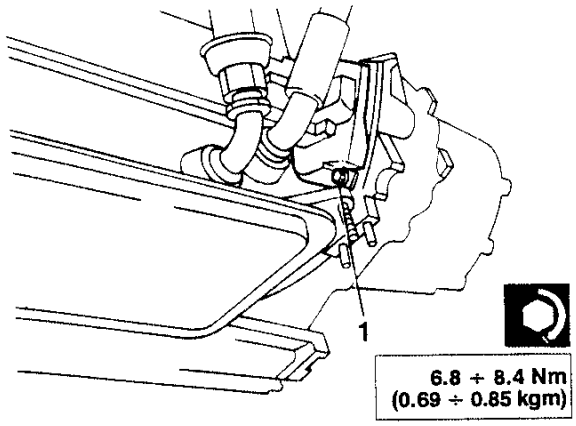
1. Position supports No. 1.820.239.000, crossmember No. 1.820.581.000 and support No. 1.820.226.000.
2. Using the appropriate hooks anchor the engine block.



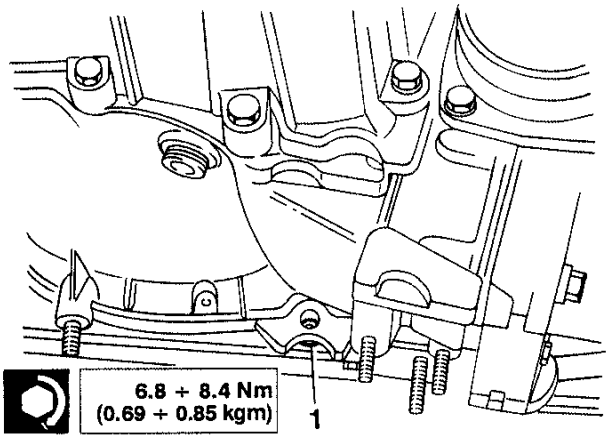
1. Loosen the nuts securing the connecting brackets between the engine and the gearbox and remove the brackets.



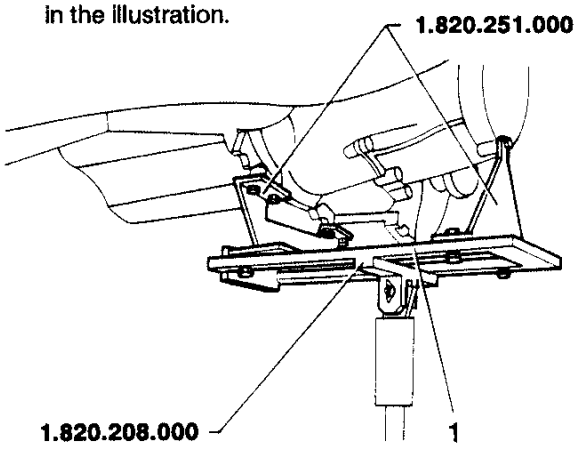
1. Loosen the hexagonal-head screw securing the front attachment of the dustguard between the engine and the gearbox.



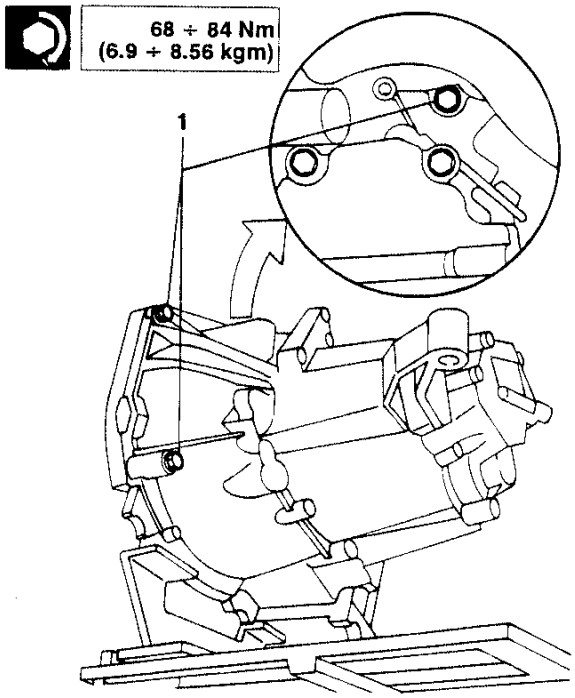
1. Loosen the sunken hexagonal-head screw securing the rear attachment of the dustguard between the engine and the gearbox.



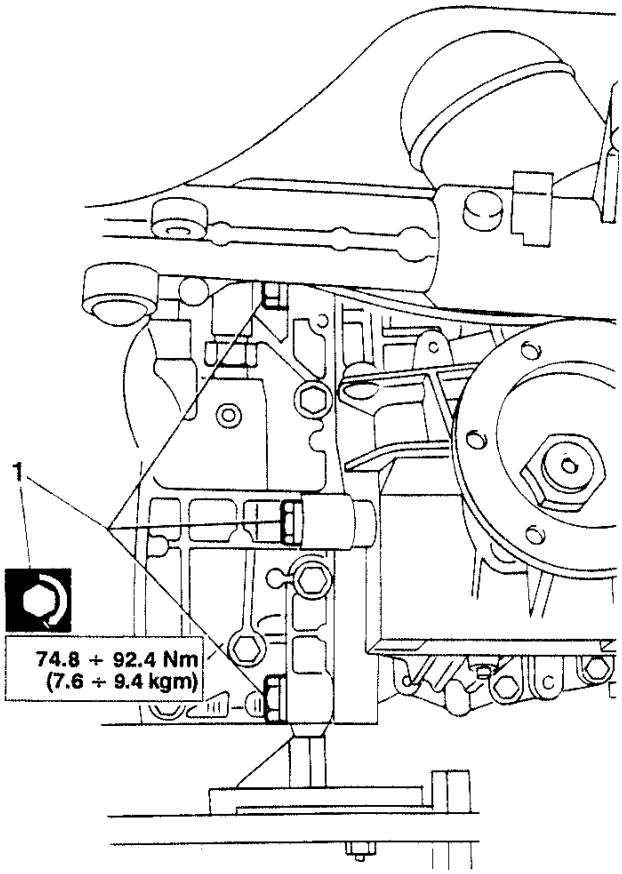
1. Set gearbox support stand No. 1.820.208.000 (fitted with gearbox support brackets No. 1.820.251.000) on a hydraulic jack and secure the gearbox as shown in the illustration.



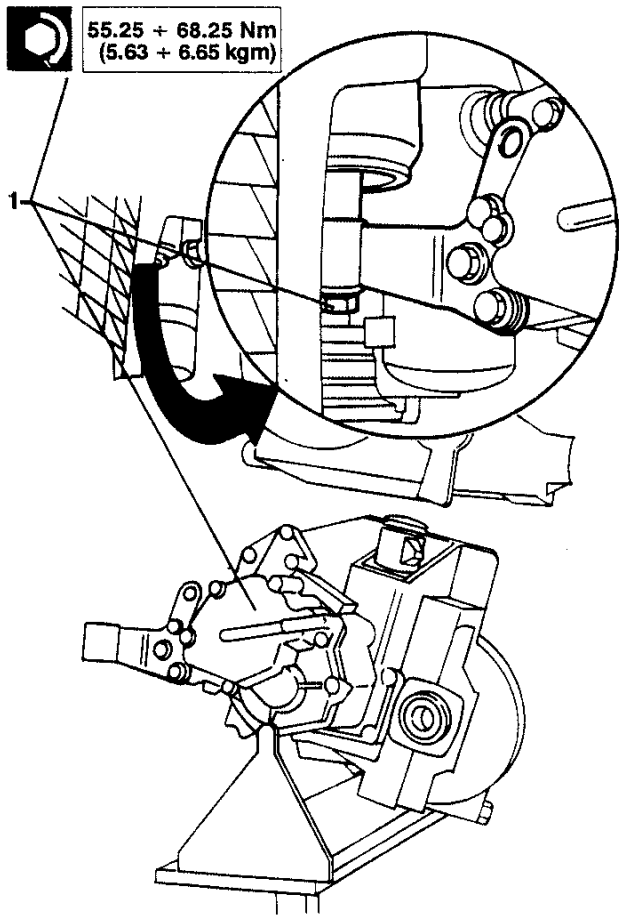
1. Loosen the screws securing the gearlever bell to the engine block.



1. Loosen the screws securing the gear lever bell to the differential.



1. Loosen the screw securing the engine unit front left-hand support and, lowering the hydraulic jack, remove the gearbox.



Refit by reversing the procedure followed for removal ensuring that all the nuts and screws are tightened to the specified torques and that the the system is refilled with the specified oil (see: TECHNICAL CHARACTERISTICS AND SPECIFICATIONS - GENERAL SPECIFICATIONS - Fluids and lubricants).

DISASSEMBLY

See: PA4655C1000000 / REPAIR INSTRUCTIONS - MECHANICAL UNITS - GR. 13 - DISASSEMBLY 2.4 V6.

CHECKS AND INSPECTIONS

See: PA4655C1000000 / REPAIR INSTRUCTIONS - MECHANICAL UNITS - GR. 13 - CHECKS AND INSPECTIONS.

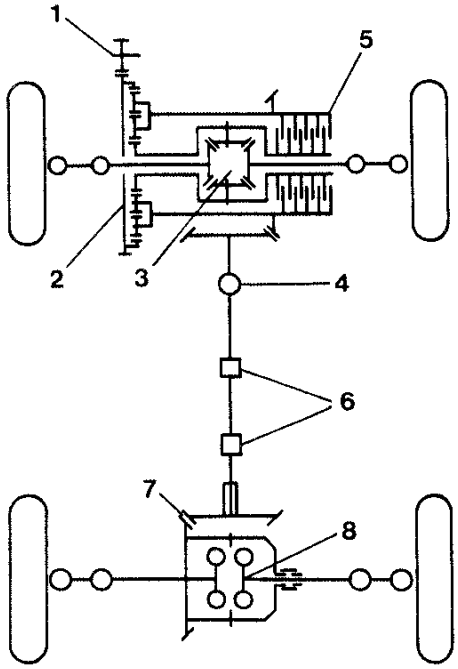
REASSEMBLY

See: PA4655C1000000 / REPAIR INSTRUCTIONS - MECHANICAL UNITS - GR. 13 - REASSEMBLY 2.4 V6.

FOUR-WHEEL DRIVE

PRINCIPLES OF OPERATION

In order to optimize the sports characteristics of the vehicles in the 155 range and at the same time improve functionality and safety, the 2.0, 16V Turbopetrol model has been equipped with a system of permanent four-wheel drive.



1. Secondary gearbox shaft
2. Epicycloidal differential or torque distributor
3. Front differential
4. Constant speed joint
5. Viscous Ferguson coupling
6. Cardan joints
7. Pinion set
8. Torsen rear differential

The permanent four-wheel drive transmission adopted for the vehicle is of the three-differential type.

47% of the deflecting torque is distributed on the front axle and 53% on the rear axle.

This distribution of the torque is proportional to the distribution of the weights on the two axles and, in addition to the typical characteristics of four-wheel drive systems, makes it possible to distribute more of the deflecting torque on the rear axle.

The redistribution of the deflecting torque between the two axles in the event of low traction with the road surface is obtained with a viscous coupling connected to the central differential.

The front differential is of the traditional type and the transmission to the rear axle is obtained through a pinion set and a drive shaft divided into three branches connected to each other by a constant speed joint and by two Cardan joints.

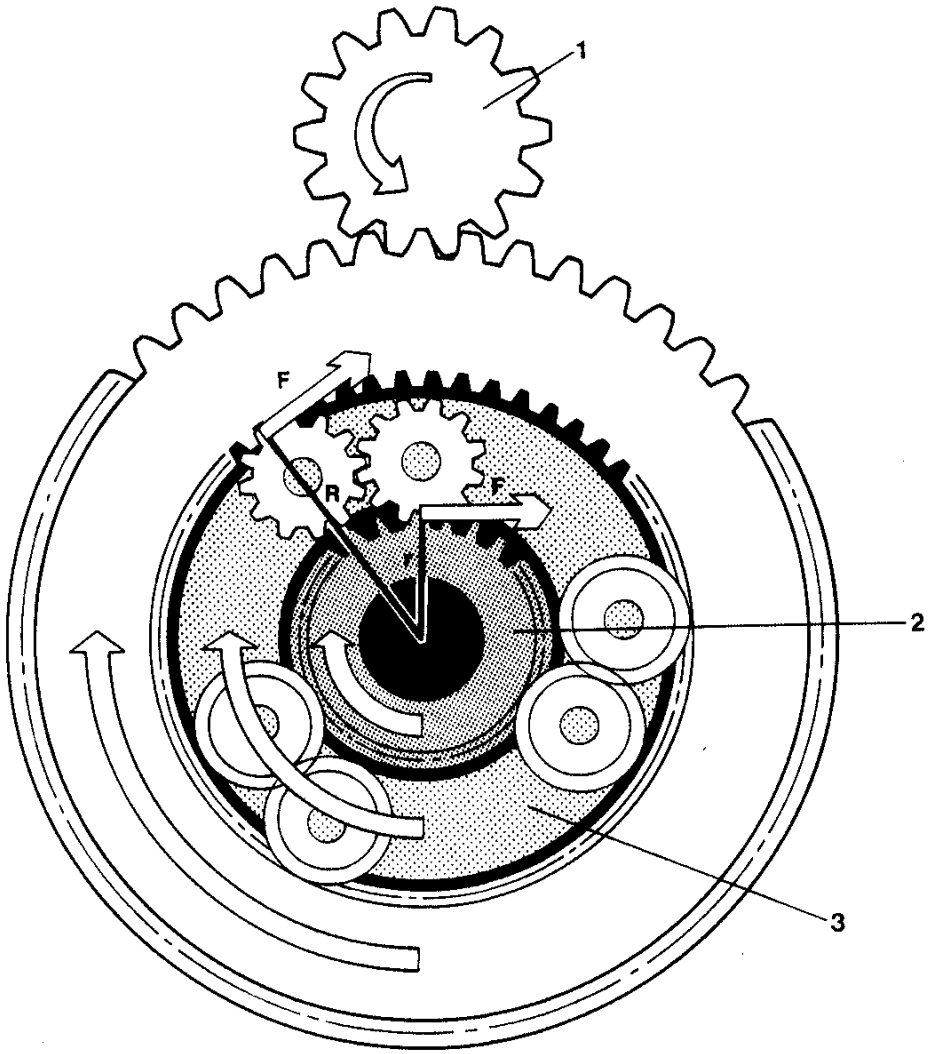
The rear low internal output differential is of the Torsen 5:1 type.

This type of transmission makes it possible to exploit the power of the engine and the road-holding of each wheel to the full, a characteristic which is particularly effective during take-off and when climbing gradients. There is also no incompatibility between the this type of transmission and the ABS system when cornering due to the action of the central differential which permits the necessary slip between the two axles. Driving is therefore improved in terms of directional stability in the capacity to maintain traction under the most adverse road conditions.

TORQUE DISTRIBUTOR - CENTRAL DIFFERENTIAL

DESCRIPTION

The torque distribution commonly known as the central differential is composed of a epicycloidal gear structured as shown in the illustration and the pinion is connected to the front shaft and the pinion shaft to the rear axle.



1. Gearbox secondary shaft
2. Front axleshaft
3. Rear axleshaft

The inner toothing of the ring gear comprises 45 teeth and the pinion 21.
A force F is transmitted from the gearbox countershaft, by way of the ring gear, to the side pinions. This force is transmitted to the pinion as the side pinions have the same number of teeth.
The torque transmitted by the ring gear obviously corresponds to the product of **F x R**, while the torque transmitted to the pinion corresponds to the product of **F x r**.
When the gears are engaged the number of teeth and the diameter of the base circle are proportional.
For this reason the the torque transmitted to the ring gear is proportional to F x 45 and that received by the pinion to F x 21.
The torque transmitted to the pinion shaft corresponds to the difference between these two torques:

$$F \times 45 - F \times 21 = F \times 24$$

The ratio between the torques transmitted to the two shafts is:

$$\text{pinion torque/side pinion torque} = 21/24$$

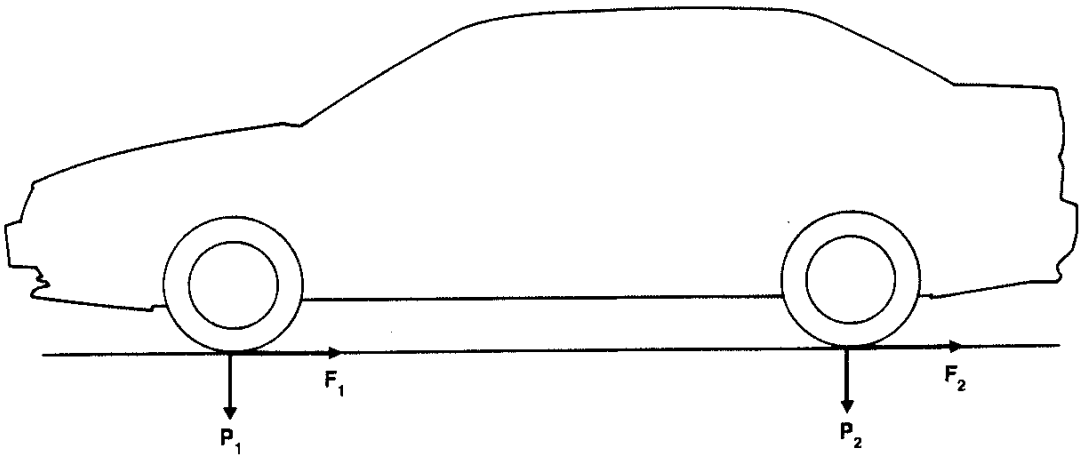
a ratio which corresponds to a distribution of the deflecting torque at 47% on the front axle and 53% on the rear axle, a result of the proportions:

$$46.66 = \frac{21 \times 100}{45} \qquad 53.33 = \frac{24 \times 100}{45}$$

The pinion shaft and the pinion respectively are connected to the box and hub of the viscous coupling

An epicycloidal gear inserted between the two axles makes it possible for them to assume different speeds even if the engine r.p.m. remains unchanged i.e. their difference can assume any value.
When cornering the wheels of the front axle follow a different trajectories from those of the wheels of the rear axle and therefore the relative drive shafts and the three elements of the ring gear freely assume different speeds.If slipping (speed difference) between the two axles were not possible the result would be rapid tyre wear caused by the sliding, vibrations and generally poor driving performance. Whenever the a situation of reduced traction arises affecting a particular axle, the relative shaft accelerates resulting in a slipping between pinion and pinion shaft.
In this case transmission of the deflecting torque to the ground by the axle is reduced, exploitation of the available power is low or non-existent control over the vehicle is reduced.
To overcome these problems a viscous coupling has been inserted between the shafts in output from the pinion and the pinion shaft. This ensures a progressive locking torque between these two elements. This torque is the result of the reciprocal speed of the pinion and pinion shaft up to the point of total lock. For modest slipping its value is reduced and rises with the necessary graduality, permitting the correct operation of the ABS system, and the speed differentiation regarding the front and rear axles which has been shown to be necessary when cornering.
As slipping between the drive shafts increases the internal output of the central differential-viscous coupling assembly decreases and, as will be shown, under these conditions the torque is gradually transferred from the axle suffering reduced traction to the axle with good traction.

Under ideal conditions the deflecting torque is distributed, with a percentage ratio of 53/47, in accordance with the adhesive weight distribution up to a point where the the loading, to a theoretical limit, is transferred entirely to a single axle.



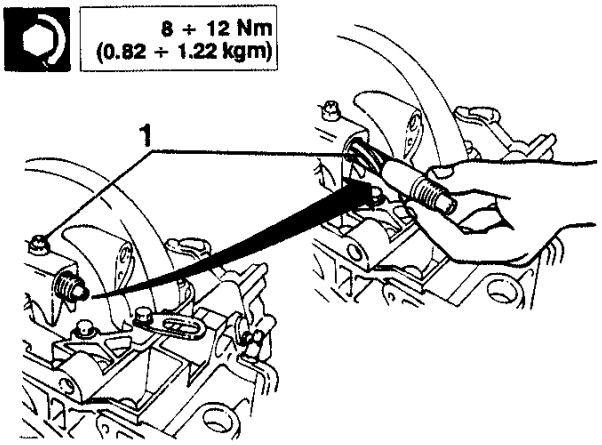
Adhesive weight $F = P \cdot f$
where:
P = load on wheel
f = wheel-ground friction coefficient

REMOVAL AND REFITTING

- Remove the gearbox and place it on a suitable support stand (see: GEARBOX - REMOVAL AND REFITTING).

1. Remove odometer connecting gear by loosening the retaining screw.

8 ÷ 12 Nm
(0.82 ÷ 1.22 kgm)



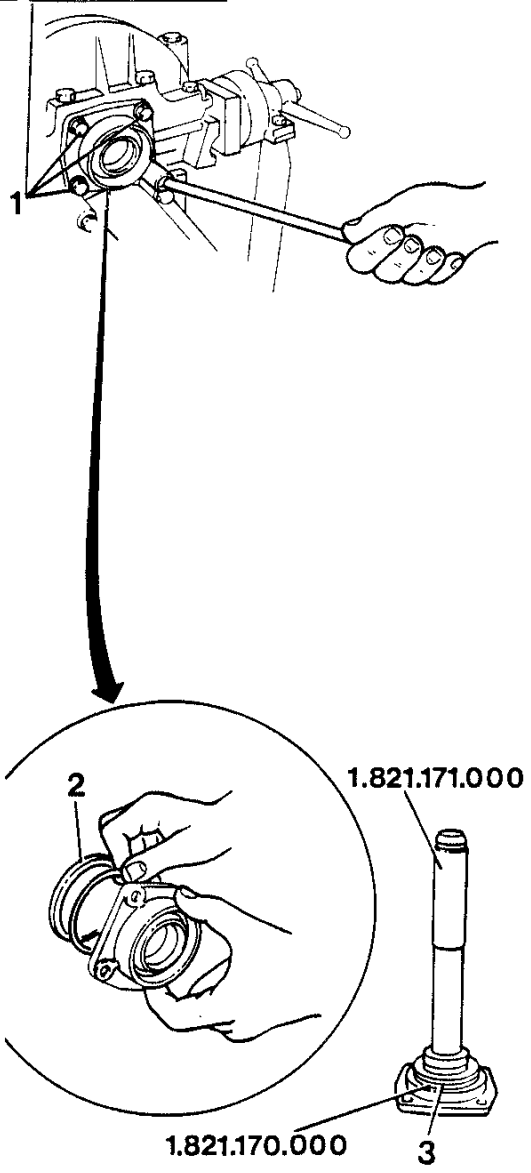
1. Loosen the four screws and remove the driveshaft oil seal cover.
2. Remove the O-Ring and shim ring.

NOTE: The O-Ring and the oil seal must be replaced if worn.

3. When replacing the oil seal, refit in the sealed box using inserting tool No. 1.821.170.000 together with grip No. 1.821.171.000.

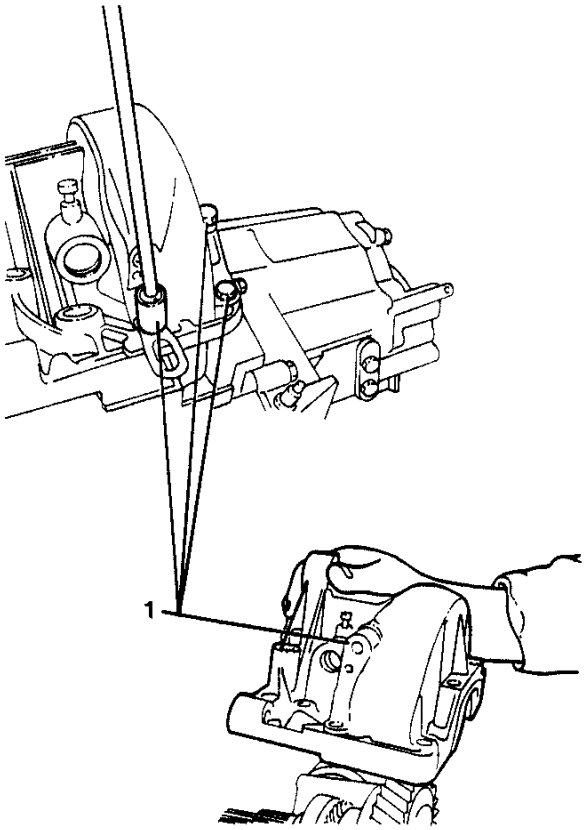
- Remove the shim rings.

21.25 ÷ 26.25 Nm
(2.2 ÷ 2.7 kgm)

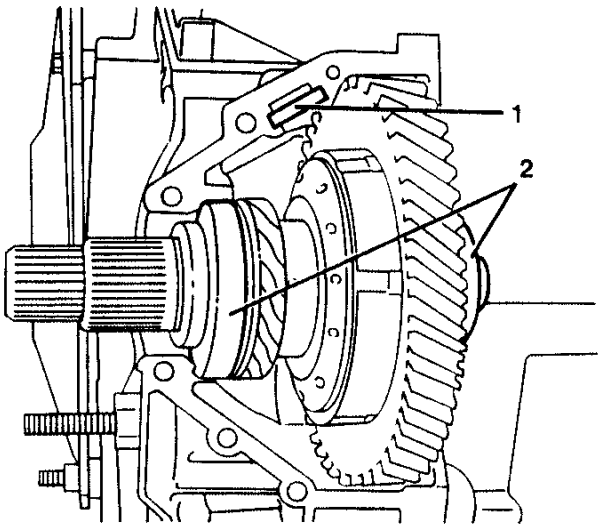


1. Loosen the ten screws securing the cover to the gearbox and remove the cover.

Refit the distributor cover by applying flat surface sealant "Loctite 573" to the mating surfaces between the distributor cover and the gearbox support.



1. Remove the magnet.
2. Remove the distributor, complete with the outer races of the tapered roller bearings, from the gearbox.

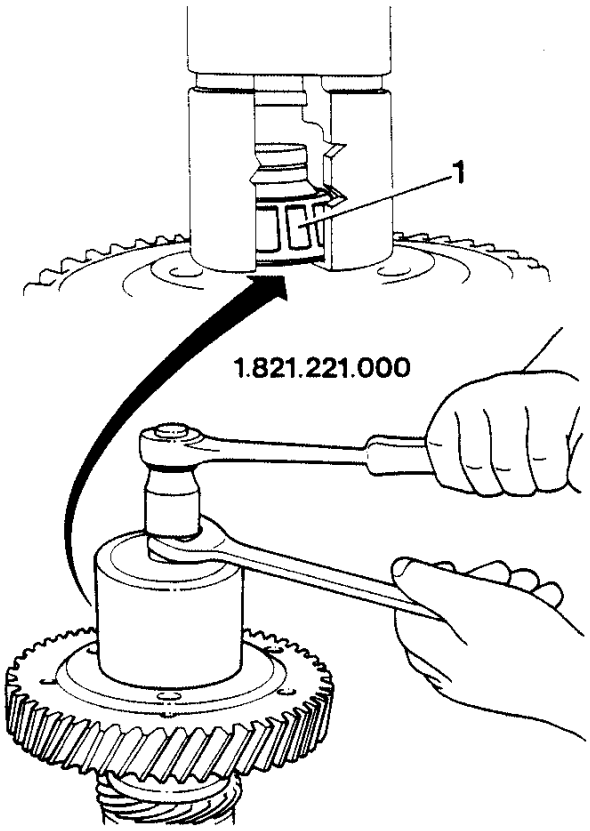


NOTE: Before final refitting measure the thickness of the shim ring between the seal cover and the gearbox-distributor support casing (see: DISTRIBUTOR ADJUSTMENT).

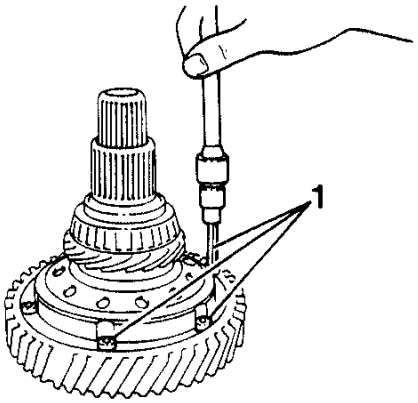
Refit by reversing the procedure followed for removal ensuring that the screws are tightened to the correct torque.

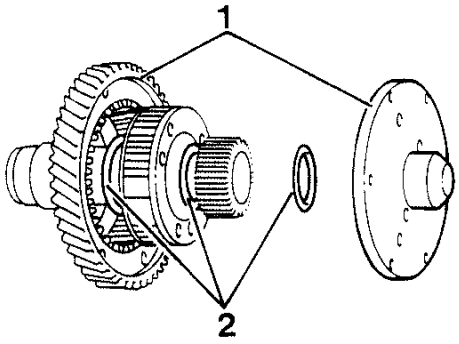
DISASSEMBLY

1. Using puller No. 1.821.221.000, remove the inner bearing race on the ring gear side.

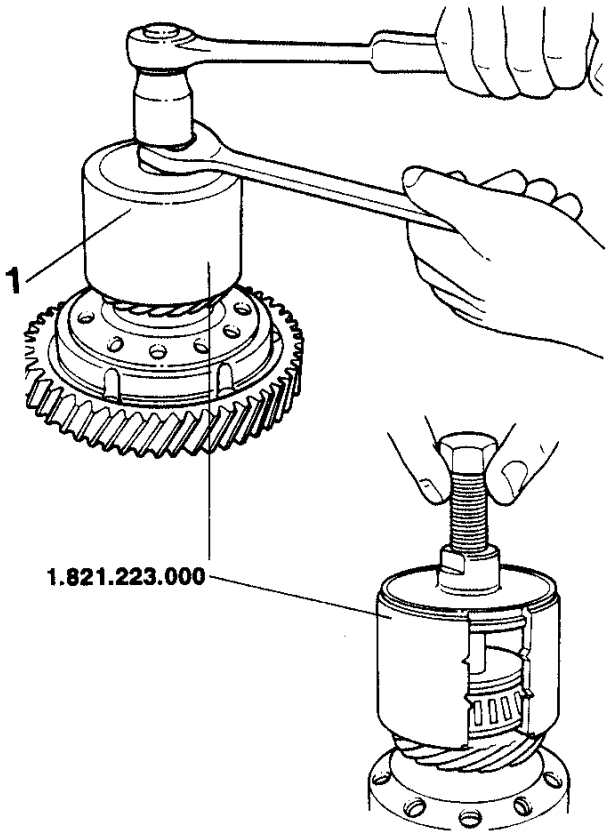


1. Loosen the six screws and disassemble the distributor casing halves.
2. Remove the shim rings, the solar gear and the side pinion casing.

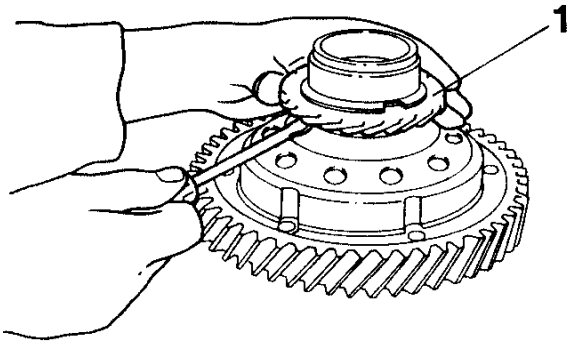




1. Using puller No. 1.821.223.000, remove the inner bearing race on the odometer side.

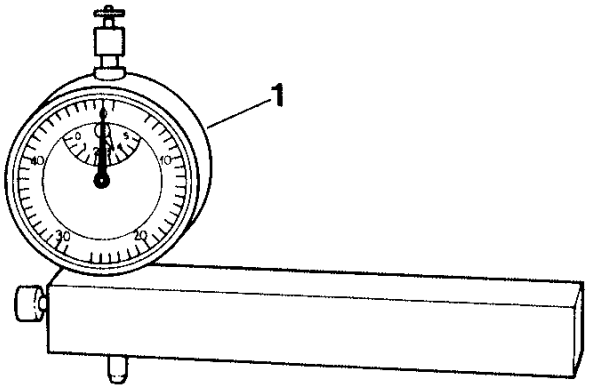


1. Remove the Teflon odometer gear.

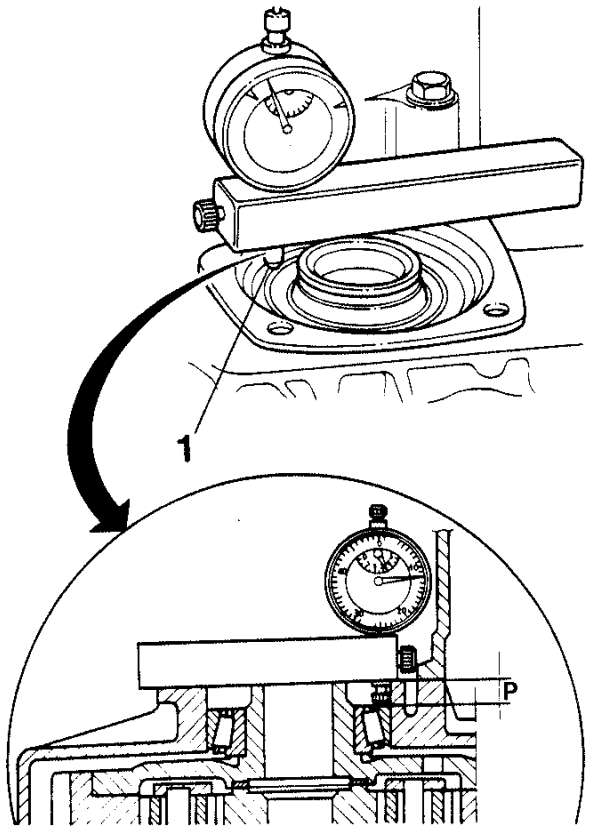


DISTRIBUTOR ADJUSTMENT

1. Install a centesimal dial gauge on the support as illustrated.



1. Measure distance "P" between the resting plane of the seal cover and the outer race of the roller bearing.

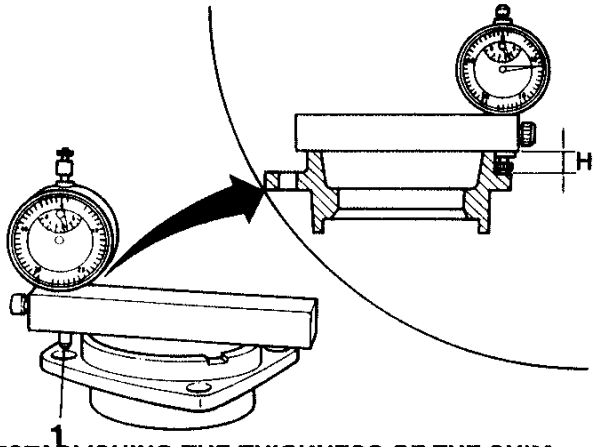


1. Measure the distance "H" on the seal cover between the mating surface of the gearbox-distributor support and the mating surface of the shim ring.

– Measure thickness "S" of the shim ring by applying the following formula:

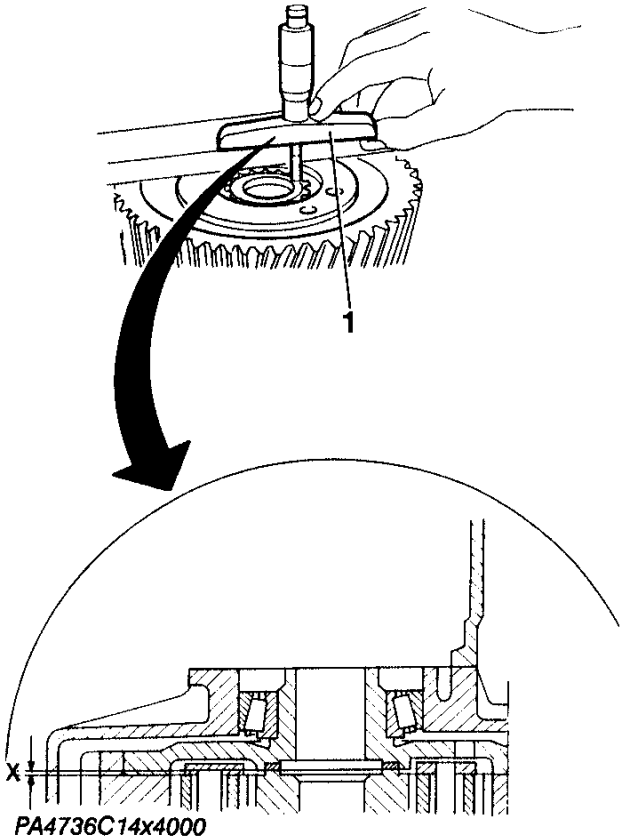
$$S = P - H + G$$

where "G" is the specified clearance = 0.12 mm.



ESTABLISHING THE THICKNESS OF THE SHIM RING BETWEEN THE CASING HALF AND SOLAR

1. Using a centesimal dial gauge on the ring gear side of the casing half, measure the distance "X" between the mating surfaces of the casing halves and the head of the solar gear.

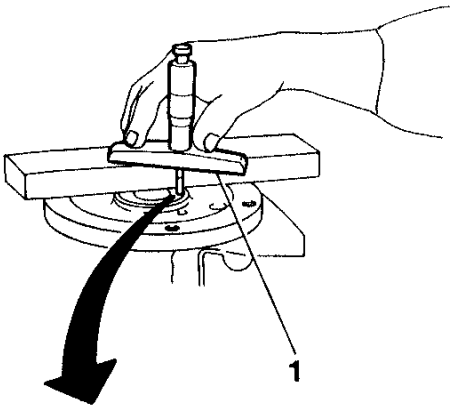


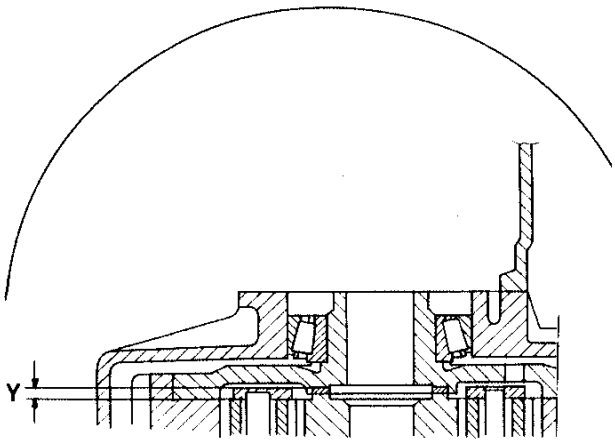
1. Using a centesimal dial gauge on the differential side of the casing half, measure distance "Y" between the mating surfaces of the casing half and the seating of the thrust ring.

– Measure the thickness of the shim ring by applying the following formula:

$$S = Y - X - G$$

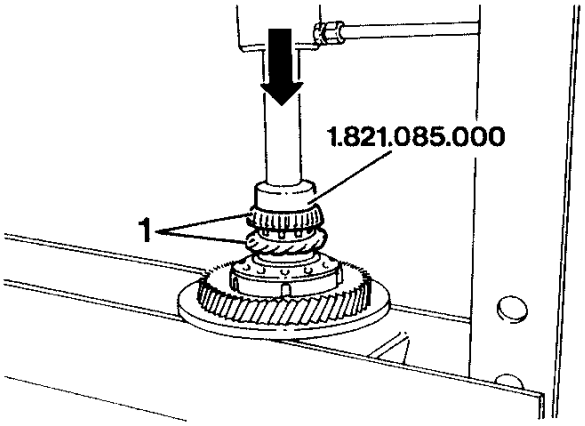
where "G" is the specified clearance:



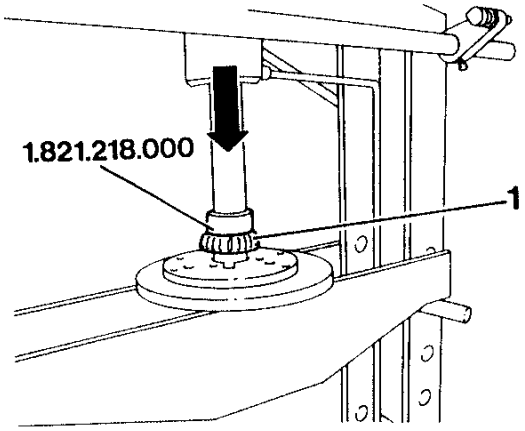


REASSEMBLY

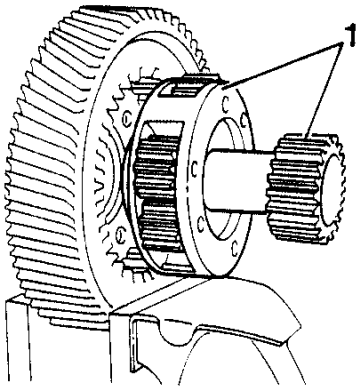
1. Insert the odometer gear and using the part of inserting tool No. 1.821.085.000 shown and working under a press, refit the inner race of the bearing on the odometer gear side.



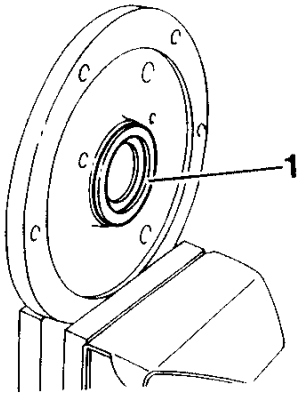
1. Using the illustrated part of the inserting tool No. 1.821.218.000 refit the inner race of the bearing on the ring gear side.



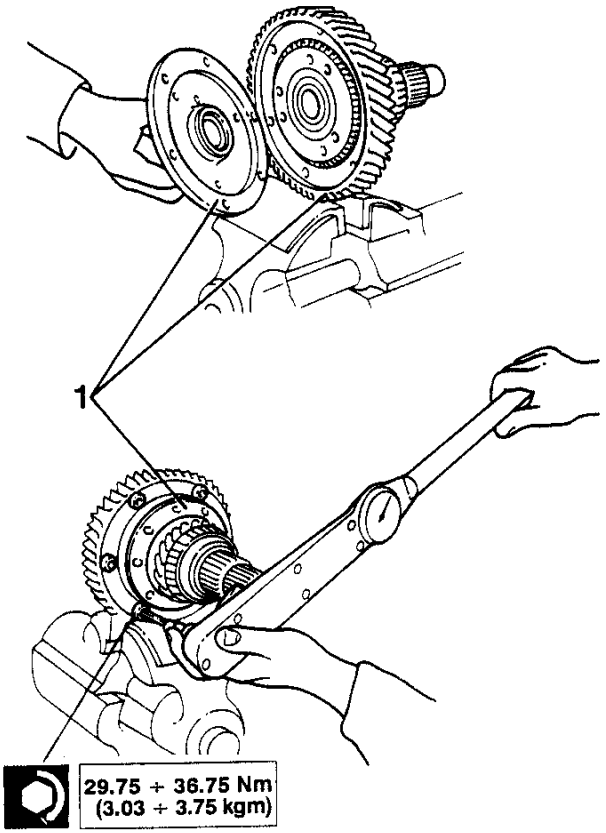
1. Working with a vice, insert the side pinion casing and the solare in the casing half on the ring gear side.



1. On the ring gear side of the casing half, install the shim ring (measured during the adjustment procedure) into its seating.



– Refit the casing halves together and tighten the screws to the correct torque.



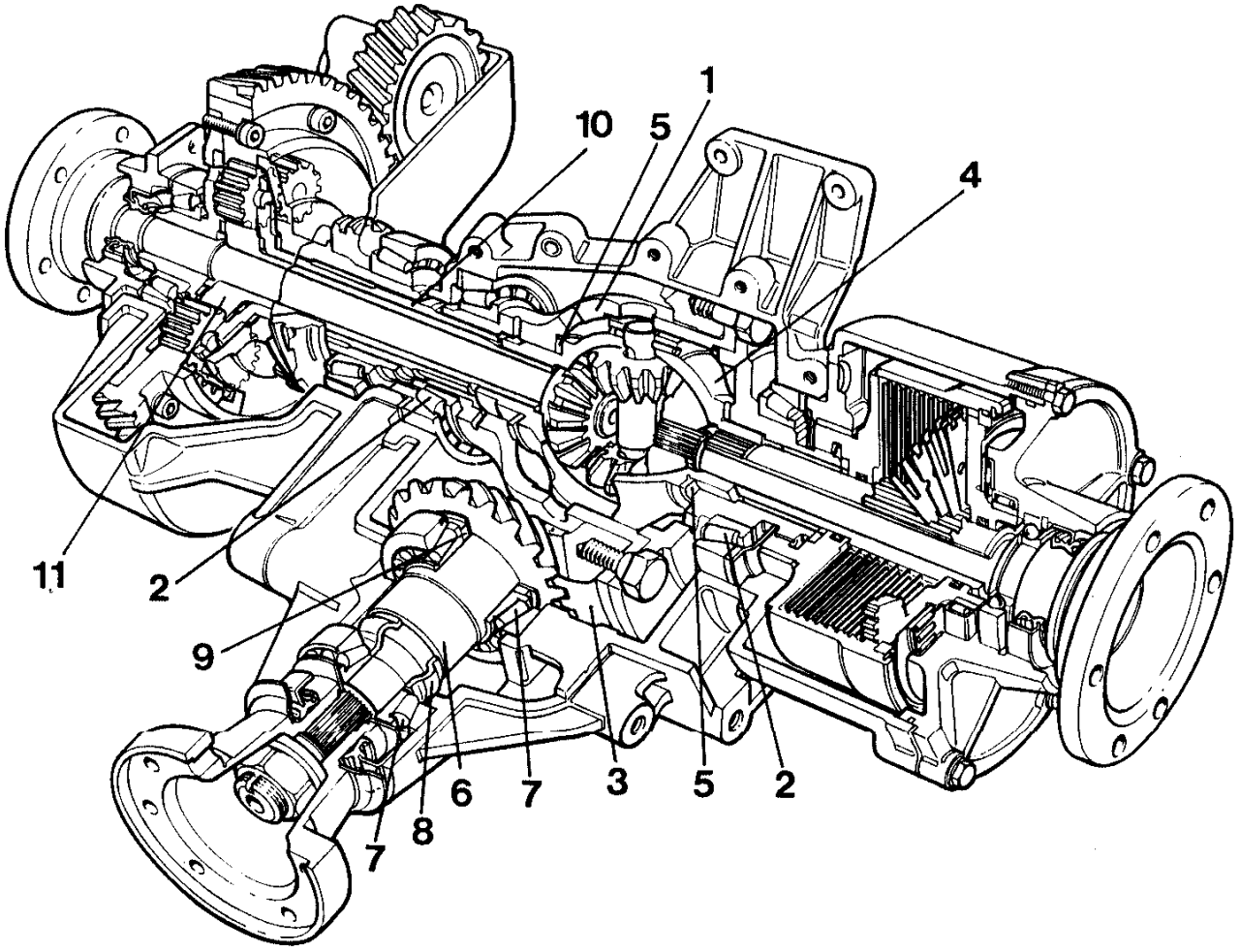
DIFFERENTIAL AND TRANSMISSION

DESCRIPTION

The front differential-transmission unit is basically composed of the following elements:

- an outer casing (1), supported at the ends by two tapered roller bearings (2), onto which a ring bevel gear has been machined (3);
- a traditional differential (4) serving as a front differential and fitted with shim rings (5) for the pre-loading of the tapered roller bearings of the outer casing;
- a tapered pinion (6) supported at the ends by two tapered roller bearings (7) fitted with a flexible spacer (8) and shim ring (9) for the adjustment of the clearance between pinion and ring gear;

it is characterized by the following functional solutions: the ring bevel gear (3) which normally forms one piece with the side pinion casing transmits the drive received from the secondary gearbox gear to the casing is in this case integral with the hollow shaft (10) of the torque distributor and has the task of transmitting drive to the rear axle by way of the tapered pinion (6). The side pinion casing is in this case rotated by the hollow shaft of the solar pinion (11) of the torque distributor.

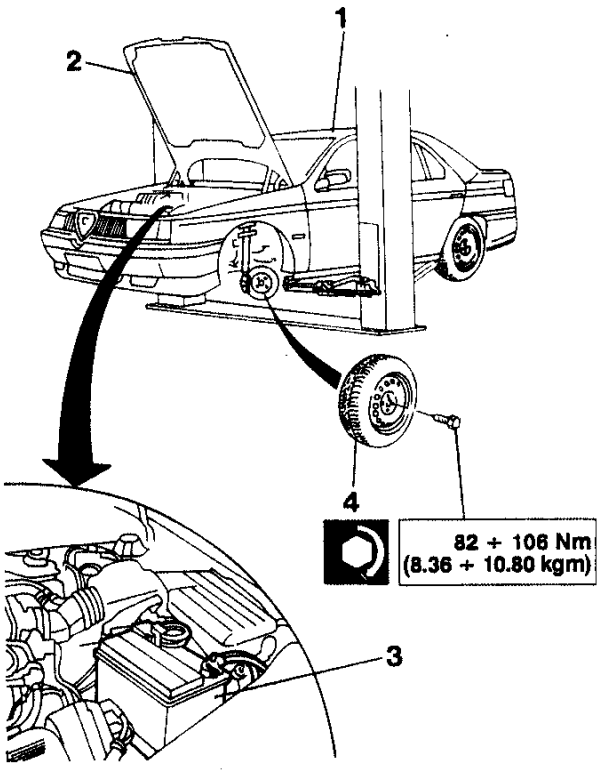


1. Outer casing of the front differential-transmission unit
2. Tapered roller bearings
3. Ring bevel gear
4. Traditional differential
5. Shim rings
6. Tapered pinion
7. Tapered roller bearings
8. Flexible spacer
9. Shim ring
10. Hollow shaft of torque distributor
11. Solar pinion of the torque distributor

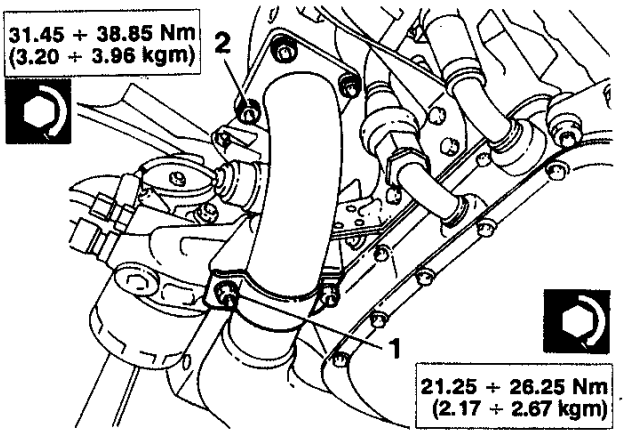
REMOVAL AND REFITTING

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

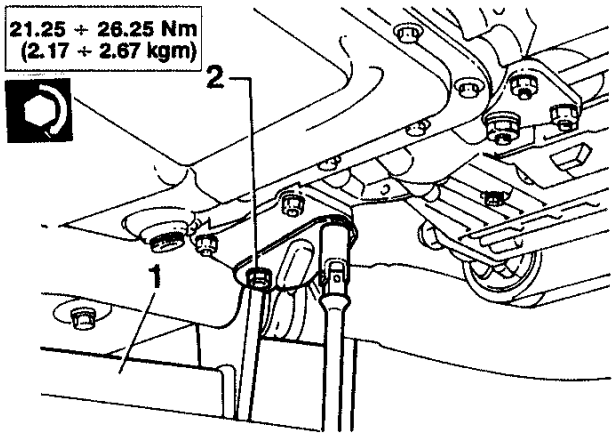
WARNING:
Protect the areas around the engine compartment with soft material to prevent the bodywork from being accidentally damaged



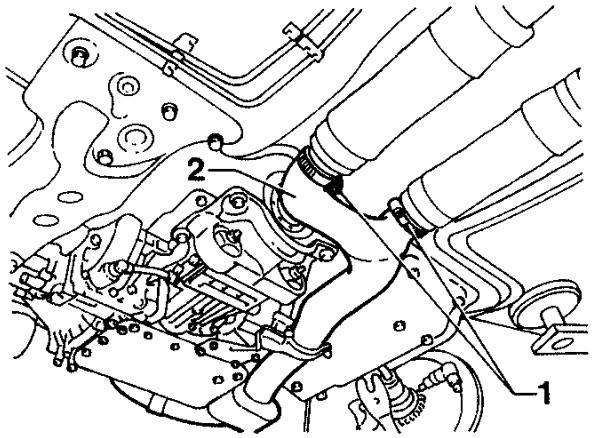
- Raise the vehicle.
1. Loosen the nuts securing the bracket supporting the exhaust pipe to the bracket connecting it to the engine.
2. Loosen the nuts securing pipe to the exhaust manifold.



1. Using a suitable tool and a hydraulic jack, support the front section of the exhaust pipe.
2. Loosen the nuts securing the exhaust pipe support bracket to the differential.

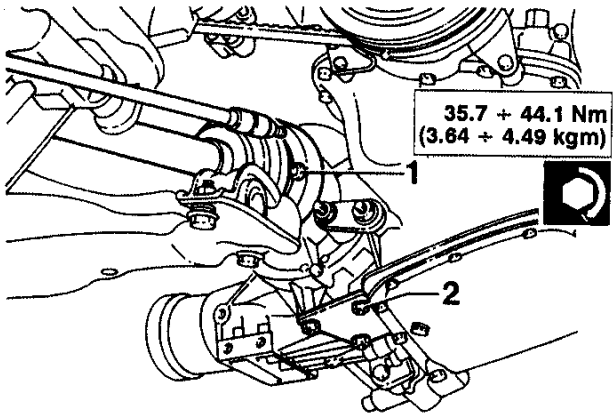


1. Loosen the clamps securing the front section of the exhaust pipe.
2. Lower the hydraulic jack and remove the front section of the exhaust pipe.



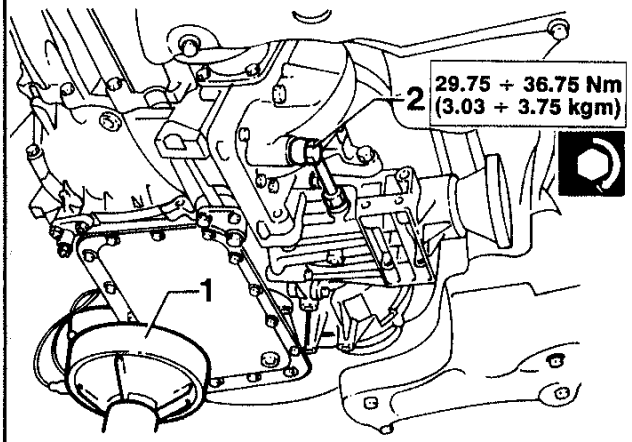
– Disconnect and remove the front section of the drive shaft (see: GR. 15 - DRIVE SHAFT - Removal and refitting).

1. Loosen the screws securing the right-hand drive shaft to the differential flange and disconnect the drive shaft.
2. Remove the bracket supporting the exhaust pipe.

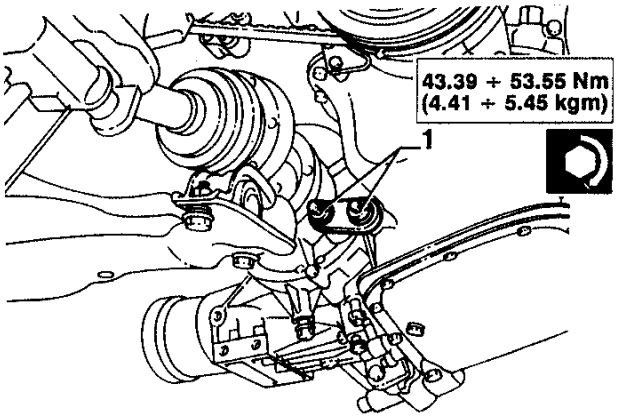


1. Using a hydraulic jack, support the engine.
2. Unscrew the connection of the oil delivery pipe to the pinion support and drain off the differential oil into a suitable container.

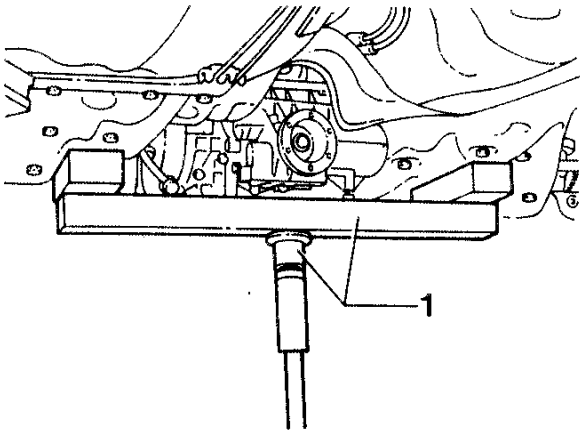
WARNING:
When refitting refill the front differential-transmission unit with the specified oil (see: TECHNICAL CHARACTERISTICS AND SPECIFICATIONS - GENERAL SPECIFICATIONS - Fluids and lubricants).



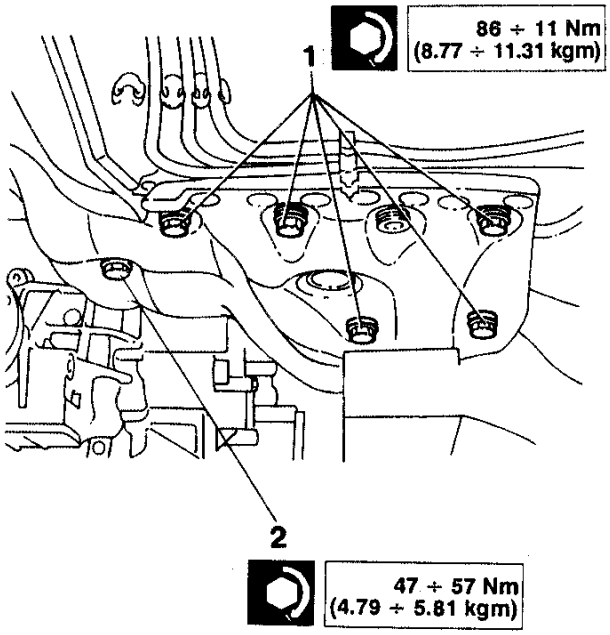
1. Loosen the nuts and remove the tie-rod between the differential and the engine sump.



1. Using a hydraulic jack and a suitable wooden support, take the weight of the front crossmember.

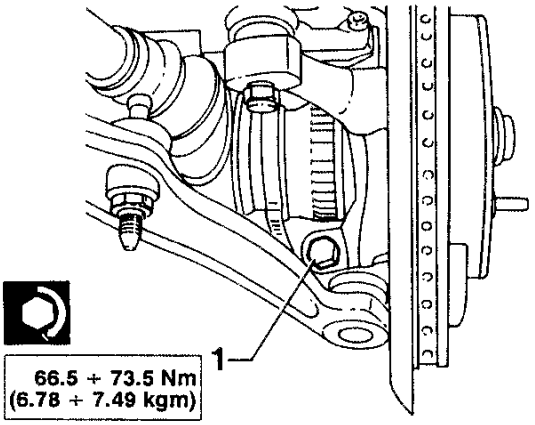


1. Loosen the screws securing the front crossmember to the body.
2. Loosen the screws securing the steering box to the front crossmember.

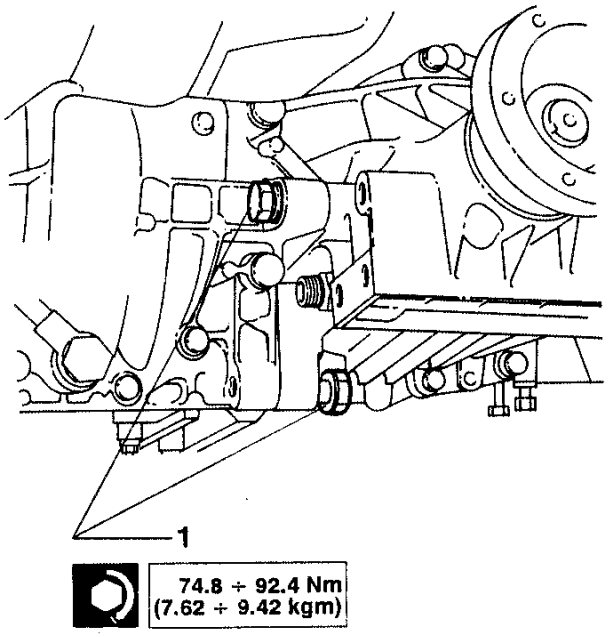


1. Loosen and remove the bolts securing the swinging arms of the suspension to the wheel support.

– Lower the jack and remove the front crossmember.

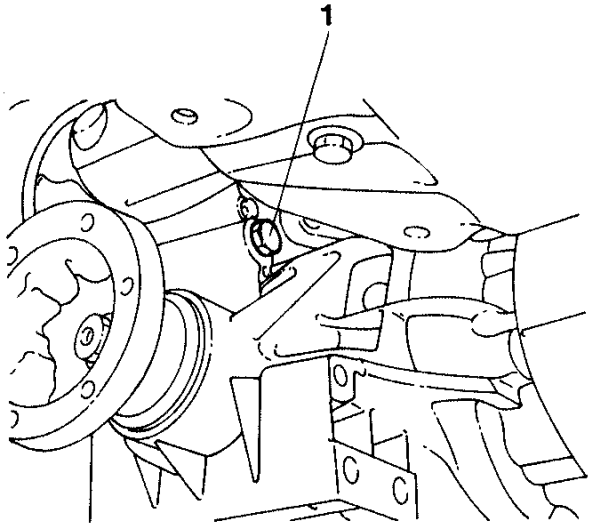


1. Loosen the lower screws securing the differential unit to the torque distributor.



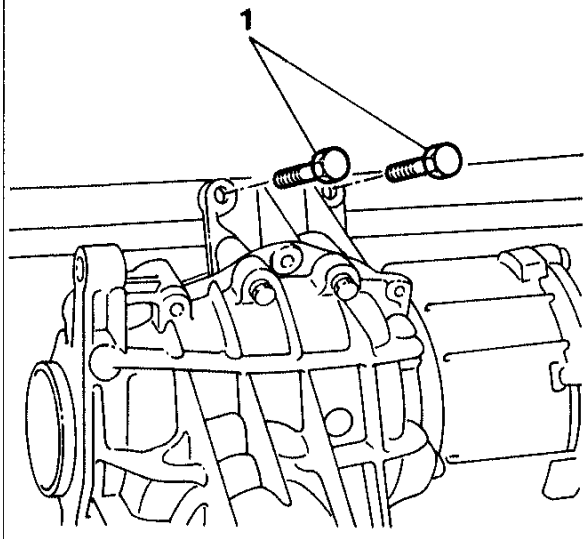
1. Loosen the upper screw securing the differential unit to the torque distributor.

74.8 ÷ 92.4 Nm (7.62 ÷ 9.42 kgm)

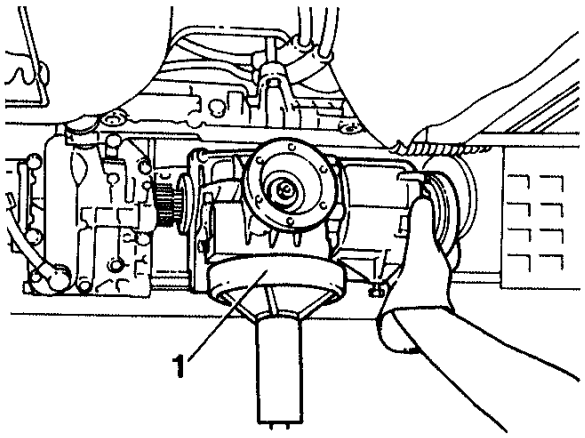


1. Loosen the screws securing the differential unit to the engine block.

21.25 ÷ 26.25 Nm (2.17 ÷ 2.67 kgm)



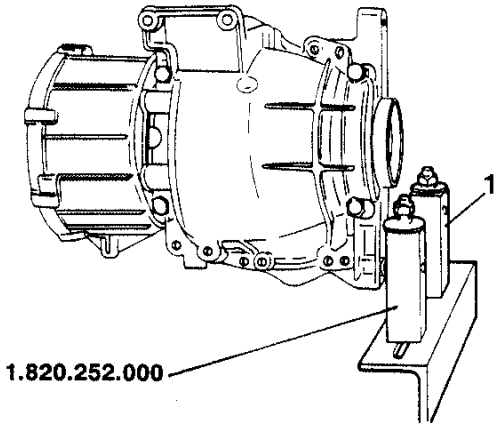
1. Using a hydraulic jack, move the differential unit to one side until the hollow shaft can be separated from the torque distributor. Remove the differential unit.



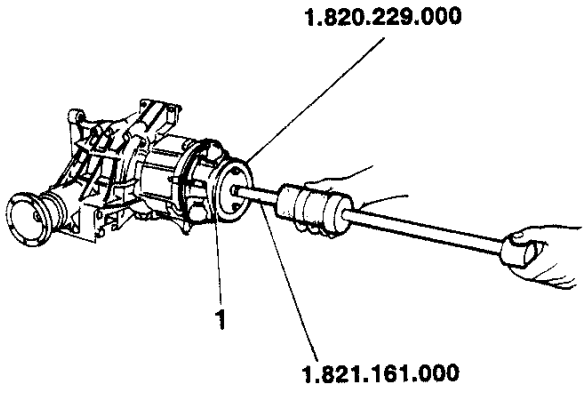
Refit by reversing the procedure followed for removal and tighten the nuts and screws to the specified torque.

DISASSEMBLY OF THE FRONT DIFFERENTIAL AND TRANSMISSION ASSEMBLY

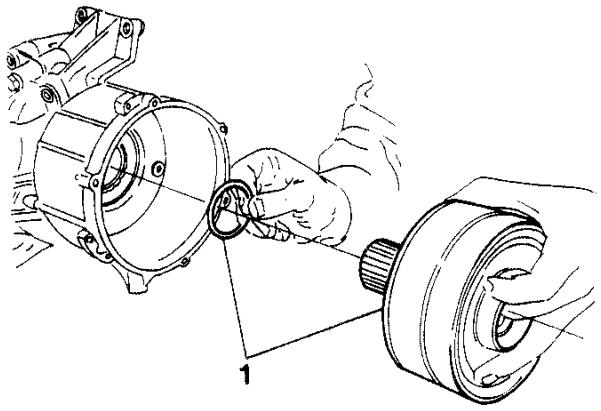
1. Position the front differential assembly on support No. 1.820.252.000 and secure it in a vice.



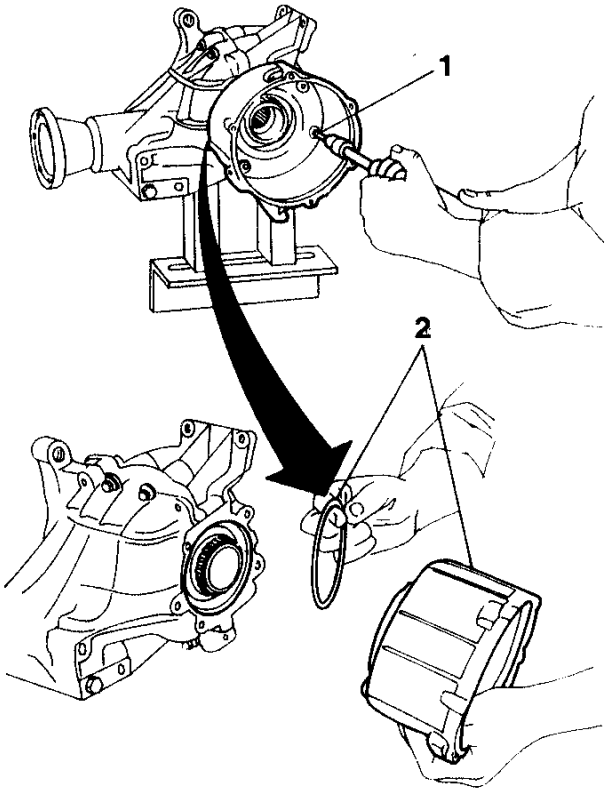
1. Loosen the screws securing the cover of the viscous coupling and remove it together with the intermediate shaft using tool No. 1.821.161.000 fixed to the pulley of the drive shaft through flange No. 1.820.229.000.



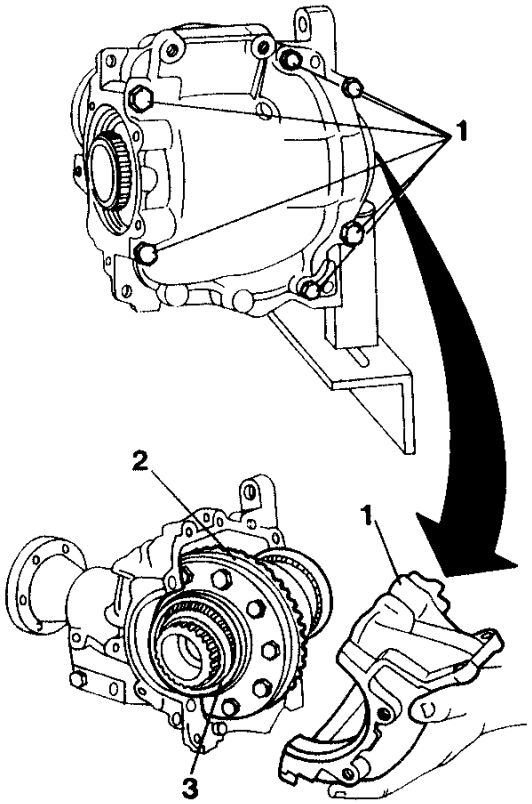
1. Remove the viscous coupling together with the shim ring.



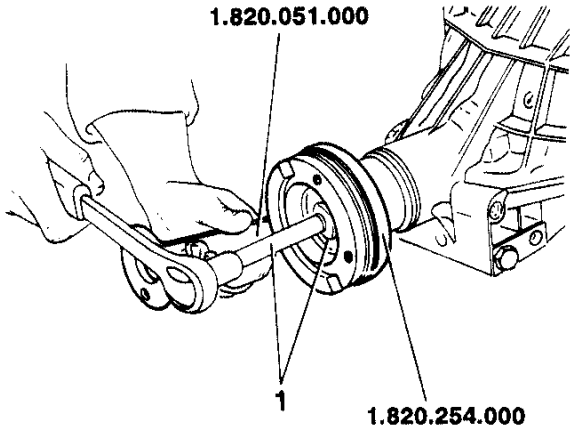
1. Loosen the screws and remove the outer casing of the viscous coupling together with the three O-rings.
2. Withdraw the bowl and shim ring.



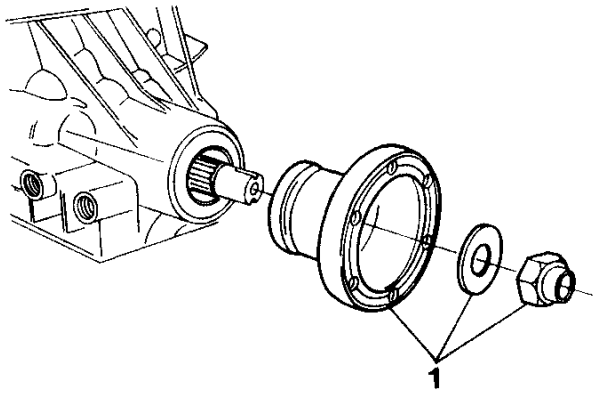
1. Loosen the ten screws and remove the front differential assembly together with the shim ring.
2. Remove the differential unit.
3. Withdraw the outer races of the tapered roller bearings.



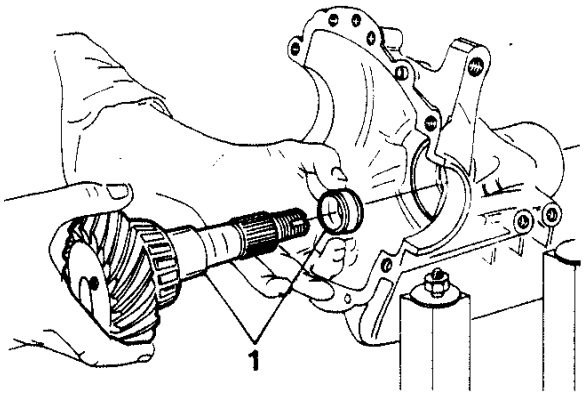
1. Loosen the pinion retaining nut by installing flange No. 1.820.254.000 on the pulley and use spanner No. 1.820.051.000 to lock the pinion.



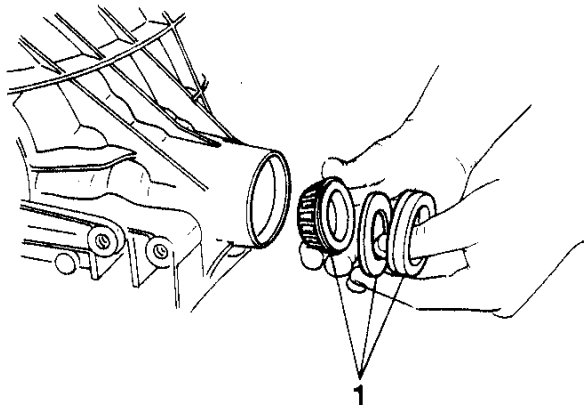
1. Remove the nut, pulley and washer.



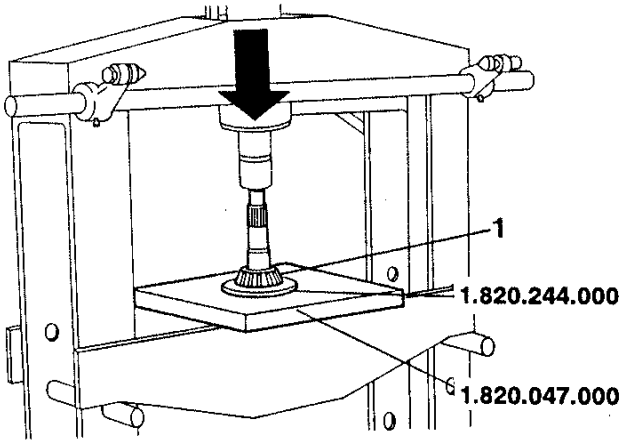
1. Remove the pinion and the pre-load ring from the bearings working from the inner side of the differential casing.



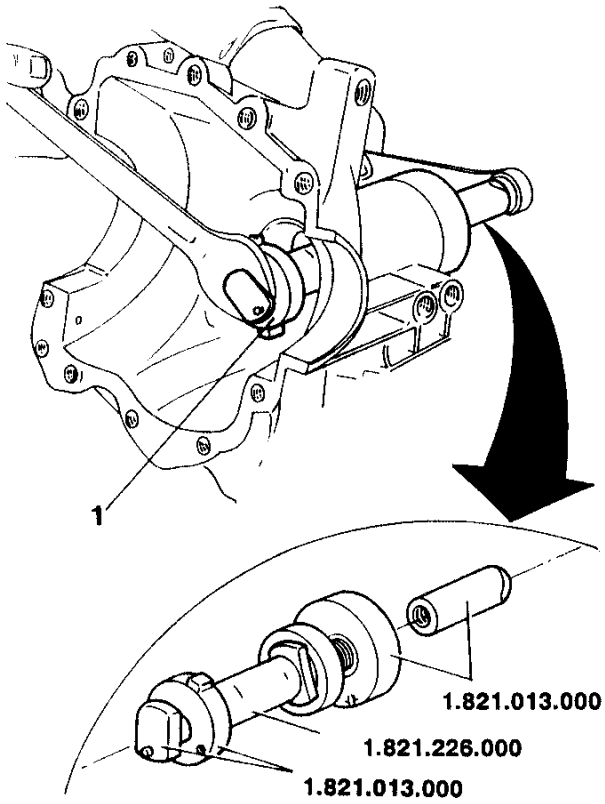
1. Remove the oil seal, washer and bearing, working from the outer side of the casing.



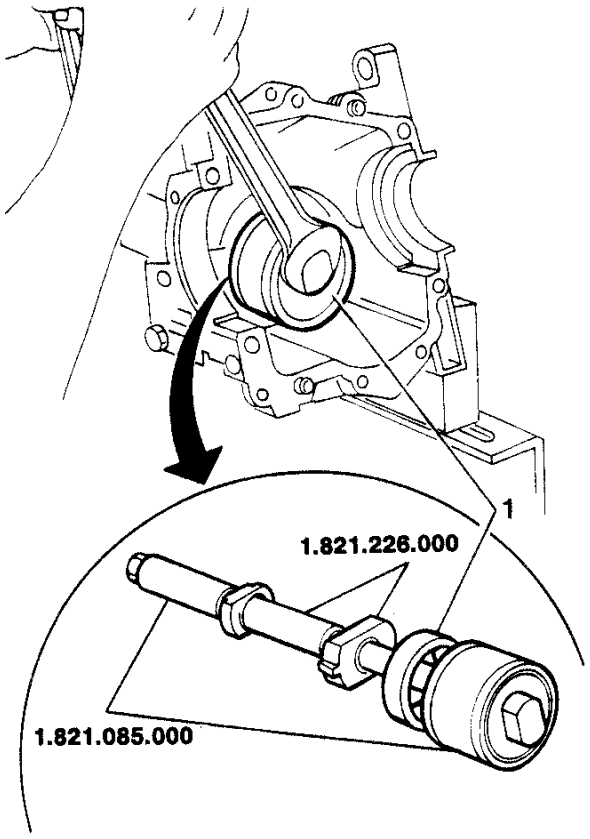
1. Remove the shim and the inner race of the bearing installed on the pinion using a press in conjunction with plate No.1.820.047.000 and half-rings No. 1.820.244.000.



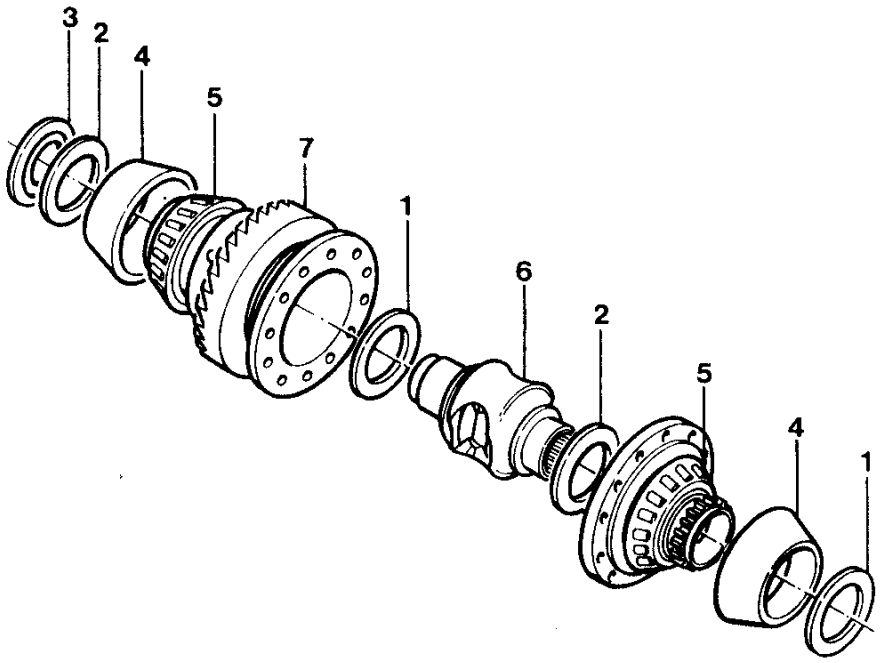
1. Remove the outer race of the tapered roller bearing from the outer side of the pinion using the illustrated parts of puller No. 1.821.013.000 and tool No. 1.821.226.000.



1. Using puller No. 1.821.085.000 in conjunction with the illustrated part of tool No. 1.821.226.000, remove the outer race of the inner pinion bearing.

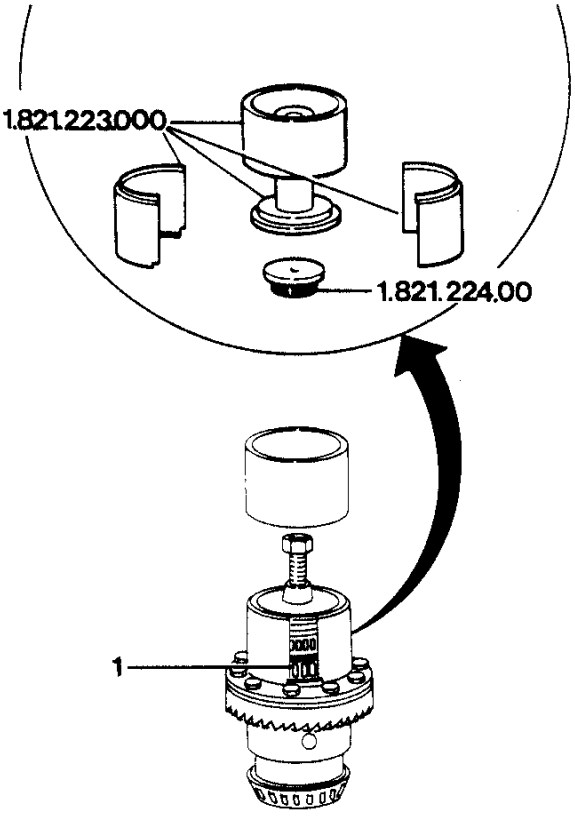


DISASSEMBLY OF THE DIFFERENTIAL UNIT

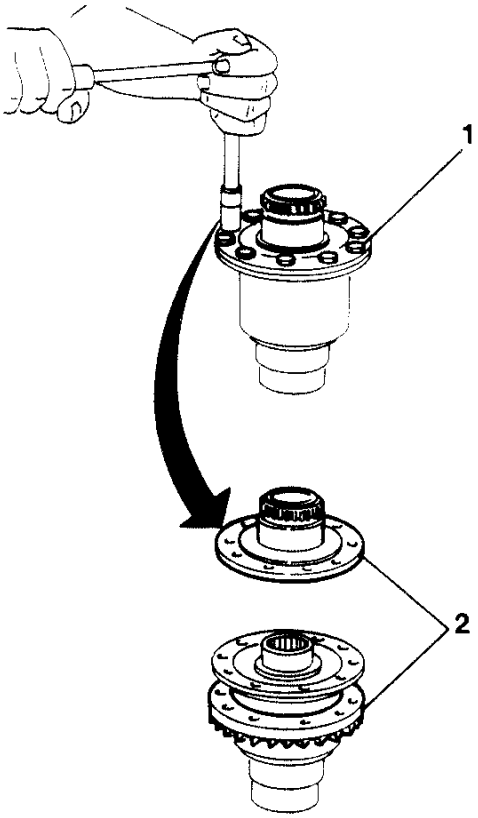


1. Thrust rings
2. Shim rings
3. Bowl
4. Bearing outer races
5. Bearing inner races
6. Side pinion casing
7. Tapered gear

1. Using tool No. 1.821.223.000 (shown in the illustration) in conjunction with the rotation flange No. 1.821.224.000, remove the the inner races of the tapered roller bearings of the differential unit.

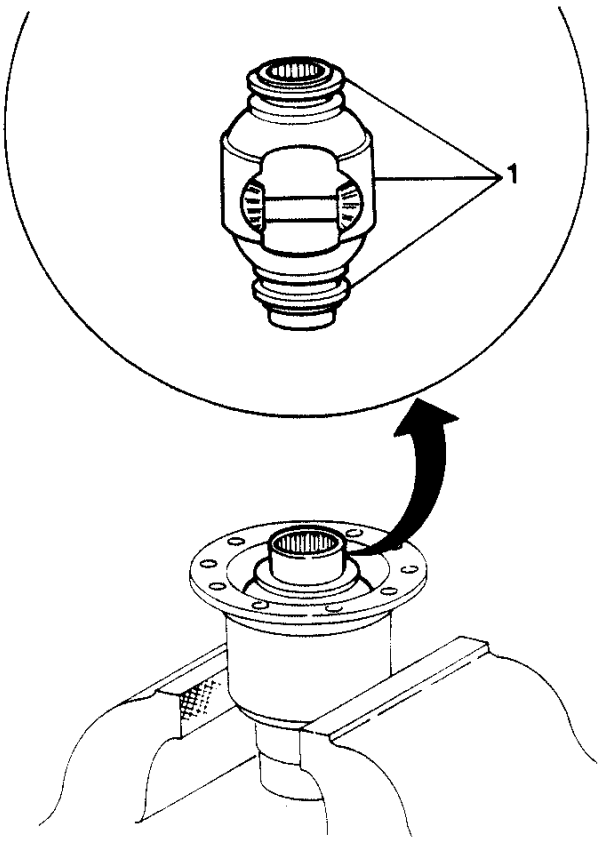


1. Loosen the ten screws securing the ring gear to the differential unit.
2. Remove the ring gear and the cover.

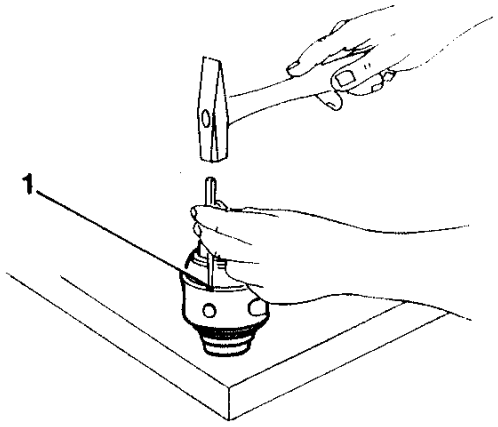


DISASSEMBLY AND REASSEMBLY OF THE PINION CASING

1. Remove the side pinion casing and the shim rings from the differential unit.



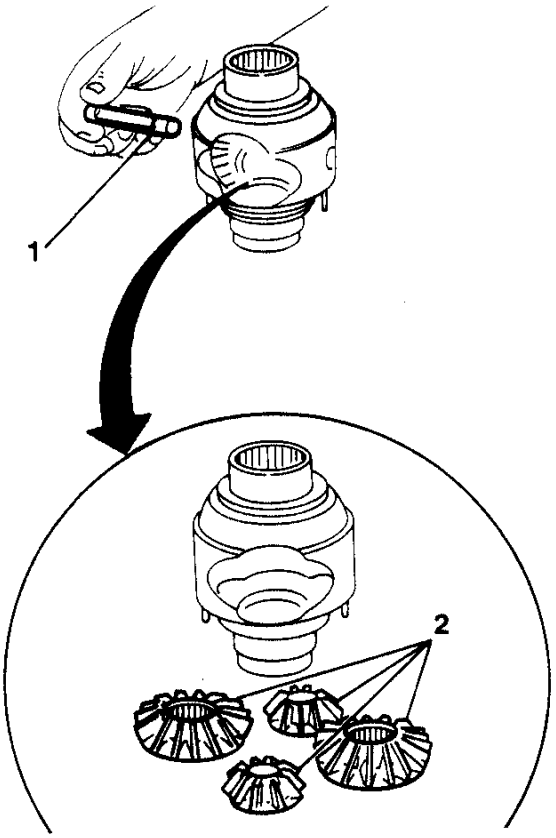
1. Remove the pin locking the side pinion pin.



1. Withdraw the pinion shaft pin.
2. Remove the crown wheels and side pinions.

NOTE: The crown wheels are installed in the side pinion casing without shim rings and as a consequence it is not possible to adjust the clearance between side pinions and crown wheels.

WARNING:
The crown wheels and side pinions must not be worn or chipped on the working surfaces and should be replaced if this type of damage is detected.



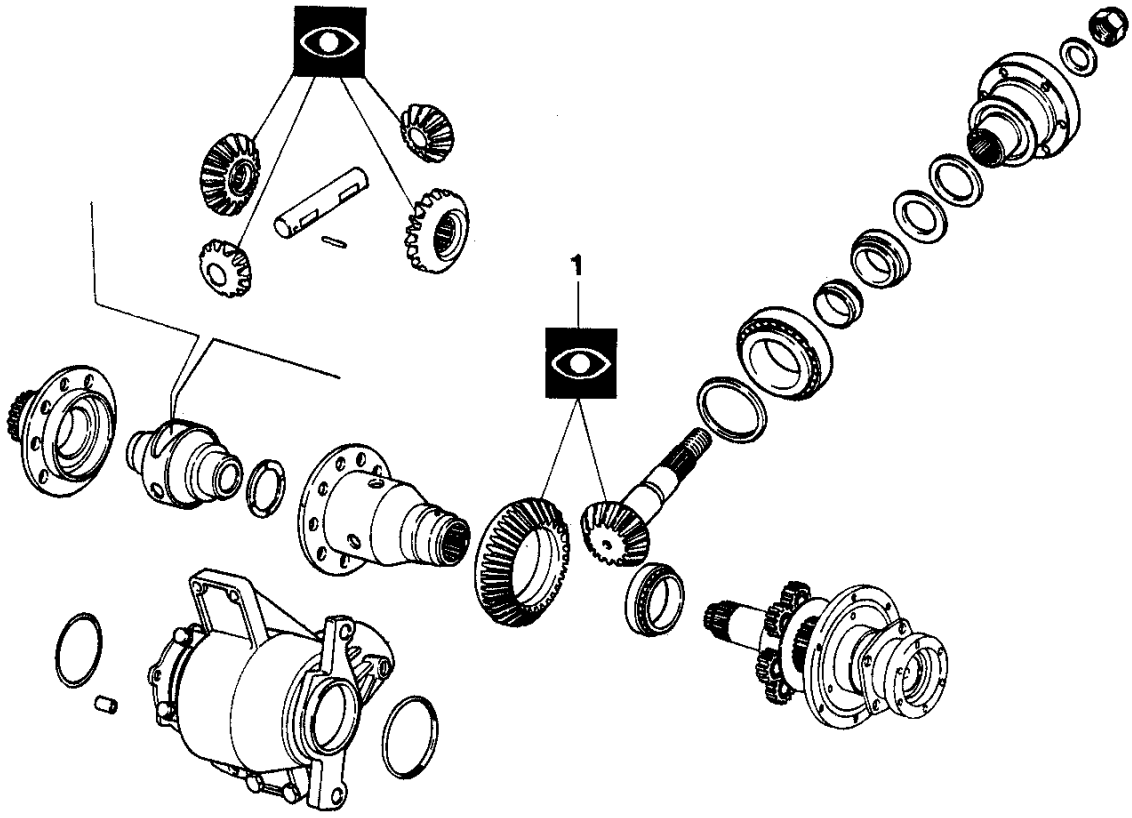
Refit the side pinion casing by reversing the procedure followed for removal and check that the crown wheels are coaxial.

CHECKS AND INSPECTIONS

The gears must not show signs of wear or chipping on their working surfaces.

1. If it is necessary to replace the ring gear ,replace the tapered pinion at the same time, or vice-versa.

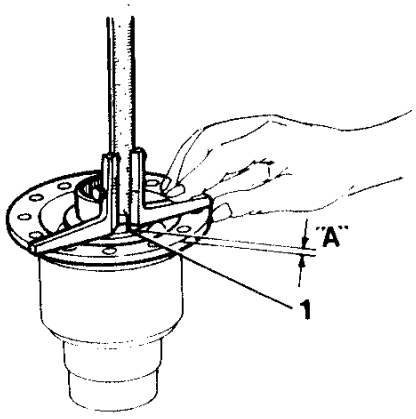
- The bearings must be replaced whenever they show signs of scoring, overheating or excessive wear.
- The casings must not show signs of cracking; the bearing seatings must not be worn or damaged.



REFITTING AND ADJUSTMENT OF THE DIFFERENTIAL UNIT

- Install a shim ring on the side pinion casing hub on the cover side of the differential unit. Then, install the side pinion casing into the differential unit casing.

1. Measure distance "A" from the plane of the outer casing of the differential unit to the upper plane of the side pinion casing using a depth gauge.

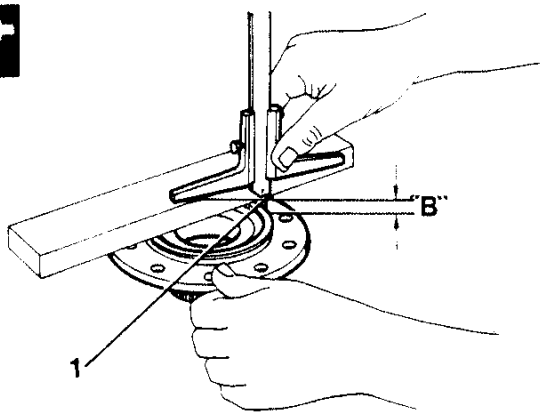


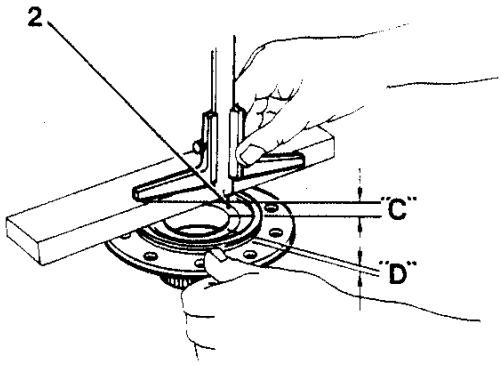
1. Position a rule of the differential unit cover. Measure distance "B" from the rule to the outer resting plane.
2. Measure distance "C" from the rule to the inner resting plane.

Calculate the distance "D" between the two planes using the following formula:

$$D = C - B$$

NOTE: "D" can be both negative and positive.

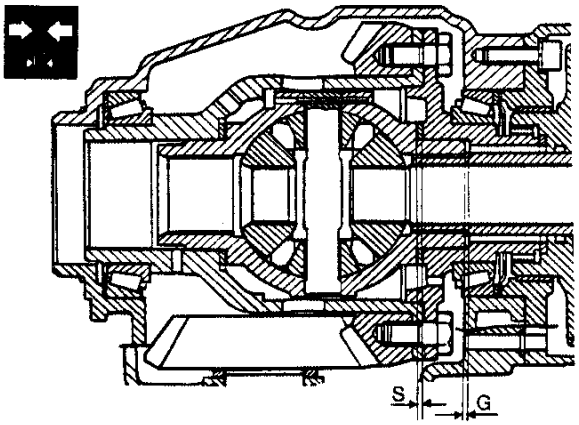




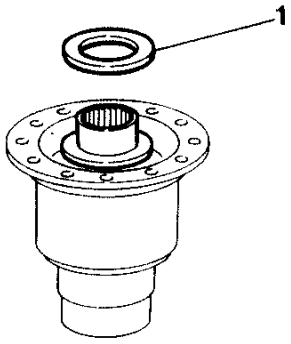
The thickness of the shim ring should be determined using the following formula:

$$S = A + (+D) - G = A + D - G$$
$$S = A + (-D) - G = A - D - G$$

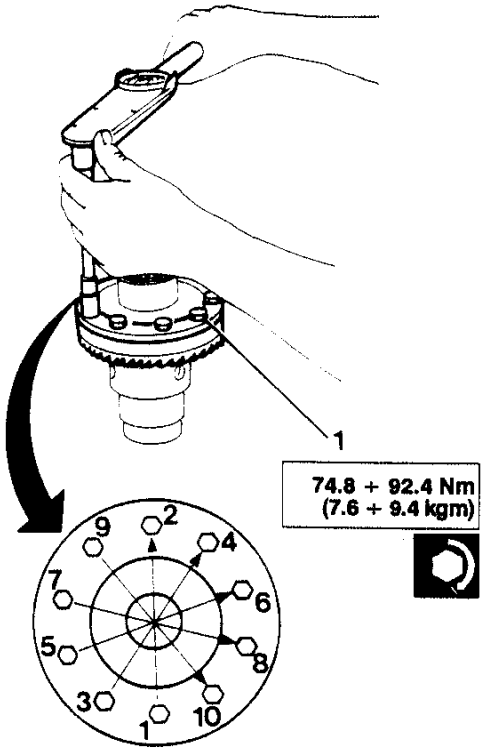
NOTE: Note that the specified clearance value,
$G = 0.425 \pm 0.325$ mm
has been calculated taking into account that the ideal thickness of the shim ring corresponds to 3 ± 0.05 mm.



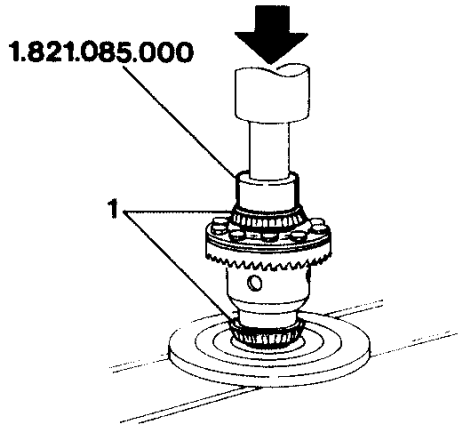
1. Install one of the previously measured shim rings on the upper side pinion casing.



1. Install the cover of the differential unit and the ring gear on the differential unit casing. Apply "Loctite 537" to the screws securing the ring gear and tighten them to the correct torque in three stages as illustrated.

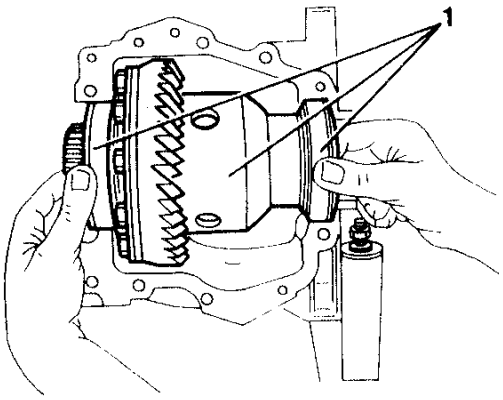


1. Install inner races of the bearings on the differential unit using a press and the part of the inserting tool No. 1.821.085.000 shown.



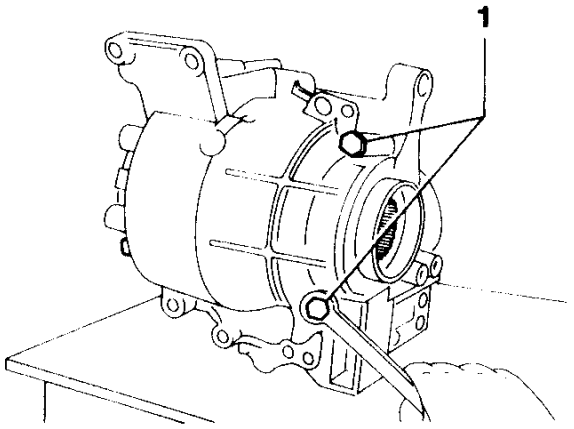
CHECKING THE ROLLING TORQUE OF THE RING BEVEL GEAR

1. Install the differential unit together with the outer races of the bearings and a shim ring into the differential casing.

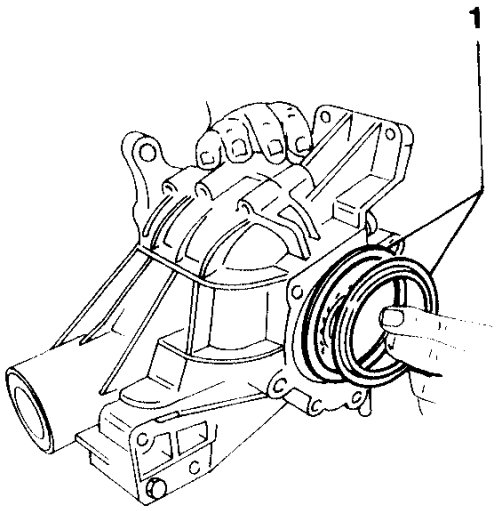


1. Tighten the four screws securing the front differential assembly.

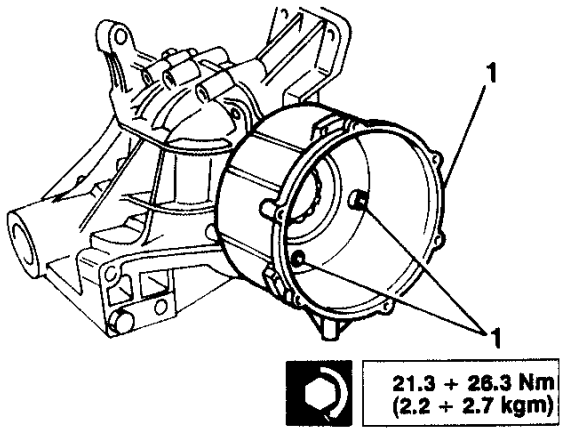
21.3 ÷ 26.3 Nm
(2.2 ÷ 2.7 kgm)



1. Install the shim ring a bowl on the differential unit.

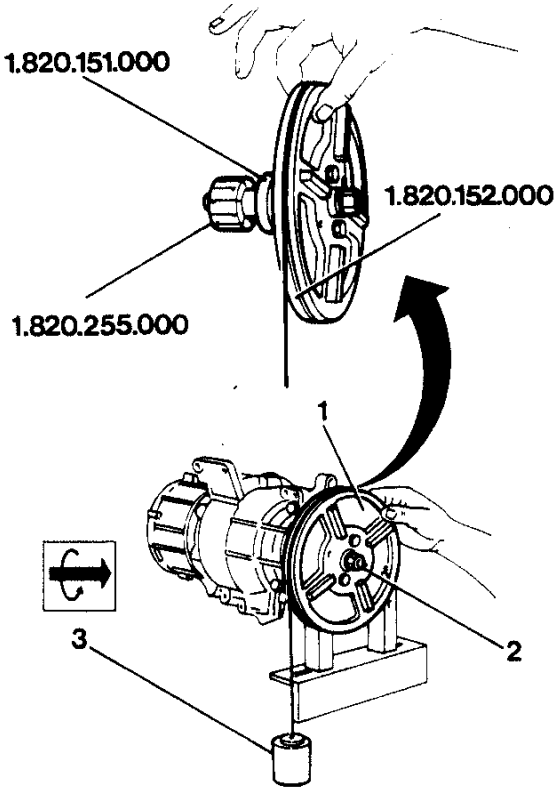


1. Install, without O-Rings, the outer casing of the Ferguson viscous coupling and tighten the retaining screws.



21.3 ÷ 26.3 Nm (2.2 ÷ 2.7 kgm)

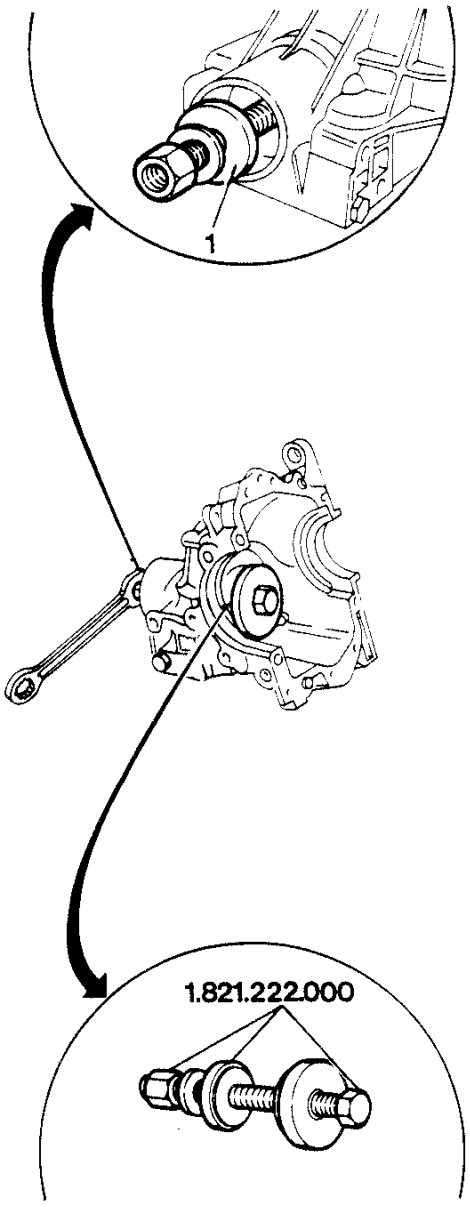
1. Install the rolling test device composed of disc No. 1.820.152.000, connection No. 1.820.151.000 and bushing No. 1.820.255.000, inside the larger grooved shaft connecting the epicycloidal gearing and differential.
2. Tighten the bolt securing the rolling device until the device turns with the differential.
- Acting on the disc, rotate the differential a few turns in both directions in order to settle the bearings.
- Wrap the weighted cable over the disc.
3. Hang a combination of weights No. 1.824.006.001, No. 1.824.006.002, No. 1.824.006.003, No. 1.824.006.004 and No. 1.824.006.005 from the cable to a total of between 1.2 - 1.5 kg and then check that they descend normally without stopping or pulling the disc too fast.



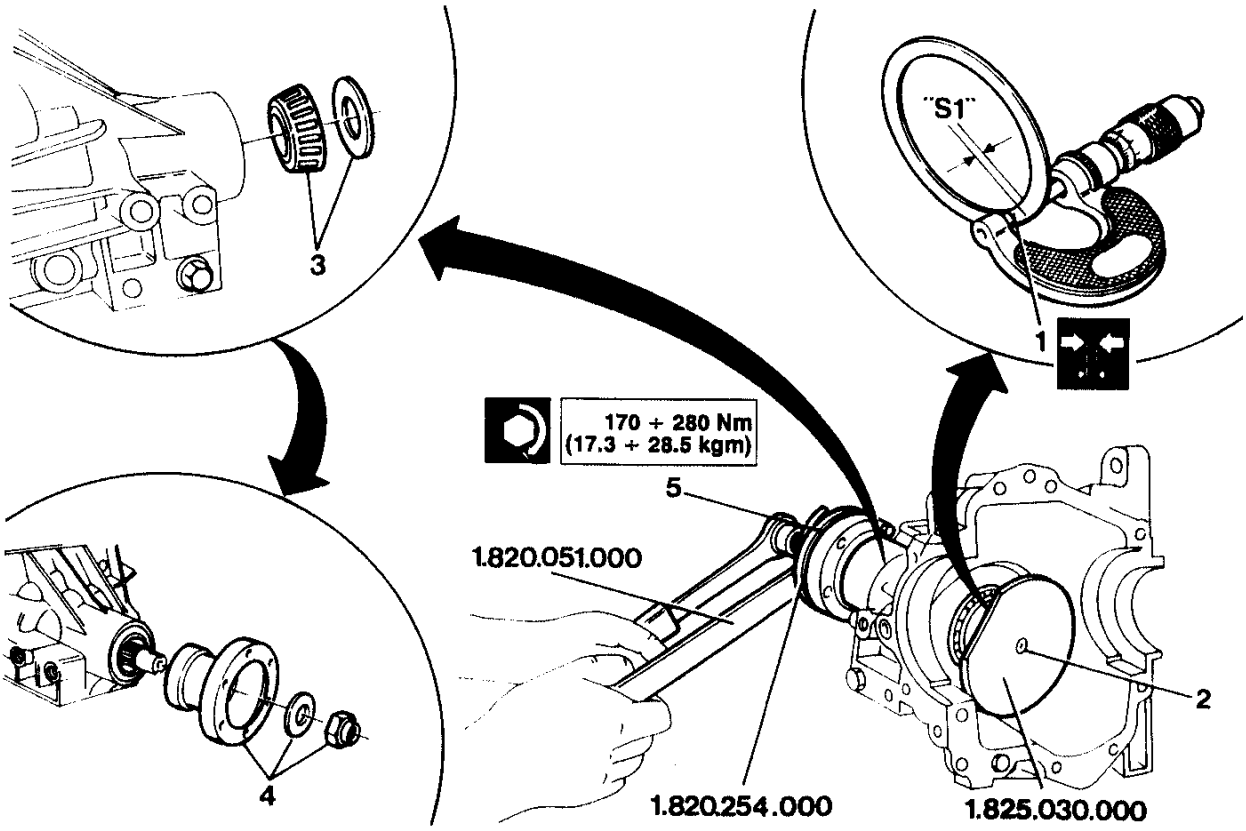
- If the weight does not descend in this way, it is necessary to disassemble the outer casing of the Ferguson viscous coupling and if the speed of descent is too fast, increase the thickness of the shim ring or reduce it if the speed is too slow.
- Repeat the procedure until the rolling torque of the ring bevel gear reaches the specified value.

ADJUSTING THE POSITION OF THE TAPERED PINION

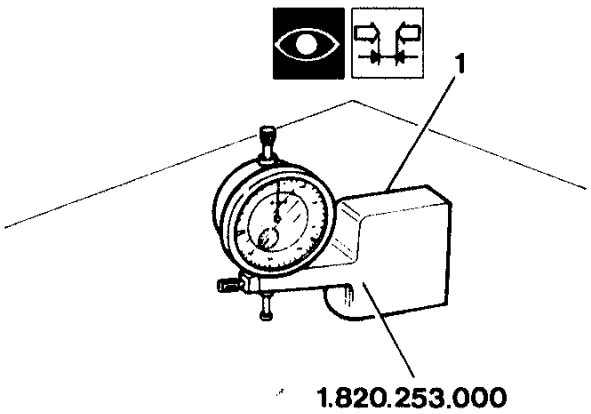
1. Using tool No. 1.821.222.000 (shown in the illustration), install the outer races of the pinion bearings beginning with the outer race of the outer bearing.



1. Measure thickness "S1" of the pinion shim ring using a micrometer.
– Install the shim ring and inner race of the inner pinion bearing on the false pinion No. 1.825.030.000.
2. Insert the false pinion in the differential/transmission assembly casing without the pre-loading ring.
3. Install the inner race of the outer bearing along with the washer.
4. Install the washer, pulley and nut.
5. Using flange No. 1.820.254.000, in conjunction with spanner No. 1.820.051.000, tighten the nut securing the tapered pinion, settle the bearings and close off until the specified rolling torque is reached (see: CHECKING ROLLING TORQUE OF THE TAPERED PINION).

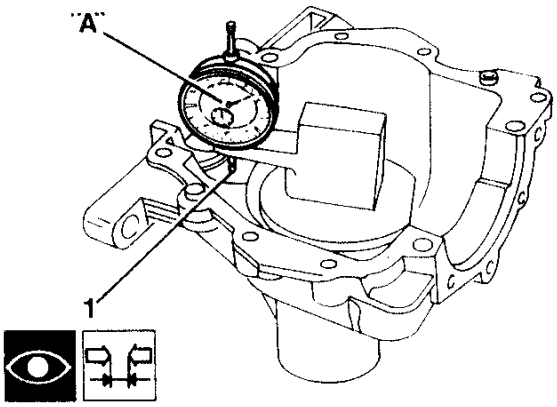


1. Install a dial gauge on support No. 1.820.253.000 and, using a reference plane, set the dial gauge to zero with a pre-load of 1 mm.



1. Position the dial gauge on the false pinion and, moving the probe along the arc of the bearing seating on the casing, measure the lowest point. Read value "A" on the dial gauge.

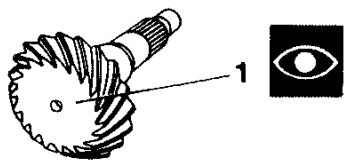
NOTE: Value "A" indicated on the dial gauge may be either negative or positive.



Read value "B" stamped on the tapered pinion by the manufacturer and note that "B" may be expressed in two ways:

I. centesimal value of the difference between the actual installation distance and that of the nominal distance (80.50 mm)
(examples: – 2; 0; +3).

II. Value of the actual installation distance in millimeters. (examples: 80.48 mm; 80.5 mm; 80.53 mm).
Obtain the expressed value, as in the first example, by subtracting 80.50 mm algebraically from this measurement
(examples: 80.48 - 80.50 = – 0.02 mm = 80.53 - 80.50 = + 0.03 mm =



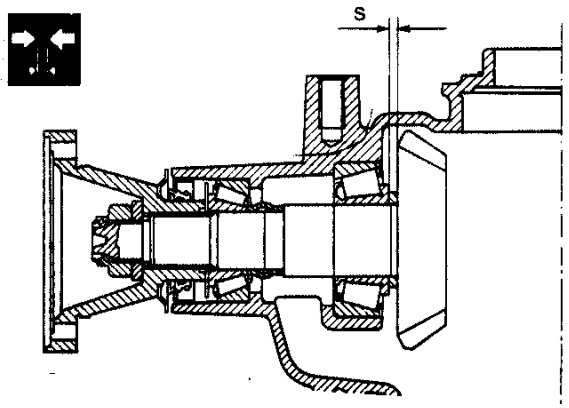
value "G" which must be added or subtracted on the basis of the sign and on the thickness of the shim ring "S_1", is measured by the following formula:

$$G = A - (+B) = A - B$$
$$G = A - (-B) = A + B$$

Example: either $A = -0.10$ (value read from the dial gauge)
or $B = -5$ (centesimal value written on the pinion)
or $S_1 = 2.80$ mm (value obtained by measuring the shim ring)
results in $G = -0.10$ mm $+ 0.05$ mm $= -0.05$ mm

It follows that in this case "G" is negative and its value must be subtracted from "S_1", so thickness "S" of the shim ring becomes:

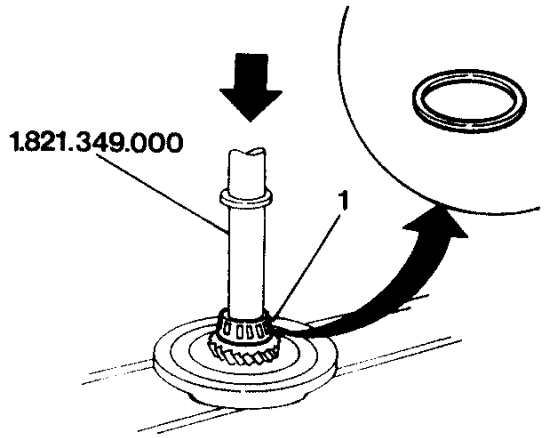
$$S = S_1 + G = 2.80 \text{ mm} + (-0.05) \text{ mm}$$
$$= (2.80 - 0.05) \text{ mm} = 2.75 \text{ mm}$$



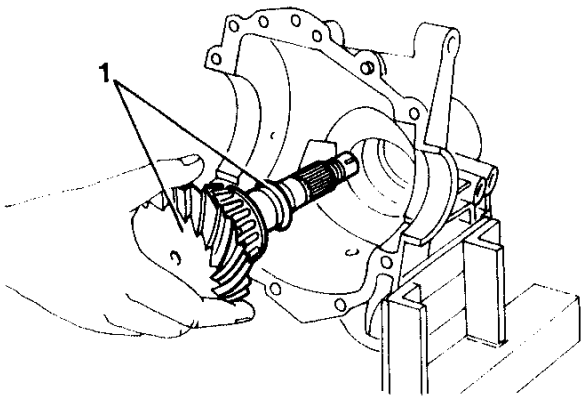
NOTE: If the value obtained in this way does not correspond to one of the shim rings supplied as a spare part, install the shim ring of the nearest size, either smaller or bigger.

– From the false pinion remove the inner race of the outer pinion bearing along with the shim ring.

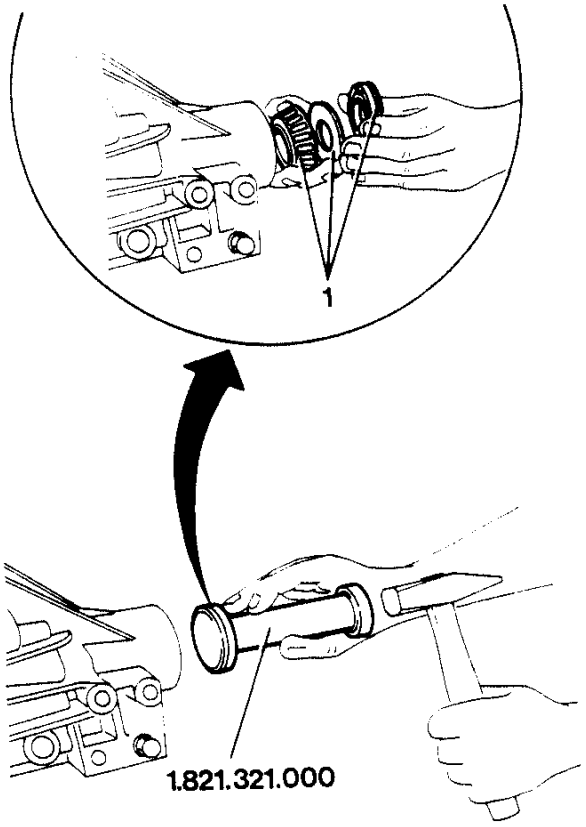
1. Install the shim ring with the thickness measured during the registration of the pinion. Using inserting tool No. 1.821.349.000 and a press, install the inner race of the outer bearing on the pinion.



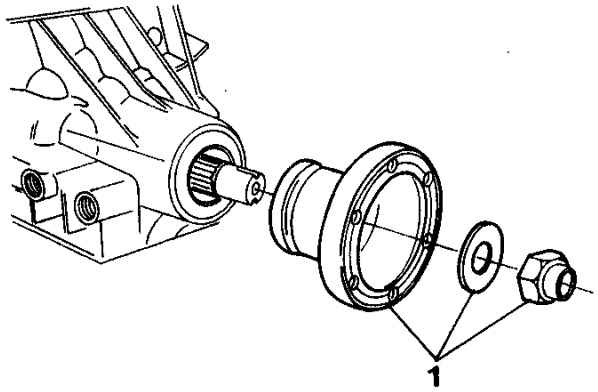
1. Install a new pre-load ring on the tapered pinion and insert the pinion into the differential casing.



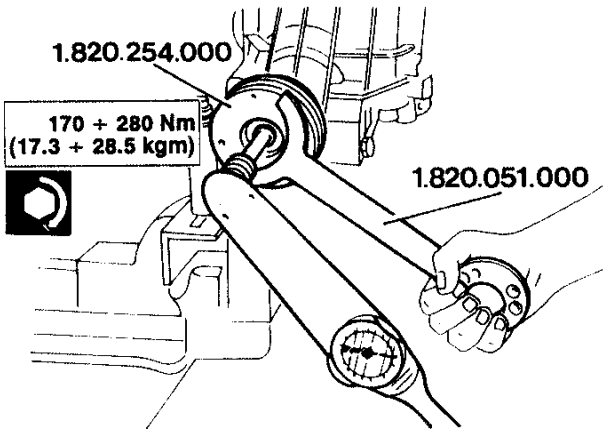
1. Reinstall the inner race of the outer pinion bearing, the washer and, using Inserting tool No. 1.821.321.000, insert the oil seal.



1. Refit the pulley, washer and position the new retaining nut.



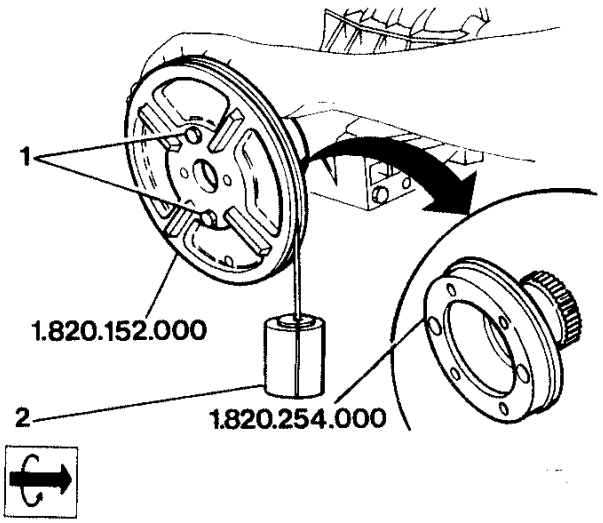
1. After installing flange No. 1.820.254.000 on the pinion pulley, use spanner No. 1.820.051.000 to lock the pulley and tighten the tapered pinion retaining nut to the minimum specified torque.



– Check the rolling torque (see: TAPERED PINION ROLLING TORQUE).

CHECKING ROLLING TORQUE OF THE TAPERED PINION

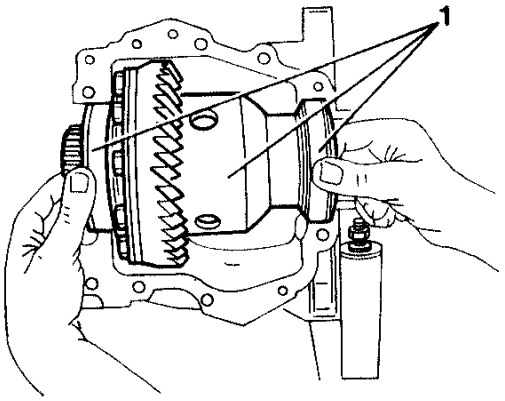
1. Using flange No. 1.820.254.000 installed on the pulley, secure disc No. 1.820.152.000 on the flange. Acting on the disc rotate the tapered pinion in both directions a few times to settle the bearings.
– Wrap the weighted cable over the disc.
2. Hang a combination of weights No. 1.824.006.001, No. 1.824.006.002, No. 1.824.006.003, No. 1.824.006.004 and No. 1.824.006.005 from the cable to a total of between 0.8 - 1.2 kg and check that they descend normally without stopping or pulling the disc too fast.



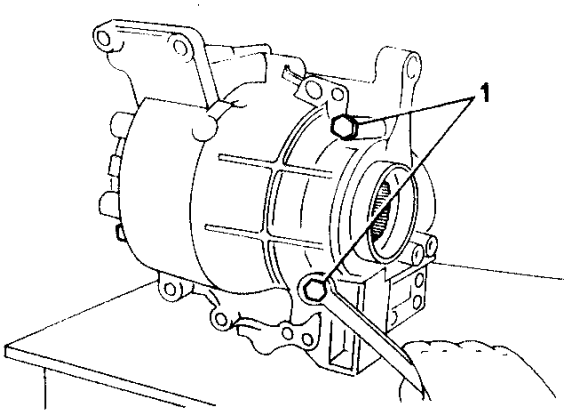
– If the weight descends too fast it is necessary to further tighten the retaining nut. Do not however exceed the specified values.

CHECKING CLEARANCE BETWEEN PINION AND RING GEAR

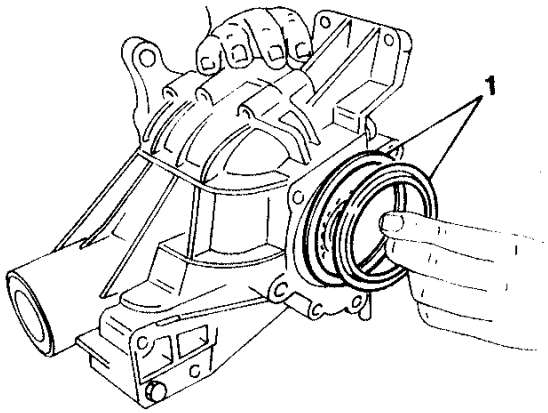
1. Install the differential unit together with the outer races of the bearings and the shim ring into the differential casing.



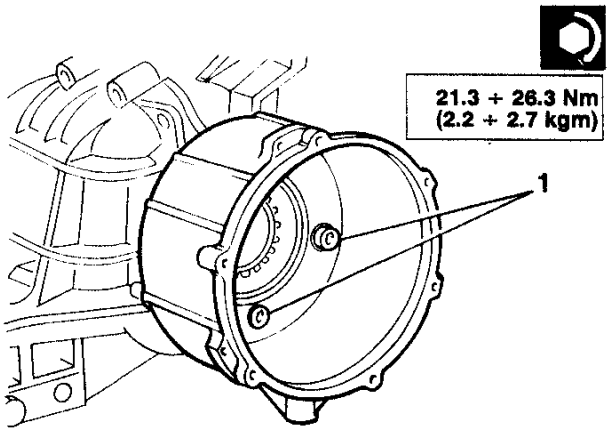
1. Install the cover on the differential casing and tighten the four screws.



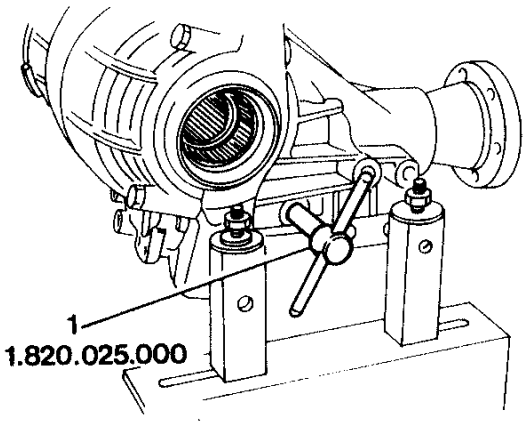
1. Install the bowl and the shim ring which was measured when checking the rolling torque of the ring bevel gear.



1. Install the outer casing of the Ferguson viscous coupling onto the differential and tighten the retaining screws.

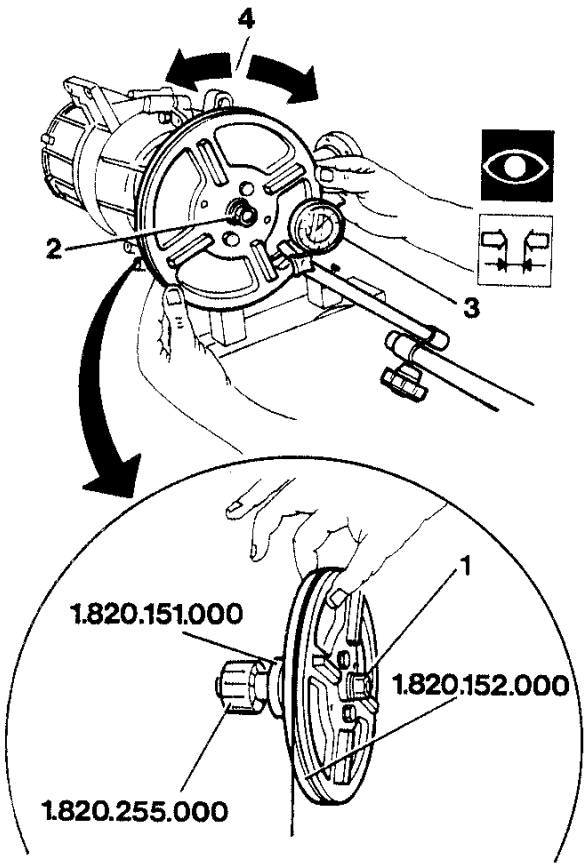


1. Tighten locking tool No. 1.820.025.000 into the differential oil drainage hole until the tapered pinion is locked.



1. Install the clearance check device composed of disc No. 1.820.152.000, connection No. 1.820.151.000 and bushing No. 1.820.255.000 onto the larger grooved shaft connecting the epicycloidal gear and the differential/transmission unit.
2. Tighten the bolt securing the clearance check device until the device turns with the differential.
3. Position the dial gauge and magnetic base onto the clearance check device as shown in the illustration so that it matches the average diameter of the ring bevel gear.
4. Acting on the disc, rotate the differential unit in both directions and measure the clearance value.

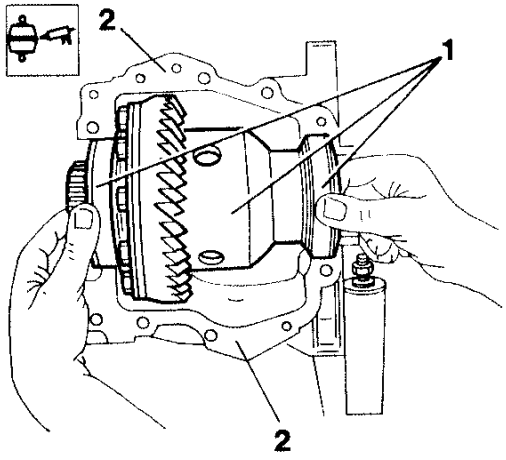
– If the clearance measured is not within the specified value it is necessary to move the ring gear towards or away from the pinion by altering the thickness of the shim-thrust ring maintaining the overall value as measured during the ring bevel gear rolling torque checking operation. Repeat the procedure until the specified clearance is obtained.



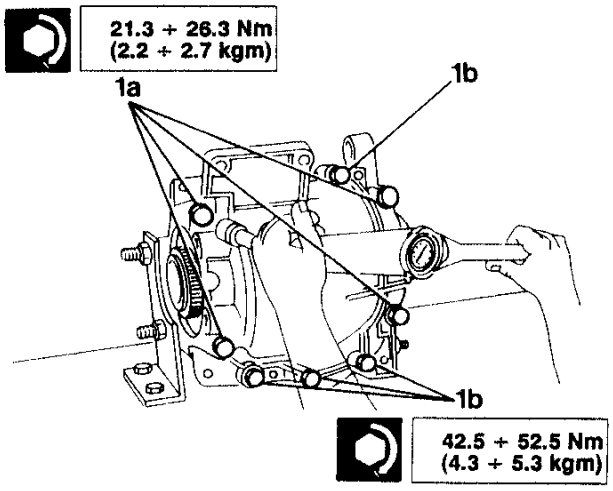
– Adjust the position of the Ferguson viscous coupling. (see: GR. 15 - ADJUSTING THE POSITION OF THE FERGUSON VISCOUS COUPLING).

REFITTING THE FRONT DIFFERENTIAL UNIT ASSEMBLY

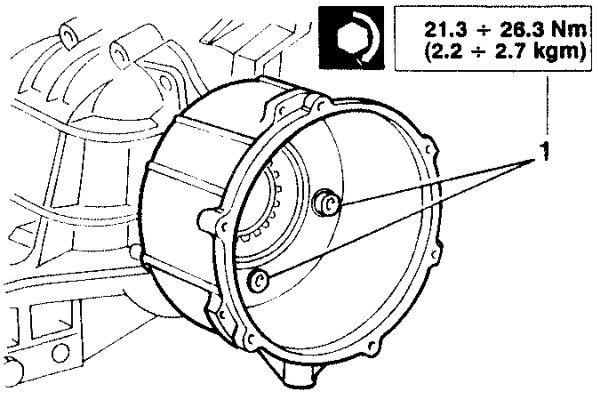
1. Install the differential unit, outer races of the bearings and shim ring in the differential casing.
2. Apply the specified sealant to the mating surfaces between the casing and cover of the differential/transmission assembly.



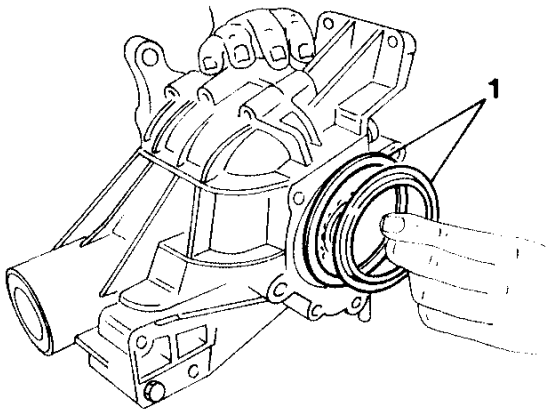
1. Install the cover on the differential casing and tighten the four screws (1A) and the six screws (1B) to the correct torque.



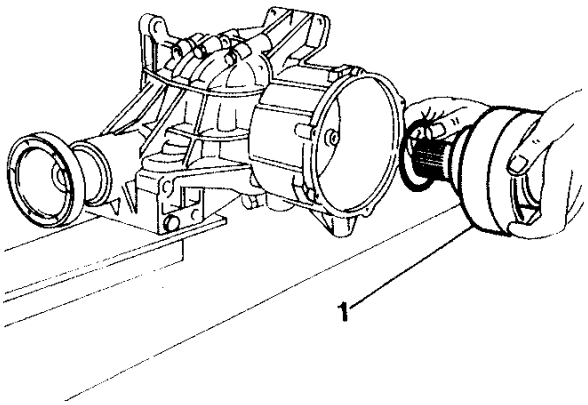
1. Install the outer casing of the Ferguson viscous coupling onto the differential together with the three O-rings and tighten the retaining screws to the correct torque.



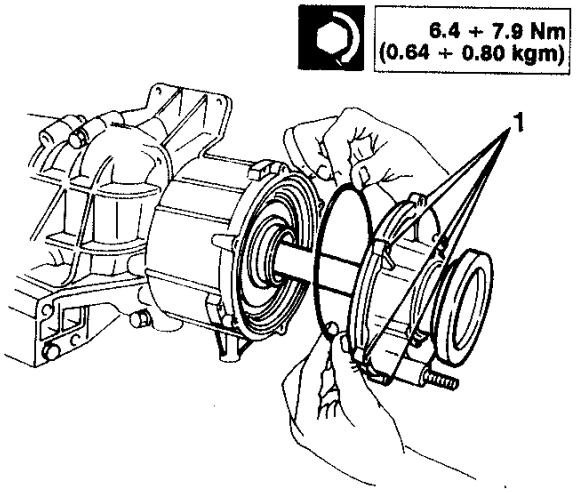
1. Install the bowl and shim ring measured previously during the ring bevel gear rolling torque check.



1. Install the shim ring on the viscous coupling and insert the coupling in the Ferguson viscous coupling casing.



1. Install the cover of the Ferguson viscous coupling, together with the O-Ring, onto the outer casing of the Ferguson viscous coupling and tighten the screws to the correct torque.

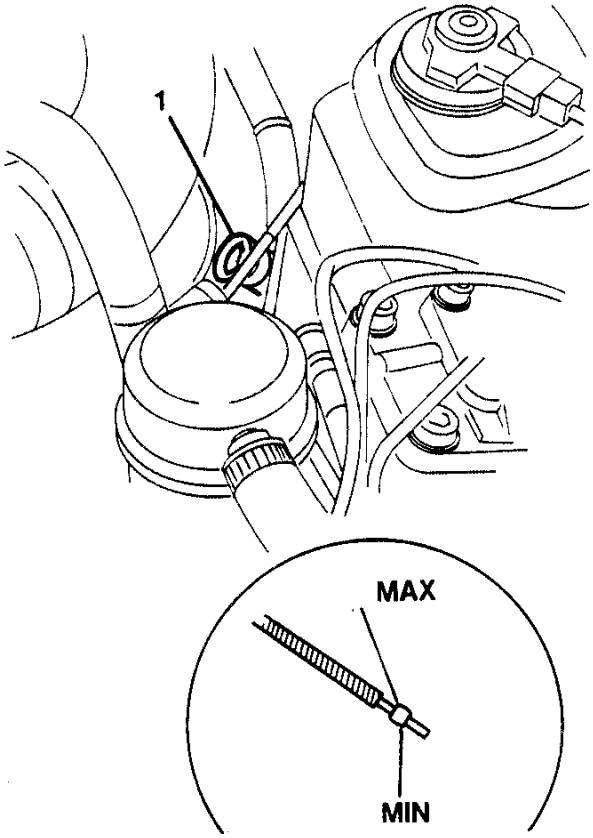


ON VEHICLE OPERATIONS

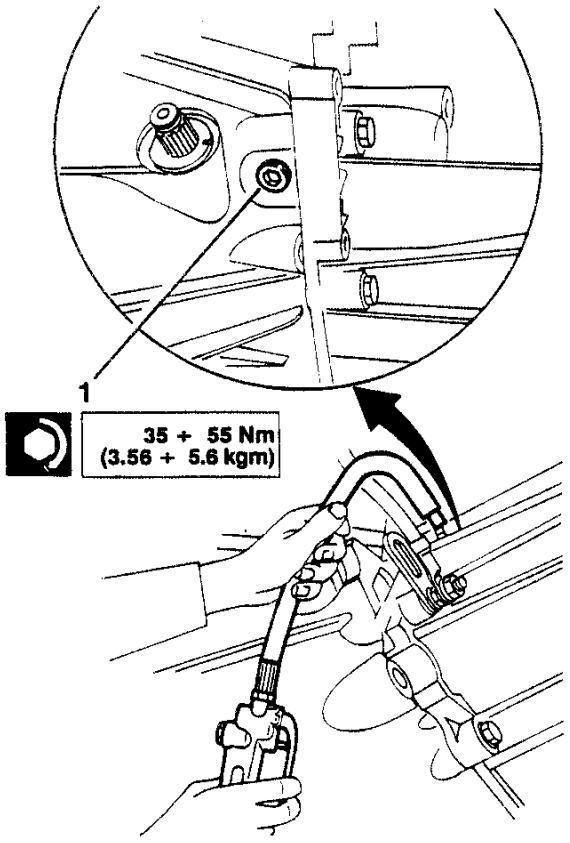
CHECKING LEVEL AND REPLACING GEARBOX - TORQUE DISTRIBUTOR - CENTRAL DIFFERENTIAL OIL

NOTE: **The gearbox-differential oil should be checked and replaced when the vehicle is level and on a vehicle lift.**

1. Check the gearbox-differential oil level using the dipstick marked with a red eyelet located in the engine compartment under the brake-clutch fluid reservoir.



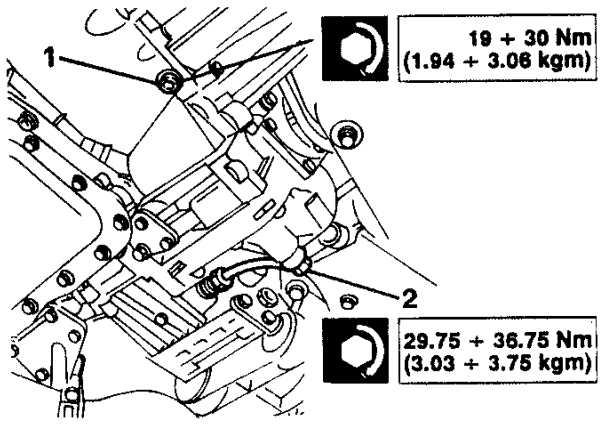
1. If it is necessary to top up the circuit unscrew the filler cap located in the upper surface of the gearbox and using a suitable pump refill with the specified oil.



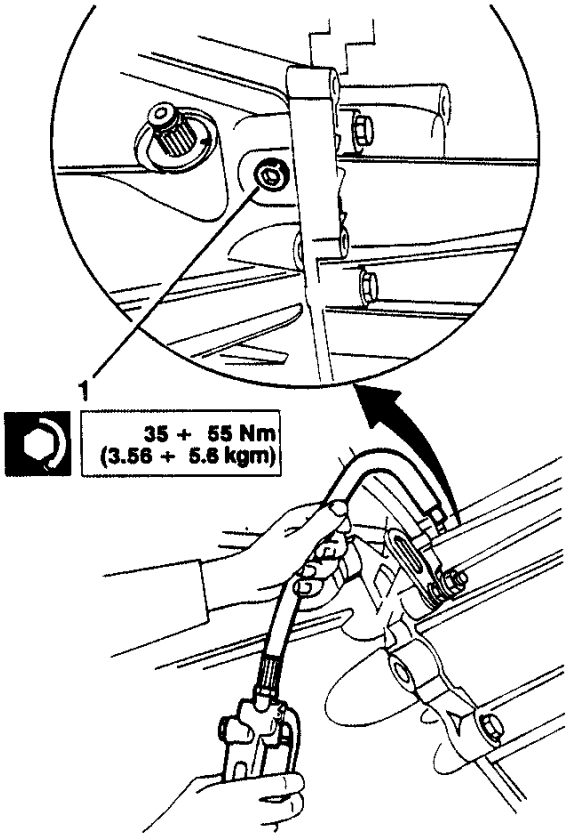
– When replacing, place a suitable container under the vehicle and proceed as follows:

1. Unscrew the drain cap located on the gear lever bell and leave the oil to drain off for at least 15 minutes.
2. Unscrew the connection located on the distributor connecting the distributor-front differential hoses and leave the oil to drain off for at least 15 minutes.

– Clean the drain cap and the connection and tighten them to the correct torque.



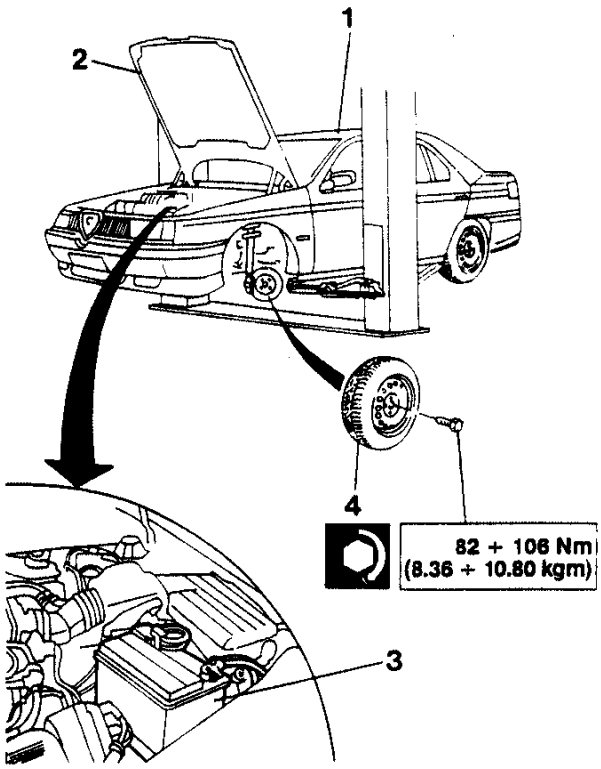
1. Unscrew the filler cap located on the upper part of the gearbox and using suitable pumping equipment, refill with the specified oil (see: TECHNICAL CHARACTERISTICS AND SPECIFICATIONS - FLUIDS AND LUBRICANTS) and them tighten the filler cap to the correct torque.



REPLACING DIFFERENTIAL CASING OIL SEAL - GEARBOX SIDE

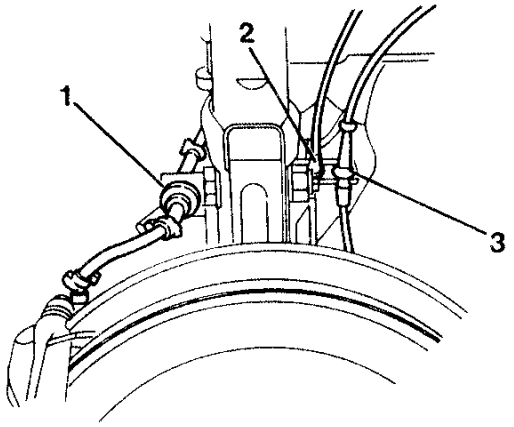
1. Position the vehicle in a lift.
2. Lift the bonnet.
3. Disconnect the battery.
4. Remove the front wheels.

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

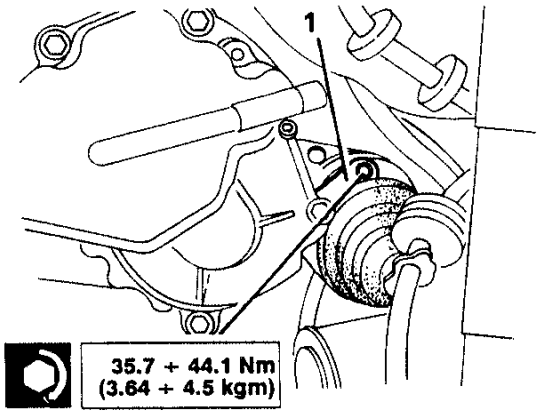


1. Disconnect the bracket securing the braking system oil hoses.
2. Disconnect the ABS system induction sensor wiring from the bracket.
3. (only for vehicles with controlled damping suspension)

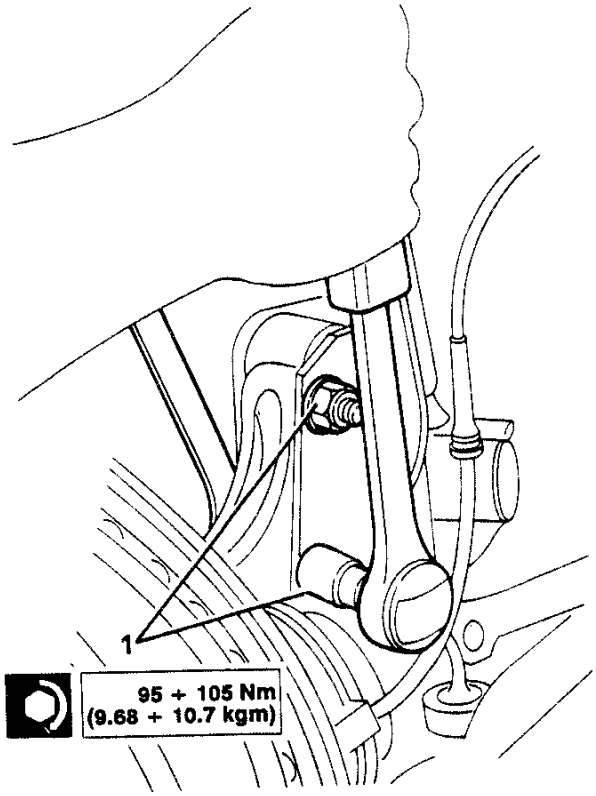
– Disconnect the CDS system solenoid valve wiring from the relative bracket located on the shock absorber.



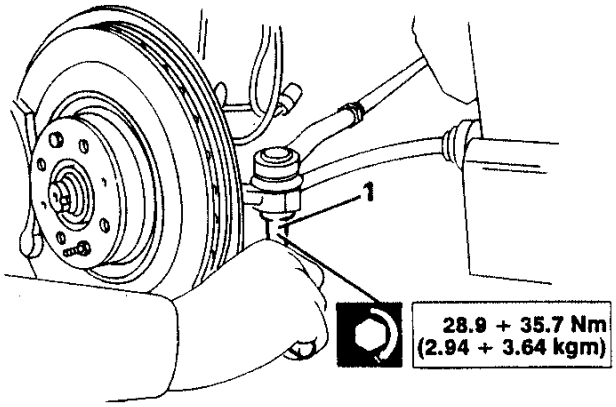
1. Unscrew and remove the six bolts securing the constant speed joint to the flange together with the three safety plates.



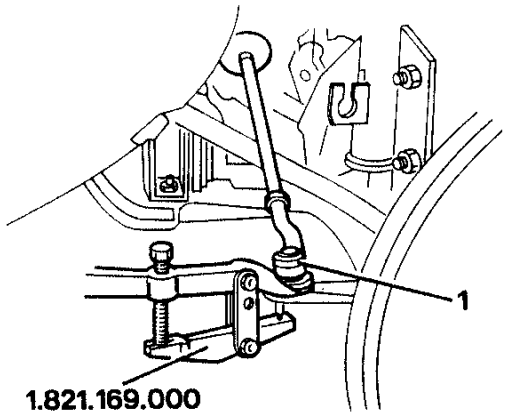
1. Unscrew and remove the bolts securing the wheel strut to the shock absorber.



1. Unscrew and remove the nut securing the ball pivot of the steering tie-rod to the wheel strut.

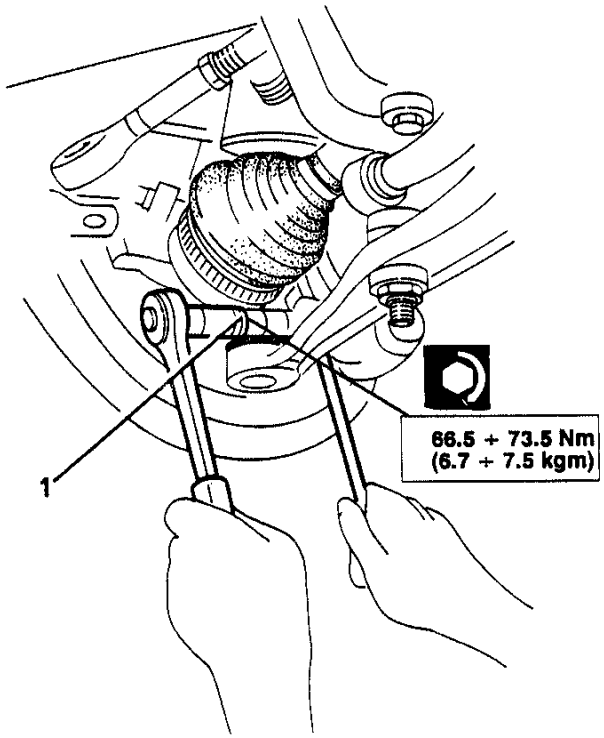


1. Using tool No.1.821.169.000 withdraw the ball pivot from the wheel strut.

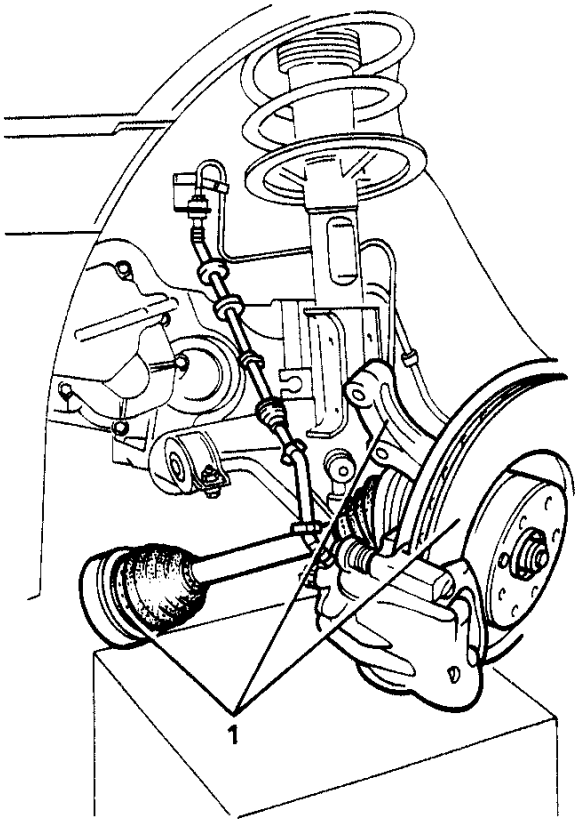


WARNING:
Before proceeding to the successive phases, place a suitable support under the suspension assembly.

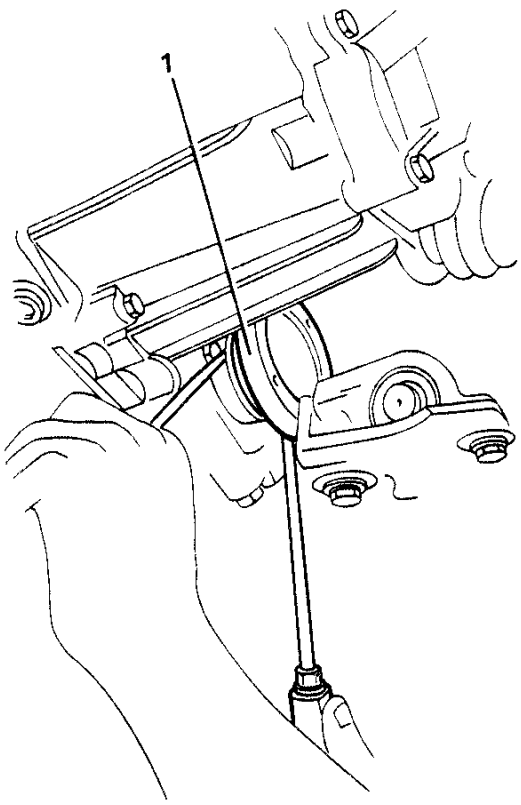
1. Unscrew the nut securing the articulated head of the swinging arm to the wheel strut.



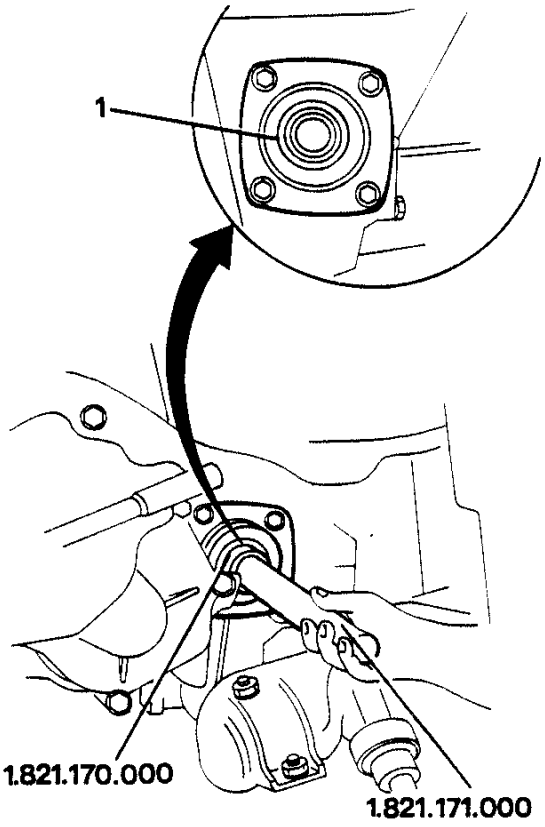
1. After placing the withdraw the wheel hub-brake disc-driveshaft assembly from the ball pivot without damaging the wiring and hoses connected to it.



1. Using two rotation levers at the same time remove the left- hand half shaft from the gearbox.



1. Remove the damaged oil seal and using inserting tool No. 1.821.170.000 together with grip No. 1.821.171.000 fit the new oil seal.

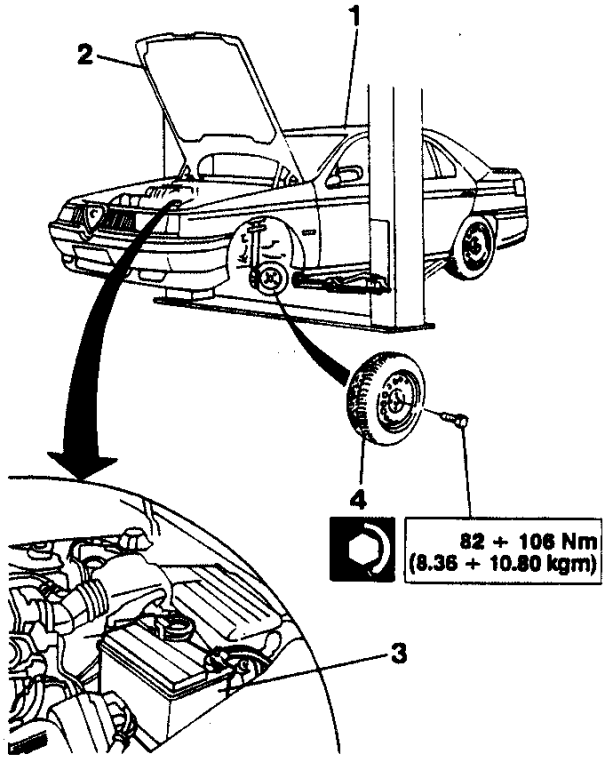


Refit the previously removed components and tighten the screws and nuts to the correct torque.

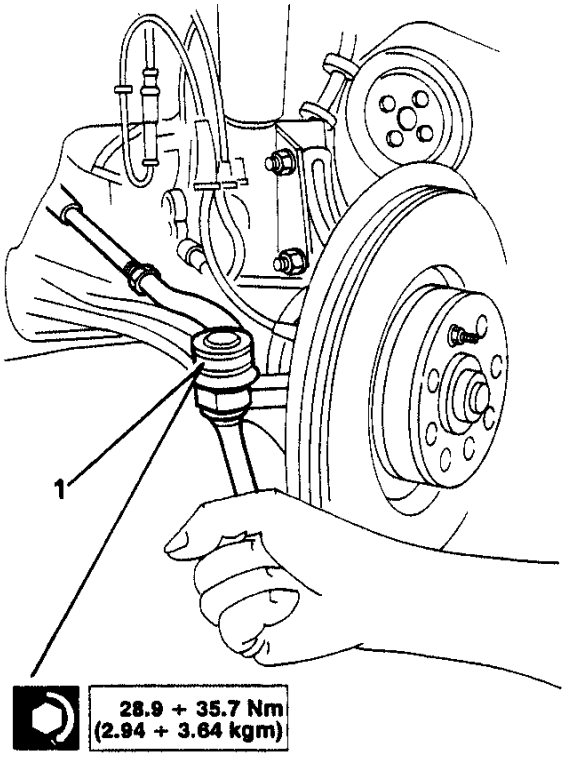
REPLACING DIFFERENTIAL CASING OIL SEAL - ENGINE SIDE

1. Place the vehicle on a lift.
2. Lift the bonnet.
3. Disconnect the battery.
4. Remove the front wheels and gravel guards.

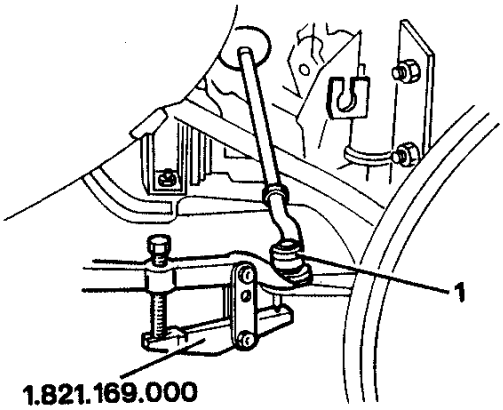
WARNING:
Protect the area around the engine compartment with soft material in order to avoid accidentally damaging the bodywork.



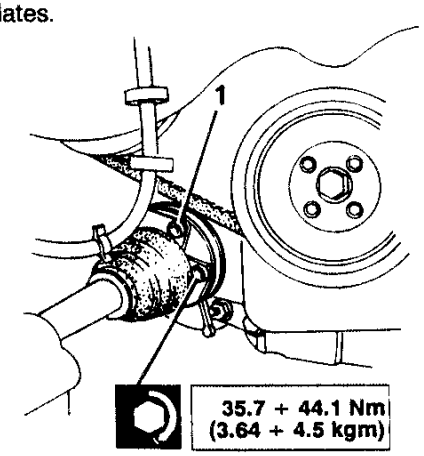
1. Unscrew and remove the nut securing the ball pin of the steering tie rod to the wheel strut.



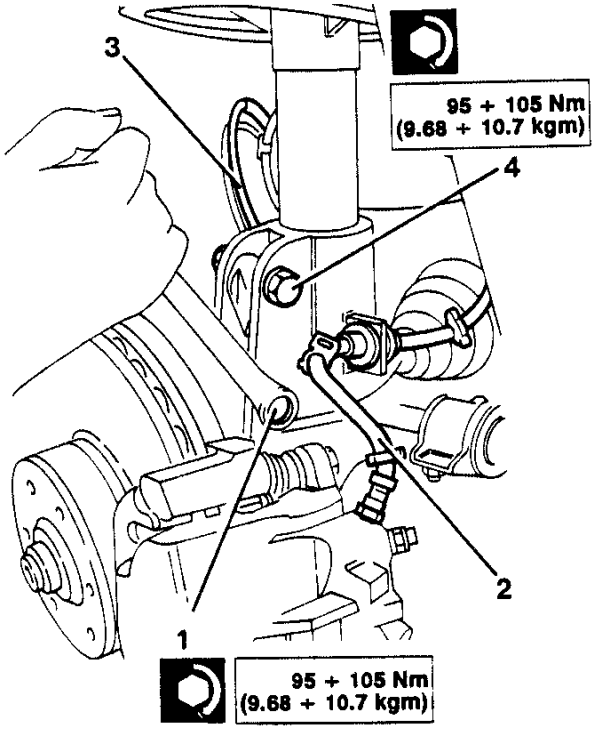
1. Using tool No.1.821.169.000 withdraw the ball pin from the wheel strut.



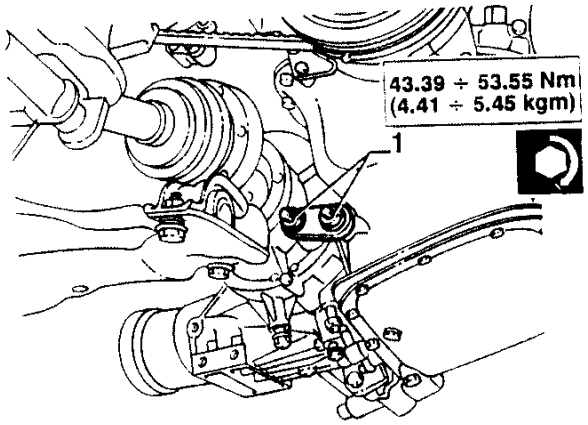
1. Unscrew and remove the six bolts securing the constant speed joint to the flange together with the three plates.



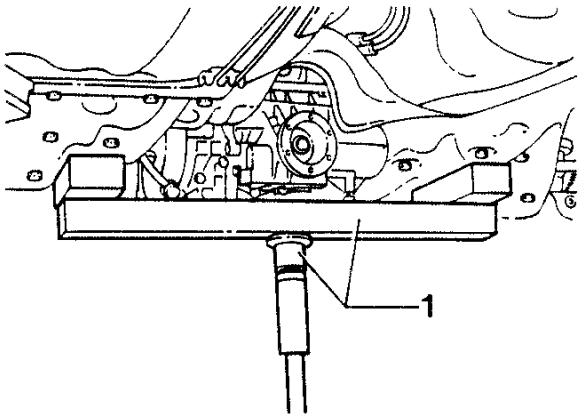
1. Unscrew and remove the lower bolt securing the wheel strut to the shock absorber strut.
2. Disconnect the bracket located on the shock absorber strut from the brake system oil hose.
3. (Only for vehicles equipped with controlled damping suspension)
   - Disconnect the CDS system solenoid valve wiring located on the shock absorber from the relative bracket.
4. Unscrew and remove the lower bolt securing the wheel strut to the strut of the shock absorber and move the half-shaft to one side.



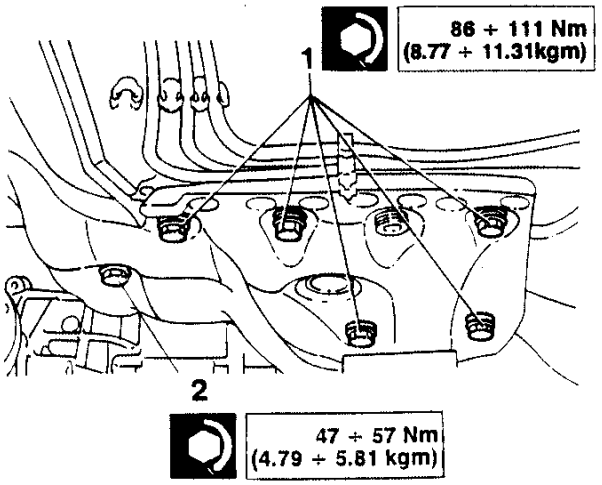
1. Unscrew the nuts securing the bracket connecting the viscous coupling and oil sump and remove the bracket.



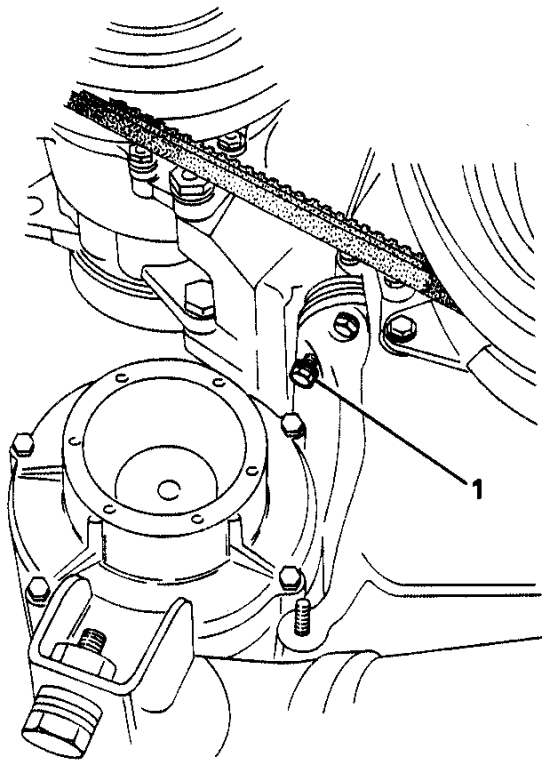
1. Using a hydraulic jack fitted with a suitable device take the weight of the front crossmember.



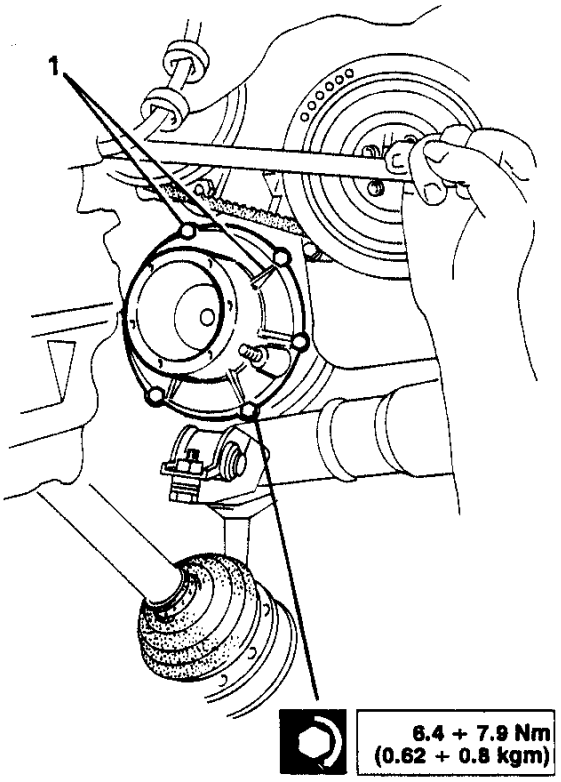
1. As far as possible loosen, but do not remove, the screws securing the crossmember to the body.
2. As far as possible loosen, but do not remove, the screws securing the steering box to the front crossmember.



1. Remove the screws (shown in the diagram) securing the oil sump to the engine block.



1. Loosen and remove the six screws securing the viscous coupling and lower the jack in order to permit the entire engine unit to be lowered and then remove the cover together with the drive shaft.



– Replace the oil seal and O-rings located on the cover of the viscous coupling (see: GR.15 - FERGUSON VISCOUS COUPLING).

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

TECHNICAL CHARACTERISTICS AND SPECIFICATIONS

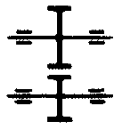
TECHNICAL SPECIFICATIONS

GEAR RATIOS

Model	Axle ratio	Gear engaged	Gear ratio	Total ratio	Speed (●) at 1000 r.p.m..
2.0 T.B.- 4x4	17/57 1 : 3.353	1a	1 : 3.500	1 : 11.735	9.280
		2a	1 : 2.176	1 : 7.296	14.926
		3a	1 : 1.524	1 : 5.110	21.311
		4a	1 : 1.156	1 : 3.876	28.096
		5a	1 : 0.917	1 : 3.075	35.415
		R	1 : 3.545	1 : 11.886	9.162

(●) The speed values refer to a vehicle equipped with 205/50 ZR15" tyres.

IDLE PINION SET RATIO

	2.0 T.B. - 4x4
	43/19 (2.263)

GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

APPLICATION	TYPE	NAME
Refilling with gearbox-differential oil	OIL	TUTELA ZC 80/S
Clutch control fork articulation and thrust bearing seating	GREASE	–
Gear engagement control rod bushing and gear lever knuckle	GREASE	FIAT Zeta 2 ISECO MOLIKOTE LONGTERM No. 2

SEALANTS AND FIXATIVES

APPLICATION	TYPE	NAME
Gearbox rear cover, torque distributor cover, differential casing ring gear retaining screws	HERMETIC	LOCTITE 573

CHECKING AND ADJUSTMENT

EPICYCLOIDAL DISTRIBUTOR - BEARING PRE-LOADING

2.0 T.B. - 4x4
Bearings not loaded = 0.12 mm

NOTE: Adjustment of the bearing preloading is carried out by using shim rings from 1.00 mm to 1.60 mm in sizes increasing by 0.05 mm

FRONT DIFFERENTIAL - CLEARANCE BETWEEN CROWN WHEELS AND SIDE PINIONS

2.0 T.B. - 4x4
≤ 0.10 mm

FRONT DIFFERENTIAL - SIDE PINION CASING CLEARANCE

	2.0 T.B. - 4x4
	0.10 - 0.75 mm

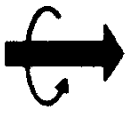
FRONT DIFFERENTIAL ASSEMBLY AND IDLE - PINION/RING GEAR CLEARANCE

	2.0 T.B. - 4x4
	0.08 - 0.15 mm

FRONT DIFFERENTIAL ASSEMBLY AND TRANSMISSION - ROLLING TORQUE OF RING BEVEL GEAR

	2.0 T.B. - 4x4
	1.8 - 2 Nm (0.18 - 0.2 Kgm)

FRONT DIFFERENTIAL ASSEMBLY AND TRANSMISSION - ROLLING TORQUE OF TAPERED PINION

	2.0 T.B. - 4x4
	0.8 - 1.2 Nm (0.08 - 0.12 Kgm)

TIGHTENING TORQUES - 2.0 TURBO 16V

GEARBOX - TORQUE DISTRIBUTOR - CENTRAL DIFFERENTIAL

See: PA4655C1000000 / REPAIR INSTRUCTIONS - MECHANICAL UNITS - GR.13 - TECHNICAL SPECIFICATIONS - TIGHTENING TORQUES - 2.4 V6.

GEARBOX OUTER LINKAGE

Description	N·m	kg·m
Nut with self-locking flange for securing the gearbox cables tensioning bracket to tunnel	7.1 - 9	0.72 - 0.92
Screw securing gearbox cables tensioning bracket to gearbox	14 - 18	1.43 - 1.83
Self-locking nut for securing bracket for gear engagement cable	14 - 18	1.43 - 1.83

ENGINE-GEARBOX ATTACHMENTS

Description	N·m	kg·m
Upper screw securing gearbox union support to engine	68 - 84	6.9 - 8.56
Lower screw securing gearbox union support to engine,	68 - 84	6.9 - 8.56
Nut for stud on gearbox support for gearbox union with engine	68 - 84	6.9 - 8.56
Screw securing starter motor to gearbox union support	20 - 25	2.04 - 2.55
Nut securing starter motor supply cable	10 - 12	1.01 - 1.22
Screw for securing lower cover to support	6.8 - 8.4	0.69 - 0.85
Screw securing gearbox support bracket to hydroelastic block	55.25 - 68.25	5.63 - 6.65

FRONT DIFFERENTIAL: TRANSMISSION

Description	N·m	kg·m
Screw securing viscous coupling support	21.25 - 26.25	2.2 - 2.7
Screw securing cover on viscous coupling support	6.4 - 7.9	0.65 - 0.80
Screw for securing cover for front differential-transmission support casing	21.25 - 26.25	2.2 - 2.7
Screw for securing cover for front differential-transmission support casing	42.5 - 52.5	4.3 - 5.3
Nut to caulk to lock tapered pinion	170 - 280	17.39 - 28.54
Screw securing ring bevel gear	74.8 - 92.4	7.6 - 9.4
Nut for securing front differential tie-rod to engine sump	43.39 - 53.55	4.41 - 5.45

FRONT DIFFERENTIAL TO DISTRIBUTOR ATTACHMENTS

Description	N·m	kg·m
Neck for flexible connection securing oil delivery hose to tapered pinion support	21.25 - 36.75	2.2 - 2.7
Straight terminal connection assembly for fixing oil delivery hose to pinion support	21.25 - 36.75	2.2 - 2.7
Nut for securing front differential tie-rod to engine sump	43.39 - 53.55	4.41 - 5.45
Screw for securing tapered pinion support to gearbox	74.8 - 92.4	7.6 - 9.4
Screw for securing tapered pinion support	21.25 - 26.25	2.16 - 2.67
Self-braking nut for screws uniting drive shafts to joints	35.7 - 44.1	3.64 - 4.49

SPECIFIC TOOLS

TOOL NUMBER	DESCRIPTION
1.820.025.000	Device for locking tapered pinion
1.820.047.000	Plate supporting half rings (Use with 1.820.244.000)
1.820.051.000	Spanner
1.820.151.000	Connection (Use with 1.820.152.000)
1.820.152.000	Disc for rolling test (Use with 1.820.151.000)
1.820.208.000	Gearbox support stand
1.820.226.000	Support/crossmember for gearbox removal and refitting
1.820.229.000	Flange for removing power take-off shafts (Use with 1.821.161.000)
1.820.239.000	Crossmember support stand
1.820.244.000	Half rings for removing inner race of pinion bearing
1.820.251.000	Bracket for removal and refitting of gearbox
1.820.252.000	Support for differential on bench
1.820.253.000	Support for dial gauge
1.820.254.000	Flange with grooved coupling
1.820.255.000	Flexible bushing for checking pinion gear clearance
1.820.581.000	Crossmember
1.821.013.000	Puller for outer race of outer pinion bearing (Use with 1.821.226.000)
1.821.085.000	Puller for outer race of inner pinion bearing (Use with 1.821.226.000)
1.821.161.000	Mallet to remove viscous coupling cover (Use with 1.820.229.000)
1.821.170.000	Inserting tool for oil seal (Use with 1.821.171.000)
1.821.171.000	Grip (Use with 1.821.170.000)
1.821.218.000	Inserting tool for bearing inner race on torque distributor ring gear side
1.821.221.000	Puller for bearing inner race-torque distributor ring gear side
1.821.222.000	Inserting tool for pinion bearing outer races

TOOL NUMBER	DESCRIPTION
1.821.223.000	Puller for tapered bearing epicycloidal group odometer side (Use with 1.821.224.000)
1.821.224.000	Reacing flange for puller (Use with 1.821.223.000)
1.821.226.000	Puller for outer rings of pinion bearings (Use with 1.821.013.000 and 1.821.085.000)
1.821.321.000	Inserting tool for oil seal
1.821.349.000	Inserting tool for inner race of outer pinion bearing
1.824.006.001	Weight for rolling test
1.824.006.002	Weight for rolling test
1.824.006.003	Weight for rolling test
1.824.006.004	Weight for rolling test
1.824.006.005	Weight for rolling test
1.825.030.000	False pinion

GROUP 15

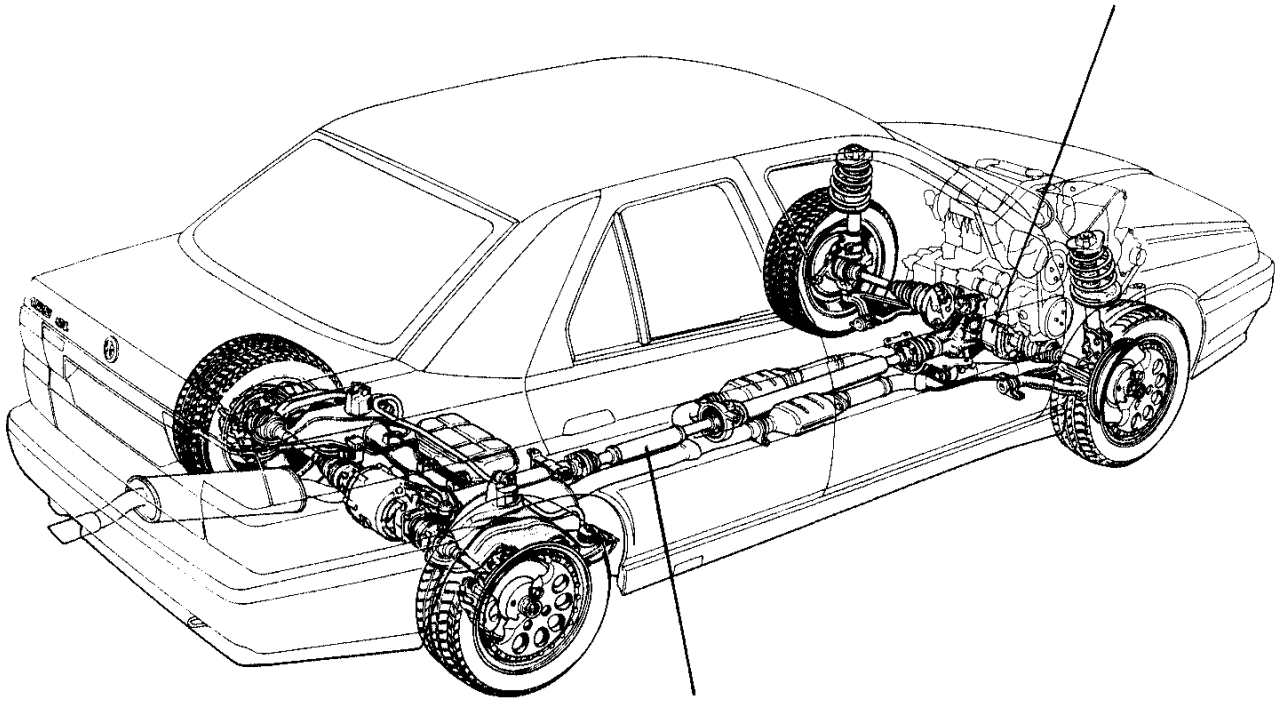
TRANSMISSION

INDEX

ILLUSTRATED INDEX

TRANSMISSION

FERGUSON VISCOUS JOINT



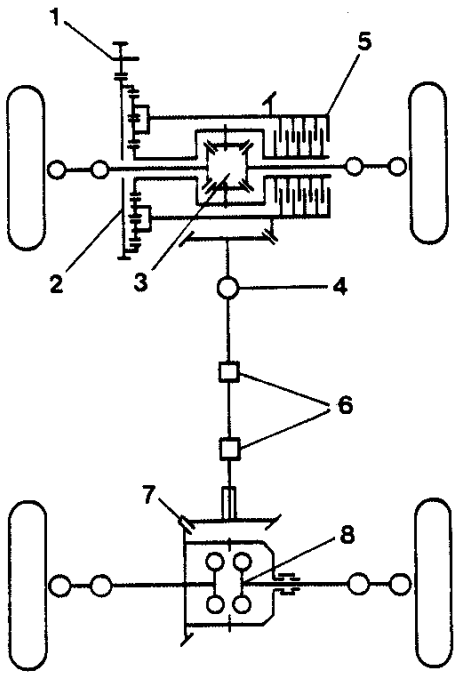
ON VEHICLE OPERATIONS

MAIN SHAFT

TRANSMISSION

DESCRIPTION

In order to optimize the sports features of the 155 range, improving both functionality and driving safety, the 2.0 turbopetrol 16 valve version has been equipped with a permanent four-wheel drive system.



1. Gearbox countershaft
2. Epicycloidal differential or torque distribution frame
3. Front differential
4. Constant speed joint
5. Ferguson viscous coupling
6. Universal couplings
7. Pinion set
8. Torsen rear differential

The permanent four-wheel drive transmission adopted for the vehicle is a three-differential type.

The deflecting torque distributed on the two axles by an epicycloidal differential is divided - 47% on the front axle and 53% on the rear axle (see: GR. 13 - GEARBOX - TORQUE DISTRIBUTION FRAME - DIFFERENTIAL AND DRIVING GEAR).

This torque distribution is proportional to distribution of weights on the two axles permitting the typical features of front-wheel drive and a greater deflecting torque on the rear axle.

Thanks to a "Ferguson" viscous coupling, linked to the central differential, it is possible to redistribute the deflecting torque on the two axles, in the case of low roadholding conditions.

The front differential is of the traditional type and the transmission to the rear axle is carried out by a pinion set and a main shaft divided in three sections, connected by a constant speed joint and two universal couplings.

The rear differential has a low internal output, of the Torsen type 5:1 (see: GR. 18 - FOUR-WHEEL DRIVE REAR AXLE).

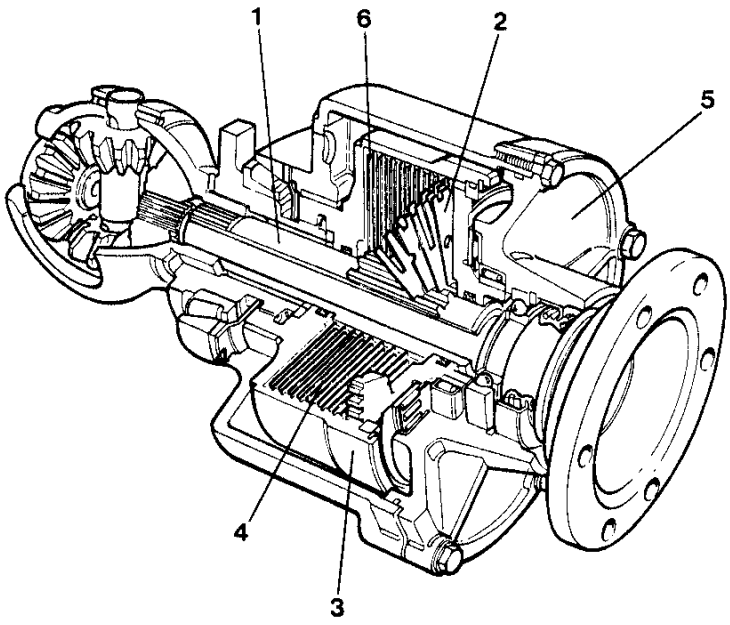
This type of transmission optimizes engine power exploiting the full adhesion of each wheel, particularly during acceleration and when travelling uphill. There is no incompatibility incompatibility with ABS system during braking and turning, thanks to the action of the central differential, which permits the necessary slipping between the two axles. Driving conditions are improved with regard to directional stability and traction, even under the most critical of road conditions.

WARNING:

If it is necessary to tow the vehicle, the operation must be carried out with all the four wheels touching the ground; if this is not possible, the vehicle must be transported when completely raised. Never tow the vehicle with two wheels on the ground and two raised as this could damage transmission.

FERGUSON VISCOUS JOINT

DESCRIPTION



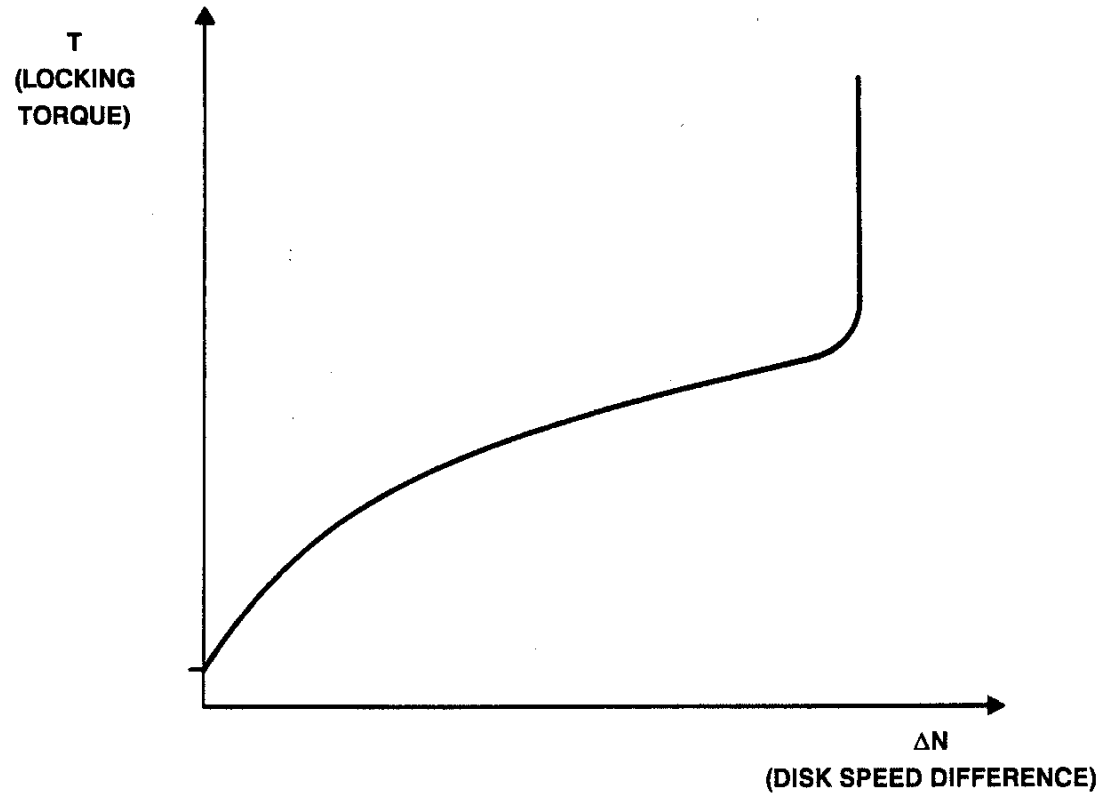
The viscous coupling consists of:

1. Hub (shaft)
2. Disks machined onto the hub
3. External casing
4. Disks machined onto the casing
5. Casing cover
6. Viscous fluid (silicone oil)

The disks machined onto the casing are located alternately to the coupled disks on the hub, and are immersed in silicone oil. The distance between the facing surfaces is small. If the disks of the two types have the same speed, the movememnt of the fluid adopts the characteristtics of a passive entrainment, If, in the other hand, the two rows of disks turn at a different speed, the fluid is entrained by the disks rotating at a higher speed. Due to the viscosity, the fluid which adheres to the fastest disks transmits a torque to the next fluid layers and these to the following layers and so on until it begins to afffect the opposite row of disks.

The decrease in fluid viscosity following a rise in temperature is compendated for by its dilation which brings about an increase in pressure resulting in the coupling blocking. The locking torque value increases as the relative speeds between the two rows of disks, and therefore the pinion shaft and pinion, increases. Thus the central sifferential with viscous coupling described previously as being an epicycloidal gear with low internal output can be adequately defined as an epicycloidal gear with variable internal output.

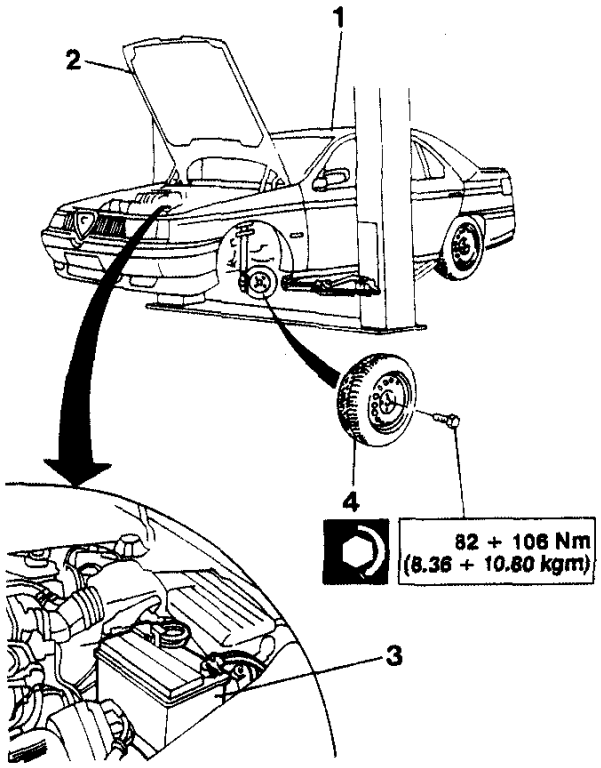
The curve characteristic of the viscous coupling is shown below. It shows how the locking torque (T) varies as the difference in speed between the disks varies (ΔN).



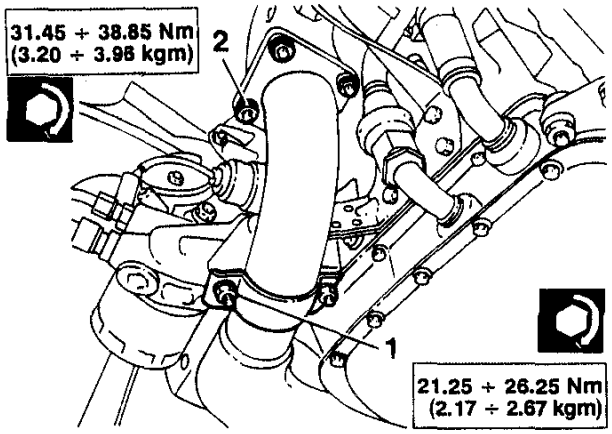
REMOVAL AND REFITTING

1. Put the vehicle on the lift.
2. Raise the bonnet.
3. Disconnect and remove the battery.
4. Remove the front wheels.

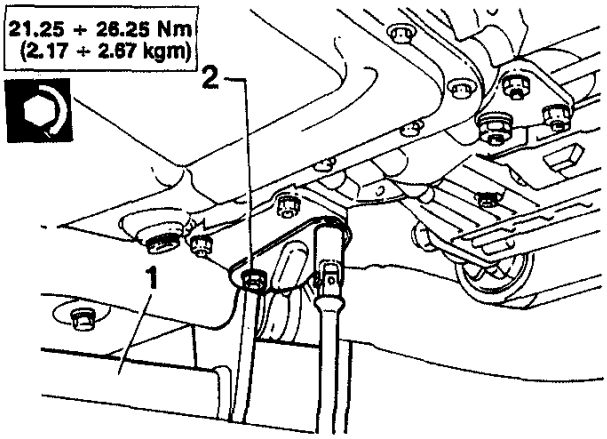
WARNING:
Protect the area around the engine compartment with soft material in order to avoid the accidental damage to the body.



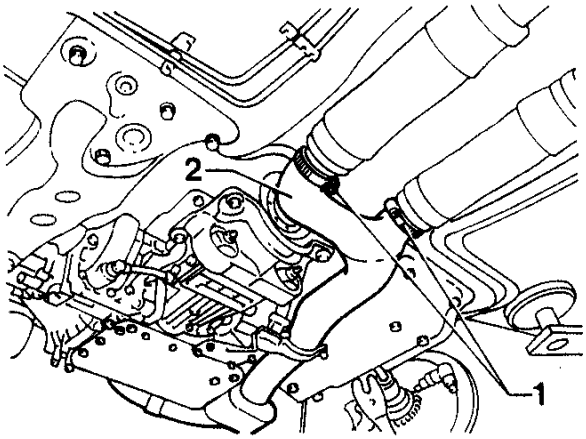
– Raise the vehicle.
1. Unscrew the nuts securing the exhaust pipe retaining brackets to engine linkage bracket.
2. Unscrew the nuts securing the piping to the exhaust manifold.



1. Using a suitable tool and a hydraulic jack, support the front end of the exhaust piping.
2. Unscrew the nuts securing the differential to the retaining bracket of the exhaust piping.

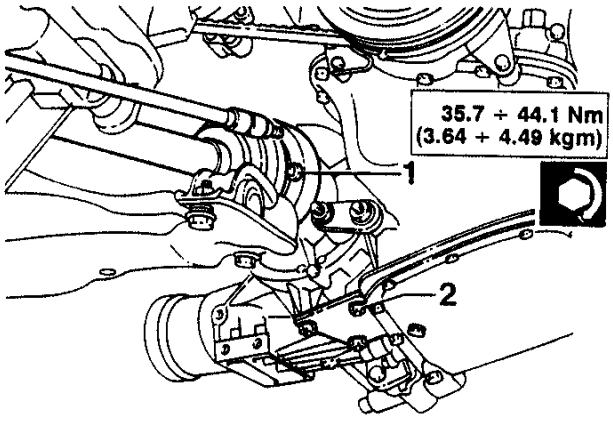


1. Loosen the clamps securing the front end of the exhaust piping.
2. Lower the hydraulic jack and remove the front end of the exhaust piping.



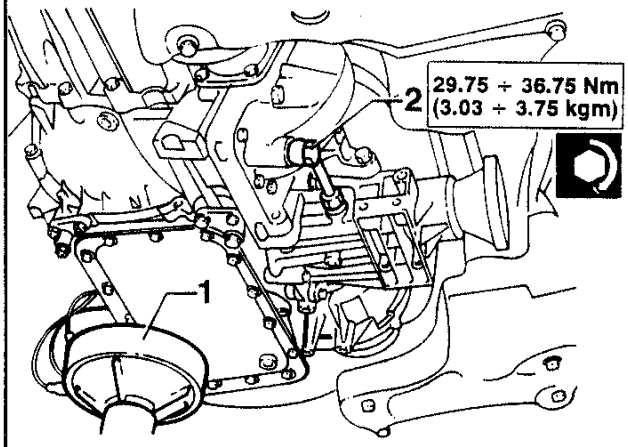
– Disconnect and remove the front end of the main shaft (see: Main shaft - Removal and refitting).

1. Loosen the screws securing the right axle shaft to the differential flange and disconnect the axle shaft.
2. Remove the bracket fastening the exhaust piping.

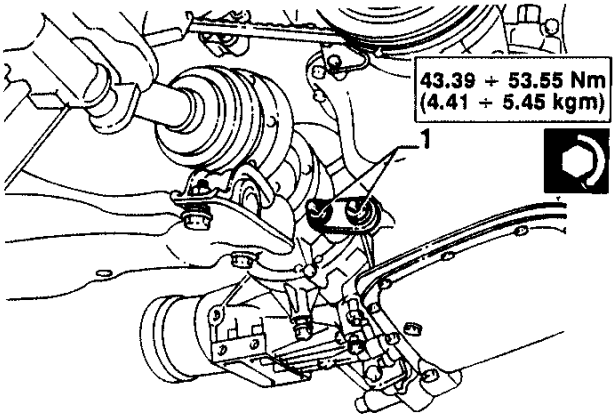


1. Using a jack, support the power unit group.
2. After arranging a suitable container, loosen the oil supply union to the support pinion and drain the differential oil.

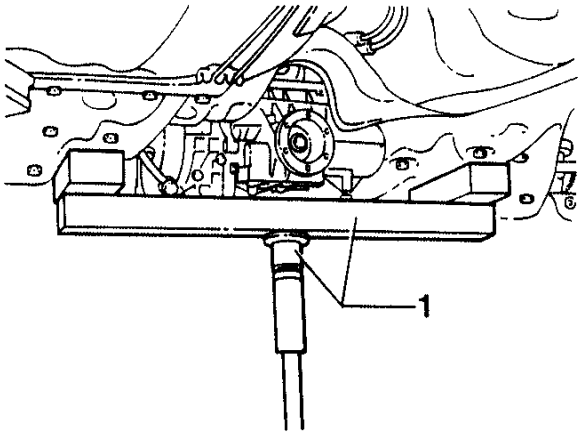
WARNING:
When refitting refill the front differential-drive gear group with the recommended oil (see: TECHNICAL CHARACTERISTICS AND SPECIFICATIONS - GENERAL SPECIFICATIONS - Fluids and lubricants).



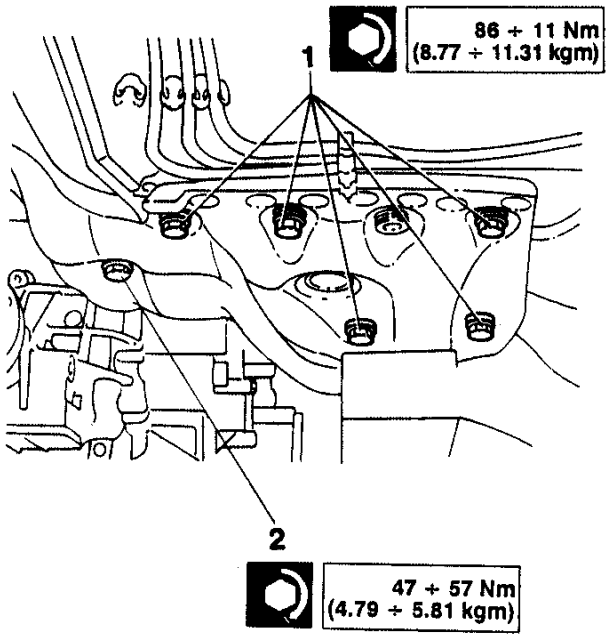
1. Loosen the nuts securing the tie-rod to the differential-engine sump and remove the tie rod.



1. Using a hydraulic jack and a suitable wooden support, support the crossrail.

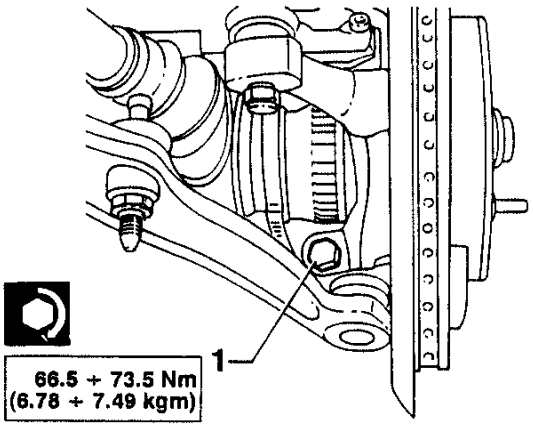


1. Loosen the screws securing the crossarail to the body.
2. Loosen the screws securing the steering box to the crossrail.

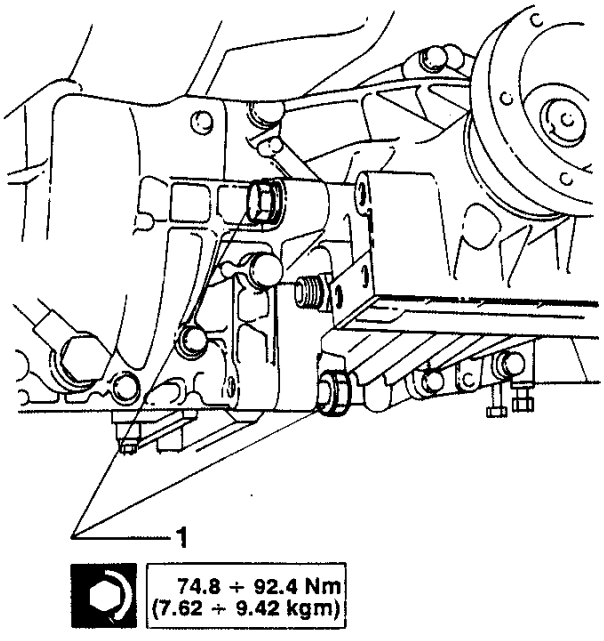


1. Loosen and remove the bolts securing the suspension swinging arms to the wheel support.

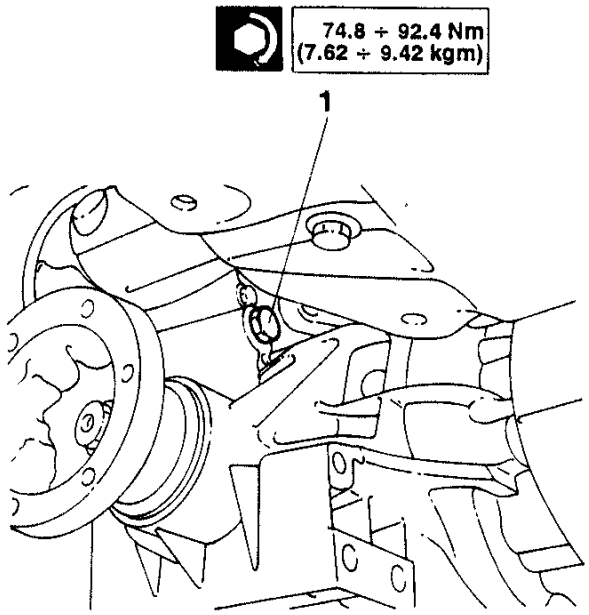
– Lower the jack and remove the crossrail.



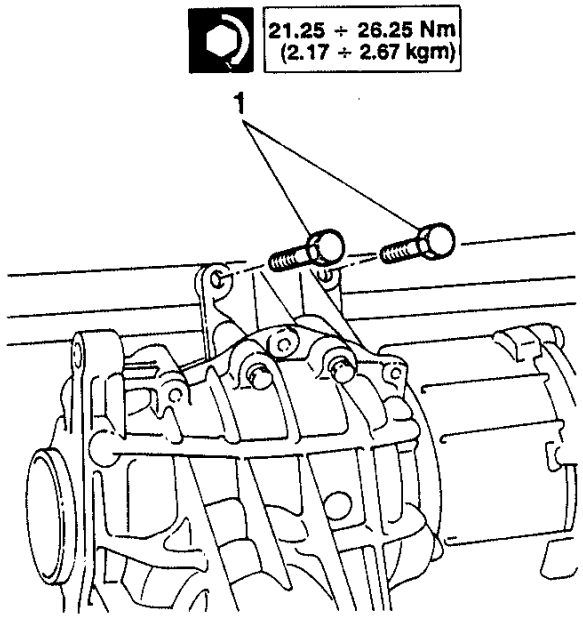
1. Loosen the lower screws securing the differential group to the torque distribution frame.



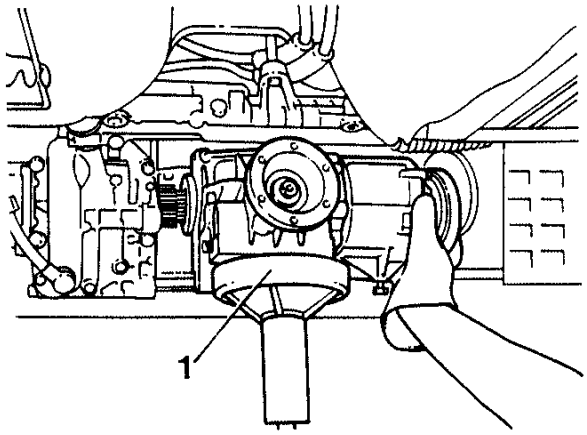
1. Loosen the upper screw securing the differential group to the torque distribution frame.



1. Loosen the screws securing the differential group to the cylinder block.



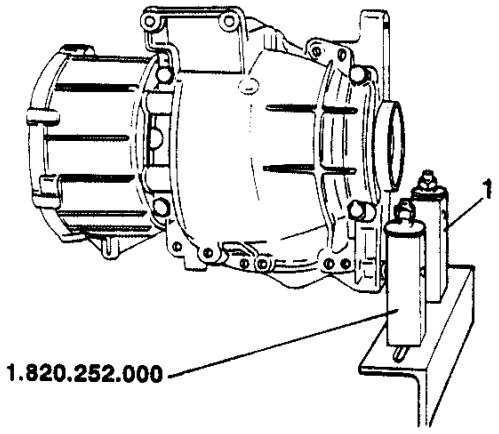
1. Using a jack, remove the differential group in order to move the hollow shaft of the torque distribution frame, then remove the differential group.



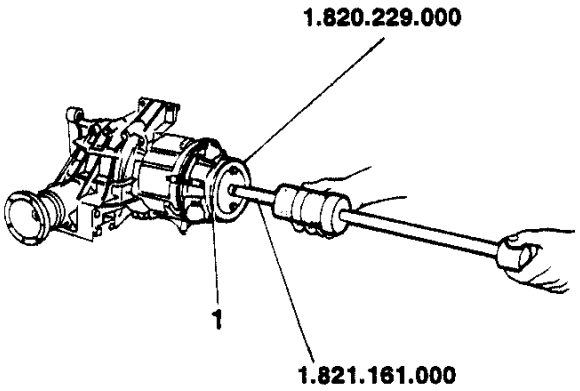
Refit by reversing the procedure followed for removal, tightening the nuts and screws to the torque indicated.

BENCH DISASSEMBLY AND REASSEMBLY

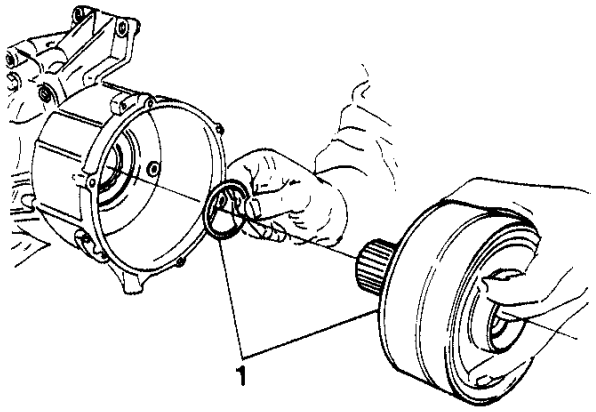
1. Place differential-drive gear group on support No. 1.820.252.000 and fit it in vice.



1. Loosen the screws securing the viscous coupling cover and remove it along with the intermediate shaft, using tool No. 1.821.161.000 fixed to the pulley halfshaft by flange No. 1.820.229.000.

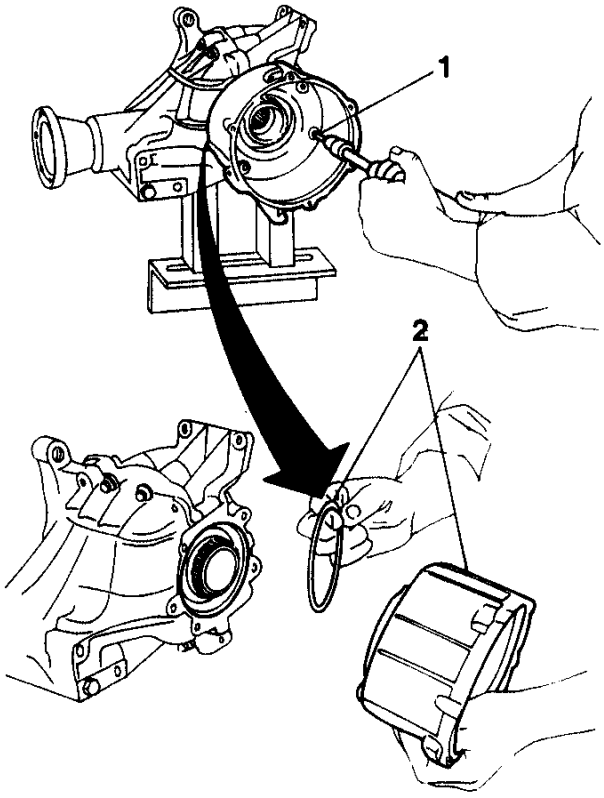


1. Remove the viscous coupling and shim ring.



NOTE: The coupling cannot be overhauled and must therefore be replaced.

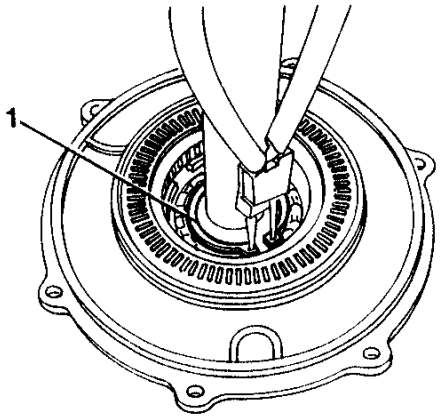
1. Loosen the screws securingexternal casing of the viscous coupling and remove it along with three O-rings.
2. Remove the cup and shim ring.



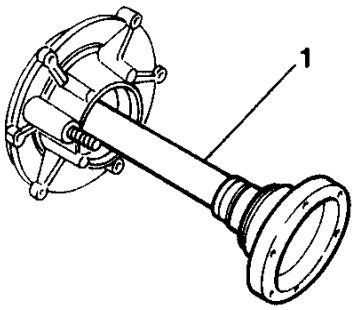
Reassemble by reversing the proceedure followed for disassembly and tighten to the specified torque.

DISASSEMBLY AND REASSEMBLY OF "FERGUSON" VISCOUS COUPLING COVER

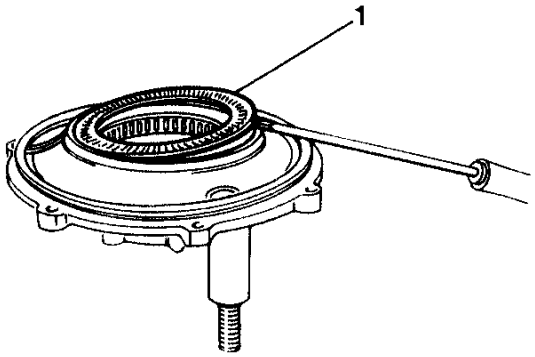
1. Remove snap ring retaining intermediate shaft.



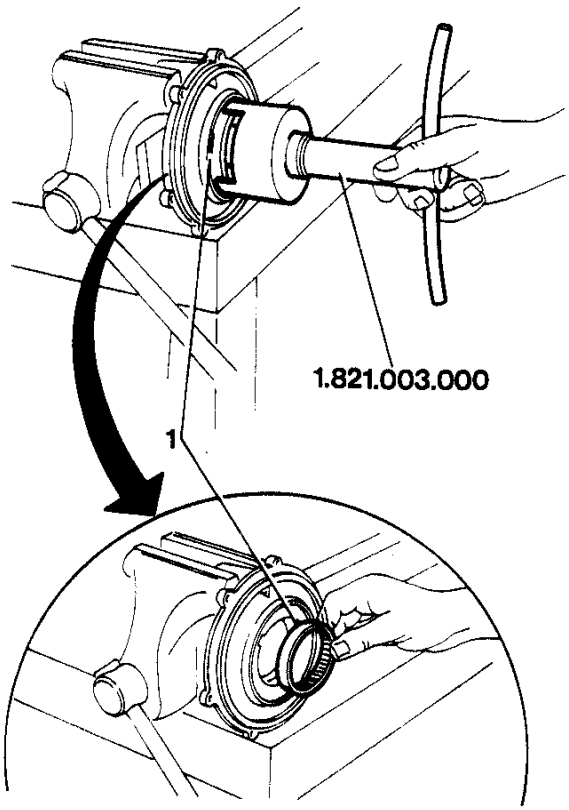
1. Remove the intermediate shaft from "Ferguson" viscous coupling casing cover.



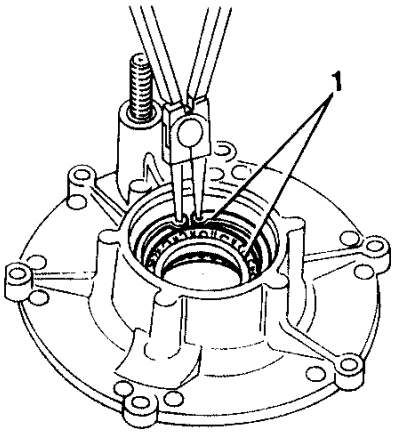
1. Remove superficial roller bearing of "Ferguson" viscous coupling support.



1. Using No. 1.821.003.000 remove internal roller bearing of the "Ferguson" viscous coupling support.

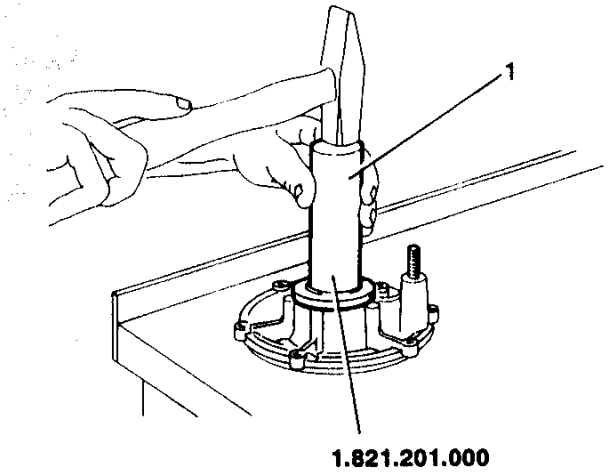


1. Remove oil guard, snap ring retaining the ball bearing of intermediate shaft support and ball bearing.



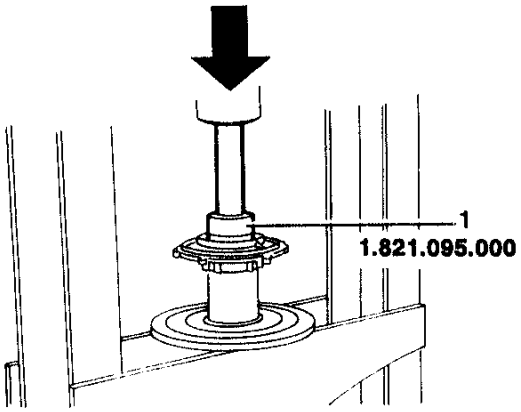
Refit by reversing the proceedure followed for disassembly, adhering to the instructions given below:

1. Fit oil guard using the inserting tool No. 1.821.201.000.



1.821.201.000

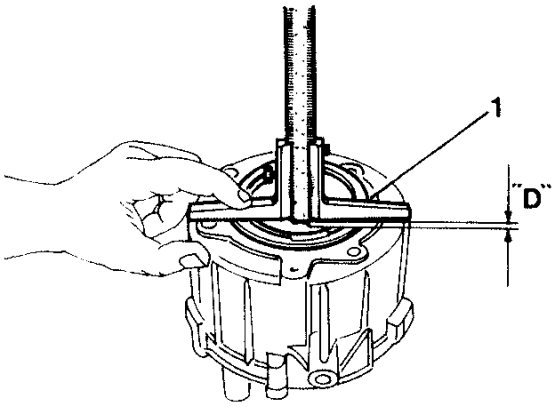
1. Install the roller bearing of the viscous coupling support using the press and the illustrated part of the inserting tool No. 1.821.095.000, together with a rotation spacer.



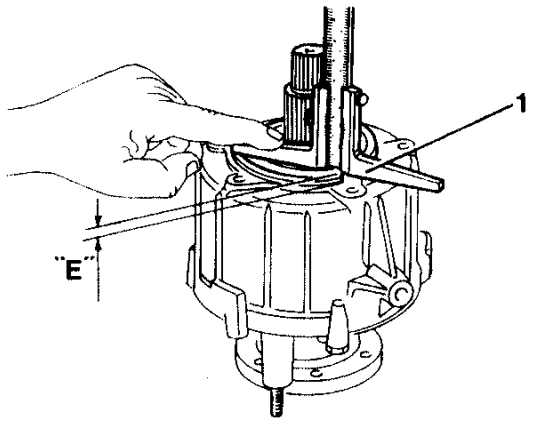
1.821.095.000

ADJUSTMENT OF "FERGUSON" VISCOUS COUPLING

1. Install the viscous coupling and the cover on the relative casing using a depth gauge, measure the distance "D" between the casing edge and the shim ring terminal plane on the viscous coupling.



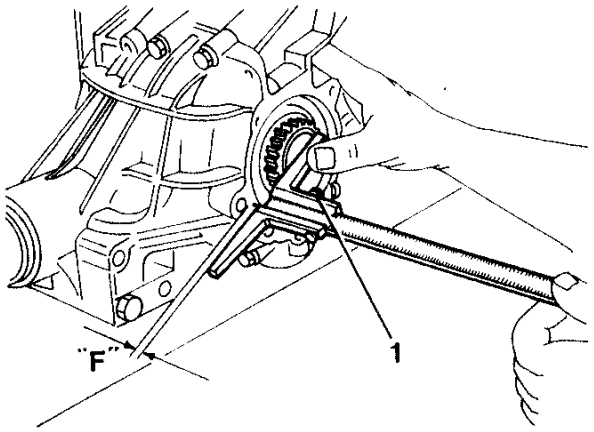
1. Measure distance "E" between the edge of the viscous coupling external casing and the supporting surface with casing of differential group support.

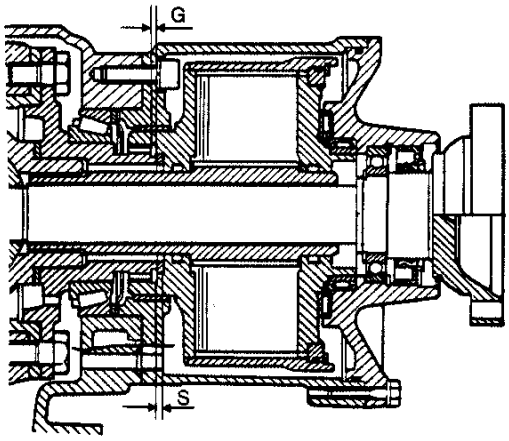


1. Measure the distance "F" between clutch gear and supporting surface on differential box.
   - Thickness "S" of the shim ring clarance between the viscous coupling and the clutch gear is obtained using the following formula:

$$S = D - E - F - G$$

NOTE: 0.13 ÷ 0.25 mm is the required clearance between the viscous coupling and the clutch gear.

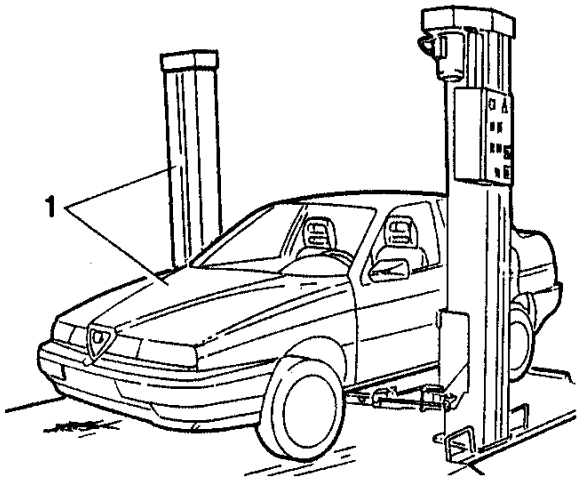




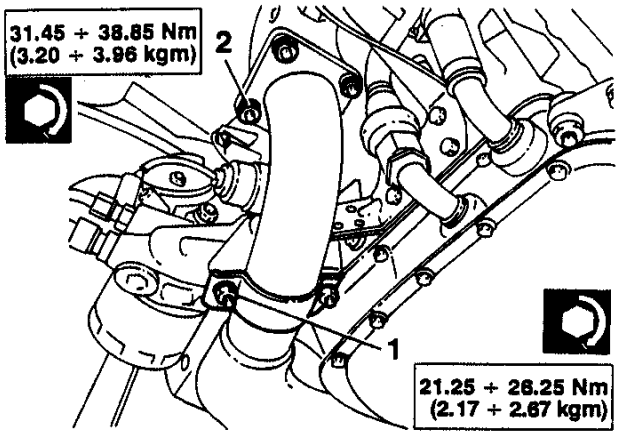
MAIN SHAFT

REMOVAL AND REFITTING

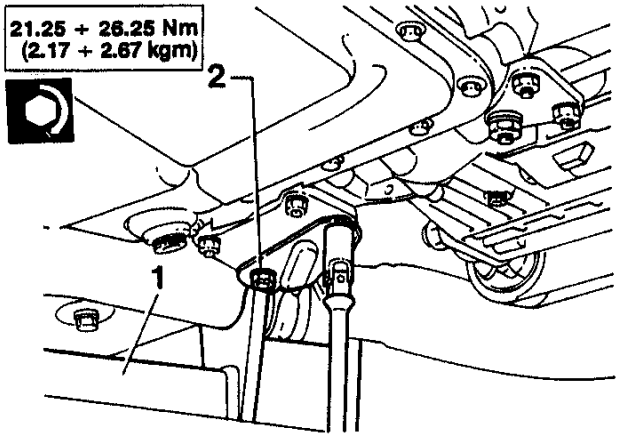
1. Put the vehicle on the lift and raise it.



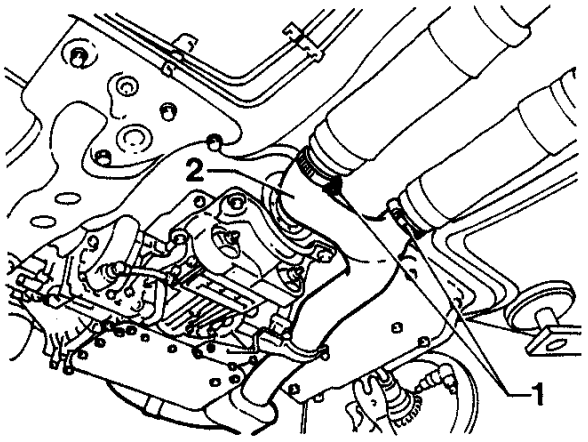
1. Loosen the nuts securing the exhaust pipe supporting bracket to the engine linkage bracket.
2. Loosen the nuts securing piping to the exhaust manifold.



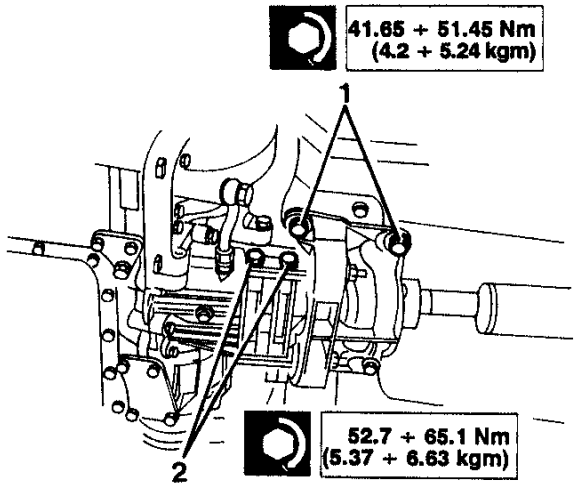
1. Using a suitable tool and a hydraulic jack, support the front end of the exhaust piping.
2. Loosen the nuts securing the exhaust pipe bracket to the differential.



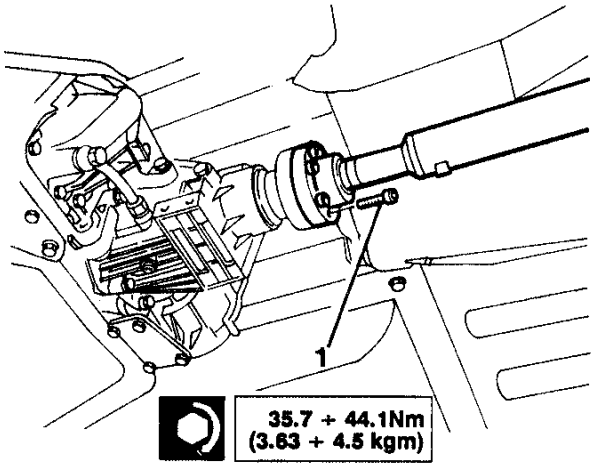
1. Release the clamps securing the front section of the exhaust pipe.
2. Lower the hydraulic jack and remove the front section of the exhaust pipe.



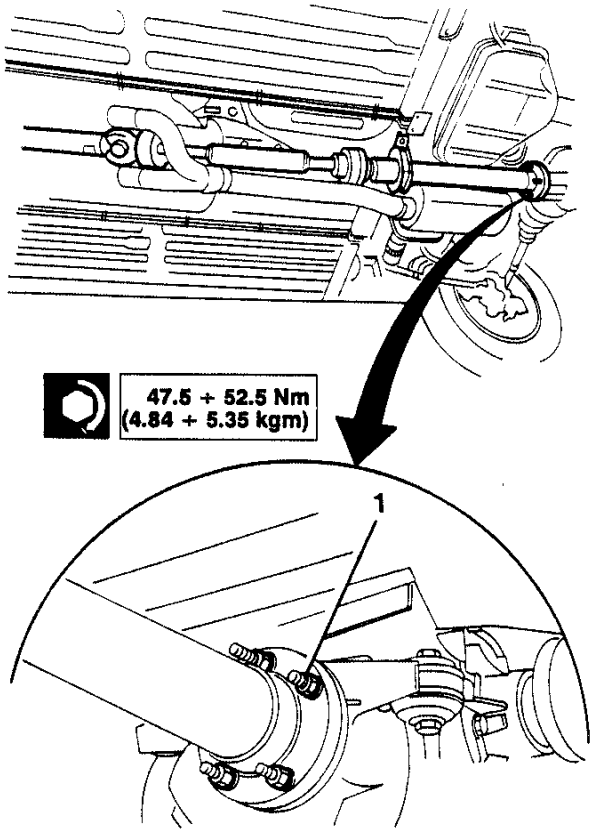
1. Loosen the four screws securing the differential support to the crossrail.
2. Loosen the two bolts securing dashpots support to the differential and remove the support.



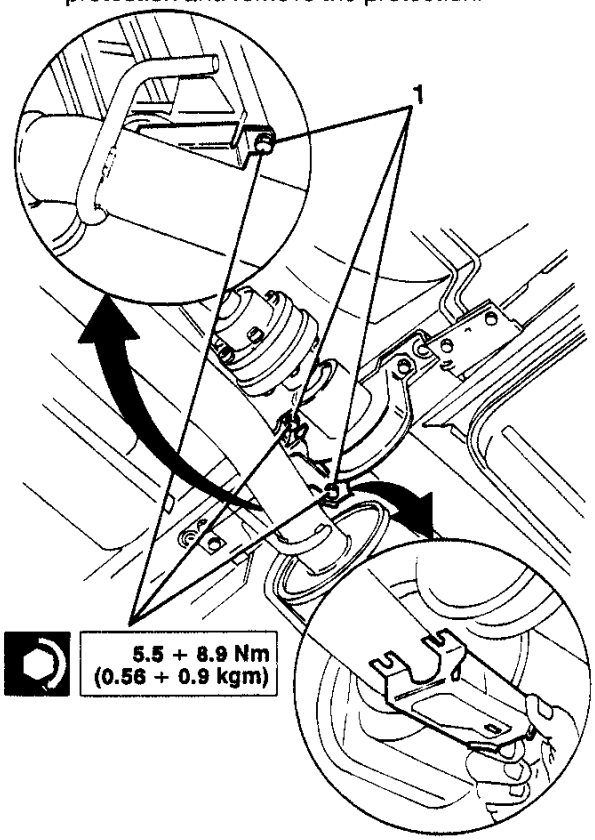
1. Loosen the six screws securing the front constant speed joint to the front differential flange and remove them together with the safety plates.



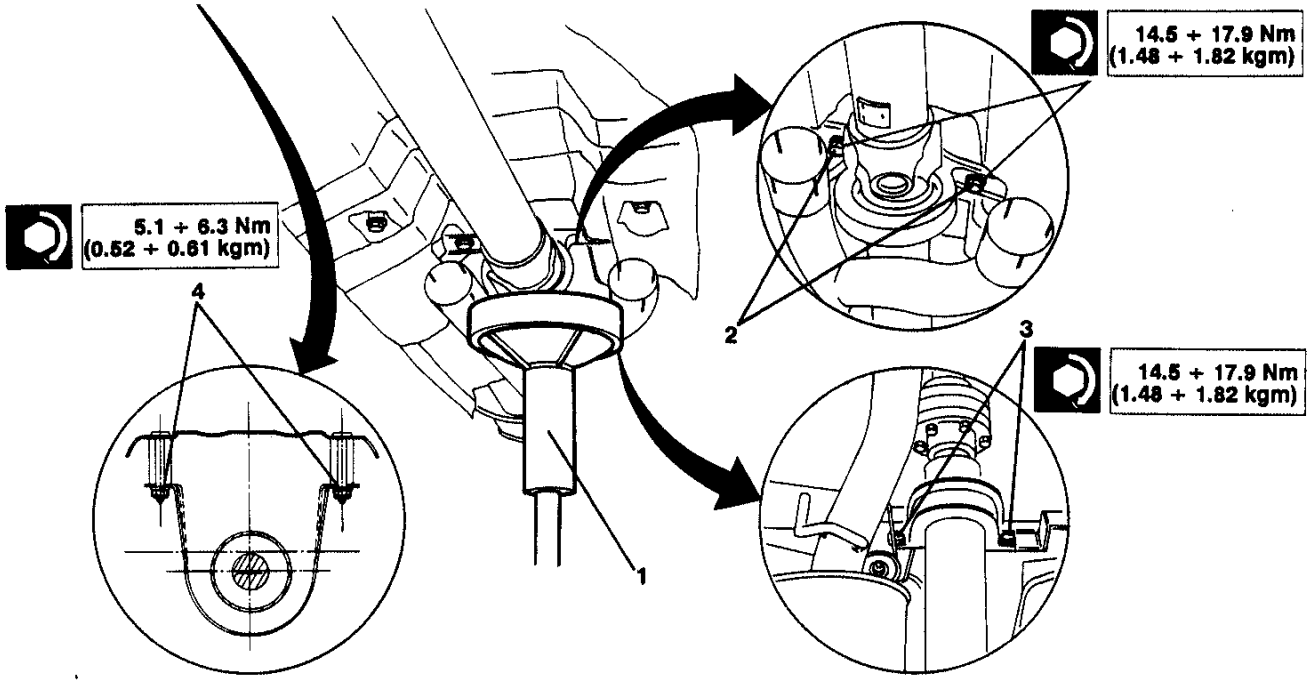
1. Loosen the six nuts securing the main shaft rear flange to the rear differential flange and remove them together with the safety plates.



1. Loosen the nuts securing the handbrake cable relay protection and remove the protection.

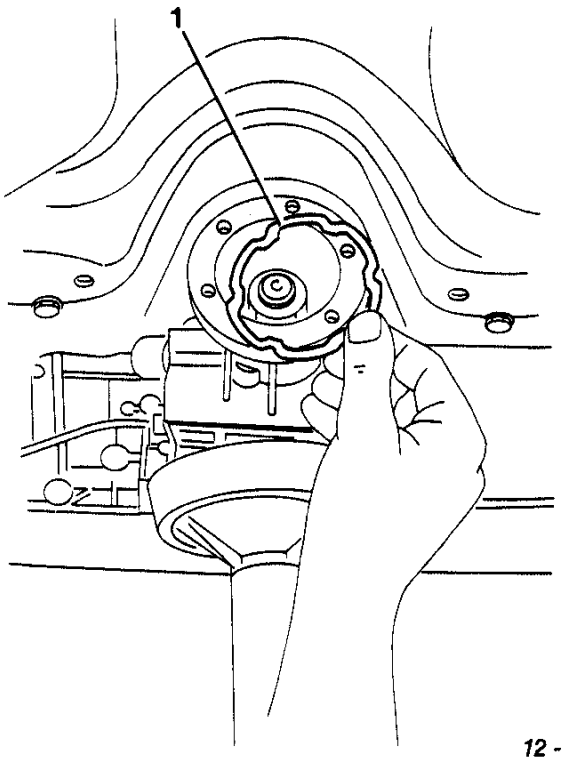


1. Support the main shaft by using a hydraulic jack.
2. Loosen the screws securing the intermediate safety flexible support to main shaft.
3. Loosen the screws securing the rear safety flexible support to main shaft.
4. Loosen the nuts securing the front safety brace to the main shaft, then lowering the hydraulic jack remove the whole main shaft.



1. Remove the gaskets on the flange of the front and rear differentials.

Refit by reversing the proceedure followed for removal, tightening the nuts and screws to the required torque and fitting new gaskets to the differential flange.

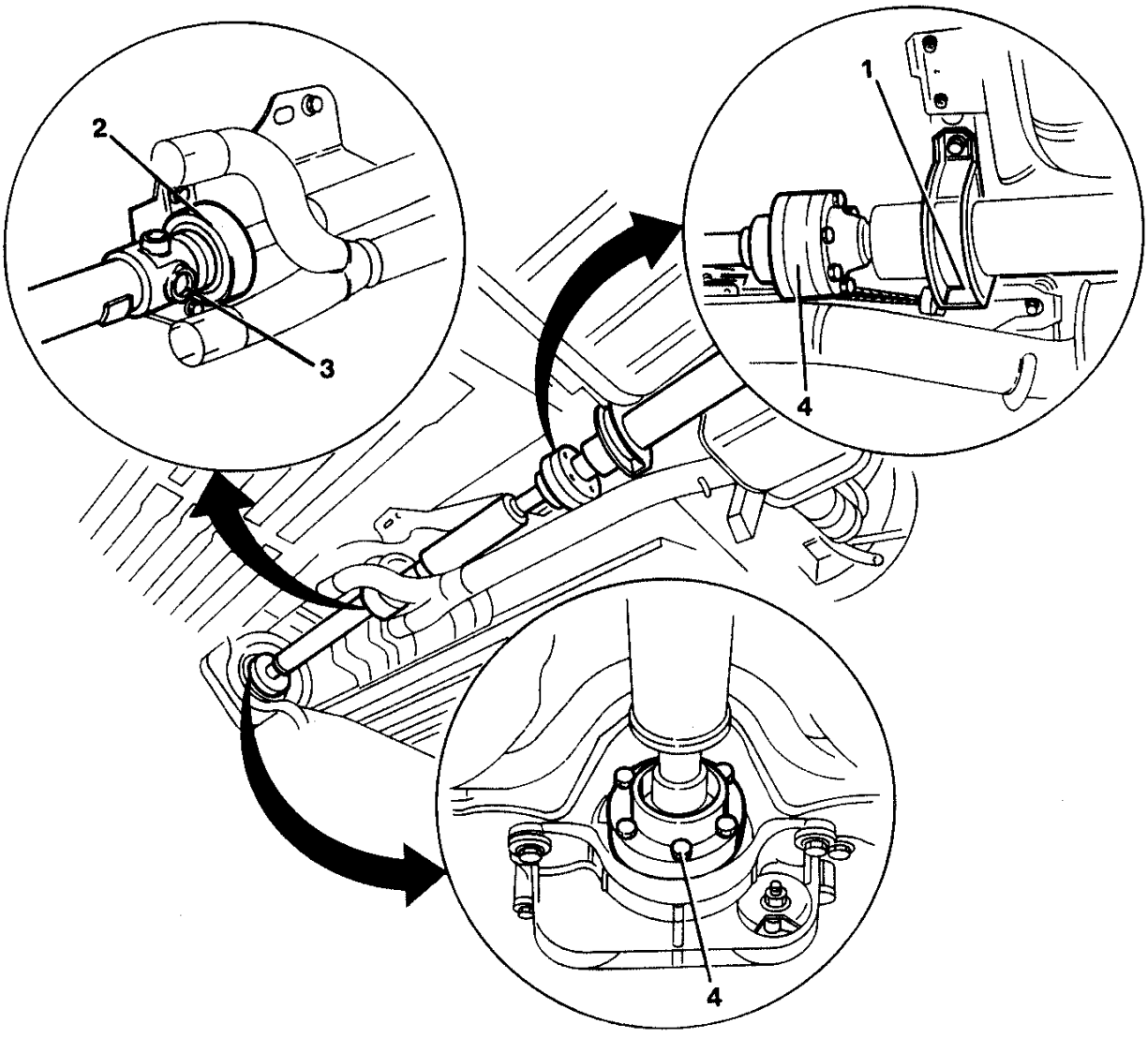


DISASSEMBLY AND REASSEMBLY

The main shaft can be broken down into the following main components:

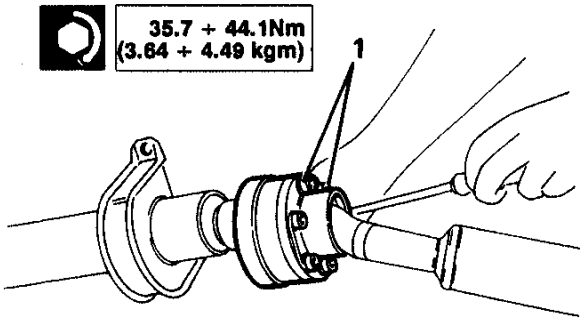
1. Rear flexible support
2. Intermediate flexible support
3. Universal coupling
4. Constant speed joints

NOTE: Before beginning the next disassembly phases it is advisable to mark the respective positions of the parts concerned.

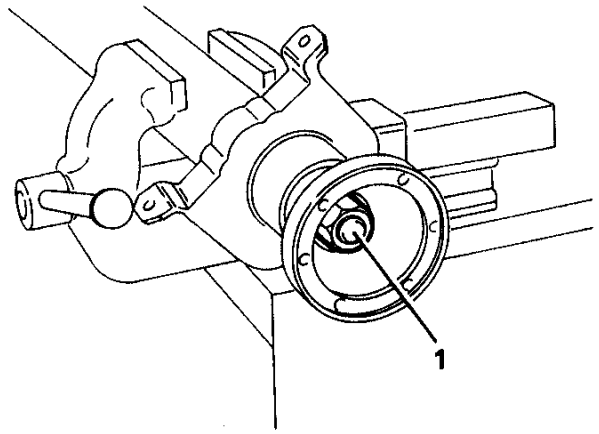


REAR ELASTIC SUPPORT

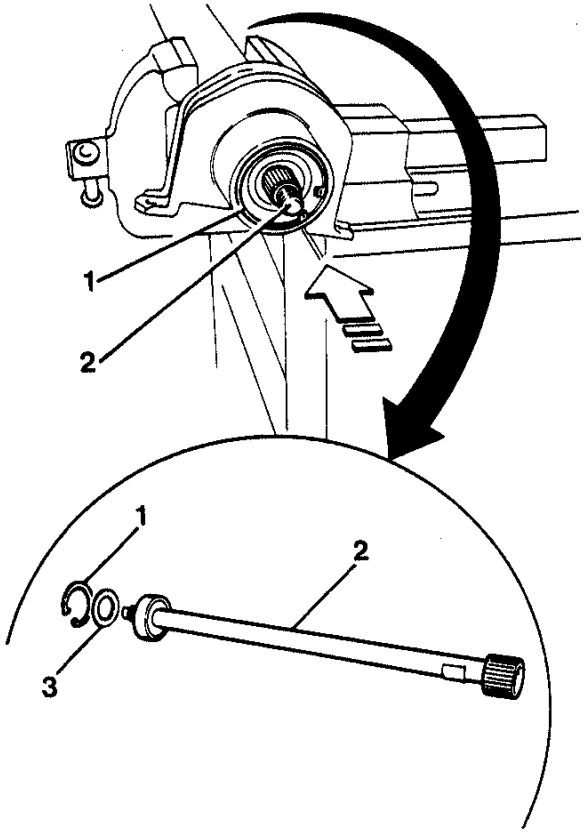
1. Loosen the screws and remove safety plates, then disconnect the constant speed joint from flange of main shaft rear section.



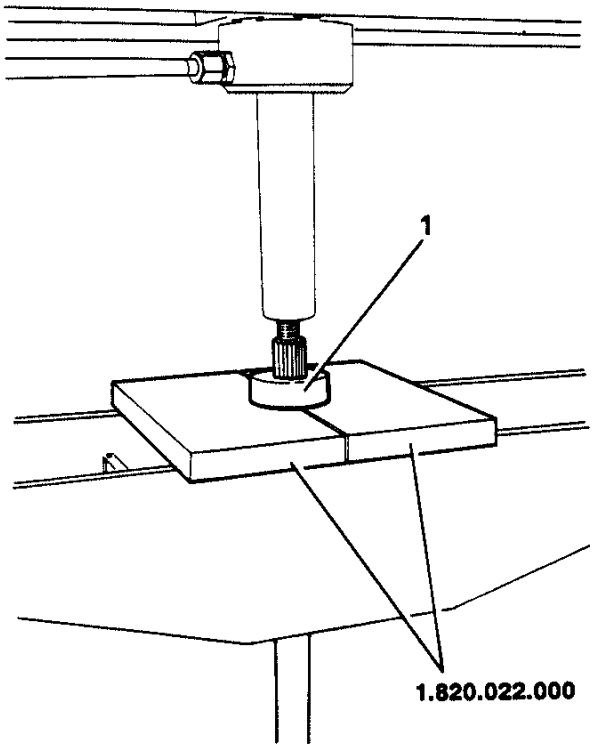
1. Operating in vice, remove the grease present on the actuating flange of the constant speed joint, then chamfer the nut securing the flange, loosen it and remove the flange.



1. Remove snap ring retaining the bearing.
2. Using a hammer of a soft material, beat in the direction indicated by the arrow and remove the shaft from the protective sheath.
3. Remove from sheath the ball bearing shim.

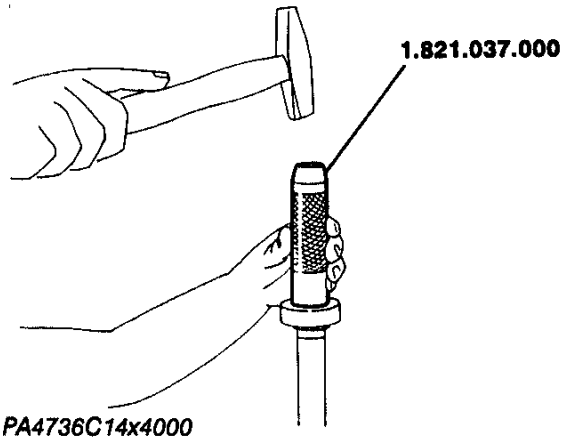


1. Using a hydraulic press and half plates No. 1.820.022.000 remove the shaft from bearing.



Reassembly by reversing the proceedure followed for disassembly adhering to the instruction given below:

- Verify the integrity of the components concerned (see: INSPECTIONS AND CHECKS) and replace them, if necessary.
- Refit bearing on main shaft using tool No. 1.821.037.000.

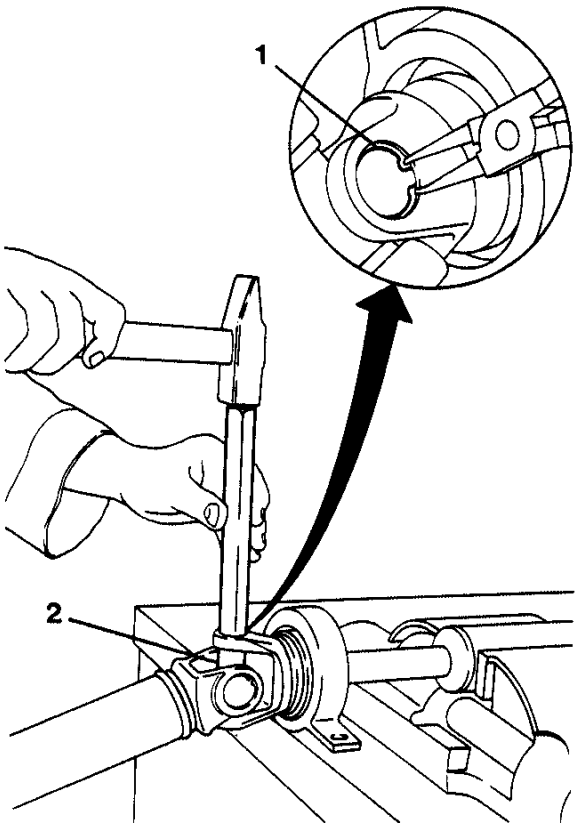


- Replace and chamfer the nut securing the main shaft to the actuating flange of constant speed joint.

UNIVERSAL COUPLING AND INTERMEDIATE FLEXIBLE SUPPORT

Universal coupling

1. Remove the snap rings retaining the needle bearings.
2. Operating in vice and using a suitable die, remove the roller bearing from seatings on the constant speed joint yokes.

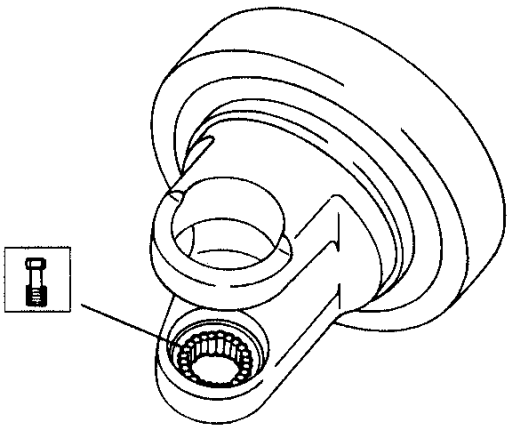


Reassembly by reversing the proceedure followed for disassembly and adhering to the instructions given below:

- Verify the integrity of the components concerned (see: CHECKS AND CONTROLS) and replace them, if necessary.

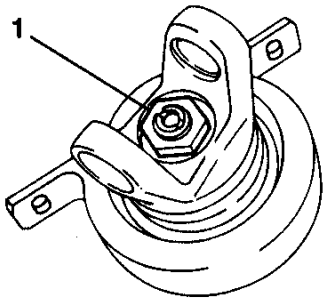
NOTE: The universal coupling crosses are supplied together with roller bearings as a spare part.

– Lubricate abundantly, using the specified grease (see: TECHNICAL CHARACTERISTICS AND SPECIFICATIONS - GENERAL SPECIFICATIONS - FLUIDS AND LUBRICANTS), the roller bearings and the universal coupling cross.

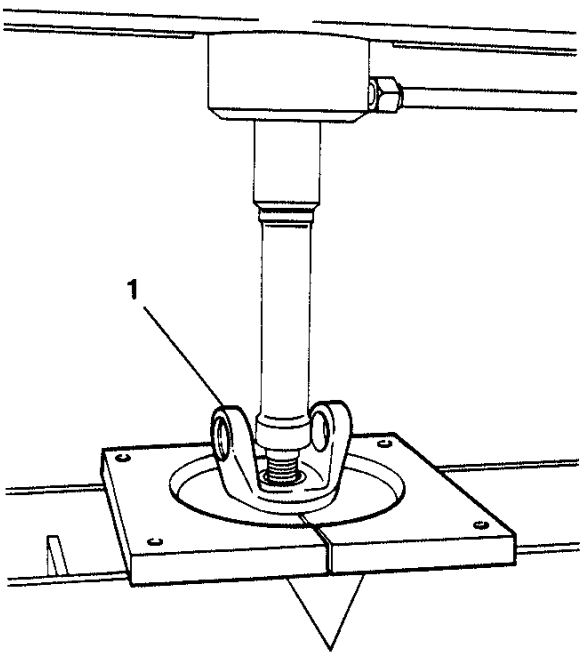


Intermediate flexible support

1. Operating in vice, chamfer and loosen the nut securing the half cross to the main shaft.

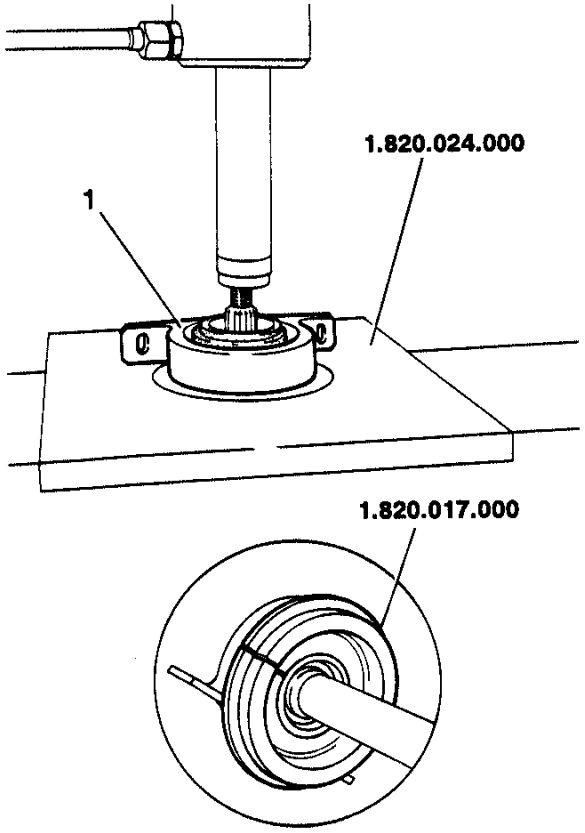


1. Using a hydraulic press and half plates No. 1.821.039.000 remove the shaft from half cross.



1.821.039.000

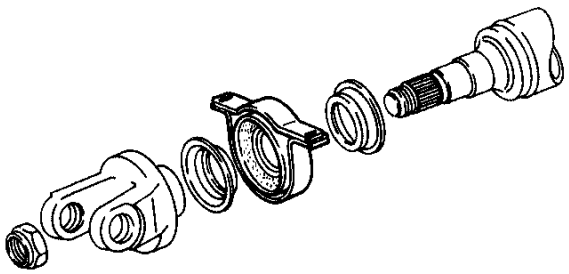
1. Using the half rings No. 1.820.017.000 placed between cup and flexible support and acting with a hydraulic press equipped with plate No. 1.820.024.000 withdraw the intermediate flexible support together with the bearing from main shaft.



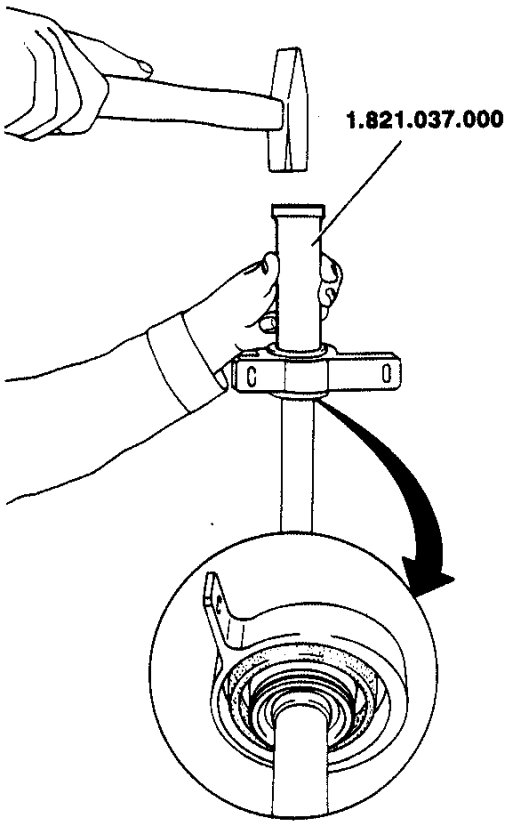
Reassembly by reversing the proceedure followed for disassembly and adhering to the instructions given below:

- Verify the integrity of the components concerned (see: INSPECTIONS AND CHECKS) and replace them, if necessary.

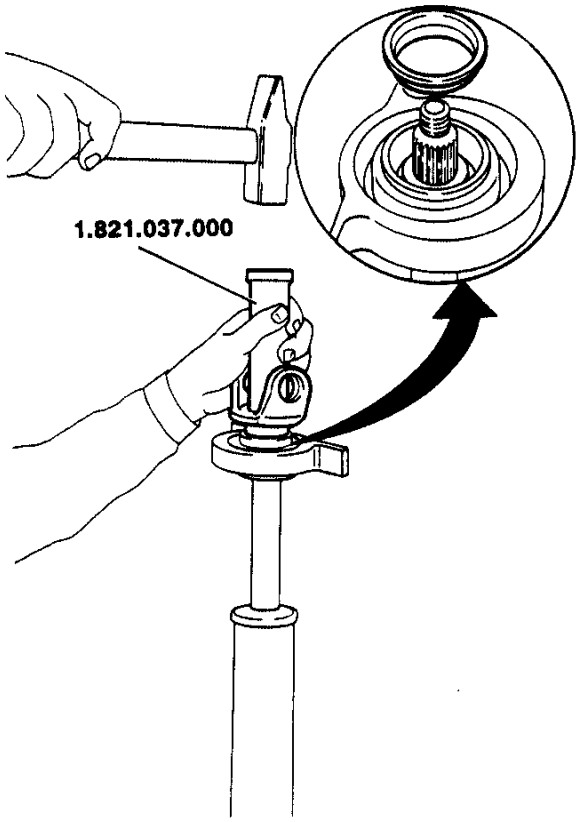
NOTE: The intermediate flexible support is as a spare part together with its bearing, therefore damage to the external structure, to the rubber crown gear or to the roller bearing mean that the entire component must be replaced.



- Before refitting the new support verify the correct position of the rear cup, then using the inserting tool No. 1.821.037.000 insert the support on the main shaft.



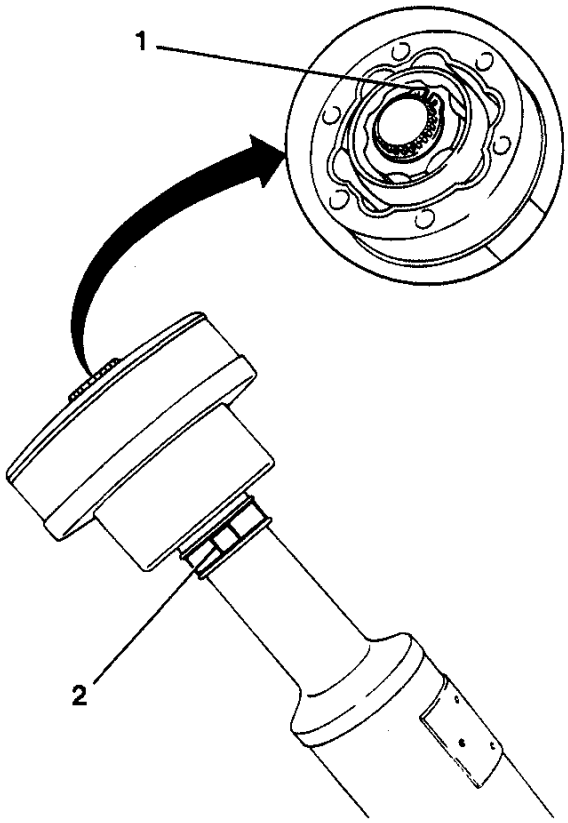
– Verify the correct position of the front cup, then using inserting tool No. 1.821.037.000 insert the half yoke on the main shaft.



– Replace and chamfer the nut securing the half cross to the main shaft.

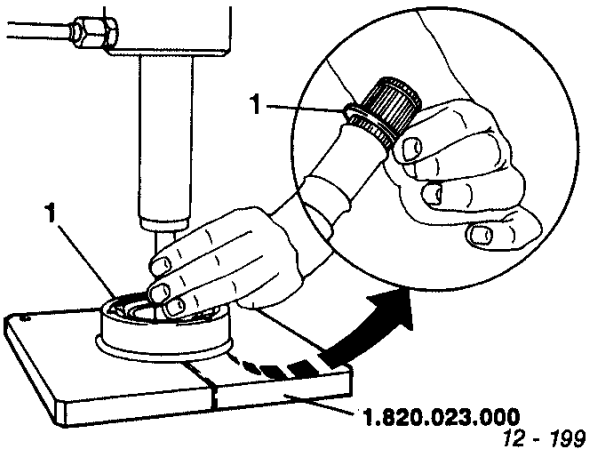
CONSTANT SPEED JOINTS

1. Operating with the main shaft in vice, remove the snap ring securing the constant speed joint.
2. Remove the clamp securing the hood.

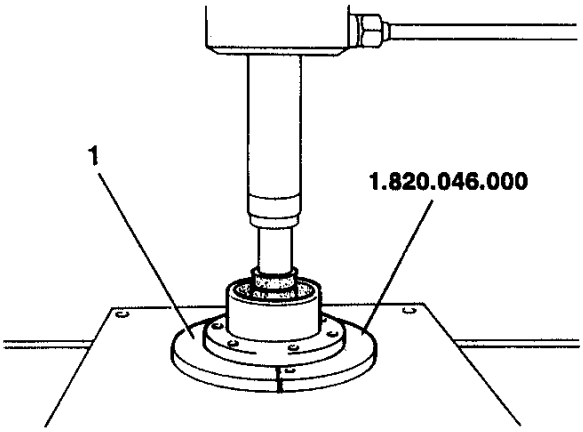


1. Using a hydraulic press, half plates No. 1.820.023.000 and a suitable die, remove the shaft from the constant speed joint along with the shim ring.

WARNING:
Removing the joint very carefully in order to avoid damaging the joint hood.



1. Using a hydraulic press, half plates No. 1.820.046.000 and a suitable die, slide off the hood fom the constant speed joint.

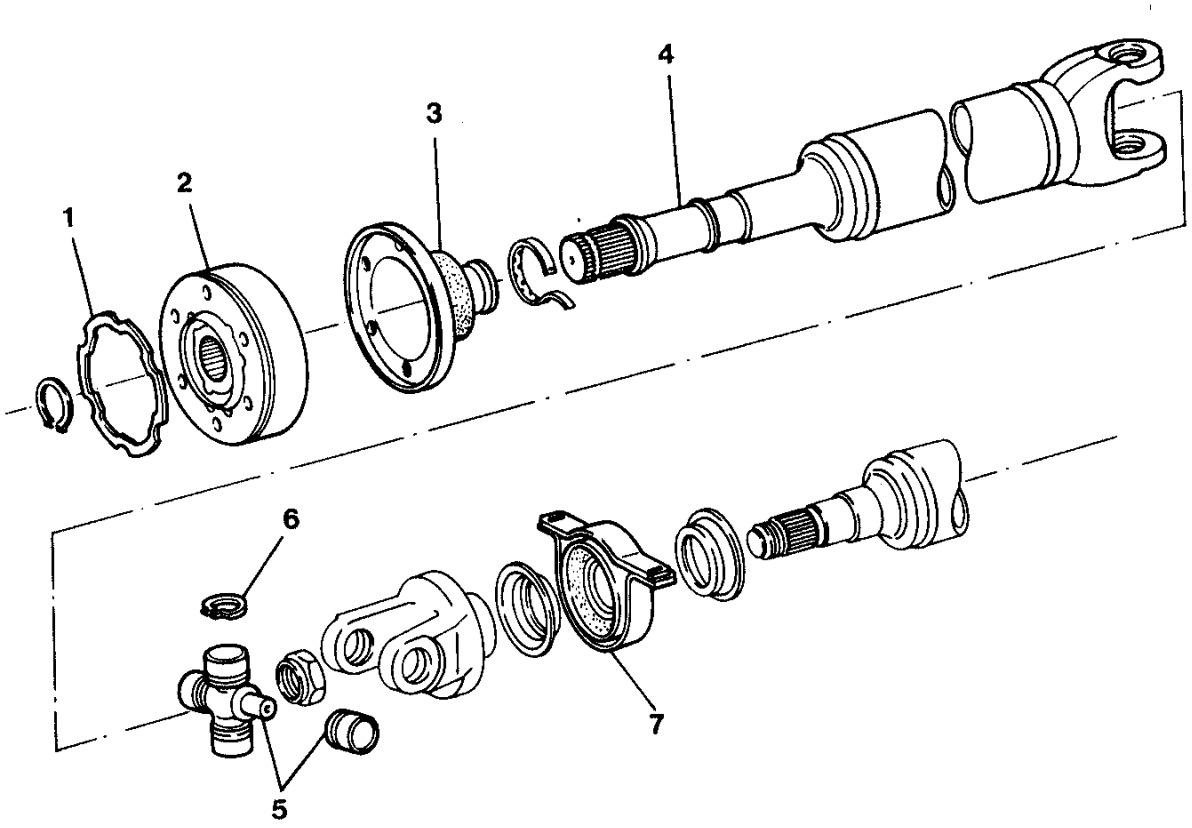


Reassembly by reversing the proceedure followed for disassembly and adhering to the instructions given below:

- Verify the integrity of the components concerned (see: INSPECTIONS AND CHECKS) and replace them, if necessary.
- Before installing the hood on the joint, using two reference screws, check the exact alignment of the holes present on the hood and the joint.
- Lubricate abundantly, using the specified grease (see: TECHNICAL CHARACTERISTICS AND SPECIFICATIONS - GENERAL SPECIFICATIONS - FLUIDS AND LUBRICANTS) constant speed joint balls and holes.

INSPECTIONS AND CHECKS

Before reassembling of each component, act as indicatted below:



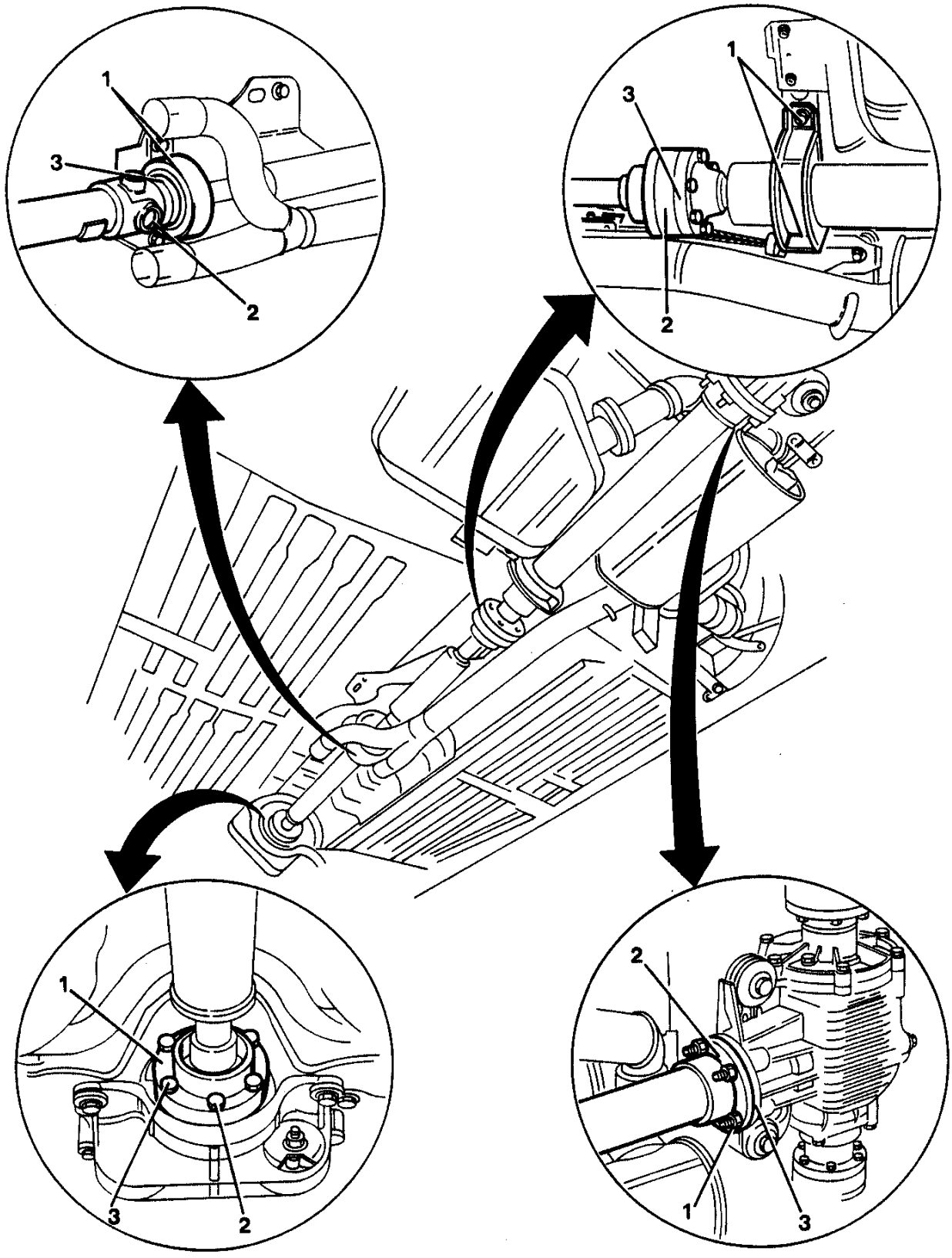
1. Check the condition of the gaskets located in connection with the front constant speed joint and the flange connecting the post differential and replace if necessary.
2. Carefully wash the constant speed joint with diesel oil or petrol and verify visually that balls and respective seatings are perfectly specular and do not show signs of seizing or scoring. Otherwise replace the damaged joint.
3. Check the condition of the hood and if replace if cracked or distorted.
4. Check the conditions of the different sections of main shaft and sheath ensuring there is no distortion, cracking or anomaly. Replace if necessary.
5. Check the superficial bearing interference conditions; replace the crossmember if cracks, negative allowances or excessive play between the parts are present.
6. Check that the axial play of the cross is between 0.01 and 0.04 mm, if the above play is higher it is necessary to replace the safety snap rings choosing the exact thickness among the following rings 1.50 - 1.53 - 1.56 - 1.59 - 1.62.
7. Check the general conditions of the flexible supports, verify that the play of the support ball bearing is not excessive and does not roll roughly. Check that the flexible support has not been deformed, that the rubber part is not worn and that it has its original flexibility. Otherwise replace the damaged supports.

ON VEHICLE OPERATIONS

MAIN SHAFT INTEGRITY CHECKS

1. Check the safety support of main shaft for damage and the relative securing devices.
2. Verify the integrity of joints and flanges securing the shaft to the differentials.
3. Verify that the universal coupling cross and differential are not leaking grease or oil.

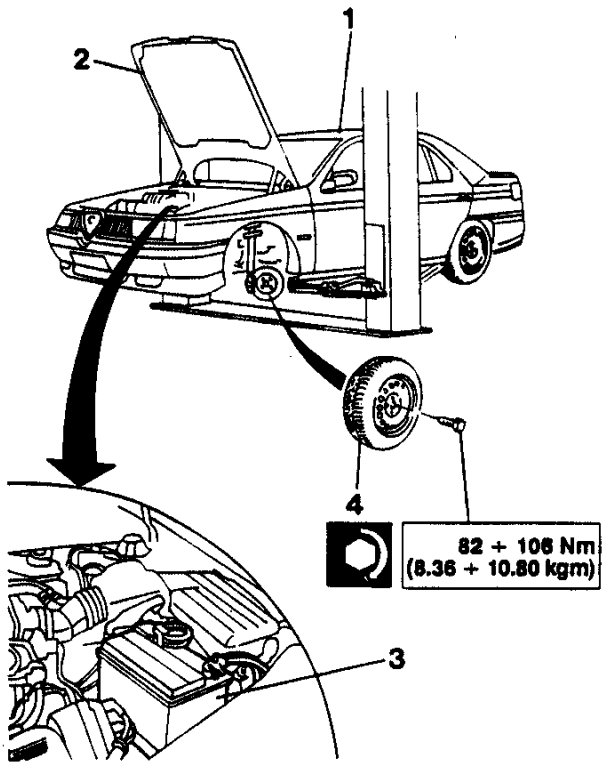
– If necessary, check the damaged components (see: DISASSEMBLY AND REASSEMBLY).


1
3
2
1
3
2
1
3
2
2
1
3

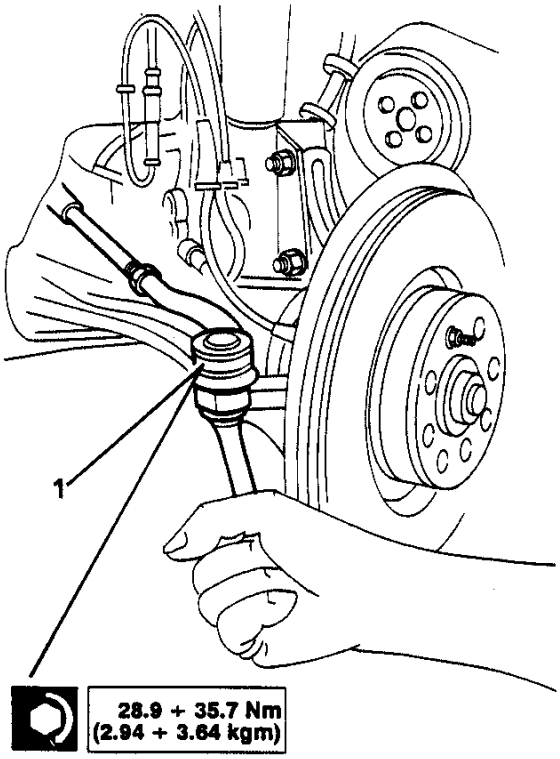
DIFFERENTIAL CASING OIL SEAL REPLACEMENT - ENGINE SIDE

1. Put the vehicle on lift.
2. Raise the bonnet.
3. Disconnect battery.
4. Remove front wheels and gravel guards.

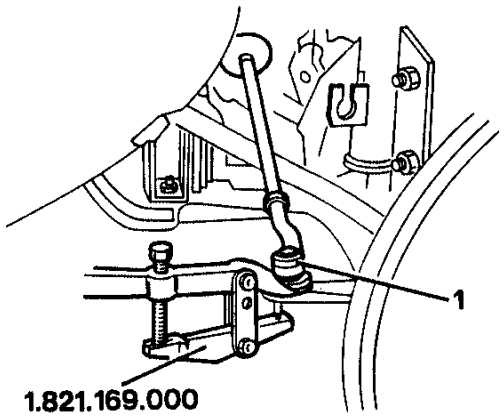
WARNING:
Protect the area surrounding the engine compartment with soft material in order to avoid accidental damage to the body.



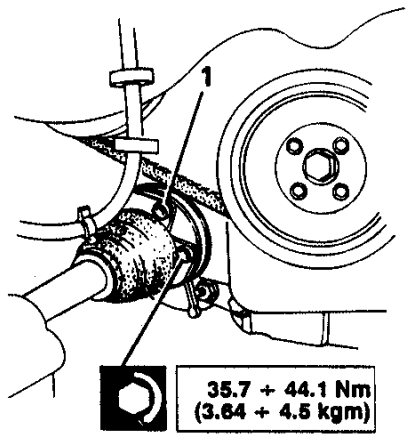
1. Loosen and remove the nut securing the steering tie-rod ball- pin to the wheel support.



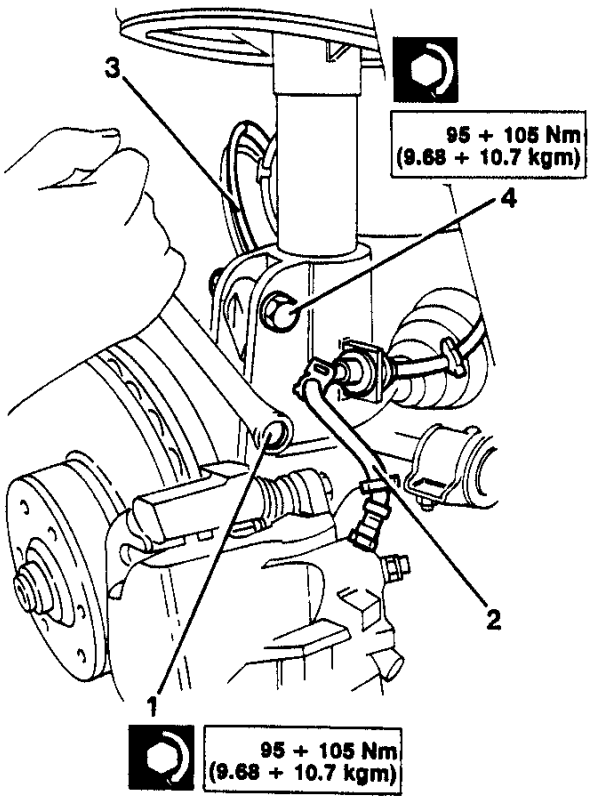
1. Using tool No. 1.821.169.000 remove the ball pin from the wheel support.



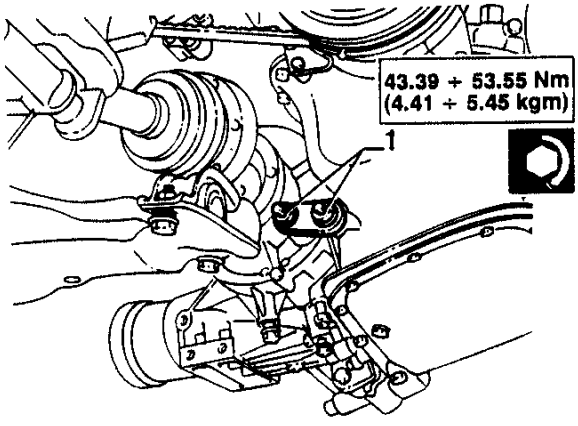
1. Loosen and remove, together with three safety plates, the nut securing constant speed joint to the flange.



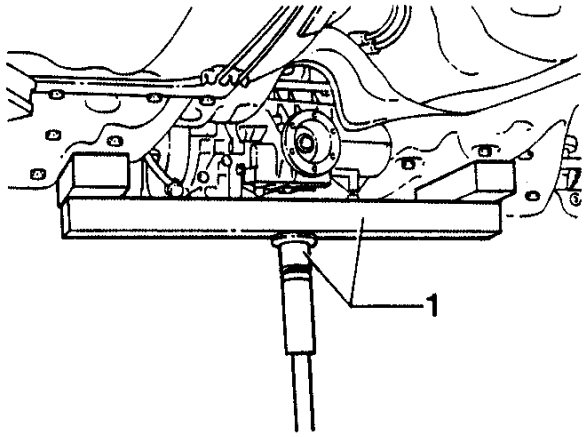
1. Loosen and remove the upper bolt securing the wheel support to the shock absorber stem.
2. Disconnect brake system oil piping from bracket on damper stem.
3. Disconnect ABS system wiring from respective bracket (for vehicle fitted with controlled damping suspension only).
- Disconnect S.C.S. system solenoid valve wiring, located on the shockabsorber, from its bracket.
4. Loosen the lower nut securing the wheel support to the damper stem, then remove the half shaft.



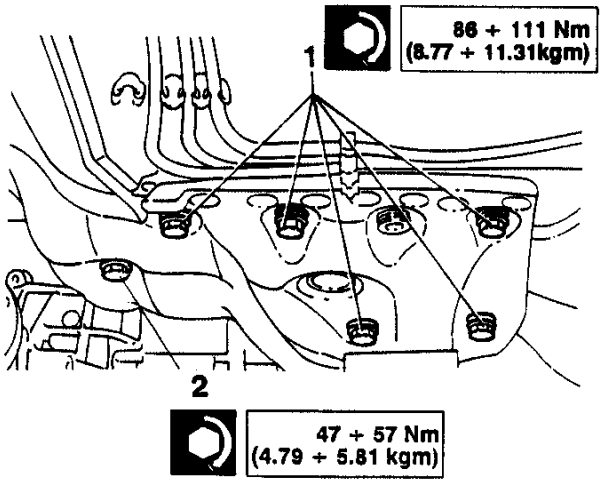
1. Loosen nuts securing the linkage bracket to the viscous coupling and engine oil sump, then remove the bracket.



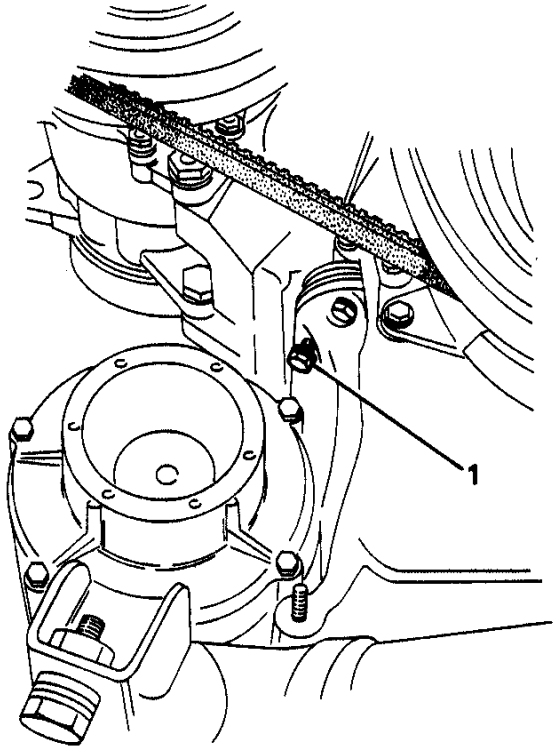
1. Using a hydraulic jack fitted with a suitable device, support the crossrail.



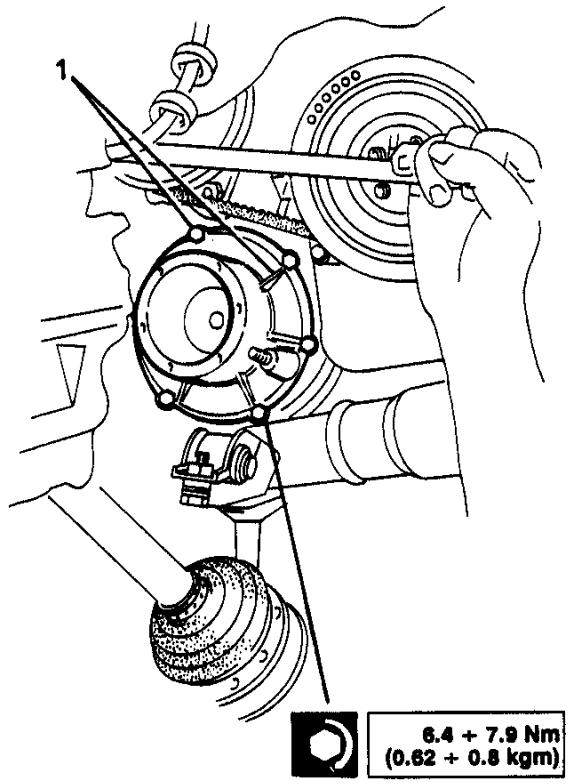
1. As far as possible loosen but do not remove, the screws securing cross member to body.
2. Loosen as much as possible, without removing, the screws securing steering box to crossrail.



1. Remove screw (shown in figure) securing oil sump to cylinder block.



1. Loosen and remove the six screws securing the cover of the viscous coupling, then by lowering the hydraulic jack in order to allow the power unit group to be lowered remove the cover together with the drive shaft.



- Replace oil seal and O-rings on viscous coupling cover (see: "FERGUSON" VISCOUS JOINT COVER DISASSEMBLY AND REASSEMBLY).

Reassembly by reversing the proceedure followed for disassembly and tighten the screws and nuts to required torque.

TECHNICAL FEATURES AND PRESCRIPTIONS

TECHNICAL FEATURES

MAIN SHAFT

Type:		into three sections
Flexible supports:	N° 1	on central section with ball bearing in support
	N° 1	on rear section with ball bearing installed inside the fixed sheath on support
Constant speed joints:	N° 1	on front section (between shaft and front differential)
	N° 1	on intermediate section (between intermediate and rear sections)
Universal couplings:	N° 1	between front and intermediate sections
Cross radial play: mm		0.01 ÷ 0.04
Thickness of safety snap rings for adjustment cross radial play: mm		1.5 - 1.53 - 1.56 - 1.59 - 1.62

GENERAL PRESCRIPTIONS

FLUIDS AND LUBRICANTS

APPLICATION	TYPE	NAME
Universal coupling cross and roll bearings Constant speed joints balls and holes	GREASE	TUTELA MRM2
Gearbox-differential unit oil refill	OIL	TUTELA ZC 80/S

TIGHTENING TORQUES

FRONT DIFFERENTIAL-VISCOUS JOINT

Description	kg·m	N·m
Revolving union securing oil supply piping to pinion support and oil exhaust	29.75 ÷ 36.75	3.03 ÷ 3.74
End straight union securing oil supply piping to pinion support	29.75 ÷ 36.75	3.03 ÷ 3.74
Nut securing front differential rod to engine sump	43.35 ÷ 53.55	4.41 ÷ 5.46
Screw securing pinion support to gearbox	74.8 ÷ 92.4	7.62 ÷ 9.42
Screw securing pinion support to alternator	21.25 ÷ 26.25	2.16 ÷ 2.67
Screw securing viscous coupling external casing to differential	21.25 ÷ 26.25	2.16 ÷ 2.67
Screw securing viscous joint casing cover	6.37 ÷ 7.87	0.65 ÷ 0.80

MAIN SHAFT

Description	kg·m	N·m
Nut locking main shaft union screws to front differential and sections	35.7 ÷ 44.1	3.64 ÷ 4.49
Nut securing safety brace to front section main shaft	5.1 ÷ 6.3	0.52 ÷ 0.64
Screw securing support flexible plug to main shaft intermediate joint	14.45 ÷ 17.85	1.47 ÷ 1.82
Screw securing support flexible plug guard pipe of main shaft rear section	14.45 ÷ 17.85	1.47 ÷ 1.82
Nut securing main shaft rear section guard pipe to differential	47.5 ÷ 52.5	4.84 ÷ 5.35
Taper screw securing support to cross member	41.65 ÷ 26.25	4.24 ÷ 5.24
Self-locking nut securing gearbox in bushings	52.7 ÷ 65.1	5.37 ÷ 6.64
Self-locking flanged nut securing pulley cover to handbrake cables	5.53 ÷ 8.93	0.56 ÷ 0.91

SPECIAL TOOLS

TOOL NUMBER TOOL	DESCRIPTION
1.820.017.000	Half rings for extracting intermediate flexible support (Use with 1.820.024.000)
1.820.022.000	Half plates for extracting main shaft rear section bearing
1.820.023.000	Half plates for extracting constant speed joint
1.820.024.000	Plate supporting half rings (Use with 1.820.017.000)
1.820.046.000	Half plates for extracting constant speed joint hood
1.820.229.000	Flange for extracting intermediate shaft
1.820.252.000	Differential support to bench
1.821.003.000	Internal bearing puller to viscous coupling
1.821.037.000	Bearing inserting tool to main shaft
1.821.039.000	Half plates for extracting main shaft universal coupling half cross
1.821.095.000	Inserting tool for bearing viscous coupling support
1.821.161.000	Mallet (Use with 1.820.229.000)
1.821.169.000	Puller for steering side tie rod pin
1.821.201.000	Oil seal inserting tool

GROUP 17

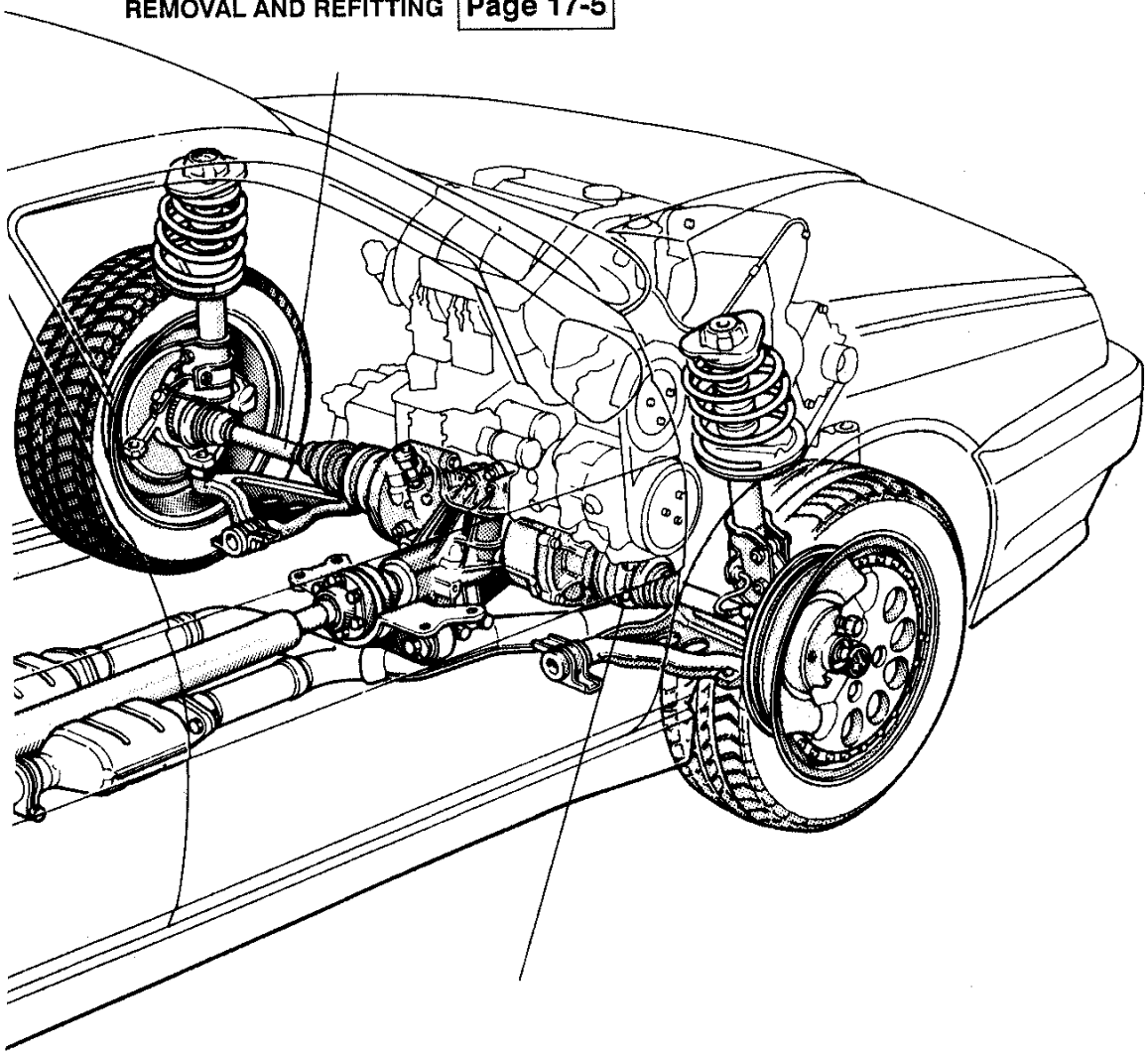
AXLE SHAFTS

INDEX

For all parts not given here, refer to the corresponding Group in publication No. PA4655C1000000.

ILLUSTRATED INDEX

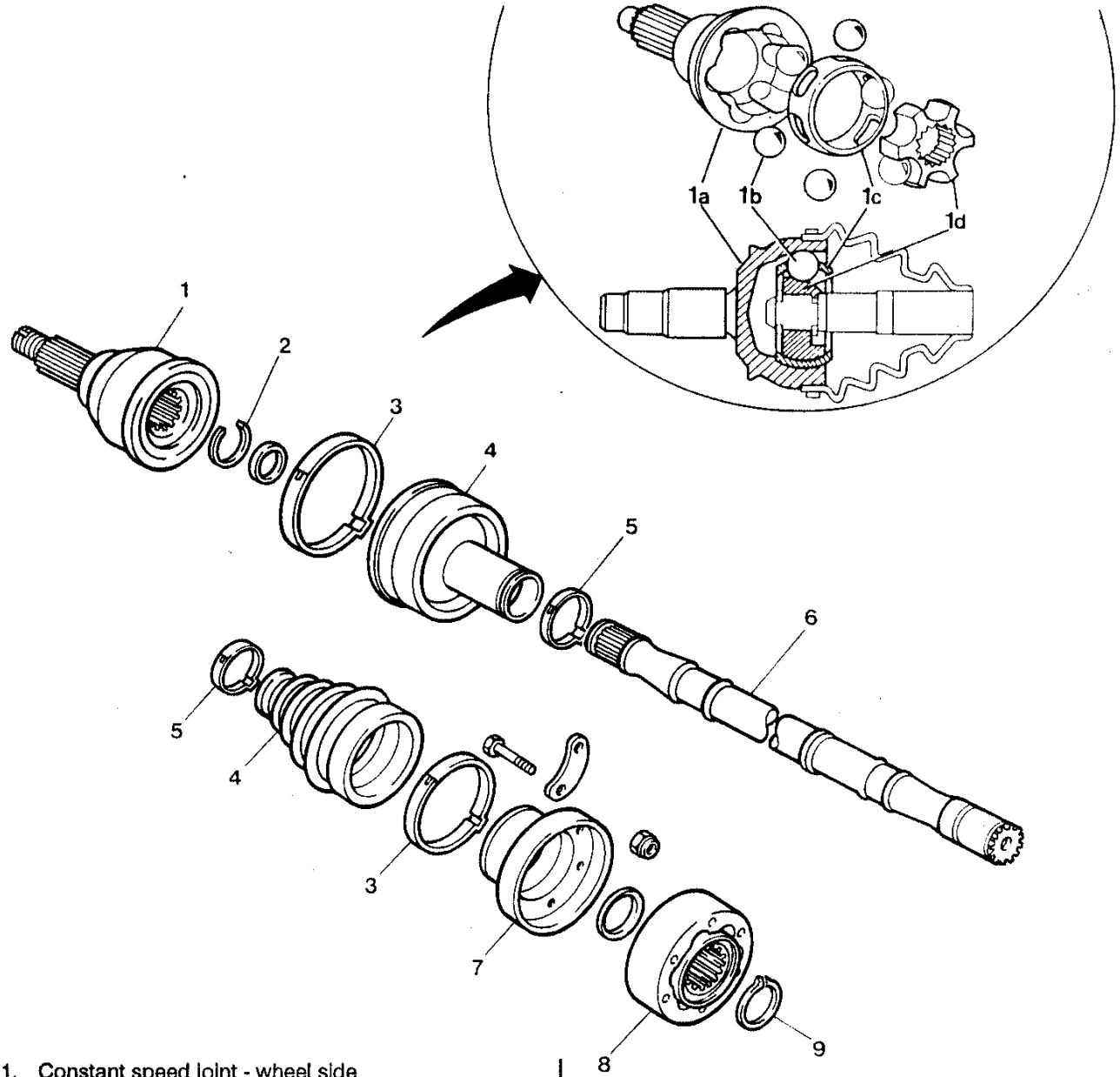
SHAFTS



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.

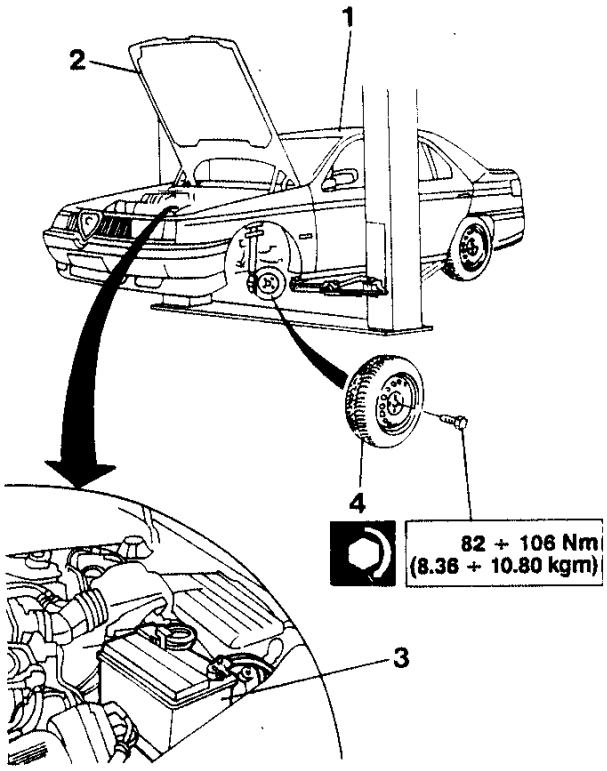
The inner core has six spherical grooves on its outer surface containing six balls (1b) kept in place by a cage (1c).

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

REMOVAL AND REFITTING

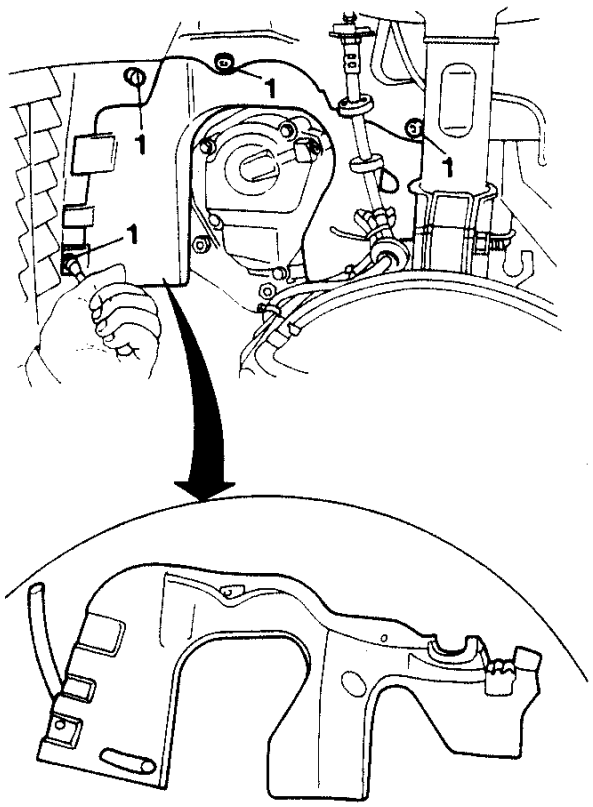
1. Set the vehicle on a lift.
2. Lift the bonnet.
3. Disconnect and remove the battery.
4. Remove the front wheels.

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

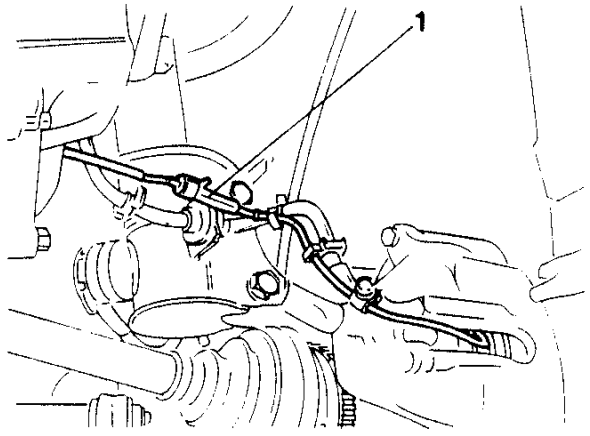


– Raise the vehicle.

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.

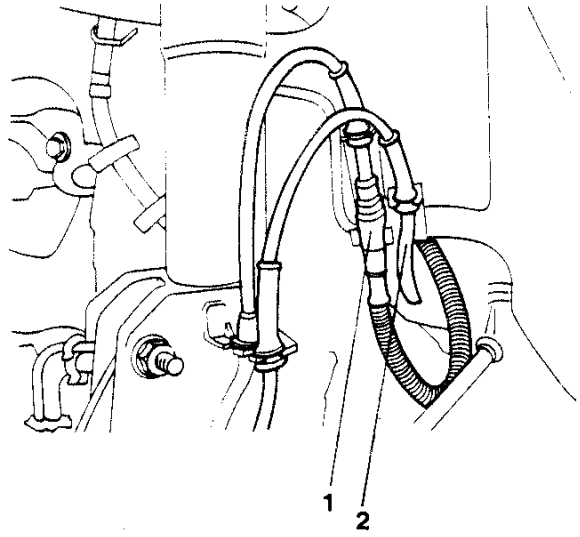


1. (only for vehicles equipped with controlled damping suspension):

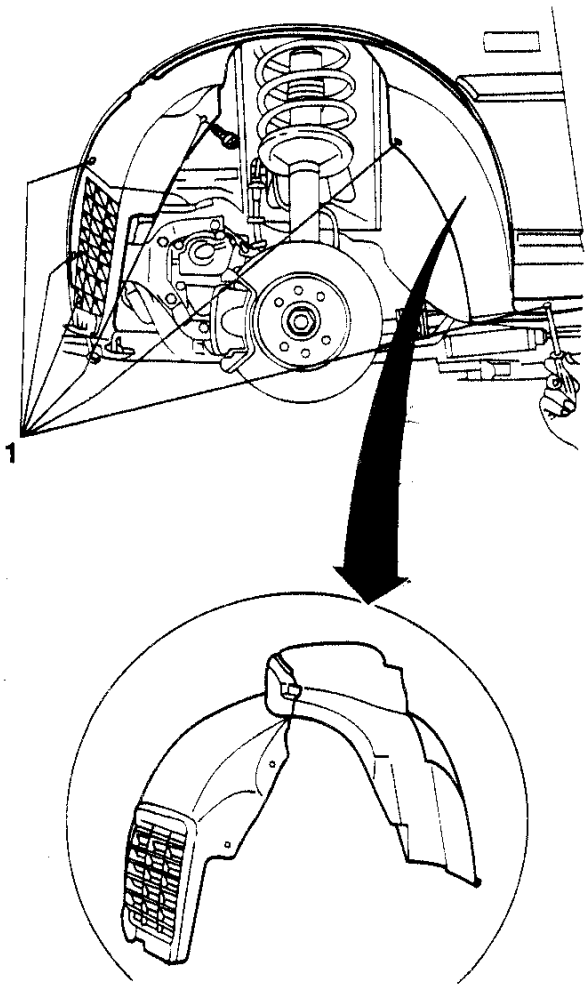
   - disconnect the connector from the controlled damping sensor.

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.



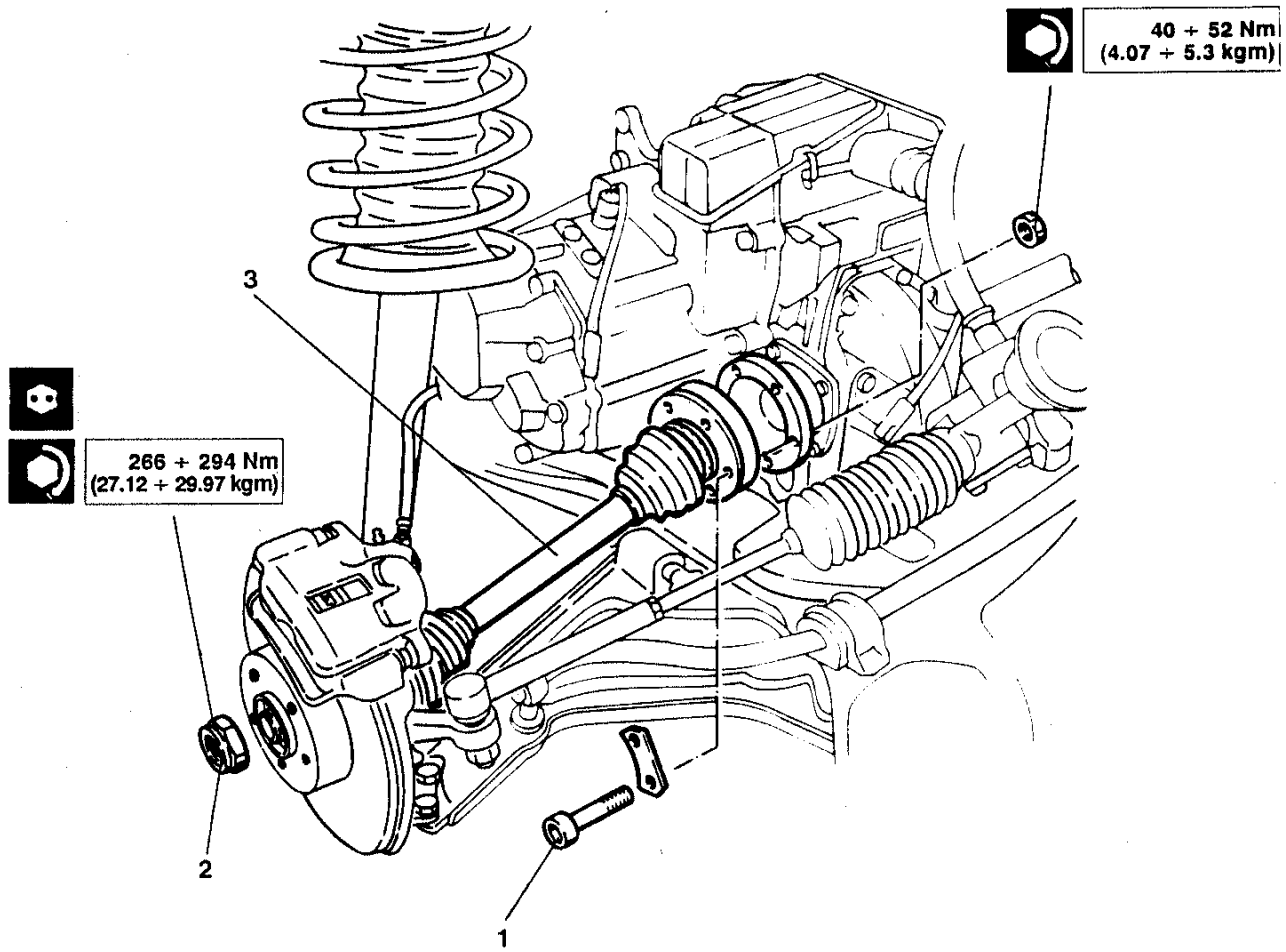
1. Loosen the screws and remove the plastic wheel-housing from the body.



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.

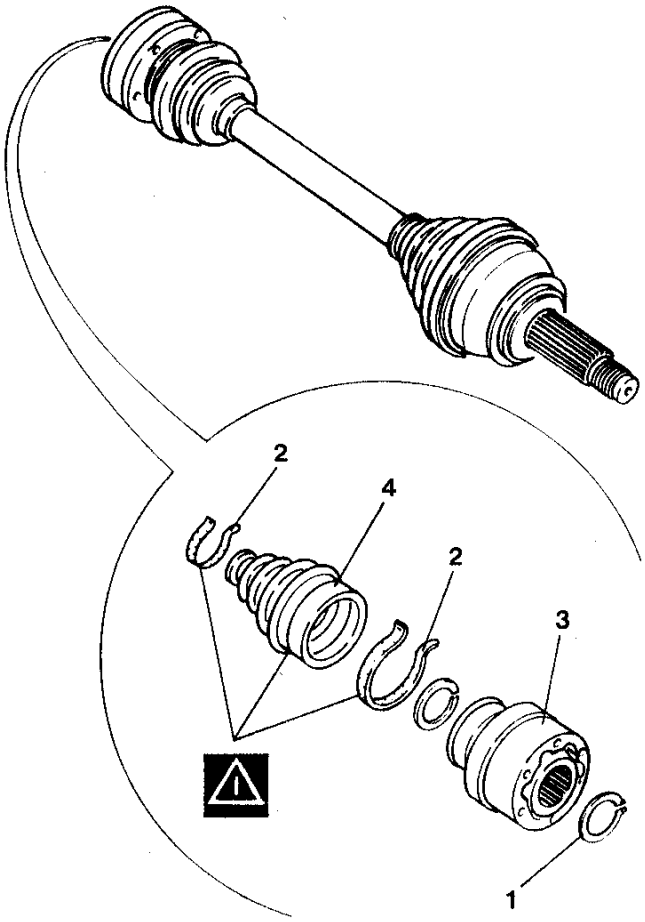


CONSTANT SPEED JOINTS

DISASSEMBLY OF JOINT ON GEARBOX SIDE

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

WARNING:
Substitute the boot and clamps when refitting.

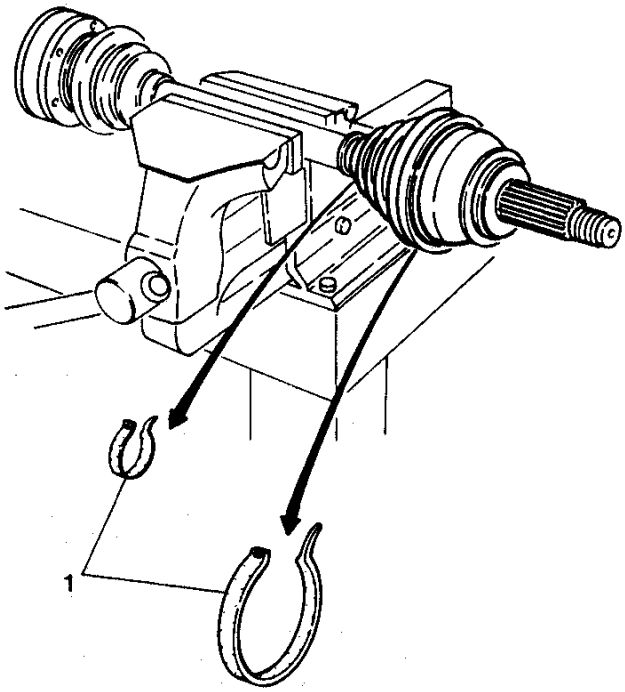


DISASSEMBLY OF JOINT ON WHEEL SIDE

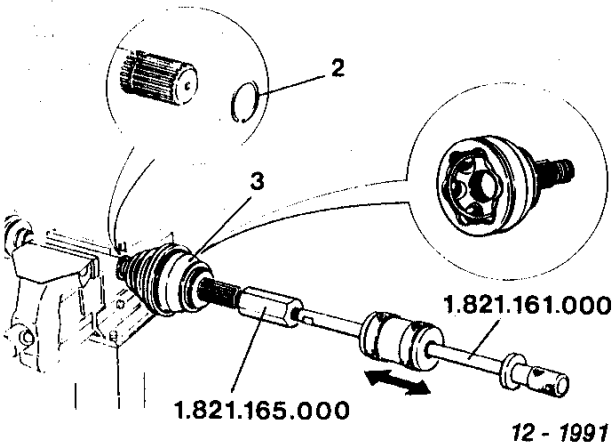
Lock the axle shaft in a vice and proceed as follows:

1. Remove the clamp securing the protective boot.

WARNING:
Substitute the boot and clamps when refitting.

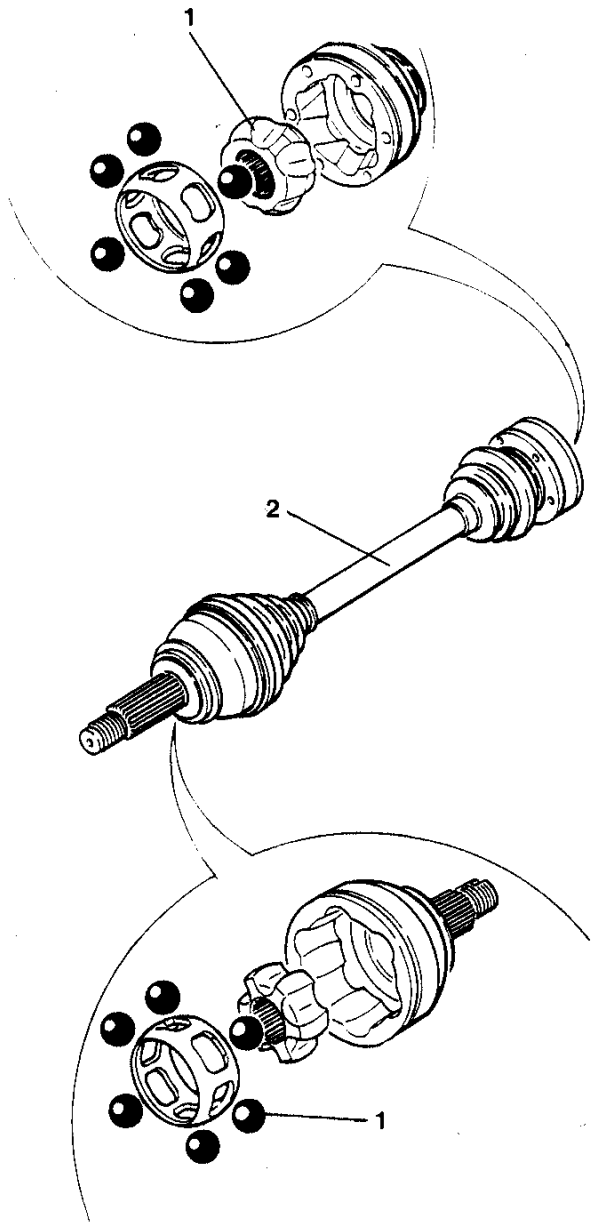


2. Remove the snap ring.
3. Using tools No. 1.821.165.000 and No. 1.821.161.000, remove the constant speed joint from the axle shaft.



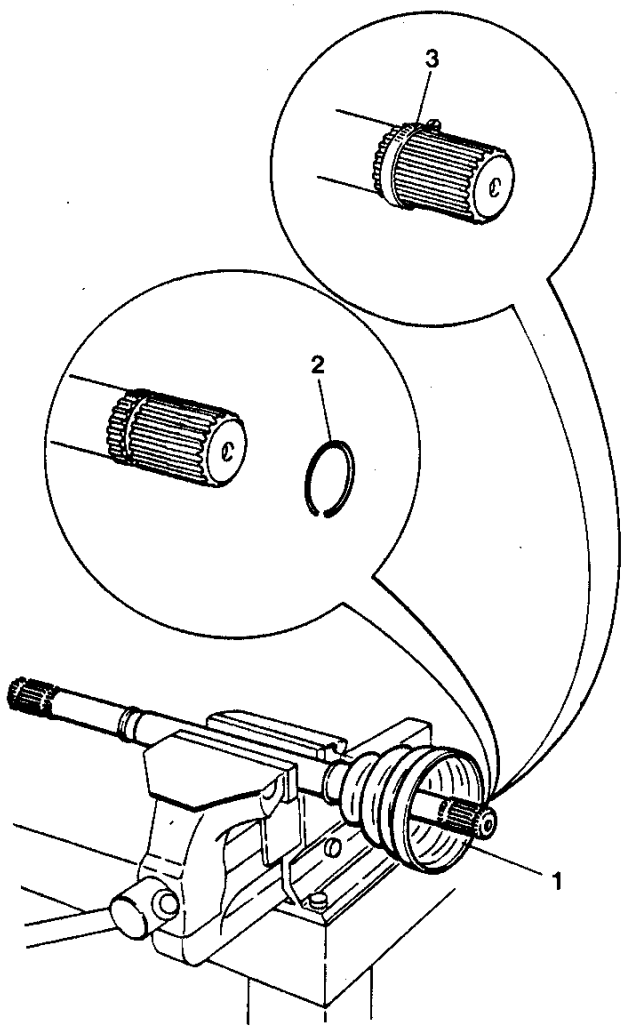
CHECKING AND ADJUSTMENT

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



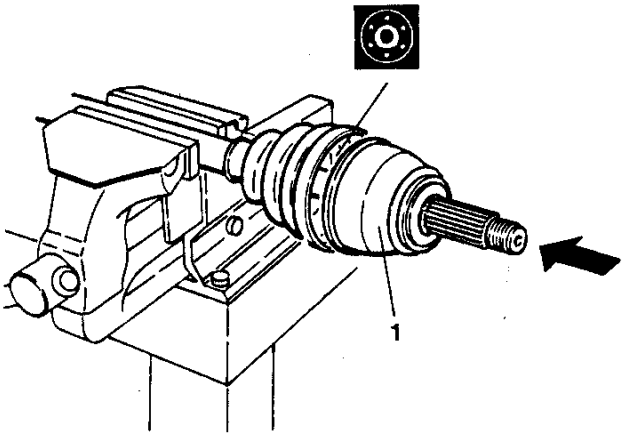
REFITTING THE JOINT ON THE WHEEL SIDE

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

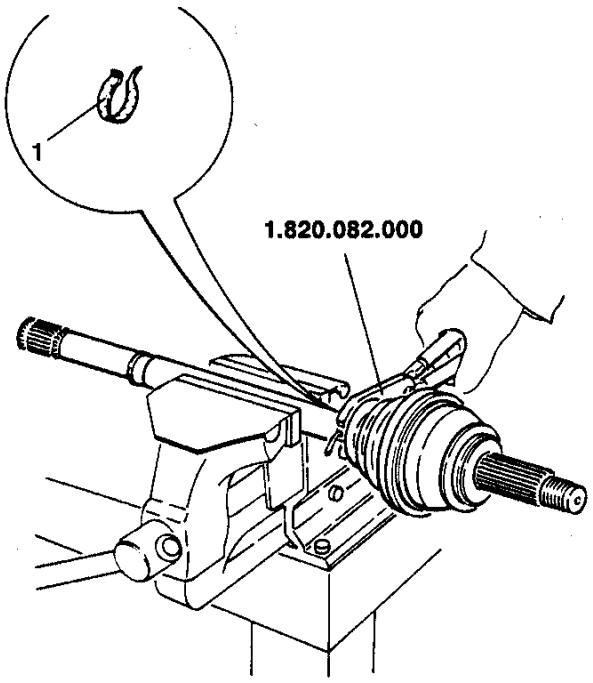


1. Position the constant speed joint on the axle shaft and using a soft mallet, drive it home.

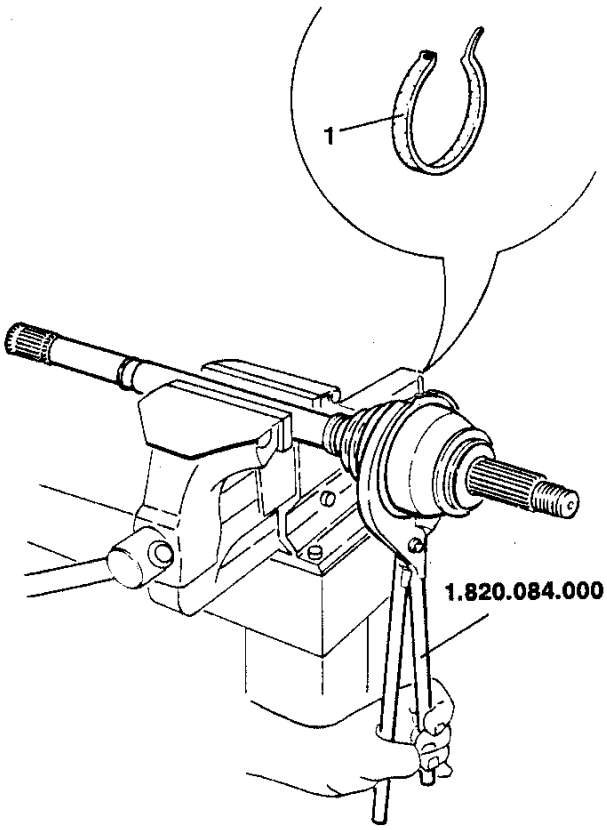
Fill the boot and grease the joint with about 120 g of the specified grease.



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



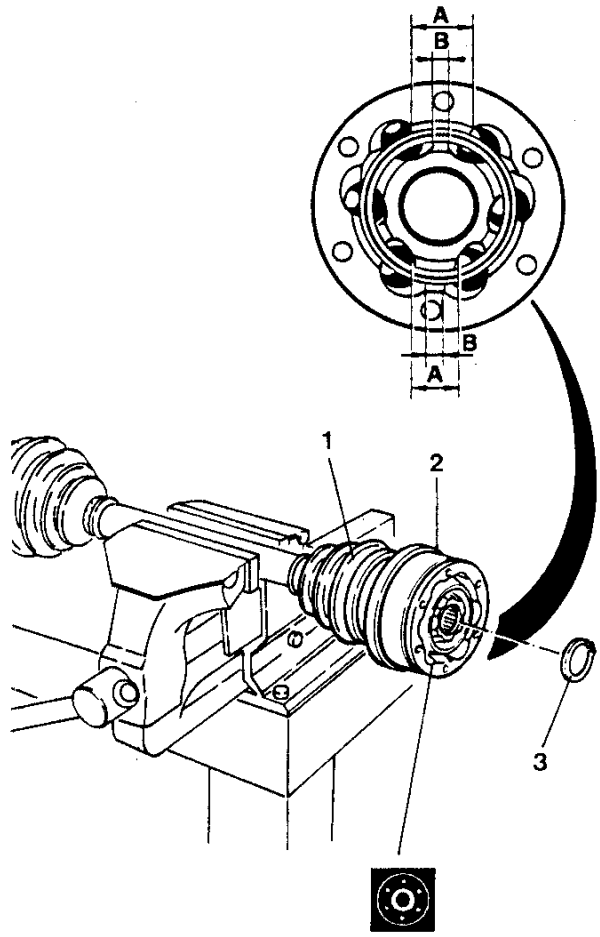
1. Using tool No. 1.820.084.000 slide the external clamp on to secure the boot.



REFITTING THE JOINT ON THE GEARBOX SIDE

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

WARNING:
Reassemble the components of the constant speed joint as shown if they have been previously removed:
A = Greatest distance between balls
B = Smallest distance between balls
Fill the boot and grease the joint with about 120 g of the specified grease.



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

TECHNICAL CHARACTERISTICS AND SPECIFICATIONS

GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

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

TIGHTENING TORQUES

Description	N·m	kg·m
Self-braking nuts for half-shaft retaining screws	35.7 - 44.1	3.64 - 4.49
Nut securing half-shaft to wheel hub	266 - 294	27.11 - 29.96

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)

GROUP 18

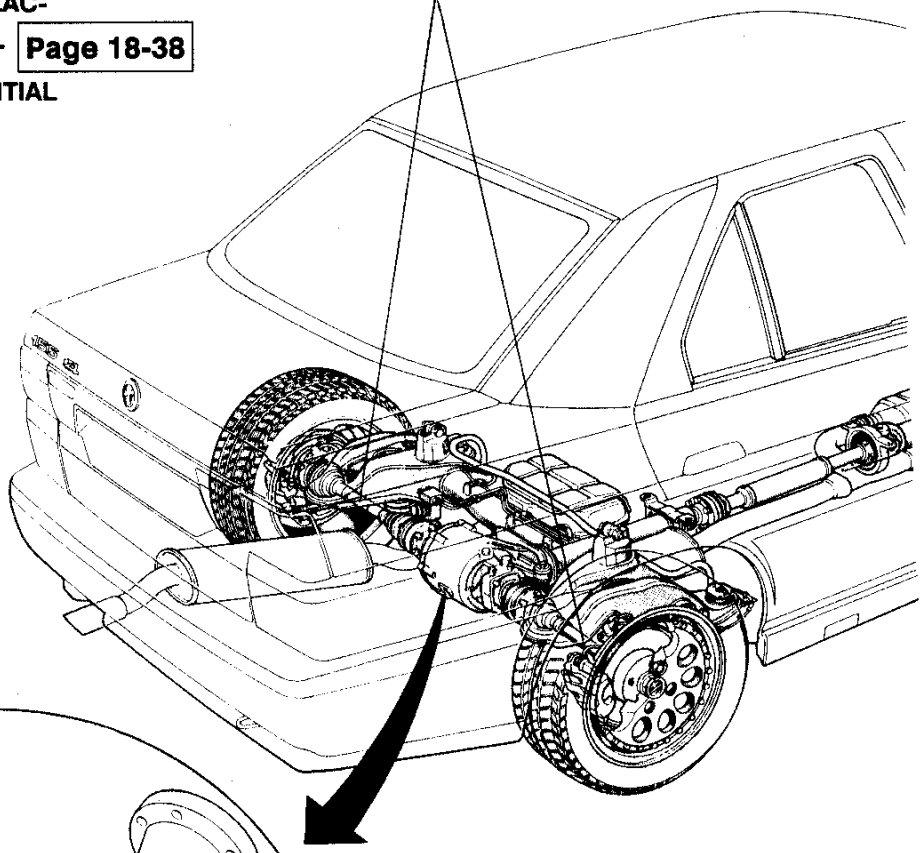
FOUR-WHEEL DRIVE REAR AXLE

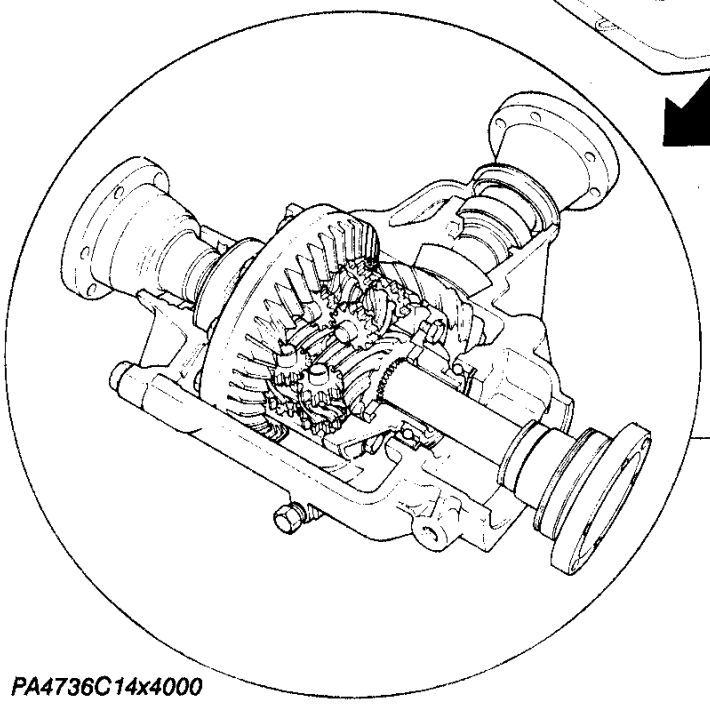
INDEX

ILLUSTRATED INDEX

REAR HALF-SHAFTS

ON-VEHICLE INTERVENTIONS





REAR DIFFERENTIAL

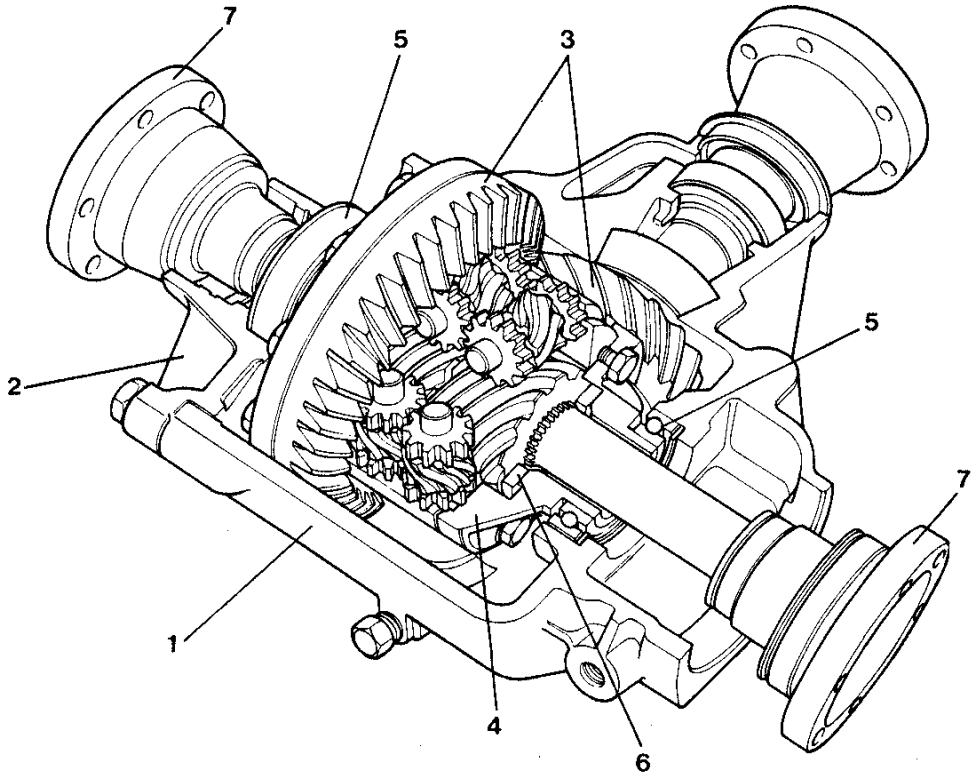
REAR DIFFERENTIAL

GENERAL REMARKS

The differential assembly is composed of an outer casing (1) and relative cover (2) fixed to the rear crossmember by flexible blocks. Inside the outer casing there is:

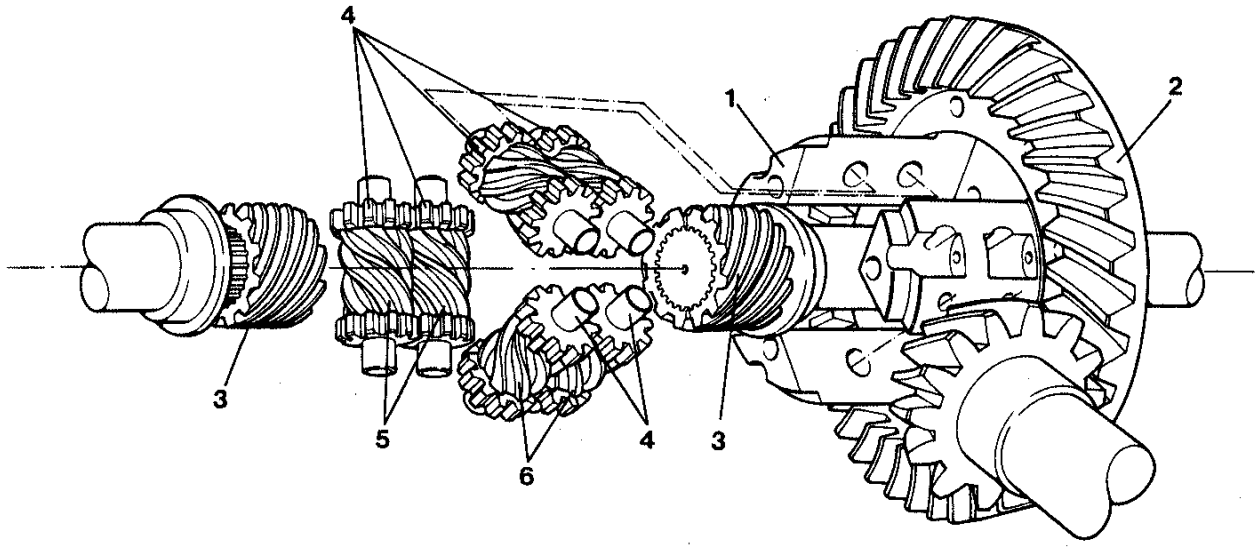
- a pinion-crown assembly (3)
- a differential casing of the "Torsen" type (4)
- two ball bearings (5) supporting the Torsen group
- two half-shafts (7) for the transmission of the drive to the rear wheels.

With the exception of the "Torsen" type differential casing which needs to be replaced in its entirety, all the components listed above can be overhauled and the relative procedures are given in the following paragraphs.



From an examination of the gearing the following can be ascertained:

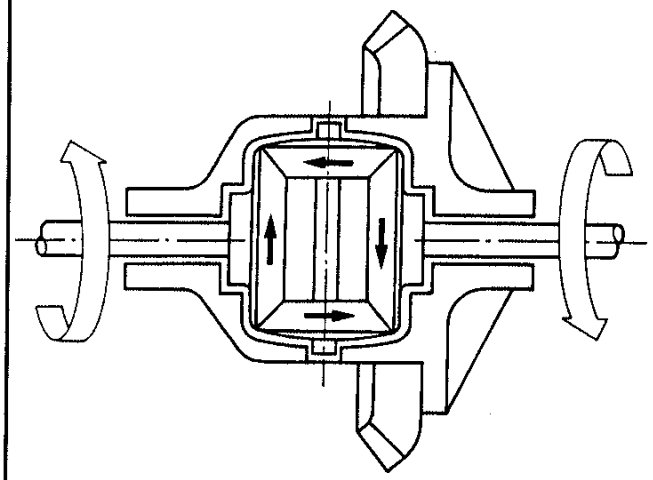
- The Torsen differential is composed of two helical gears (3) which are connected to the half-shafts by a grooved coupling and consequently to the wheels.
- The helical gears perform the same function that the crown wheels perform in a traditional differential while each pair of helical reactor gears (5), all of which are linked to each other, perform the same function as that of the side pinions in the differential.
- The two helical gears (3) are constantly driven by the three pairs of reactor gears which are set at right angles to the gears themselves.
- The helical gears which form the pair of reactor gears are linked together by two pairs of straight-toothed gears (6) located at their ends (INVEX SYSTEM); the reactor gears are connected to the casing (1) by pins (4).



FUNCTIONAL DESCRIPTION

Throughout history many variously structured devices have been designed to permit a "differential effect". The system most widely adopted by the motor industry employs an epicycloidal gear currently referred to as a "traditional" differential. In the differential illustrated in this section an epicycloidal gear has been adopted on the front axle.

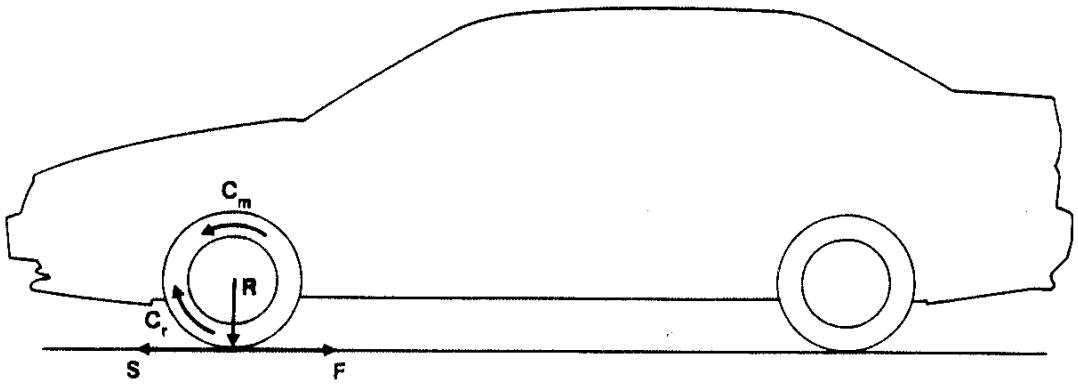
In this system two half-shafts connected to the wheels are machined on the two taper gears, of equal size and form which are termed **crown wheels**. These are coupled with another pair of tapered idle gears, the **side pinions**, on a pin forming a single unit with the **differential casing** which is in turn connected to the gearbox through a kinematic linkage.



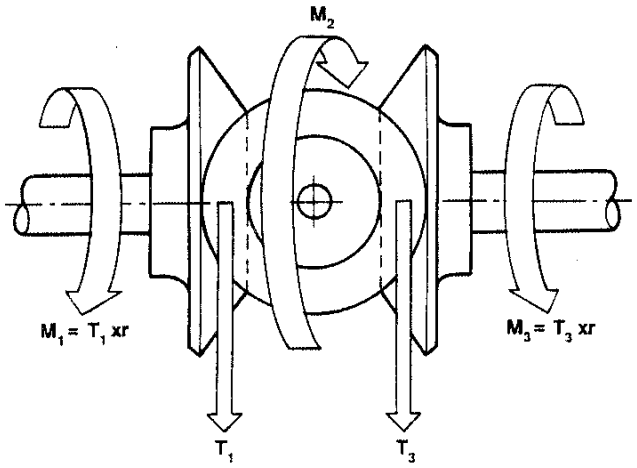
This gearing is structured so that it locks the casing in place allowing one of the crown wheels to rotate; the other crown wheel rotates in the opposite direction at the same speed **(transmission ratio ($\tau = -1$)).**

To understand the way in which the differential works it is necessary to bear in mind that the differential effect is only produced when the resistance against the forward motion is different for each wheel.

When the vehicle is travelling in a straight line on an even road surface, the resistance (S) met by the wheels is the same, as are the resisting torques received by the crown wheels (M_1, M_3) and transmitted to the side pinions (T_1 x r, T_3 x r where r = wheel radius); it is obvious that the deflecting torque is divided equally between the two wheels.



Cm = Deflecting torque
Cr = S x R = Resisting torque



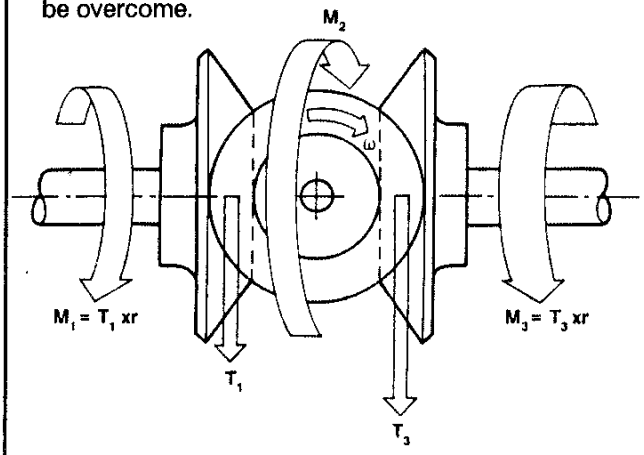
M_2 = Deflecting torque
M_1, M_3 = Resisting torque

As a consequence the side pinions are subject to two equal and antagonistic forces. Each side pinion rotates around the shaft of the crown wheels turned by a pin, but does not rotate around itself: it behaves in fact, like a key connecting the crown wheels; the two wheels assuming the same rotational speed.

On the other hand, to rotate the side pinions, the internal friction must be overcome; friction is experienced at the entrance to the tapered wheels, between the tapered wheels and the casing and between the side pinions and their pins.

The traditional differential is composed of a gear with low internal friction and its output, indicated by (η), assumes a value of about $\eta = 0.9$.

Therefore, as the side pinions rotate and the differential action is produced it is necessary for a situation to arise which can lead to a dissymmetry between the two resisting torques so that the internal friction of the gearing can be overcome.



$M_2 - M_1 - M_3 = 0$ $\quad M_1 < M_3$

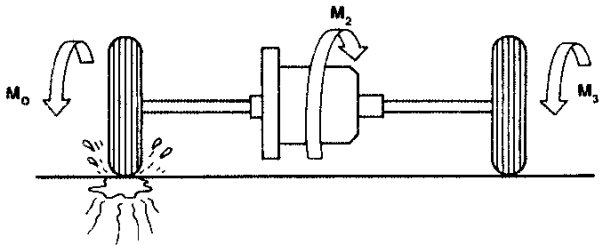
$M_1 = (\eta)\, M_3$ $\quad (\eta) < 1$

The two forces transmitted to the side pinions by the crown wheels are still antagonist forces, but of a different degree; the side pinions, rotating around their pins act like **speed transfer axles** which transfer the speed subtracted from one wheel to the wheel encountering the least resistance.

When cornering, the steering action imposed by the driving system leads to an asymmetrical distribution of the loading on the two wheels so that the low internal friction of the differential is overcome.

As the internal friction has been overcome, the side pinions, under these conditions are able to rotate around their shaft in such a way that the outer wheel turns faster than the inner wheel.

To maintain the correct driving characteristics when cornering, it is therefore necessary for the drive wheels to be interdependent as this leads to a situation where, whenever the driving wheels are experiencing a different degree of slippage, the torque which can be transmitted by the engine to the wheel with good traction is only slightly superior to that which can be transmitted to the wheel with the lowest degree of traction. This difference is that which is required to overcome the internal friction.



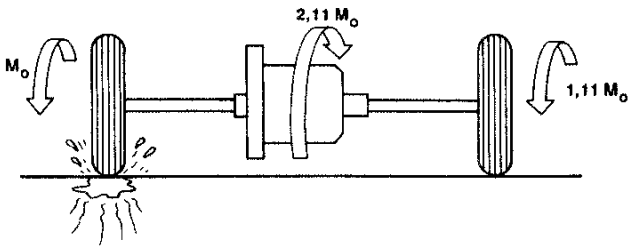
$M_2 - M_0 - M_3 = 0$

$M_0 = (\eta)\ M_3$

From an examination of the numerical values we can see that, as the output of the differential $\eta = 0.9$, if M_0 is the maximum torque which can be transmitted to the ground by one of the wheels, to the other wheel, which is conferring the driving force we can at most apply a torque:

$M_3 = \frac{M_0}{0.9}$ as $\frac{1}{0.9} = 1.11$ it follows that $M_3 = 1.11 \times M_0$.

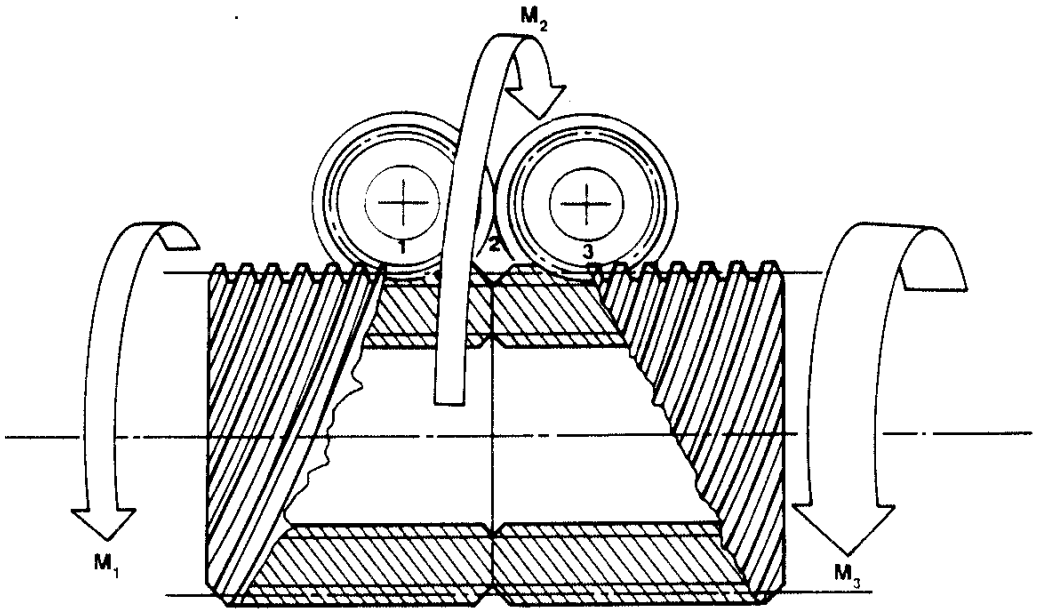
Therefore a torque of $M_2 = M_0 + 1.11\ M_0$; $M_2 = 2.11\ M_0$ can be transmitted by the engine without causing the wheels to slip.



If a torque above this value is transmitted, the wheel with the lowest degree of traction will begin to slip causing the pinion, side pinions, the casing, drive shaft and engine to accelerate with it, resulting in a reduction in the output whatever the driving conditions, particularly during take off and acceleration, reducing the road holding.

As a consequence a low output differential characterized by high internal friction values is necessary. For this reason a Torsen 5:1 differential with an output of $\eta = 0.2$ has been fitted to the rear axle on the four-wheel drive version in the 155.

If the workings of the traditional differential are examined we can see that for a differential to carry out its function there must be a dissymmetry between the resisting torques such that the internal friction of the gearing can be overcome.



From the balance equation we can see that:

$$1)\ M_2 - M_1 - M_3 = 0$$

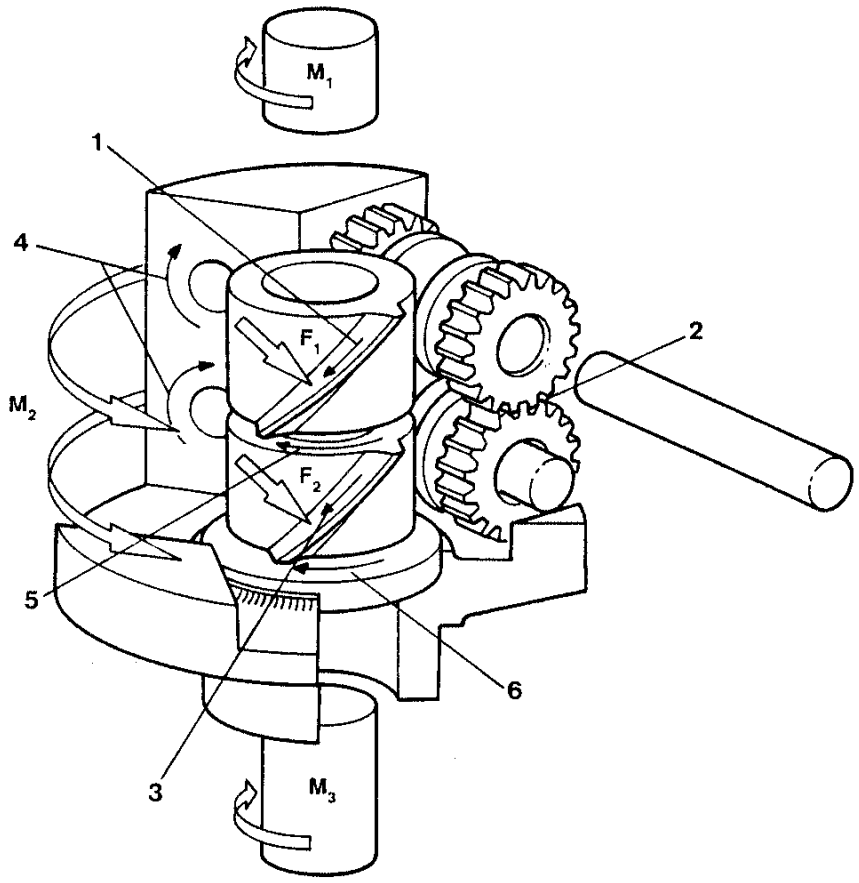
$$2)\ M_1 = \eta\, M_3$$

with η as the overall internal output of the gearing

Supposing that both the resisting torque M_3 is greater than M_1, it must be greater to such a degree that it can overcome:

a) The friction between the helical gears (1) - (3)

b) The friction between the straight-toothed gears (2), the friction produced between the side pinions and the pinion shaft casing (4), that produced between the two crown wheels (5) and that produced between the crown wheel and the pinion shaft casing.



F_1, F_2 = Forces transmitted between the side pinions and crown wheels
M_1, M_2 = Resisting torques
M_2 = Deflecting torque

The crown wheel helix is angled at = 40°.
This angle corresponds to the maximum output in the transmission of the drive through the four helical gears, $\eta_a = 0.65$ (with a friction coefficient between the spirals = 0.1*) and the output values are as follows:
$\eta_a \cong 0.6$ overall output of the coupling
$\eta_b \cong 0.3$ output corresponding to the friction values

$$\eta = \eta_a \times \eta_b = 0.65 \times 0.3 \cong 0.2$$

overall internal output of the gearing to be substituted in the balance equations so that:

from 2) we obtain: $M_1 = \eta M_3$
from which: $M_1 = 0.2\ M_3$
therefore: $M_1 = M_3$

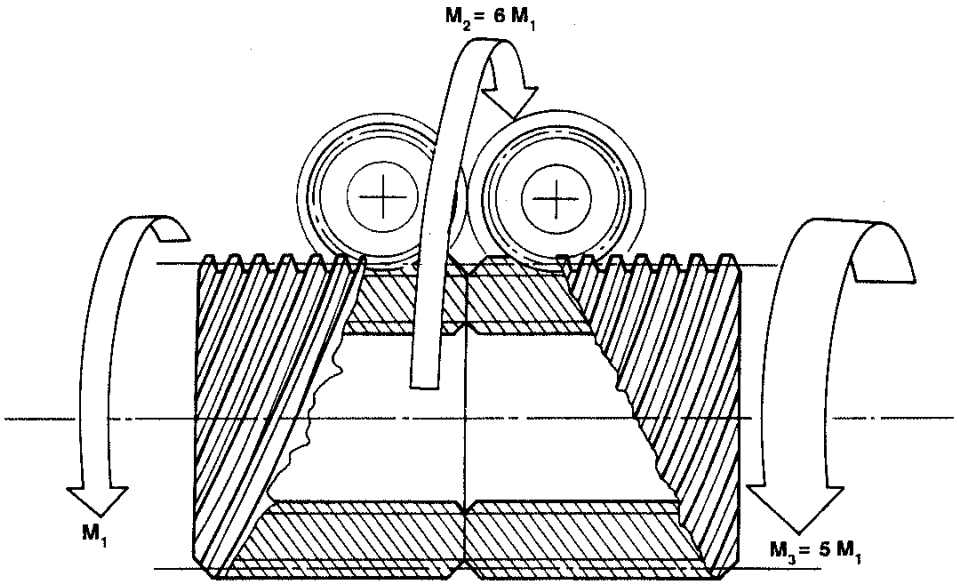
* To maintain this coefficient it is necessary to use the specified oil.

Replacing M3 in 1): $M_2 = M_3 + M_1$
we have: $M_2 = 5\ M_1 + M_1$
therefore: $M_2 = 6\ M_1$

For a differential with an internal output of 0.2 to function the deflecting torque must be divided in a ratio of 5:1 between the two wheels - the Torsen 5:1.

As a consequence of the above we can see that a differential with an internal output of $\eta = 0.2$ allows the wheels to rotate at different speeds only when it is acted upon by a torque which is 5 times above that acting on the other wheel.
If the ratio between the two torques is below this value, the differential locks and the wheel under critical road-holding conditions maintains the same speed as that under normal road holding conditions.

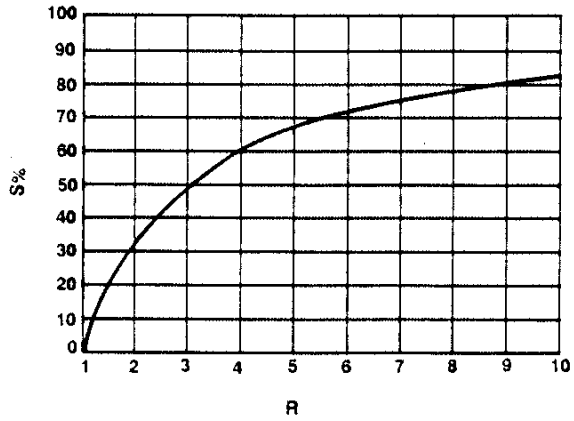
In sum: $\eta = 0.2$
Basic ratio = 5:1 (Torsen 5:1)



In situations where $M_3 < 5\ M_1$, the shaft acts like a rigid shaft.

When cornering this division of the deflecting torque is governed by the action of the steering and by the differing road holding conditions affecting the wheels. When the vehicle is travelling is a straight line this division is manifest only when the road holding conditions affecting the wheels differ to a notable degree.
During take-off a traditional differential allows just over double the torque transmitted by the low traction wheel to be transmitted to the ground but with the Torsen 5:1 a torque which is 6 times greater can be transmitted.

It is possible to produce Torsen differentials with differing basic ratios from 2:1 to 9:1. The range currently produced extends from 2:1 to 5:1.



Correspondence between the basic ratio and the locking potential.
S% = Self-locking percentage
R = Basic ratio between torques

The various types of Torsen all have the same angle of spiral on the crown wheels (= 40°), and differ due to their friction coefficient affecting the resting surfaces (points 6 and 5).

In the various types of Torsen, needle bearings with bronze and steel shims (surface treated) are applied to these surfaces. Another solution to alter the friction is to increase the average radius of the shims.

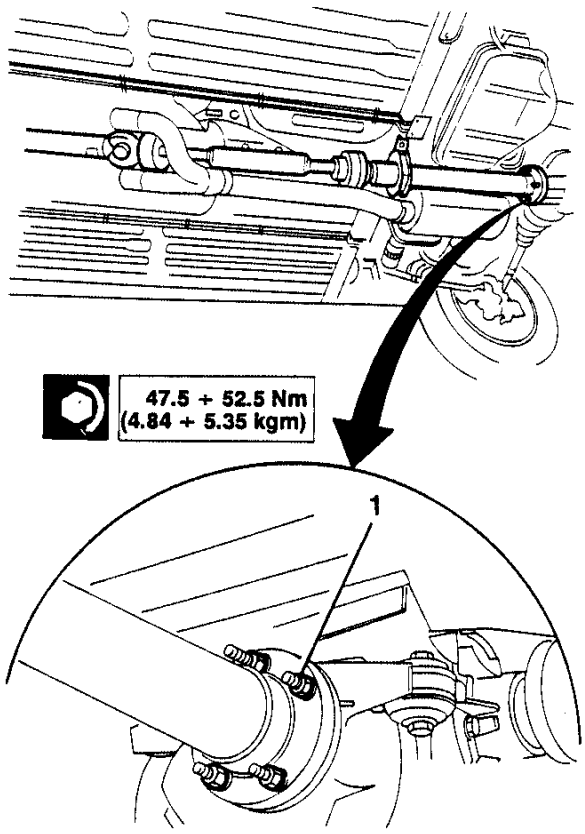
In the Torsen 5:1, used on the 167 vehicle, there is no shim between the two crown wheels however, on the sides in contact with the crown wheels there is a steel shim.

Expressed as a locking percentage: $\% = \left(\frac{M_3 - M_1}{M_2}\right)$

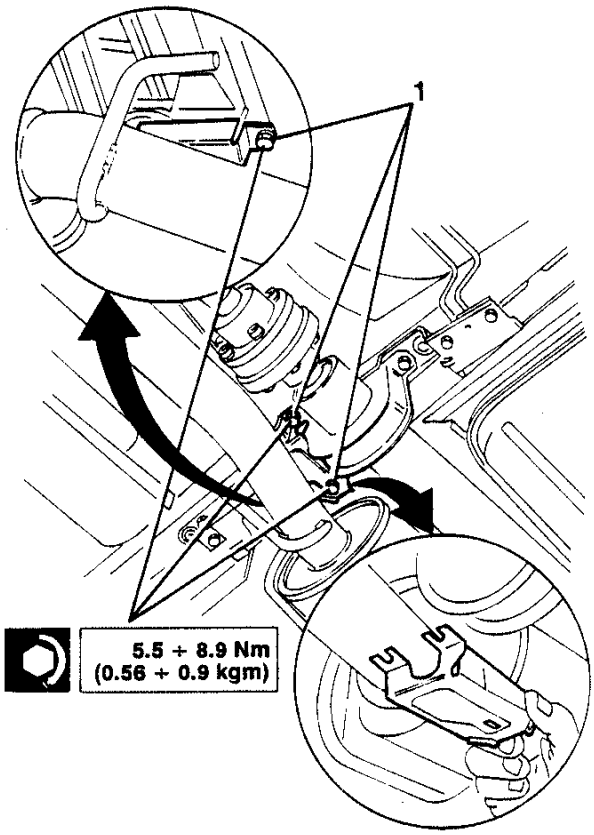
The limits of the currently produced range run from 30% to 68%.

REMOVAL AND REFITTING

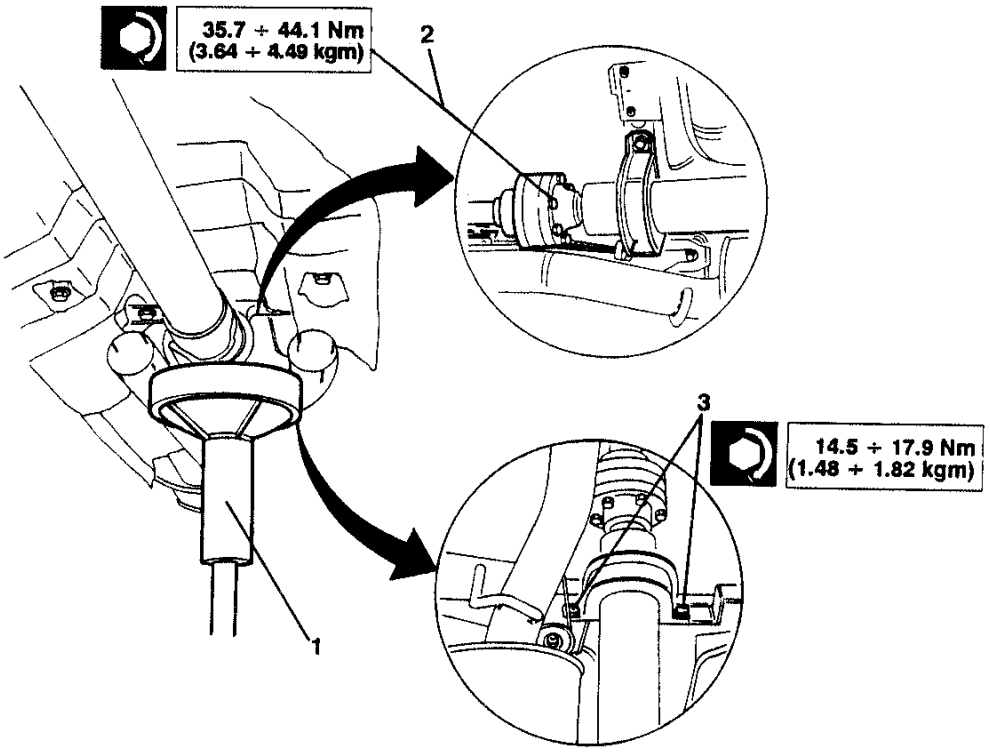
1. Unscrew the six nuts securing the rear flange on the drive shaft to the flange on the rear differential.



1. Unscrew the nuts securing the handbrake cable idle protection and remove the protection.

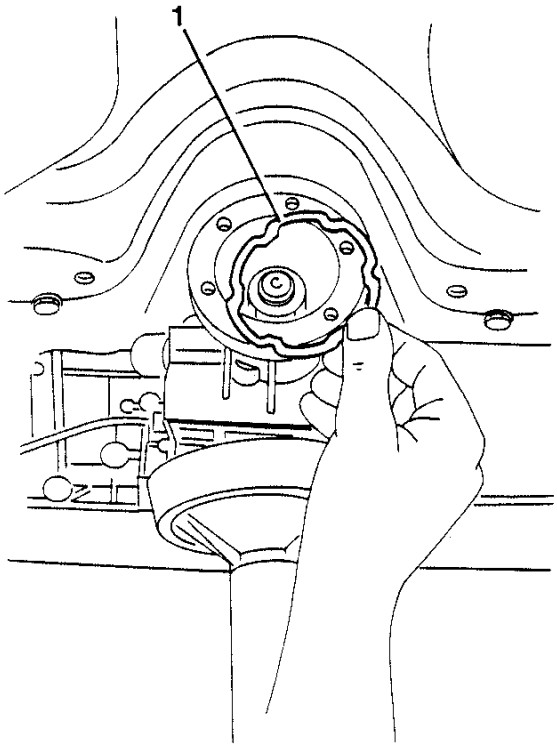


1. Using a hydraulic lift, support the rear section of the drive shaft.
2. Loosen the screws securing the flange connecting the constant speed joint to the rear section of the drive shaft and disconnect the joint.
3. Loosen the screws securing the rear safety flexible support to the body and lower the hydraulic lift and remove the rear section of the drive shaft.

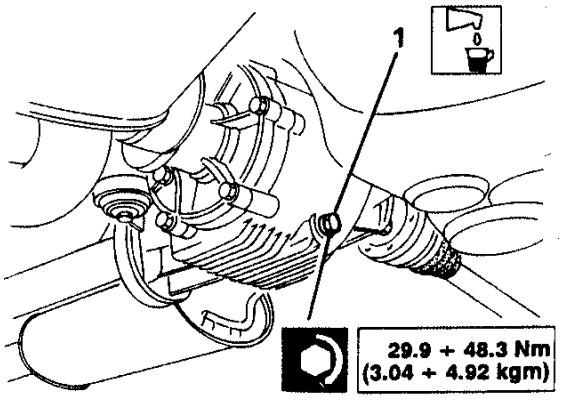


1. Remove the gasket from the attachment flange of the rear differential.

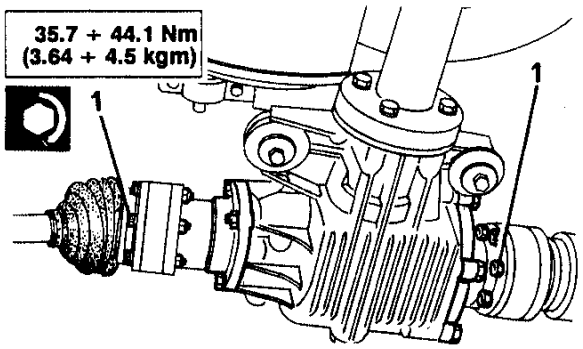
Refit by reversing the procedure followed for removal tightening the nuts and screws to the correct torque and positioning the new gasket on the rear differential attachment flange.



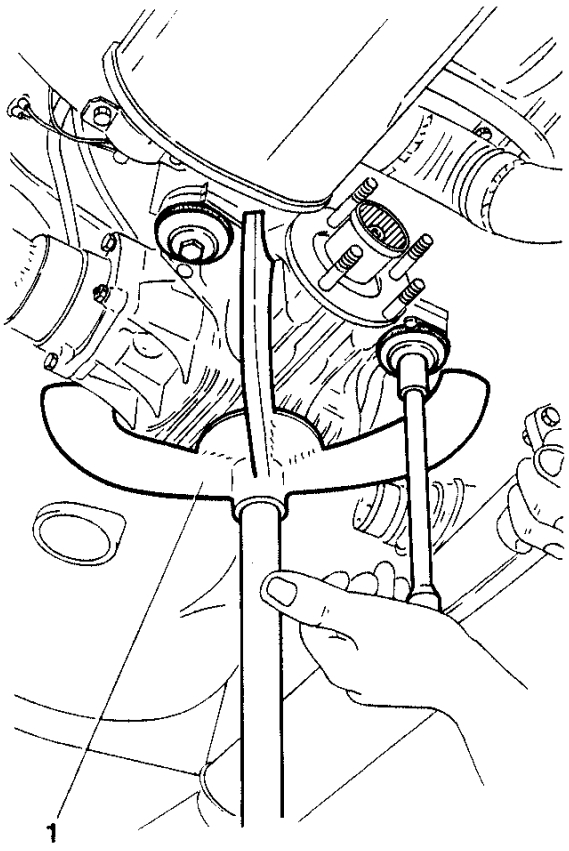
1. After positioning a suitable container under the rear differential, unscrew the drain cap and allow the oil in the differential to drain out.



1. Loosen the six screws securing each of the constant speed joints to the rear half-shafts and disconnect the half-shafts moving them so that they do not get in the way when the differential is disconnected.



1. After positioning a hydraulic jack fitted with a supporting cradle, loosen the screws securing the differential flexible supports to the rear crossmember.
– Lower the hydraulic jack and remove the differential.

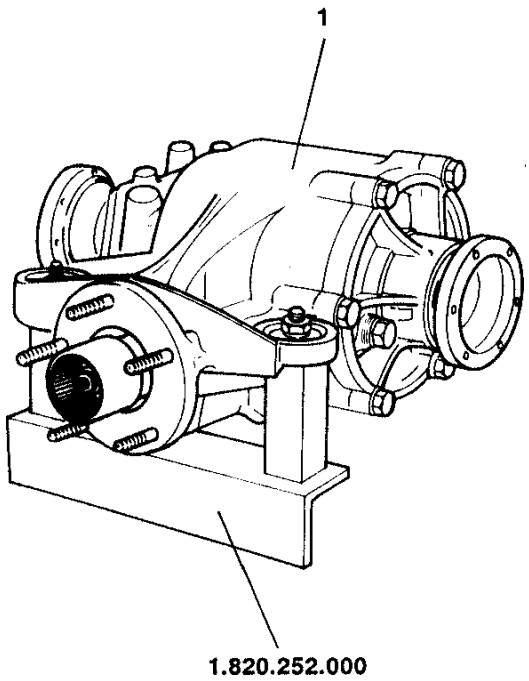


Refit by reversing the procedure followed for removal and observe the following:

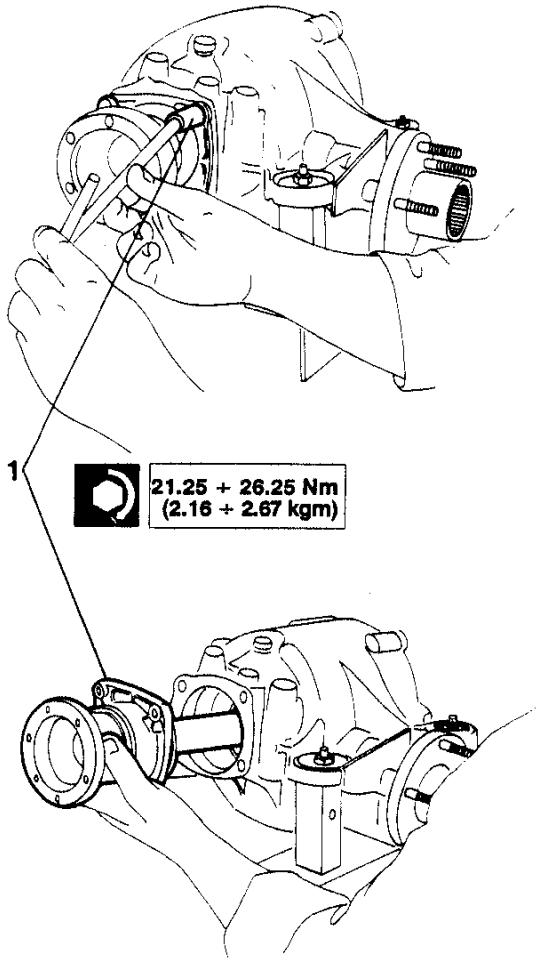
- Tighten the previously loosened or removed nuts and screws to the specified torque.
- Using the specified oil (See: TECHNICAL CHARACTERISTICS AND SPECIFICATIONS - FLUIDS AND LUBRICANTS) refill the rear differential and tighten the filler cap to the correct torque.

DISASSEMBLY

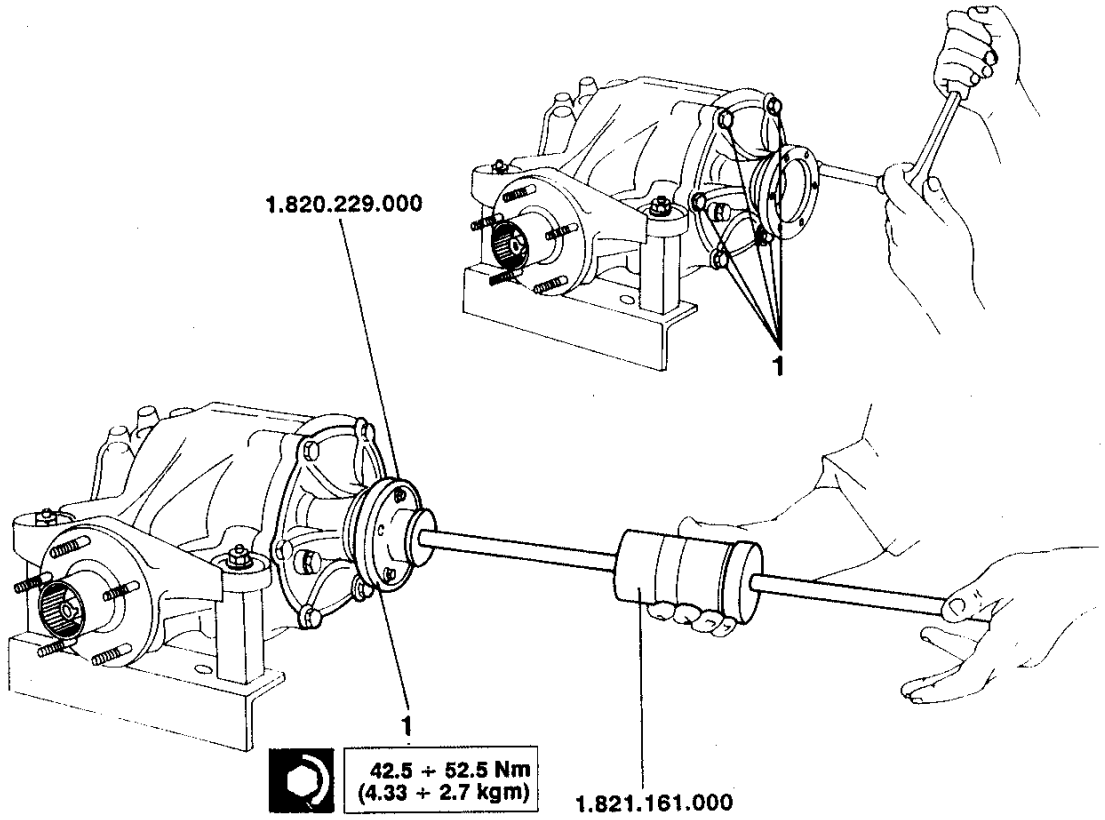
1. As shown, fit the differential to support No. 1.820.252.000 and position in a vice.



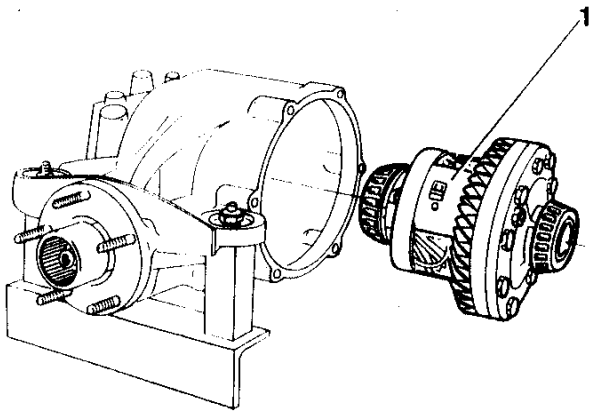
1. Loosen the screws securing the differential casing rear right- hand cover to the differential and remove it along with the shaft and O-ring.



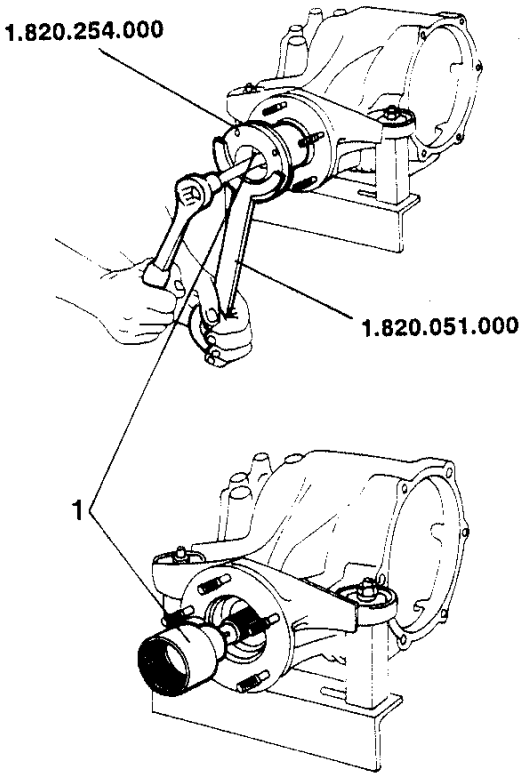
1. Loosen the screws securing the differential casing left-hand cover to the differential and remove it using tool No. 1.821.161.000 fixed to the half-shaft pulley with flange No. 1.820.229.000.



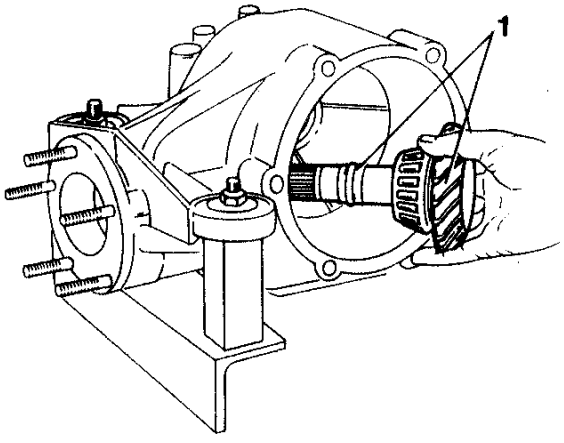
1. Remove the Torsen differential from the differential casing.



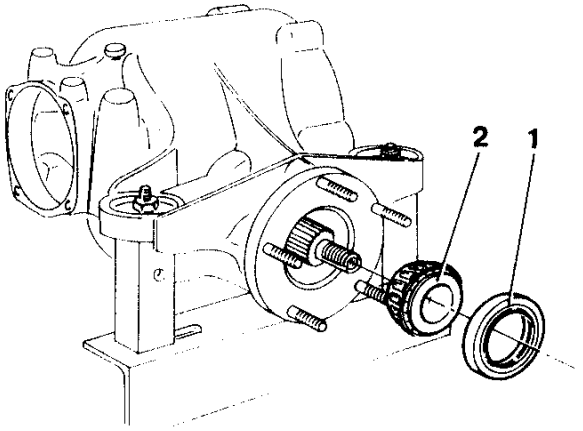
1. Install flange No. 1.820.254.000 on the grooved sleeve using spanner No. 1.820.051.000 in order to lock the flange. Loosen the bolt securing the pinion and remove the sleeve, nut and washer.



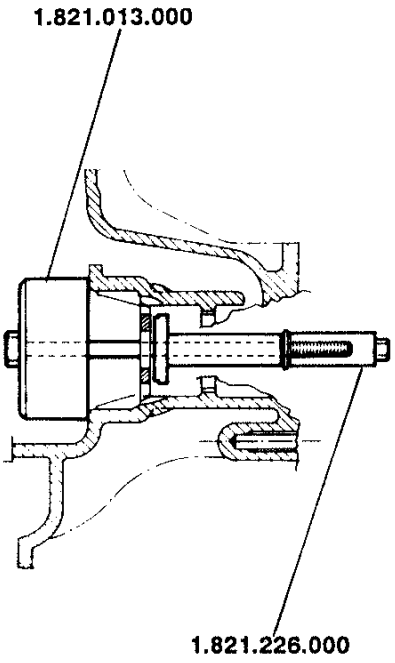
1. Remove the pinion together with the bearing and the flexible spacer.



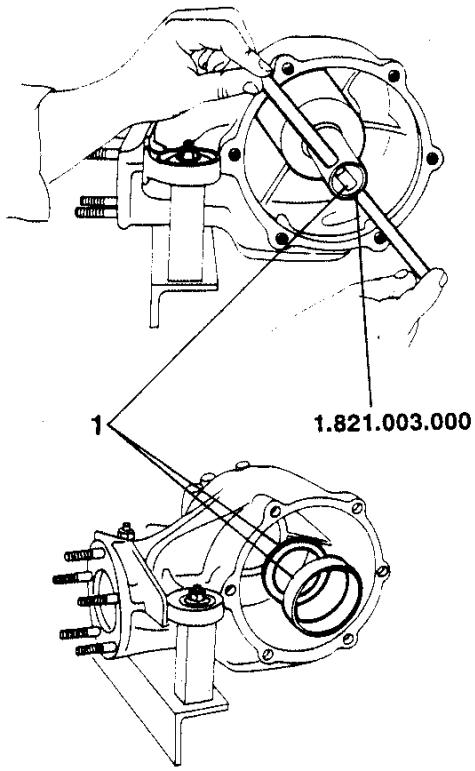
1. Remove the oil seal and washer.
2. Remove the inner race of the outer pinion bearing.



1. Using puller No. 1.821.013.000 together with puller No. 1.821.226.000, remove the inner race of the outer and inner tapered pinion bearings.

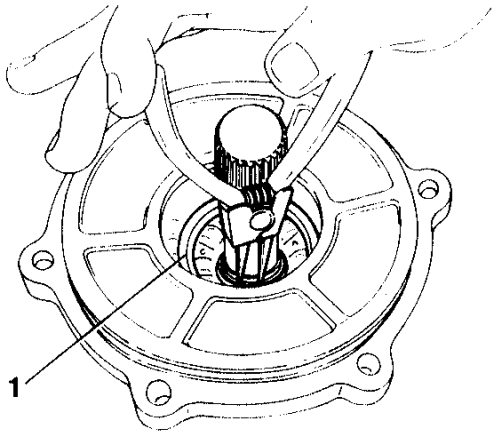


1. Remove the outer race of the "Torsen differential bearing and the shim ring using puller No. 1.821.003.000.

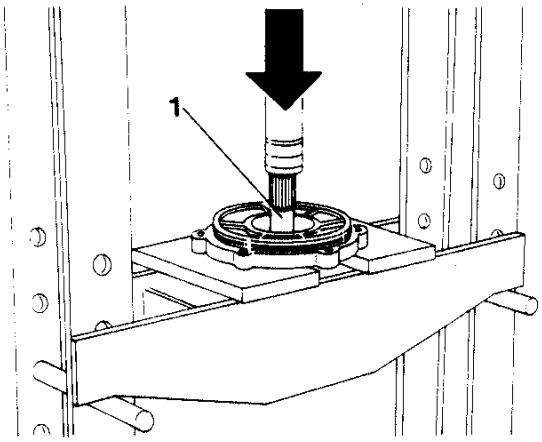


DISASSEMBLING AND REASSEMBLING THE RIGHT-HAND HALF-SHAFT COVER

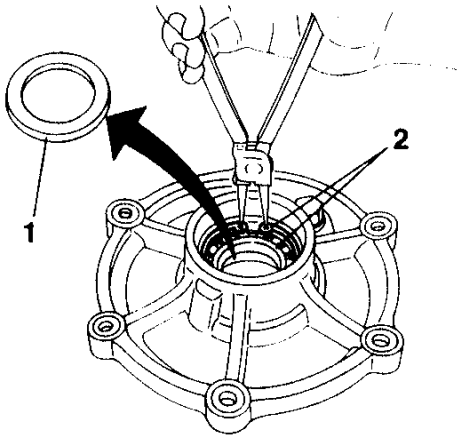
1. Remove the flexible ring sealing the half-shaft to the cover.



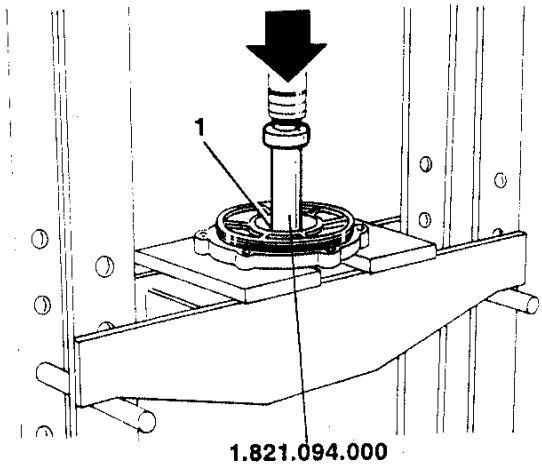
1. Working under a press, separate shaft and cover.



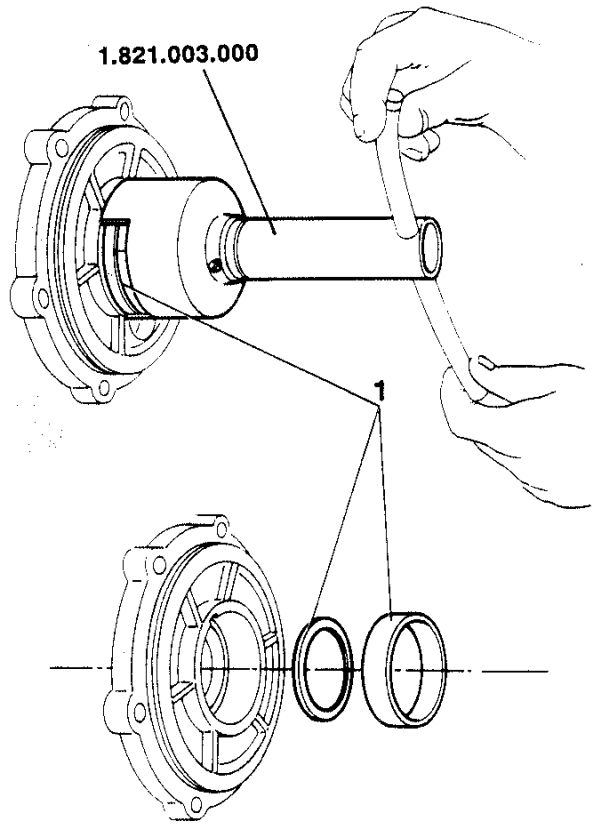
1. Remove the oil seal.
2. Remove the ball bearing flexible seal ring.



1. Remove the ball bearing using punch No. 1.821.094.000.

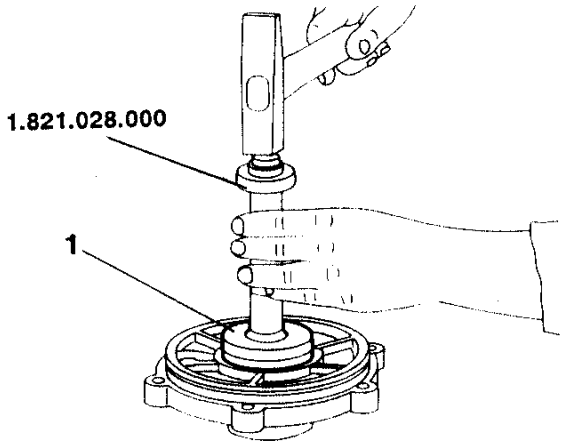


1. Remove the outer race of the Torsen differential bearing using puller No. 1.821.003.000 and shim ring.

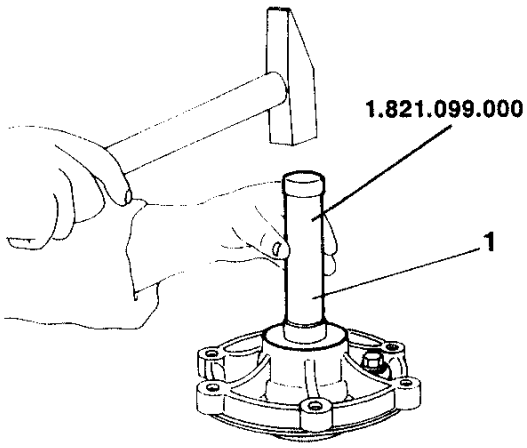


Refit by reversing the procedure followed for removal and observe the following:

1. Refit the shim ring and the outer race of the Torsen differential using inserting tool No. 1.821.028.000.



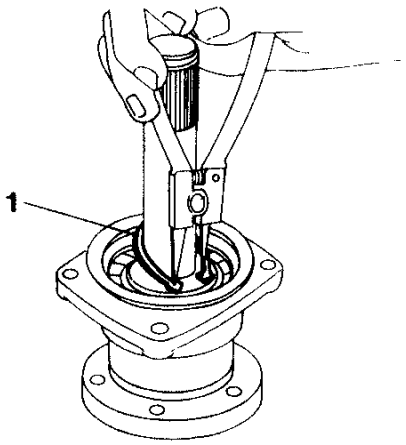
1. Insert the oil seal using inserting tool No. 1.821.099.000.



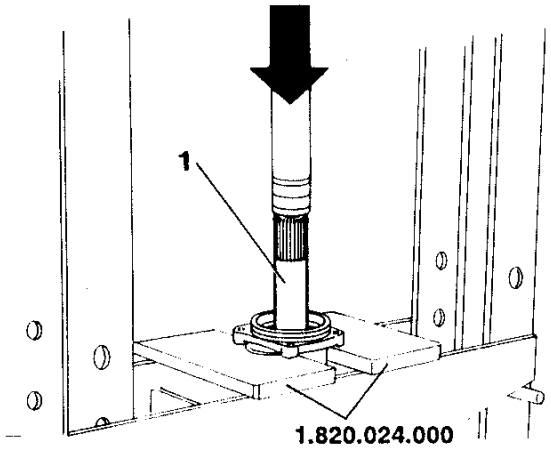
– The shaft is refitted after the differential has been installed.

DISASSEMBLING AND REASSEMBLING THE LEFT-HAND HALF-SHAFT COVER

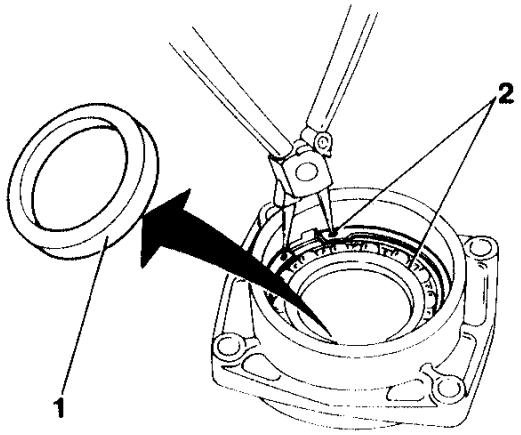
1. Remove the flexible ring sealing the half-shaft to the cover.



1. Remove the shaft using half-plate No. 1.820.024.000 while working under a press.

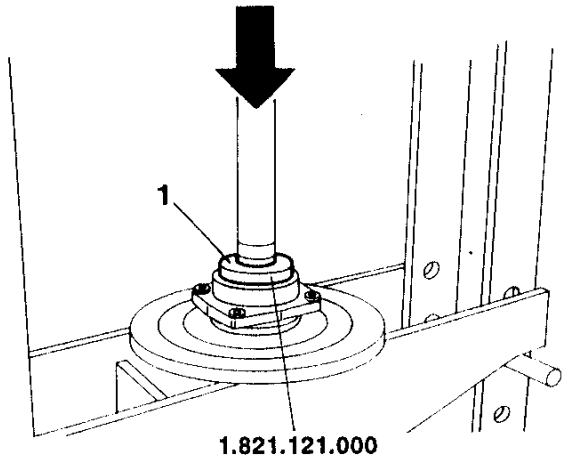


1. Remove the oil seal.
2. Remove the flexible ball bearing seal ring and bearing.



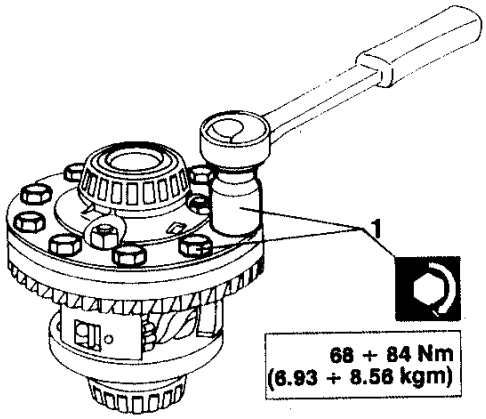
Refit by reversing the procedure followed for removal and observe the following.

1. Working under a press, install the ball bearing and then the oil seal using part of inserting tool No. 1.821.121.000.

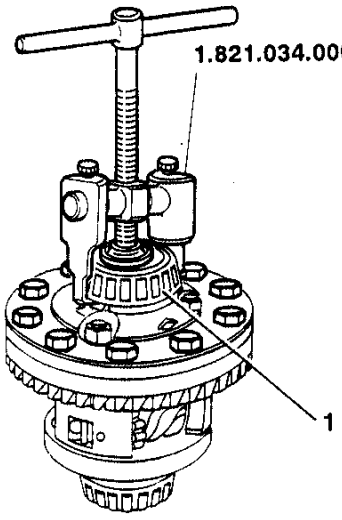


DISASSEMBLING THE TORSEN DIFFERENTIAL

1. Loosen the ten screws securing the crown wheel to the Torsen differential.



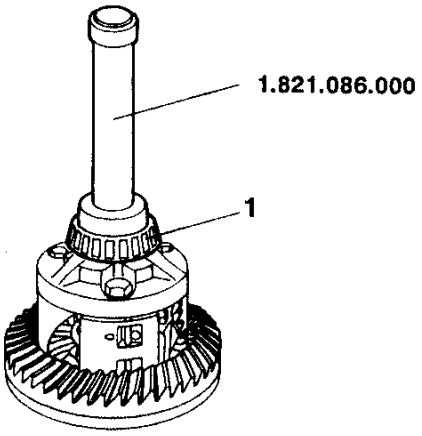
1. Using puller No. 1.821.034.000, remove the two inner races of the Torsen differential bearing.



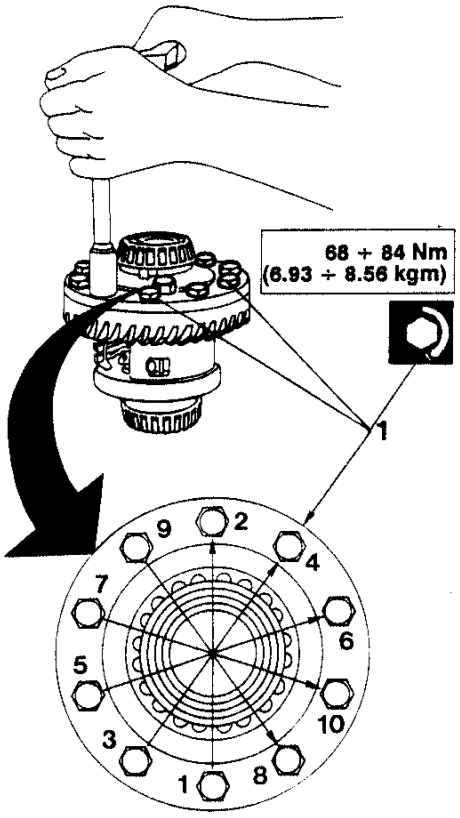
NOTE: This differential cannot be overhauled and must be replaced if a fault develops.

REFITTING THE TORSEN DIFFERENTIAL

1. Install the inner races of the Torsen differential bearings using inserting tool No. 1.821.086.000.

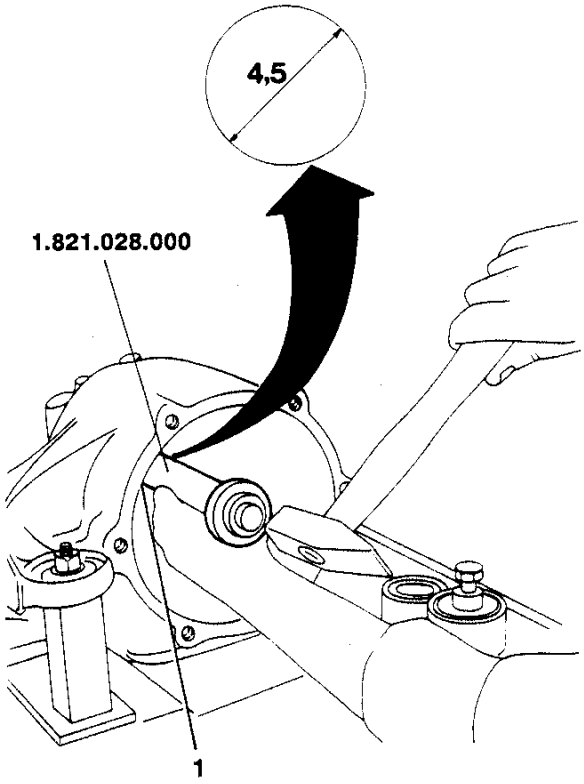


1. Apply "LOCTITE 537" to the screws securing the crown wheel and in the order shown in the diagram, tighten them to the specified torque.

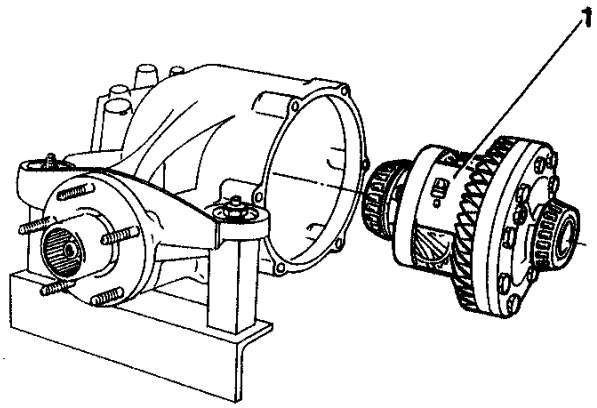


CHECKING ROLLING TORQUE OF THE TAPERED RING GEAR

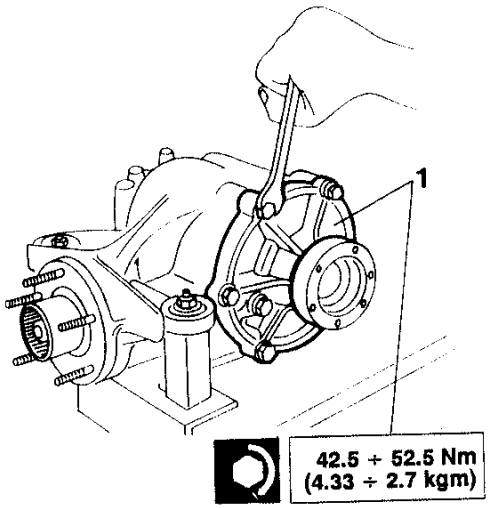
1. Insert the shim ring/s and the outer race of the Torsen differential in the differential casing using inserting tool No. 1.821.028.000.



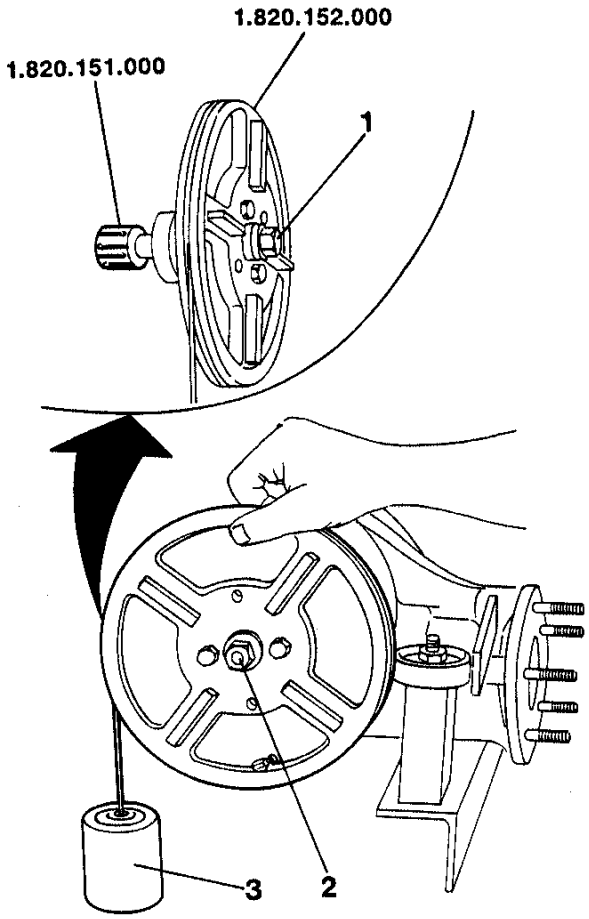
1. Insert the Torsen differential in the differential casing.



1. Install the differential casing left-hand cover without O- ring, onto the differential and tighten the retaining screws.

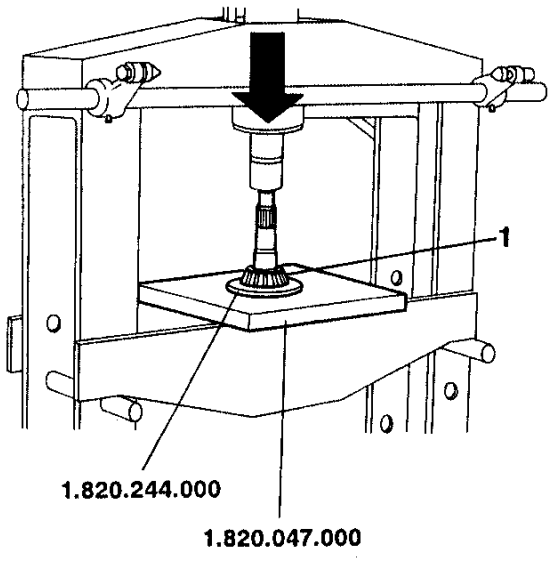


1. Install the check device composed of disc No. 1.820.152.000, connection and bushing No. 1.820.151.000 in the seating of the left- hand half-shaft.
2. Tighten the nut securing the rolling device until the device rotates together with the differential.
- Acting on the disk, rotate the differential a few times in both directions in order to settle the bearings.
- Wind the weighted cord around the disc.
3. Hang a combination of weights No. 1.824.006.001, 1.824.006.002, 1.824.006.003, 1.824.006.004 and 1.824.006.005 on the support cable to a value of 1.2 - 1.5 kg. Check that the weights are lowered smoothly without stopping or dragging the disc too fast.
- If the weights are not lowered normally the differential must be disassembled and the thickness of the shim increased if the descent is too rapid and decreased if it is too slow.
- Repeat the procedure until the tapered ring gear rolling torque reaches the specified value (See: TECHNICAL CHARACTERISTICS AND SPECIFICATIONS - CHECKS AND ADJUSTMENTS).



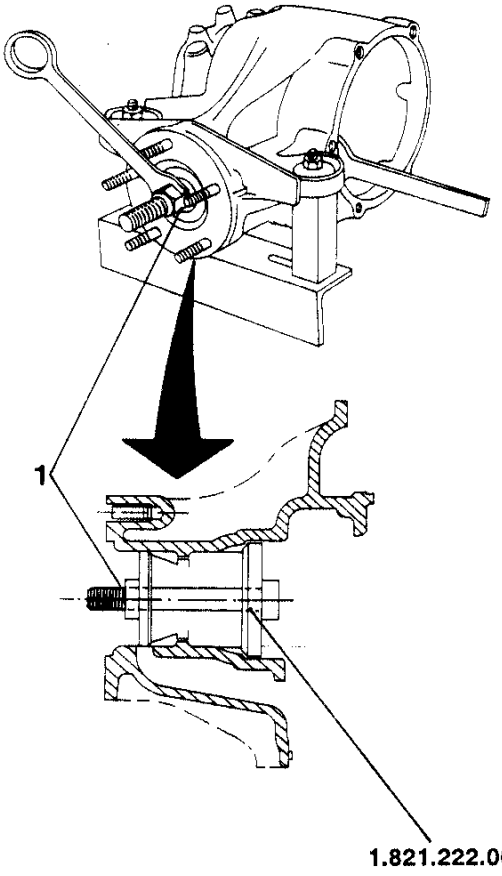
DISASSEMBLING THE TAPERED PINION

1. Remove the inner race of the tapered roller bearing and the shim ring fitted to the pinion using plate No. 1.820.047.000, half- rings No. 1.820.244.000 and working under a hydraulic press.

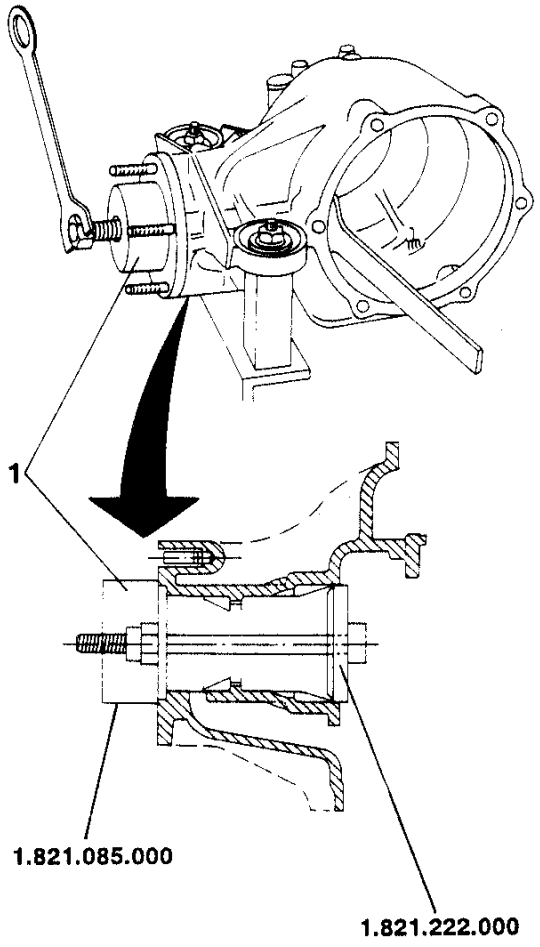


ADJUSTING POSITION OF TAPERED PINION

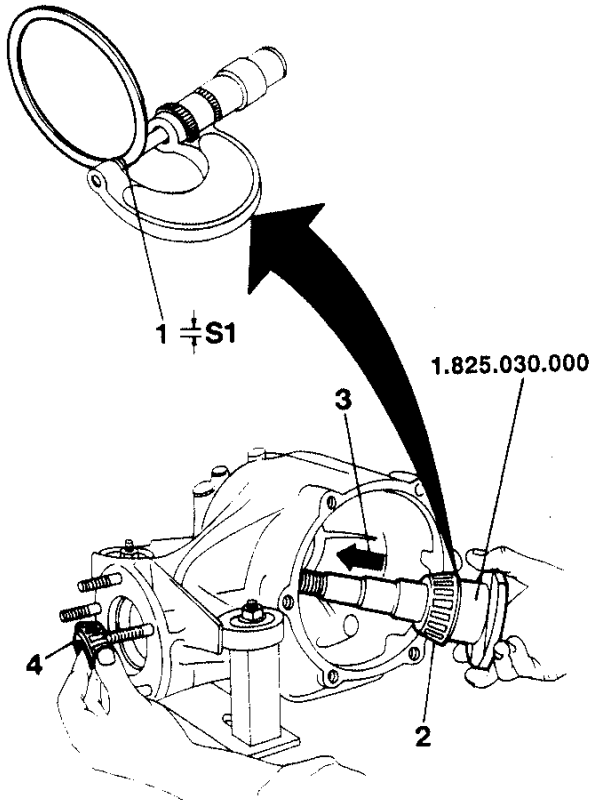
1. Using inserting tool No. 1.821.222.000 install the outer race of the outer pinion bearing.



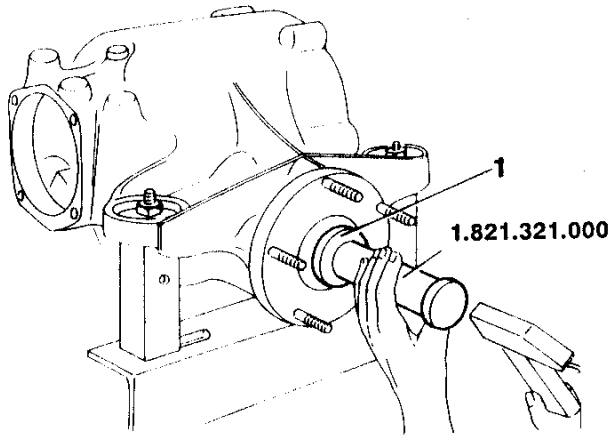
1. Using inserting tool No. 1.821.222.000, together with the part of inserting tool No. 1.821.085.000 shown, install the outer race of the inner pinion bearing.



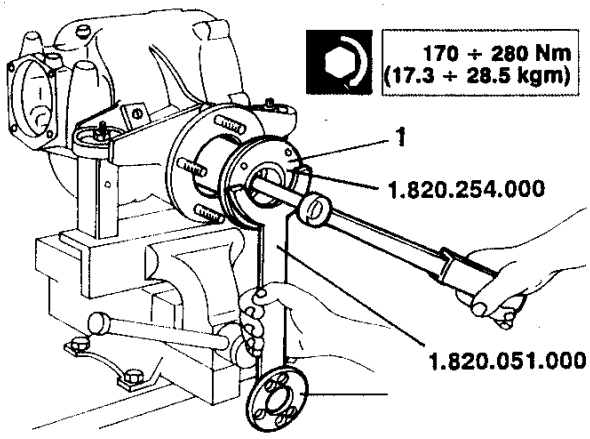
1. Measure thickness "S_1" of the pinion shim ring using a micrometer.
2. Install the shim ring and the inner race of the inner pinion bearing on the dummy pinion No. 1.825.030.000.
3. Insert the dummy pinion, without pre-load ring, into the differential casing.
4. Install the inner race of the outer pinion bearing.



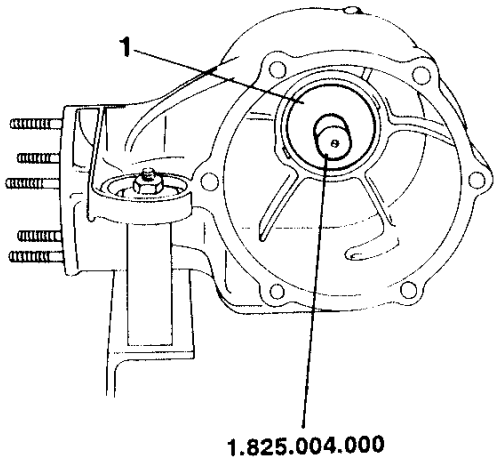
1. Insert the oil seal using inserting tool No. 1.821.321.000.



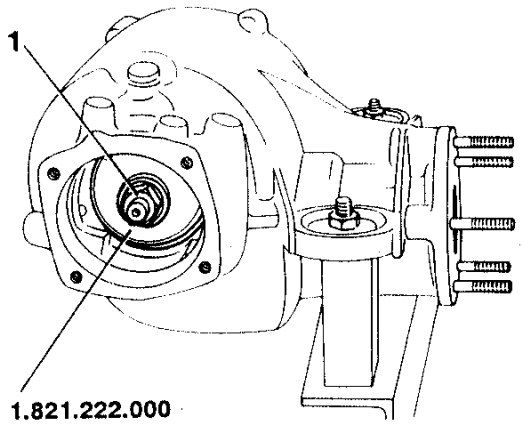
1. Install the toothed sleeve and using flange No. 1.820.254.000, together with spanner No. 1.820.051.000, lock the pinion by tightening the retaining nut and then settle the bearings and tighten until the specified rolling torque is reached. (See: TAPERED PINION ROLLING TORQUE).



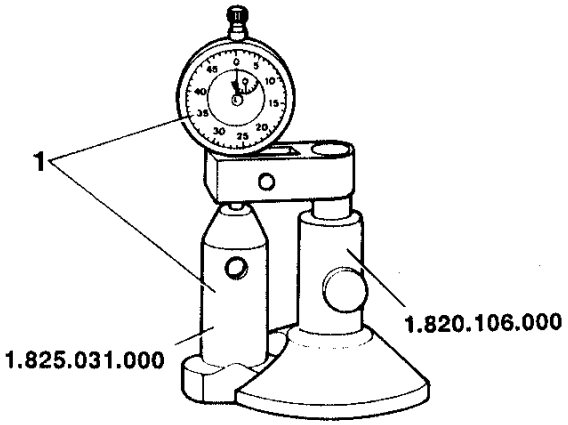
1. Install the part of the check tool No. 1.825.004.000 (shown in the illustration) in the differential casing.



1. Fix control tool No. 1.825.004.000, installing the illustrated part of inserting tool No. 1.821.222.000 from the outer part of the differential casing.

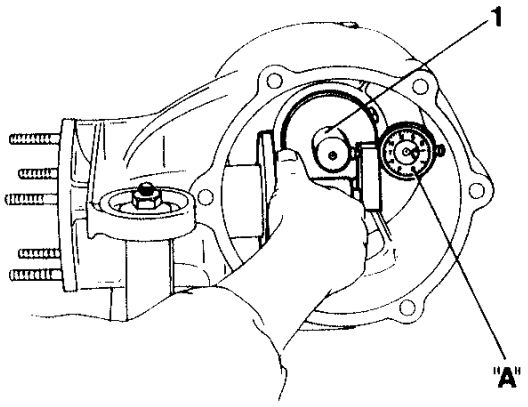


1. Install a dial gauge on support No. 1.820.106.000 and set it with a pre-loading of 1 mm, using the reference gauge No. 1.825.031.000.



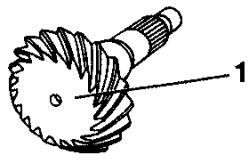
1. Maintaining the base of the support of the dial gauge on the resting plane of the dummy pinion, position the pointer of the dial gauge on the check tool as shown. Measure the highest point by moving the dial gauge around the circumference of the control tool. Read value "A" on the dial gauge.

NOTE: Value "A" may be either positive or negative.



1. Rear the value "B" marked on the tapered pinion by the manufacturer and note that this value may be expressed in two ways:
   - centesimal value of the difference between the effective installation distance and the nominal distance (80.50 mm)
     (e.g.: –2; 0; +3).
   - Effective installation distance in millimeters. (e.g.: 80.48; 80.5; 80.53).
     Obtain the expressed value by algebraically subtracting 80.50 mm from this value as in the first example.

   (e.g.: 80.48 - 80.50 = –0.02 mm
   = –2 hundredths
   80.53 - 80.50 = + 0.03 mm
   = +3 hundredths.



The value "G", to be added or subtracted from the thickness of the shim ring "S_1", is measured using the following formula:

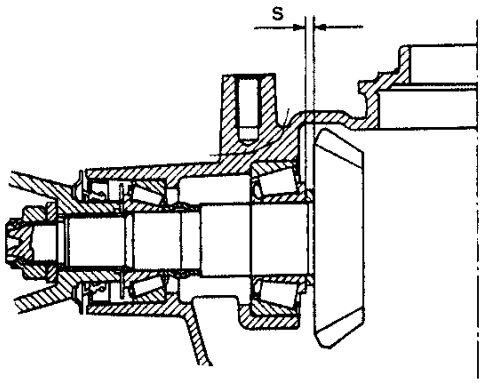
$$G = A - (+B) = A - B$$
$$G = A - (-B) = A + B$$

Example:
both A = 0.15 mm (value read from the dial gauge)
and B = 5 (centesimal value marked on the pinion)
and S_1 = 2.85 mm (value obtained by measuring the shim ring)
results in G = A - (+B)
= 0.15 mm - 0.05 mm
= 0.10 mm

It follows that in this case "G" is positive and the value must be added to "S_1", therefore the thickness "S" of the shim ring becomes:

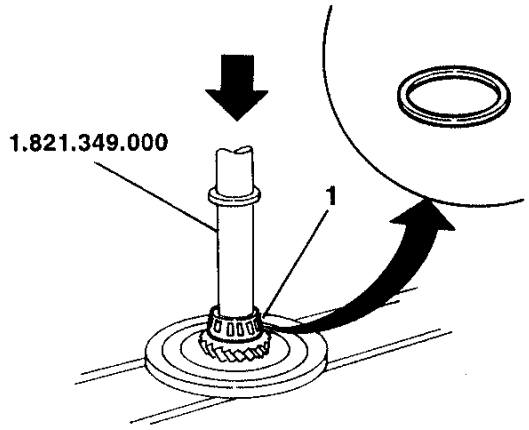
$$S = S_1 + G$$
$$= (2.85 + 0.10)\ mm = 2.95\ mm$$

NOTE: If the value thus obtained does not correspond to one of the shims supplied as a spare part, install the shim ring of the next size up or down.

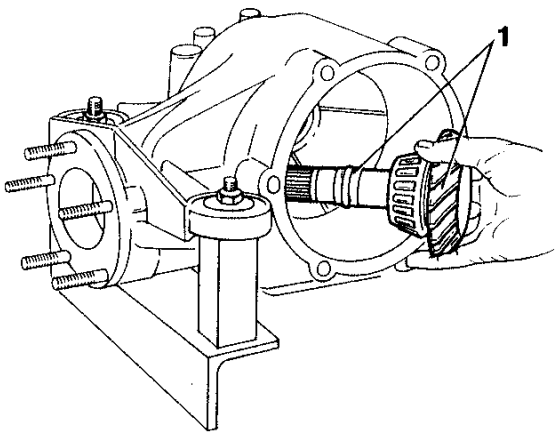


REFITTING TAPERED PINION

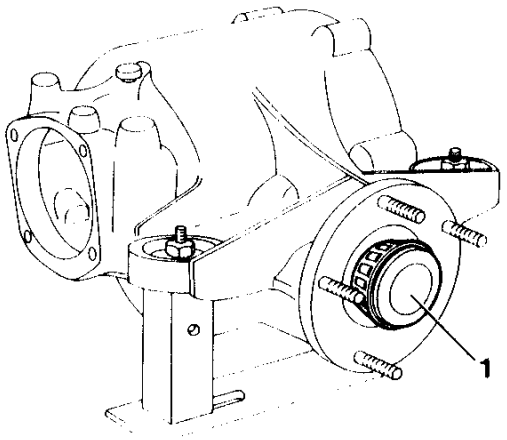
1. Install the shim ring with the thickness measured during the adjustment of the tapered pinion on the pinion and using inserting tool No. 1.821.349.000 and the press, install the inner race of the inner pinion bearing.



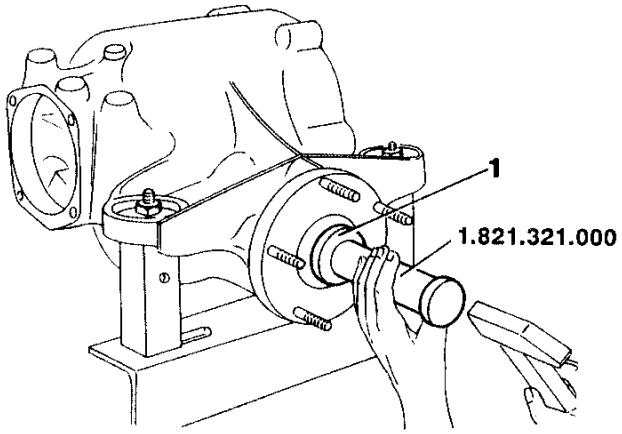
1. Insert the tapered pinion together with the new preload ring into the differential casing.



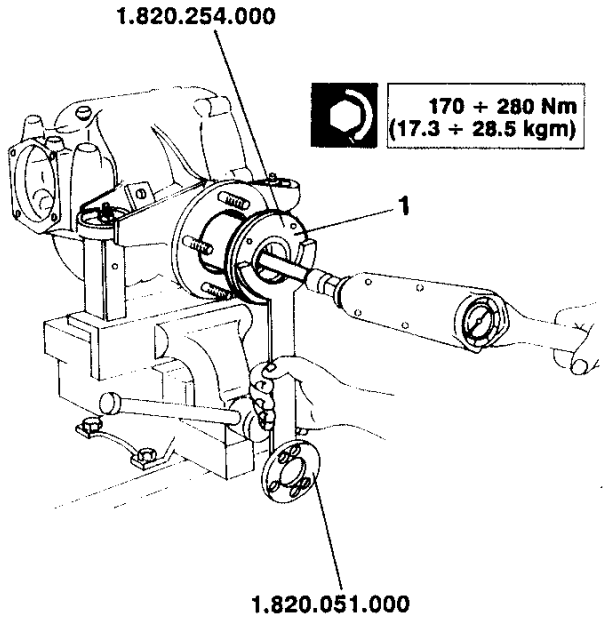
1. Install the inner race of the outer pinion bearing and washer.



1. Install the washer and the oil seal using inserting tool No. 1.821.321.000.

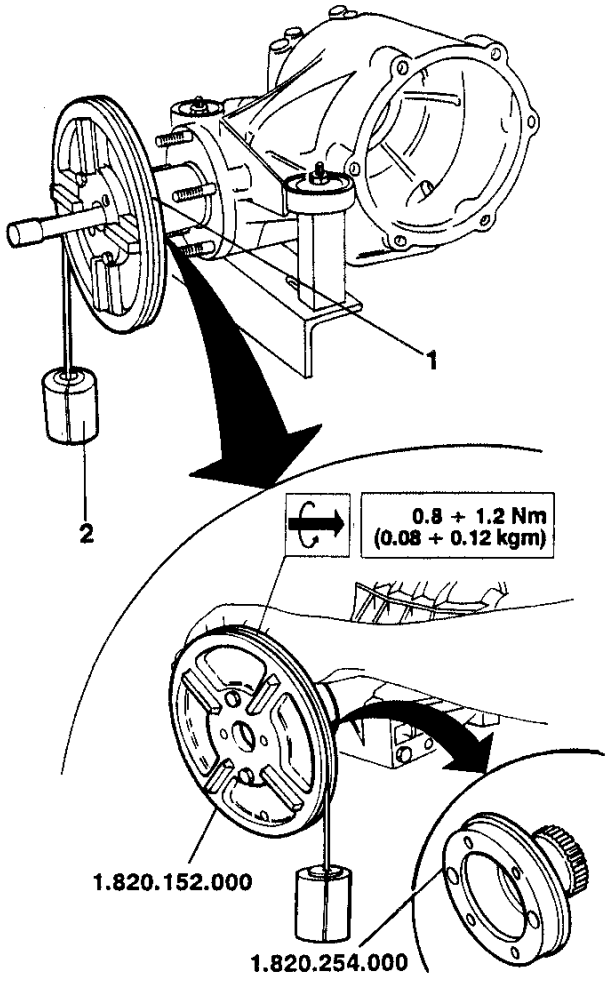


1. Position the toothed sleeve on the pinion shaft and using flange No. 1.820.254.000 together with spanner No. 1.820.051.000 to lock the pinion, tighten the nut securing the pinion until the correct torque value is obtained.



CHECKING ROLLING TORQUE OF TAPERED PINION

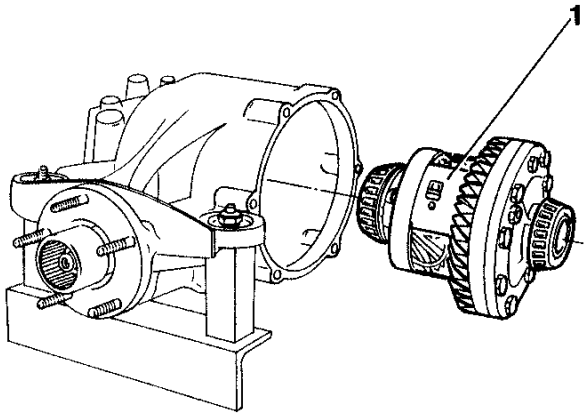
1. Using flange No. 1.820.254.000 installed on the toothed sleeve, fix disc No. 1.820.152.000 on the flange.
- Acting on the disc, rotate the tapered pinion in both directions a few times to settle the bearings.
- Wind the weighted cable around the disc.
2. Hang a combination of weights No. 1.824.006.001, 1.824.006.002, 1.824.006.003, 1.824.006.004 and 1.824.006.005 on the support cable to a value of 0.8 - 1.2 kg.
   Check that the weights are lowered smoothly without stopping or dragging the disc too fast.



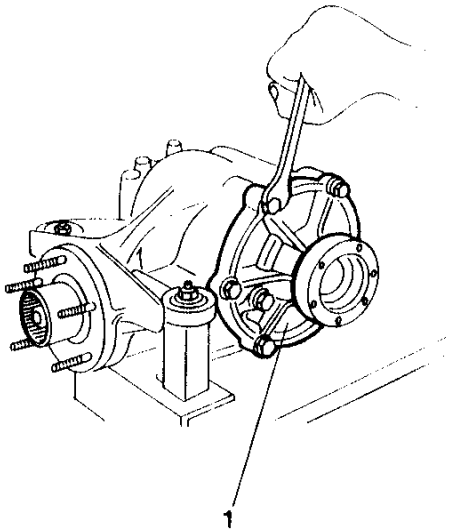
– If the weight descends too fast, tighten the nut securing the pinion to a torque value which is greater than the previous one as long as it is within the specified limits.

CHECKING CLEARANCE BETWEEN PINION AND CROWN GEAR

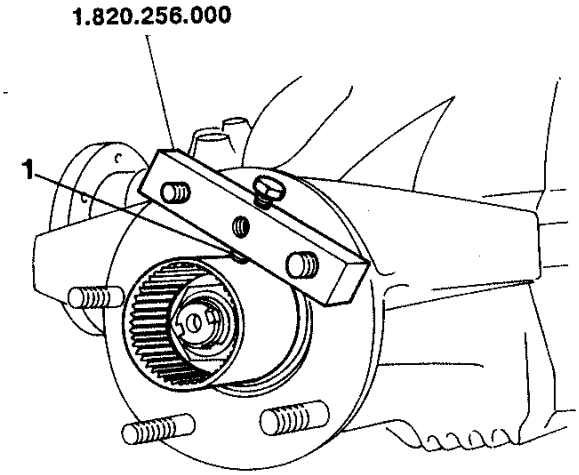
1. Insert the Torsen differential in the outer casing of the differential assembly.



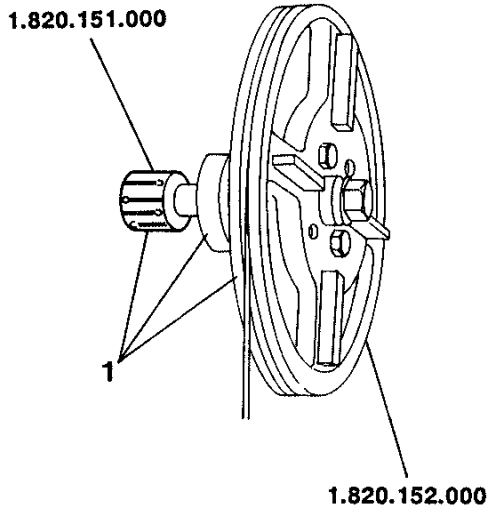
1. Install the left-hand cover of the differential without the O- ring into the differential and tighten the retaining screws.



1. Install locking tool No. 1.820.256.000 on the two drive shaft connecting pins and tighten the screw located on the tool until the toothed sleeve locks.



1. As shown, mount the clearance control device using disc No. 1.820.152.000 and connection and bushing No. 1.820.151.000.

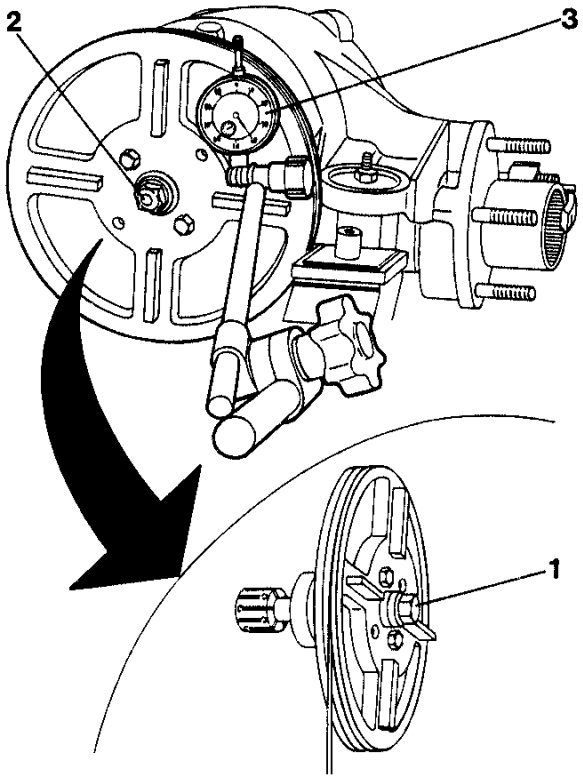


1. Install the clearance control device in the seating of the left- hand half-shaft.

2. Tighten the nut securing the check device until the device turns together with the differential.

3. As shown in the illustration, position the magnetic base dial gauge on the clearance control device corresponding to the average diameter of the tapered ring gear.

– Acting on the disc, rotate the differential assembly in both directions reading the clearance value off the dial gauge.



– If the clearance value does not correspond to the specified value, the ring gear must be moved closer or further away from the pinion by adding or subtracting to the shim rings, ensuring that the overall thickness of the shims is kept at the value measured when checking the rolling torque of the tapered ring gear. Repeat the procedure CHECKING CLEARANCE BETWEEN PINION AND RING GEAR).

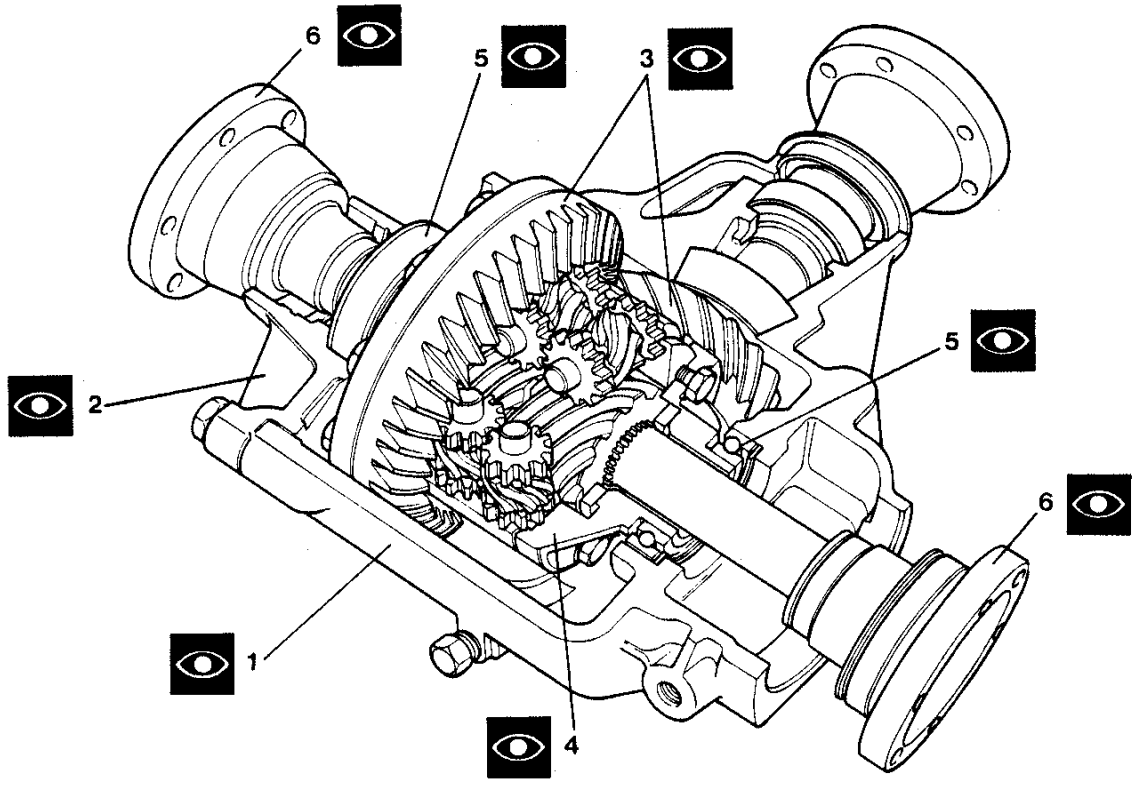
CHECKS AND INSPECTIONS

GEARS

1. Check the condition of the outer casing ensuring that there are no cracks or alterations. Replace if necessary.
2. Check the surface conditions of the covers and relative seals and attachments ensuring that there is no sign of cracking, deformation or damage. Replace the damaged components if necessary.
3. Check the crown wheel and relative pinion for nicks or excessive wearing.

WARNING:
When replacing the ring gear (after high mileage) the pinion must also be replaced.

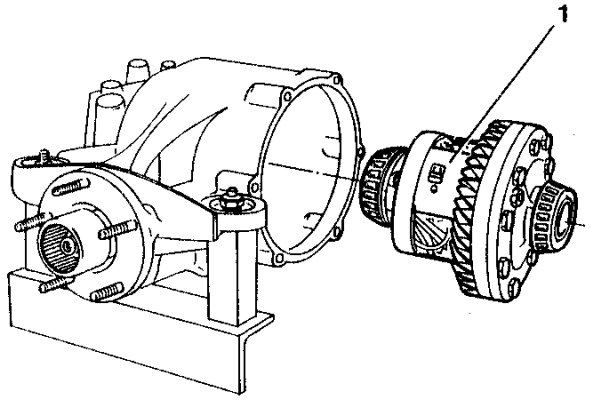
4. Check the inside of the casing ensuring that there are no signs of cracking or deformation. Replace the casing is necessary along with the gears contained within.
5. Check the bearings for scoring, signs of overheating and excessive wear and replace if necessary.
6. Check the state of the half-shafts ensuring that there are no signs of deformation, cracking of the flanges or nicks on the grooved end. If necessary replace the relative components.



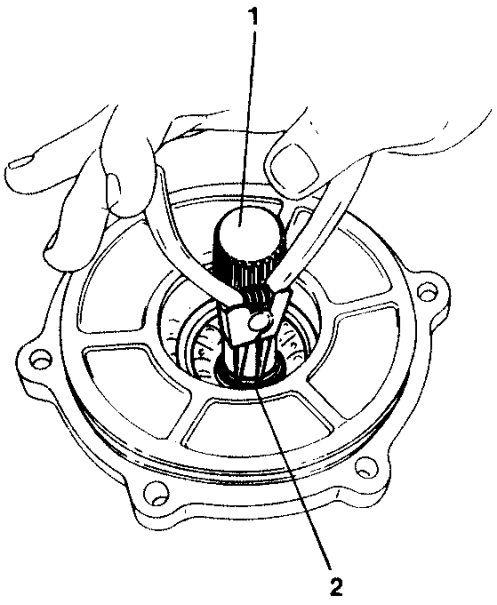
– Before refitting the differential assembly ensure that the checks and adjustments described above have been correctly carried out and (See: CHECKING ROLLING TORQUE OF TAPERED RING GEAR - ADJUSTING POSITION OF TAPERED PINION - CHECKING ROLLING TORQUE OF TAPERED PINION - CHECKING CLEARANCE BETWEEN PINION AND RING GEAR).

REFITTING

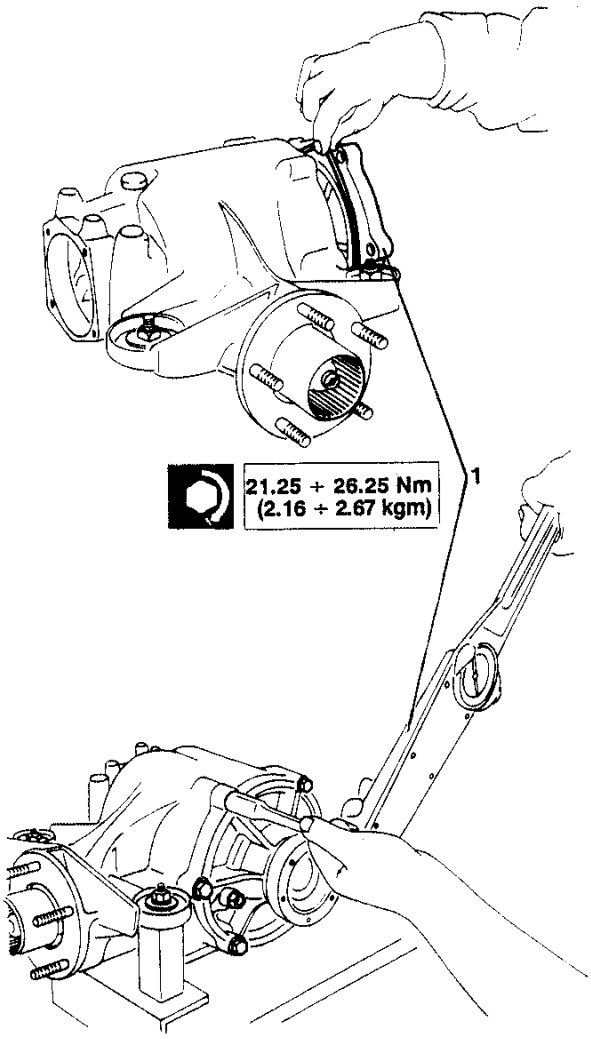
1. Insert the Torsen differential in the differential casing.



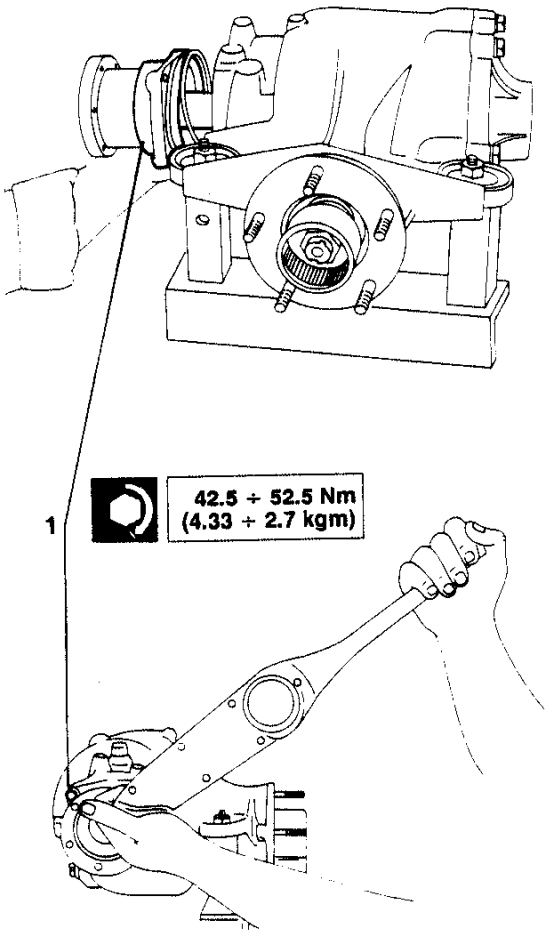
1. Refit the previously removed shaft in the right-hand cover of the differential casing.
2. Refit the flexible half-shaft seal ring to the cover.



1. Install the right-hand cover of the differential casing together with O-ring in the differential and tighten the screws to the specified torque.



1. Install the left-hand differential casing cover.

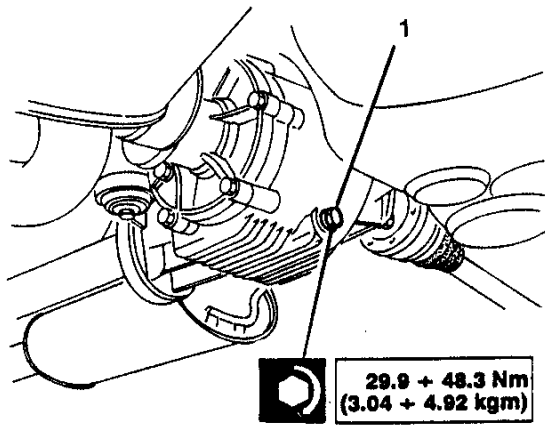


REAR HALF-SHAFTS

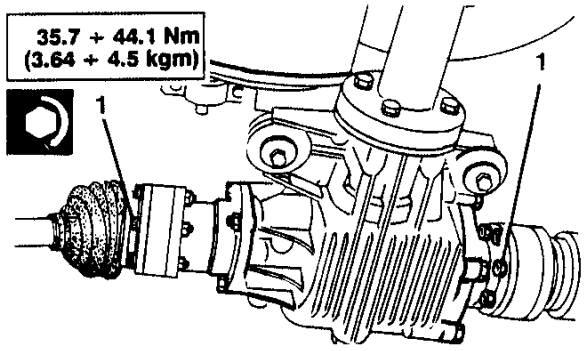
REMOVAL AND REFITTING

– Position the vehicle on a lift and remove the rear wheels.

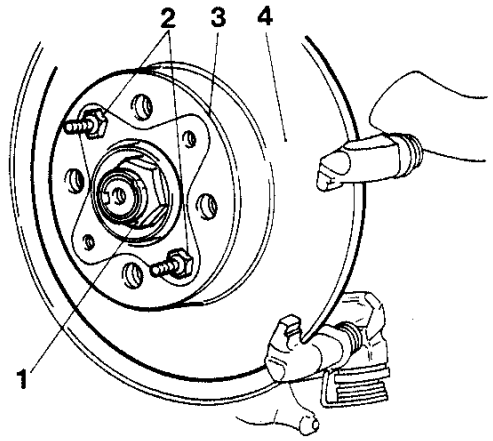
1. After placing a suitable container under the vehicle, unscrew the cap shown in the diagram and allow the differential oil to drain off.



1. Unscrew the bolts securing the rear half-shafts to the differential flange and disconnect the half-shafts.



1. Unscrew the nut securing the half-shaft to the wheel hub.
2. Unscrew the screws securing the brake disk to the wheel hub.
3. Remove the shim disc located in front of the brake disk.
4. Remove the brake disk.



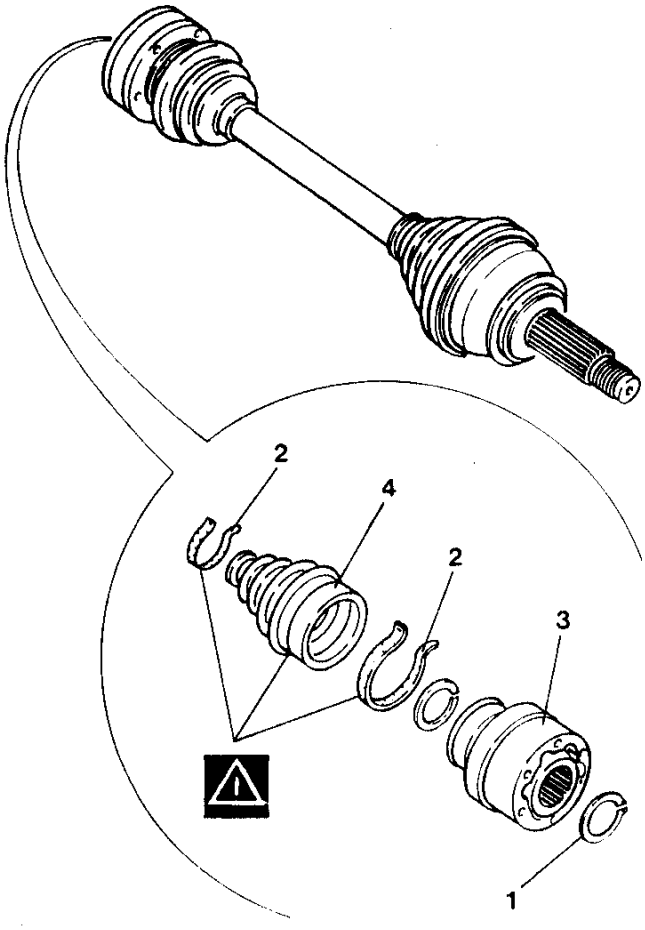
– Withdraw the half-shaft from the inner part of the wheel hub.

DISASSEMBLING THE CONSTANT SPEED JOINTS

JOINT ON DIFFERENTIAL SIDE

1. Remove the flexible retaining ring
2. Remove the clamp securing the bellows
3. Pull the constant speed joint out from the half-shaft.
4. Withdraw the protective cover.

WARNING:
Replace the protective cover and clamp when substituting.

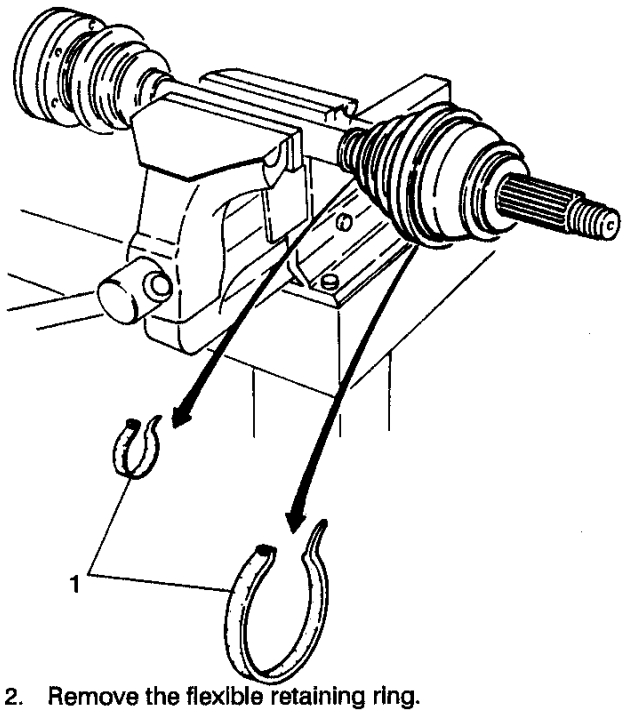


DISASSEMBLING JOINT ON WHEEL SIDE

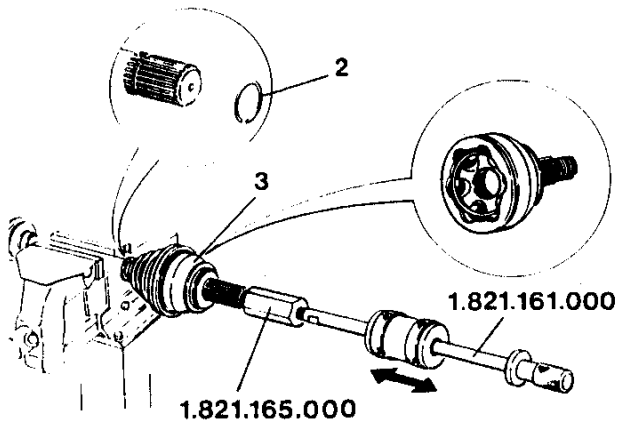
Clamp the half-shaft in a vice and proceed as follows.

1. Remove the clamp securing the protective cover.

WARNING:
Replace the protective cover and clamp when substituting.

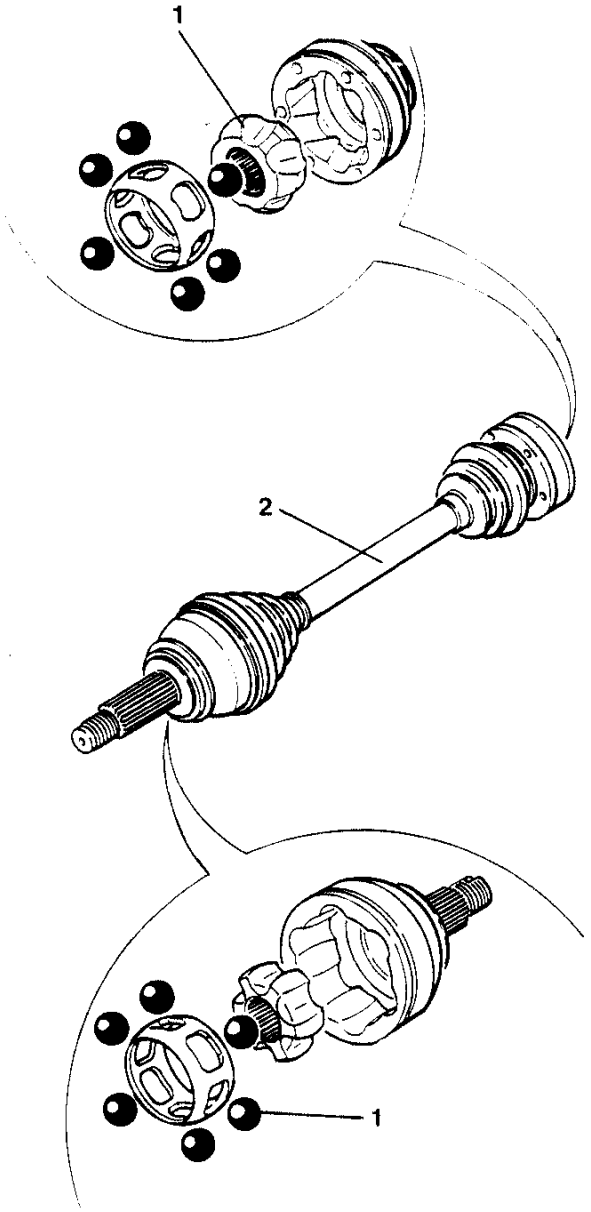


2. Remove the flexible retaining ring.
3. Using tool No. 1.821.165.000 and No.1.821.161.000, remove the constant speed joint from the half-shaft.



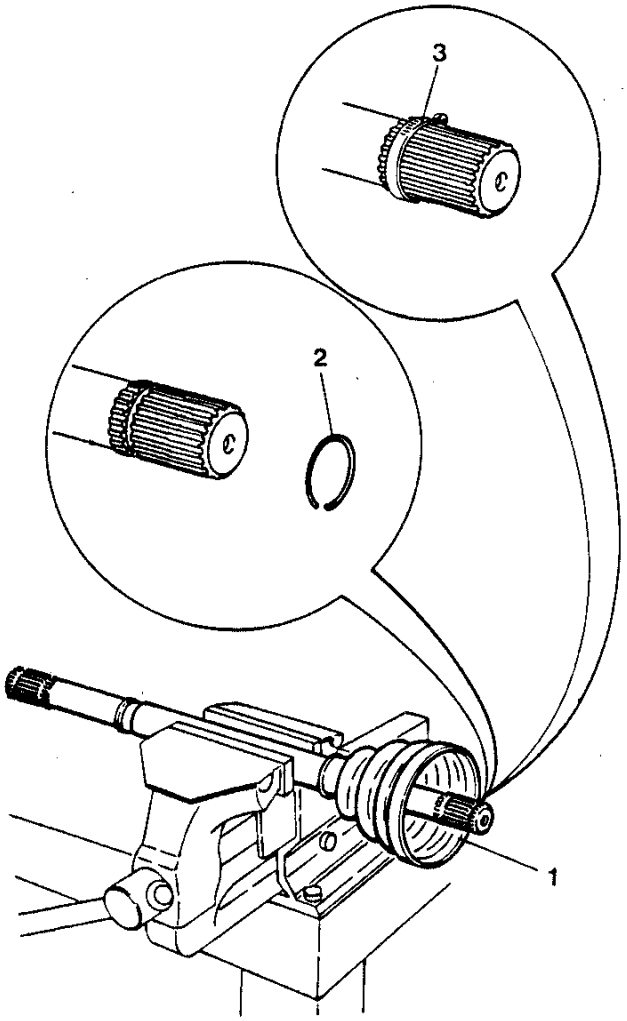
CHECKS AND INSPECTIONS

1. Using petroleum, lubricate the components of the joint and check that the balls and relative seats are not worn or cracked.
2. Check that the shaft is not deformed or cracked and that it shows no traces of wearing.



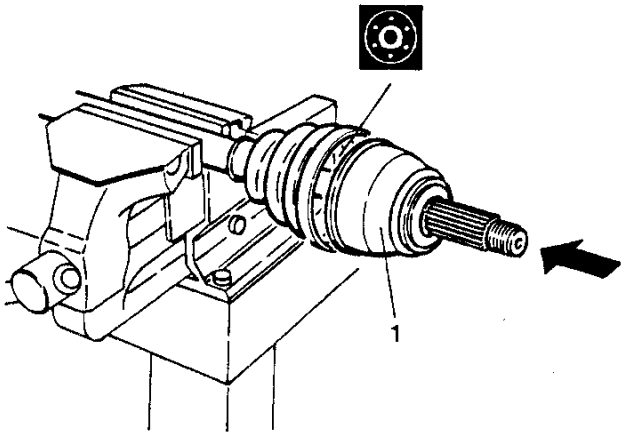
REFITTING JOINT ON WHEEL SIDE

1. Fit a new boot to the half-shaft.
2. Position the flexible retaining ring in its seating.
3. Secure the flexible ring with the clamp.

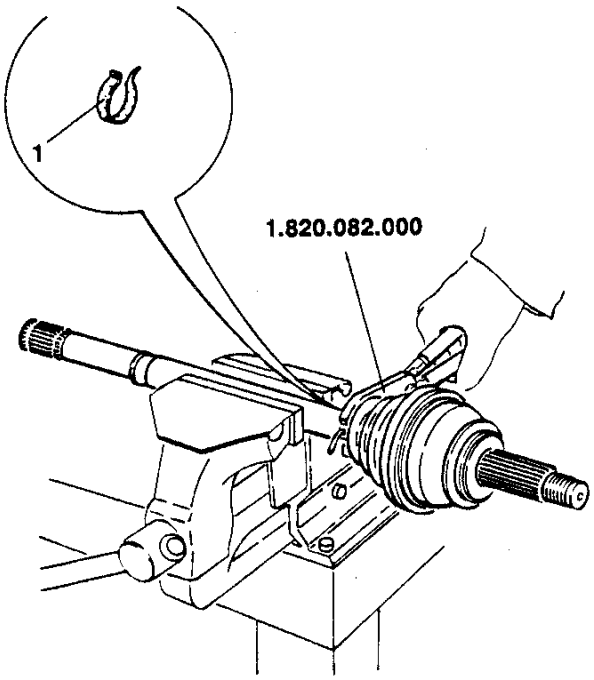


1. Position the constant speed joint on the half-shaft and, using a rubber mallet, push it home.

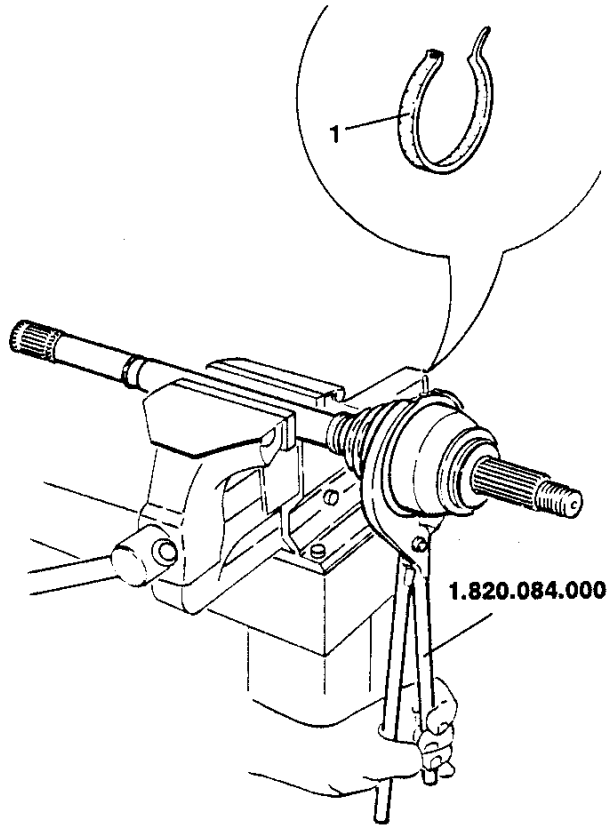
Fill the boot and grease the joint with about 120 g of the specified grease.



1. Using tool No. 1.820.082.000 fit the inner clamp to secure the boot.



1. Using tool No. 1.820.084.000 fit the outer clamp to secure the boot.

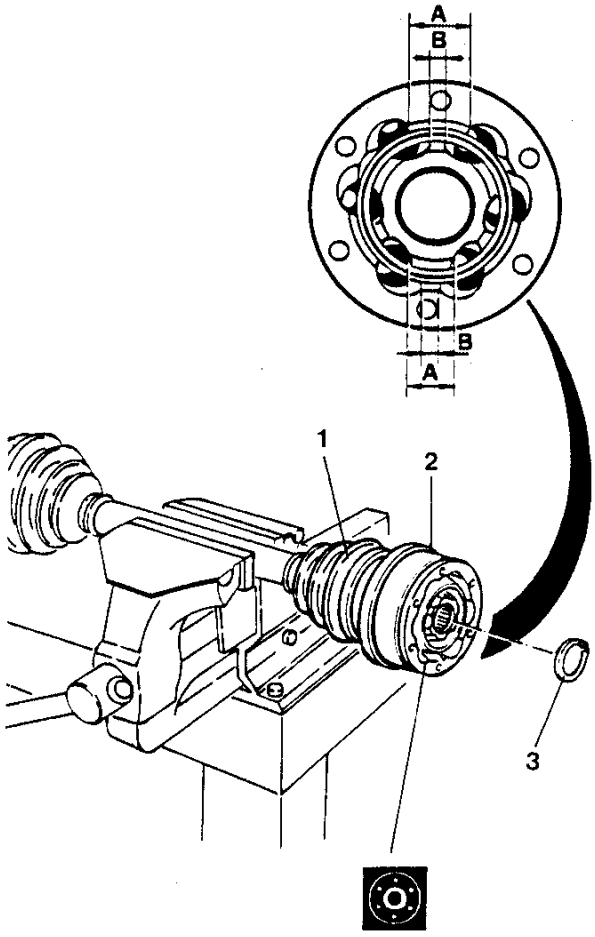


REFITTING THE JOINT ON THE DIFFERENTIAL SIDE

1. Fit a new boot onto the half-shaft.

WARNING:
If previously disassembled, reassemble the components of the constant speed joint as shown
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 flexible ring.



ON-VEHICLE INTERVENTIONS

CHECKING LEVEL AND REPLACING REAR DIFFERENTIAL OIL

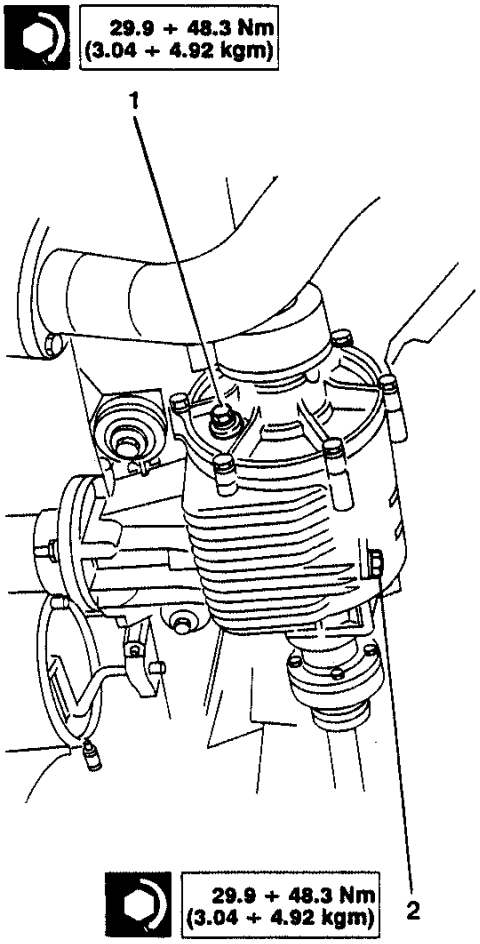
NOTE: When checking or changing the oil in the rear differential, the vehicle must be level on a vehicle lift.

1. When checking the level of the oil in the rear differential, unscrew the oil cap and check that the oil touches the lower edge of the hole in the differential casing.

– If necessary refill the system with the specified oil through the filler neck, clean the cap and tighten to the correct torque.

2. When replacing the oil in the rear differential, place a suitable container under the vehicle, remove the drain plug and allow the oil to drain off for at least 15 minutes.

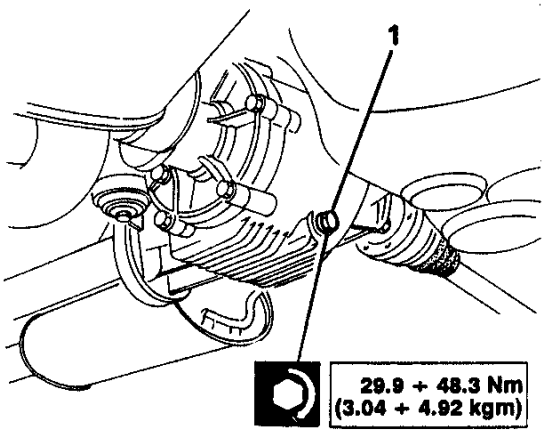
– Clean the drainage plug, screw it back on and pour new oil in through the filler neck until it reaches the lower edge of the filler hole. Clean the cap and tighten it to the specified torque.



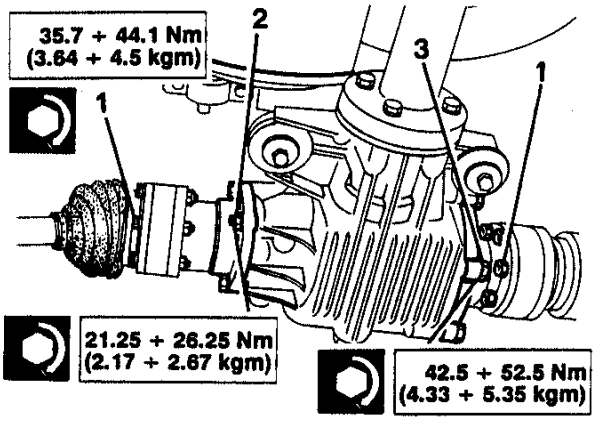
REPLACING REAR DIFFERENTIAL OIL SEAL

– Place the vehicle on a lift.

1. After placing a suitable container under the vehicle, unscrew the plug as shown in the illustration and allow the oil in the differential to drain off.



1. Unscrew the bolts securing the half-shafts to the flanges of the differential and disconnect the half-shafts.
2. Loosen the screws and nut securing the right-hand cover of the differential and remove the cover.
3. Loosen the screws securing the left-hand cover of the differential and remove the cover.



– After removing the two covers from the differential, replace the O-rings and oil seals on a bench (See: GR. 18 - FOUR-WHEEL DRIVE REAR AXLE - DISASSEMBLY).

TECHNICAL CHARACTERISTICS AND SPECIFICATIONS

TECHNICAL SPECIFICATIONS

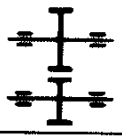
DISTRIBUTION OF DEFLECTING TORQUE

Axle	%
Front	47
Rear	53

RATIO ON WHEELS

Model	gear engaged	gear ratio	cylindrical reduction pair	Front idle pinion set	Rear idle pinion set	Ratio on wheels
2.0 T.B.- 4x4	1a	1 : 3.500	17/57 1 : 3.353	19/43 1 : 2.263	43/19 2.263 : 1	1 : 11.735
	2nd	1 : 2.176				1 : 7.296
	3rd	1 : 1.524				1 : 5.110
	4th	1 : 1.156				1 : 3.876
	5th	1 : 0.917				1 : 3.075
	Reverse	1 : 3.545				1 : 11.886

IDLE PINION SET RATIO (front and rear)

	2.0 T.B. - 4x4
	19/43 (1 : 2.263)

GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

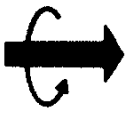
APPLICATION	TYPE	NAME
Rear differential oil	OIL	TUTELA W 90/M DA
Rear half-shaft constant spee joints	GREASE	TUTELA MRM 2

SEALANTS AND FIXATIVES

APPLICATION	TYPE	NAME
Screws securing tapered ring gear	HERMETIC	LOCTITE 573

CHECKS AND ADJUSTMENTS

REAR DIFFERENTIAL ASSEMBLY - TAPERED PINION ROLLING TORQUE

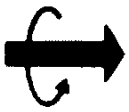
	2.0 T.B. - 4x4
	0.8 - 1.2 Nm (08 - 0.12 Kgm)

TAPERED PINION SHIM RINGS

	2.0 T.B. - 4x4
	S = 2.55 - 3.35 mm

NOTE: The thickness S is obtained using shim rings of a thickness between 2.55 mm and 3.35 mm in steps of 0.05 mm

REAR DIFFERENTIAL ASSEMBLY - TAPERED RING GEAR ROLLING TORQUE

	2.0 T.B. - 4x4
	1.8 - 2 Nm (0.18 - 0.2 Kgm)

REAR DIFFERENTIAL ASSEMBLY - PINION/RING GEAR CLEARANCE

	2.0 T.B. - 4x4
	0.08 - 0.15 mm

NOTE: The adjustment of the clearance between pinion and ring gear is obtained using shims with a thickness of between 0.18 mm and 0.20 mm in steps of 0.05 mm.

TIGHTENING TORQUES

REAR DIFFERENTIAL

Description	N·m	kg·m
Nut to be caulked for locking pinion	0.8 - 1.2	0.08 - 0.12
Screw securing ring gear	68 - 84	6.93 - 8.56
Magnetic threaded tapered plug for oil drainage	29.9 - 48.3	3.05 - 4.92
Screw securing left-hand cover	42.5 - 52.5	4.33 - 5.35
Magnetic threaded tapered plug for oil filling	29.9 - 48.3	3.05 - 4.92
Screw securing right-hand cover	21.25 - 26.25	2.16 - 2.67
Nut for stud on right-hand cover	21.25 - 26.25	2.16 - 2.67

REAR HALF-SHAFTS

Description	N·m	kg·m
Screws securing half-shafts	35.7 - 44.1	3.64 - 4.49
Nut securing half-shafts to wheel hub	266 - 294	27.12 - 29.97
Screw securing rear brake disk	5.4 - 12.6	0.55 - 1.28

SPECIFIC TOOLS

TOOL NUMBER	DESCRIPTION
1.820.024.000	Halfplate
1.820.047.000	Halfring support plate (Use with 1.820.244.000)
1.820.051.000	Spanner
1.820.082.000	Pliers for installing clamps on joint protection boots
1.820.084.000	Pliers for installing clamps on joint protection boots
1.820.106.000	Support for dial gauge
1.820.151.000	Connection (Use with 1.820.152.000)
1.820.152.000	Disc for rolling test (Use with 1.820.151.000)
1.820.229.000	Flange for pulling half-shaft
1.820.244.000	Half-rings for removing inner race of pinion bearing
1.820.252.000	Support for differential on bench
1.820.254.000	Flange with grooving for rolling torque
1.820.256.000	Plate for locking pinion for clearance check
1.821.003.000	Puller for outer race of differential bearing
1.821.013.000	Puller for outer races of pinion bearings
1.821.028.000	Inserting tool for outer race of differential casing bearing
1.821.034.000	Puller for inner races of differential bearings
1.821.085.000	Inserting tool for outer race of outer pinion bearing
1.821.086.000	Inserting tool for inner races of differential bearings
1.821.094.000	Punch
1.821.099.000	Inserting tool for oil seal
1.821.121.000	Inserting tool
1.821.161.000	Mallet (Use with 1.820.229.000) (Use with 1.821.165.000)
1.821.165.000	Puller for constant speed joint

TOOL NUMBER	DESCRIPTION
1.821.222.000	Inserting tool for outer rings of pinion bearings
1.821.226.000	Puller for outer rings of pinion bearings
1.821.321.000	Inserting tool for oil seal
1.821.349.000	Inserting tool for inner race of inner pinion bearing
1.824.006.001	Weight for rolling test
1.824.006.002	Weight for rolling test
1.824.006.003	Weight for rolling test
1.824.006.004	Weight for rolling test
1.824.006.005	Weight for rolling test
1.825.004.000	Check apparatus
1.825.030.000	Dummy pinion
1.825.031.000	Reference gauge

GROUP 21

FRONT SUSPENSION

INDEX

For all parts not given here, refer to the corresponding Group in publication No. PA4655C1000000.

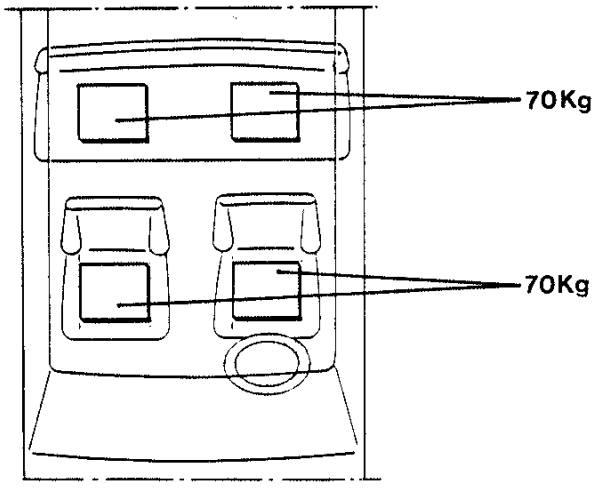
CHECKING TRIM AND CHARACTERISTIC ANGLES

CHECKING TRIM OF FRONT WHEELS

PRELIMINARY OPERATIONS

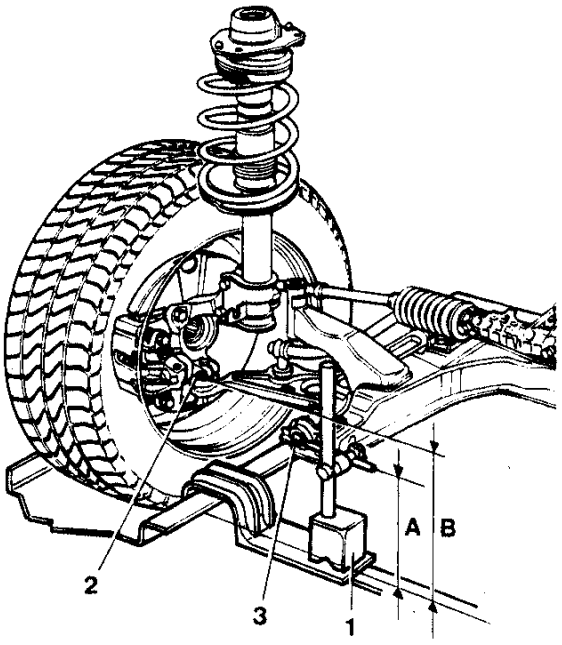
Wheel trim should be checked after the following operation and checks have been completed:

- 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.



CHECKS AND INSPECTIONS

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

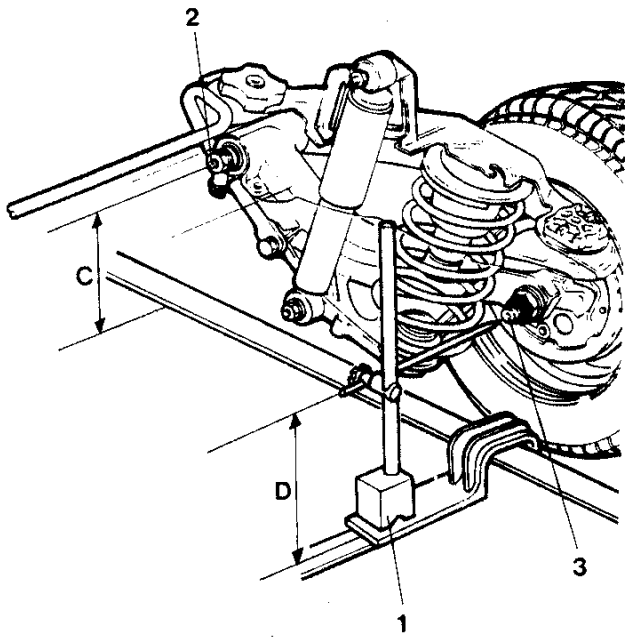
Wheel trim should be checked after the following operations and checks have been completed:

- 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.

CHECKS AND INSPECTIONS

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.



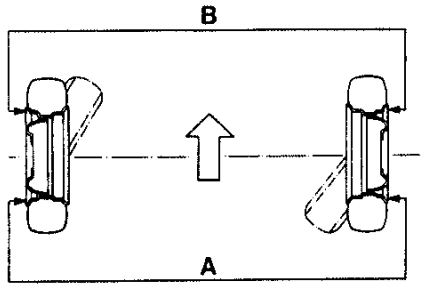
CHECKING CHARACTERISTIC ANGLES

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:
  - 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 that there is no play on the articulated pin of the steering tie-rod.
- Set the vehicle on a lift.

CHECKING FRONT WHEEL TOE-IN AND TOE-OUT

1. Using the appropriate tools, check that the toe in/out values are as specified (See: TECHNICAL CHARACTERISTICS AND SPECIFICATIONS - Checks and adjustments).



If the toe-in values are different from the specified values operate as follows:

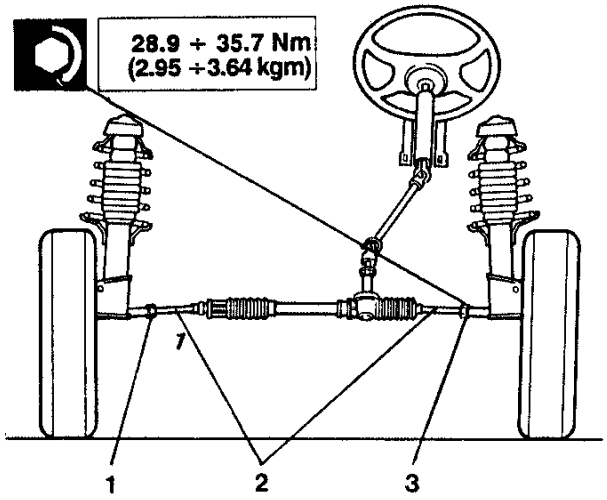
1. Loosen the side nuts of the side steering tie-rods.

WARNING:
Each time the front wheels are put in toe, it is necessary to check that the boots rotate freely on the tie-rod. If necessary pull them off and lubricate with the specified grease.

2. Rotate the tie-rods until the specified value is reached without though altering the position of the steering wheel.

NOTE: The adjustments must be carried out for the tie-rods of both wheels.

3. Tighten the tie-rod retaining nuts to the correct torque.



CHECKING CAMBER AND CASTER ANGLE

- Check that the camber and caster values (which cannot be asjusted) correspond to those specified (See: TECHNICAL CHARACTERISTICS AND SPECIFICATIONS - Checks and adjustments).

NOTE: If the measured values are not within the specified limits, check body squaring (See: REPAIR INSTRUCTIONS - BODYWORK - 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		2.0 T.B. 4x4
Inner diameter	(mm)	150
Outer diameter	(mm)	178.2
Outher diameter	(mm)	14.1
Number of coils		5.56
Direction of coil		Right
Free length	(mm)	398

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

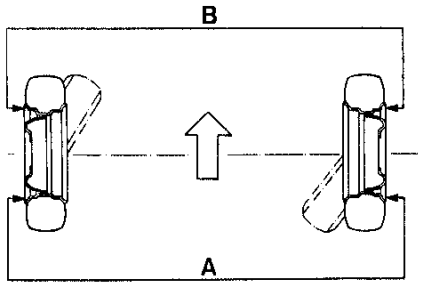
GENERAL SPECIFICATIONS

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

CHECKS AND ADJUSTMENTS

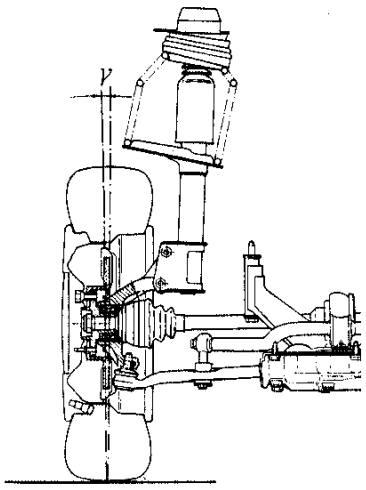
FRONT WHEEL TOE-IN

A-B	2.0 T.B. 4x4
	–0.26 ± 1 *
	0 ± 1 •

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

• Values measured with vehicle in static load condition.

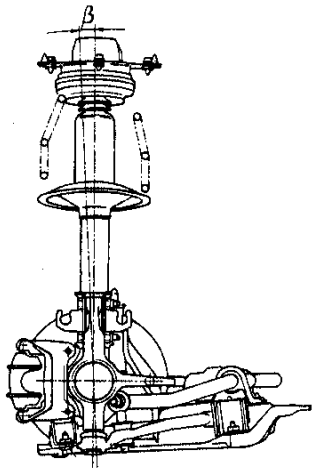
WHEEL CAMBER ANGLES

	$\gamma = -3 \pm 20'$ *
	$\gamma = -21' \pm 20'$ •
	(characteristics cannot be adjusted)

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

• Values measured with vehicle in static load condition.

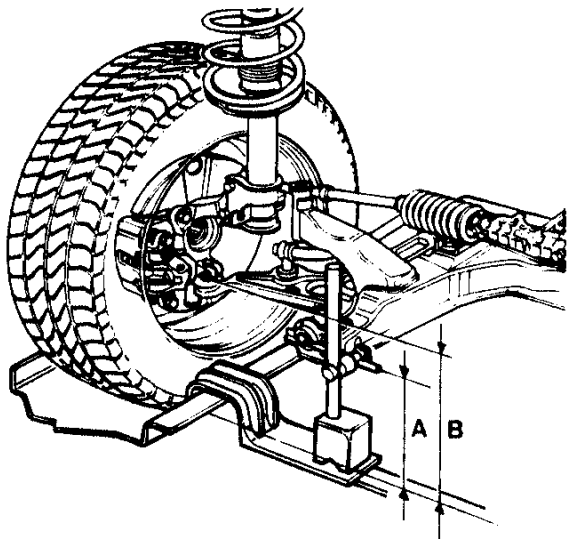
FRONT WHEEL CASTER ANGLE

	2.0 T.B. 4x4
	3° 10' ± 30' *
	3° 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.

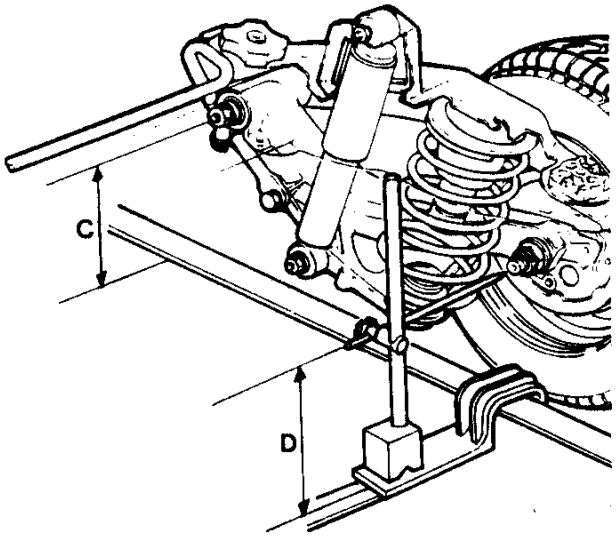
FRONT TRIM

B-A	2.0 T.B. 4x4 (mm)
	–5 ± 7 *
	–33 ± 7 •

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

• Values measured with vehicle in static load condition.

REAR TRIM

C-D	2.0 T.B. 4x4 (mm)
	1.6 ± 7 *
	-36 ± 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	66.5 ÷ 73.5	6.78 ÷ 7.49
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	83 ÷ 102.9	8.49 ÷ 10.49
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

GROUP 22

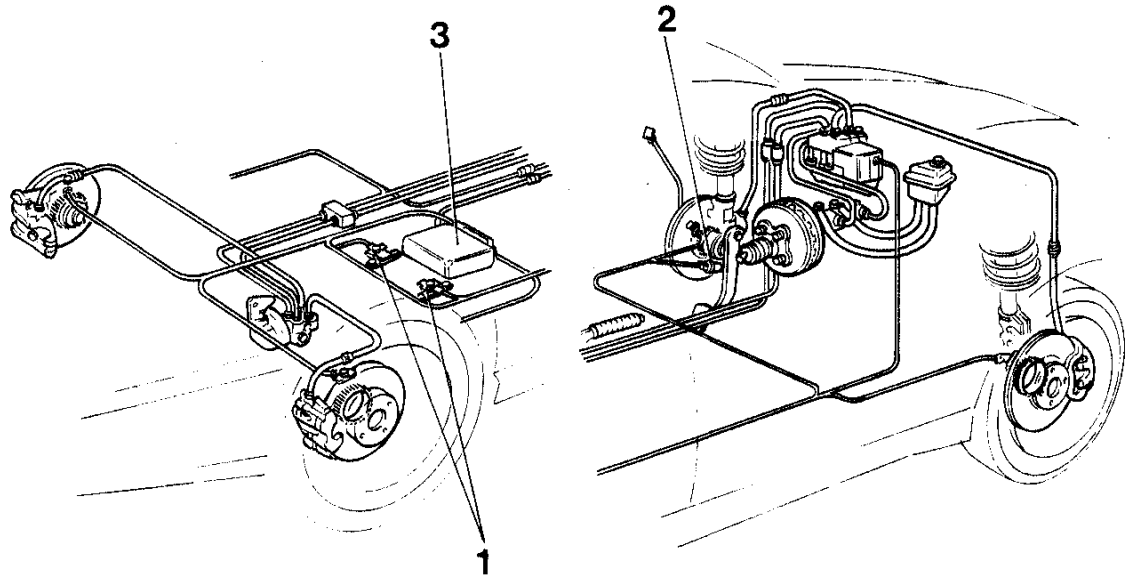
FRONT AND REAR BRAKES

INDEX

FRONT AND REAR BRAKES

HYDRAULICALLY CONTROLLED BRAKING SYSTEM WITH A.B.S. (Anti Blockier System) BOSCH 2S

DESCRIPTION



1. Longitudinal and transversal acceleration sensors
2. Switch on clutch pedal
3. Integrated A.B.S. / engine control unit

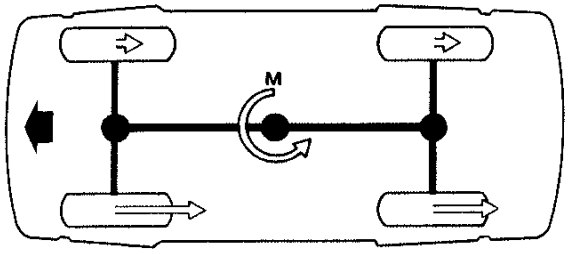
System identification

The hydraulically controlled braking system is integrated as standard on the 2.0 T.B. 4x4 version, by an A.B.S BOSCH 2S anti-wheel lock system (6 sensors, 4 channels).

System components

The system, specifically designed for vehicles fitted with four-wheel drive, differs from the 2E type used for other versions in the 155 range in that it has the components listed below and for the different method of operation;

- two supplementary sensors (1) for the measurement of both longitudinal and transversal acceleration to which the vehicle is subject when in motion.



- a switch applied to the clutch pedal which informs the electronic control unit whether the clutch is engaged or not
- electronic control units both of the ABS system and the integrated engine management system are interfaced with each other in order to optimize the functioning of the system itself.

Operation logic ("prudential" or maximum anti-lock efficiency)

One of the characteristics of four-wheel drive vehicles is the tendency to increase the spinning effect to which the vehicle is subject when braking in situations where there is a difference in traction between the two sides of the vehicle.

The spinning effect is caused by the almost rigid coupling between the two axles and between the two wheels of the same axle.

In order to reduce this phenomenon, the control unit adopted for the 2S version of the ABS BOSCH sytem uses an operational logic indicated by the letters GNC, of the "prudential" type. This logic, which aims to generate a more even braking torque, is baed on the modulation of the braking torque on the wheels with the greatest degree of traction and is already used on the two-wheel drive vehicles fitted with a last generation ABS system even though in these cases the braking regulation is very short (only one modulation cycle).

For the 155 four-wheel drive, the GMA logic is active for successive braking modulation cycles.

In addition to the advantages of this system there is also a disadvantage in that this type of logic, to prevent the vehicle from spinning, penalizes the braking action when cornering if road holding is low. If the risk of spinning is mimimal or if the bend is taken at high speed, the control unit abandons the "prudential" function restoring the full ABS efficiency.

The specific conditions which permit the exclusion of the new type of logic are communicated to the control unit by the ABS system via the longitudinal (minimal spin) and transversal (bend at high speed) accelerometers.

Corrective function of the "fast idle"

When there is a situation of combined deceleration and braking on vehicles fitted with four-wheel drive (like the 155 2.0 TB 4x4), especially when this occurs on snow or ice, the two braking actions (engine and brakes) are also distributed to the rear axle which is already in a critical position, resulting in the tendency to brake this axle more than needed. In this situation the ABS control unit induces that of the electronic management of the engine integrated with it (3) to momentarily increase the idle speed. This corrective function, called "fast idle", is excluded if switch (2) located on the clutch pedal signals that the engine is disengaged from the drive system.

TECHNICAL CHARACTERISTICS AND SPECIFICATIONS

TECHNICAL SPECIFICATIONS

MASTER CYLINDER

Model	Type	Diameter	Stroke
2.0 T.B. 4x4	ISOVAC	15/16" (23.8 mm)	5/8" (16+16 mm)

SERVO BRAKE

Model	Type	Diameter of operating cylinder
2.0 T.B. 4x4	ISOVAC	7"+8" (17.78 + 20.32 cm)

FRONT BRAKE CALIPERS

Model	Type	Piston diameter (mm)	Brake pad area (cm^2)	Brake pad nominal thickness (mm)
2.0 T.B. 4x4	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)
2.0 T.B. 4x4	GIRLING	34	21	$14\ ^{-0}_{+0.4}$

GENERAL SPECIFICATIONS

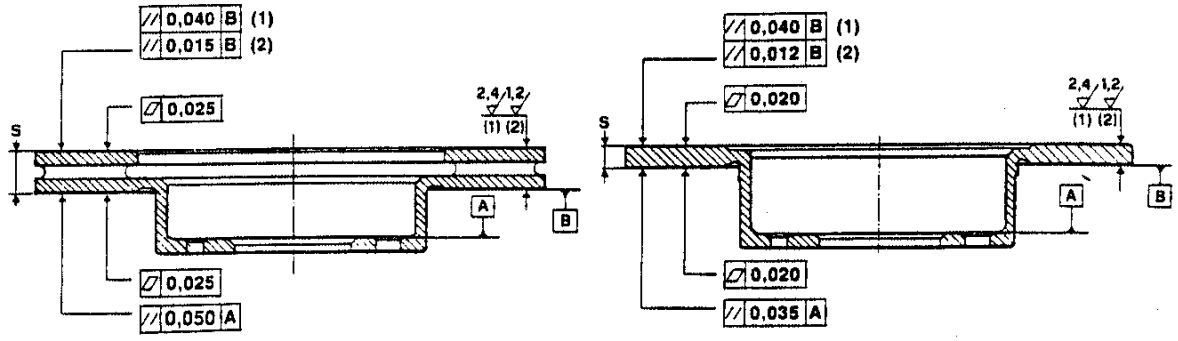
FLUIDS AND LUBRICANTS

APPLICATION	TYPE	NAME
Pedal joints and bushes	GREASE	TUTELA MR3
Brake/clutch hydraulic system refill	FLUID Class: DOT 4 SAE J170 3F	ALFA ROMEO BRAKE FLUID SUPER DOT 4
Seat for anti-lock front/rear wheel inductive sensor	GREASE	FIAT Zeta 2

CHECKS AND ADJUSTMENTS

BRAKE DISK		2.0 T.B. 4x4	
		FRONT	REAR
Diameter	(mm)	284	240
Limit operating thickness	(mm)	20.2	9.2
Minimum thickness after grinding	(mm)	21.2	10.2
Nominal thickness	(mm)	22.2	11.2

BRAKE DISK GRINDING DIMENSIONS

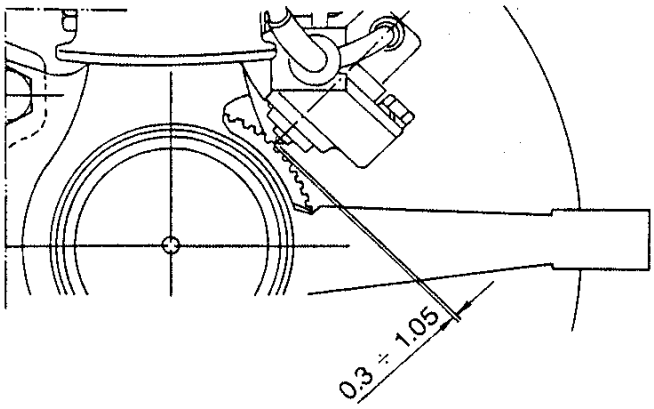


1. Radial
2. Circumferential

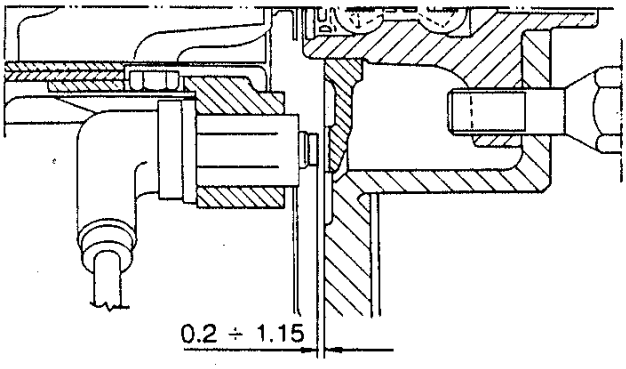
BRAKE PAD	FRONT	REAR
Limit operating thickness	3 mm	

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	83.3 ÷ 102.9	8.49 ÷ 10.49
Screw securing front brake calipers	74.8 ÷ 92.4	7.62 ÷ 9.42
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
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
Screw securing front and rear, right and left guards to strut	5.1 ÷ 6.3	0.52 ÷ 0.64
Pipe connection on brake pump	9.35 ÷ 11.55	0.95 ÷ 1.18

GROUP 25

REAR SOSPENSIONS

INDEX

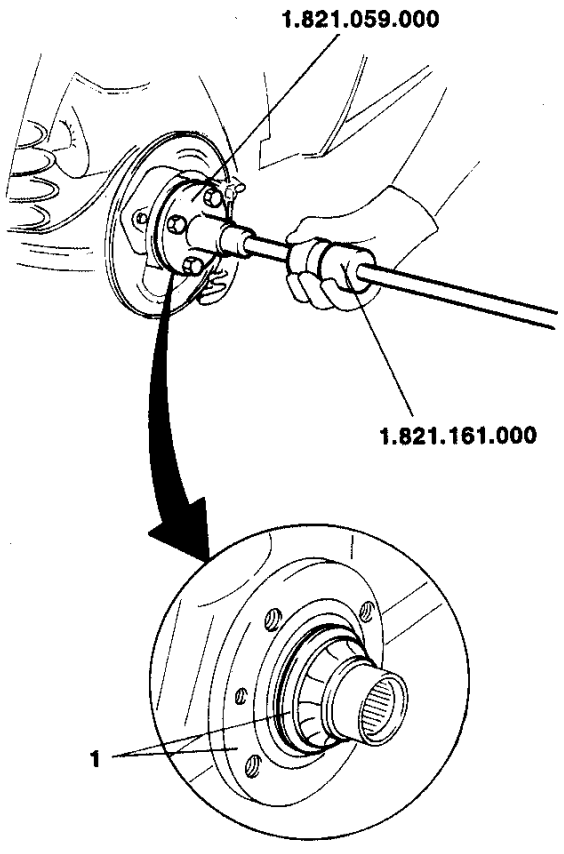
For all parts not given here, refer to the corresponding Group in publication No. PA4655C1000000.

WHEEL HUB AND REAR BEARING

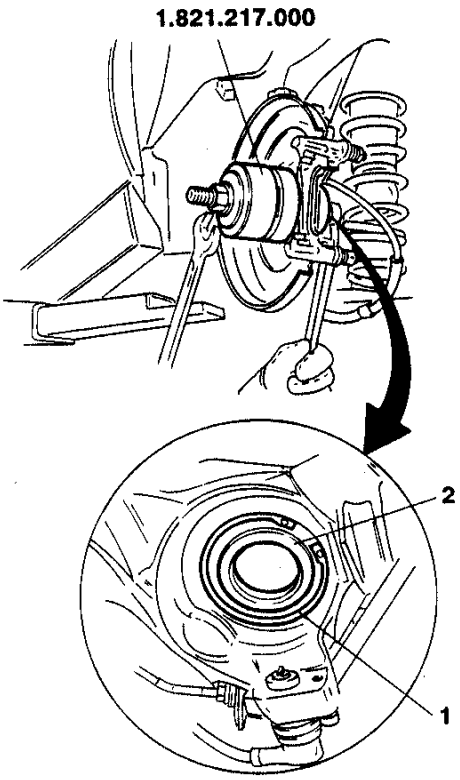
REMOVAL AND REFITTING

- Remove the rear wheel.
- Remove the rear brakes complete with calipers and discs (See: PA4653C1000000 - GR. 22 - REAR BRAKES - REMOVAL AND REFITTING).
- Remove the rear halfshafts (See: GR. 18 - REAR AXLE - FOUR-WHEEL DRIVE).

1. Using flange No. 1.821.059.000 together with mallet No. 1.821.161.000, remove the wheel hub together with the outer race of the bearing.
- If necessary pull off and replace the bearing race.

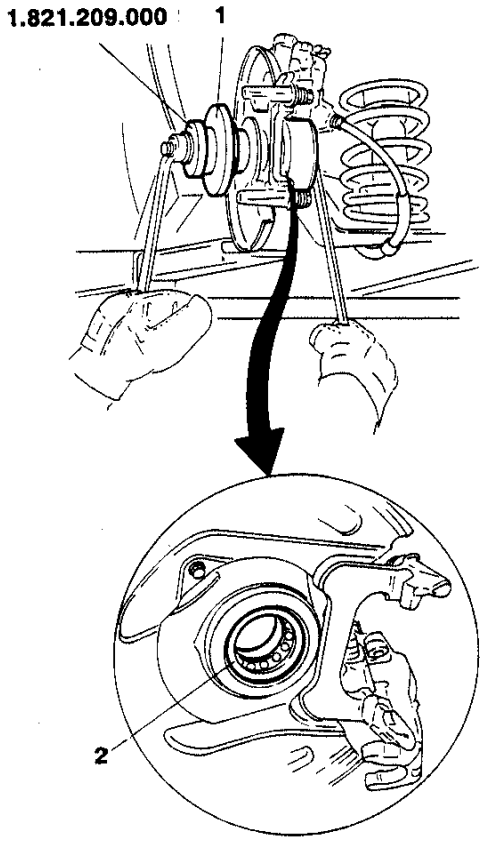


1. Remove the retaining seeger from the inner race of the bearing.
2. Using puller No. 1.821.217.000 remove the inner race of the bearing.



Refit the inner race of the bearing using inserting tool No. 1.821.209.000.

1. Refit the wheel hub in the swinging arm using inserting tool No. 1.821.209.000.
2. Proceed as instructed at the previous stage resting the rotational part of the inserting tool on the inner race of the bearing.



TECHNICAL CHARACTERISTICS AND SPECIFICATIONS

TECHNICAL CHARACTERISTICS

Independent wheel suspension with longitudinal tie-rod arms, helical springs, telescopic, pressurized hydraulic shock absorbers of the blade type with stabilizer bar.

HELICAL SPRINGS

CHARACTERISTICS		2.0 T.B. 4x4
Inner diameter	(mm)	94
Outer diameter	(mm)	121.8
Cable dimensions	(mm)	13.9
Number of coils		6.5
Direction of coil		Right-hand
Free length	(mm)	305

SHOCK ABSORBERS

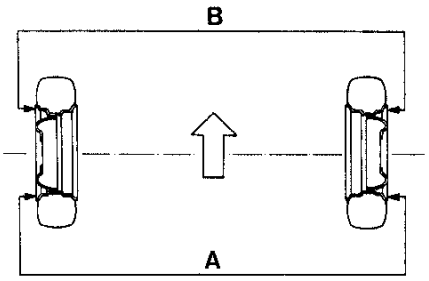
		Normal	C.D.S.
Type: telescopic hydraulic pressurized blade type		BOGE	
Stroke	(mm)	104.5	
Outer diameter	(mm)	58	
Controlled damping suspension solenoid valve power supply		(see: ELECTRICAL-ELECTRONIC DIAGNOSIS SECTION 31)	

STABILIZING BAR

Bar diameter	(mm)	19

CHECKS AND ADJUSTMENTS

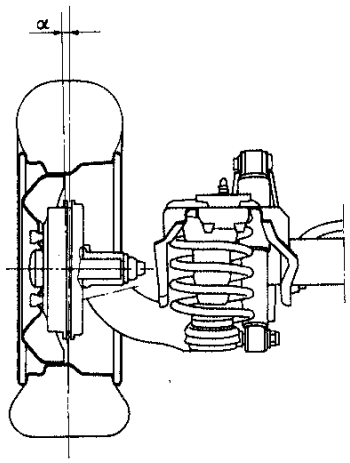
REAR WHEEL TOE-IN

A-B	2.0 T.B. 4x4
	1.6 mm *
	3.4 mm •
	(characteristic cannot be adjusted)

* Values measured when empty and in running condition (serviced as specified).

• Values measured with statically loaded vehicle.

REAR WHEEL CAMBER

	2.0 T.B. 4x4
	−1° * •
	(characteristic cannot be adjusted)

* Values measured when empty and in running condition (serviced as specified).

• Values measured with statically loaded vehicle.

REAR TRIM

(See GR. 21 - Front suspension - Technical characteristics and specifications).

TIGHTENING TORQUES

Description	N·m	kg·m
Hexagonal head screw for fixing front flexible block to body	91.8 ÷ 113.4	9.36 ÷ 11.56
Hexagonal head screw for fixing rear flexible block to body	91.8 ÷ 113.4	9.36 ÷ 11.56
Bolt for fixing rear suspension swinging arm to chassis	142.5 ÷ 157.5	14.53 ÷ 16.05
Screw securing lower shock absorber to swinging arm	57.8 ÷ 71.4	5.89 ÷ 7.28
Hexagonal head screw for fixing upper shock absorber to chassis	47.6 ÷ 58.8	4.85 ÷ 5.99
Hexagonal head screw for fixing stabilizer bar to rear suspension arm	47.6 ÷ 58.8	4.85 ÷ 5.99
Hexagonal head screw for fixing stabilizer bar support bracket to suspension arm	23.8 ÷ 29.4	2.43 ÷ 2.99
Wheel pillar (for versions with light alloy wheels)	83.3 ÷ 102.9	8.49 ÷ 10.49
Hexagonal nut to caulk for securing wheel to rear coupling	266 ÷ 294	27.12 ÷ 29.97
Self-braking hexagonal nut securing suspension spring rotation ring	5.1 ÷ 6.3	0.52 ÷ 0.64

SPECIFIC TOOLS

TOOL NUMBER	DESCRIPTION
1.820.003.000	Tool for removing and refitting rear axle
1.822.005.000	Extension spanner for tightening nut securing rear wheel hub
1.821.161.000	Mallet (Use with 1.821.059.000)
1.821.059.000	Flange for extracting rear wheel hub (use with 1.821.161.000)
1.821.217.000	Puller for wheel hub bearing
1.821.209.000	Inserting tool for fitting wheel hub bearing and refitting wheel hub

GROUP 28

WHEELS AND TYRES

INDEX

For all parts not mentioned here see the corresponding group of manual "155 - REPAIR MANUAL" - PA4655C1000000

TECHNICAL DATA AND SPECIFICATIONS

SPECIFICATIONS

EXCEPT "'95 VERSION"

Specifications \ Versions		155 ⊠ (167A2C-167A2E)	
Rim sizes			6J x 15"
Tyre sizes			205/50 R15" 86V
Tyre pressure bar (kg/cm^2)	with reduced load (2 persons)	front rear	2.5 2.3
	with full load	front rear	2.8 2.5
Compact spare wheel	rim size		4J x 15"
	tyre size		115/70 R15" 90M
	tyre pressure bar (kg/cm^2)		4.2

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

'95 VERSION

Specifications \ Versions		155 (167A2E)	
Rim sizes		7JX16"	6.5JX15"*
Tyre sizes		205/45 ZR16	205/50 ZR15*
Tyre pressure bar (kg/cm^2)	with reduced load (2 persons) front	2.5	
	rear	2.3	
	with full load front	2.8	
	rear	2.5	
Compact spare wheel	rim size	4B x 15"	
	tyre size	115/70 R15 90M	
	tyre pressure bar (kg/cm^2)	4.2	

(*) Optional rim - tyre match 6.5JX15" - 205/50 ZR15

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

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

RIM SIZE	RIM CAMBER
6.5JX15"	37 mm
7JX16"	41 mm