

GEARBOX

GROUP 13

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DESCRIPTION

- The speed gear is of the "mechanical type" with 5 speeds plus reverse and is part of a mechanical assembly including also the clutch and differential units.

Namely, the front part includes the clutch unit with thrust bearing and control fork, and supports the ends of both main and pinion shafts.

The intermediate part is composed of a flange on which speed gear shafts with the related forks and rods for speed selection and engagement are supported and secured. This part constitutes a compact assembly which can be easily removed from rear part which, on its turn, supports the ends of speed gear shafts, acts as differential-speed gear casing, and contains the differential system.

- Speed change takes place via a central floor lever connected to gear-box through a speed control lever and a linkage of "isostatic type".

This type of linkage allows a very smooth speed change to be obtained preventing the slightest sticking.

The isostatic control makes use of two levers: one for the speed selection and the other for the speed engagement, both housed on gear-box.

The first lever, through tie rod and bracket, controls the rotation of speed selector rod around its axis, thus allowing speed selection to be obtained.

The second lever permits the longitudinal movements of speed selector rod, thus determining the engaging of the previously selected speeds.

- The forward speeds gears, in constant mesh, are helical-toothed to guarantee the utmost quietness and are fitted with synchronizers operated by sleeves.
- The reverse gears are straight toothed. Engagement takes place through the movement of a sliding gear which transmits the rotation of main shaft gear to that of pinion shaft thus causing motion reversal.
- The sleeves movement takes place through forks operated by the speed selector rods. The rods slide on a flange inside which are located the positioning devices and some interlock plungers having the purpose of preventing the simultaneous engagement of several speeds.

Another safety device for the reverse speed is secured on the clutch speed gear casing; it has the purpose of preventing the accidental

transition from 5th speed to reverse. The synchronizers, via friction action, cause the driven gear and coupling sleeve to assume same speed. This ease final coupling which causes the mating of coupling toothing between sleeve and driven gear.

In detail, the synchronizers of 2nd, 3rd, 4th and 5th speed, are fitted with two equal retainers: one used to gear down and the other to gear up, with a guide sector and a locking sector. The 1st speed synchronizer, in addition to the conventional retainer for the transition from the 2nd to 1st speed, and the guide and locking sectors, is fitted with another retainer for the transition from the neutral to the first speed, with spring, two plates and a pawl.

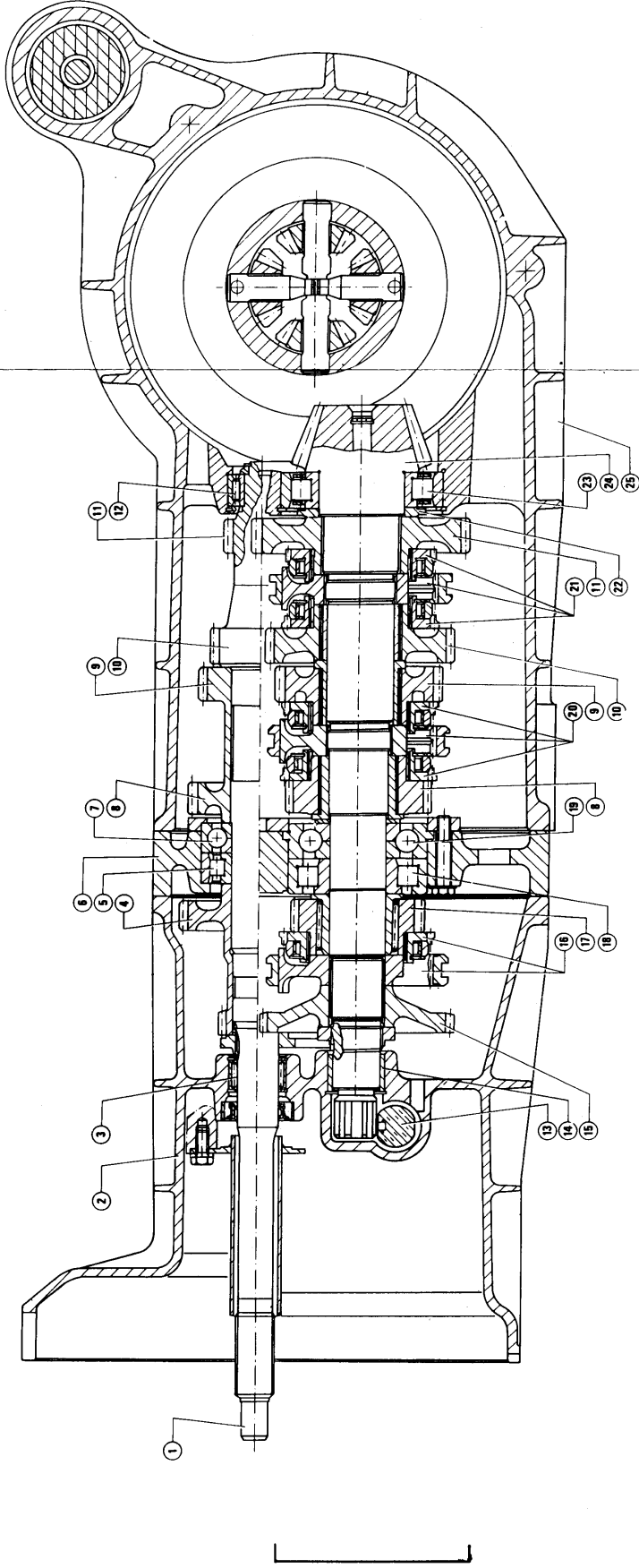
This solution allows a very smooth engagement of 1st speed to be obtained; in fact, in the event of sticking of sleeve toothing on gear front toothing, the spring is compressed and permits the gears to perform a slight rotation and then, a correct mating.

NOTE:

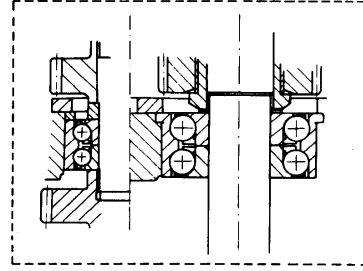
On certain models (See Unit 00 - Use of Units in the Car), a modified pinion underhead bearing, without retainer ring, is now assembled.

The two types of bearing are not interchangeable.

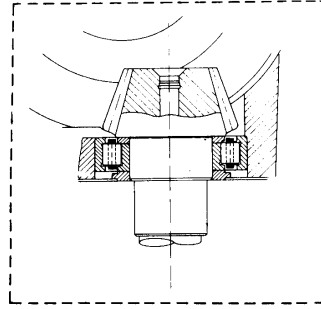
Solution with intermediate roller-ball compound bearings



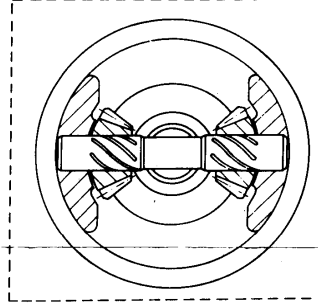
- 1 Main shaft
- 2 Clutch-speed gear casing
- 3 Main shaft support front needle bearing
- 4 5th and reverse speeds gear
- 5 Main shaft intermediate roller bearing
- 6 Intermediate flange
- 7 Main shaft intermediate ball bearing
- 8 4th speed gear
- 9 3rd speed gear
- 10 2nd speed gear
- 11 1st speed gear
- 12 Main shaft support rear needle bearing
- 13 Electronic odometer socket
- 14 Pinion shaft support front bush
- 15 Reverse speed gear
- 16 5th speed synchronizers
- 17 5th speed gear
- 18 Pinion shaft intermediate roller bearing
- 19 Pinion shaft intermediate ball bearing
- 20 3rd and 4th speeds synchronizers
- 21 1st and 2nd speeds synchronizers
- 22 Ring nut for pinion shaft rear roller bearing
- 23 Pinion shaft rear roller bearing
- 24 Pinion shaft
- 25 Differential-speed gear casing



Solution with intermediate skew ball bearings



Pinion bearing, modified



Two-side pinion differential

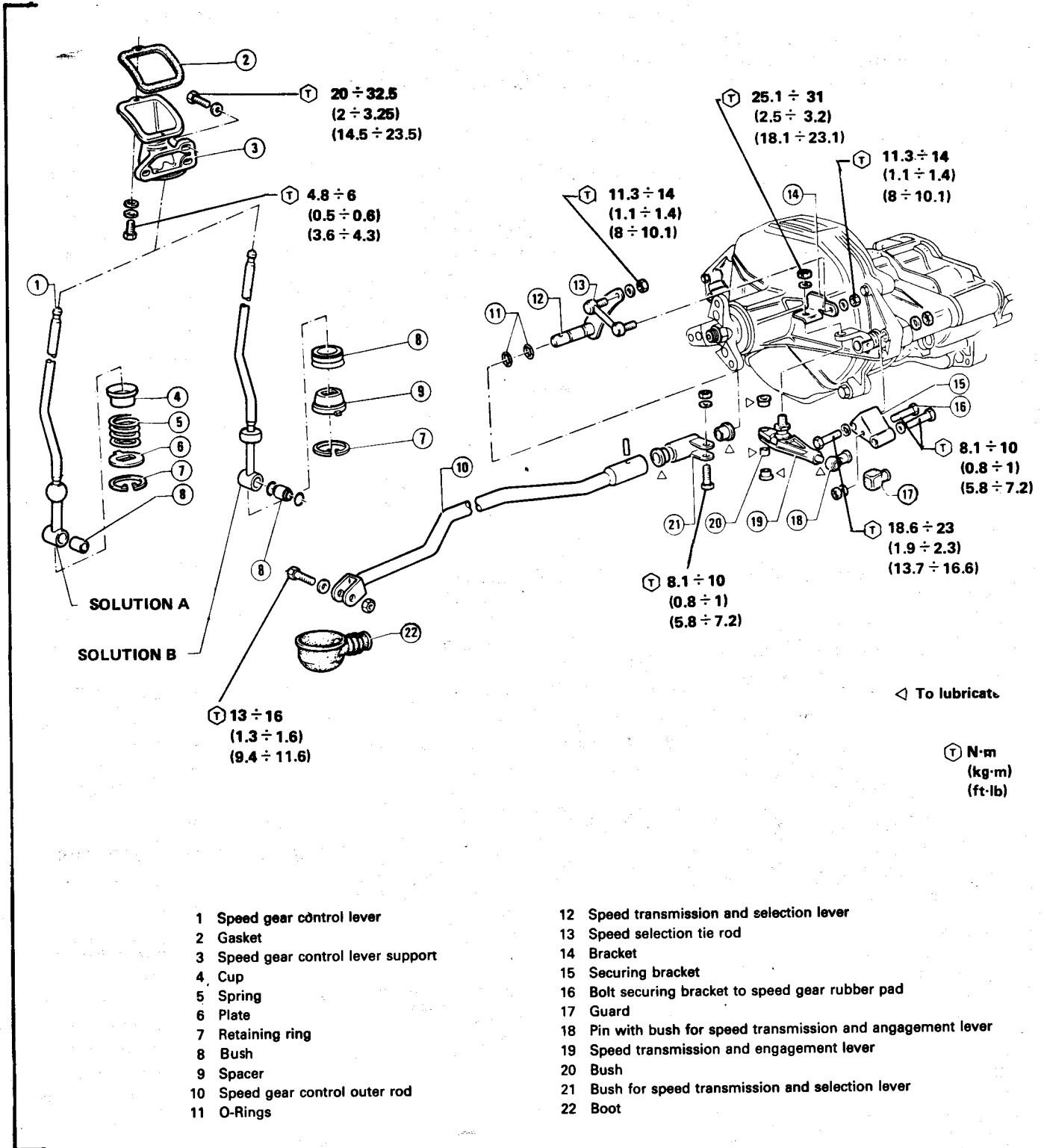
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OUTER LINKAGE

SPEED GEAR CONTROL ASSEMBLY



- 1 Speed gear control lever
- 2 Gasket
- 3 Speed gear control lever support
- 4 Cup
- 5 Spring
- 6 Plate
- 7 Retaining ring
- 8 Bush
- 9 Spacer
- 10 Speed gear control outer rod
- 11 O-Rings

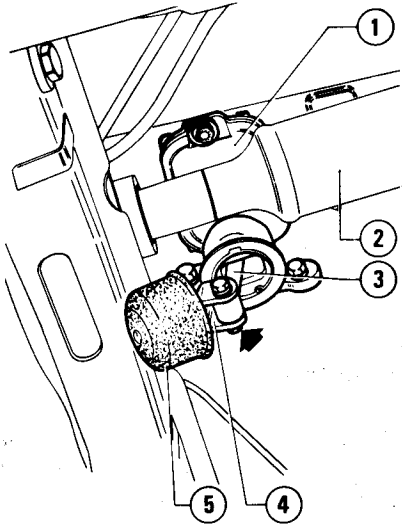
- 12 Speed transmission and selection lever
- 13 Speed selection tie rod
- 14 Bracket
- 15 Securing bracket
- 16 Bolt securing bracket to speed gear rubber pad
- 17 Guard
- 18 Pin with bush for speed transmission and engagement lever
- 19 Speed transmission and engagement lever
- 20 Bush
- 21 Bush for speed transmission and selection lever
- 22 Boot

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REMOVAL

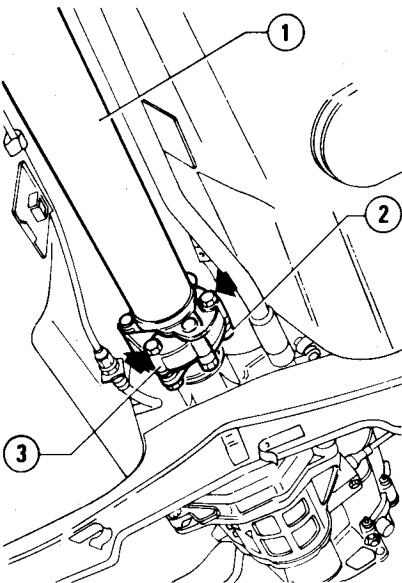
1. Set vehicle on lift, remove front and central element of exhaust pipe (Refer to: Group 04 - "Exhaust system - Removal" of the "WORKSHOP MANUAL - Engines").

2. Move boot ⑤ and detach rod ④ from the related lever ③ by unscrewing the securing bolt. Recover boot.



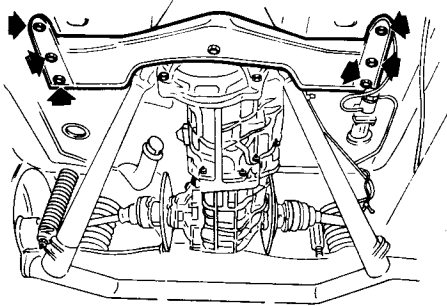
- 1 Speed gear control lever support
- 2 Propeller shaft
- 3 Speed gear control lever
- 4 Speed control rod
- 5 Boot

3. Detach propeller shaft ① by unscrewing the three bolts securing rubber pad ③ to flange ②.

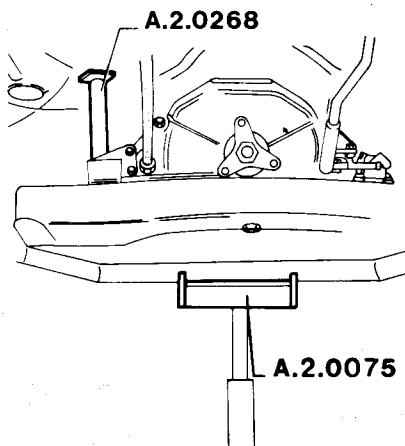


- 1 Propeller shaft
- 2 Flywheel-clutch shaft flange
- 3 Rubber pad

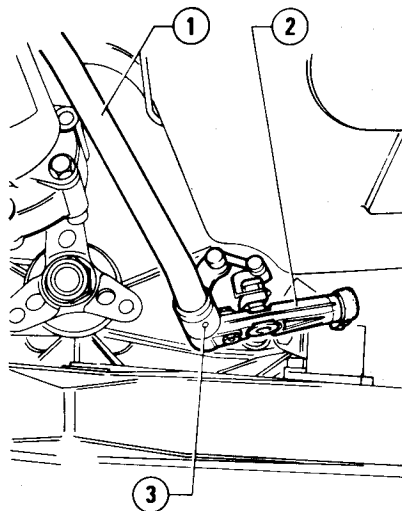
4. Unscrew the six screws securing axle front cross member to body.



5. By means of a column lift fitted with support A.2.0075, operate on the De Dion axle in order to lower cross member together with clutch-speed gear-differential unit and then, interpose spacer A.2.0268 between one arm of axle and body.



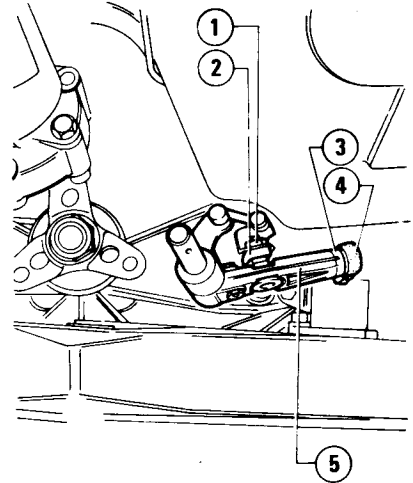
6. Withdraw pin ③ and remove rod ① separating it from lever ②.



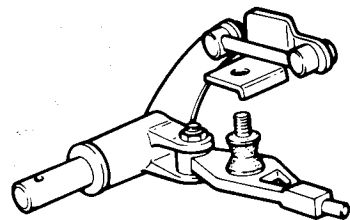
- 1 Speed control rod
- 2 Speed transmission and engagement lever
- 3 Connection pin

7. Unscrew and remove nut ① securing lever ⑤ to lever ② on speed selection and engagement lever.

Release the speed transmission and engagement lever from lever ② and remove it by withdrawing pin ③ of lever ⑤ from boot ④ inner ball joint.



- 1 Nut securing speed transmission and engagement lever to rear lever
- 2 Rear lever on speed selection and engagement rod
- 3 Pin for speed transmission and engagement lever
- 4 Boot
- 5 Speed transmission and engagement lever



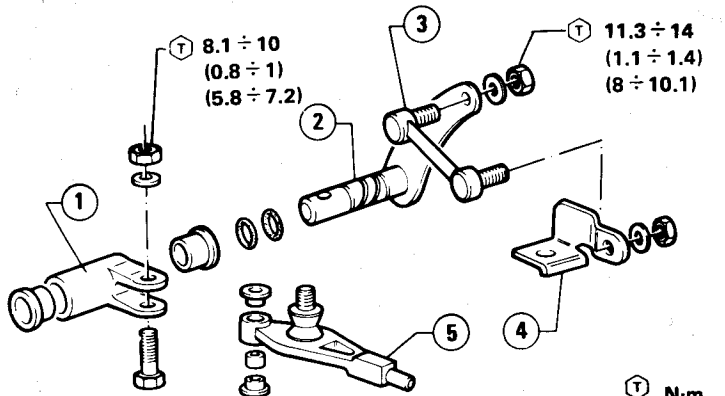
CHECKS AND INSPECTIONS

1. Clean the metal items of outer linkage with alcohol and verify they are in good conditions.
2. Check wear degree of bushes on linkage articulated joints.
3. Check ball joints of speed transmission and engagement lever and of speed selection tie rod. Replace them in the event of excessive clearance or seizing.
4. Check that rubber boot is in good conditions. Replace it if worn or damaged.
5. If required, disassemble the isostatic control assembly as shown in the figure.

GEARBOX

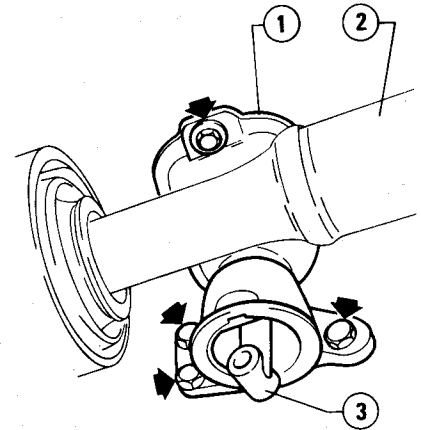
- O-Rings must be replaced at each dis-assembly.
- Reassemble the unit tightening

screws and nuts to the prescribed torque shown in the figure.



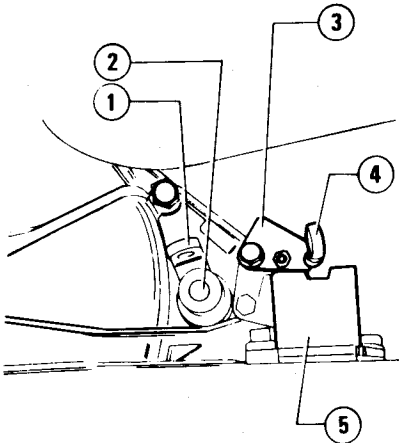
- 1 Bush for speed transmission and selection lever
- 2 Speed transmission and selection lever
- 3 Speed selection tie rod
- 4 Bracket
- 5 Speed transmission and engagement lever

⊕ N·m
(kg·m)
(ft·lb)



- 1 Speed gear control lever support
- 2 Propeller shaft
- 3 Speed gear control lever

6. If required, unscrew the two bolts securing bracket (3) to clutch - speed gear - differential unit and to rubber pad (5). Remove the bracket.



- 1 Rear lever speed selection and engagement rod
- 2 Speed selection and engagement rod
- 3 Securing bracket
- 4 Isostatic control articulated joint
- 5 Rubber pad

INSTALLATION

For the installation, reverse the order of removal and comply with the following. Refer to figure of page 13-5.

1. Lubricate the below items with the prescribed grease (Molykote Longterm No. 2).

- Bushes for speed transmission and selection lever
- Ball joint for speed transmission and engagement lever
- Innerside of bushes for speed transmission and engagement lever

2. Replace the connecting spring pin with a new one.
3. Tighten screws and bolts to the torques specified in "Service Data and Specifications - Tightening Torques".
4. Check proper functioning of isostatic control.

SPEED GEAR CONTROL LEVER

REMOVAL

1. Operating from passenger compartment inside, withdraw knob of speed gear lever and rubber boot.
2. Carry out steps 1 and 2 of paragraph "Speed Gear Control Assembly - Removal".
3. Unscrew the four screws securing support (1) to body and remove it with lever (3).

DISASSEMBLY

With reference to figure of page 13-5 remove retaining ring (7) by means of suitable pliers, and withdraw plate (6), spring (5), cup (4) and lever (1).

CHECKS AND INSPECTIONS

1. Verify components' good conditions.
2. Verify that spring is not strained.

REASSEMBLY

To reassemble, reverse the order of disassembly taking care to lubricate the ball joint of speed gear control lever with the prescribed grease (ISECO Molykote BR2).

INSTALLATION

To reinstall lever, reverse the order of removal and comply with the following.

1. Take care when inserting lever into dust cover to prevent damaging it.
2. Tighten screws and bolts to the prescribed torques indicated in "Service Data and Specifications - Tightening Torques".

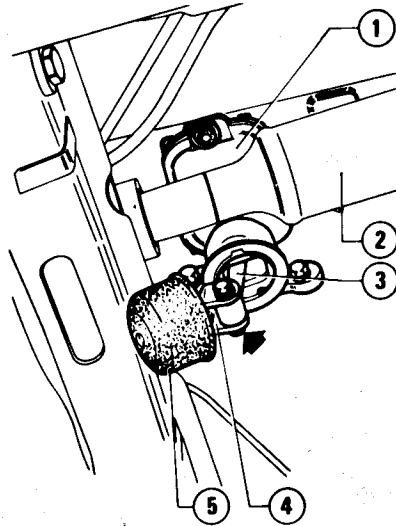
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SPEED CONTROL ROD

REMOVAL AND INSTALLATION

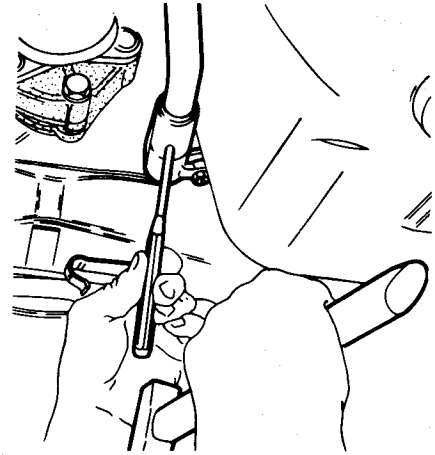
1. Set vehicle on a lift, remove front and central component of exhaust pipe (Refer to: Group 04: "Exhaust system - Removal" of the "WORKSHOP MANUAL - Engines").

2. Move boot ⑤ and disconnect rod ④ from the related lever ③ by unscrewing the securing bolt. Recover boot.



- 1 Speed control lever support
- 2 Propeller shaft
- 3 Speed control lever
- 4 Speed control rod
- 5 Boot

3. By means of a suitable punch, remove the speed control rod securing pin from the speed transmission and selection lever bush; remove rod.



4. Reassemble in reverse order to disassembly operations, replacing the connecting spring pin with a new one.

REMOVAL AND INSTALLATION OF CLUTCH-SPEED GEAR - DIFFERENTIAL UNIT

Refer to Group 17 "Removal and Installation of clutch-speed Gear-Differential Unit".

SEPARATION AND RECONNECTION AT BENCH OF SPEED GEAR UNIT FROM/TO DIFFERENTIAL UNIT

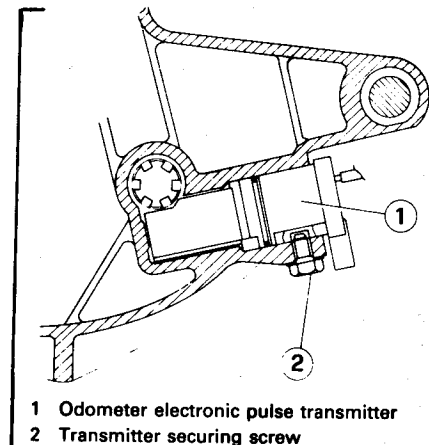
SEPARATION

1. Clutch unit separation.

Refer to: Group 12 "Separation and Reconnection at Bench of Clutch Unit from/to speed Gear and Differential Units - Separation".

2. Separation of clutch-speed gear casing.

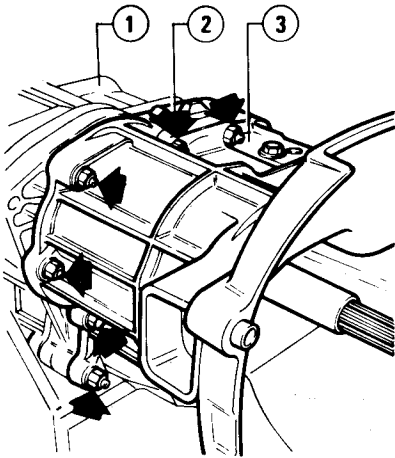
- a. Drain the oil from unit, if not already done during unit removal from vehicle.
- b. Unscrew the securing screw and remove the odometer electronic pulse transmitter ①.



- 1 Odometer electronic pulse transmitter
- 2 Transmitter securing screw

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c. Loosen and remove the nuts with related washers securing casing ③ to flange ②.

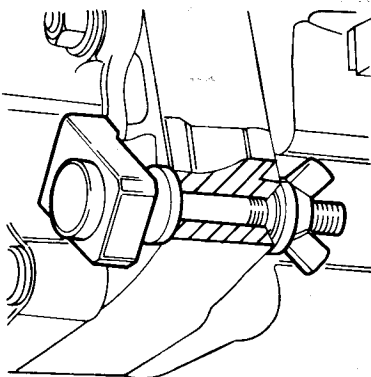


- 1 Speed gear-differential casing
- 2 Intermediate flange
- 3 Speed gear-clutch casing

CAUTION:

The intermediate flange surfaces mating with clutch-speed gear casing and speed gear-differential casing are fitted with sealant.

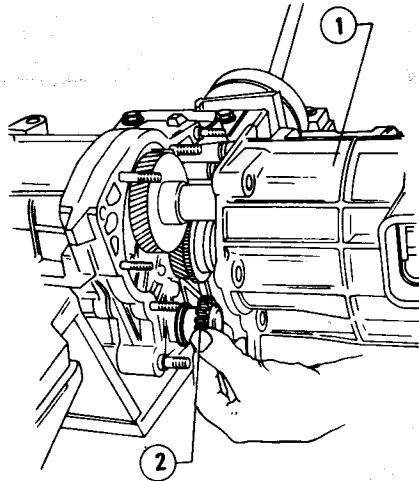
When removing only the clutch-speed gear casing, the intermediate flange can be secured to the speed gear-differential casing not concerned in the disassembly, by means of suitable clamps.



d. Withdraw casing ① and, at the same time, recover gear ②.

CAUTION:

Take care not to drop the Reverse transmission gear.

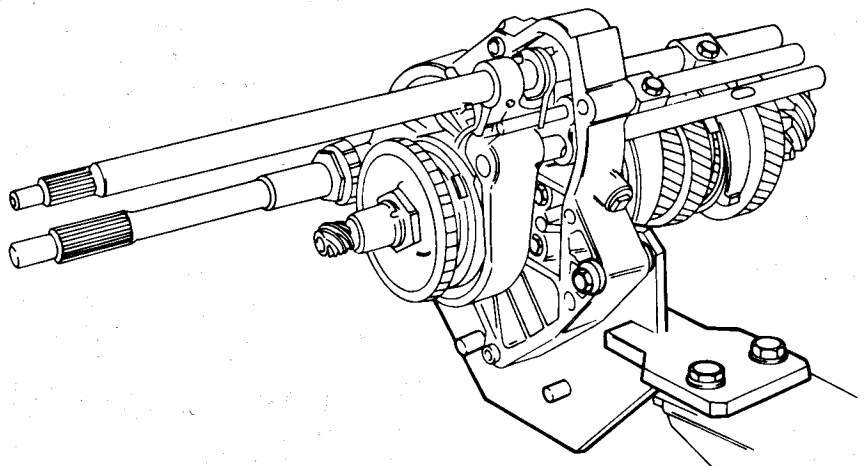
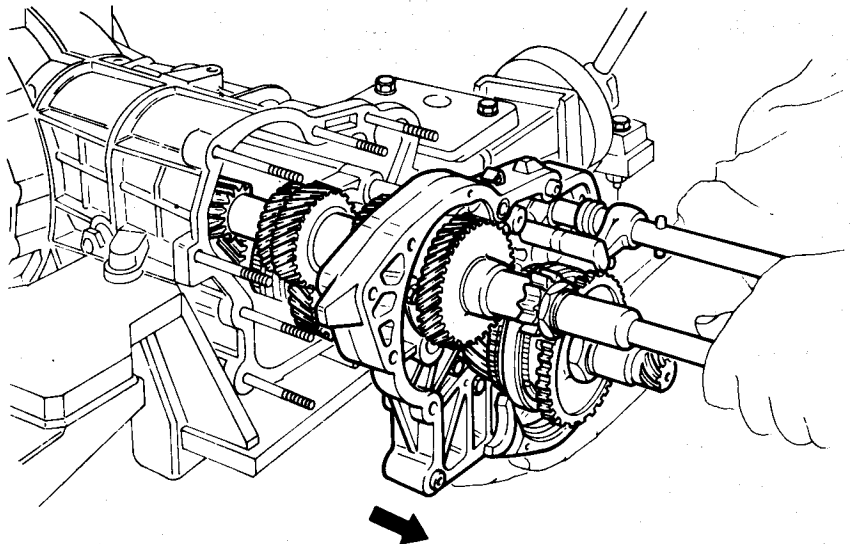


- 1 Clutch-speed gear casing
- 2 Reverse sliding gear

3. Intermediate flange positioning on overhaul stand.

a. Withdraw intermediate flange complete with primary and pinion shafts and rods and forks from differential-speed gear casing.

b. Apply the special support to intermediate flange, complete with the related shafts and control devices, then secure flange to an overhaul stand fitted with connection brackets.



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RECONNECTION

1. Intermediate flange connection to differential-speed gear casing

a. Clean the intermediate flange surfaces mating with clutch-speed gear casing and differential-speed gear casing with denatured ethyl alcohol.

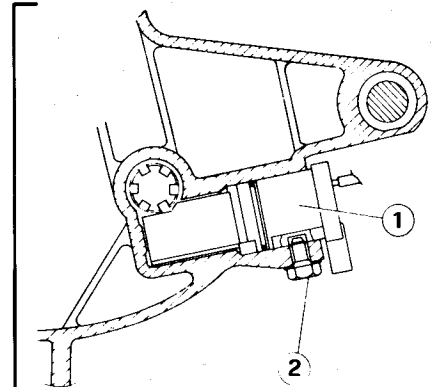
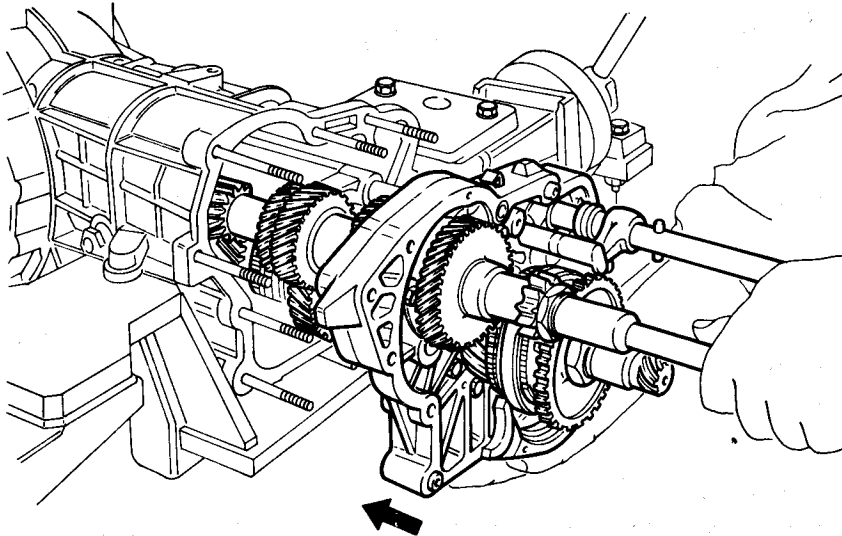
Apply a coat of sealant to the mentioned seal surfaces.

Sealant:

Sealing compound **LOWAC Perfect Seal**

b. Mount intermediate flange, complete with shafts, rods and forks on differential-speed gear casing.

f. Mount the odometer electronic pulse transmitter and secure it with the suitable screw.



1 Odometer electronic pulse transmitter
2 Transmitter securing screw

c. Lubricate pin of the reverse speed sliding gear housed in the clutch-speed gear casing.

d. Apply the clutch-speed gear casing to intermediate flange taking care to position the reverse speed gear on the 5th and reverse speeds control fork, subsequently centering it in the related pin.

e. Screw the nuts securing clutch-speed gear casing to intermediate flange and tighten them crosswise (refer to figure for the tightening order) to the prescribed torque.

2. Clutch unit installation

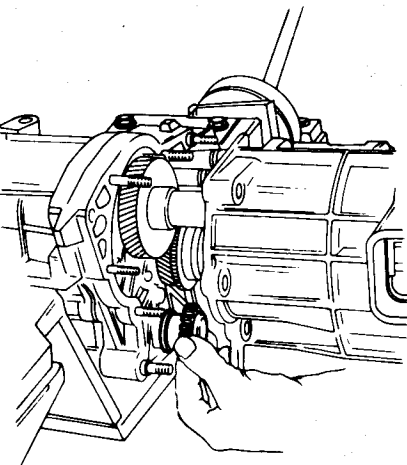
a. Reconnect clutch unit to differential-speed gear unit (refer to: Group 12 - "Separation and Reconnection at Bench of Clutch Unit from/to speed Gear and Differential Units - Reconnection")

b. Fill the differential-speed gear casing with the prescribed quantity of suggested oil.

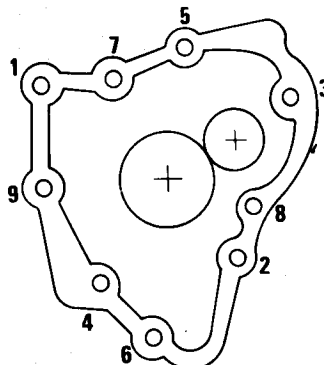
Differential-speed gear refilling

Oil:

AGIP Rotra SX 75W90
IP Pontiac HDS 75W90



T: Tightening torque
Nuts securing clutch-speed gear casing to intermediate flange
12 to 13 N·m
(1.2 to 1.4 kg·m)
(8.7 to 10.1 ft·lb)

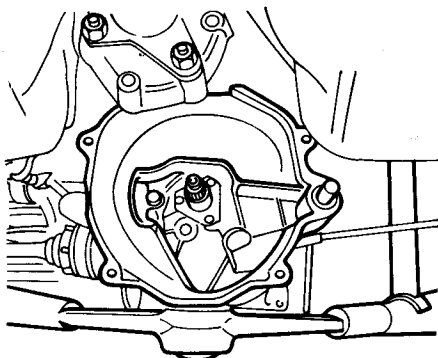


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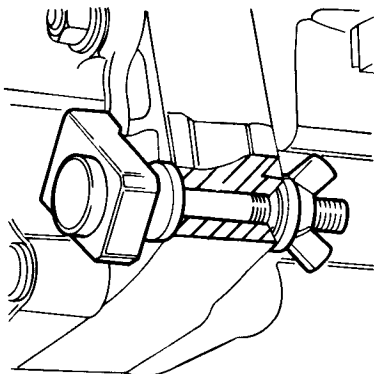
REMOVAL AND INSTALLATION OF SPEED GEAR UNIT (Intervention on vehicle)

REMOVAL

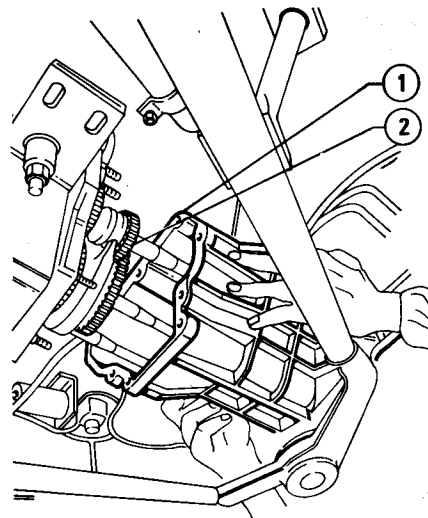
1. Set vehicle on lift and lock front wheels with suitable safety chocks.
2. Raise vehicle and drain oil from differential-speed gear casing.
3. Detach clutch unit (refer to Group 12 - "Clutch Unit Removal and Installation (Intervention on vehicle) Removal")



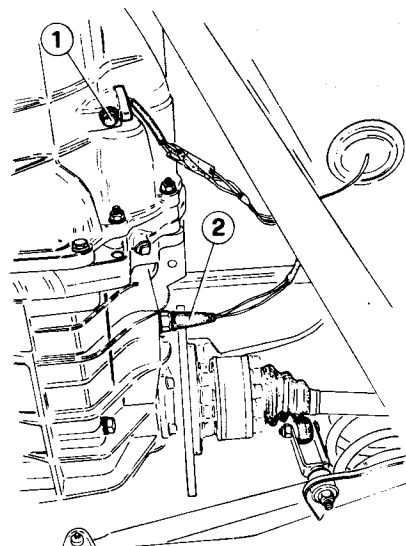
5. By means of suitable clamps, secure intermediate flange to differential-speed gear casing.
Set a column lift under speed gear unit, in the vicinity of intermediate flange, the column lift must be fitted with a support with clamps to secure support itself to gearbox.



Take care not to drop the reverse speed transmission gear.



4. Disconnect connection ②, unscrew screw ① and remove odometer pulse transmitter.

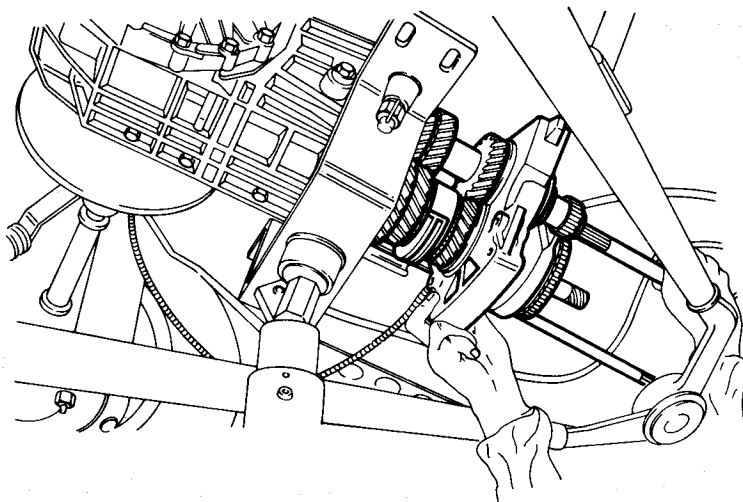


- 1 Screw securing odometer pulse transmitter to gearbox
- 2 Connection for reverse lights switch cable

- Unscrew screws and nuts connecting clutch-speed gear and differential-speed gear casings.
Remove clutch-speed gear casing ①; if necessary, tap by means of a resin mallet; then recover gear ②.

- 1 Clutch-speed gear casing
- 2 Reverse speed transmission gear

6. If required, disconnect the intermediate flange previously secured to differential-speed gear casing and remove it, complete with shafts, gears and speed engagement devices.



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INSTALLATION

For installation, reverse the order of removal and comply with the following.

- Clean the flange surfaces mating with differential-speed gear and clutch-speed gear casings with denatured ethyl alcohol, then lay a coat of the prescribed sealant.

Sealant:

Sealing compound LOWAC Perfect

Seal

- Lubricate clutch fork spherical pin and the thrust bearing seat with the prescribed grease.

Grease:

AGIP Grease 33 FD

IP Autogrease FD

- Lubricate the seat of propeller shaft rear joint with 5 cm³ (0.30 cu.in) of the prescribed grease.

Grease:

ISECO Molykote BR2

- Comply with the following tightening torques

Ⓣ: Tightening torques

- Nuts securing clutch-speed gear casing to differential-speed gear casing

Perform tightening crosswise

12 to 13 N·m

(1.2 to 1.4 kg·m)

(8.7 to 10.1 ft·lb)

- Screws securing clutch unit to differential-speed gear casing

29 to 32 N·m

(2.9 to 3.2 kg·m)

(21 to 23.1 ft·lb)

- Screws securing propeller shaft joint to clutch shaft fork

Solution with intermediate skew ball bearings

40 to 50 N·m

(4 to 5 kg·m)

(28.9 to 36.1 ft·lb)

Solution with intermediate roller/ball bearings

55 to 57 N·m

(5.6 to 5.8 kg·m)

(40.5 to 41.9 ft·lb)

- Unions of clutch hydraulic system pipes

8 to 10 N·m

(0.8 to 1 kg·m)

(5.8 to 7.2 ft·lb)

- Unions of clutch hydraulic system hoses

10 to 15 N·m

(1 to 1.5 kg·m)

(7.2 to 10.8 ft·lb)

- Refill the differential-speed gear casing with the prescribed oil up to reaching filler hole level.

Oil:

AGIP Rotra SX 75W90

or

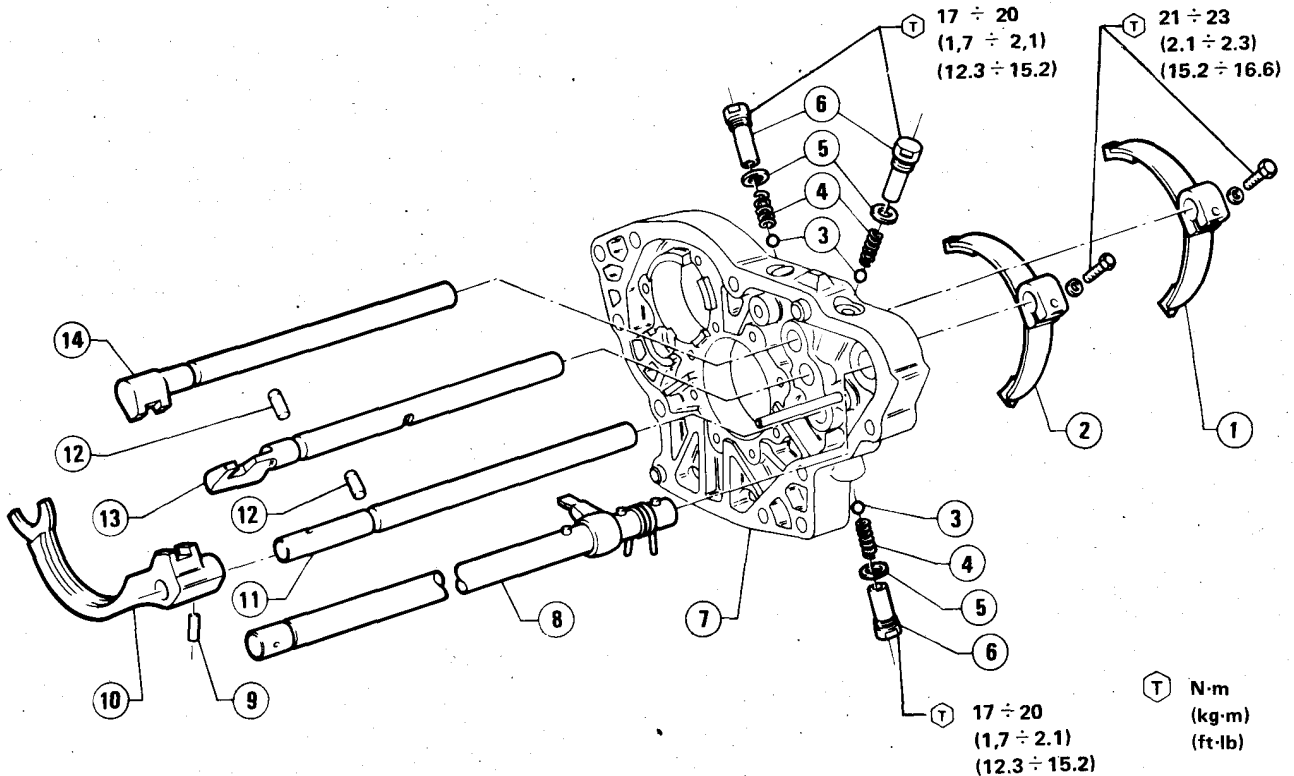
IP Pontiax HDS 75W90

- Bleed air from clutch system

GEARBOX

OVERHAUL AT BENCH OF SPEED GEAR UNIT

RODS AND FORKS



- 1 1st - 2nd speeds fork
- 2 3rd - 4th speeds fork
- 3 Ball
- 4 Spring
- 5 Washer
- 6 Plug-container
- 7 Intermediate flange

- 8 Speed selection and engagement control rod
- 9 Spring pin
- 10 5th and reverse speeds fork
- 11 5th and reverse speeds rod
- 12 Detent ball
- 13 3rd and 4th speeds rod
- 14 1st and 2nd speeds rod

DISASSEMBLY

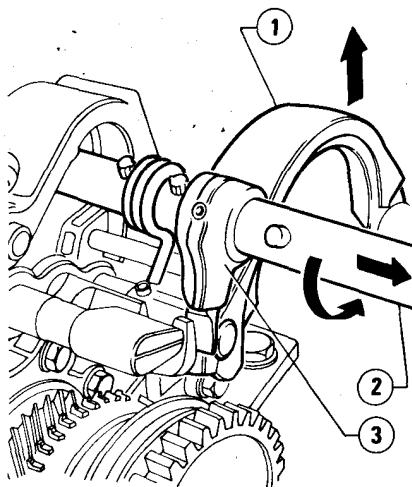
Set the intermediate flange on an overhaul stand (Refer to: "Separation and Reconnection at Bench of Speed Gear Unit from/to Differential Unit") then disassemble rods and forks operating as follows.

1. Disassembly of speed selection and engagement rod

- a. Rotate rod ② counterclockwise to win reaction of spring thus obtaining the rotation of lever ③ tooth; at the same time rotate counterclockwise fork ①, then withdraw rod ②.

To rotate rod, temporarily insertion is

recommended of the related lever with securing pin.

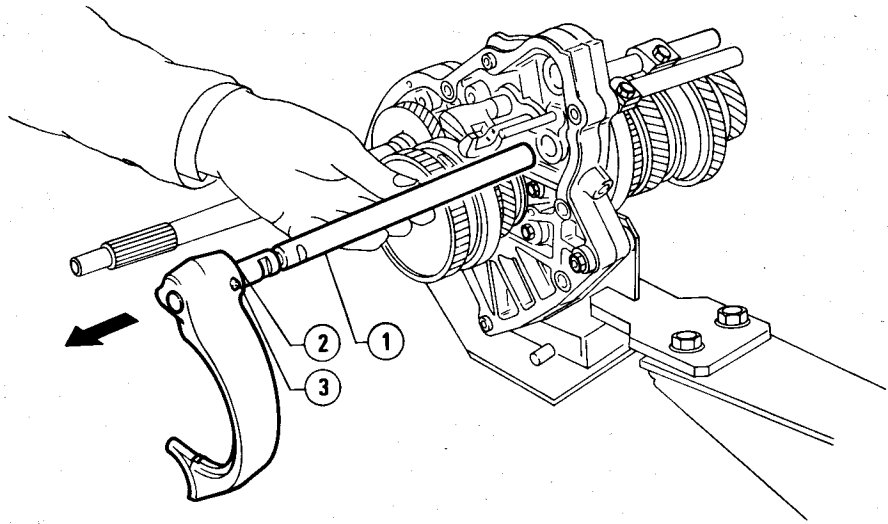
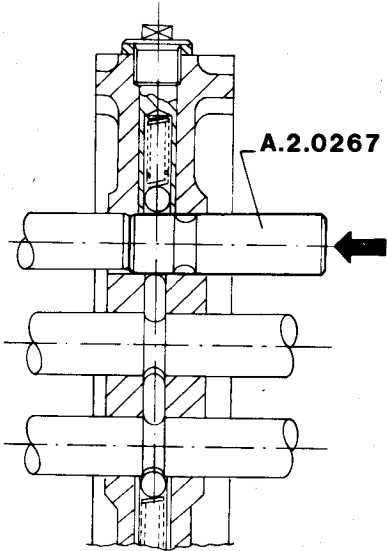


- 1 5th - Reverse speeds fork
- 2 Speed selection and engagement lever
- 3 Speed selection lever

2. Disassembly of speed engagement rods

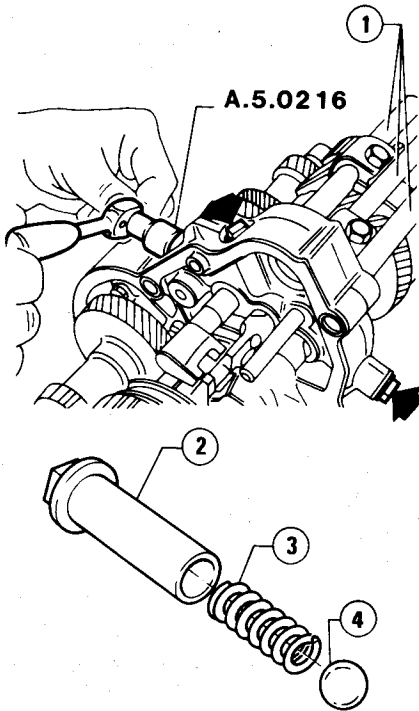
Should removal of one rod only, or no check related to rods detent ball unit and speed engagement interlock plungers be required, interlock plungers must be secured by means of dummy rods A.2.0267 to be inserted, at the same time, at the opposite side with respect to withdrawal of speed engagement rods.

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- 1 5th and Reverse speeds rod
- 2 5th and Reverse speeds fork
- 3 Securing pin

a. By means of spanner A.5.0216, unscrew and remove the three containers (2), shown in the figure, with the related springs (3) and rods (1) positioning balls (4).

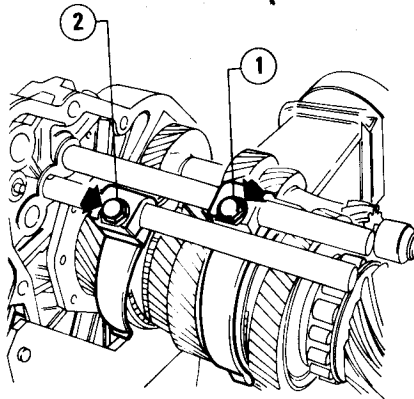


- 1 Speed engagement rods
- 2 Container
- 3 Thrust spring
- 4 Detent ball

b. Remove rod (1) with fork (2) for 5th and reverse speeds engagement control and, if required, disassemble them by removing pin (3) by means of a punch.

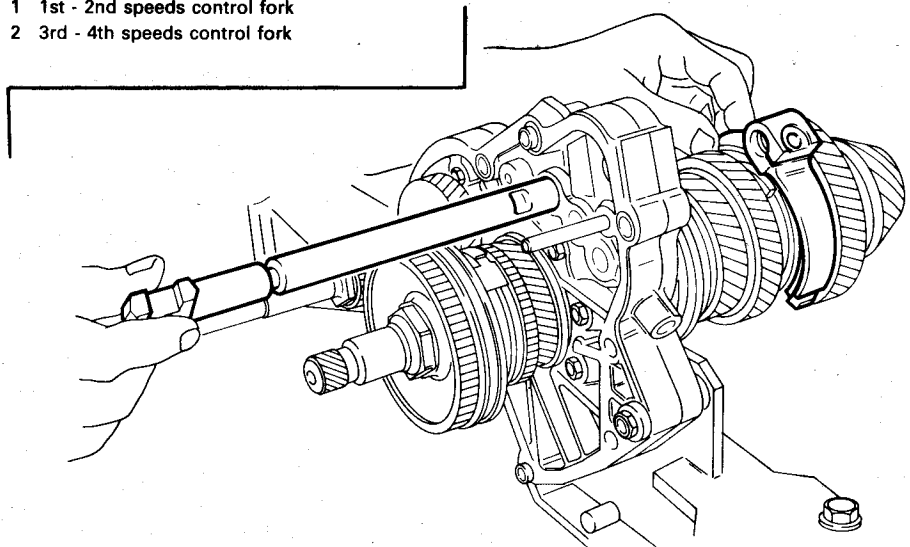
Mark the position related to rod-fork so that correct position can be restored when reassembling.

c. Unscrew and remove the screws securing forks (1) and (2) to the related rods.



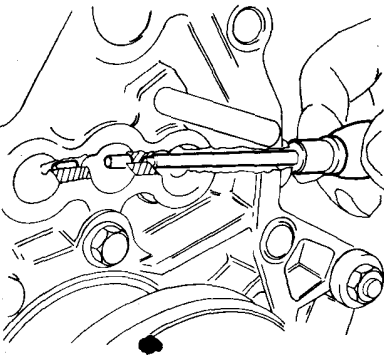
- 1 1st - 2nd speeds control fork
- 2 3rd - 4th speeds control fork

d. Withdraw the 1st-2nd speeds engagement control rod and subsequently that related to 3rd-4th speeds engagement control by removing, at the same time, the related forks.



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- e. Remove the speed engagement interlock plungers from intermediate flange.



CHECKS AND INSPECTIONS

Before carrying out the check-operations, carefully wash the components. This allow the superficial defects, wear degree and efficiency of a few items to be better identified.

1. Springs, balls, pawls.

- a. Verify good conditions of rods detent ball thrust springs; in the event of suspected strain, replace them. If required, check spring stiffness.

Test load

$$C = 90 \text{ to } 97.6 \text{ N} \\ (9.18 \text{ to } 9.95 \text{ kg})$$

Unloaded spring length

$$L = 30.6 \text{ mm (1.2 in)}$$

Loaded spring length

$$L_c = 18.8 \text{ mm (0.74 in)}$$

- b. Verify that rods detent balls and interlock plungers are free from scratches or seizing.

2. Rods and forks

- a. Verify that rods are free from deformations and that no sign of scratch or seizing is present on control rod slots.
b. Verify that speed control forks are not deformed or too worn.
c. Verify that rods slide freely in their seats without excessive clearance.

REASSEMBLY

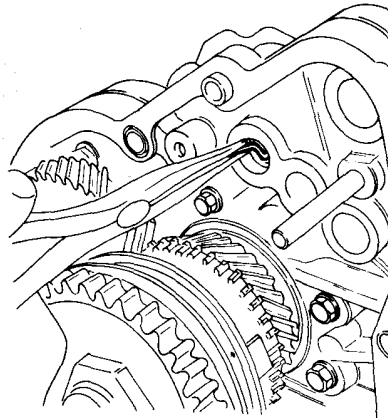
1. Reassembly of speed engagement rods.

- a. Lubricate the speed engagement interlock plungers with the prescribed grease, then insert them into the related seats on intermediate flange.

Speed engagement and anti-slipping devices

Grease:

AGIP F1 Grease 33 FD
IP Autogrease FD



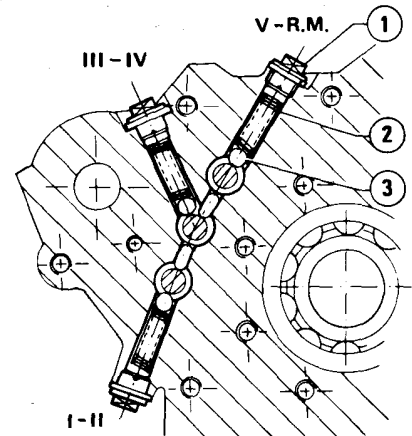
- b. Position fork on 1st-2nd speed sleeve. Lubricate the working surfaces and insert the related rod into intermediate flange inserting if on fork.
c. Carry out same procedure to reassemble rod and fork of 3rd-4th speed.
d. If previously detached, reconnect 5th. Reverse speeds control fork on the related rod by means of a new pin, then insert the unit into intermediate flange.

When reassembling fork, align the marks carried out during disassembly.

- e. Lubricate detent balls (3) with the prescribed grease (Grease: AGIP F1 Grease 33 FD or IP Autogrease FD) then insert them into the related seats on intermediate flange, together with springs (2). Screw plugs (1) and tighten them with spanner A.5.0216 to the prescribed torque.

(T): Tightening torque
Containers securing springs and rods detent balls

$$17 \text{ to } 20 \text{ N}\cdot\text{m} \\ (1.7 \text{ to } 2.1 \text{ kg}\cdot\text{m}) \\ (12.3 \text{ to } 15.2 \text{ ft}\cdot\text{lb})$$



- 1 Plug
2 Thrust spring
3 Speed engagement rods detent ball

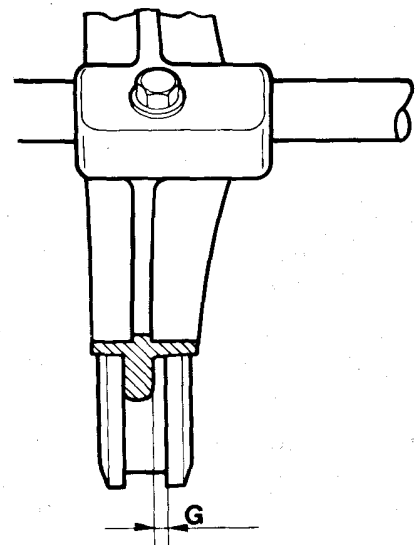
2. Securing of speed engagement forks.

To correctly secure the 1st-2nd and 3rd-4th speeds control forks follow the below procedures.

- a. Set speed gear unit to neutral position.
b. Center the synchronizers sleeves, related to the mentioned speeds, on the related hubs and tighten the forks securing screws.
c. Engage the 1st speed, then the 2nd verifying each time that sleeve axial clearance "G" is that prescribed.

Sleeve axial clearance

$$G = 0.7 \text{ to } 0.9 \text{ mm} \\ (0.0275 \text{ to } 0.0354 \text{ in})$$



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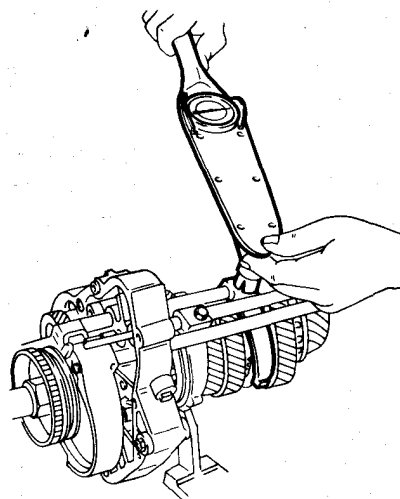
d. Repeat same operation for the 4th and 5th speeds.

e. If necessary, carry out the suitable adjustments, then tighten to the prescribed torque.

T : Tightening torque

Screws securing 1st-2nd and 3rd-4th speeds forks

21 to 23 N·m
(2.1 to 2.3 kg·m)
(15.2 to 16.6 ft·lb)



3. Reassembly of speed selection and engagement rod.

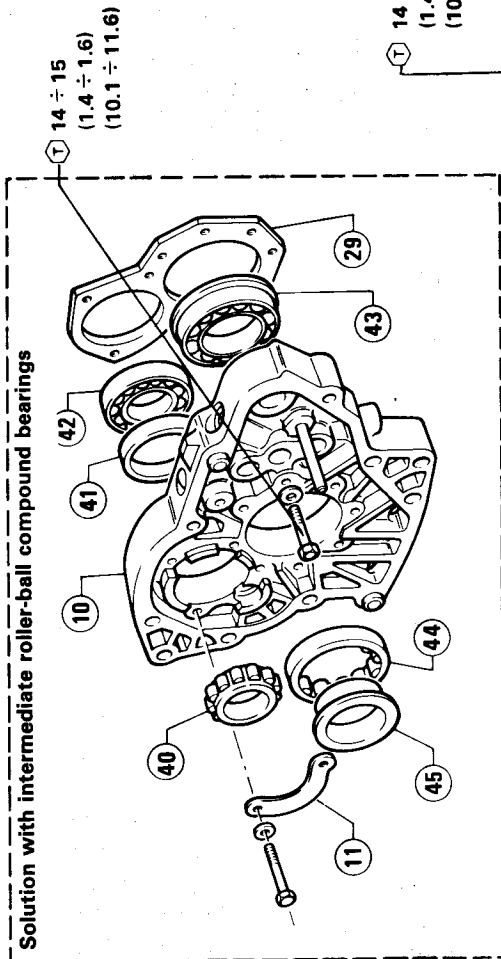
Install the speed selection and engagement rod taking care to centre tooth of the related lever on the slots of the speed control devices for 1st-2nd and 3rd-4th speed rods.

Correctly bed the return spring on stud.

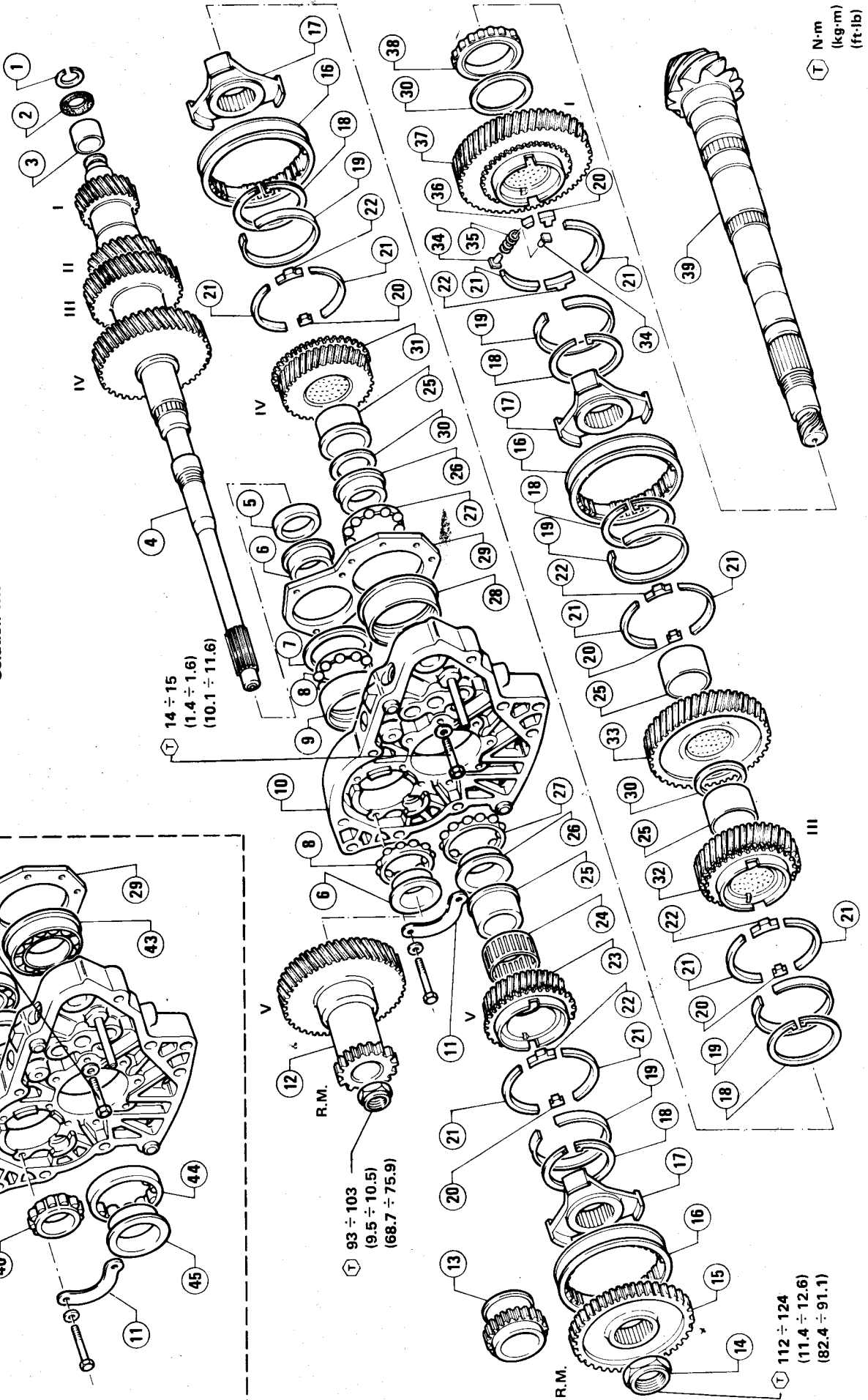
SHAFTS AND GEARS

- 1 Retaining ring
- 2 Plastic bevel bush
- 3 Inner ring for main shaft rear needle bearing
- 4 Main shaft
- 5 Spacer
- 6 Inner ring for main shaft intermediate flange bearing
- 7 Spacer
- 8 Cage with balls for mainshaft intermediate flange
- 9 Outer ring for main shaft intermediate flange bearing
- 10 Intermediate flange
- 11 Fastener for main shaft intermediate flange bearings outer ring
- 12 5th and reverse speeds driving gear
- 13 Reverse speed idle gear
- 14 Nut
- 15 Reverse speed driven gear
- 16 Sleeve
- 17 Hub
- 18 Retaining ring
- 19 Synchronizer ring
- 20 Guide sector
- 21 Retainer
- 22 Locking sector
- 23 5th speed driven gear
- 24 Pinion shaft cage with needles
- 25 Bush
- 26 Internal ring for pinion shaft intermediate flange bearing
- 27 Cage with balls for pinion shaft intermediate flange
- 28 Outer ring for pinion shaft intermediate flange bearing
- 29 Shoulder plate
- 30 Shim
- 31 4th speed driven gear
- 32 3rd speed drive gear
- 33 2nd speed driven gear
- 34 Strikers
- 35 Spring
- 36 Pawl
- 37 1st speed driven gear
- 38 Pinion shaft roller bearing
- 39 Pinion shaft
- 40 Roller bearing for main shaft intermediate flange
- 41 Outer ring for main shaft intermediate flange roller bearing
- 42 Main shaft intermediate flange ball bearing
- 43 Pinion shaft intermediate flange ball bearing
- 44 Outer ring for pinion shaft intermediate flange roller bearing
- 45 Inner ring for pinion shaft intermediate flange roller bearing
- 46 Ring nut

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Solution with intermediate skew ball bearings



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DISASSEMBLY

1. Rods and forks disassembly.

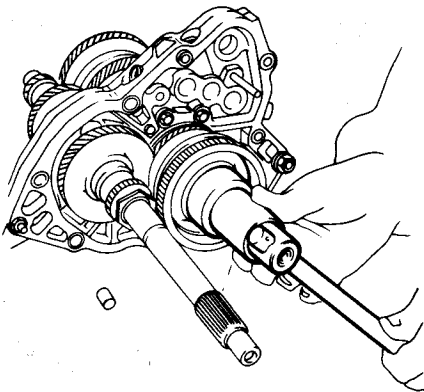
Refer to: "Rods and forks - Disassembly".

2. Measurement of pinion shaft dimensions.

Should the speed gear only be overhauled without interventions on differential unit, the "A" dimension must be measured between intermediate flange inner plane and pinion head outer plane.

This measurement is indispensable to restore the initial working conditions of bevel pinion.

- Remove the traces of old sealant from intermediate flange planes using denatured ethyl alcohol.
- Operate on control sleeves related to 1st-2nd and 3rd-4th speeds to engage two speeds in order to block shafts rotation.
- Remove calking from pinion shaft securing nut, then release pinion shaft.

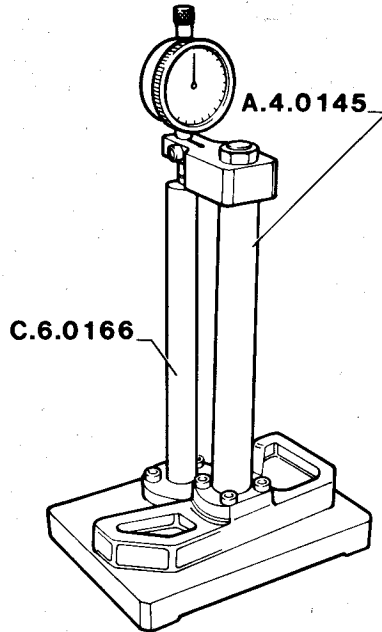


- Retighten nut to the prescribed torque.

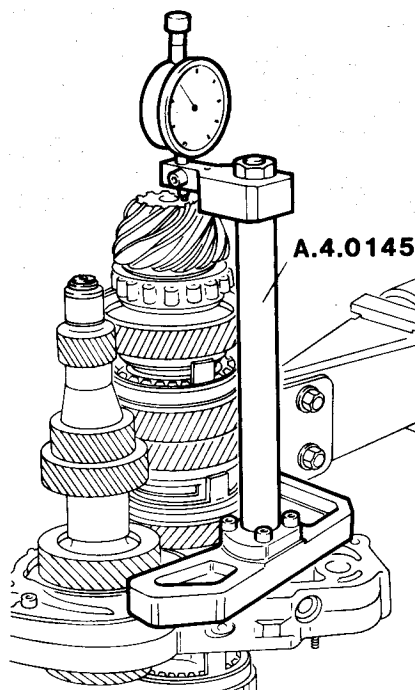
T: Tightening torque

Pinion shaft securing nut
112 to 124 N·m
(11.4 to 12.6 kg·m.)
(82.4 to 91.1 ft·lb)

- Install a centesimal gauge on support A.4.0145, the reset gauge on reference gauge C.6.0166 to the nominal dimension "A".

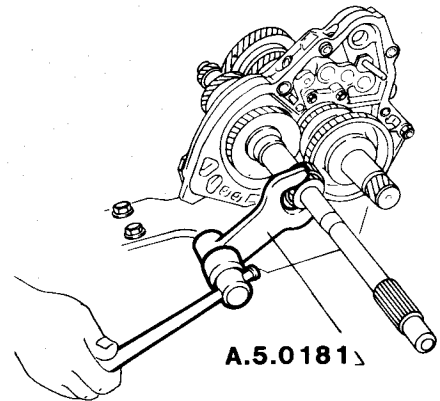


- Rest the centesimal gauge support on intermediate flange inner plane and gauge probe on pinion head plane. Measure and note down the read value.

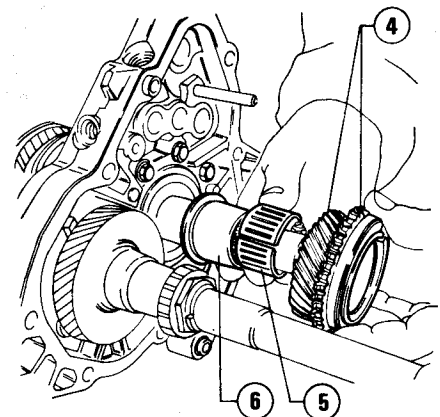
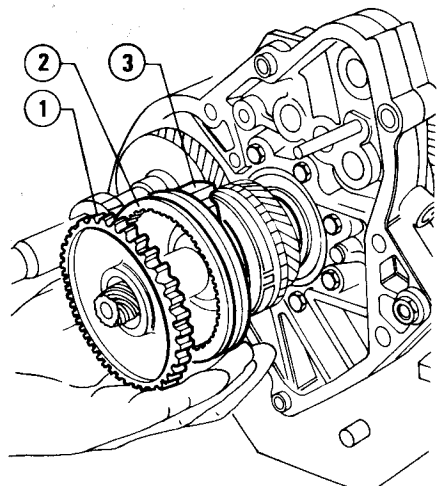


3. Shafts disassembly

- By means of a suitable spanner, unscrew the pinion shaft securing nut.
- Remove calking from main shaft securing nut, then release it by means of spanner A.5.0181.



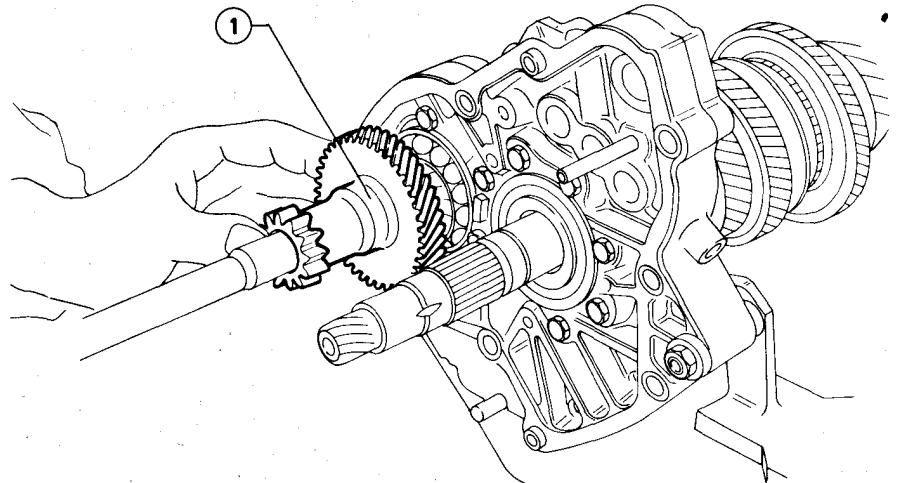
- Remove the following items from pinion shaft: the nut previously loosened, gear ①, sleeve ② with the hub ③ located underneath, gear ④, cage ⑤ with related bush ⑥.



- Reverse speed driven gear
- 5th - Reverse speeds sleeve
- 5th - Reverse speeds hub
- 5th speed driven gear
- Cage with needles for 5th and Reverse speeds
- 5th - Reverse speeds bush

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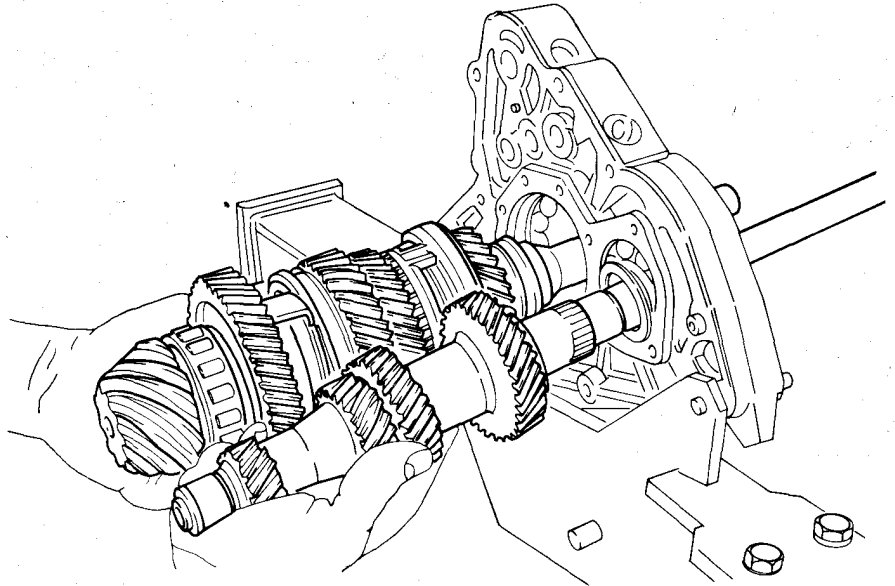
- d. Remove the previously loosened nut and gear ① from main shaft.



1 5th - Reverse speeds driving gear

- e. By means of a resin mallet, tap on tangs of main and pinion shafts then withdraw them at the same time from intermediate flange. The rear inner races of intermediate flange ball bearings must be removed at the same time of shafts removal.

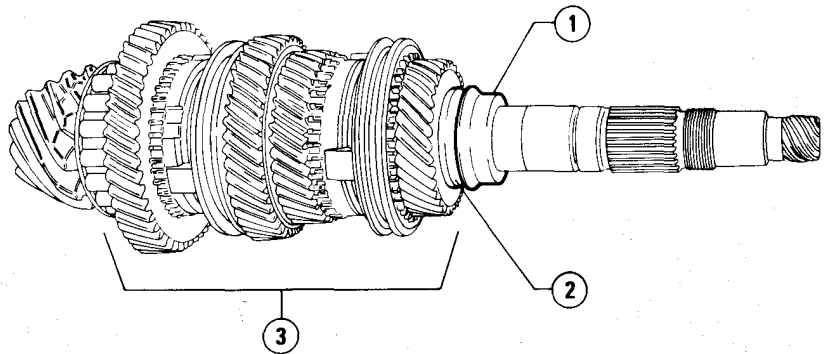
Take care not to drop front inner half-races of bearings.



- f. Remove front inner half-races from intermediate flange.

4. Pinion shaft disassembly

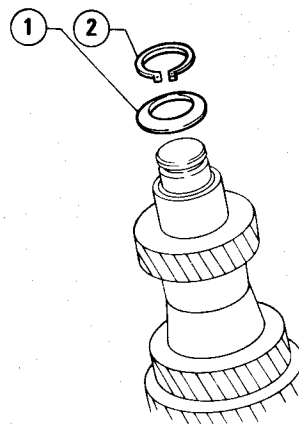
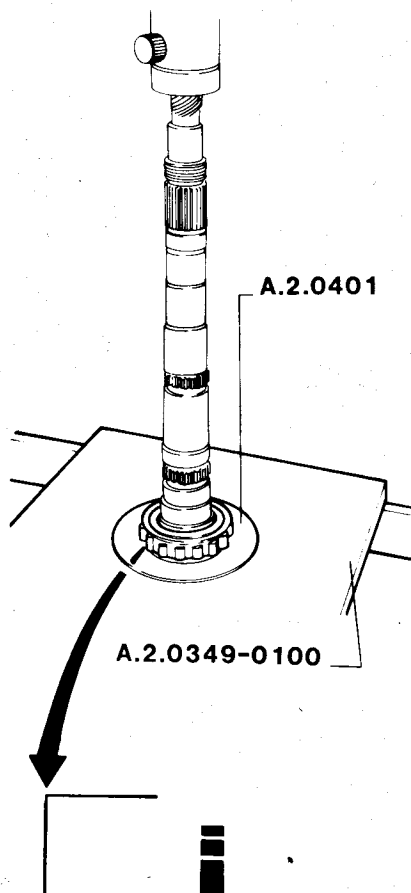
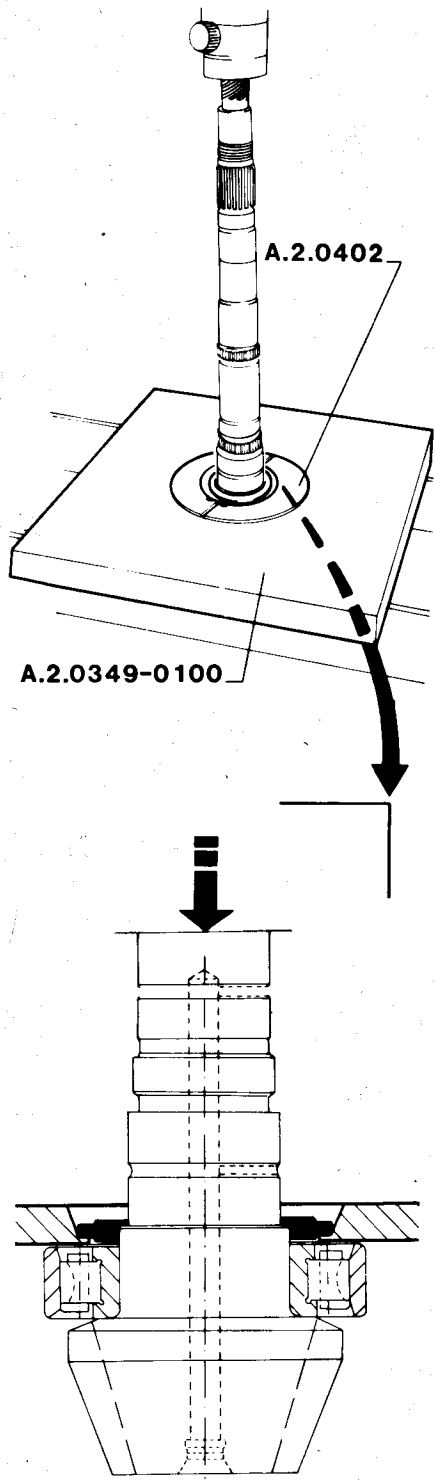
- a. Remove inner half-race ①, shim ring ② and then the whole gear package ③ composing shaft itself from pinion shaft.



- 1 Intermediate flange bearing inner half-race
2 Shim ring for pinion-ring bevel gear distance adjustment
3 Driven gear package

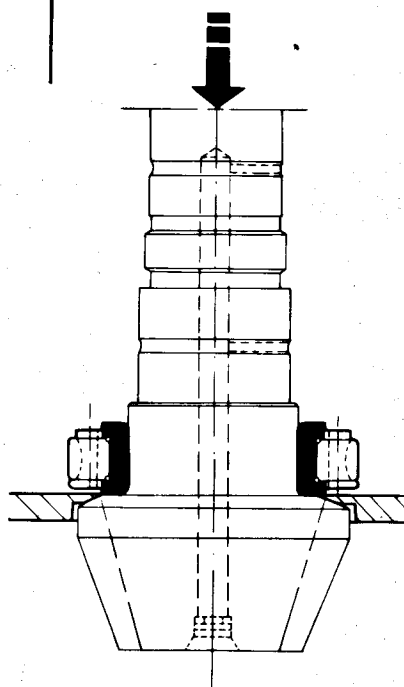
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b. Withdraw rear roller bearing ring nut from pinion shaft operating at press and making use of plate A.2.0349-0100 with tool A.2.0402.



1 Retaining ring
2 Plastic bevel bush

c. Withdraw inner race of rear needle bearing from main shaft, by means of puller A.3.0361.



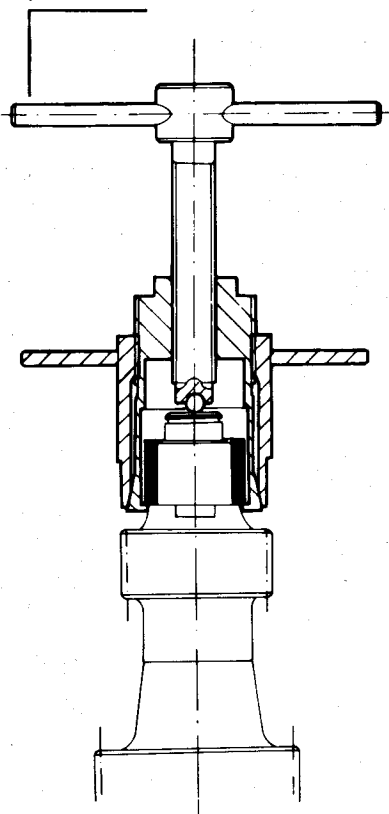
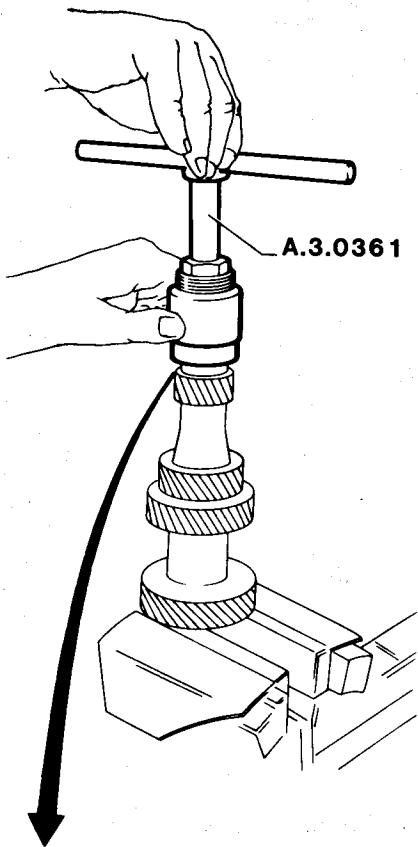
5. Main shaft disassembly

c. Withdraw rear roller bearing inner race from pinion shaft always operating at press with plate A.2.0349-0100 and tool A.2.0401.

a. Withdraw inner half-race of intermediate flange bearing from main shaft.

b. Secure main shaft to vice fitted with protective jaws, then remove retaining ring ① and bush ②.

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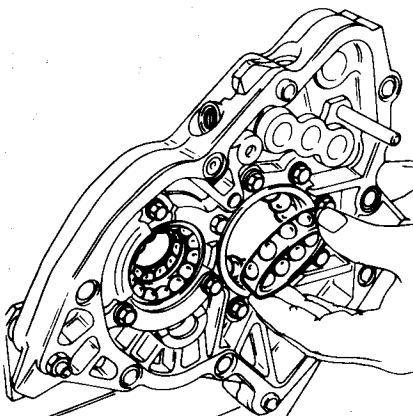


6. Intermediate flange disassembly

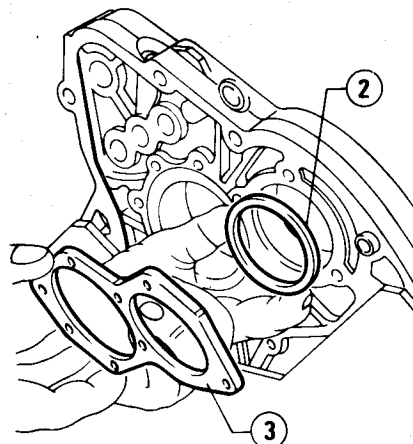
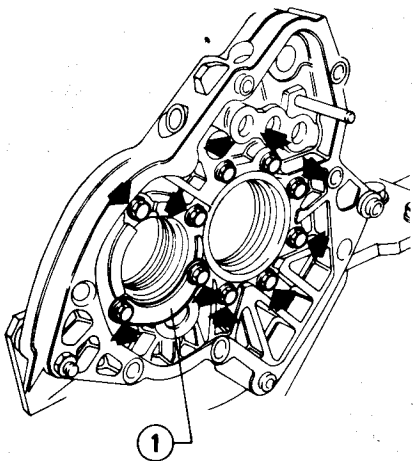
Solution with intermediate skew ball bearings.

a. Withdraw rolling elements (balls with cages) from outer races of intermediate flange bearings.

CAUTION:
If bearings are not to be replaced, mark them so that original position can be restored during reassembly.

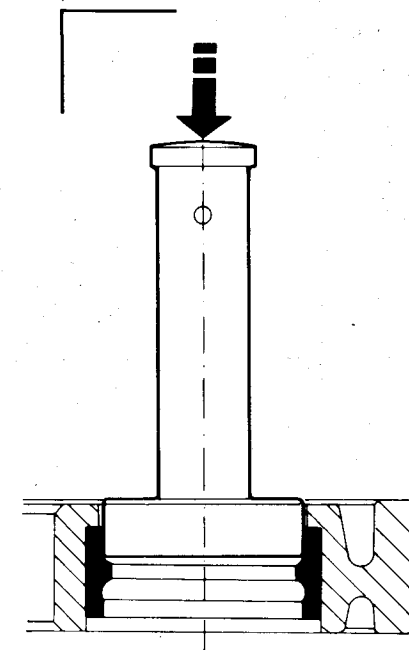
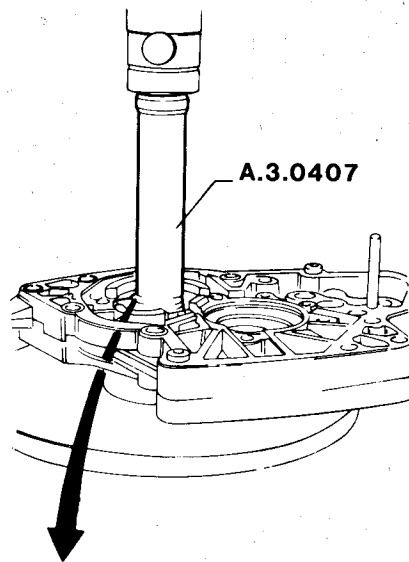


b. Unscrew and remove the screws with related washers securing plate ③ to intermediate flange. Recover clamp ①, plate itself and spacer ②. Remove intermediate flange from support on overhaul stand.



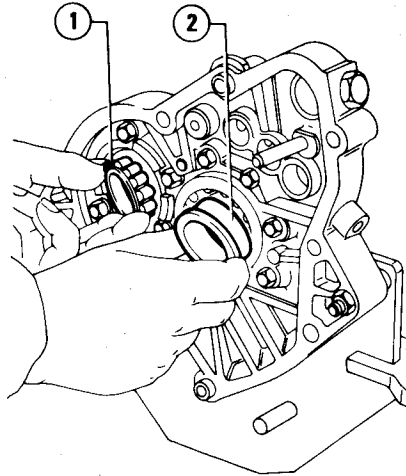
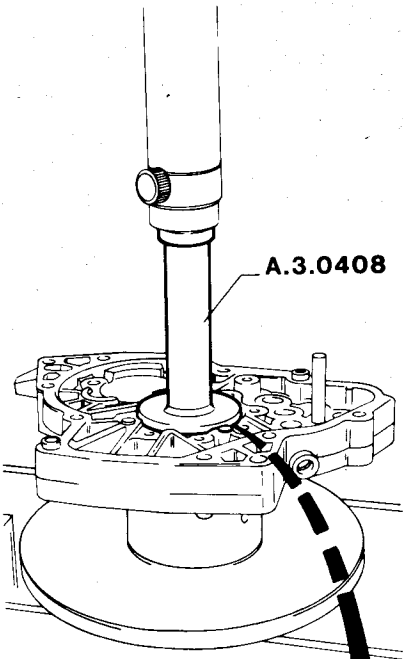
- 1 Bearing outer race clamp
- 2 Shoulder spacer
- 3 Shoulder plate for bearing outer races

c. Withdraw main shaft bearing outer ring from intermediate flange operating at press, with suitable base and puller A.3.0407.



d. Withdraw pinion shaft bearing outer ring from intermediate flange always operating at press, with suitable base and puller A.3.0408.

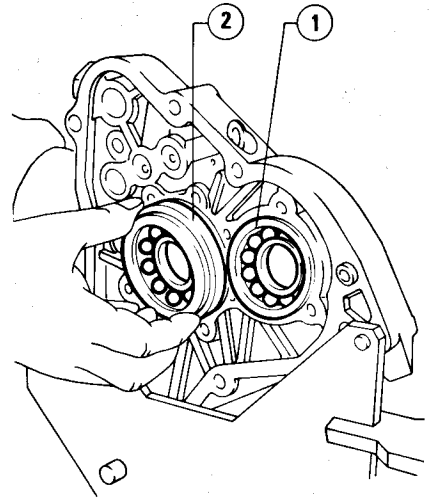
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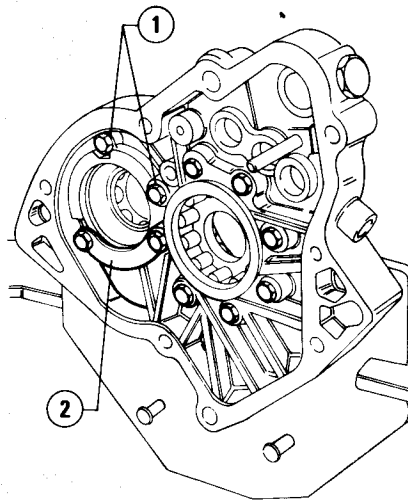
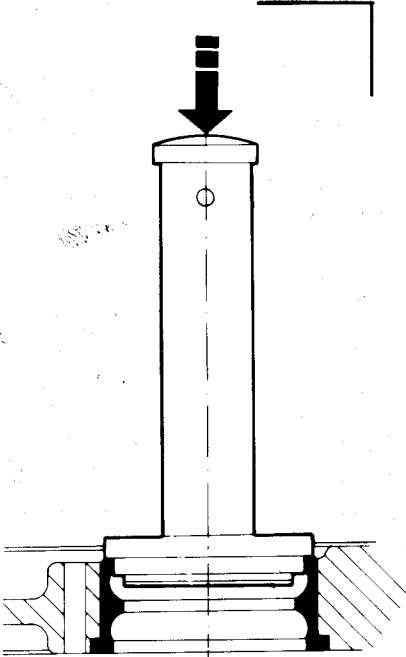
- 1 Main shaft bearing inner race
- 2 Pinion shaft bearing inner race

b. Unscrew and remove screws (1) with related washers securing plate (3). Recover retainer (2) and plate itself.

c. Withdraw ball bearings of main (1) and pinion (2) shafts.

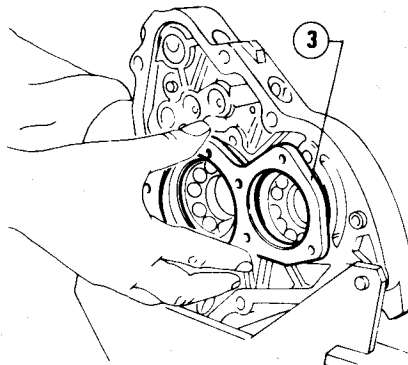


- 1 Main shaft ball bearing
- 2 Pinion shaft ball bearing

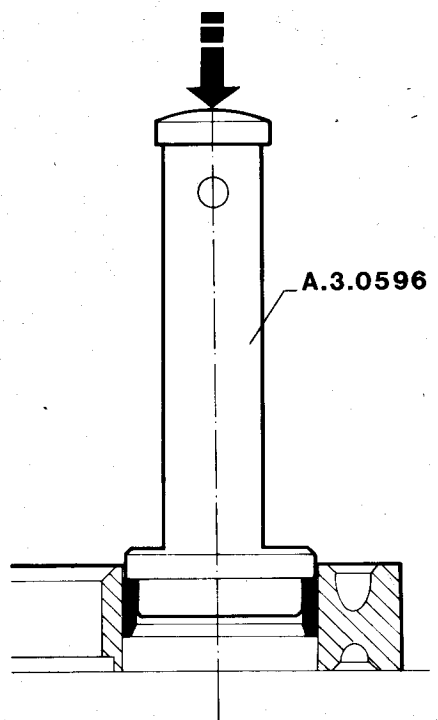


d. Operating at press with suitable base and puller A.3.0596, withdraw outer ring of main shaft bearing from intermediate flange.

e. Always operating at press with suitable base and puller A.3.0192 withdraw outer ring of pinion shaft bearing from intermediate flange.



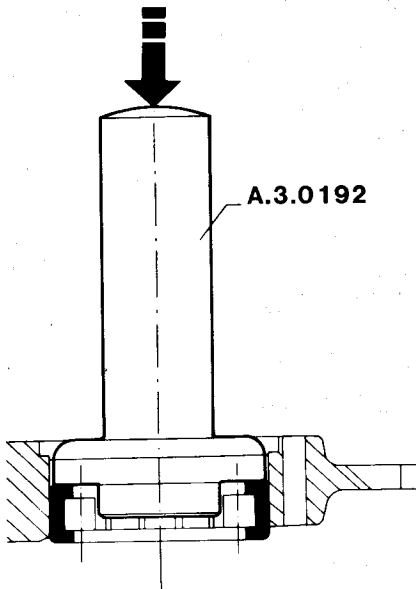
- 1 Plate securing screws
- 2 Bearing retainer
- 3 Bearing retaining plate



Solution with intermediate roller/ball bearings

a. Disassemble inner races (1) and (2) of roller bearings related to main and pinion shaft.

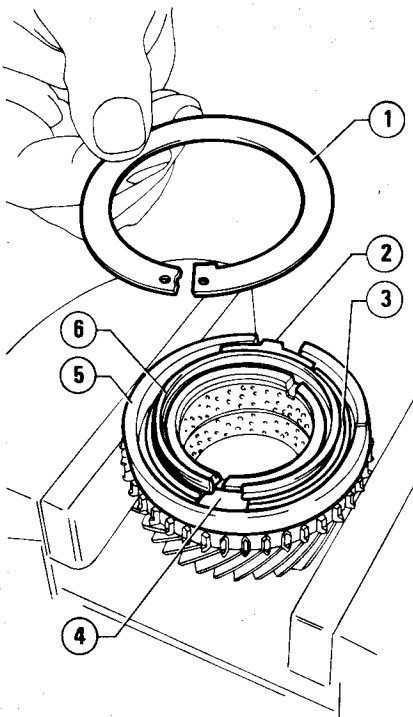
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7. Synchronizers disassembly

a. Synchronizers for 1st, 2nd, 3rd, 4th, 5th speeds.

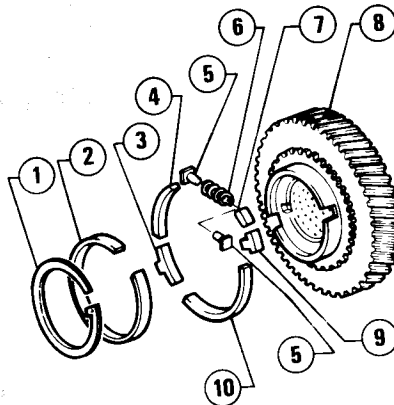
Secure the gear concerned on a vice fitted with protective jaws and, by means of a plier, remove retaining ring ①. Then, withdraw ring ⑤, sectors ② and ④ and retainers ③.



- 1 Retaining ring
- 2 Locking sector
- 3 Retainers
- 4 Guide sector
- 5 Synchronizing ring

b. 1st speed synchronizer

Operating as per the previous step, remove retaining ring ①, then withdraw ring ②, sectors ③ and ⑨, retainers ④ and ⑩, spring ⑥ with the two strikers ⑤ and pawl ⑦.



- 1 Retaining ring
- 2 Synchronizing ring
- 3 Locking sector
- 4 Retainer
- 5 Strikers
- 6 Spring
- 7 Pawl
- 8 Gear
- 9 Guide sector
- 10 Retainer

b. Bearings

Verify conditions of surfaces related to rings and rolling elements making sure they are free from scratches, imprints, grinding caused by scoring due to foreign matters.

c. Synchronizers

Verify that:

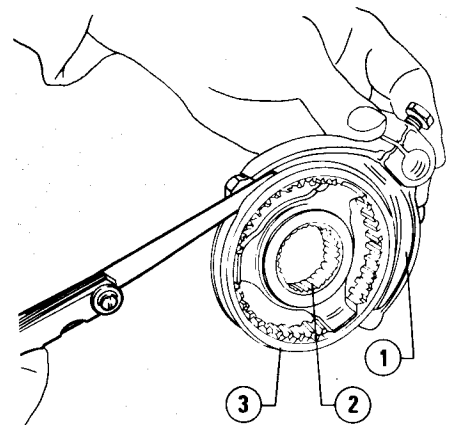
- Synchronizer rings are free from excessive wear.
- Retainers are free from overheating signs in the working points.
- Locking and guide sectors are not excessively scratched in the working points.
- Synchronizer sleeves slide freely on the related hubs.
- Engagement front toothing on sleeves and the corresponding toothing on gears are free from seizing and excessive wear.

d. Forks and sleeves

Check working surfaces of forks ① and sliding sleeves ③ verifying they are free from seizing and that axial clearance is within the prescribed values.

Sleeve fork axial clearance

0.7 to 0.9 mm
(0.0275 to 0.0354 in)



- 1 Control fork
- 2 Hub
- 3 Sleeve

CHECKS AND INSPECTIONS

Before carrying out the checks, carefully wash the items, then blow them with compressed air. This permits a better identification of superficial defects, wear and efficiency of a few components.

a. Gears and splined sections

Verify gears teeth. If irregular wear or spalled teeth are found on gears, replace the gears and verify that gears they mate with are not spalled.

Verify also the threaded and splined surfaces of shafts and, particularly, the housings for bearings inner races.

Gear axial and radial clearance

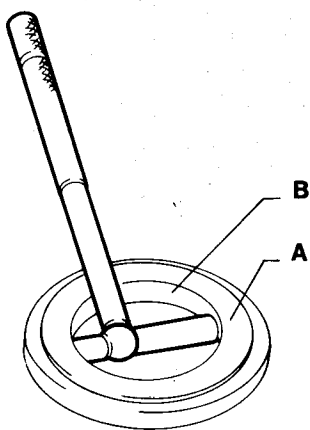
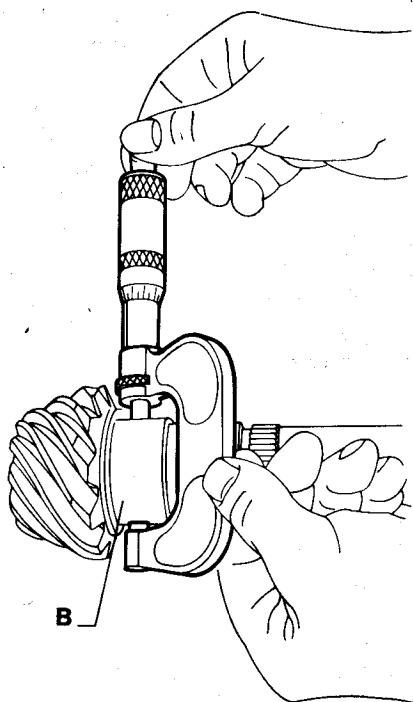
0.10 to 0.15 mm
(0.00394 to 0.00591 in)

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e. Pinion shaft and rear spacer

Verify that squareness deviation of ring nut support plane **A** of pinion shaft rear roller bearing does not exceed **0.02 mm (0.000787 in)** and that installation interference fit between seats **B** of pinion shaft and ring nut is within the prescribed values, i.e.:

**0.019 to 0.060 mm
(0.000748 to 0.0024 in)**

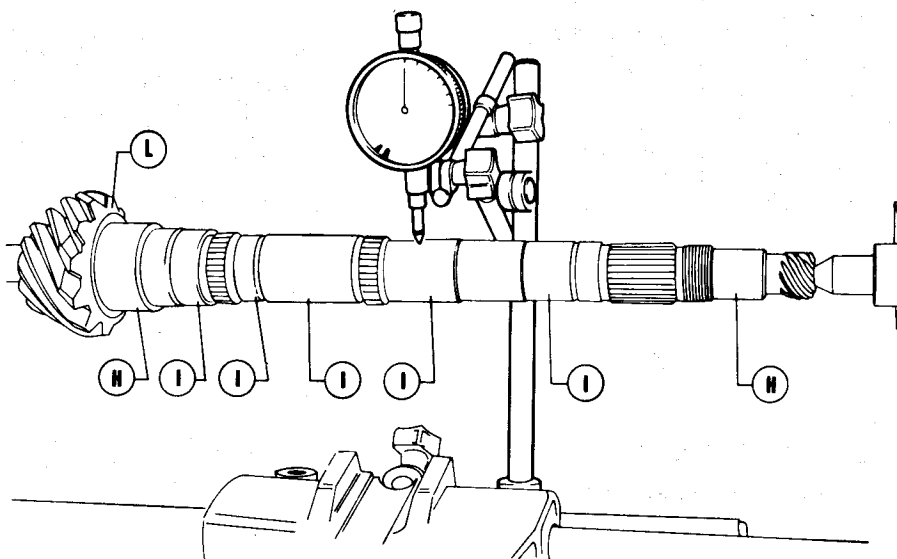


By means of gauge, verify that:

- pinion shaft eccentricity in the seats **H** of front needle bearing and rear roller bearing with respect to seats **I** of bushes related to gears and intermediate bearings does not exceed **0.02 mm (0.000787 in)**.

- Squareness deviation of abutment plane **L** related to rear bearing inner race with respect to seats **H** of bearings must not exceed:

0.02 mm (0.000787 in)



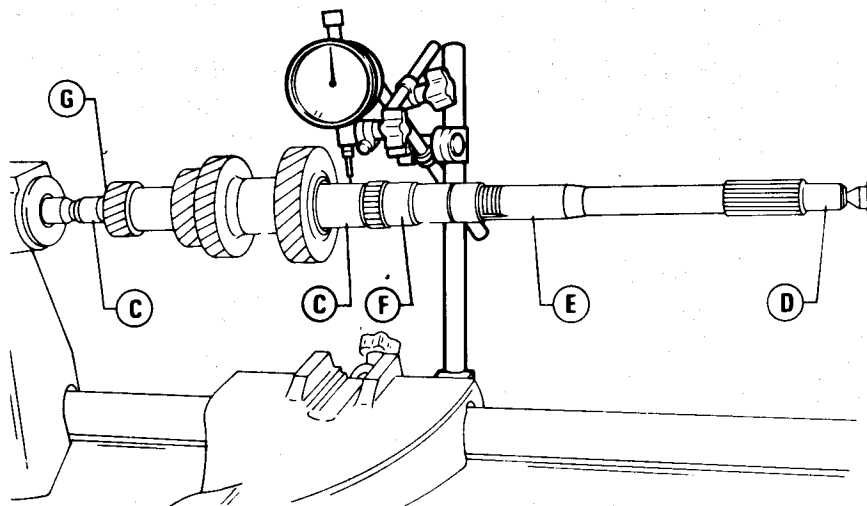
f. Main shaft

By means of gauge, verify that:

- main shaft eccentricity in the seats **C** of bearings related to differential-speed gear casing and of intermediate flange with respect to clutch shaft centering seat **D**, seat **E** of differential-speed gear casing bearing and to seat **F** of 5th speed gear does not exceed **0.03 mm (0.00118 in)** tolerance.

- Squareness deviation of abutment plane **G** related to rear bearing inner race with respect to seats **C** of bearings does not exceed:

0.03 mm (0.00118 in).



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REASSEMBLY

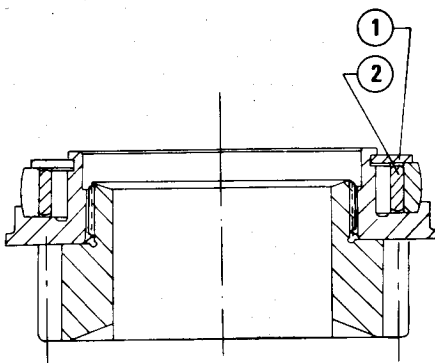
1. Synchronizers reassembly

a. Synchronizers for 2nd, 3rd, 4th, 5th speeds.

Reassemble synchronizers on gears, starting with the positioning of locking and guide sectors followed by retainers, synchronizing ring and retaining ring.

CAUTION:

At the end of reassembly, make sure that ring ① is correctly mounted in its seat and that ring ② can move freely.



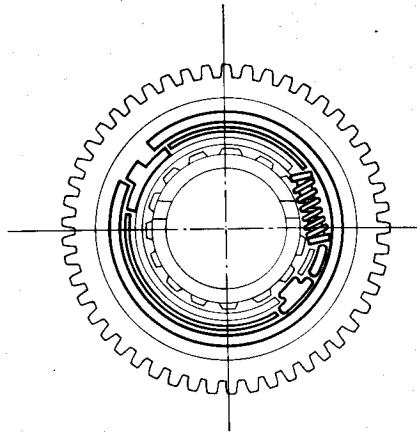
- 1 Retaining ring
- 2 Synchronizing ring

b. 1st speed synchronizer

Reassemble synchronizer operating as per the previous step and by correctly positioning the spring with the related strikers and the pawl.

CAUTION:

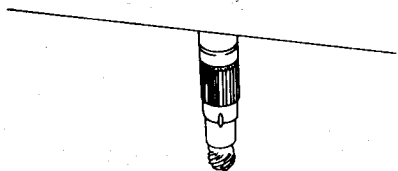
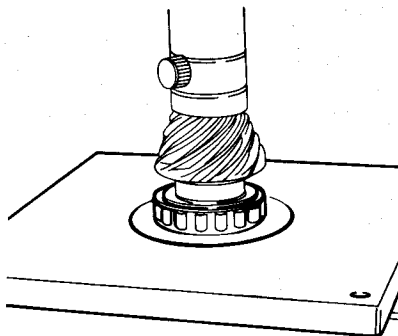
The retainers are of different length, as a consequence, they must be mounted just as per figure.



2. Pinion shaft reassembly

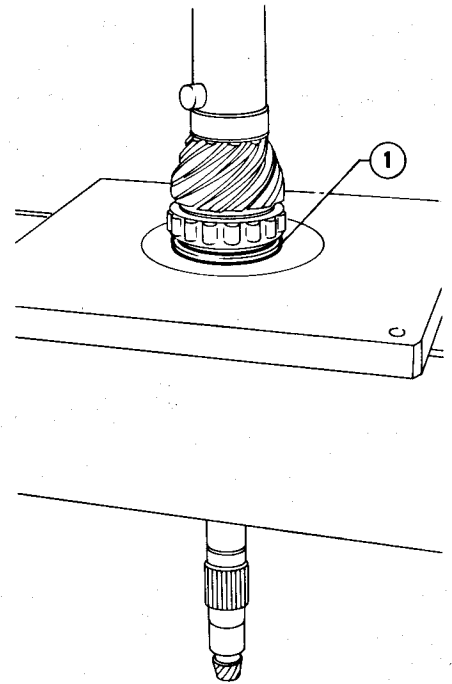
a. If previously disassembled, reassemble roller bearing runner race at the press and by means of a plate.

Install bearing with the protrusion towards pinion head.



b. Heat ring nut ① (140 °C, 284 °F) and insert it into pinion shaft, by means of the plate mentioned above.

To obtain the best installation, cool down the ring nut with compressed air when it is still under pressure, held in the press.



1 Ring nut

c. To complete pinion shaft reassembly, reverse the disassembly operations taking care to lubricate gears bushes, before reassembly, with the prescribed oil.

Oil:

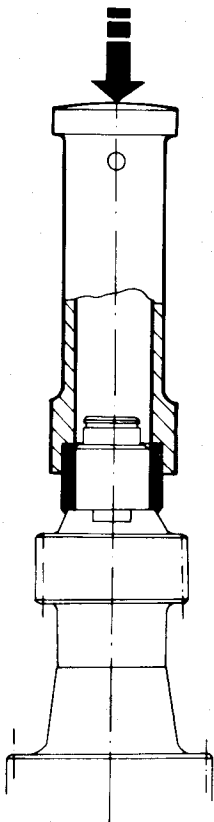
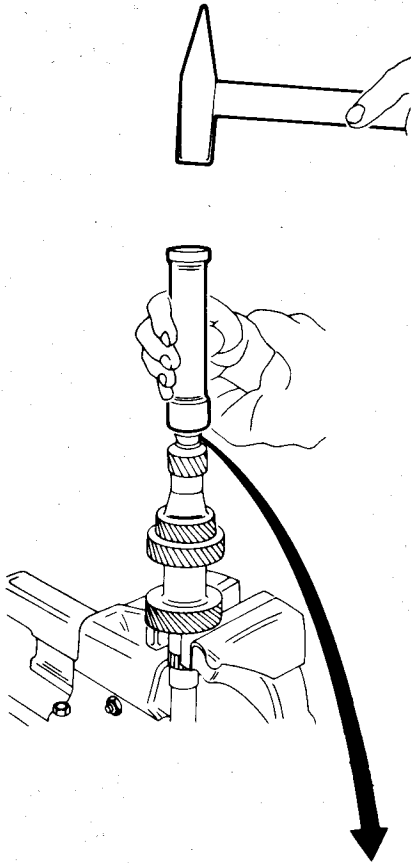
AGIP Rotra SX 75W90
IP Pontiax HDS 75W90

For correct installation of gear package, refer to exploded views of page 13-17

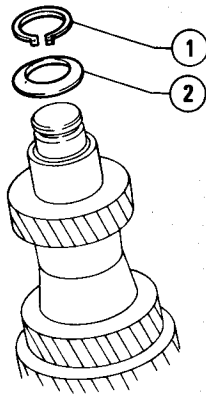
3. Main shaft reassembly

a. If previously disassembled, mount the rear bearing inner race on main shaft, making use of a suitable driver.

GEARBOX

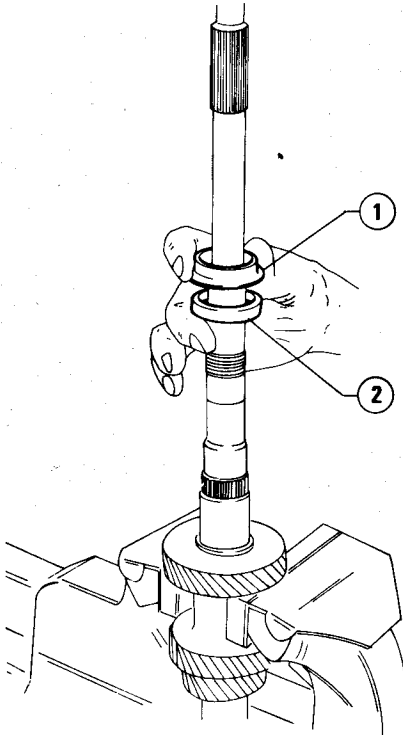


b. Reinstall bush ① and secure it with ring ②.



- 1 Plastic bush
- 2 Retaining ring

c. Insert spacer ② and then rear inner half-race ① of intermediate flange bearing on main shaft.



- 1 Rear inner half-race
- 2 Spacer

4. Intermediate flange reassembly

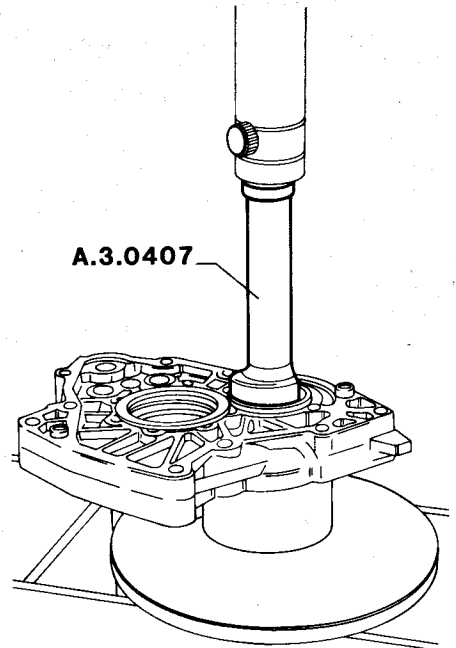
CAUTION:
Before installing roller bearings, lubricate them with the prescribed grease.

Grease:
AGIP F1 Grease 33 FD
IP Autogrease FD

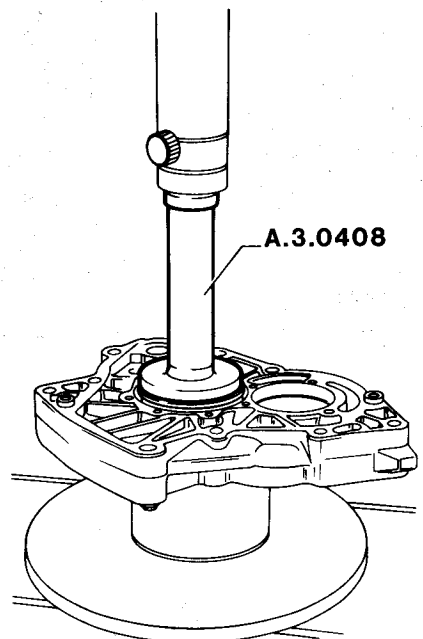
Solution with intermediate skew ball bearings

a. Operating at press and making use of tool **A.3.0407** insert outer race of main shaft ball bearing until it strikes against the intermediate flange striker.

Exert the utmost care during insertion in order not to force the intermediate flange striker.



b. Always operating at the press and making use of tool **A.3.0408**, insert outer race of pinion shaft ball bearing until it mates with the plane of intermediate flange front side.

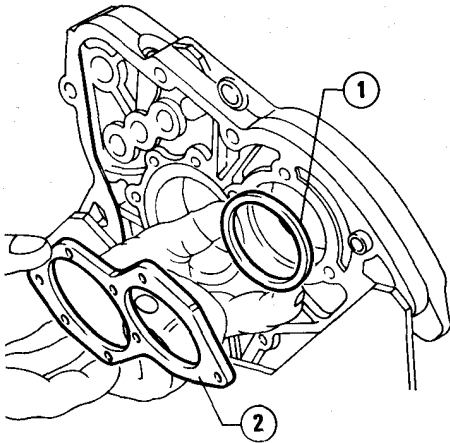


GEARBOX

c. Set intermediate flange on the special support, then secure it on an overhaul stand fitted with connection brackets.

d. Position spacer ① and plate ② on intermediate flange rear side.

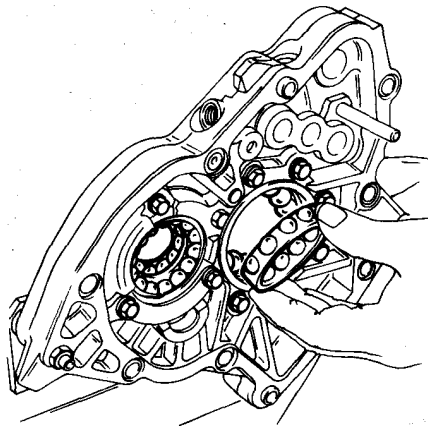
e. Apply retainer ③ on rear side, then screw the plate securing screws without tightening them.



- 1 Shoulder spacer
- 2 Bearings shoulder plate
- 3 Bearing outer race retainer

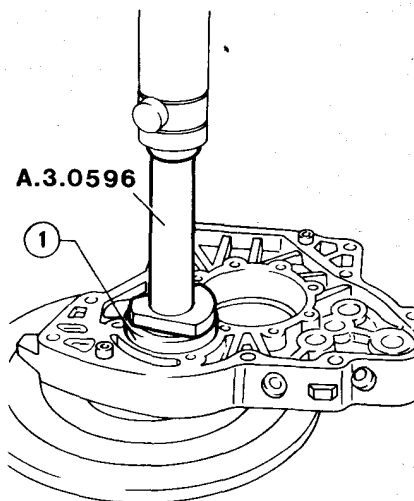
f. Reinstall both front and rear cages with balls related to intermediate flange bearings.

For the re-used bearings, the cages with rolling elements must occupy the same position noted during disassembly.



Solution with intermediate roller/ball bearings

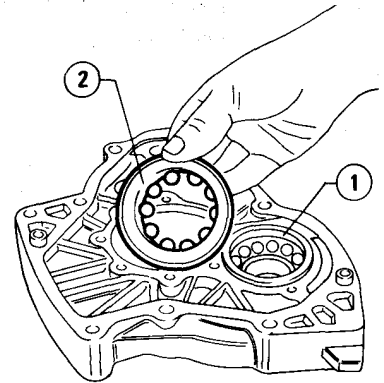
a. Operating at press and by means of tool A.3.0596, insert outer race ① of main shaft roller bearing until it mates with interne diare flange striker.



- 1 Roller bearing outer race

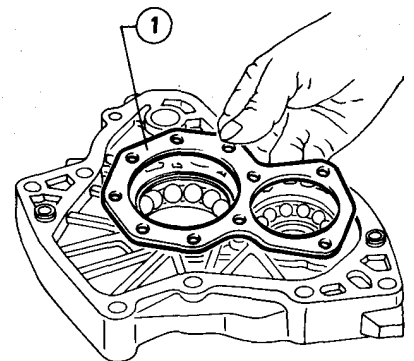
b. Reinstall on flange in the following order:

- main shaft ball bearing ① complete with inner half-race.
- pinion shaft ball bearing ② taking care to position it correctly with the thinner lip upwards.



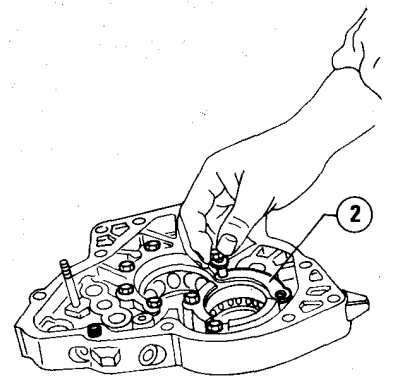
- 1 Main shaft ball bearing
- 2 Pinion shaft ball bearing

c. Temporarily apply the bearings retaining plate ① and retainer ② to flange by screwing the plate securing screws without tightening them.



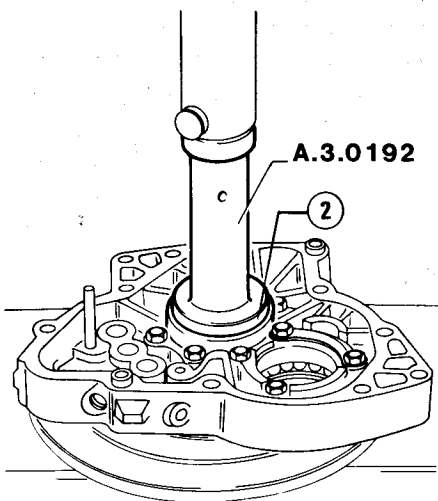
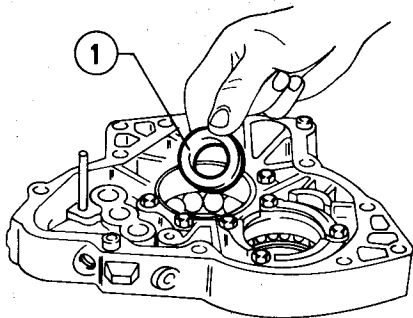
- 1 Bearings retaining plate
- 2 Bearing retainer

d. Reassemble inner half-race ① of pinion shaft ball bearing then, with the press and by means of tool A.3.0192, insert pinion shaft roller bearing ②.



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Insertion must be carried out with the utmost care without forcing components.

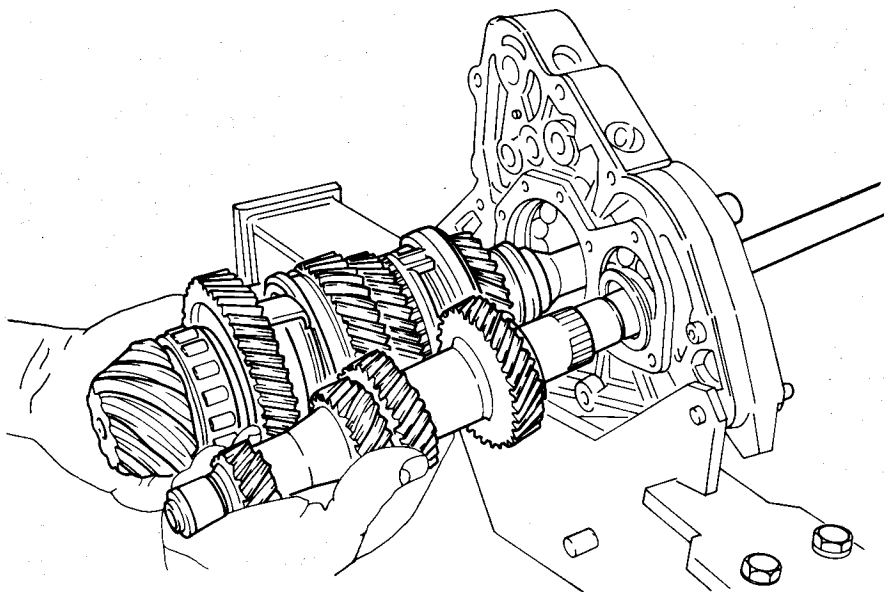


- 1 Pinion shaft inner half-race
- 2 Pinion shaft roller bearing

e. Set intermediate flange on the special support, then secure it to an overhaul stand fitted with connection brackets.

5. Tightening of bearings retaining plate screws

a. Insert roller bearings inner races of main and pinion shafts; then install shafts themselves positioning them, at the same time, in the intermediate flange.



b. Position intermediate flange on differential-speed gear casing taking care to align pinion shaft correctly, then rotate both speed gear shafts so as to bed the bearings. Next tighten the bearing retaining plate securing screws to the prescribed torque.

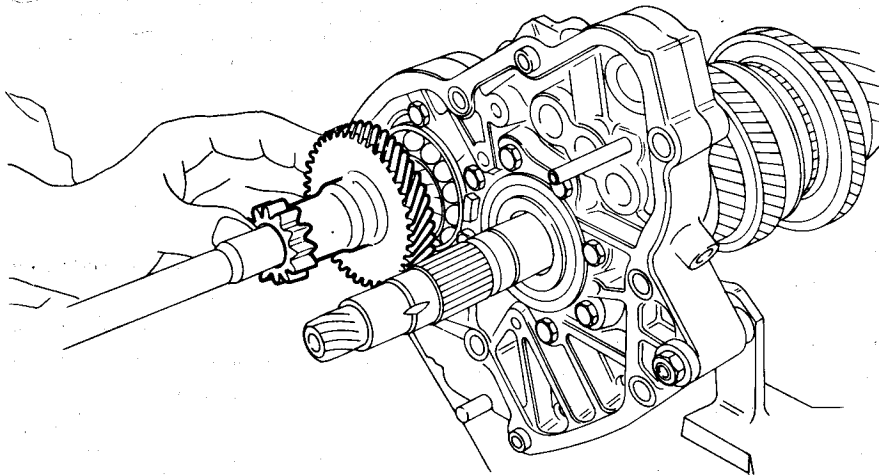
T: Tightening torque
Screws securing shoulder plate to intermediate flange
14 to 15 N·m
(1.4 to 1.6 Kg·m)
(10.1 to 11.6 ft·lb)

c. Remove intermediate flange complete with main and pinion shafts from differential-speed gear casing, and set it on an overhaul stand to complete the reassembly operations.

6. Shafts reassembly

a. Insert front inner half-races of intermediate flange bearings on shafts, taking care to bed them into the related seats on flange itself.

b. Install the 5th and Reverse speeds gear on main shaft, then screw nut without tightening it.



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c. Install the 5th and Reverse speeds gear package on pinion shaft, then screw nut without tightening it.

For correct installation of package, refer to exploded views of page 13-17.

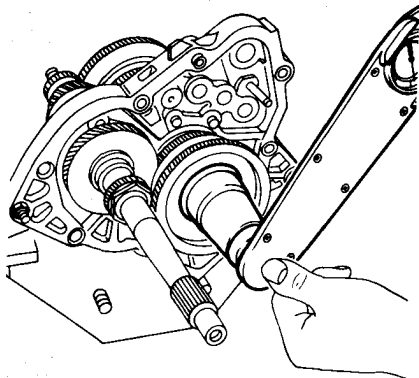
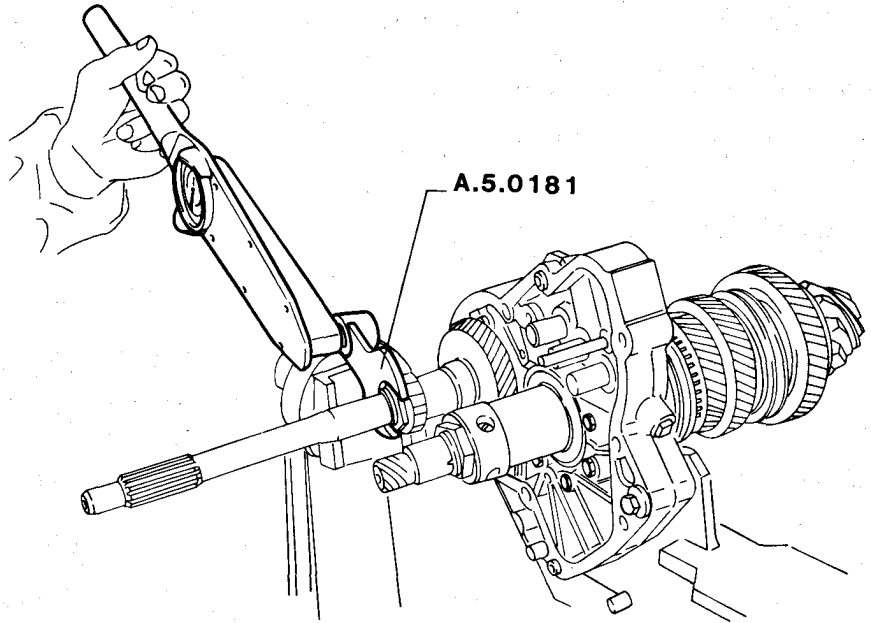
d. Operate on the control sleeves for the 1st-2nd and 3rd-4th speeds to engage two speeds in order to block shafts rotation.

e. By means of a torque spanner, tighten pinion shaft nut to the prescribed torque.

T: Tightening torque

Bevel pinion nut

112 to 124 N·m
(11.4 to 12.6 kg·m)
(82.4 to 91.7 ft·lb)



f. By means of a torque spanner fitted with wrench A.5.0181, tighten main shaft nut to the prescribed torque.

T: Tightening torque

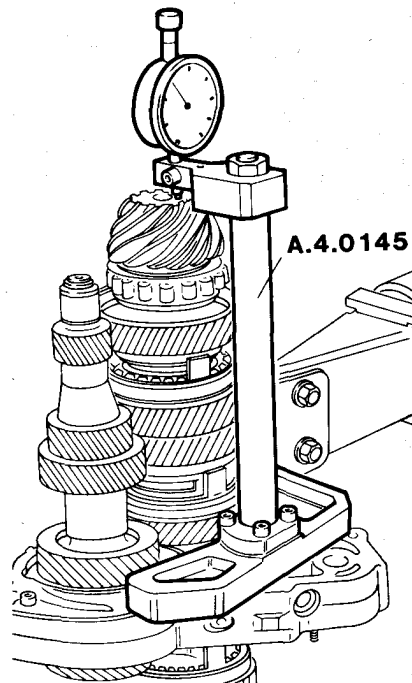
Main shaft nut

93 to 103 N·m
(9.5 to 10.5 kg·m)
(68.7 to 75.9 ft·lb)

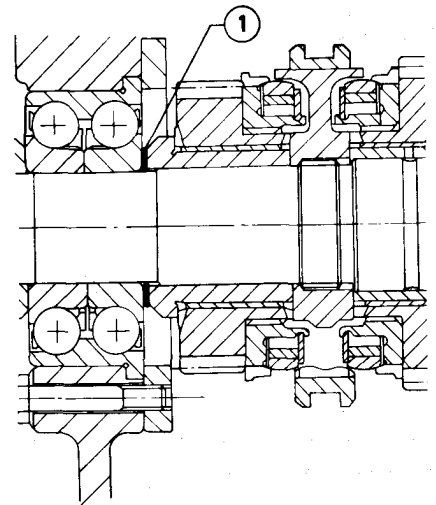
7. Verification of pinion shaft dimension

a. By means of a centesimal gauge mounted on support A.4.0145, verify that dimension "A" measured between intermediate flange inner plane and pinion head upper plane corresponds to the value measured before disassembly.

0.03 mm (0.00118 in) tolerance is allowed.



b. If the value does not correspond to that prescribed, modify thickness of the ring ① between bush of 4th speed gear and half-race of intermediate bearing.



1 Shim ring

c. Caulk the nuts of both speed gear shafts from one side only.

8. Rods and forks reassembly.

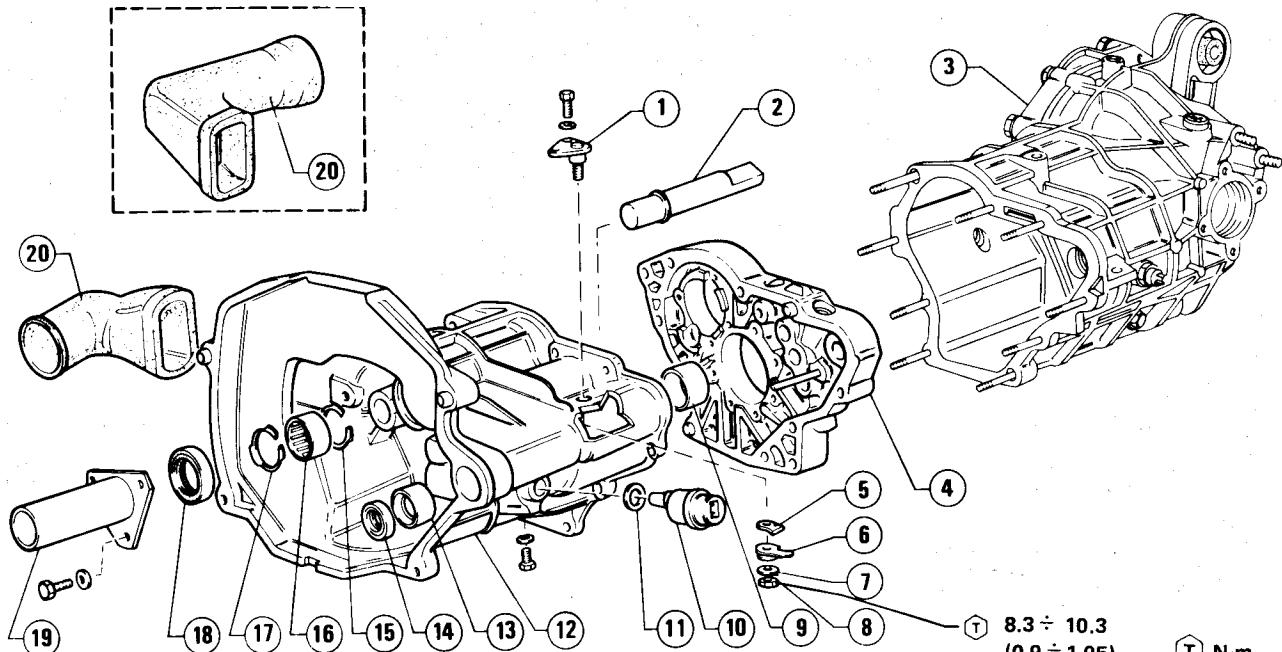
Refer to: "Rods and Forks - Reassembly".

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CLUTCH - SPEED GEAR CASING

Solution with intermediate roller/ball bearings

Solution with intermediate skew ball bearings



- 1 Safety device support
- 2 Reverse speed gear pin
- 3 Differential-speed gear casing
- 4 Intermediate flange
- 5 Plate
- 6 Pawl
- 7 Washer
- 8 Nut
- 9 Pinion shaft bush
- 10 Odometer pulse transmitter

- 11 Washer
- 12 Clutch - speed gear casing
- 13 Guide bush
- 14 Oil seal ring
- 15 Retaining ring
- 16 Main shaft needle bearing
- 17 Retaining ring
- 18 Oil seal ring
- 19 Tube
- 20 Sleeve

T N·m
(kg·m)
(ft·lb)

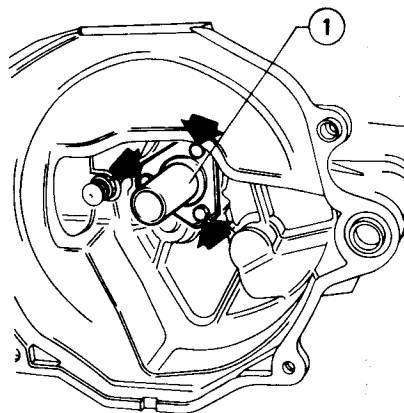
CAUTION:

The clutch - speed gear casing in aluminium alloy, take then the utmost care to prevent damaging it.

DISASSEMBLY

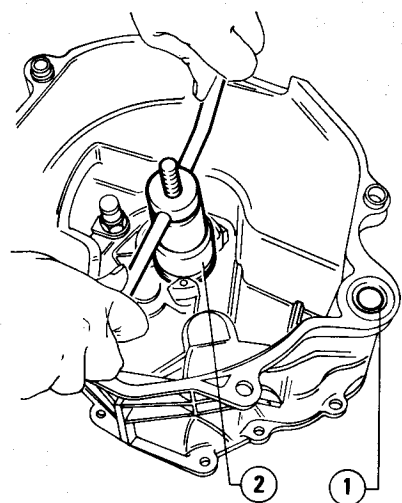
Remove the clutch - speed gear casing from the whole unit (Refer to: "Separation and Reconnection at Bench of Speed Gear Unit from/to Differential unit - Separation") and disassemble it operating as follows:

1. Release and remove the screws with the related washers securing tube ① from clutch - speed gear casing; remove tube.



1 Thrust bearing guide tube

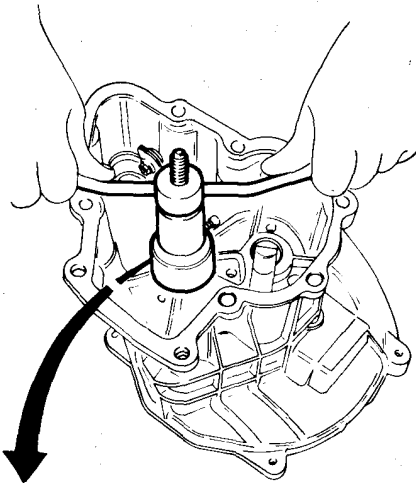
2. By means of suitable puller, remove oil seal rings ① and ②.



1 Oil seal ring for speed selection and engagement rod
2 Main shaft oil seal ring

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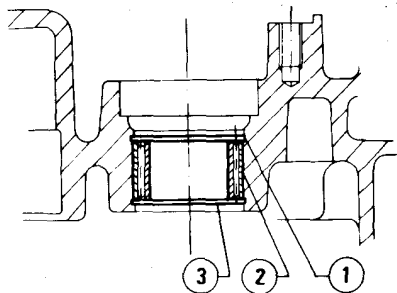
3. By means of same puller, remove bush ①.



1 Pinion shaft support bush

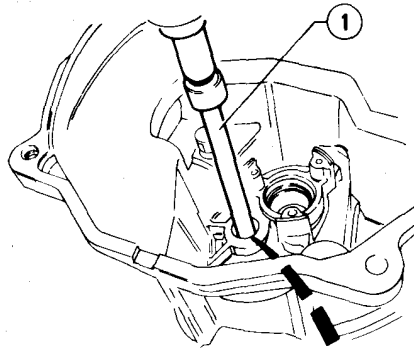
4. Withdraw main shaft needle bearing operating as follows:

- a. Remove retaining ring ①.
- b. Withdraw bearing ②.
- c. If necessary, remove retaining ring ③.



1 Front retaining ring
2 Needle bearing
3 Rear retaining ring

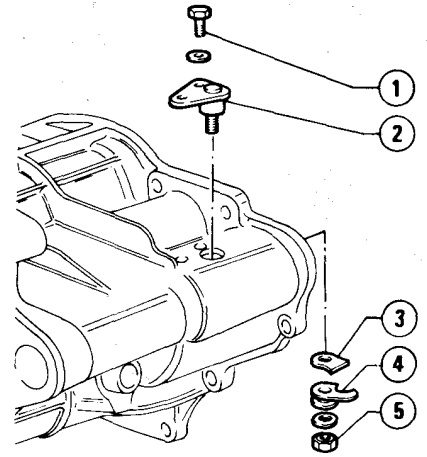
5. Rest clutch-speed gear casing on half-plates and, by means of suitable punch, remove pin ②.



1 Punch
2 Reverse speed pin

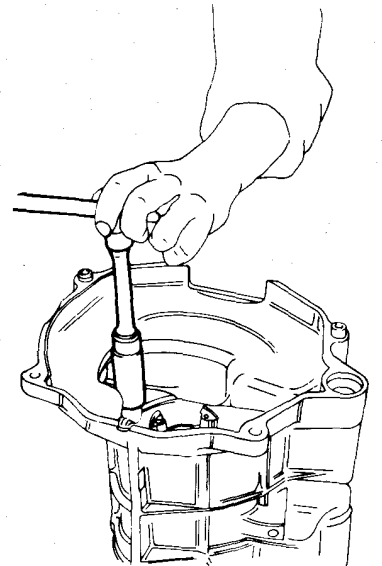
6. Disassemble interlock plunger (it prevents accidental transition from 5th to reverse speed) operating as follows:

- a. Unscrew nut ⑤, withdraw interlock plunger ④ and the plate ③ underneath.
- b. Loosen the two screws ① and remove support ②.



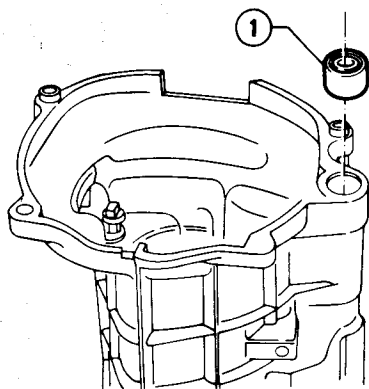
1 Screw
2 Safety device support
3 Plate
4 Interlock plunger
5 Inner nut securing interlock plunger

7. By means of suitable spanner, unscrew the clutch fork pin and remove it with the washer underneath.



8. If necessary, withdraw bush ① from clutch-speed gear casing.

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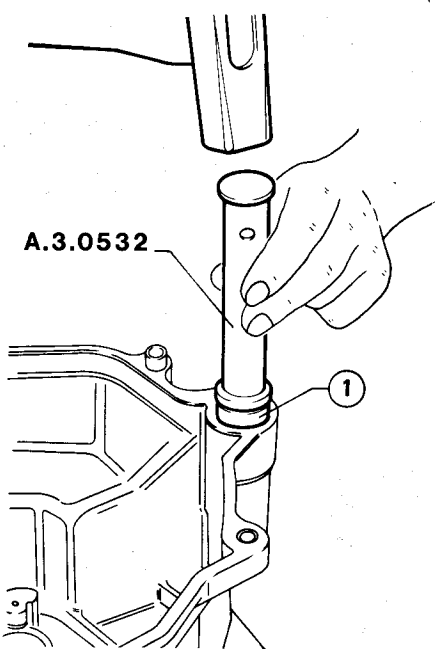
1 Guide bush for speed selection and engagement rod

CHECKS AND INSPECTIONS

1. Clean the casing with solvent removing sealant traces in correspondance with mating surfaces between clutch-speed gear casing and intermediate flange and in correspondance with the housing of reverse speed safety device.
2. Verify that casing is free from scratches and splinters.

REASSEMBLY

1. If previously removed, reinstall guide bush of speed selection and engagement rod operating as follows:
 - a. By means of driver **A.3.0532**, reinstall bush (1) on clutch-speed gear casing, previously heated at a temperature within 140 to 160 °C (284 to 320 °F).



1 Guide bush for speed selection and engagement rod

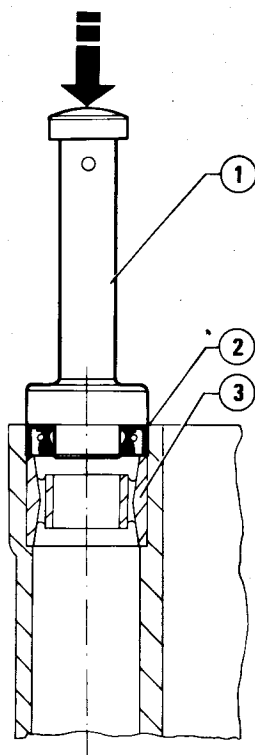
- b. Let the clutch-speed gear casing cools down, then install oil seal ring (2) inserting it by means of driver (1) after lubricating outer surfaces and inner lea^p with the prescribed oil and grease, respectively.

Oil:

AGIP Rotra SX 75W90
IP Pontiax HDS 75W90

Grease:

ISECO Molykote BR2



- 1 Oil seal ring driver
- 2 Oil seal ring
- 3 Guide bush for speed selection and engagement rod

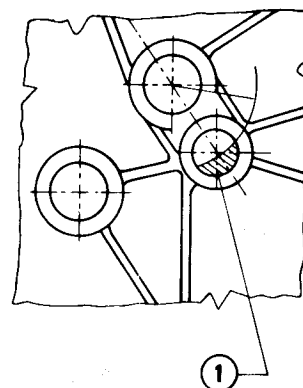
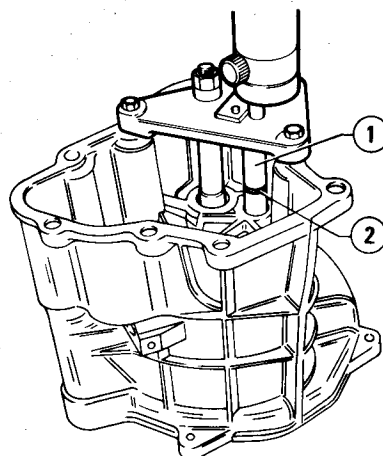
2. Tighten fork pin into the related seat.
3. Reassemble interlock plunger by reversing the order of disassembly (Refer to: "Disassembly" - step 6) applying a coat of the prescribed sealant on the mating surface between the support for reverse speed engagement safety device and clutch-speed gear casing.

Sealant:

Sealing compound LOWAC Perfect Seal

T: Tightening torque
Nut securing plate for reverse speed engagement safety device
8.3 to 10.3 N·m
(0.9 to 1.05 kg·m)
(6.5 to 7.2 ft·lb)

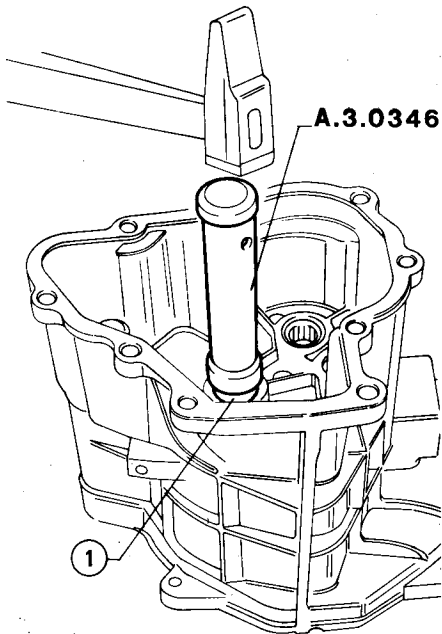
4. Reassemble the reverse speed pin operating as follows:
 - a. Install retaining ring (2) on pin.
 - b. Heat the clutch-speed gear casing at a temperature within 140 to 160 °C.
 - c. Position pin into the related seat on clutch-speed gear casing. Secure the pin positioning tool to clutch-speed gear casing.
 - d. Insert pin until retaining ring comes into contact with clutch-speed gear casing.



- 1 Reverse speed pin
- 2 Retaining ring

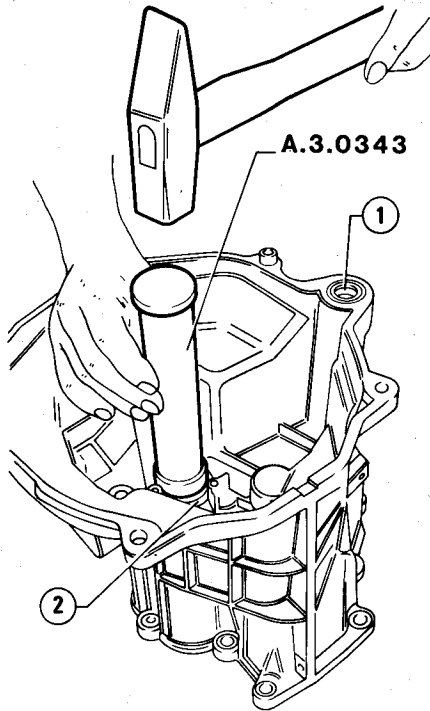
5. Reassemble the main shaft needle bearing by reversing the order of disassembly (Refer to: "Disassembly" - step 4).
6. Reinstall bush (1) making use of driver **A.3.0346**.

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1 Pinion shaft support bush

7. Reassemble oil seal rings ① and ② operating as per figure, by means of driver A.3.0343.



- 1 Oil seal ring for speed selection and engagement rod
- 2 Main shaft oil seal ring

8. Reassemble guide tube by reversing the order of disassembly (Refer to: "Disassembly" - step 1)

Once the clutch-speed gear casing has been reassembled, reconnect it to Differential unit (Refer to: "Separation and Reconnection at Bench of Speed Gear Unit from/to Differential Unit - Reconnection").

SERVICE DATA AND SPECIFICATIONS

SERVICE DATA

Gear ratios	Alfa 90		13		20		20 (Iniezione)		20 (6V Iniezione)		24 (turbo diesel)		25 (Iniezione)	
	LH	RH	LH	RH	LH	RH	LH	RH	LH	RH	LH	RH	LH	RH
Speed gear ratios														
1st speed	162.02	—	162.12	—	162.14	162.15	162.10	—	162.06	—	162.06	—	162.18	162.19
2nd speed														
3rd speed														
4th speed														
5th speed														
R speed														
Differential ratio														
1st speed														
km/h (mi/h)														
2nd speed														
km/h (mi/h)														
3rd speed														
km/h (mi/h)														
Differential-speed gear overall ratios														
Nominal speed at 1000 r.p.m.														

(1) Alfa 90/20 and Alfa 90/20 (Iniezione) versions for Switzerland, Sweden and Australia
 (2) Also valid for versions for Switzerland, Sweden and Australia

GEARBOX

Gear ratios	18		20 (iniezione *)		20 (6V iniezione)		24 (turbo diesel)		25 (6V iniezione) (*)	
	LH 162.02.1	RH —	LH 162.14.1 162.14.2	RH 162.15.1	LH 162.10.1	RH —	LH 162.06.1	RH —	LH 162.18.1	RH 162.19.2
Speed gear ratios	1 : 2.875									
1st speed	1 : 3.500									
2nd speed	1 : 1.720									
3rd speed	1 : 1.226									
4th speed	1 : 0.946									
5th speed	1 : 0.780									
R. speed	1 : 3.000									
Differential ratio	9/41		10/43		9/41		12/41		10/41	
1st speed	1 : 13.096		1 : 12.362		1 : 13.096		1 : 11.960		1 : 11.787	
km/h (mi/h)	8.683 (5.39)		9.198 (5.74)		8.682 (5.39)		9.507 (5.90)		9.646 (5.99)	
2nd speed	1 : 7.835		1 : 7.396		1 : 7.835		1 : 6.684		1 : 7.052	
km/h (mi/h)	14.511 (9.01)		15.374 (9.55)		14.512 (9.01)		17.012 (10.57)		16.123 (10.01)	
3rd speed	1 : 5.584		1 : 5.272		1 : 5.584		1 : 4.299		1 : 5.027	
km/h (mi/h)	20.362 (12.65)		21.567 (13.40)		20.362 (12.65)		26.452 (16.43)		22.620 (14.05)	
Differential-speed gear overall ratios	1 : 4.309		1 : 4.068		1 : 4.309		1 : 3.232		1 : 3.879	
Nominal speed at 1000 r.p.m.	26.387 (16.39)		27.948 (17.36)		26.387 (16.39)		35.174 (21.85)		29.314 (18.21)	
4th speed	1 : 3.553		1 : 3.354		1 : 3.553		1 : 2.665		1 : 3.198	
km/h (mi/h)	32.002 (19.88)		33.900 (21.06)		32.002 (19.88)		42.660 (26.50)		35.552 (22.08)	
5th speed	1 : 13.665		1 : 12.900		1 : 13.665		1 : 10.251		1 : 12.300	
km/h (mi/h)	8.321 (5.17)		8.815 (5.48)		8.314 (5.16)		11.093 (6.89)		9.245 (5.74)	

(*) Also valid for versions for Switzerland, Sweden and Australia

GEARBOX

Alfa 75 (1)		16		18		20		6V iniezione	
		LH	RH	LH	RH	LH	RH	LH	RH
Gear ratios		161.000	161.010	161.020	161.030	161.080	161.090	161.180	161.190
Speed gear ratios		1 : 3.500							
1st speed		1 : 1.956							
2nd speed		1 : 1.258							
3rd speed		1 : 0.946							
4th speed		1 : 0.780							
5th speed		1 : 3.000							
R. speed		11/42							
Differential ratio		12/41							
1st speed		1 : 11.960							
km/h (mi/h)		8.149 (5.06)							
2nd speed		1 : 7.468							
km/h (mi/h)		14.582 (9.06)							
3rd speed		1 : 4.803							
km/h (mi/h)		22.673 (14.09)							
4th speed		1 : 3.612							
km/h (mi/h)		30.149(18.74)							
5th speed		1 : 2.978							
km/h (mi/h)		36.568 (22.73)							
R. speed		1 : 11.454							
km/h (mi/h)		9.507 (5.91)							
Differential-speed gear overall ratios		1 : 4.299							
Nominal speed at 1000 r.p.m.		25.331 (15.74)							
1 : 3.233		33.694 (20.94)							
1 : 2.665		40.863 (25.40)							
1 : 10.251		10.623 (6.60)							

(1) Model with gearbox-rear axle long ratios (Switzerland, Sweden and Australia excluded).

GEARBOX

Giulietta		16		18		20		20 (turbo diesel)	
		LH	RH	LH	RH	LH	RH	LH	RH
Gear ratios		113.48	113.49	113.50	113.51	113.56	113.57		
1st speed		1:3.500							
2nd speed		1:1.956							
3rd speed		1:1.258							
4th speed		1:0.946							
5th speed		1:0.780							
R. speed		1:3.000							
Differential ratio		11/42		11/42		10/43		11/43	
1st speed		1:13.37		1:13.37		1:15.05		1:13.681	
km/h (mi/h)		8.11 (5.04)		8.13 (5.05)		7.20 (4.47)		7.96 (4.94)	
2nd speed		1:7.47		1:7.47		1:8.41		1:7.646	
km/h (mi/h)		14.51 (9.01)		14.56 (9.04)		12.89 (8.01)		14.243 (8.85)	
3rd speed		1:4.80		1:4.80		1:5.40		1:4.917	
km/h (mi/h)		22.57 (14.02)		22.64 (14.06)		20.04 (12.45)		22.148 (13.76)	
4th speed		1:3.61		1:3.61		1:4.07		1:3.698	
km/h (mi/h)		30.01 (18.64)		30.09 (18.69)		26.65 (16.55)		29.448 (18.29)	
5th speed		1:2.98		1:2.98		1:3.35		1:3.049	
km/h (mi/h)		36.31 (22.55)		36.52 (22.68)		32.32 (20.07)		35.717 (22.18)	
R. speed		1:11.42		1:11.42		1:12.90		1:11.727	
km/h (mi/h)		9.46 (5.87)		9.49 (5.89)		8.40 (5.22)		9.286 (5.77)	
Differential-speed gear overall ratios									
Nominal speed at 1000 r.p.m.									

GEARBOX

Giulietta		16		18		20		20 (turbochase)	
		LH 113.48	RH 113.49	LH 113.50	RH 113.51	LH 113.56	RH. 113.57	LH 113.52	
Speed gear ratios		1:3.500							
		1:1.956							
		1:1.258							
		1:0.946							
		1:0.780							
		1:3.000							
Differential ratio		11/42		11/42		10/43		11/43	
1st speed		1:13.37		1:13.37		1:15.05		1:13.681	
km/h (mi/h)		8.11 (5.04)		8.13 (5.05)		7.20 (4.47)		7.96 (4.94)	
2nd speed		1:7.47		1:7.47		1:8.41		1:7.646	
km/h (mi/h)		14.51 (9.01)		14.56 (9.04)		12.89 (8.01)		14.243 (8.85)	
3rd speed		1:4.80		1:4.80		1:5.40		1:4.917	
km/h (mi/h)		22.57 (14.02)		22.64 (14.06)		20.04 (12.45)		22.148 (13.76)	
4th speed		1:3.61		1:3.61		1:4.07		1:3.698	
km/h (mi/h)		30.01 (18.64)		30.09 (18.69)		26.65 (16.55)		29.448 (18.29)	
5th speed		1:2.98		1:2.98		1:3.35		1:3.049	
km/h (mi/h)		36.31 (22.55)		36.52 (22.68)		32.32 (20.07)		35.717 (22.18)	
R. speed		1:11.42		1:11.42		1:12.90		1:11.727	
km/h (mi/h)		9.46 (5.87)		9.49 (5.89)		8.40 (5.22)		9.286 (5.77)	
Differential-speed gear overall ratios									
Nominal speed at 1000 r.p.m.									

GEARBOX

Alfa 75	T6		T8		turbo		20		20 (turboDiesel)		6V iniezione	
	LH	RH	LH	RH	LH	RH	LH	RH	LH	RH	LH	RH
	161.000	161.010	161.020	161.030	161.340	161.350	161.080	161.090	161.040	—	161.180	161.190
Speed gear ratios	1 : 2.875											
1st speed	1 : 3.500											
2nd speed	1 : 1.720											
3rd speed	1 : 1.226											
4th speed	1 : 0.946											
5th speed	1 : 0.780											
R. speed	1 : 3.000											
Differential ratio	9/41		10/43		11/43		10/43		11/39		10/41	
1st speed	1 : 13.096		1 : 12.362		1 : 11.238		1 : 12.362		1 : 12.407		1 : 11.787	
km/h (mi/h)	8.315 (5.17)		8.809 (5.47)		9.690 (6.02)		8.809 (5.47)		8.777 (5.45)		9.239 (5.74)	
2nd speed	1 : 7.835		1 : 7.396		1 : 6.723		1 : 7.396		1 : 6.934		1 : 7.052	
km/h (mi/h)	13.899 (8.64)		14.724 (9.15)		16.198 (10.07)		14.724 (9.15)		15.705 (9.76)		15.442 (9.60)	
3rd speed	1 : 5.584		1 : 5.272		1 : 4.792		1 : 5.272		1 : 4.460		1 : 5.027	
km/h (mi/h)	19.502 (12.12)		20.656 (12.84)		22.725 (14.12)		20.656 (12.84)		24.417 (15.18)		21.663 (13.46)	
4th speed	1 : 4.309		1 : 4.068		1 : 3.698		1 : 4.068		1 : 3.353		1 : 3.879	
km/h (mi/h)	25.273 (15.71)		26.770 (16.64)		29.448 (18.30)		26.770 (16.64)		32.478 (20.19)		28.074 (17.45)	
5th speed	1 : 3.553		1 : 3.354		1 : 3.049		1 : 3.354		1 : 2.765		1 : 3.198	
km/h (mi/h)	30.650 (19.05)		32.469 (20.18)		35.717 (22.19)		32.469 (20.18)		39.385 (24.48)		34.052 (21.16)	
R. speed	1 : 13.665		1 : 12.900		1 : 11.727		1 : 12.900		1 : 10.635		1 : 12.300	
km/h (mi/h)	7.969 (4.95)		8.442 (5.25)		9.286 (5.77)		8.442 (5.25)		10.240 (6.36)		8.854 (5.50)	
Differential-speed gear overall ratios												
Nominal speed at 1000 r.p.m.												

GEARBOX

Alfa Romeo	16		18		20		20		24	
	LH 117.18	RH -	LH 117.17	RH -	LH 117.01	RH -	LH 117.13	RH 117.14	LH 117.06	RH 117.02
Speed gear ratios	1:3.500									
1st speed	1:3.500									
2nd speed	1:1.956									
3rd speed	1:1.258									
4th speed	1:0.946									
5th speed	1:0.780									
R. speed	1:3.000									
Differential ratio	11/43		11/42		11/42		10/41		11/42	
1st speed km/h (mi/h)	1:13.681		1:13.363		1:13.363		1:14.35		1:13.363	
2nd speed km/h (mi/h)	8.298 (5.15)		8.495 (5.28)		8.495 (5.28)		7.90 (4.91)		8.508 (5.28)	
3rd speed km/h (mi/h)	1:7.646		1:7.468		1:7.468		1:8.019		1:7.468	
4th speed km/h (mi/h)	14.847 (9.22)		15.201 (9.44)		15.201 (9.44)		14.17 (8.8)		15.225 (9.46)	
5th speed km/h (mi/h)	1:4.917		1:4.803		1:4.803		1:5.514		1:4.803	
R. speed km/h (mi/h)	23.087 (14.34)		23.635 (14.68)		23.635 (14.68)		22 (13.66)		23.673 (14.7)	
Differential-speed gear overall ratios	1:3.698		1:3.612		1:3.612		1:4.206		1:3.612	
Nominal speed at 1000 r.p.m.	30.697 (19.07)		31.428 (19.52)		31.428 (19.52)		29.26 (18.17)		31.478 (19.55)	
1st speed	1:3.049		1:2.978		1:2.978		1:3.198		1:2.978	
2nd speed	37.232 (23.12)		38.119 (23.68)		38.119 (23.68)		35.49 (22.04)		38.180 (23.71)	
3rd speed	1:11.727		1:11.454		1:11.454		1:12.3		1:11.454	
4th speed	9.680 (6.01)		9.911 (6.15)		9.911 (6.15)		9.22 (5.73)		9.927 (6.16)	

GEARBOX

Gear ratios		GTV 2.0		GTV 625 Vers. 1985	
		LH 113.17	RH 113.18	LH 113.15.1 113.15	RH 113.16.1 113.16
Speed gear ratios	1st speed	1 : 3.500		1 : 2.875	
	2nd speed	1 : 1.956		1 : 1.720	
	3rd speed	1 : 1.258		1 : 1.226	
	4th speed	1 : 0.946		1 : 0.946	
	5th speed	1 : 0.780		1 : 0.780	
	R. speed	1 : 3.000		1 : 3.000	
Differential ratio		10/43		10/41	
Differential speed gear overall ratios	1st speed	1 : 15.05		1 : 11.788	
	km/h (mi/h)	7.53 (4.68)		9.646 (6.00)	
	2nd speed	1 : 8.41		1 : 7.052	
	km/h (mi/h)	13.48 (8.37)		16.123 (10.01)	
	3rd speed	1 : 5.40		1 : 5.027	
	km/h (mi/h)	20.98 (13.03)		22.620 (14.05)	
Nominal speed at 1000 r.p.m.	4th speed	1 : 4.07		1 : 3.879	
	km/h (mi/h)	27.90 (17.33)		29.315 (18.21)	
	5th speed	1 : 3.35		1 : 3.198	
	km/h (mi/h)	33.83 (21.01)		35.553 (22.08)	
	R. speed	1 : 12.90		1 : 12.30	
	km/h (mi/h)	8.79 (5.46)		9.244 (5.74)	

GEARBOX

GENERAL SPECIFICATIONS

FLUIDS AND LUBRICANTS

Applicat. No.	Application	Type	Name	Q.ty
1	Differential-speed gear roller bearings Detent devices Clutch fork spherical pin and thrust bearing seat	GREASE	- AGIP: Grease 33 FD - IP: Autogrease FD Std. No. 3671-69833	-
2	Propeller shaft rear joint seat Ball joint on speed control lever Reverse speed sliding gear inner bush Bush for bevel pinion on clutch-speed gear casing	GREASE	ISECO: Molykote BR2 Std. No. 3671-69841	5 cm ³ -
3	Clutch-speed gear casing seal rings - Inner seal lip - Outer surface	GREASE OIL	ISECO: Molykote BR2 Std. No. 3671-69841 - AGIP: Rotra SX 75W90 - IP: Pontiax HDS 75W90 Std. No. 3631-69412	-
4	Differential-speed gear unit oil refilling	OIL	- AGIP: Rotra SX 75W90 - IP: Pontiax HDS 75W90 Std. No. 3631-69412	kg 2.570 (1) (5.66 lb) kg 2.070 (2) (4.56 lb)
5	Bushes for speed transmission and selection lever and speed transmission and engagement lever (isostatic control) (2) Ball joint on speed transmission and engagement lever end	GREASE	Molykote Longterm No. 2 Std. No. 3671-69831	-

(1) For models **Alfetta**.

For cars with high top-up plug of models: **Giulietta**

GTV 2.0

and

GTV 6 2.5

(2) For models **Alfa 90** and **Alfa 75**

For cars with low top-up plug of models: **Giulietta**

GTV 2.0

and

GTV 6 2.5

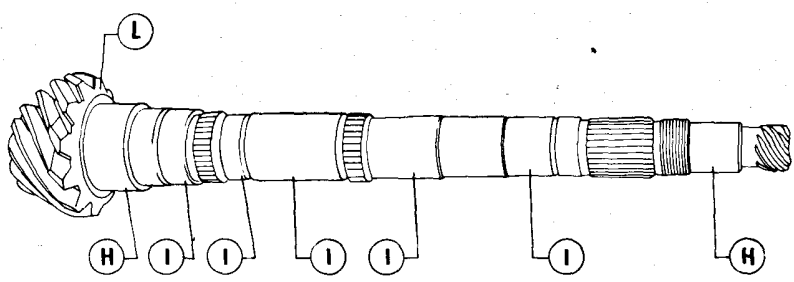
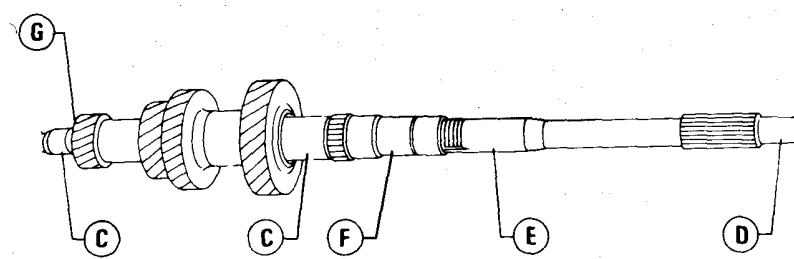
GEARBOX

SEALANTS AND SURFACE FIXING AGENTS

Application	Type	Name	Q.ty
<p>Surfaces of differential-speed gear casing and clutch-speed gear casing mating with intermediate flange</p> <p>Mating surfaces between Reverse speed engagement safety devices and differential-speed gear casing</p> <p>NOTE: Use denatured ethyl alcohol to clean the surfaces</p>	<p>SEALING COMPOUND</p>	<p>LOWAC Perfect Seal Seal Std. No. 3522-00011</p>	<p>-</p>

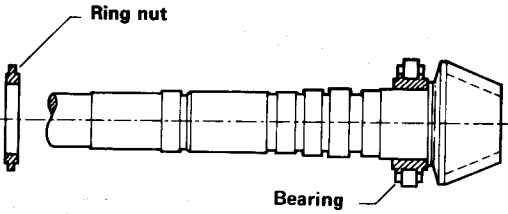
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CHECKS AND ADJUSTMENTS

Axial clearance between fork and synchronizers sleeves	G	mm (in)	0.7 to 0.9 (0.0275 to 0.0354)
Spring test load	C	N (Kg lb)	90 to 97.6 (9.18 to 9.95; 20.25 to 21.96)
Spring length			
- Unloaded	L	mm (in)	30.6 (1.2)
- Loaded	L _C	mm (in)	18.8 (0.74)
Gears axial and radial clearance		mm (in)	0.1 to 0.15 (0.00394 to 0.00591)
Pinion, shaft and rear ring nut			
- Squareness deviation of ring nut support planes		mm (in)	0.02 (0.000787)
- Ring nut installation interference fit		mm (in)	0.019 to 0.060 (0.000748 to 0.00236)
- Eccentricity in seats H of front and rear bearings with respect to seats I of gear bushes and intermediate bearings		mm (in)	0.02 (0.000787)
- Squareness deviation for abutment plane L of rear bearing inner race with respect to seats H		mm (in)	0.02 (0.000787)
			
Main shaft			
- Eccentricity in seats C of differential-speed gear casing bearings and intermediate flange with respect to centering seat D on clutch shaft, to seat E of clutch-speed gear casing bearing and to seat F of 5th speed gear		mm (in)	0.03 (0.00118)
- Squareness deviation of abutment plane G for rear bearing inner race with respect to seats C of bearings		mm (in)	0.03 (0.00118)
			

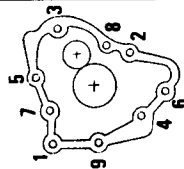
GEARBOX

HEATING TEMPERATURES

Application	Measurement unit	°C (°F)
Heating temperature for roller bearing locking ring nut of bevel pinion shaft (head side) 		140 (284)
Heating temperature of clutch-speed gear casing for installation of Reverse speed gear pin, and bush of speed selection and engagement rod		140 to 160 (284 to 320)
Heating temperature of 3rd and 4th speed driving gears for installation on main shaft		195 to 210 (383 to 410)

GEARBOX

TIGHTENING TORQUES

Application	Gearbox type	With roller-ball compound bearings	With skew ball bearings
Main shaft nut		93 to 103 (9.5 to 10.5; 68.7 to 75.9)	
Bevel pinion shaft securing nut		112 to 124 (11.4 to 12.6; 84.4 to 91.1)	
Nuts securing differential speed gear casing and clutch-speed gear casing to intermediate flange		12 to 13 (1.2 to 1.4; 8.7 to 10.1)	
Tightening order			
Screws securing shoulder plate to intermediate flange		14 to 15 (1.4 to 1.6; 10.1 to 11.6)	
Containers for the laking of spring and balls securing rods		17 to 20 (1.7 to 2.1; 12.3 to 15.2)	
Nut securing speed control rear lever to speed selection and engagement lever (1)		28 to 32 (2.8 to 3.3; 20.3 to 23.9)	
Nut securing joint connecting rear lever to speed control rod (1)		20 to 31 (2 to 3.2; 14.5 to 23.1)	
Nut securing ball joint connecting rear lever to transmission lever (2)		25.1 to 31 (2.5 to 3.2; 18.1 to 23.1)	
Nut securing speed selection tie rod (2)		11.3 to 14 (1.1 to 1.4; 8 to 10.1)	
Bolt securing speed selection and transmission lever to speed transmission and engagement lever (2)		8.1 to 10 (0.8 to 1; 5.8 to 7.2)	

Unit: N·m (kg·m; ft·lb)

GEARBOX

Unit: N·m (kg·m; ft·lb)

Application	Gearbox type	With roller-ball compound bearings	With skew ball bearings
Bolt and screw securing bracket to speed gear rubber pad (2)		8.1 to 10 (0.8 to 1.5; 8 to 7.2)	
Bolts securing speed gear unit rubber pads to casing		18.6 to 23 (1.9 to 2.3; 13.7 to 16.6)	
Fast idle switch (on intermediate flange)		40 to 48 (4.1 to 4.9; 26.9 to 35.4)	
Screws securing clutch unit to differential speed gear unit		29 to 32 (2.9 to 3.2; 21 to 23.1)	
Screws securing propeller shaft joint to clutch shaft fork		55 to 57 (5.6 to 5.8) (40.5 to 41.9)	39 to 49 (4 to 5) (28.9 to 36.1)
Unions for clutch hydraulic system pipes		8 to 10 (0.8 to 1; 5.8 to 7.2)	
Unions for clutch hydraulic system hoses		10 to 15 (1 to 1.5; 7.2 to 10.8)	
Screws securing forks of 1st-2nd-3rd and 4th speed		21 to 23 (2.1 to 2.3; 15.2 to 16.6)	
Screws securing speed gear-differential unit to lateral support small block		18.6 to 23.5 (1.9 to 2.4; 13.7 to 17.3)	
Screws (lower) securing speed control lever support to body		20 to 32.5 (2 to 3.25; 14.5 to 23.5)	
Screws (upper) securing speed control lever support to body		4.8 to 6 (0.5 to 0.6; 3.6 to 4.3)	
Nut securing plate for Reverse speed engagement safety device		8.3 to 10.3 (0.9 to 1.05; 6.5 to 7.2)	
Bolt securing lever to external speed control rod		13 to 16 (1.3 to 1.6; 9.4 to 11.6)	

(1) For versions **Giulietta** **Alfetta** **GTV 20** **GTV 6 25** without "isostatic" control
 (2) For versions **Giulietta** **Alfetta** **GTV 20** **GTV 6 25** with "isostatic" control

GEARBOX

TROUBLE DIAGNOSIS AND CORRECTIVE ACTION

Condition	Probable cause	Corrective action
Transmission is faulty when in forward speeds	<p>Once detected where the noise comes from and established that it does not originate from the engine, proceed as follows in order to, identify the faulty unit</p> <ul style="list-style-type: none"> - run the car to the speed where noise is most emphasized. - adjusting the speed as required, change alternatively - and within reasonable sequences - all different speeds <p>Once determined the cause of the noise, repair or replace the faulty components</p> <ul style="list-style-type: none"> • Oil level insufficient or oil not of the prescribed type • Oil leaks from oil seal rings of differential carrier a/o from topping-up or drain plugs • Main shaft bearings (in this case, noise should be present also with speed gear in neutral) • Pinion shaft bearings (noise present only if speed is engaged and this with all speeds) 	<p>Fill-up to proper level or replace oil with the prescribed type</p> <p>Replace oil seal rings a/o plugs</p> <p>Replace bearings</p> <p>Replace bearings</p>
Noisy when vehicle is moving even if speedgear is in neutral	<ul style="list-style-type: none"> • Bearings of differential inner drive shafts faulty or seized • Bevel pinion bearings noisy 	<p>Replace bearings</p> <p>Check a/o replace</p>
Noisy when in one particular speed	<ul style="list-style-type: none"> • Gear teeth mating surfaces worn or seized 	<p>Replace gears</p>
Noisy both during acceleration and deceleration (drive shafts already checked)	<ul style="list-style-type: none"> • Differential gears worn or damaged • Hypoid gear excessive clearance • Crown wheel and pinion securing screws loosened • Bevel pinion shim (determining pinion-crown axis distance) worn or damaged • Pinion shaft securing nut loosened • Gear package excessive clearance 	<p>Replace gears</p> <p>Verify and replace if necessary</p> <p>Tighten the screws</p> <p>Replace washer with another with shim determined by adjustment</p> <p>Check speed gear components a tighten nut</p> <p>Adjust package</p>

GEARBOX

Condition	Probable cause	Corrective action
Transmission noisy when in curve, both with speed engaged and when in "neutral" (drive shafts already checked)	<ul style="list-style-type: none"> Teeth of side pinion and crown wheel gears worn, damaged or seized 	Replace differential casing
Transmission noisy when in "neutral" (with vehicle stationary)	<ul style="list-style-type: none"> Driving torque irregular variation Not enough oil 	<p>Adjust idling r.p.m.</p> <p>Fill up to correct level</p>
Transmission noisy when in reverse speed	<ul style="list-style-type: none"> Reverse gears worn or damaged 	Replace the faulty components
Speed engagement/disengagement is difficult	<p>First of all, determine whether trouble is due to speed gear or control system. Check whether clutch correctly engages when pedal is released and disengages when pedal is pressed. If clutch is not faulty, the trouble is due to speed gear control system.</p>	
Stiffening of speed gear control a/o non-return of lever to neutral	<ul style="list-style-type: none"> Excessive friction in the rotation of tie rod joints of speed transmission and engagement lever Excessive tightening between speed transmission and selection lever bush and speed transmission and engagement lever Insufficient lubrication of speed transmission and selection lever and speed transmission and engagement lever bushes O-rings for speed transmission and selection lever broken or too worn, with consequent water a/o dust seepage Insufficient oil level in the differential-speed gear casing Synchronizing unit faulty Inner controls deformed or worn 	<p>Replace selection tie rod and central ball joint of speed transmission and engagement lever</p> <p>Replace levers, shoulder rings, bushes and pin</p> <p>Grease the points subject to friction</p> <p>Replace O-rings and grease pin of speed transmission and selection lever</p> <p>Restore oil correct level</p> <p>Refer to: "Synchronizing unit grinds or is faulty"</p> <p>Repair or replace the faulty components</p>
Excessive clearance in speed selection	<ul style="list-style-type: none"> Abnormal wear of pin and related bushes connecting speed transmission and engagement lever with speed transmission and selection lever bush 	Replace the worn components

GEARBOX

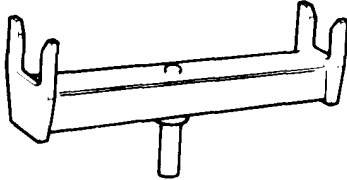
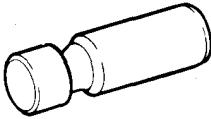
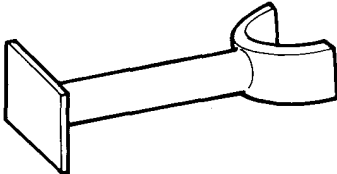
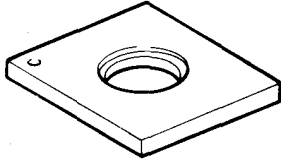

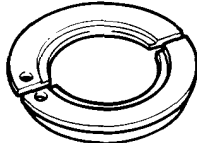
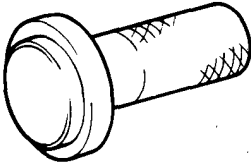
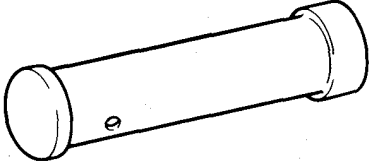
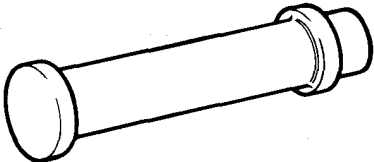
Condition	Probable cause	Corrective action
Noisy	<ul style="list-style-type: none"> • Incorrect positioning of the unit in the longitudinal direction with interferences • Interference with rear floor sidewall 	<p>Verify a/o adjust control assembly position</p> <p>Rivet the area concerned</p>
Speed slip out	<ul style="list-style-type: none"> • Sleeves and gears worn or faulty • Excessive clearance of the gear which becomes disengaged (Noise present both in acceleration and deceleration) 	<p>Replace the worn components</p> <p>Verify gear package adjustment</p>
Speed engagement is poor	<ul style="list-style-type: none"> • Control levers bushes worn • Pawls worn or damaged • Springs fatigued or broken • Rods milling worn or damaged • Selector fork a/o lever worn or damaged 	<p>Replace the worn components</p> <p>replace pawls</p> <p>Replace springs</p> <p>Replace rods</p> <p>Replace selector a/o levers</p>
Synchronizing unit grinds or is faulty	<ul style="list-style-type: none"> • Sleeve and gear with front tothing worn or damaged • Incorrect distance between front tothing of gear and sleeve • Synchronizing ring worn • Sleeve splines worn or damaged 	<p>Replace the faulty components</p> <p>Replace the faulty components</p> <p>Replace</p> <p>Replace</p>
Reverse lights do not light when engaging the Reverse speed	<ul style="list-style-type: none"> • Reverse lights switch faulty 	<p>Replace switch</p>
Speed selector lever vibrates and is noisy	<ul style="list-style-type: none"> • Lever return spring fatigued • Speed control lever bushes faulty • Refer to other steps concerning the noisy speed 	<p>Replace the faulty components</p> <p>Replace the faulty components</p>

GEARBOX

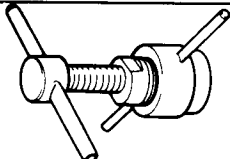
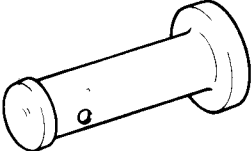
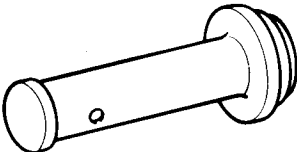
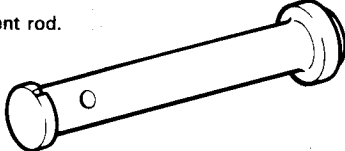
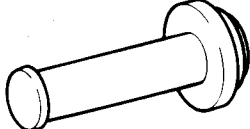

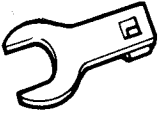
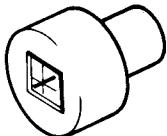
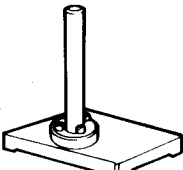
Condition	Probable cause	Corrective action
Seizure or breakage	<ul style="list-style-type: none"><li>• Insufficient oil level or oil not of the prescribed type<li>• Insufficient clearances<li>• Gears and bearings incorrect adjustment<li>• Excessive torque or improper use of clutch<li>• Securing screws loosened	<p>Replace the faulty components and use the prescribed oil</p> <p>Adjust clearances and replace the faulty components</p> <p>Check the speed gear unit</p> <p>Replace the faulty components</p> <p>Replace the faulty components and restore the rightening torques</p>

GEARBOX

SPECIAL SERVICE TOOLS

Tool number	Tool name	Page ref.
A.2.0075	Support for jacking up car 	13-6
A.2.0267	Dummy rods for striking rod balls and speed engagement detent balls. 	13-13
A.2.0268	Spacer for removing De Dion axle 	13-6
A.2.0349-0100	Half-ring support plate for disassembling ring nut and inner race of pinion shaft bearing (to be used with A.2.0401 and A.2.0402) 	13-20
A2.0401	Half-rings for removing inner race of pinion shaft rear bearing - (to be used with A.2.0349/0100) 	13-20
A.2.0402	Half-rings for removing ring nut of pinion shaft rear bearing - (to be used with A.2.0349-0100) 	13-20
A.3.0192	Puller-driver for outer race of pinion shaft bearing on intermediate flange (Solutions with intermediate roller/ball bearings) 	13-22 13-27
A.3.0343	Driver for main shaft oil seal ring 	13-33
A.3.0346	Driver for pinion shaft bush 	13-32

GEARBOX

Tool number	Tool name	Page ref.
A.3.0361	Puller for inner race of main shaft rear bearing 	13-20
A.3.0407	Puller-driver for outer race of pinion shaft intermediate bearing (Solution with intermediate skew ball bearings) 	13-21 13-26
A.3.0408	Puller-driver for outer race of pinion shaft intermediate bearing (Solution with intermediate skew ball bearings) 	13-21 13-26
A.3.0532	Driver for bush of speed selection and engagement rod. 	13-32
A.3.0596	Puller-driver for outer race of main shaft bearing on intermediate flange (Solution with intermediate roller/ball bearings) 	13-22 13-27
A.4.0145	Support of gauge for determining pinion shim (to be used with C.6.0166) 	13-18 13-29
A.5.0181	Wrench, 30 mm. for main shaft nut 	13-18 13-29
A.5.0216	Spanner for plug of speed control rod ball 	13-14 13-15
C.6.0166	Reference gauge for determining pinion shim (to be used with A.4.0145) 	13-18