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D2.01 DISMANTLING

This paragraph describes the dismantling procedure of the entire gearbox-differential unit from the car. This procedure is necessary in case of overhaul or complete replacement of the gearbox or in case of repair work that cannot be carried out with the gearbox installed in the car.

NOTES

The procedure and the figures refer to the disassembly of a electronically controlled gearbox. The disassembly procedure for a mechanically controlled gearbox is similar, for this reason only the differences are illustrated.

Procedures

The gearbox-differential unit must be lifted from the engine compartment. To carry out this procedure it is necessary to use a movable hydraulic hoist or a bridge crane with **200 kg** minimum capacity and two safety belts to sling the unit.

IMPORTANT

Before starting procedures within the engine compartment, adequately protect all the polished surfaces of the car body and chassis.

- Drain the engine oil (A 3.01).
- Remove:

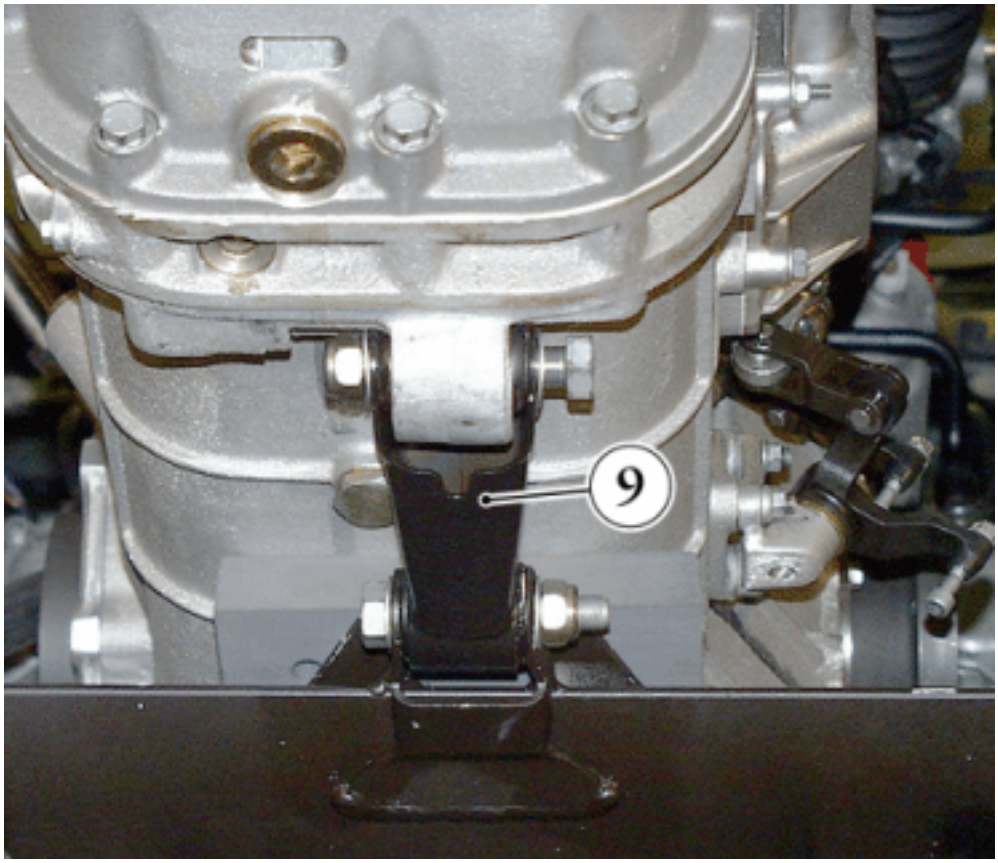
  - the engine compartment boot (M 2.01);

  - the side protection guards of the engine compartment (M 2.13);

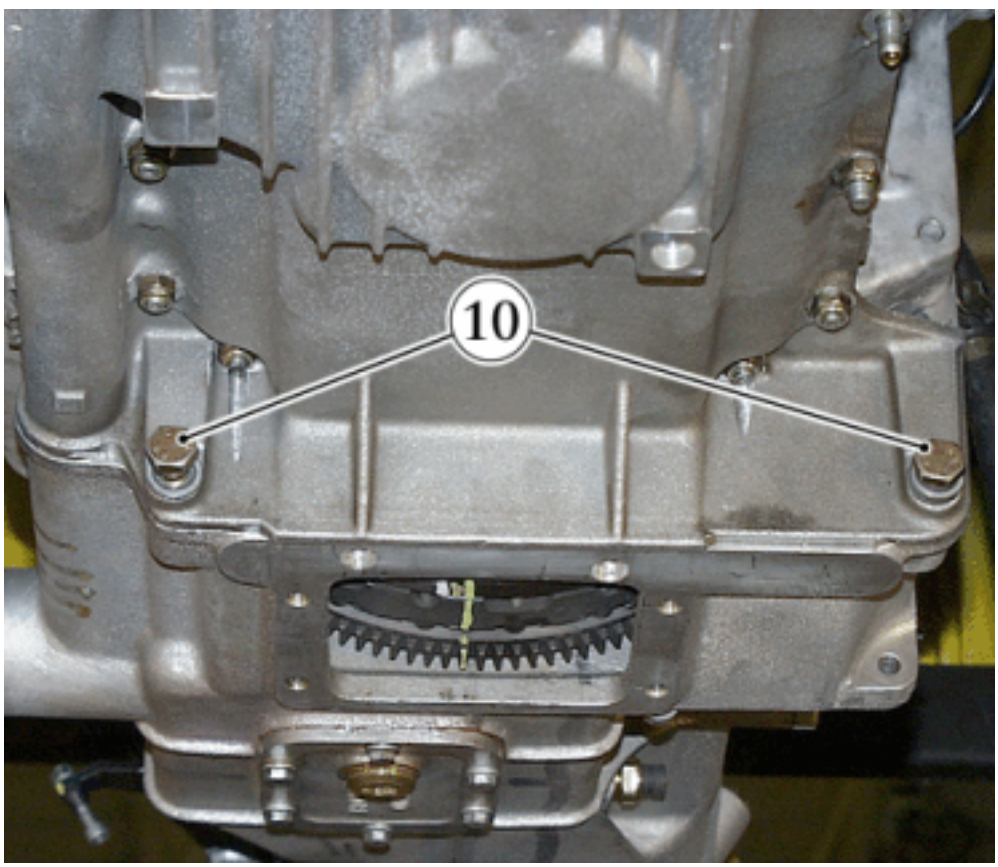
- the complete soft top unit (N 2.01);

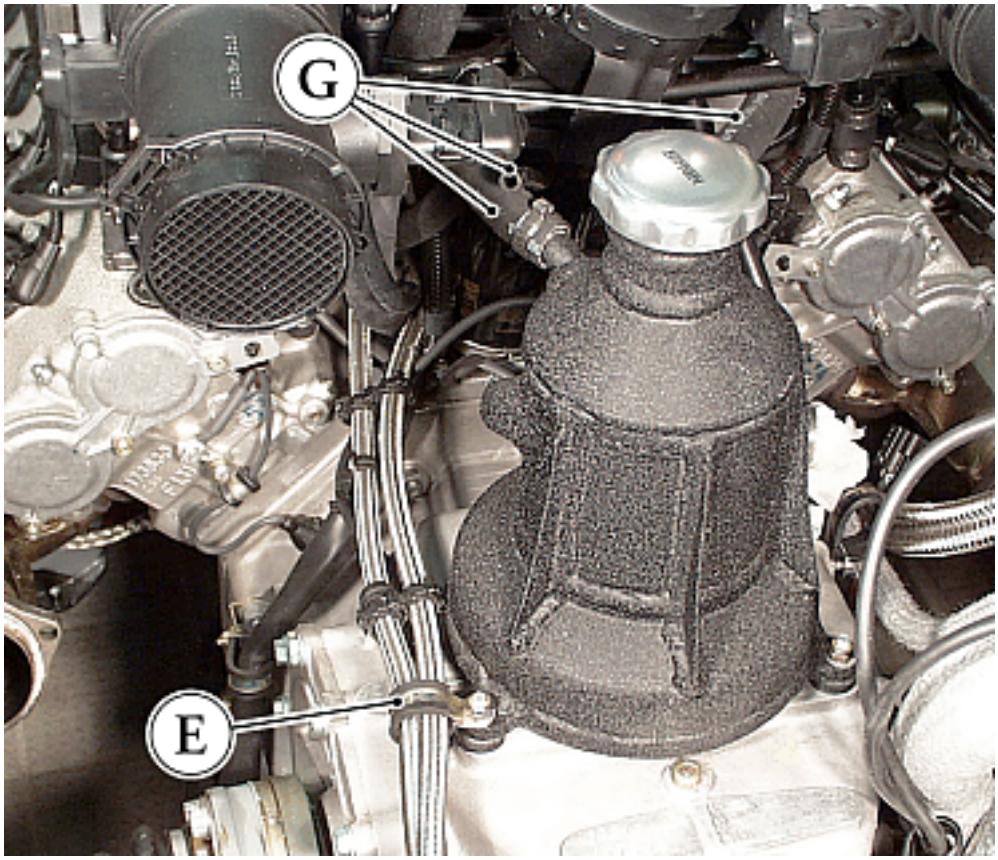
IMPORTANT

***FROM the vehicle Ass. No. 41464**, the gearbox-differential unit can be removed without having to lift the top unit. This is possible because the new top housing bays are equipped with openings which provide access to the fastening screws of the side frame supporting the gearbox. Such screws can therefore be removed without lifting the top.*

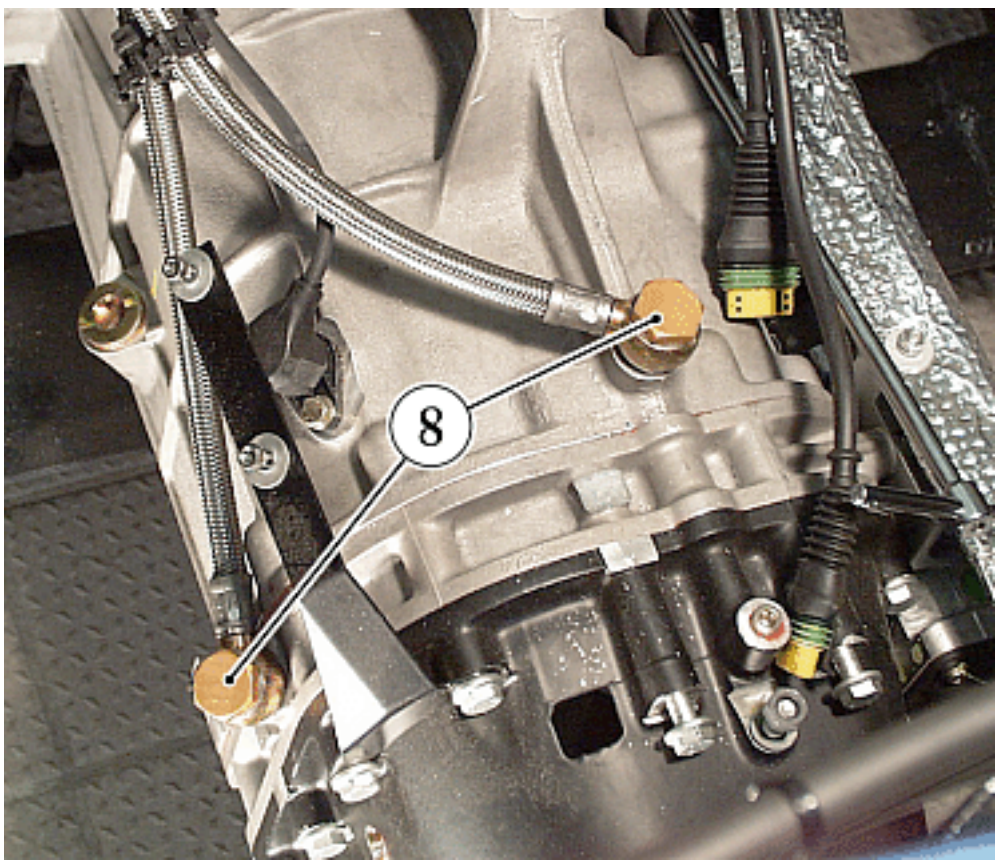


• In the lower part of the engine, unscrew the screws **(10)** fastening the lower part of the gearbox to the engine.





- Re-assemble the oil coolant pipes onto the gearbox, re-utilizing the original gaskets and locking the unions (**8**) to the prescribed torque.



- Unscrew and remove the eight screws fastening the flywheel to the crankshaft.
- Remove the washer **(3)** and the flywheel together with the toothed wheel.
- Detach the toothed wheel from the flywheel.

Check the work surface of the clutch disk on the flywheel. No grooves or deformations should appear. Check the flatness of the surface.

If the flywheel requires grinding, stick to the prescribed values (D 1.01).

- During re-assembly, the flywheel and the washer **(3)** may be mounted in a single position since the screw **(4)**, positioned with the yellow mark on the flywheel, is offset with respect to the others.

IMPORTANT

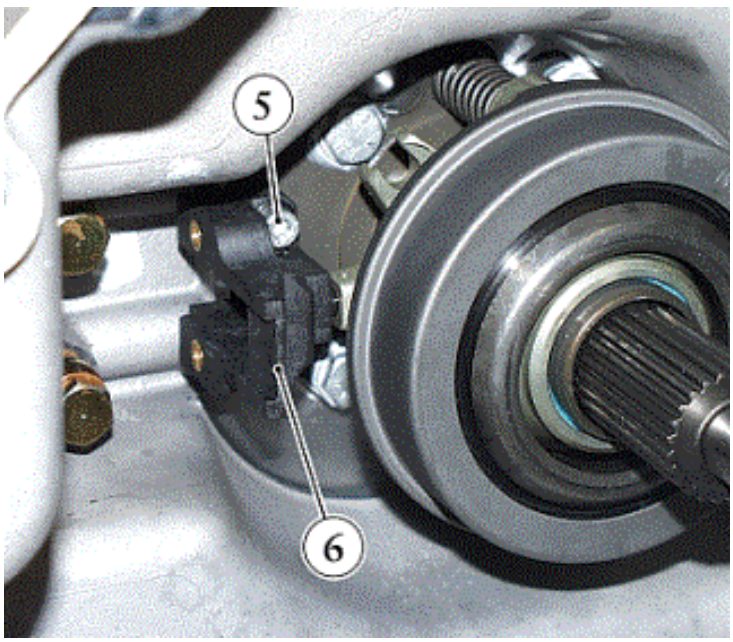
Always use new screws and washers every time the unit is refitted.

- Lock the engine rotation and tighten the flywheel screws to the prescribed torque.

Thrust bearing unit parts for clutch and pipes

- Unscrew the two screws **(5)** fastening the guide support **(6)** and remove the latter from the flange.

To prevent problems during the clutch position resetting stage, **FROM Ass.ly No. 50345** a guide mount **(6)** has been introduced. This has a longer housing slot for the anti-rotation pin (increased from 27.8 to 33 mm).



Notes for "F1" gearbox

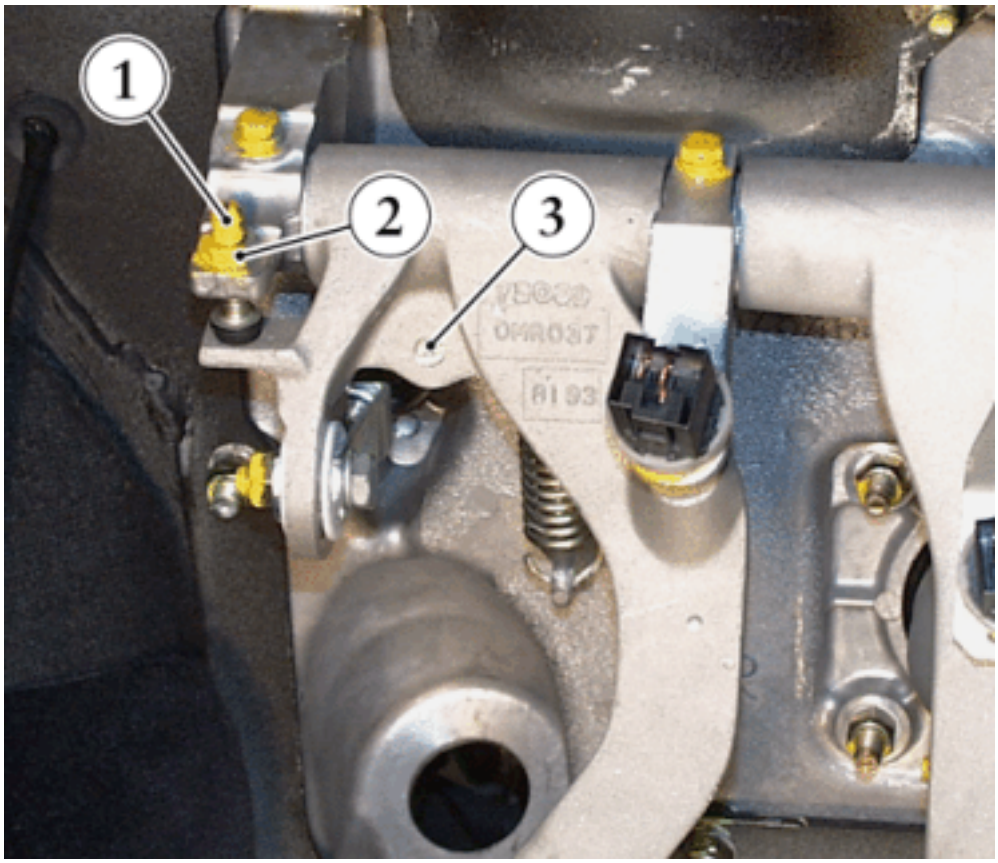
In **"F1"** gearboxes the bracket **(6)** supports the clutch position sensor (D 6.08).

The bearing guide function is made of two stud bolts **(16)** which also contribute to fastening the bearing holder flange.

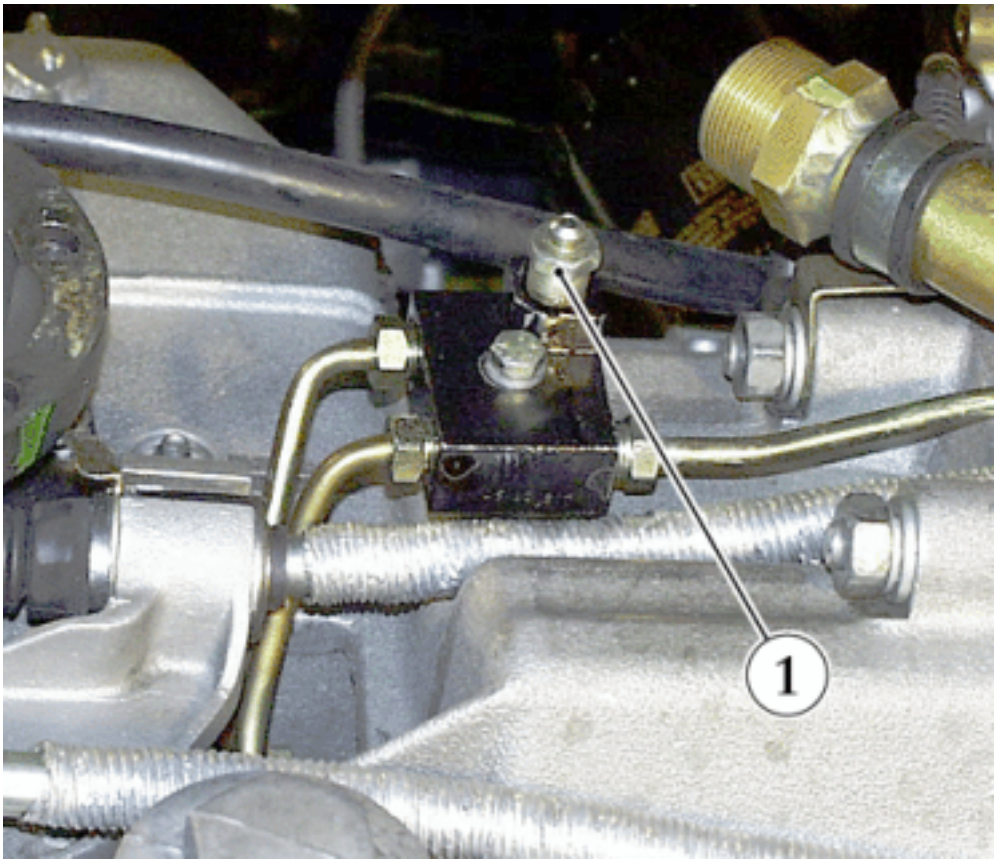
To prevent problems during the clutch position resetting stage, **FROM Ass.ly No. 53232** a stud bolt **(16)** with a longer shaft has been introduced.

to adjust the pedal into the resting position, in order to align it with the brake pedal. Proceed as described.

- Loosen the lock-nut (**2**) and unscrew the adjusting screw (**1**).



- Loosen the lock-nut (**B**) and turn the pump adjusting screw (**A**) until the pedal is properly positioned.

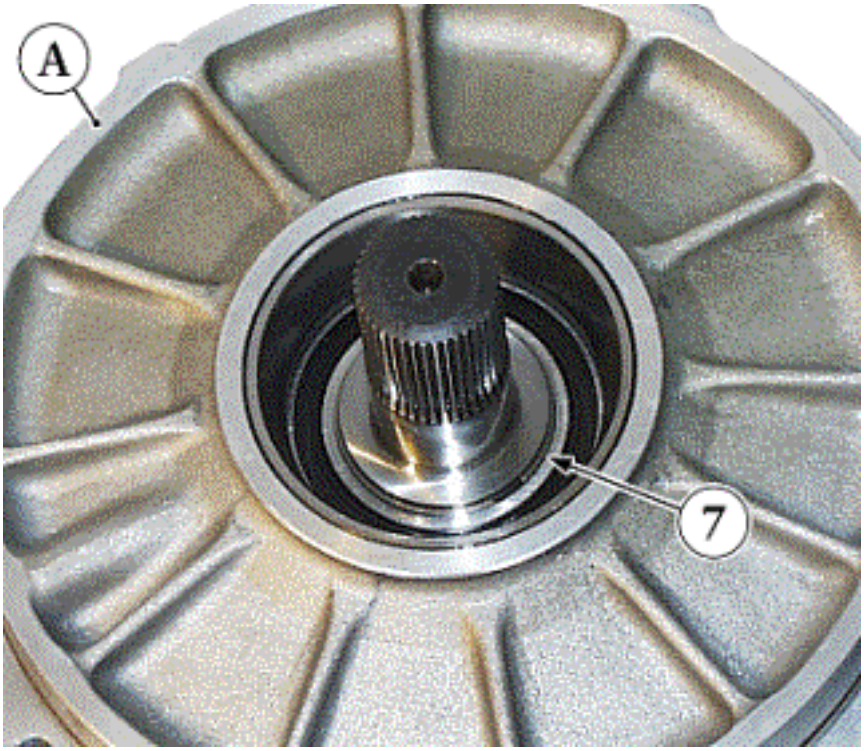


- Press the clutch pedal and simultaneously unscrew the bleeding union; carry out the necessary number of cycles until only fluid comes out of the pipe, without air bubbles.
- Tighten the bleeding union to the prescribed torque and re-assemble the protection plug.
- Fill-up the fluid in the tank to the **"MAX"** level.
- Re-assemble the parts removed during the procedure.

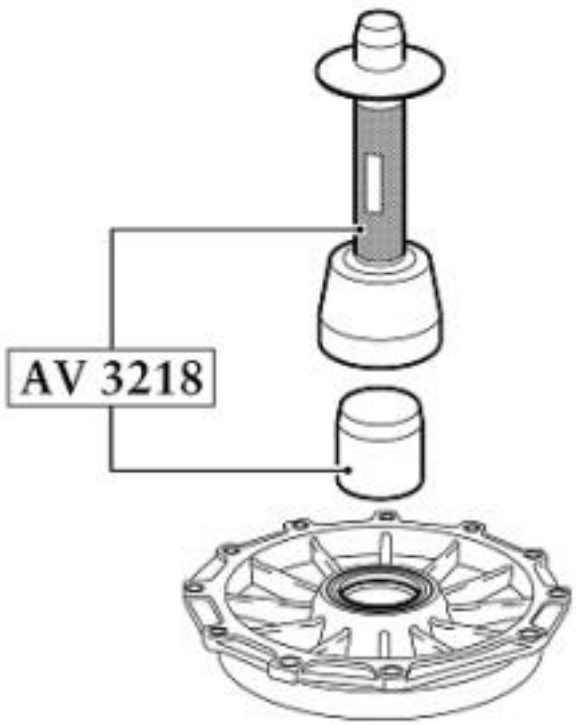
Electronically Controlled gerabox

Clutch Draining

In the system, as well as the union **(1)** on the gearbox (see mechanical gearbox), there is also a second union **(2)** on the block for the clutch pipe rapid coupling, located in position with the right-hand rear fastening point of the gearbox support frame.



- Position the grommet with its closed side facing outwards and, reusing the **AV 3218** punch, bring it flush with the cover.

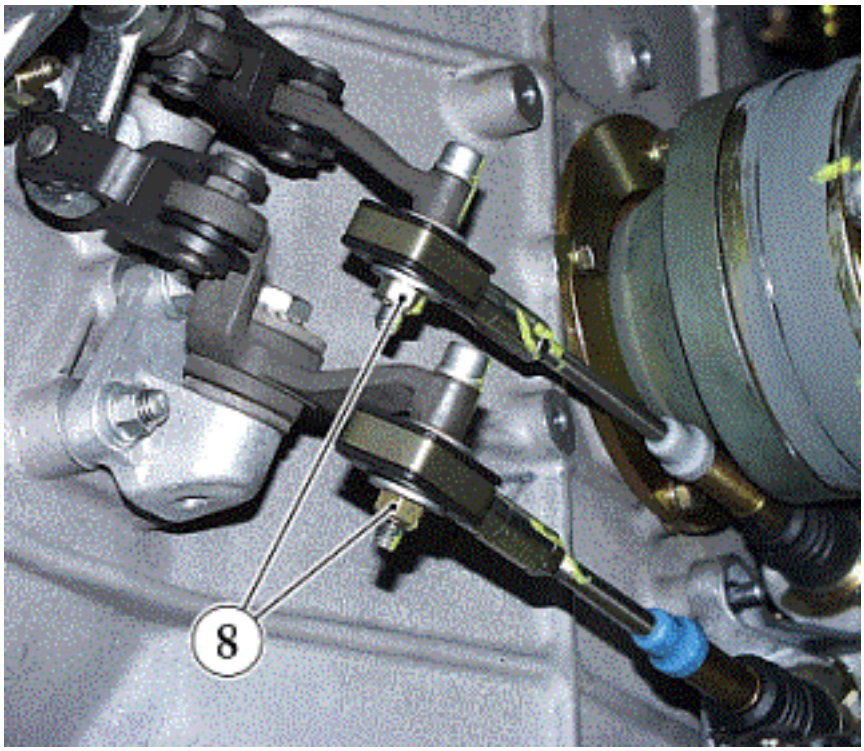


- Grease the flange pin with gearbox oil, then mount the differential cover **(A)** onto the flange shaft
- Rest the inner ring of the differential lid's **(A)** bearing on the base of the **(a) AV**

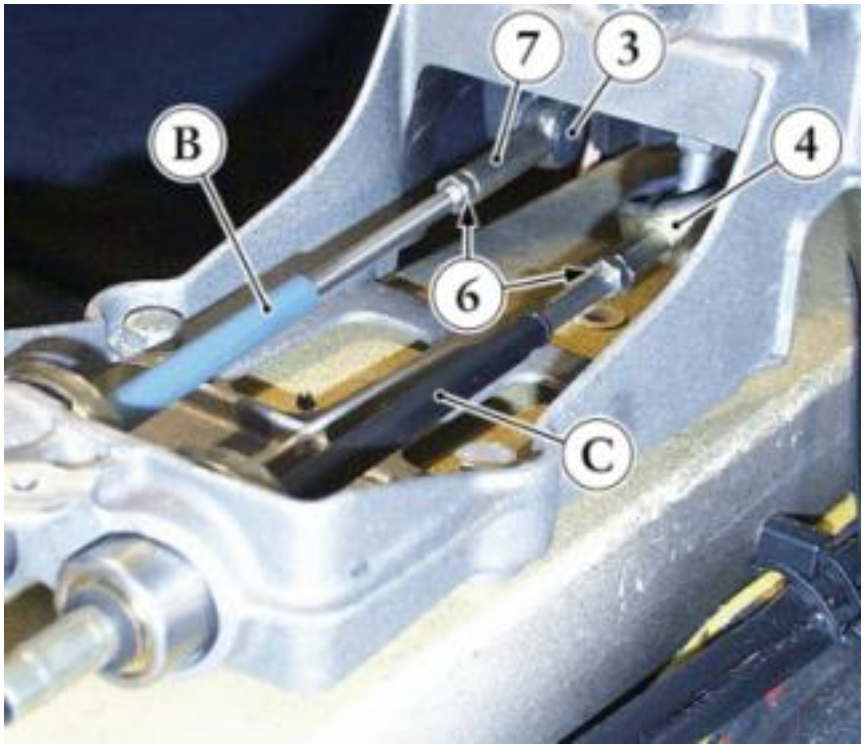
Gearshift selection levers (Mechanically controlled gearbox)

In case of excessive end float of the gear-shift selection levers on the respective pivots, it is possible to replace the levers which are supplied as spare parts complete with roller bearings.

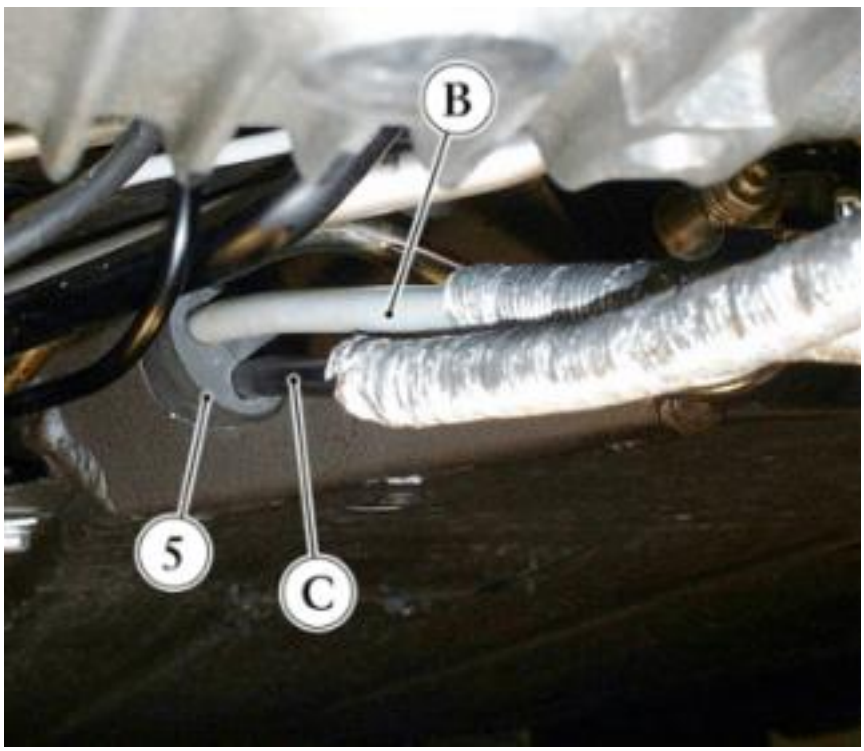
- To gain access to the levers it is necessary to remove the rear part of the underfloor (M2.12).
- Remove the joints of the control cables from the levers, unscrewing the nuts **(8)** on the fulcrum screws.



- Remove the seeger ring on the pivots **(9)** and remove the connecting rods from the gear-shift selection and engagement levers.
- Unscrew the screw **(10)** and slide off the lever with all the support parts.



• Working from under the car, make sure that the cable hitch **(5)** is correctly positioned on the chassis and lay the cables next to the propeller, avoiding intertwining.



• Connect the cable joints to the levers on the right-hand side of the gearbox, making sure that the cable with the protection **(B, light blue)** is connected to the lower selection lever.

D4.04 DETACHING/RE-FITTING THE GEARBOX SUPPORT MOVABLE FRAME





Tightening torques

Screws for fastening frame to chassis	**28,5 Nm**
Screws for fastening frame to gearbox	**98 Nm**
Screw fastening the cross member to the frame	**9,8 Nm**

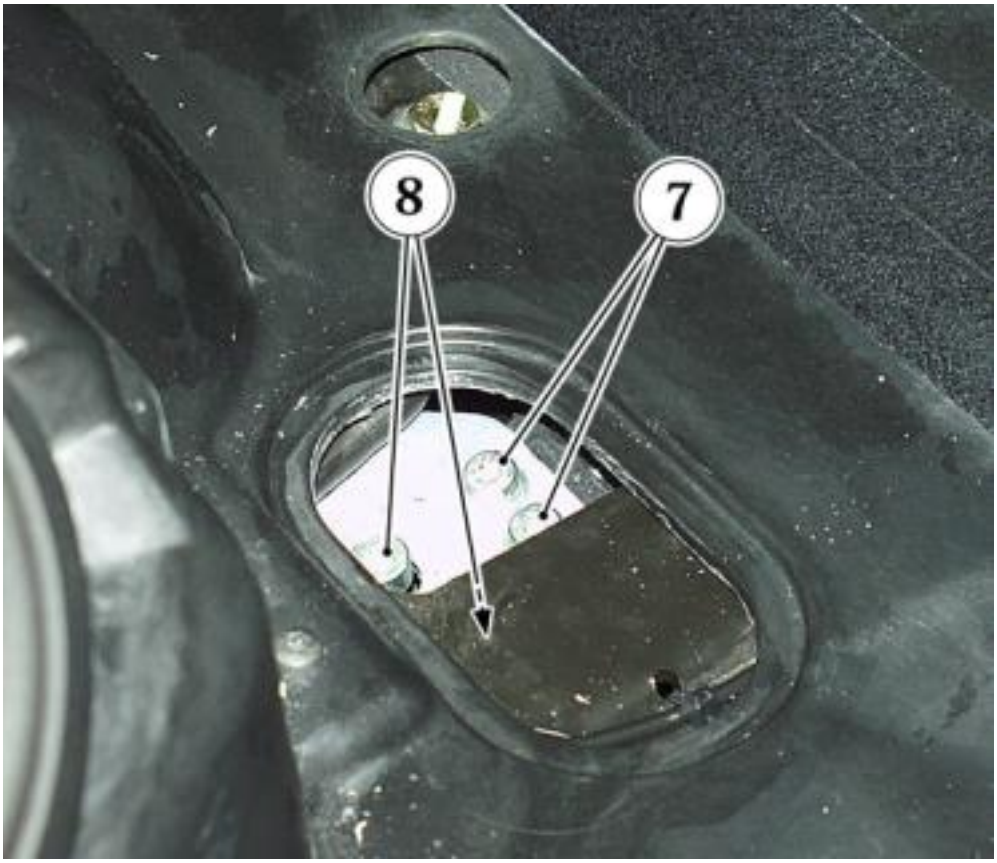
Detaching the frame

- Remove the rear part of the underfloor (M 2.12);
- Remove the engine compartment side guards (M 2.13);
- Remove the coolant expansion tank (B 5.05) leaving it connected to the system.
- Remove the air intake way (B 7.03).
- Remove the complete soft top unit (N 2.01).

IMPORTANT

FROM the vehicle Ass. No. 41464*, the movable side frame which supports the gearbox can be removed without having to lift the top unit. This is possible because the new top housing bays are equipped with openings which provide access to the side frame's front fastening screws. Such screws can therefore be removed without lifting the top.*

- Detach the pipes**(1)**which connect the vacuum tank to the chambers and to the solenoid valves for the pneumatic actuation system from the movable frame.



- Remove the movable frame from the engine compartment.

Re-attaching the frame

- Position the movable frame on the gearbox, making it rest on the frame supports.
- Secure the movable frame inserting the fastening screws **(5)**, **(7)** and **(8)**.

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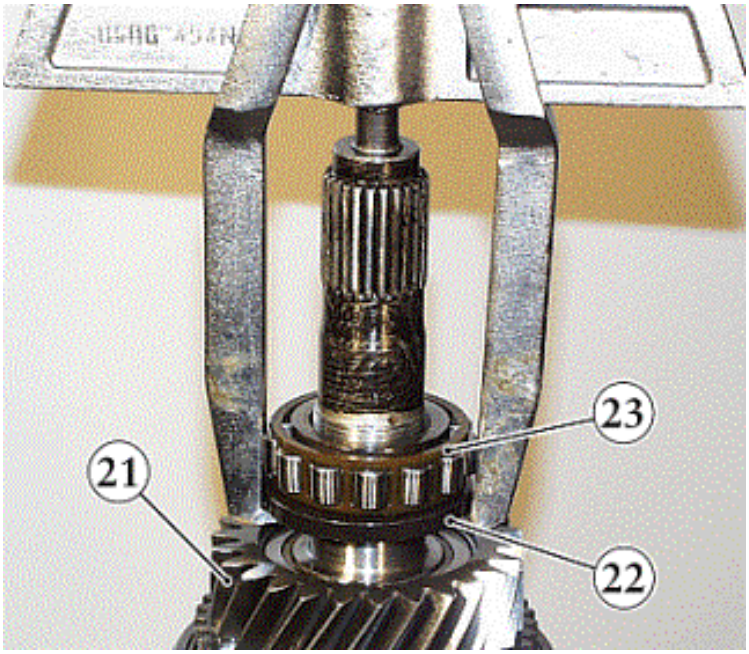


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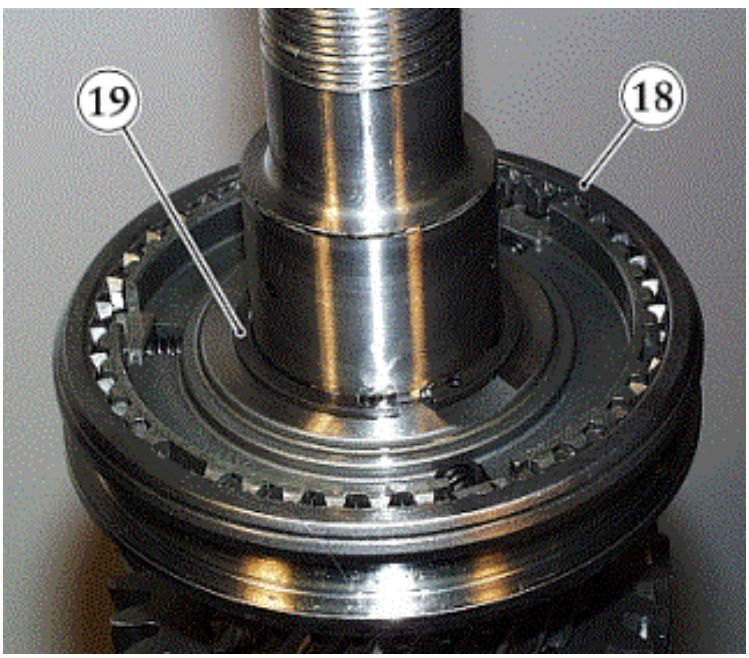
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1 Gearbox housing
2 Intermediate plate
3 Rear Cover
4 Retaining plate for plate bearings
5 Main shaft rear nut
6 Reverse drive gear
7 Main shaft ball bearing
8 Main shaft
9 Complete 5th speed gear
10 Roller cage
11 Complete 5th -6th speed double contact synchroniser
12 Flexible ring
13 6th speed gear spacer
14 Complete 6th speed gear
15 3rd- 6th speed gear shoulder ring nut
16 Roller cage
17 Complete 3rd speed gear
18 Complete 3rd -4th speed double contact synchroniser
19 Flexible ring
20 Roller cage
21 Complete 4th speed gear
22 Support washer
23 Main shaft roller bearing
24 Main shaft front ring nut
25 Front tapered roller bearing
26 Spacer for bearings
27 Rear tapered roller bearing
28 Spacer for bushing
29 Bearing holder bushing
30 Lay shaft ring nut
31 3rd-4th speed double gear
32 5th-6th speed double gear
33 2nd speed gear shoulder ring
34 Complete 2nd speed gear
35 Flexible ring
36 Complete 1st- 2nd speed triple contact synchroniser
37 1st speed gear bushing
38 Roller cage
39 Complete 1st speed gear
40 1st speed gear shoulder wheel
41 Lay shaft rear roller bearing

- Remove the race with bearing's rollers **(23)** and the **4th** gear speed support washer **(22)**.
- Detach the **4th** gear speed **(21)** and the roller cage **(20)** from the main shaft.



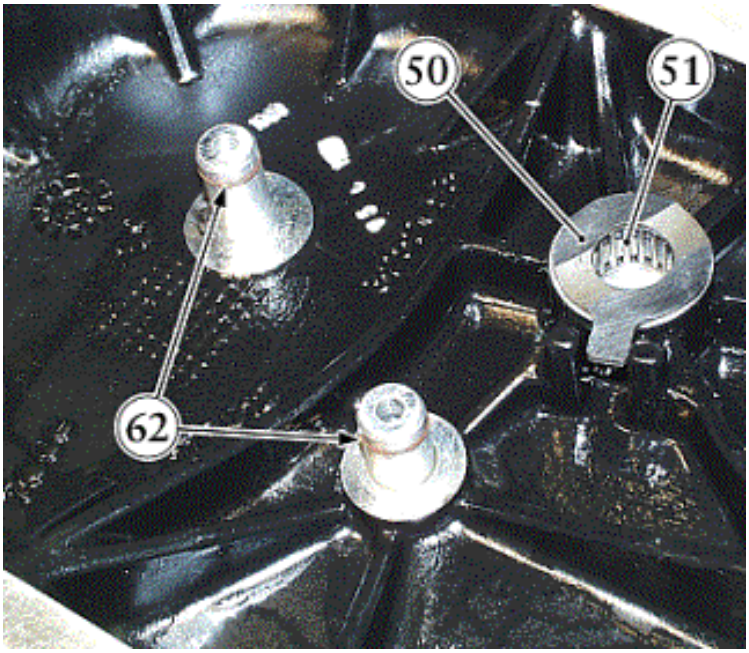
- Remove the flexible ring **(19)** and detach the sliding sleeve as well as the **3rd -4th** speed synchroniser components **(18)**.



- Insert the arms of extracting tool **AV 3272** in the hub wedge seats and detach the complete **3rd - 4th** speed synchroniser **(18)** and the **3rd** gear speed **(17)**..

IMPORTANT

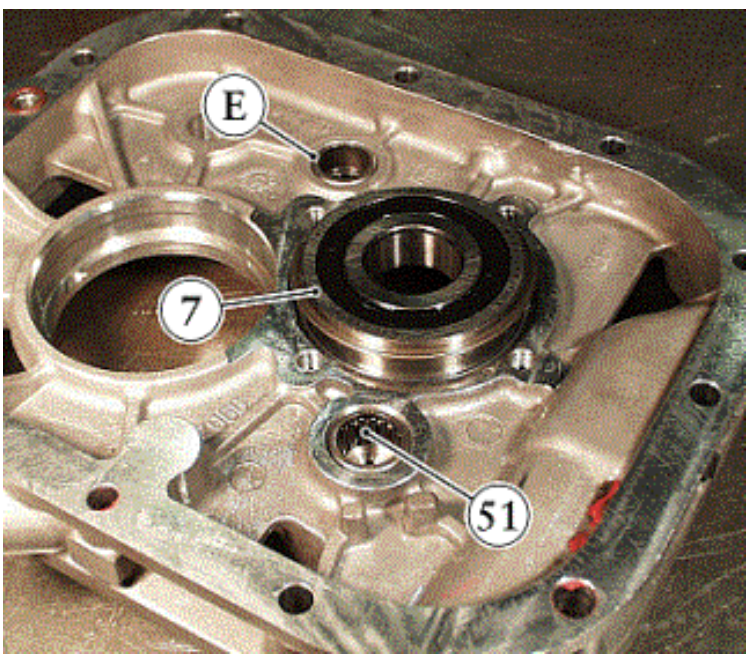
*Avoid letting the extracting tool arms grip under the toothing of the synchroniser or under the **3rd** speed gear.*



Intermediate plate

Once the bearing retaining plate **(4)** has been removed, it is possible to extract the tapered bearing **(7)**. Use the **AV 3264** punch for removing and fitting the bearing. The bearing has a ledge to help obtain the correct position on the plate.
A roller casing **(51)**, identical to the one on the rear cover, is installed in position with the oil pump on the intermediate plate, along with a ball bushing **(E)** for the fork support rod, which is identical to the one fitted inside the gearbox housing.

- Use the bushing extractor **USAG 468S11** to remove said components.



- To extract the outer race **(G)** of the roller bearing **(41),** work from the oil pump side using a punch, and utilising the specific notches machined on the plate. Work with great care to avoid damaging the seat.

Lubrication of the crown and pinion takes place by suction of the oil from the bottom of the housing and through a nozzle **(54)** which aims the oil jet directly on the crown toothing.
A sheet **(Q)** is inserted in position with the ducts connecting the differential compartment with the one housing the gear shafts. This partially obstructs the said ducts and therefore prevents the oil from draining too quickly.

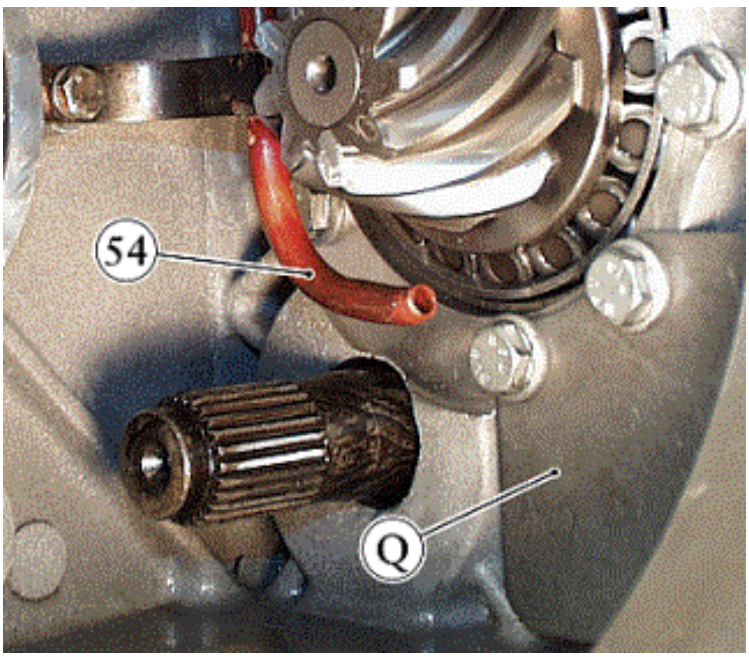
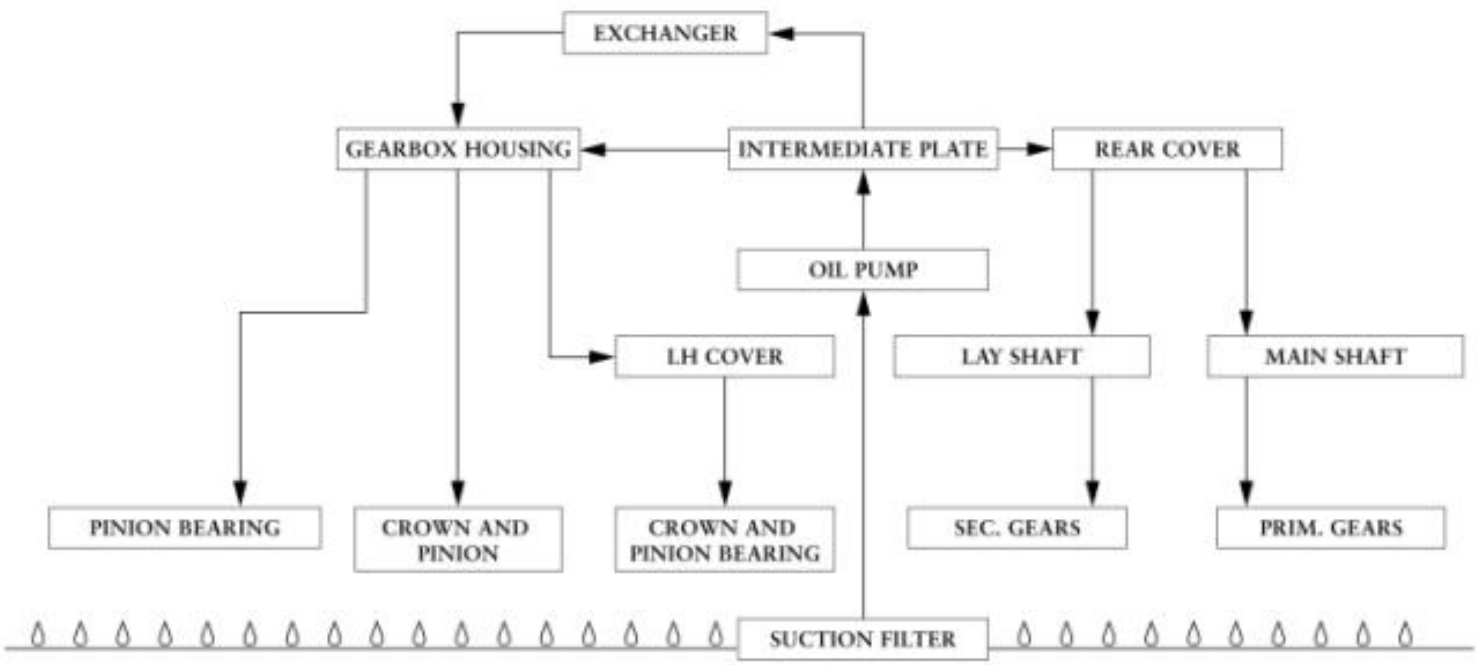
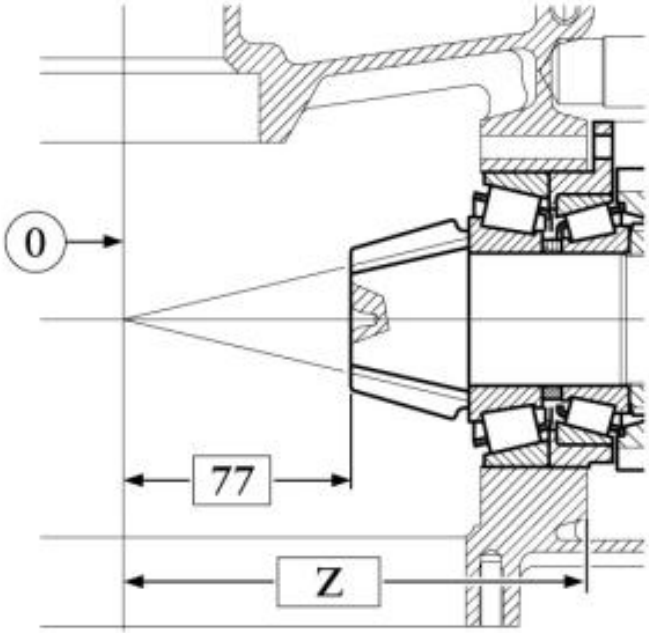


Fig. 7 illustrates the gear lubrication circuit.

Fig. 7





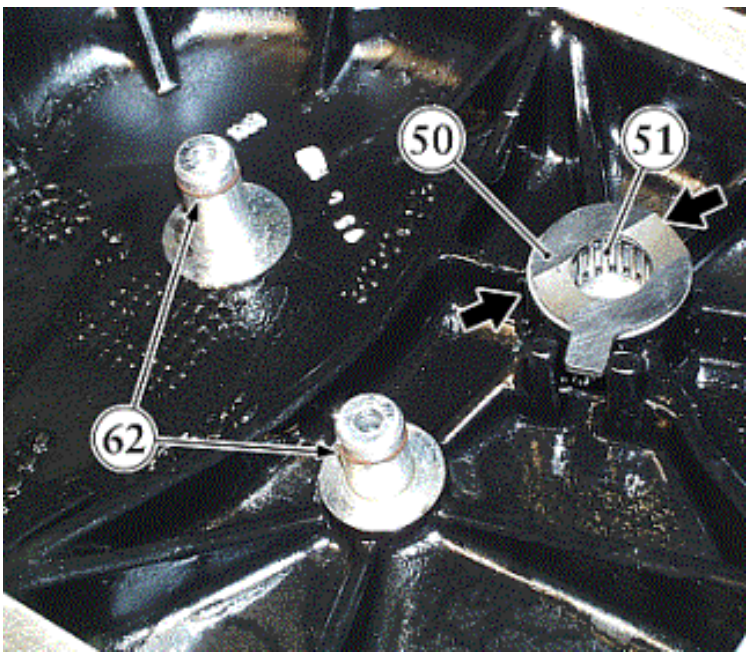
- Clean and degrease the surface of the lay shaft and the inner surface of the double gears **(31** and **32)**.

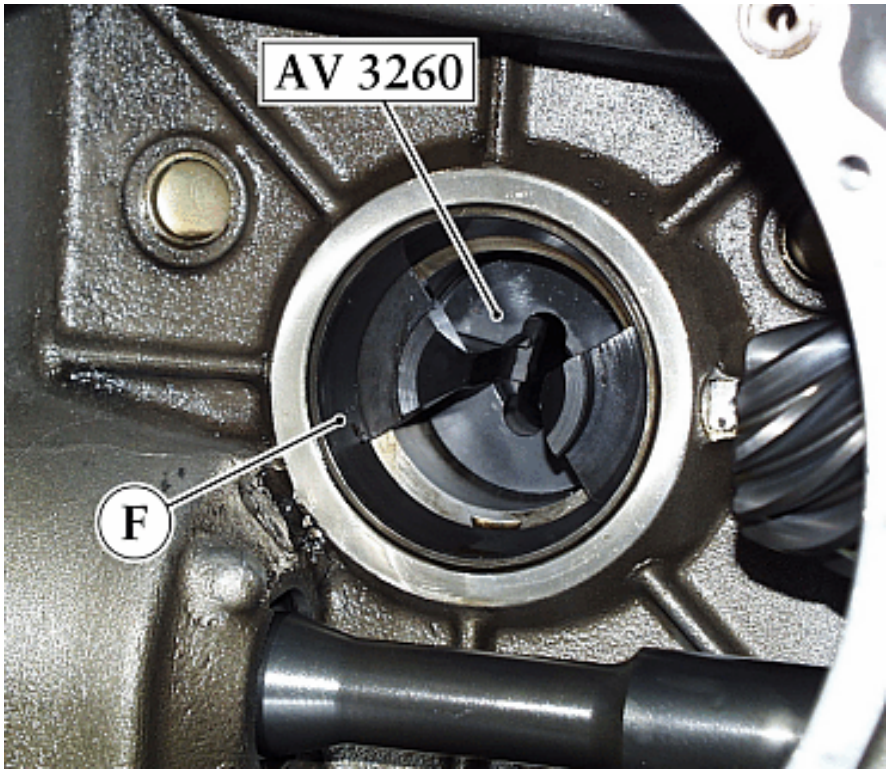
IMPORTANT

*Put the two gears in the oven, in the correct assembly position, and leave them for at least two hours at a temperature of **140°C**.*

- Position the pinion on the base **AV3255 (a)** and use a tubular punch **(b)** to fit the **3rd – 4th** speed double gear. Rest the newly formed assembly on the surface of the press and align it with the thrust axle before fitting the first gear **(31)**.
- Leave it on load **(10.000 kg)** for at least **15 minutes** and let the shaft cool down.
- Mount the **5th – 6th** speed double gear **(32)** following the same procedure and using a tubular punch **(c).**

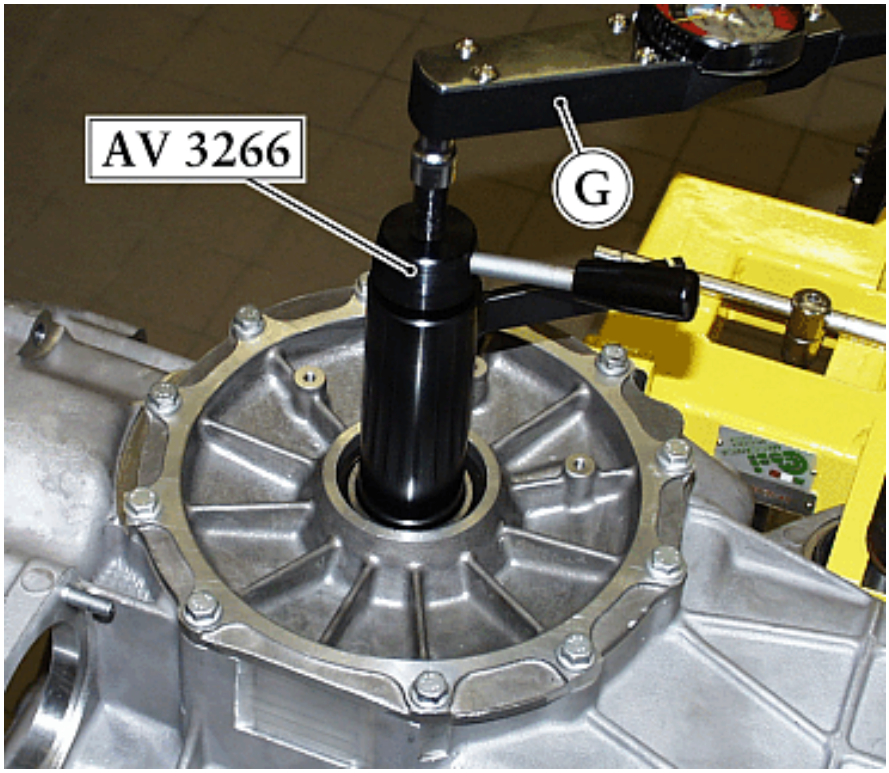
- Install the shoulder ring **(50)** on the roller casing **(51)** with its lubrication milling facing outwards and with its protrusion inserted between the plate clamps.
- Check that the second roller casing **(51)** and the new O-rings **(62)** are inserted on the rear cover.
- Grease the O-rings and the shoulder ring seat **(50)** on the cover, to keep it in position between the clamps during cover assembly. Make sure its lubrication milling is opposite the cover.
- Check that the centring dowels **(60)** and the new O-rings **(61)** are mounted on the plate before applying a strip of **CAF4 sealant** on the plate surface, as in the previous coupling.
- Mount the rear cover **(3)** on the plate **(2)**.
- Apply the recommended locking product on the fixing screws' threading and tighten them to the prescribed torque, working crosswise.
- Proceed by fitting the differential unit (D 5.01).





Calculating the spacer thickness

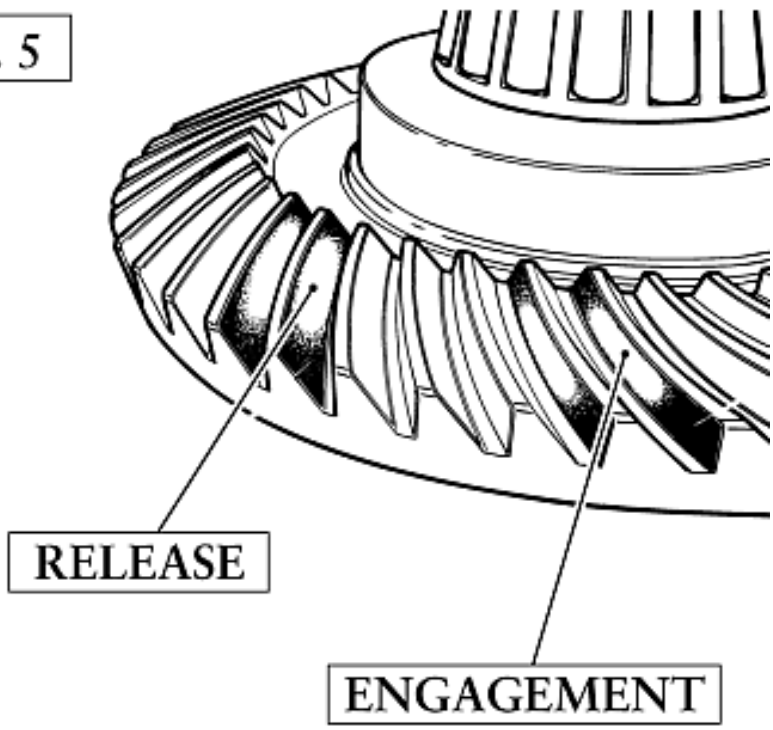
The value of the tapered roller bearing pre-load is essential for correct functioning and for crown wheel and pinion durability: this value is determined by the thickness of the shoulders **(7)** and **(12)**.
It is possible to fit new bearings reusing the original spacers and checking that the rolling torque and the backlash correspond with the specified values (D 1.01).
The procedure we are going to illustrate shows how to determine the thickness of the shoulders, taking as references the values **“R”** and **“S”** of the seats on the gearbox housing, compared to the theoretic value **(45,10 mm)** of the distance between the crown and pinion axle **“0”** (see Fig. **2**).



At this re-assembly stage, it is a good rule to check the contact impression of the pinion's toothing on the crown.

- Apply red lead paint to the crown and make the crown and pinion do some revolutions.
- Check that the impression on the crown corresponds to 3/4 of the tooth side, both on the tensioning side and on the releasing one (see Fig. **5**).

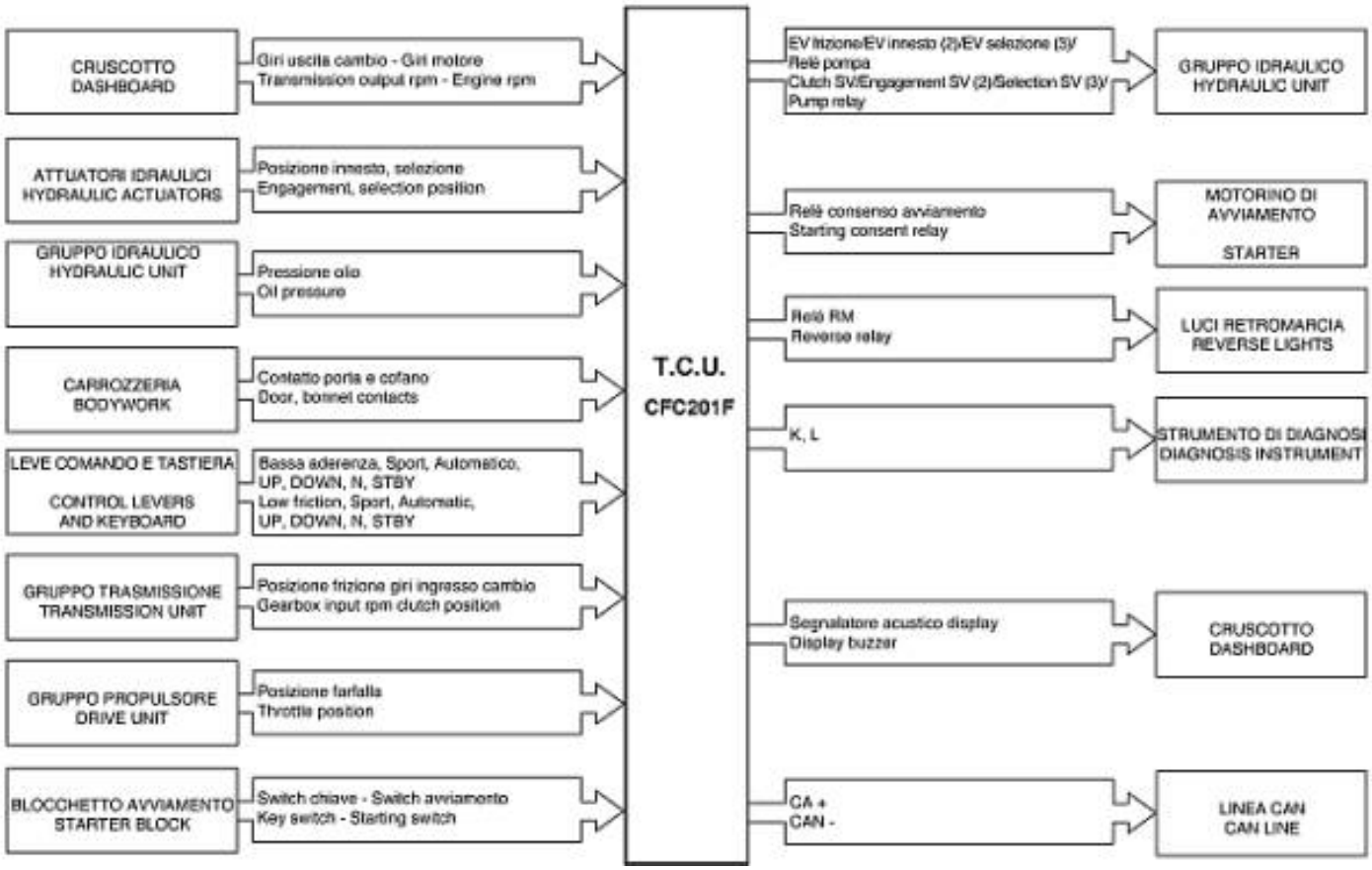
Fig. 5



The distance of the crown toothing's inner edge and the beginning of the impression should result between **5–8 mm**.

D6.03 TRANSMISSION CONTROL UNIT (TCU)

The TCU is designed to: (see block diagram)

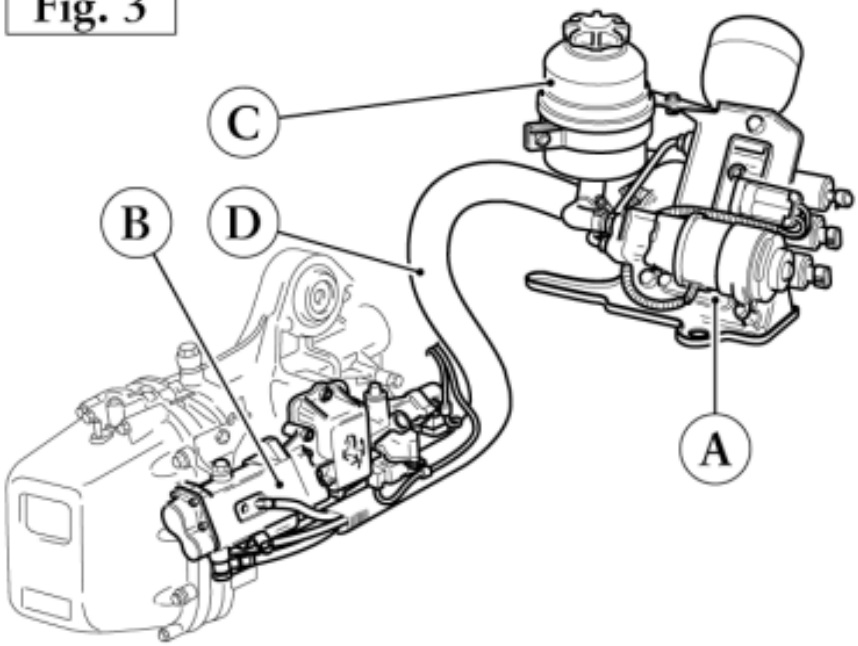


- acquire signals coming from sensors;
- interface with driver control device;
- interface with engine ECUs, drive control (ASR/MSR) and instrument panel;
- control the hydraulic sub-system.

The signals that TCU must receive concern:

- engine revolutions;
- primary transmission shaft speed;
- clutch actuator position;
- gear selection actuator position;
- gear engagement actuator position;
- key turned to **"running"**;
- driver door switch status;
- foot-brake pedal switch status;
- power unit oil pressure;
- CAN line signal (see block diagram);
- engine compartment lid on-off switch.

Fig. 3



- The Power Unit **(A)**, fixed to the rear right hand part of the chassis;
- The actuator unit **(B)**, fitted on the gearbox housing.

In the **hydraulic system** there are also:

- an annular actuator for clutch movement
- a tank for oil collection **(C)**;
- a set of lines **(D)** for hydraulic pressure use, linking the Power Unit to the gear and clutch actuators.

WARNING

In case of damage to pipes (after an accident, for egs.) that might have introduced foreign matters into the circuit, the Power Unit, the actuator and the respective pipes must be replaced.

Replacing the hydraulic lines

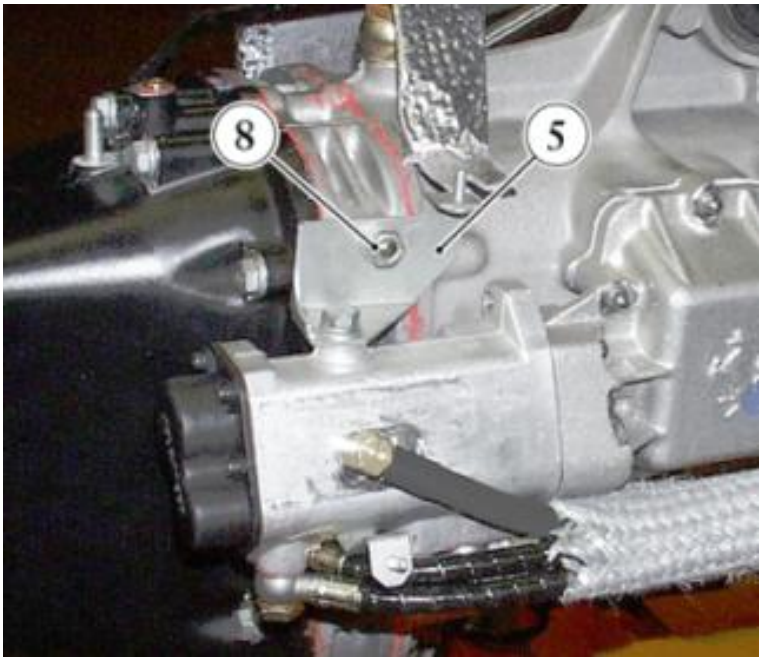
CAUTION

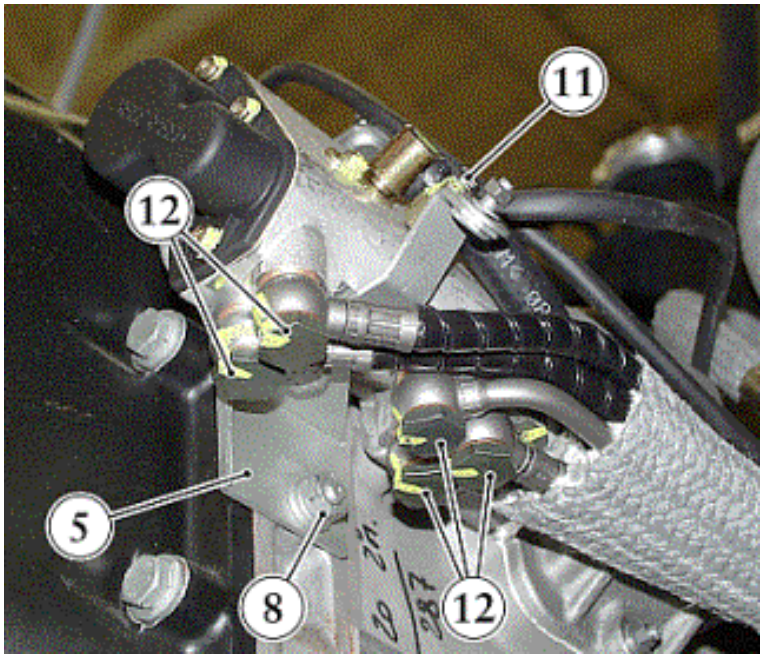
The hydraulic system contains high pressure oil.

NOTES

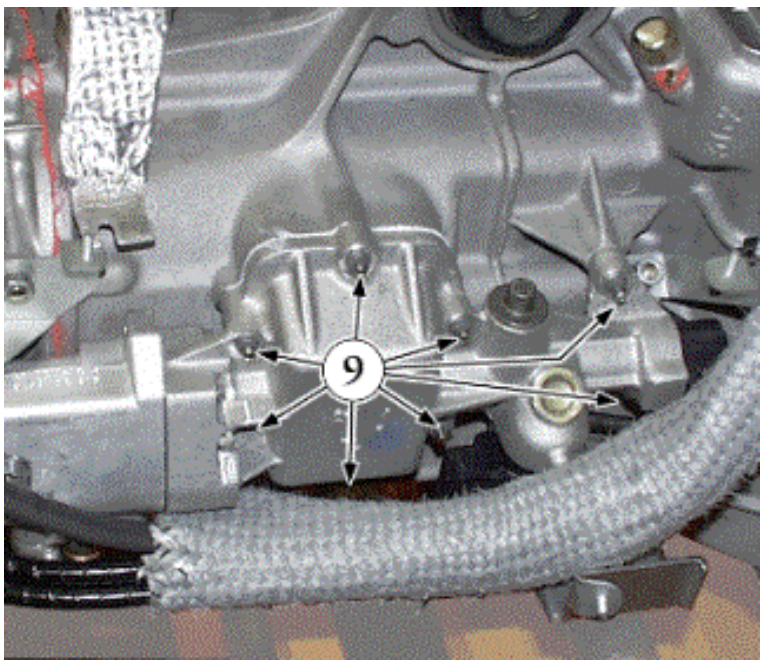
As draining must be carried out at the end of the procedures, it is necessary to remove the actuator from the gearbox housing D 6.07).

- Detach the tube from the Power Unit D 6.06) and from the actuator D 6.07) by removing the union pipes or, by loosening the pipe restraining clamp if the pipe is rubber.



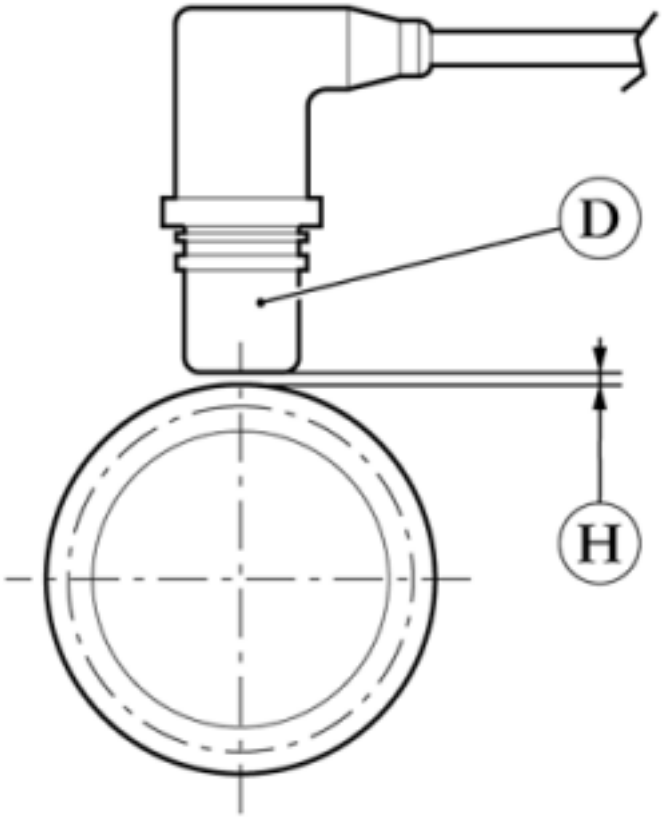


- Unscrew the nuts **(9)** and remove the actuator unit from the gearbox housing, hitting with a plastic hammer on the unit's coupling flange, to detach the unit fixed to the housing with dope during assembly.



Re-assembly

- Clean the actuator's and gearbox's coupling surfaces, to eliminate all traces of dope.
- Use **AREXONS 2144** dope on the actuator coupling flange and assemble the unit on the gearbox housing.
- Tighten the fastening nuts to the prescribed tightening torque.
- Re-assemble the actuator's holding-protection brackets **(4)** and **(5)**, fastening the nuts at the prescribed tightening torque.



Hydraulic Circuit Pressure Sensor (E)

This sensor is fitted on the Power Unit and has the following features:

- With the engine running and the car at rest, if the driver's door is opened without pressing the brake pedal, the gear is automatically disengaged and shifted to neutral.
- With the engine running and the car at rest, if the engine lid is opened without pressing the brake pedal, the gear is automatically disengaged and shifted to neutral.
- With the engine running and the car stopped, if a gear remains engaged for over **4 seconds** without operating on the brake or accelerator pedals, the gear is disengaged and shifted to neutral.
- With the engine running, car at rest and gear engaged, the gear is automatically disengaged and shifted to neutral after **10 minutes**, even if the brake pedal is pressed.
- In case of severe system failure, which would not ensure a safe driving of the car, the engine stop is requested if the vehicle is at a standstill or running at a speed below **15 km/h**.
- Only in the event of icy road-bed is it possible to request the **"low grip"** mode by pressing the relative push-button on the central console. Under these conditions, the clutch control is more gradual, pick-up is performed in second gear and the engine cannot be used if it exceeds **3100 rpm**. The latter function is controlled by the automatic gear-shifting which is automatically activated any time that said threshold is exceeded. In sixth gear instead, the engine can be used in its thorough operating range.

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