



The 01X manual gearbox complies with the necessary requirements for being used in the Exeo, thanks to its mechanical configuration and its simple maintenance.

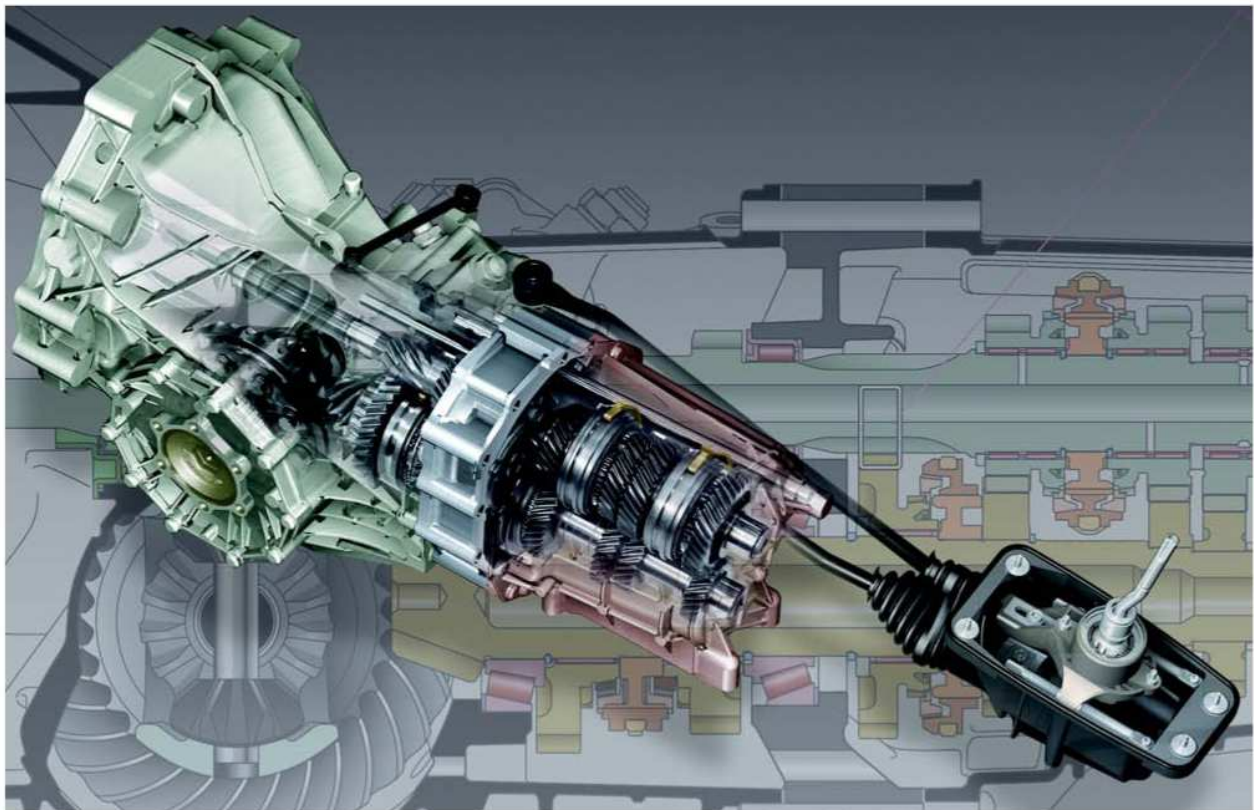
The main **requirements** of the gearbox are:

- To be destined to a front drive vehicle with a longitudinally placed frontal engine.
- To have numerous transmission ratios so that it can be combined with a wide range of petrol and diesel engines.
- To favour a controlled consumption and a low level of polluting emissions.
- To offer a good dynamic performance.
- To perfectly combine Comfort and Sportiness.

The **mechanical configuration** of the 01X manual gearbox has been developed in such a way that it is a determining component for compliance with the gearbox requirements . Mechanically, it features the following:

- Hydraulic activation clutch
- Three housings for all the internal components.
- Six synchronised gears.
- Two shafts on which all the pinions are fitted.

As for the **maintenance** of the 01X manual gearbox, it has been optimised in such a way that it is reduced to checking the oil level.



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**Note:** The exact instructions for checking, adjusting and repair are included in the ELSA application.

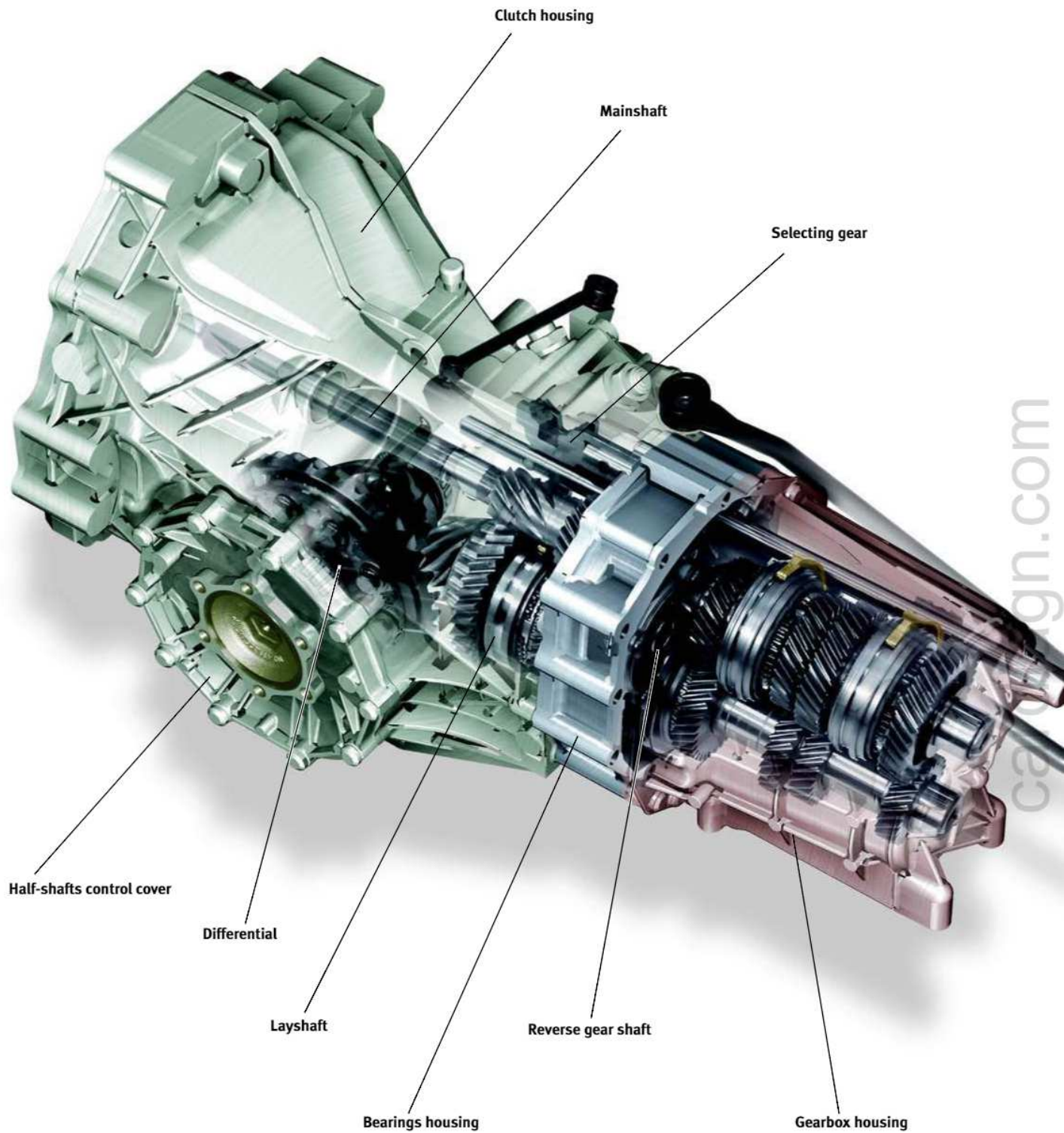
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## GENERAL ASPECTS



The 01X manual gearbox is fitted **longitudinally** in front drive **vehicles**, and is combined with an ample range of petrol and diesel engines from 75 kW up to 147 kW.

Such conditionings, position and engine ranges made it necessary to take up to four aspects into account when designing the gearbox.

- The gearbox attachment.
- The housings that make up the gearbox.
- The internal components.
- And the transmission ratios for each powertrain.

The gearbox has two **attachment points**: to the engine and to the tunnel crossbar.

The engine attachment is simple because the clutch housing has many drillings with which to compensate for the inclination angle of each family of engines.

It is attached to the tunnel crossbar by means of a **silentblock** fixed with screws to the rear of the gearbox.

The internal components of the gearbox are concealed in **three housings**: Clutch housing, Bearing housing and Gearbox housing

The **internal components** of the gearbox are grouped into five mechanisms: mainshaft, layshaft, reverse gear shaft, differential and rods.

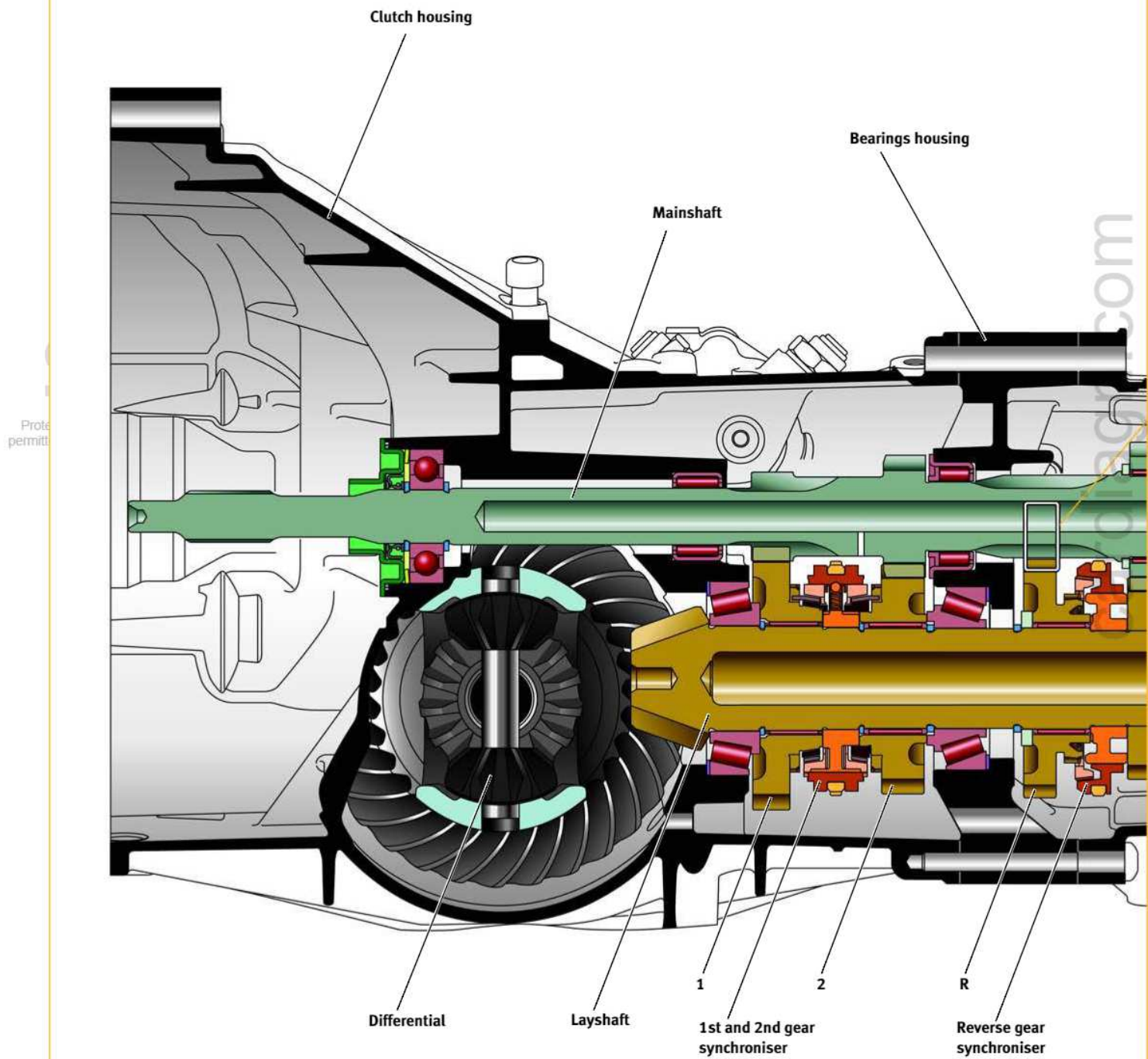
The 01X manual gearbox is manufactured with different **transmission ratios**, using one or another depending on the engine it is coupled to.

The gearbox transmission ratio is easily identified thanks to the designation letters machined on the top of the clutch housing. These data are absolutely necessary for replacing or adjusting the internal components.

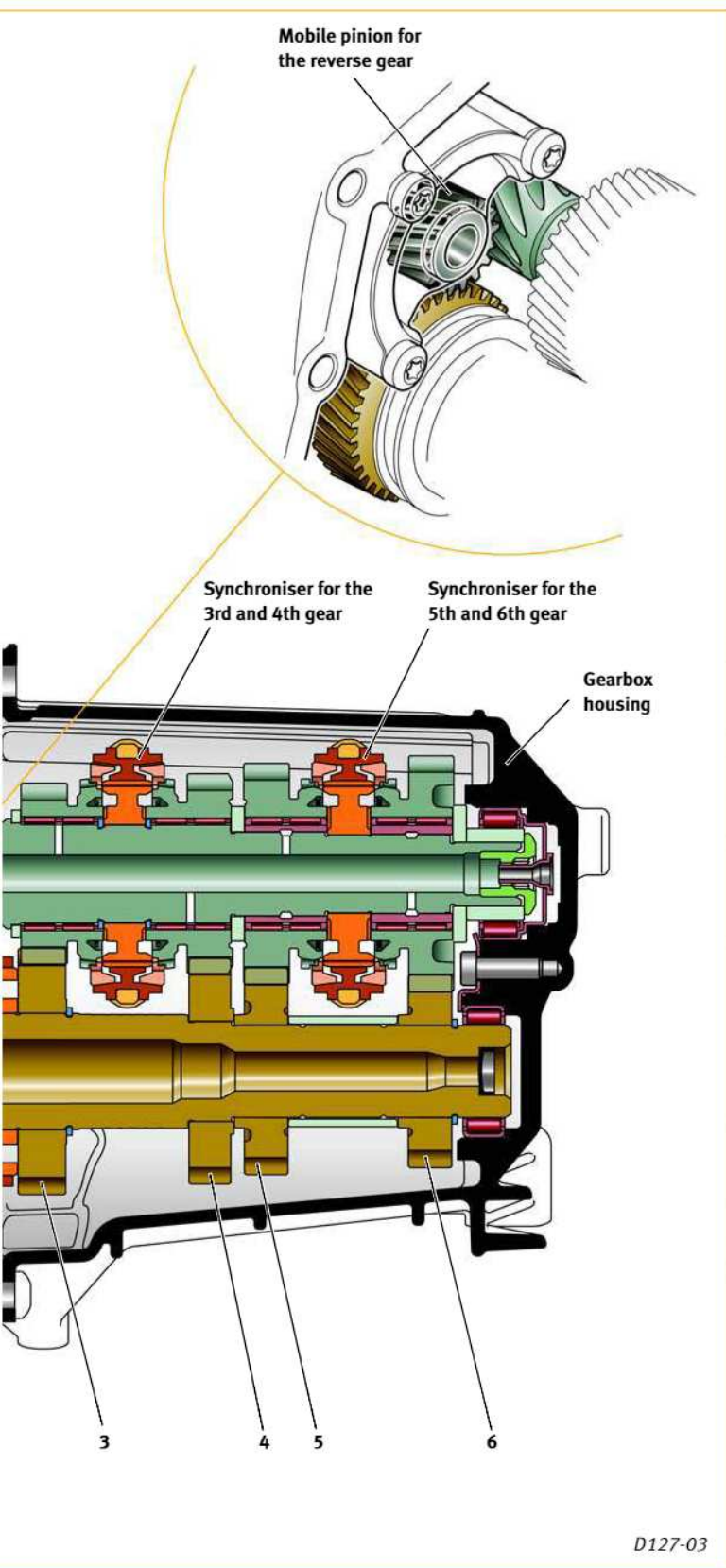
Shift lever

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# MECHANICAL CONFIGURATION







The most relevant features of the 01X manual gearbox mechanical configuration are:

- Operation based on the parallel pinions principle.
- All the gears are synchronised.
- The reverse gear pinion is fitted on its own shaft.
- The crown wheel and pinion set is hypoidal.
- The differential is screwed onto the crown.

The **parallel pinions** principle implies having two permanently engaged pinions. One of the pinions is fitted on the mainshaft and the other one on the layshaft.

On each couple, one of the pinions is a single assembly with the shaft and the other pinion rotates freely on its own shaft, under these conditions no torque is transferred. To transfer torque it is necessary for the mobile pinion to couple on its shaft, which is achieved by the appropriate synchroniser.

All the **gears** of the gearbox are **synchronised**. The synchronisers are spread out as follows:

- The 3rd., 4th., 5th. and 6th. gears synchronisers on the mainshaft.
- And, the 1st., 2nd. and reverse gear synchronisers on the layshaft

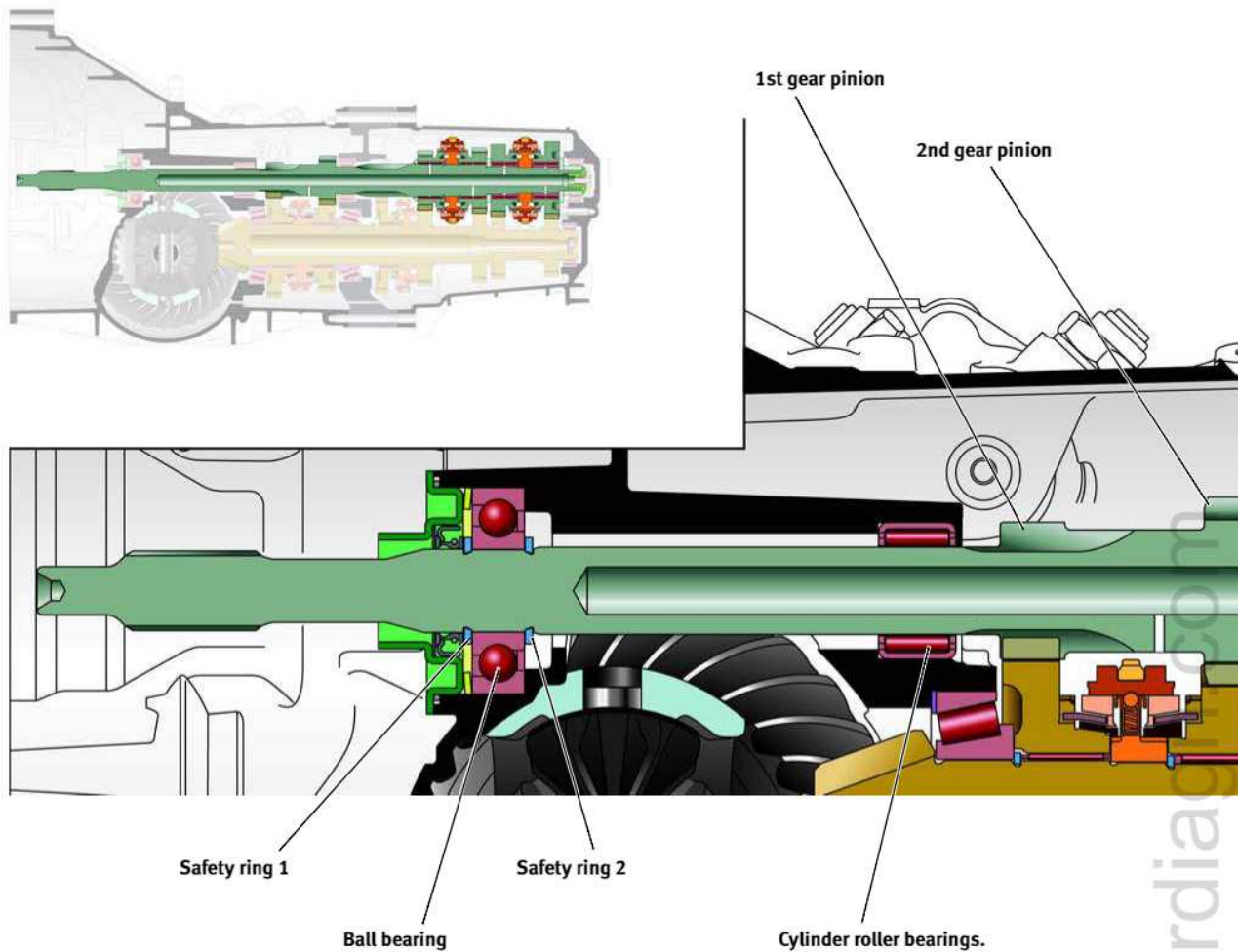
The **reverse gear pinion** is constantly free-wheeling against a mainshaft pinion and with a layshaft pinion. Its function is to reverse the layshaft direction of rotation without influencing the transmission ratio.

The **crown wheel and pinion set** is hypoidal, engaging takes place slightly below the line of the centre of the crown.

The **differential** compensates for the rotation revolutions of each wheel in curves.

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# INTERNAL COMPONENTS



## MAINSHAFT

The main shaft transfers motion and torque from the clutch to the inside of the gearbox.

The main characteristics of the input shaft are:

- It is partially hollow.
- It leans on four roller bearings.
- It has three pinions and three ribs machined on it.

- Four mobile pinions are fitted onto it.

- It has axial drillings.
- It requires adjustments.

The mainshaft is **partially hollow** to reduce masses in motion. It is only compact in the section between the clutch splines and the ball roller bearing.

The mainshaft leans on four **bearings**:

- One ball bearing and one cylinder roller bearing on the clutch housing.

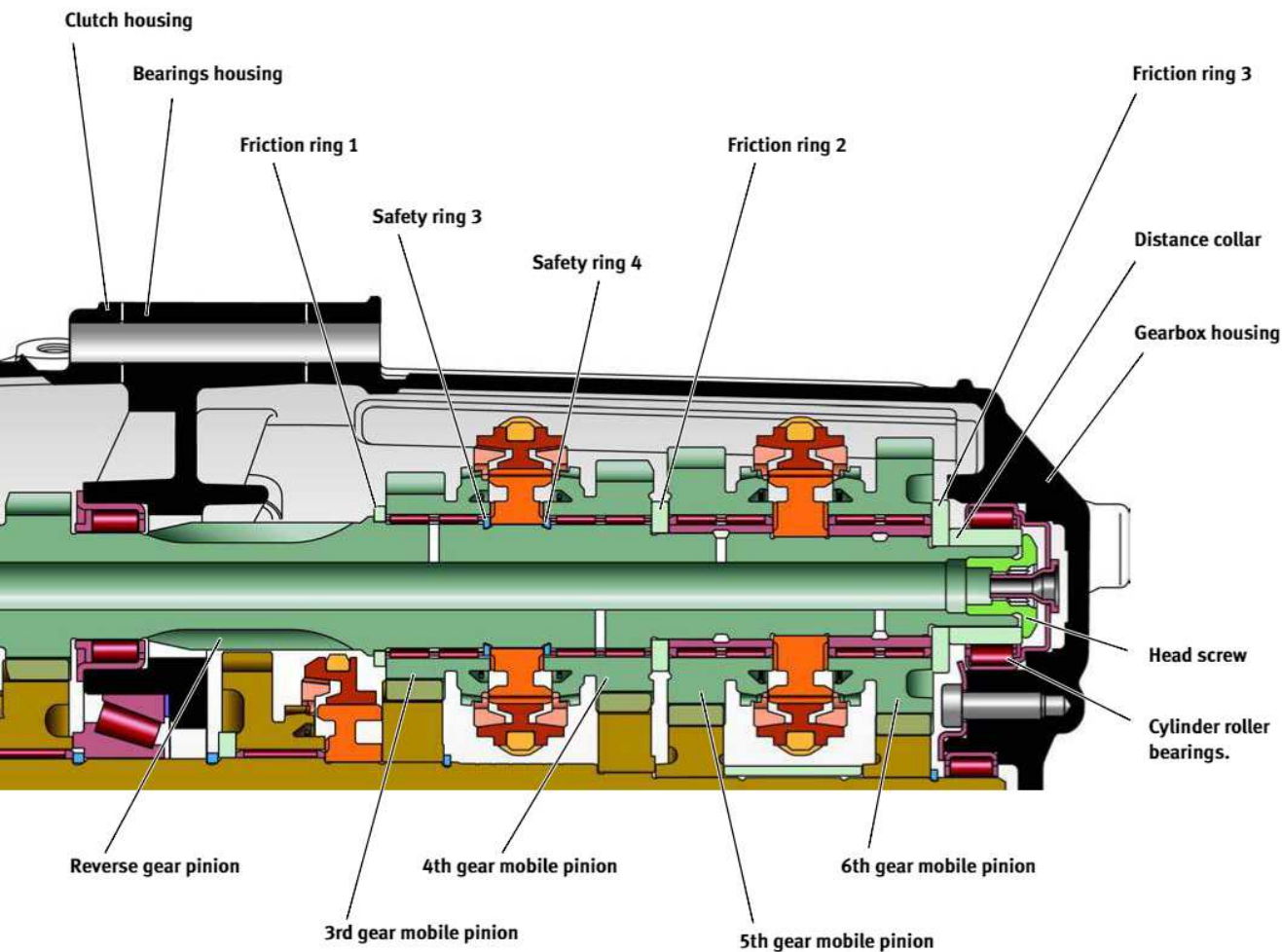
- One cylinder roller bearing attached by a screw onto the bearings housing.

- One cylinder roller bearing on the clutch housing, the interior race of which is attached to the mainshaft.

The mainshaft has three **machined** pinions and splines. The pinions, starting from the clutch side are for the 1st. gear, the 2nd. gear and the reverse gear. And the splines, in the same order, are for the clutch, for the 3rd. and 4th. gears synchroniser body and for the 5th. and 6th. gears synchroniser.

The four **mobile pinions** fitted on the mainshaft lean on needle bearings. Each of the pinions takes





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part only in one gear and they are the ones used in the 3rd., 4th, 5th. and 6th. gear.

The mainshaft has **axial drillings** to lubricate the needle bearings of the 3rd., 4th., 5th., and 6th. gears mobile pinions.

### ADJUSTING

Correct **adjusting** and operation of the mainshaft is achieved by adjusting the shim of the three friction rings, four safety rings and the head screw tightening torque.

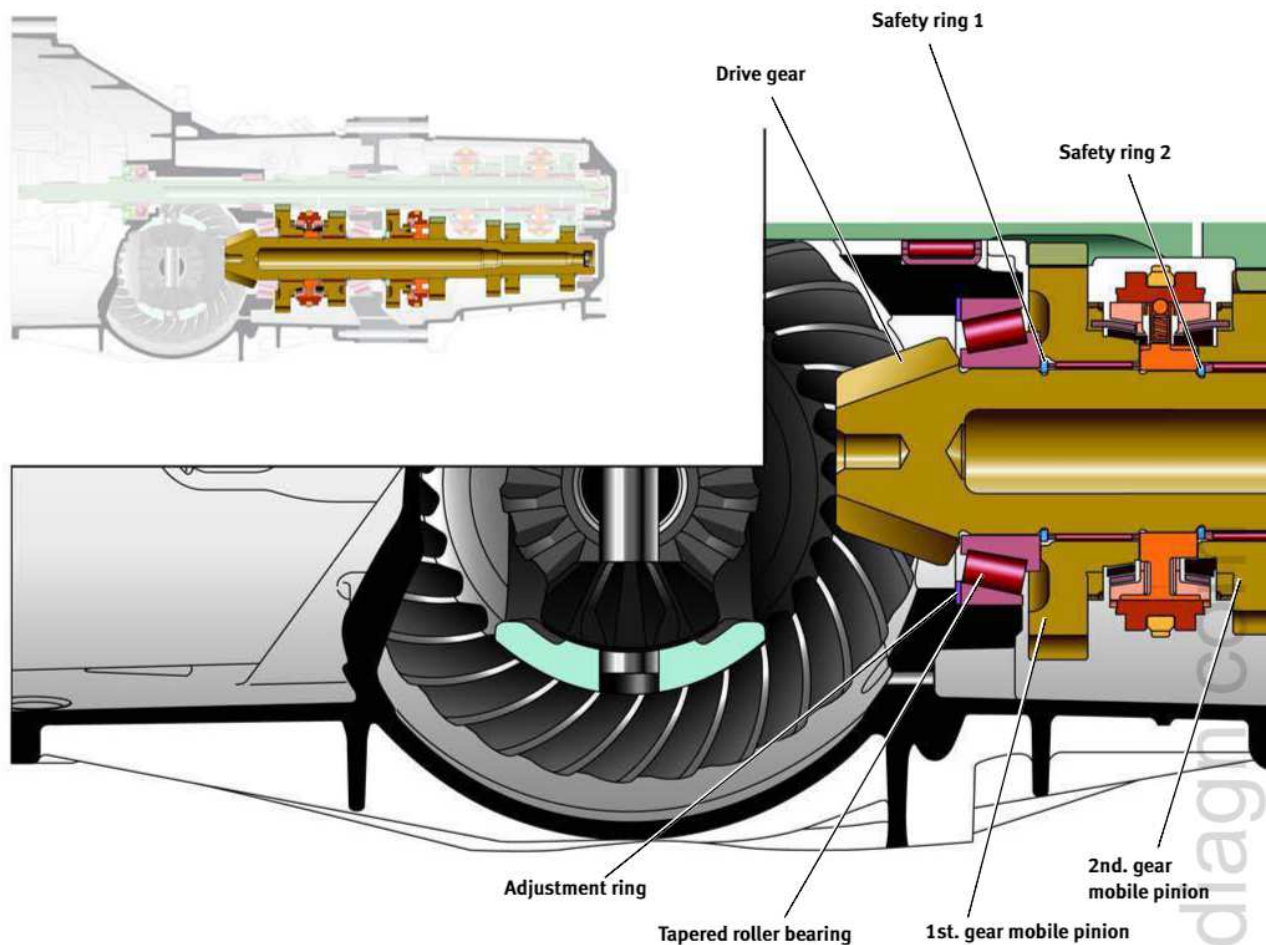
The friction rings are placed between:

- The mainshaft and the 3rd. gear pinion,
- The 4th. and 5th. gears pinions,
- The 6th. gear pinion and the distance collar.

The mainshaft safety rings are fitted each at either side of the:

- Ball bearing.
- The 3rd. and 4th. gears synchroniser.

# INTERNAL COMPONENTS



## LAYSHAFT

The main characteristics of the layshaft are:

- It is partially hollow.
- It leans on three bearings
- It has a drive pinion and six splines machined on it.
- Three mobile pinions and four fixed pinions are fitted on it.
- It requires adjusting.

The layshaft is **hollow** in all its extension except for the drive pinion zone. It has a sealing cover for the interior hollow to prevent oil getting into it.

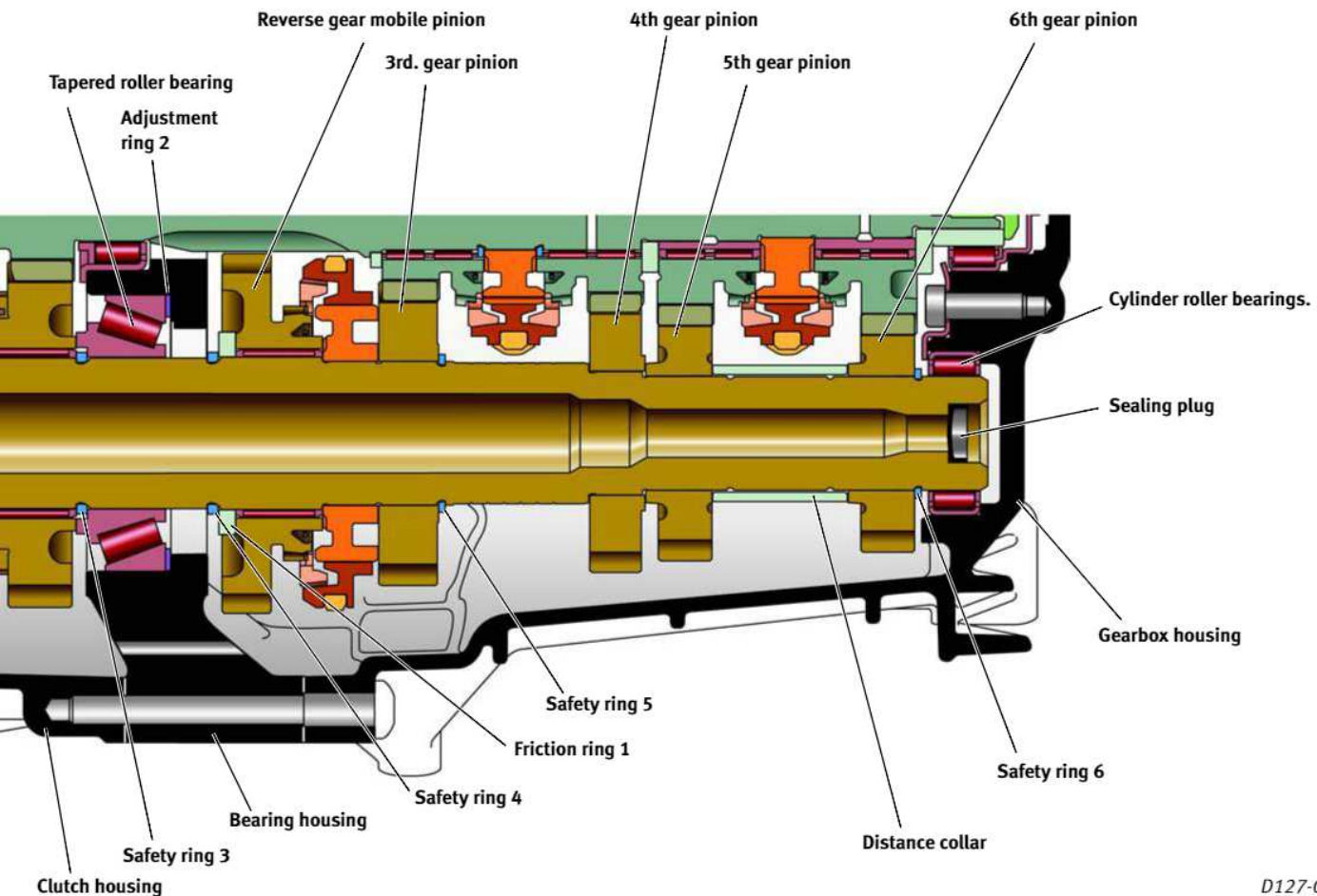
The layshaft **leans** on three **bearings**:

- A tapered roller bearing on the clutch housing.

A tapered roller bearing on the bearings housing.

- A cylinder roller bearing on the gearbox housing, the interior race of which is machined on the shaft itself.

**Machined** on the layshaft are a drive pinion and six splines (one for the 1st. and 2nd. gear synchronisers, another one for the reverse gear synchroniser, and one more for each of the pinions of the 3rd., 4th., 5th. and 6th. gears).



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The layshaft has seven gears, **four pinions** (3rd., 4th., 5th. and 6th.) and **three mobile** pinions (1st., 2nd. and reverse) every mobile pinion rotates freely on a needle bearing.

### ADJUSTING

**Adjusting** of the layshaft requires correct fitting of:

- One friction ring between the safety ring pinion and the 3rd. gear.

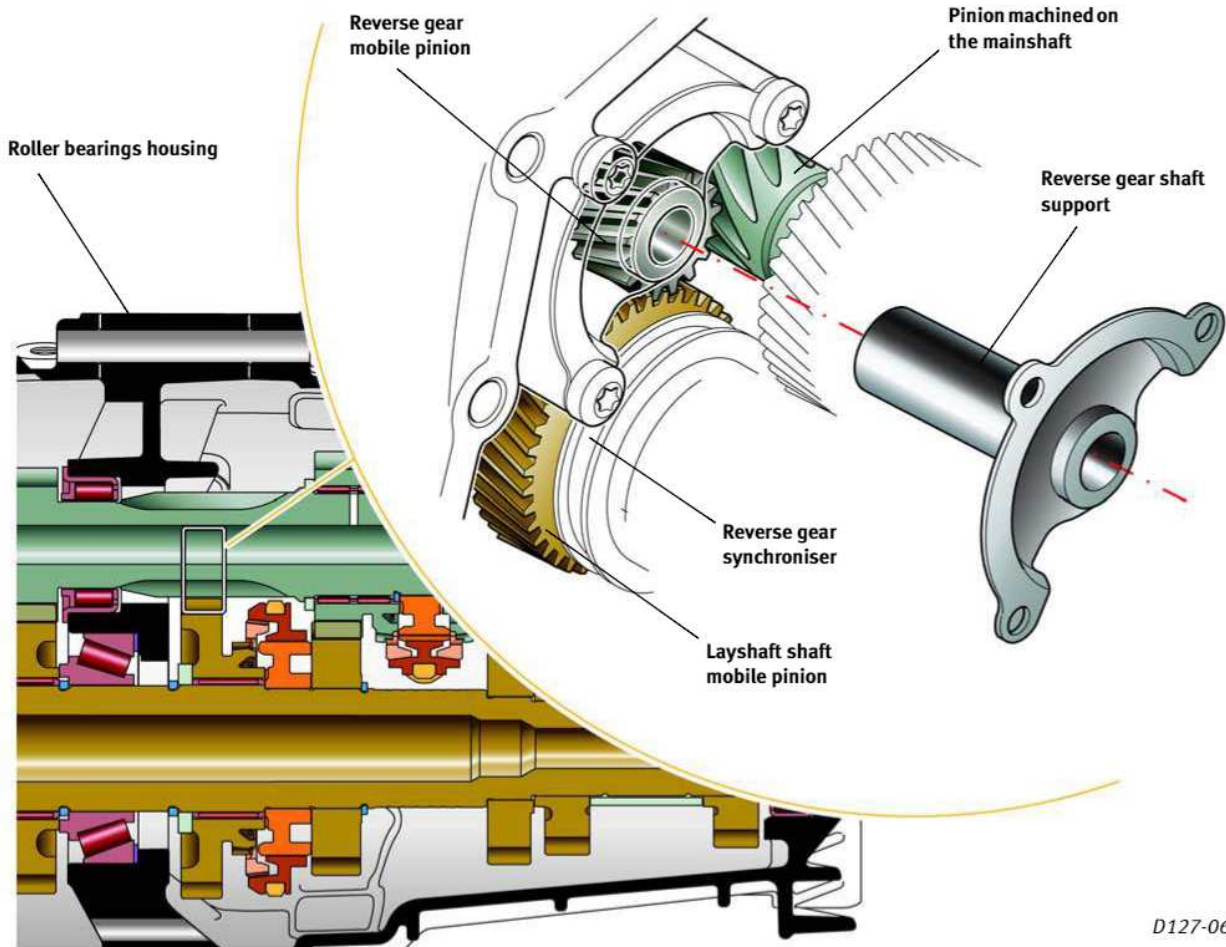
- One distance collar between the 5th. and 6th. gears.

- Two adjustment rings for the tapered roller bearings.

- And, finally, six safety rings to control the axial play of: the tapered roller bearing, the body of the 1st and 2nd. gears synchroniser, the mobile pinion of the 2nd. gear, the friction ring, the 3rd. gear pinion and the 6th. gear pinion.



# INTERNAL COMPONENTS



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## REVERSE GEAR

The function of the reverse gear pinion is to reverse the layshaft direction of rotation without influencing the transmission ratio.

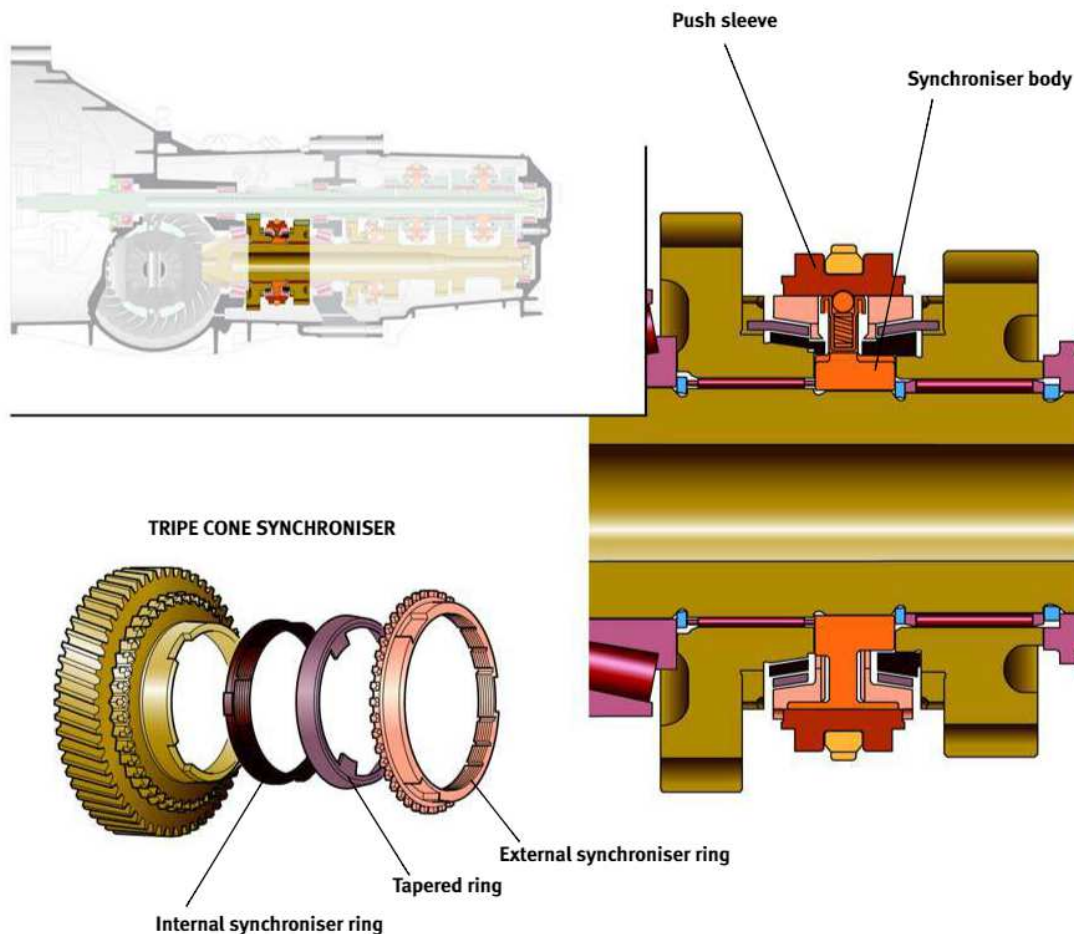
The following are **involved** in transmitting the reverse gear torque

- The reverse gear shaft.
- The reverse gear mobile pinion.
- The reverse gear synchroniser.

The **reverse gear shaft** is attached at both its ends. At one end it fits into the roller housing and at the other end, by means of a support and three screws, it is attached to the bearings housing at the side of the gearbox housing.

The **reverse gear mobile pinion** rotates freely on a needle bearing on the reverse gear shaft. There is a drive ring at either side of the pinion. The reverse gear mobile pinion is permanently engaged with the pinion machined on the mainshaft and with the layshaft mobile pinion.

The **reverse gear synchroniser** is fitted on the layshaft. If the synchroniser push sleeve is in neutral position all the pinions rotate but do not transfer any torque. If the push sleeve moves, the reverse gear is engaged, torque is transmitted and the direction of rotation of the layshaft is reversed.



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## SYNCHRONISERS

The function of synchronisers is to equalise the speed of rotation of the mobile pinion and its shaft before engaging the gear.

This action is known as 'synchronising' and takes place during the gear shifting cycle.

The 01X manual gearbox has all the gears synchronised and uses two types of synchronisers: single and triple cone.

**Single synchronisers** are used for the 3rd, 4th, 5th, 6th, and reverse gears. They are made up by the synchroniser body, the push sleeve and a single synchroniser ring.

The **triple cone synchronisers** are used in the 1st gear. They are made up by the synchroniser body, the push sleeve and three synchroniser rings.

## OPERATION

When moving the fork of a gear the push sleeve gets out of neutral position and moves towards the mobile pinion.

This axial movement also moves the synchroniser rings.

When all the components move they press against each other increasing the number of frictioning components meshed and therefore the total frictioning surface. With this technique the synchroniser performance is also increased and the engaging of the gears is enhanced.

# INTERNAL COMPONENTS

## CROWN WHEEL AND PINION SET

The 01X manual gearbox crown wheel and pinion set features:

- The components that make it up.
- The hypoid type of mesh.
- The assumed functions.

The crown wheel and pinion set **is made up of a** drive pinion machined on the layshaft and a crown screwed onto the differential housing. The teeth on both components are helycoidal.

The **engaging** of the pinion on the crown is **hypoidal**, that is, it engages slightly above the centre line of the crown in order to achieve:

- A more robust drive pinion.
- Larger contact surface among the teeth.
- Greater torque transfer.
- A reduction of the efforts.

The **functions** assumed by the crown wheel and pinion set are:

- To convert the layshaft rotary movement of the layshaft into another rotary movement perpendicular to such shaft.
- To increase the torque received from the layshaft when reducing the transmission ratio, and therefore reduce the size of the pinions and of the gear set.

## DIFFERENTIAL

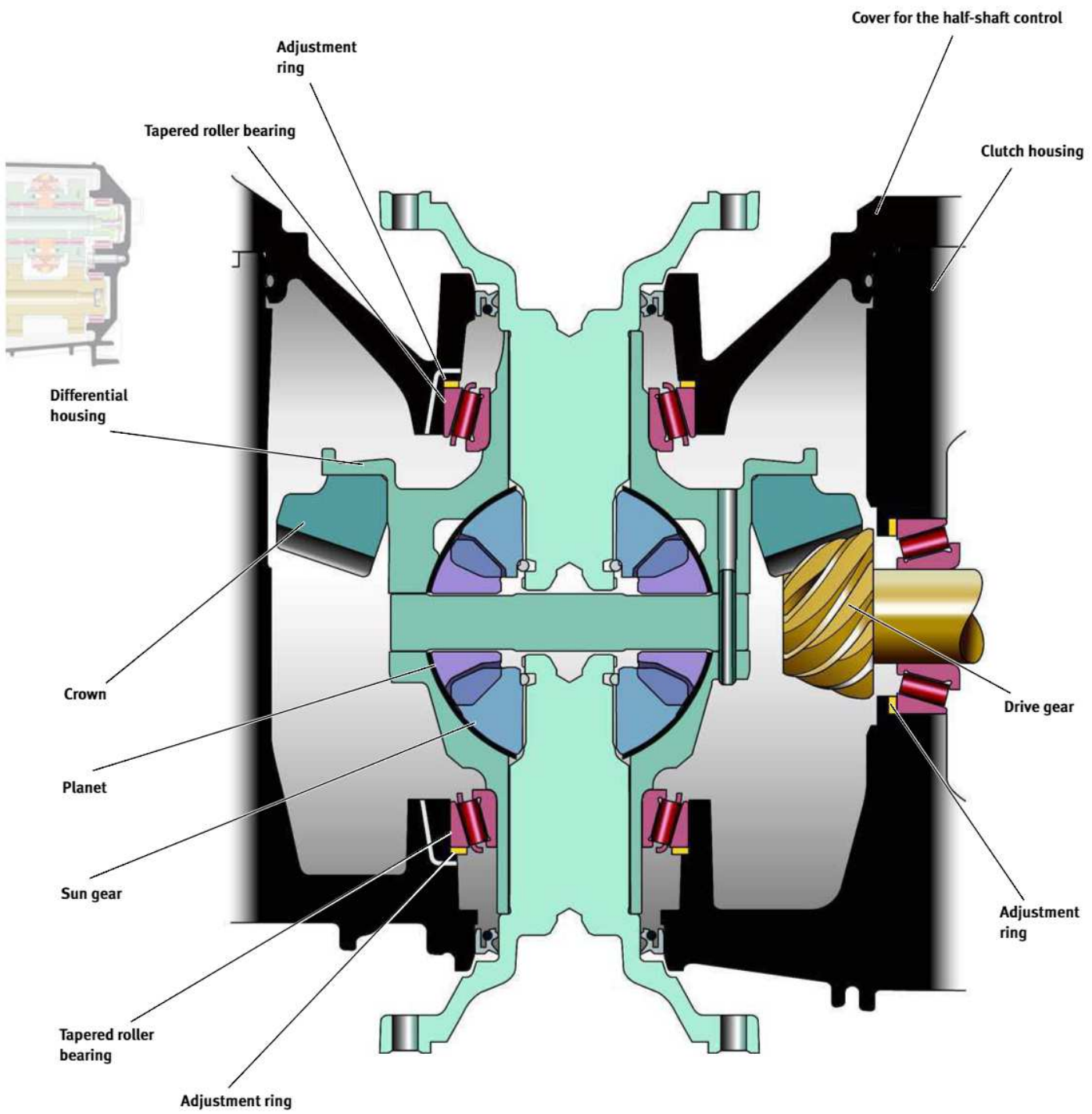
The differential is made up by the differential housing, two planets and two sun gears

The differential adapts the revs of the drive wheels, when the vehicle is driving around a bend, to prevent one of the wheels being dragged.

The differential housing leans on two tapered roller bearings, one on the clutch housing and another one on the half-shaft controls cover. On the exterior of each bearing there is an adjustment ring to guarantee the correct axial play of the differential.







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# INTERNAL COMPONENTS

## SELECTION GEARS

The mechanisms that make up the selection gears system for selecting and engaging the gears are grouped into:

- Selector shaft and attachment collars.
- Forks.
- Locating collars.

### SELECTOR SHAFT AND LOCATING COLLARS.

The main function of the **selector shaft** and of the two **locating collars** is to move a single fork to engage or disengage a gear when the driver activates the gearbox lever.

On the next pages you will find detailed information about how both components work and about the rest of their functions.

### FORKS.

The 01X manual gearbox has four **forks**, each of which is attached to its **fork bar**.

When a fork moves a push sleeve it makes the mobile pinion a single assembly with the shaft, that is, it engages a gear.

Except for the reverse gear fork, which only engages this gear, the rest of the forks can engage two gears.

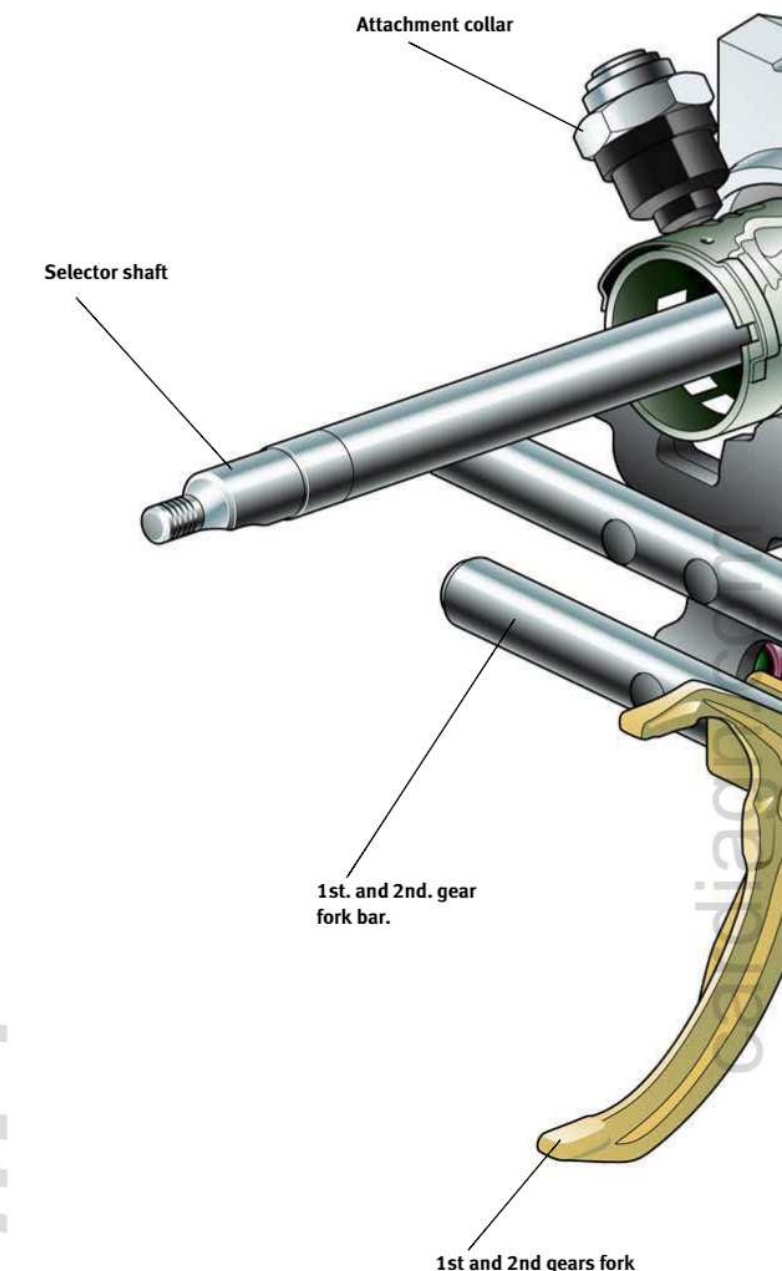
- 1st and 2nd gear.
- 3rd and 4th gear.
- 5th and 6th gear.

Each fork bar leans on two ball bearings, organised as follows:

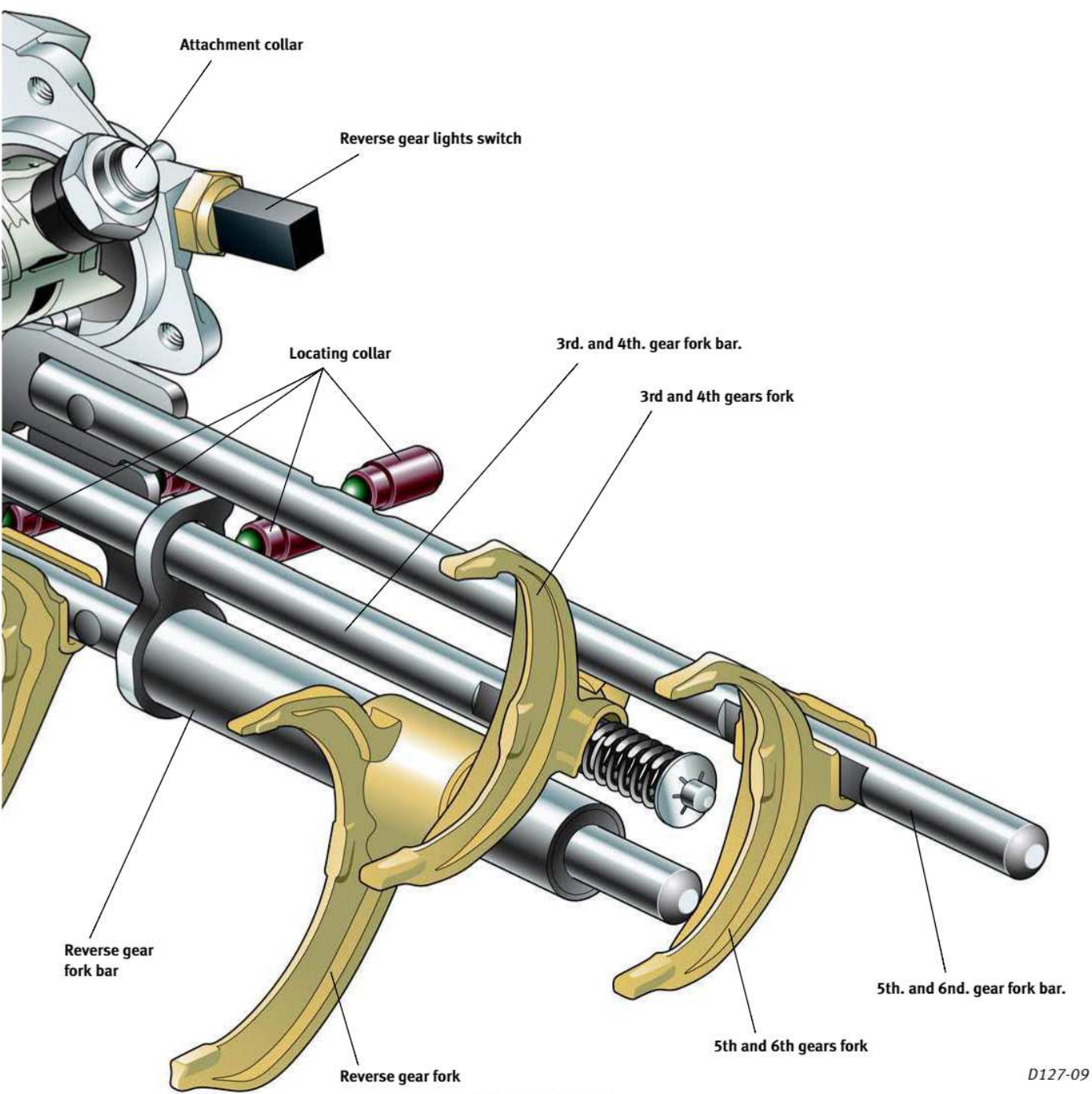
- The 1st. and 2nd. gears fork bar leans on a bearing on the clutch housing and on another one on the gearbox housing.
- The 3rd. and 4th. gears fork bar leans on a bearing on the clutch housing and on another one on the bearings housing.
- The 5th. and 6th. gears fork bar leans on a bearing on the bearings housing and on another one on the gearbox housing.
- The reverse gear fork bar leans on two bearings on the 1st. and 2nd. gear bar.

### LOCATING COLLARS

The function of each of the four **locating collars** is to hold the position of a fork bar, whether the synchroniser rod is in neutral position or engaging a gear position.



The reverse gear, and 1st. and 2nd. gear locating collars are fitted on the clutch housing.

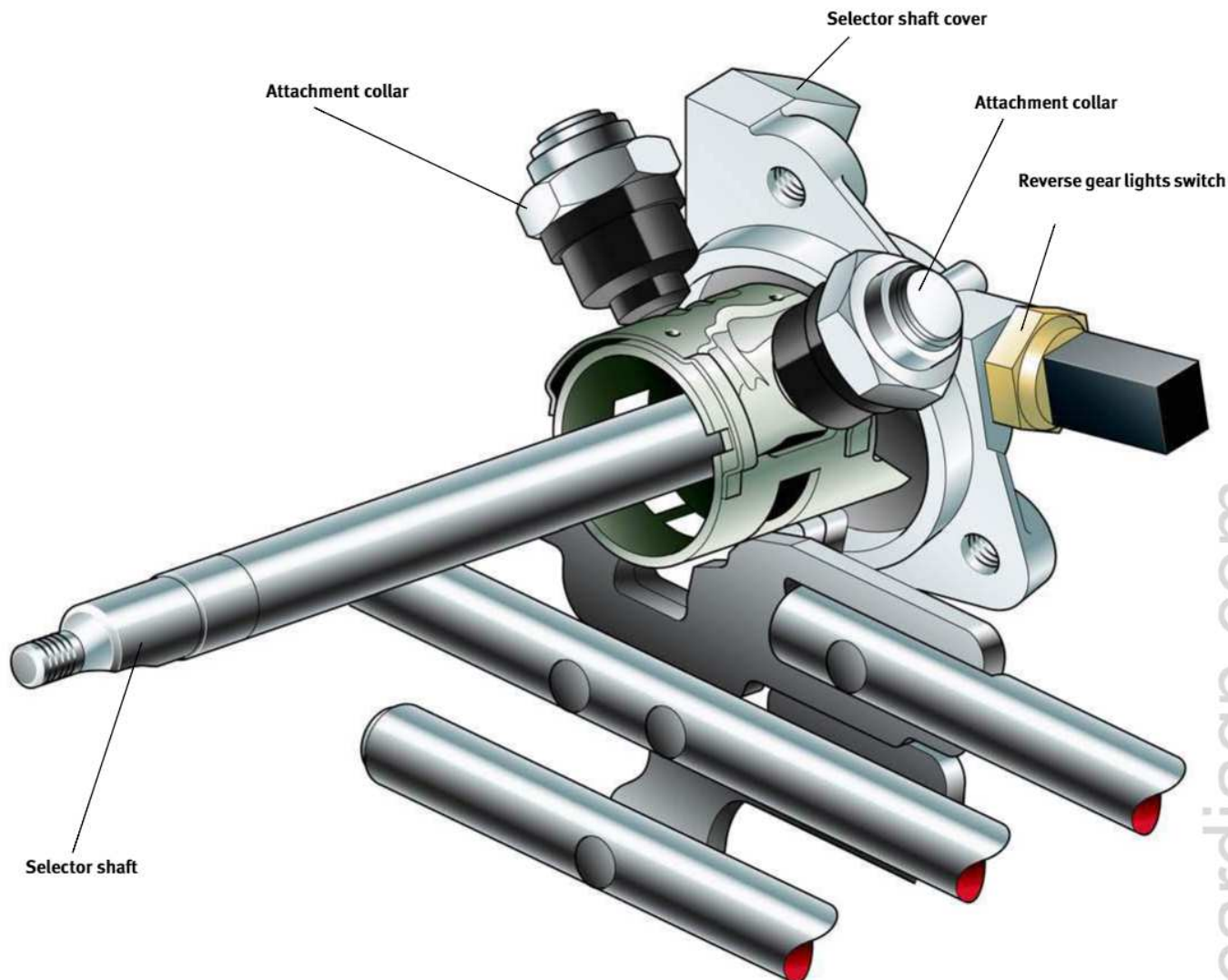


And the locating collars for the 3rd.and 4th. gears, and for the 5th. and 6th. gears are fitted on the bearing housing.

Bear in mind that when removing the sleeves from the housings they must be replaced by new ones.



# INTERNAL COMPONENTS



## SELECTOR SHAFT

The selector shaft is the internal selection gears system part which has the greatest influence on selection and engaging of the gears.

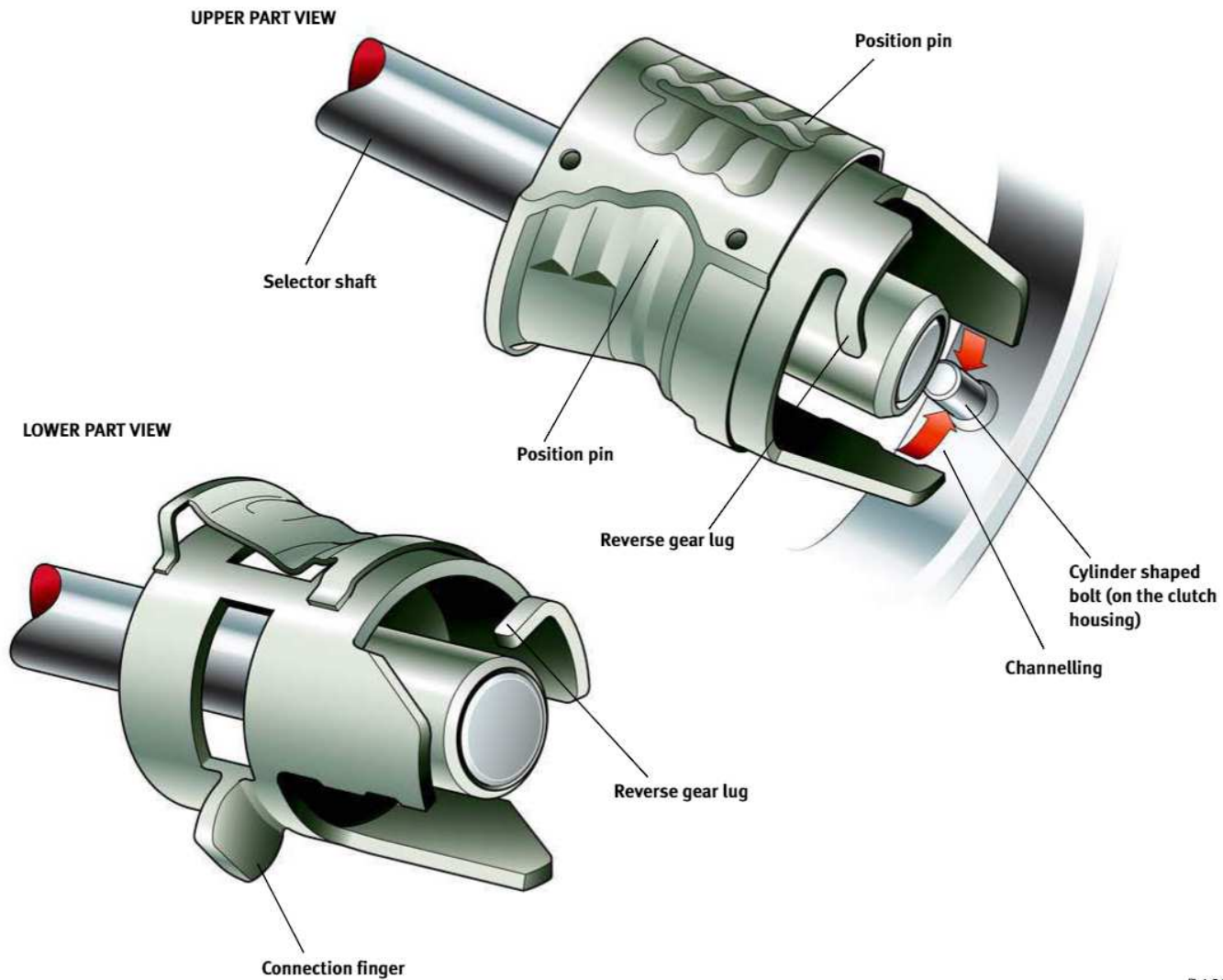
When the driver moves the lever the selector shaft moves axially or rotates on its own shaft.

The selector shaft **leans** on a bearing with four races of balls on the the selector shaft cover, and on a sleeve on the clutch housing.

When the selector shaft rotates or moves axially, it drags the following mechanisms with it.

- A connection finger.
- A channelling.
- One reverse gear lug.
- Two position pins.

When the **connection finger** moves longitudinally it selects one or another fork and



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with the rotation movement it engages or disengages a gear.

The combination of the selector shaft **channelling** and the **cylinder shaped bolt** on the clutch housing limits the axial and rotation movements of the selector shaft. This bolt can be removed to make it easier to take out the selector shaft.

The **reverse gear lug** presses on the reverse gear switch when engaging into reverse.

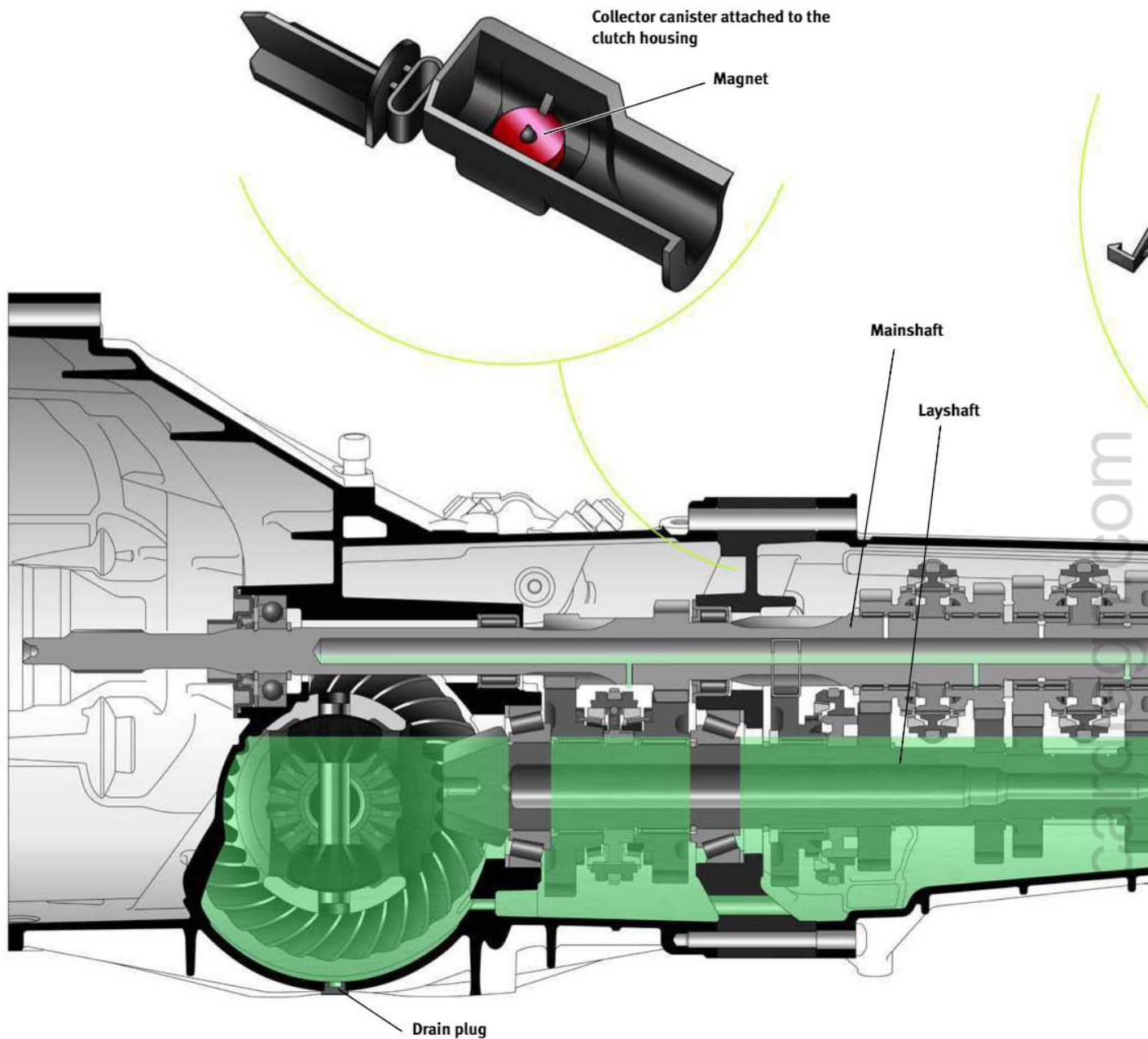
The position pins and attachmet collars assume two functions: to hold the shift lever between 3rd. and 4th. gear when the gearbox is in neutral, and to prevent the selector shaft from moving unless the shift lever is activated.

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## erWin

# LUBRICATION



The oil **lubricates** the mobile components of the gearbox to reduce friction between them and thus prevent wear.

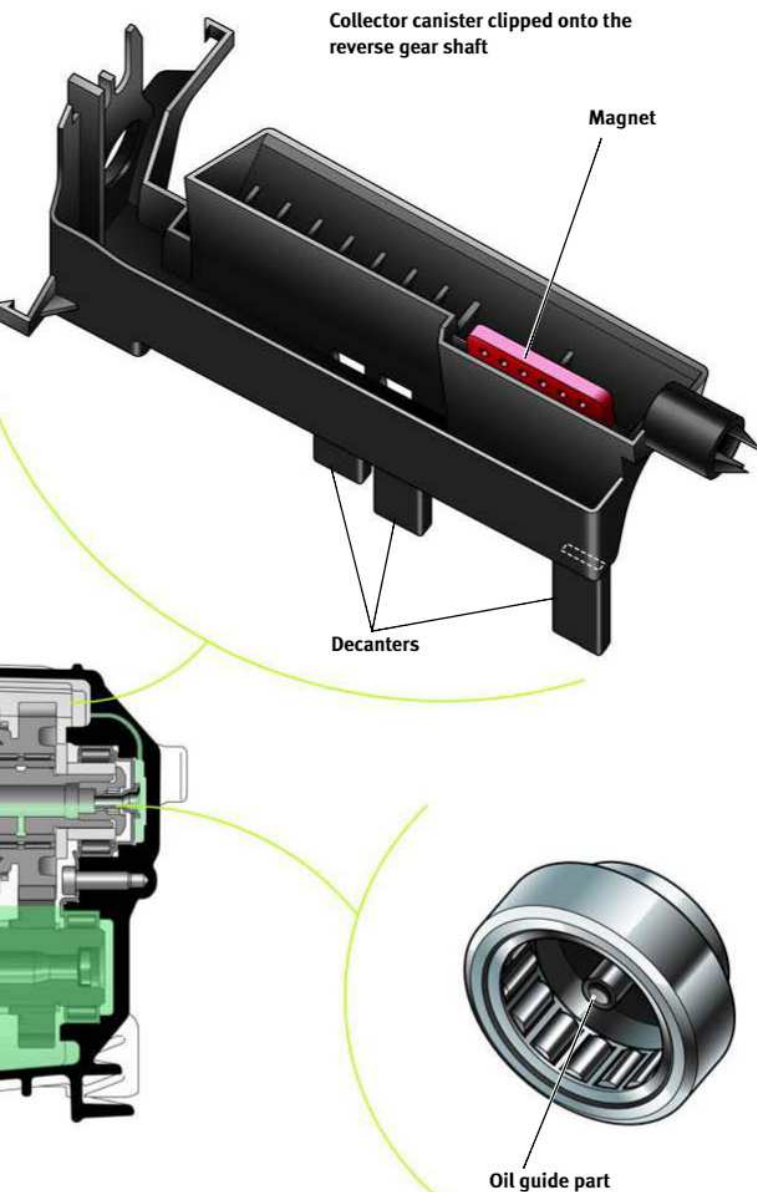
Correct lubrication is enhanced because of:

- The internal configuration which favours oil flow.

- The position of the fill-up and drain plugs which simplify maintenance.

- The magnets that catch any existing shavings. Internal components are lubricated in two ways: immersion and gushing.





In the **gushing** type of lubrication two particulars have to be highlighted regarding the mainshaft.

- Lubrication of the mobile pinions teeth.
- Lubrication of the needles bearings of the mobile pinions.

In both cases the layshaft must rotate to make the oil bubble-up.

Part of the oil splashed reaches the collector cup attached to the clutch housing. The oil is driven to the inside of the reverse gear shaft, flowing through it, to reach a second collector canister press-fitted on the reverse gear shaft. The second canister channels the oil flow to:

- The mobile pinions teeth of the 4th., 5th and 6th. gears by means of three collectors.
- The oil guide part to help the oil enter the mainshaft and lubricate the needle bearings of the mobile pinions.

**Oil flow** inside the gearbox is guaranteed thanks to the large drillings that connect the three interior chambers (differential chamber, 1st. and 2nd. gear chamber, and 3rd. to 6th. gears chamber).

The manual gearbox has two **plugs**, the **drain plug** and the **fill-up or level plug**. The drain plug is at the lower part of the differential housing, which is the lowest part of the gearbox. The fill-up plug is placed on the half-shafts control cover. The oil level of the gearbox is reached when the oil reaches the edge of the fill-up plug.

Any possible **shavings** that might occur during the life of the gearbox are caught by three magnets the gearbox has in:

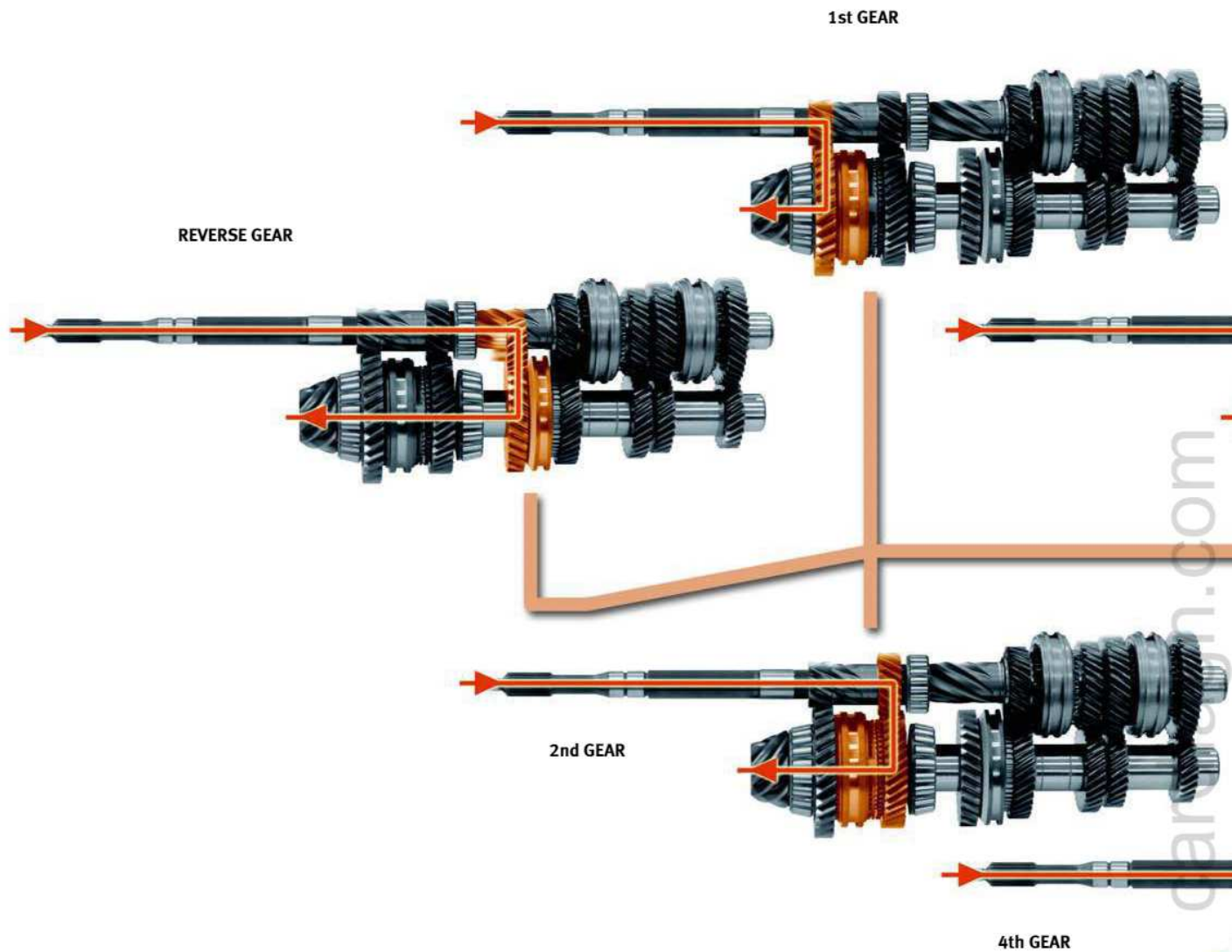
- The lower part of the clutch housing.
- The collector canister attached to the clutch housing.
- The collector canister attached to the bearings housing.

The layshaft, crown wheel and pinion set, and differential components are lubricated by **immersion**.

The rest of mechanisms are lubricated by **gushing**: the interior rods system, the mainshaft and the reverse gear.

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## POWER FLOW

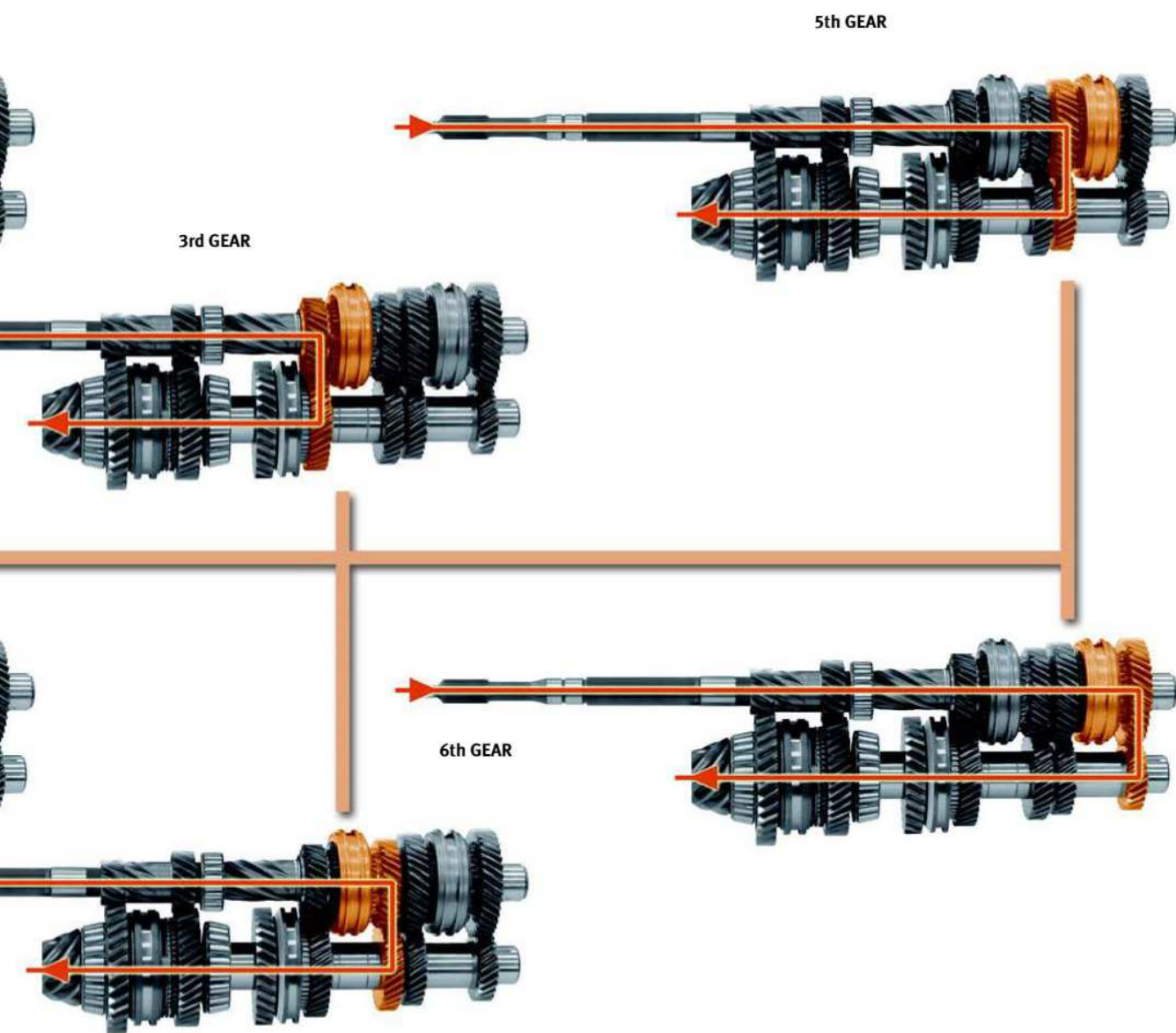


Engine rotation torque reaches the manual gearbox through the clutch and via the layshaft.

The 1st., 2nd. and reverse gears pinions are machined on the mainshaft and the synchronisers for the rest of the gears are press-fitted to the shaft.

The 1st., 2nd. and reverse gears pinions and the rest of the gears pinion rotate with the layshaft.

When the driver engages some gear the appropriate mobile pinion becomes a single assembly with its shaft; thus the rotation torque is



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transferred from the mainshaft to the layshaft and finally to the crown and pinion set with the differential.

Each of the gears has its own downgearing as a result.

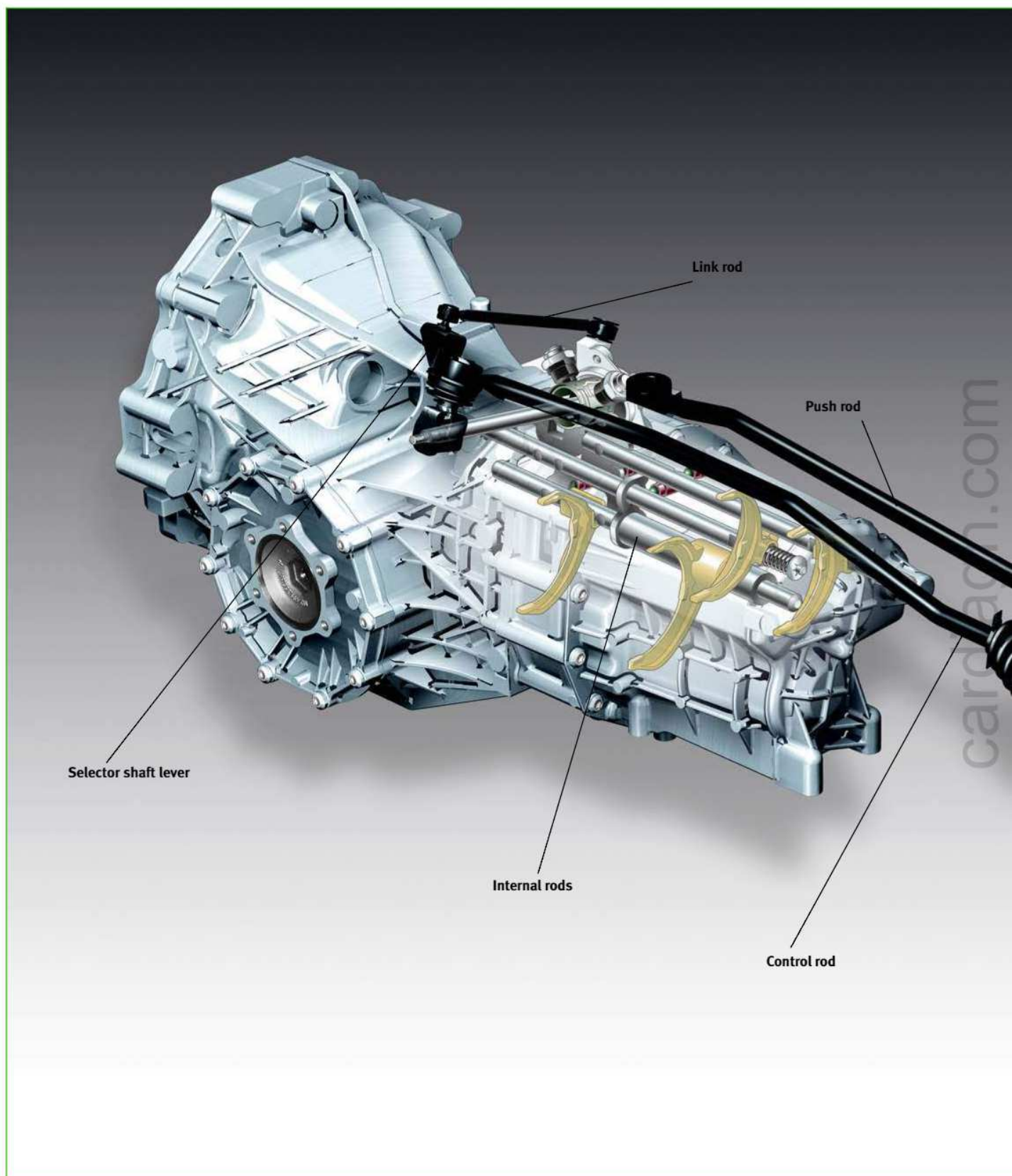
The layshaft reversing is achieved by interspersing the reverse gear mobile pinion between the mainshaft and the layshaft.

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## GEARBOX CONTROL





Shift lever

Gear shift lever housing

The movements made by the driver on the shift lever are transferred to the interior of the gearbox by the control components in two movements: the selection and the engaging movements.

The **selection movement** is the movement where the gearbox lever moves laterally. The purpose of this movement is to select only one fork.

The **engaging movement** is the movement where the gearbox lever moves longitudinally. And as a result a gear is engaged inside the gearbox.

The external components of the gearbox control that take part in selecting and connecting the gears are:

- The gearbox housing and shift lever.
- The control rod.
- The push rod.
- The linking rod.
- The selector shaft lever.

The shift lever is connected at one of its ends to the control bar. At the other end the control bar is attached to the selector shaft lever. And the selector shaft is also linked to the lever.

The push rod and the linking rod serve the purpose of making the gear selection and engaging movements more precise so that the relative movements between the powertrain and the car body are not transmitted to the shift lever.



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# GEARBOX CONTROL

## SELECTION MOVEMENT

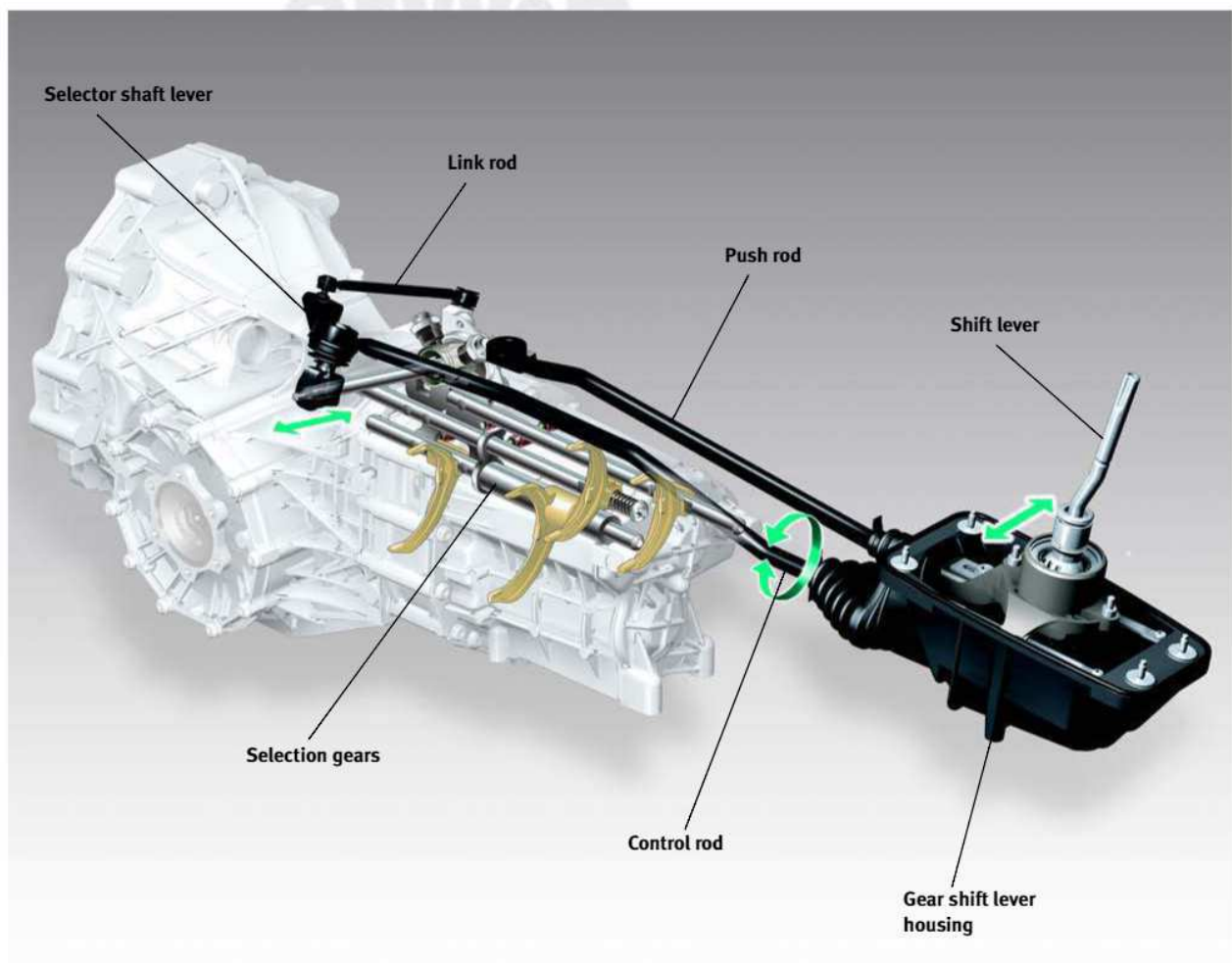
When the lever moves sideways the lever mechanisms convert this movement into rotary movements of the control bar.

The other end of the control bar is attached to the selector shaft lever, and the lever to the selector shaft.

The resulting movement inside the gearbox is an axial movement of the selector shaft, with the corresponding movement of the connection finger towards the hollow of the selected fork.

Selecting the reverse gear requires overcoming a safety lock placed on the shift lever assembly, which blocks accidental engaging of the reverse gear. To do so the shift lever has to be pressed downwards until the force of a spring is overcome; this is the only way to end the blocking: by moving the lever to the left and forward.

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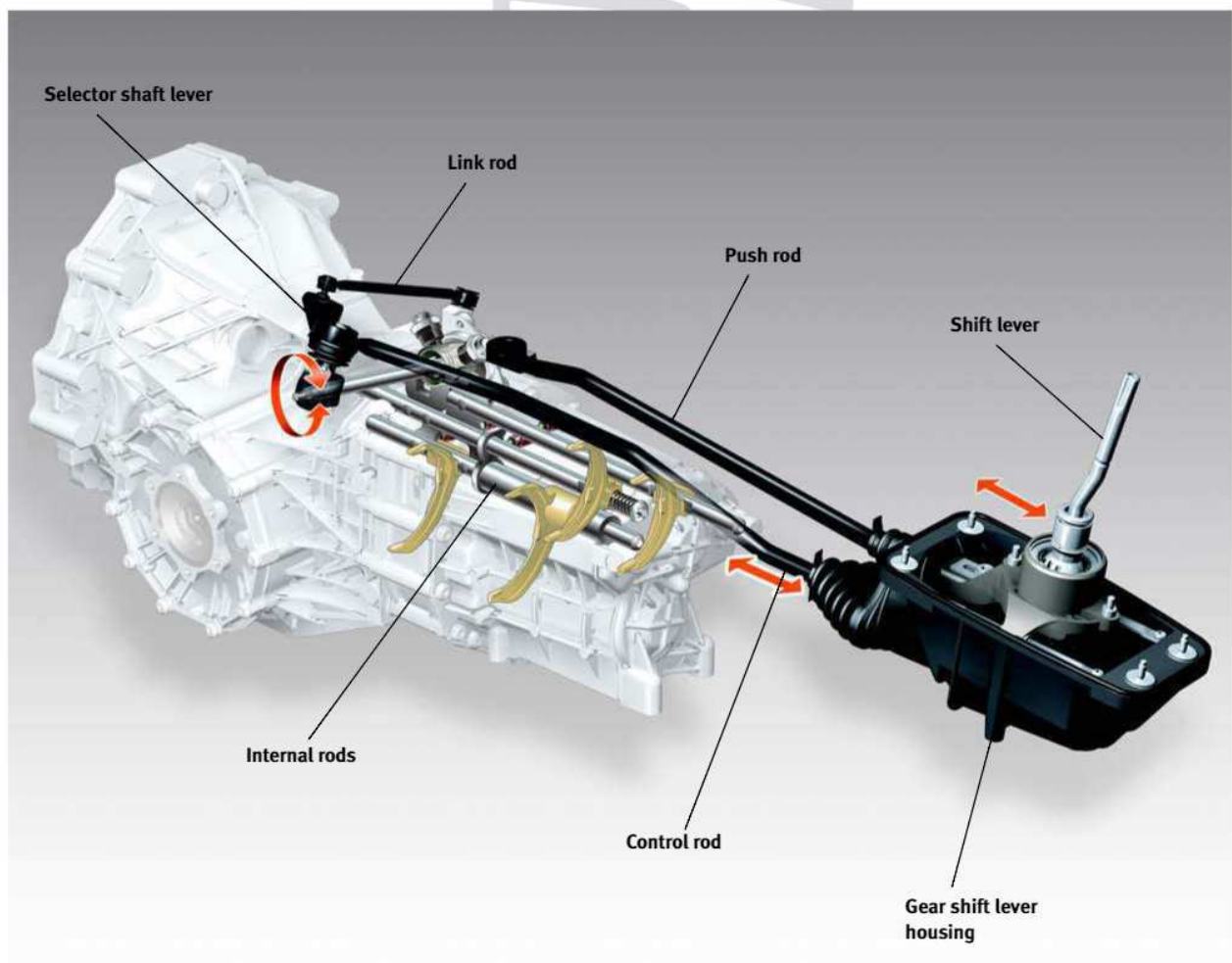
## ENGAGEMENT MOVEMENT

The engagement movement, forwards or backwards displacing of the shift lever, generates a longitudinal movement of the control bar.

The result of such movement inside the gearbox is a rotary movement of the selector shaft.

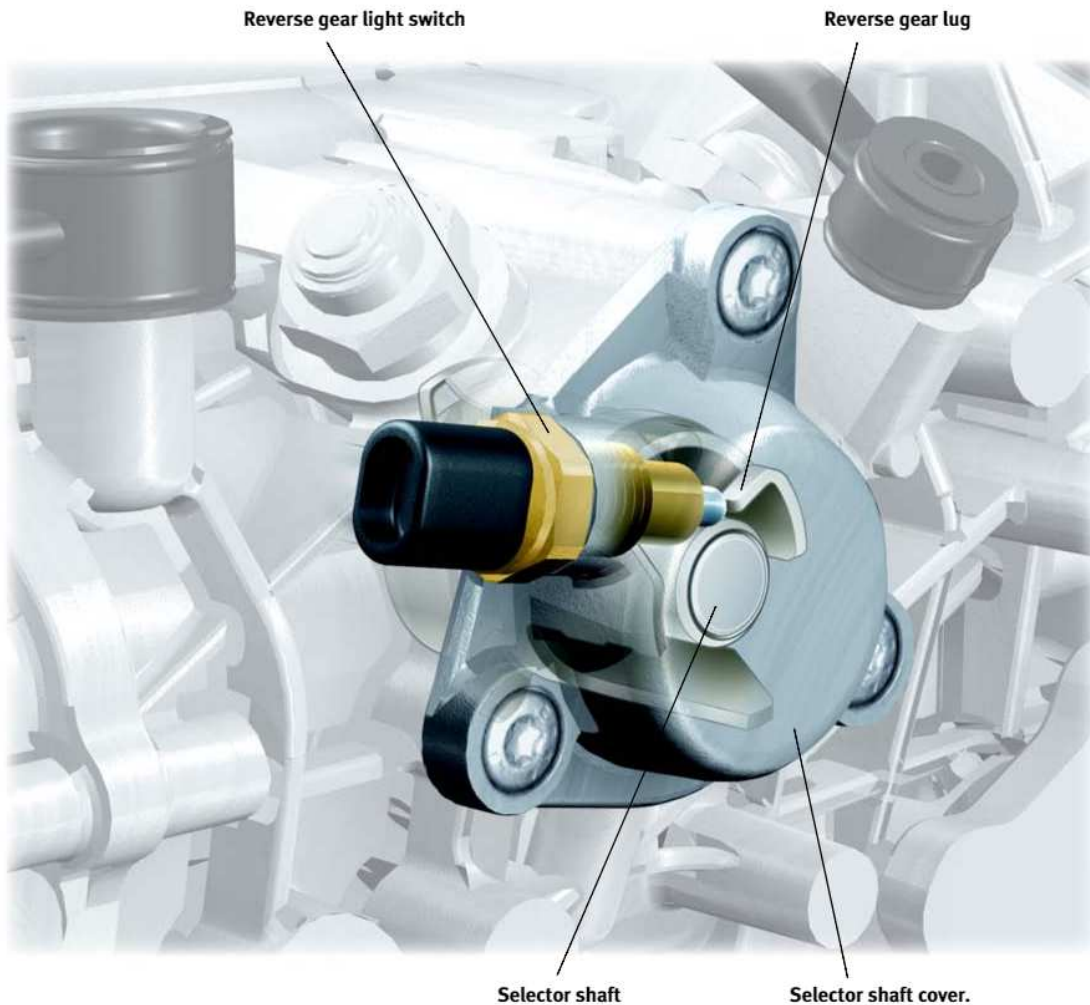
When the selector shaft rotates, the connection finger rotates and moves the previously selected fork.

The fork moves the push sleeve of a synchroniser to engage or disengage a gear.



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# SENSORS



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## **REVERSE LIGHTS SWITCH F4**

The reverse lights switch is screwed on the selector shaft cover.

The switch is placed in the selector shaft zone of influence, specifically in a channelling that gives access to the **reverse gear lug**.

When engaging into reverse, the lug presses the reverse gear lights and closes the electrical contact.

The switch receives the signal from terminal 15 in one of its pins and when engaging reverse the gear light switch closes and the terminal 15 signal reaches the comfort system central control unit J393.

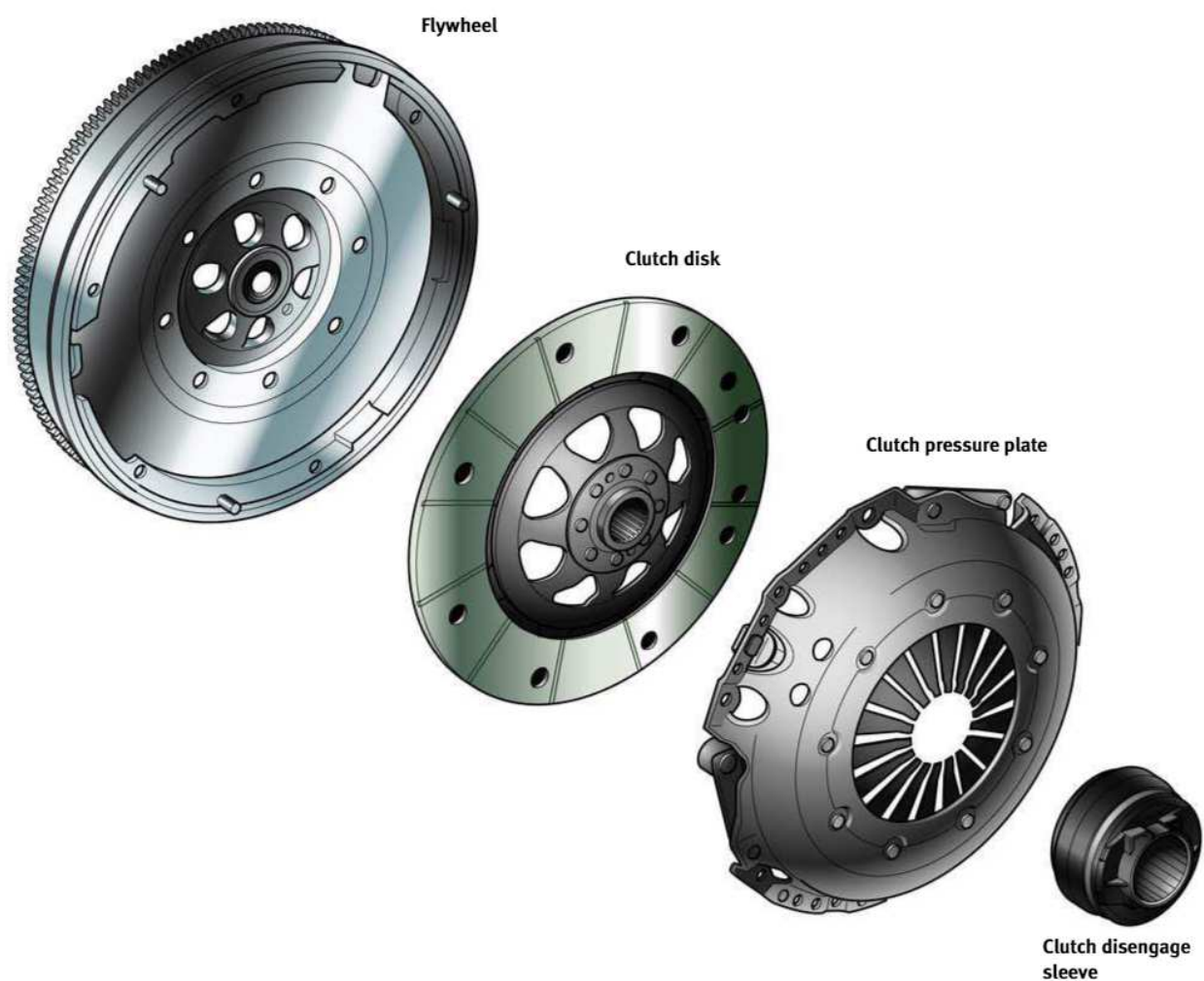
# CLUTCH

## FLYWHEEL AND CLUTCH

The clutch has been designed in such a way that its activation and coupling takes place in a progressive and elastic way so that the torque is transmitted smoothly and without jerking.

The basic mechanisms that take part in transferring torque by the clutch are:

- Flywheel.
- Clutch disk.
- Clutch pressure plate
- Clutch disengaging sleeve.



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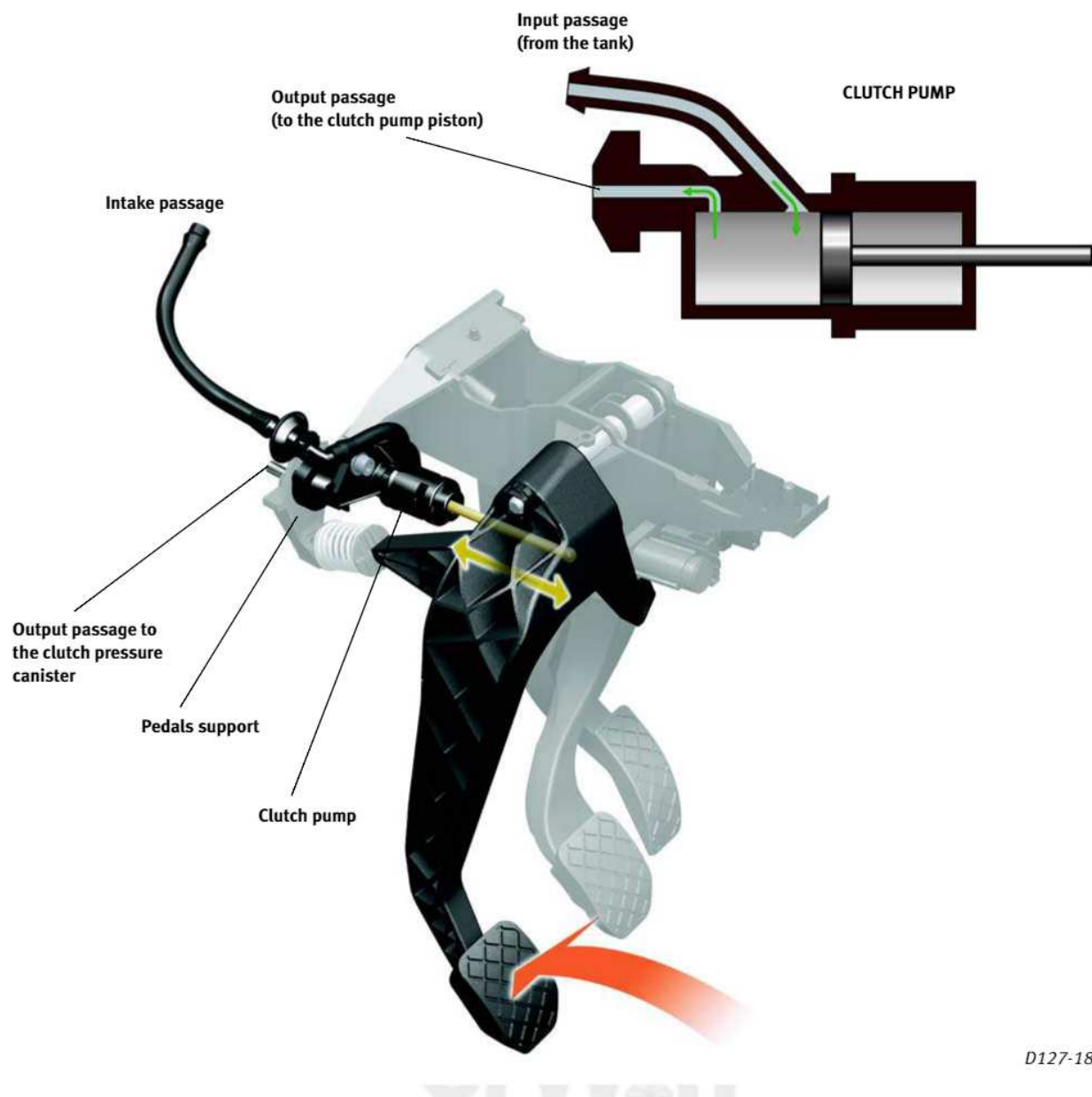
# CLUTCH

## CLUTCH PUMP

The clutch pump is connected to the pedals support.

The pump has two passages, one that links it to the clutch pump piston and the other passage linking it to the brakes fluid canister.

When pressing the pedal hydraulic pressure is transferred from the pump to the clutch pump piston.



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## CLUTCH PUMP PISTON

The clutch pump piston is attached with a screw to the outside of the gearbox housing.

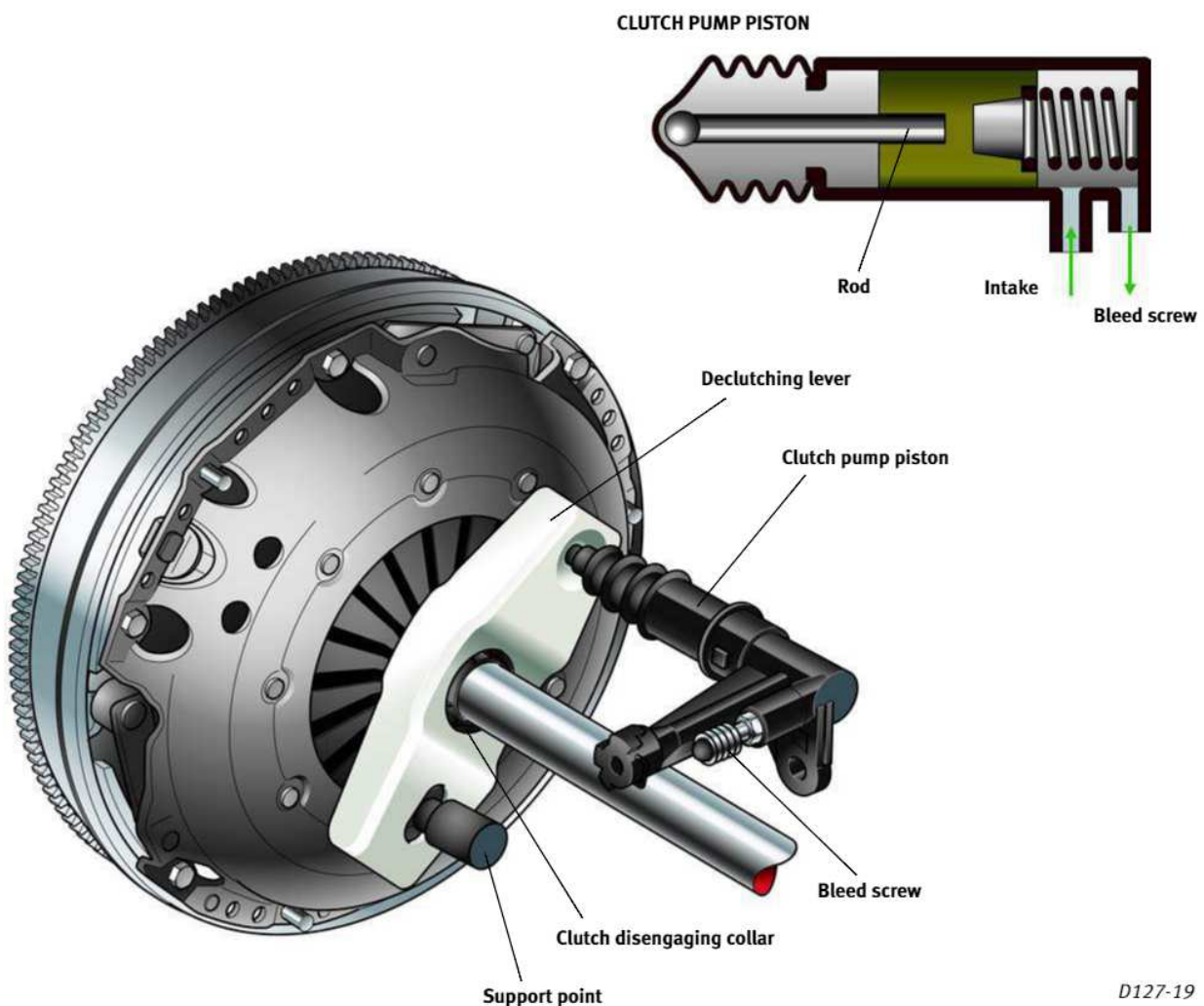
The pump includes a bleed screw to bleed the air from the clutch hydraulic circuit.

The hydraulic pressure generated by the clutch pump reaches the clutch pump piston along a single passage.

As the hydraulic pressure increases the piston moves the clutch disengage lever. This movement of the lever acts on the declutching sleeve.

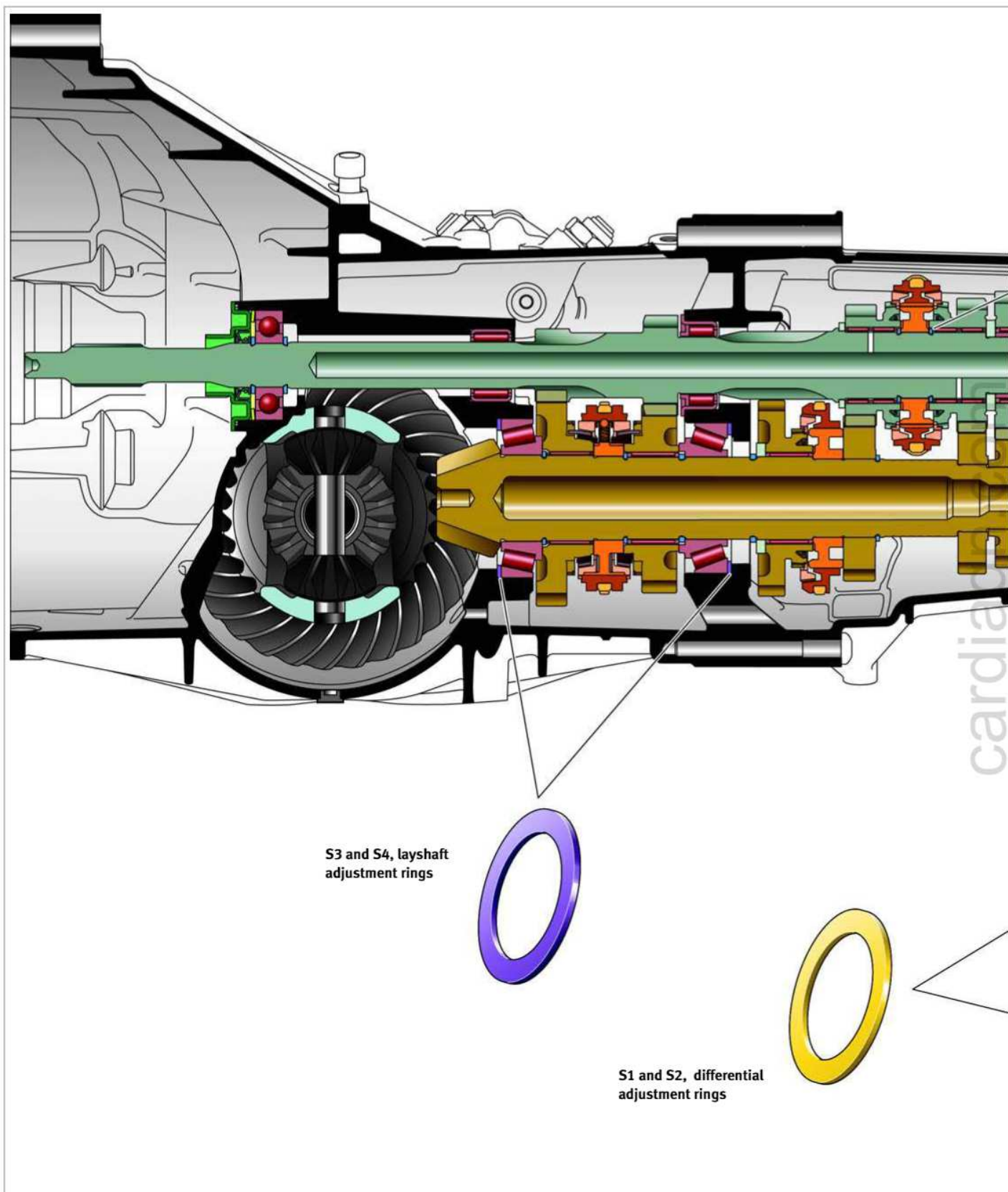
Operating pressure depends on the clutch diaphragm resistance and also of how worn out the clutch is.

**Note:** If the clutch pump piston is removed from the gearbox, do not press the pedal as otherwise the piston inside the pressure canister would be ejected and damage the set.



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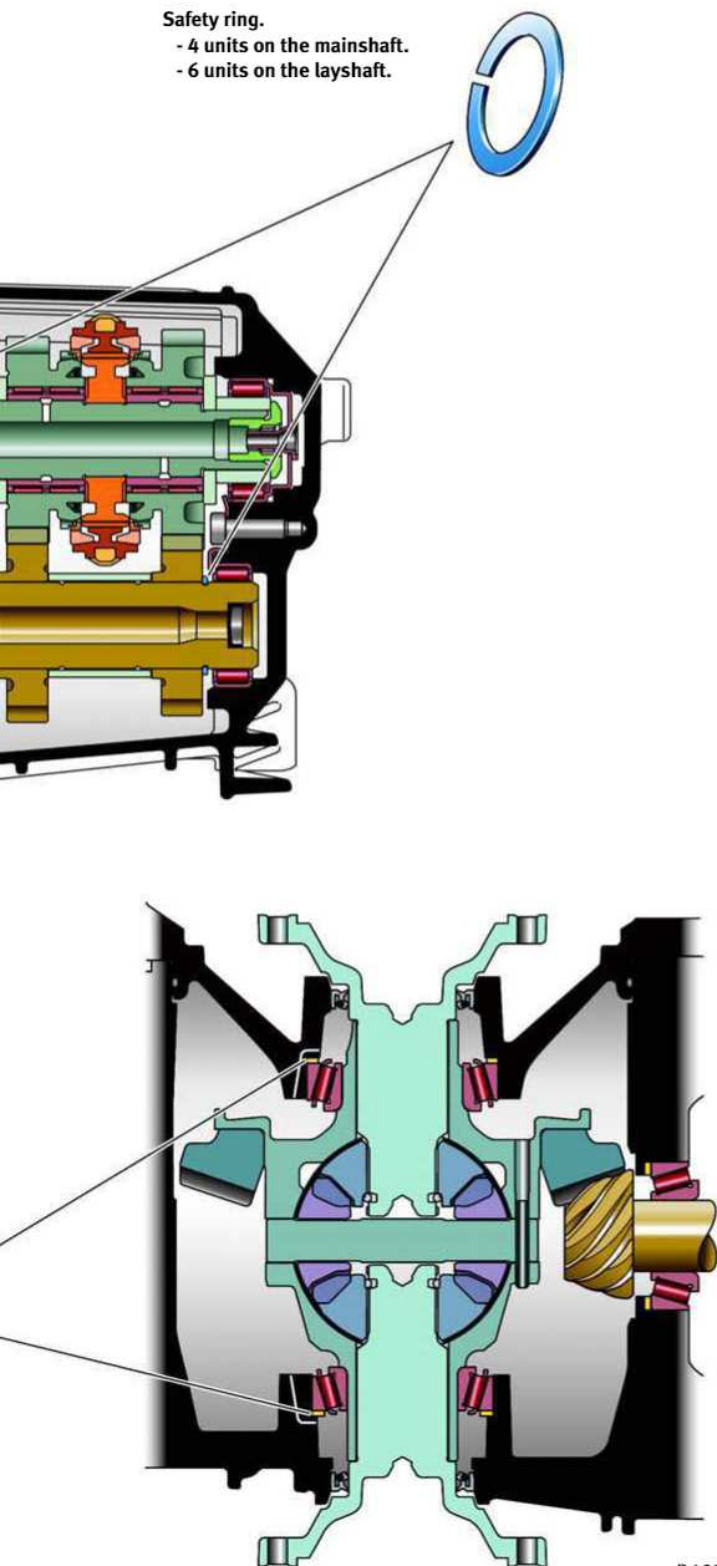
## MAINTENANCE AND REPAIR





**Safety ring.**

- 4 units on the mainshaft.
- 6 units on the layshaft.



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**INTERNAL ADJUSTINGS**

Adjustments needed inside the gearbox vary according to the part replaced during repair.

The mechanisms that require adjusting are:

- Four safety rings and a screw on the mainshaft.
- Six safety rings and two adjustment rings on the layshaft.

- Two adjustment rings on the differential

Synchronisers do not need adjustments as such, however it is basic to respect the rings wear limits and the assembly measures for the new rings.

**SEALANTS AND SEALS**

To keep the gearbox sealed-off sealing paste, seals and O-rings are used.

The **sealing paste** is applied between the clutch housing and the bearings housing, and between the bearings housing and the gearbox housing.

Although when repairing the gearbox it is only necessary to remove the gearbox housing, the bearings housing must always be removed to restore the sealant between both housings. This is the result of sharing the screws for both housings.

Every time the **seals** or **O-rings** are removed they have to be replaced by new ones to guarantee perfect sealing.

**OIL**

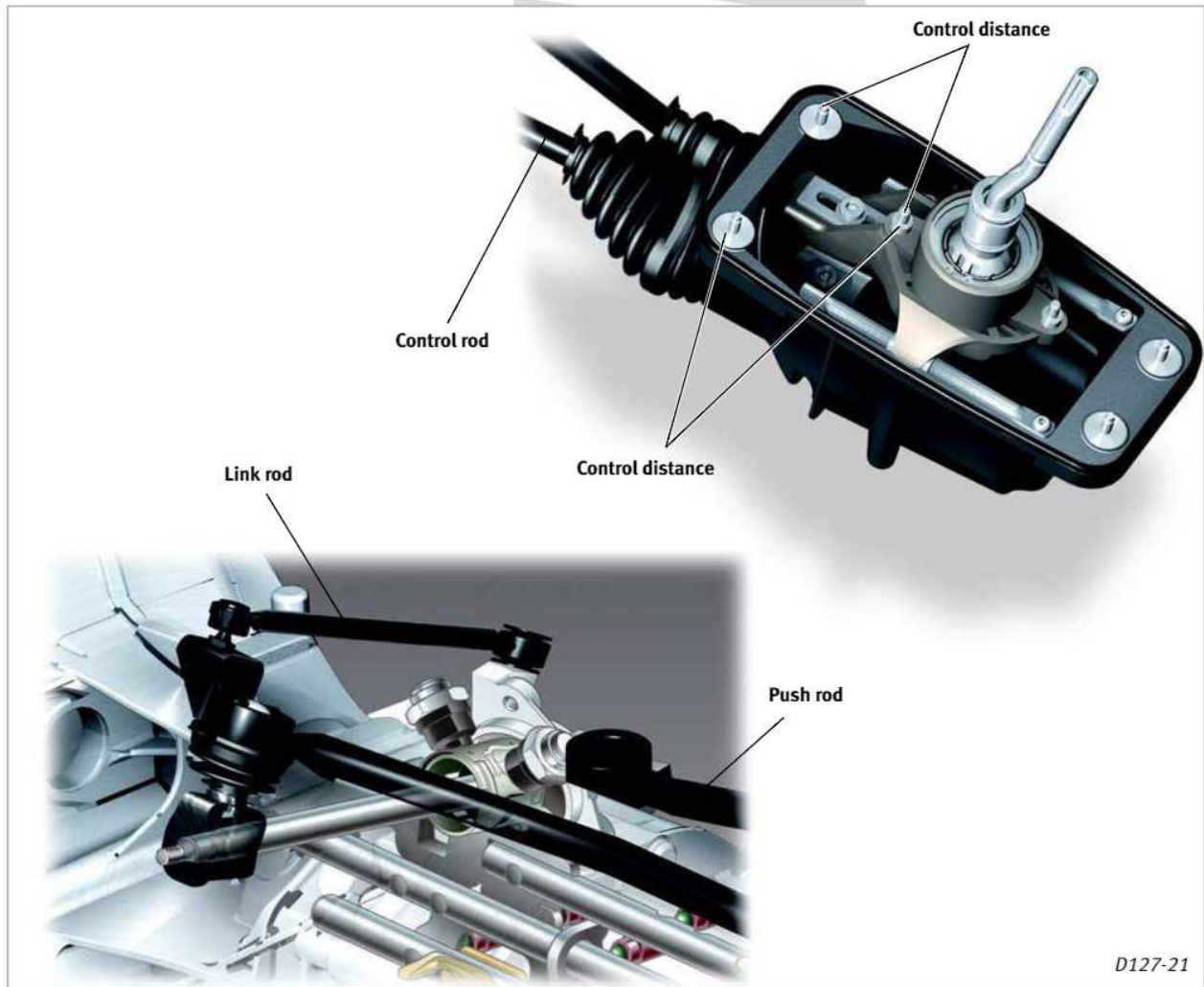
The manual gearbox uses approximately three litres of syntetic oil SAE 75 W 90 for gears. The gears oil is lifelong and the level needs to be checked every 30,000 km.

The hydraulic clutch shares the same oil with the brakes system. Oil needs to be replaced every two years.

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# MAINTENANCE AND REPAIR



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## **ADJUSTINGS TO THE GEARBOX ACTIVATION MECHANISM**

It is easy to adjust the shift lever because of the small number of parts involved in the gears activation.

Before starting the adjustment the following points need to be checked:

- The activation elements are in proper condition and operate smoothly.
- The gearbox, clutch and clutch activation mechanism must be in perfect conditions.
- The gearbox must be in neutral, no gears should be engaged.

To adjust the lever it is necessary for the distance between the centre of the spigots to be the same in both cases.

Once the adjustment has been done the following has to be confirmed:

- In neutral the shift lever faces the 3rd. and 4th. gears.
- All the gears are to be engaged several times.
- And confirm again that the shift lever is facing the 3rd. and 4th. gears.



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**Technical status 09.08.** Due to constant product development and improvement, all data displayed is subject possible changes.

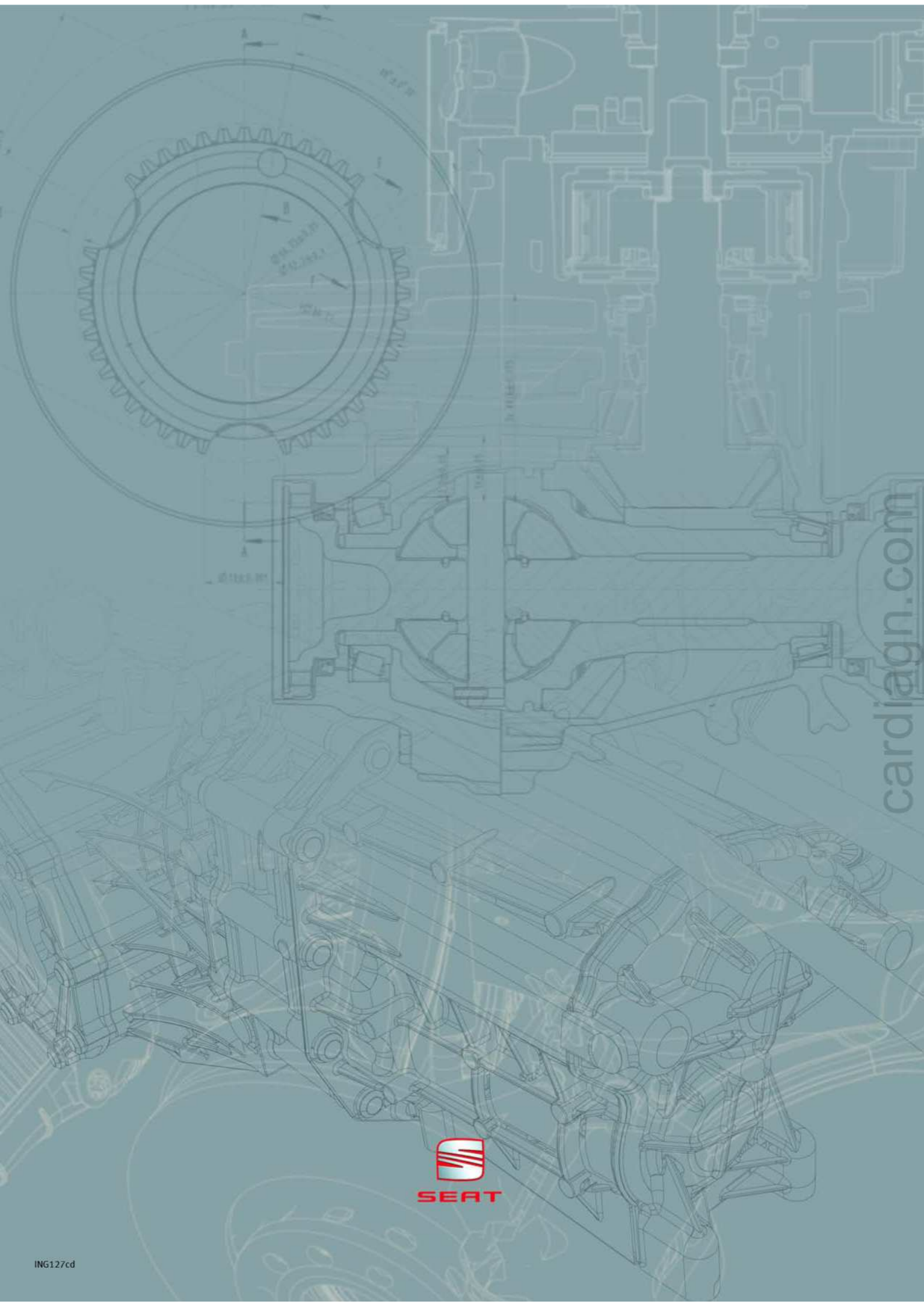
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