

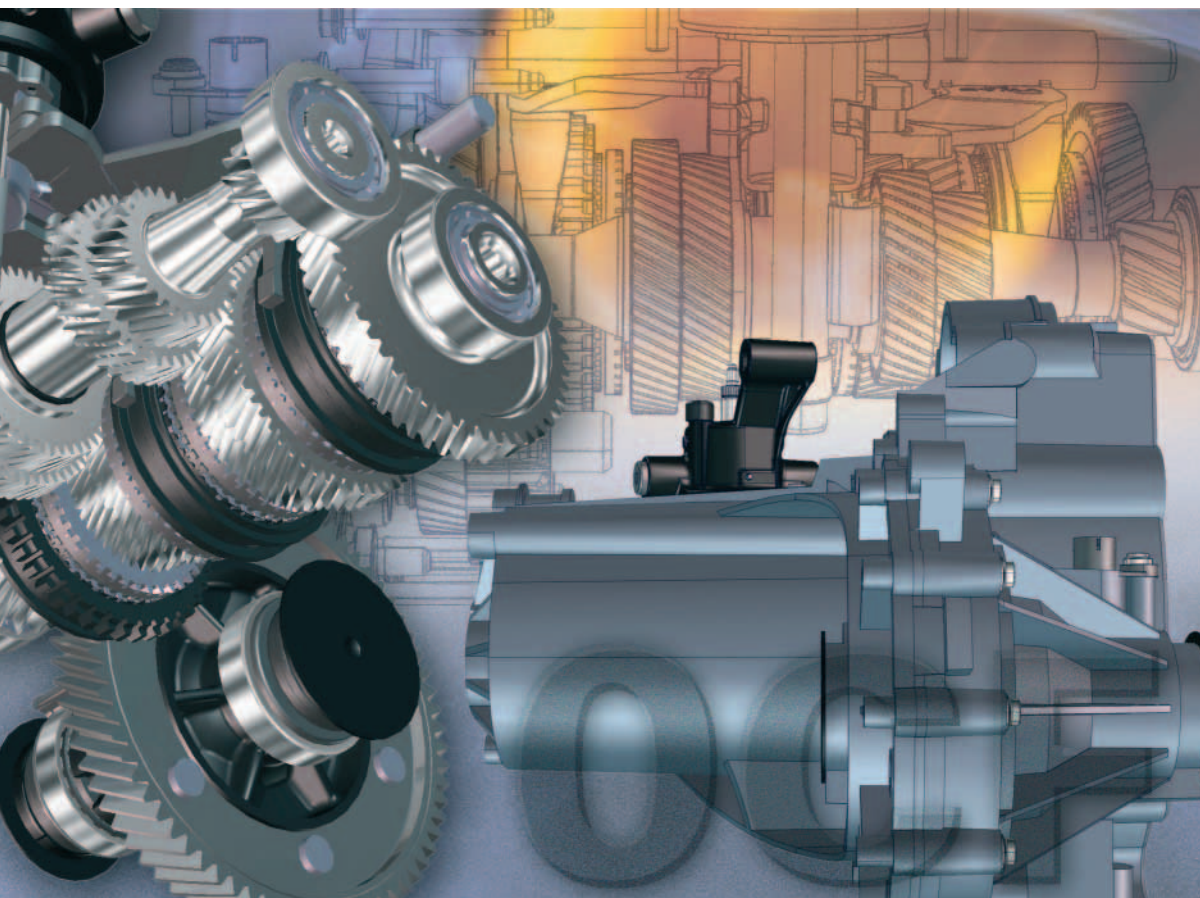
**Service Training**



**Self-study Programme Technology 509**

# **Manual Gearbox 0CF**

Design and function



The launch of the up! sees Volkswagen offer a new 5-speed manual gearbox.

The manual gearbox OCF features a compact, lightweight design. It thus meets the main requirements that have been set for the up!.

The following goals were achieved during the development of the gearbox:

- Greater efficiency
- Reduction in weight by optimising all gearbox components
- Simple design
- Simplification of assembly steps

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**The self-study programme presents the design and function of new developments!**  
**The content will not be updated.**

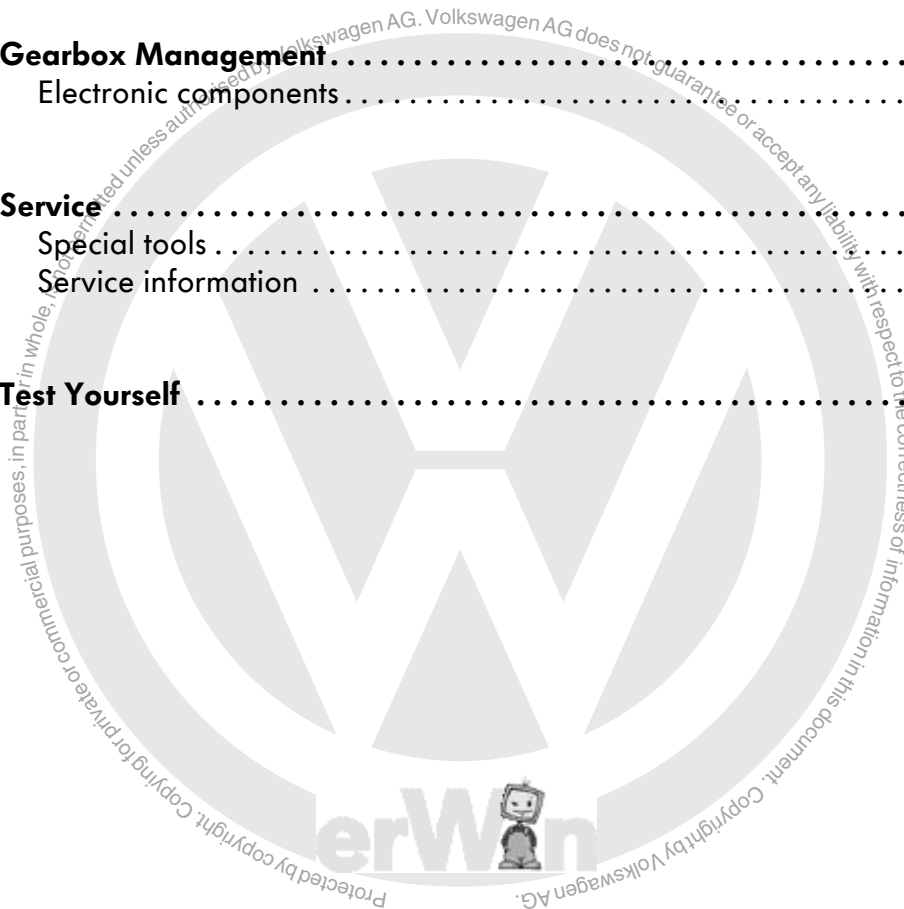
Current testing, setting and repair instructions can be found in the provided service literature.



**Important  
note**



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# Introduction

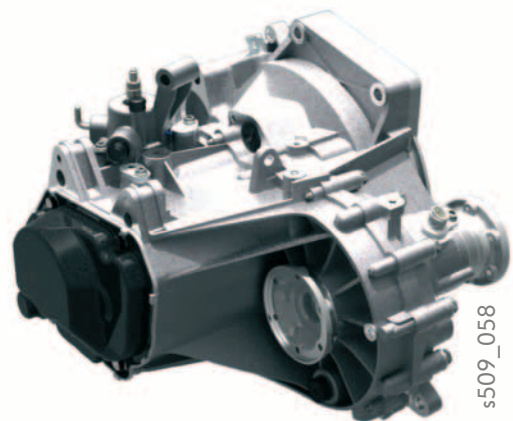


## Volkswagen manual gearboxes

Even though they have been around for a long time, manual gearboxes are not outdated technology. They have been adapted to new requirements over and over again. Consequently, manual gearboxes have had a decisive influence on aims such as reducing fuel consumption and noise.

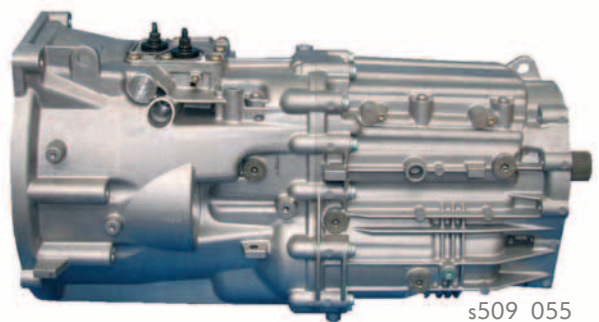
In Volkswagen's gearbox development department, manual gearboxes for a wide range of conditions and requirements in vehicle use have been planned. The spectrum ranges from the manual gearbox 02T for engines that deliver low torques and for compact installation spaces to the manual gearbox 08D for engines that deliver high torques. The manual gearbox 0CF as featured in the up! has now been added to the range. This gearbox covers the needs of the small car segment in particular.

Manual gearboxes are and will remain a worthwhile addition for the task of transmitting power from the engine to the drive wheels.



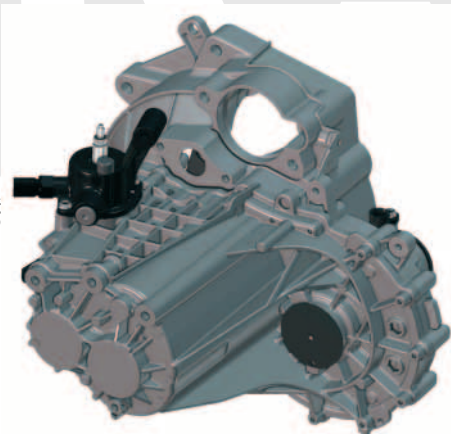
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Manual gearbox 02T



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Manual gearbox 08D

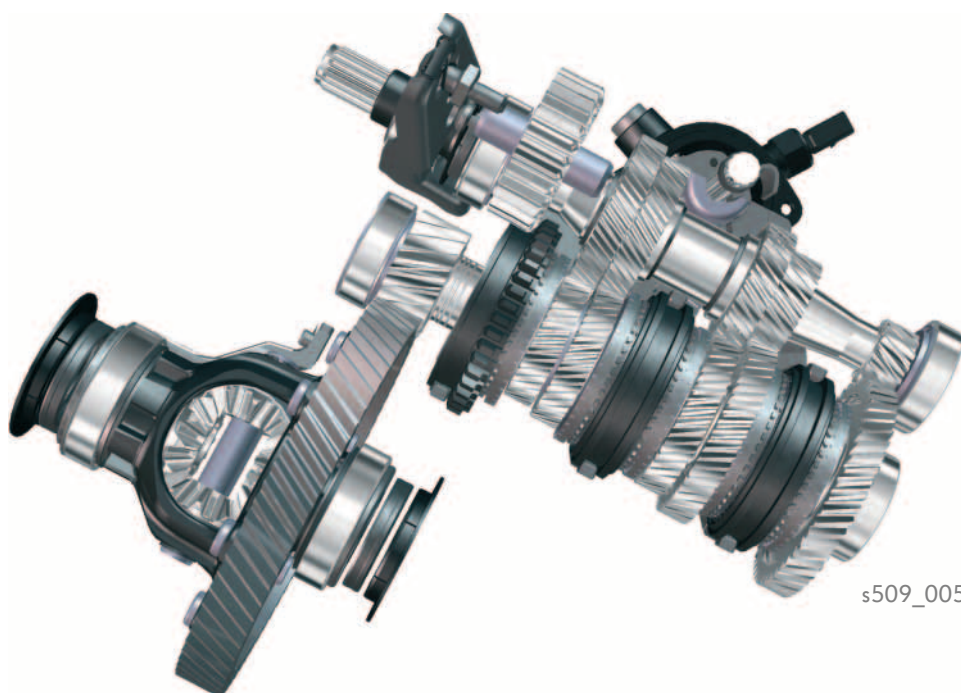


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5-speed manual gearbox 0CF

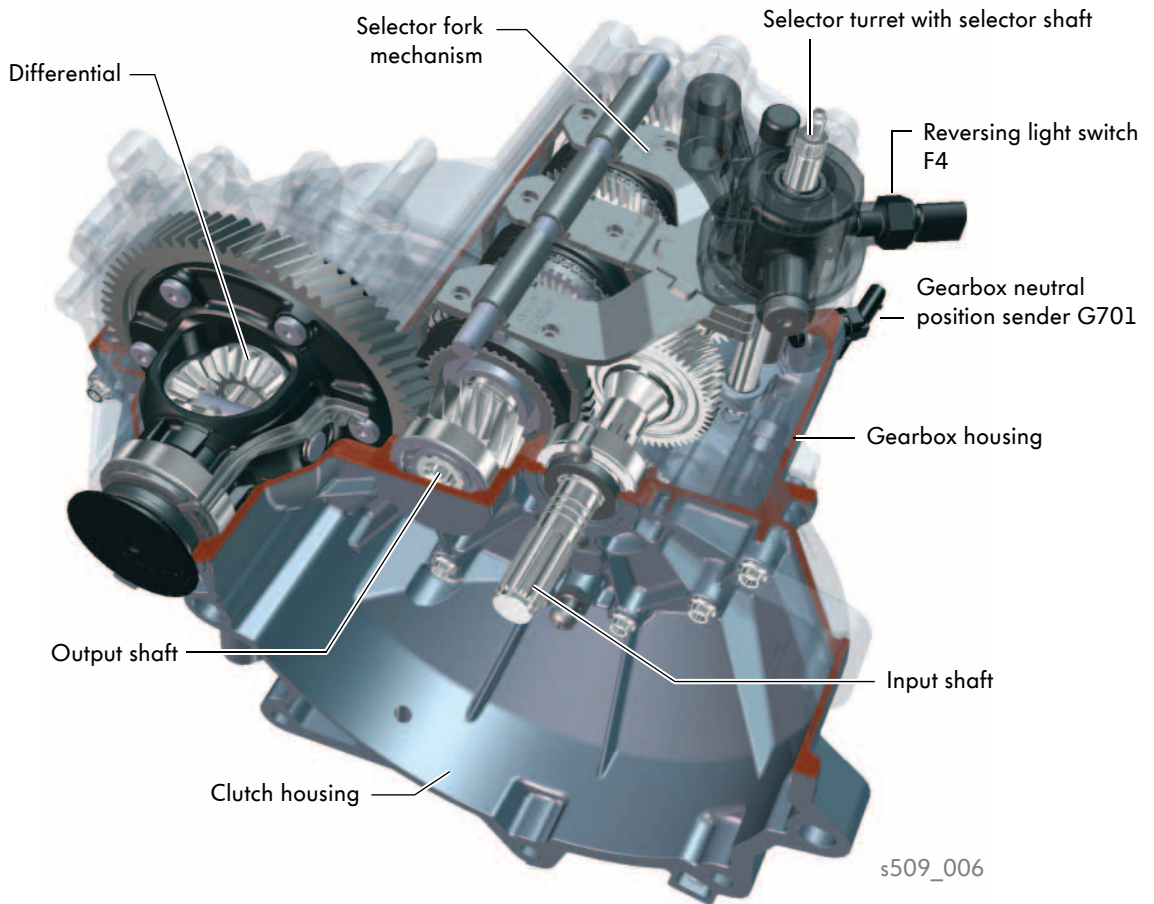
## Technical data

Gearbox code	OCF
Gearbox type	5-speed manual gearbox; 2-shaft manual gearbox with additional shaft for reverse gear
Installation type	Front/transverse installation
Installation length/installation width	356 mm/462 mm
Max. input torque	120 Nm
Material used for gearbox and clutch housing	Aluminium
Gear oil	SAE 75 W
Initial fill/oil change quantity	1.2 l / 1.1 l
Weight	26.7 kg with oil
Spread	4.57 both with 44 kW and 55 kW
Final drive ratio	44 kW: 74 to 19 55 kW: 75 to 18
Gear pairs	Identical for 44 kW and 55 kW
Top speed	Reached in 4th gear



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## Overview of gearbox design

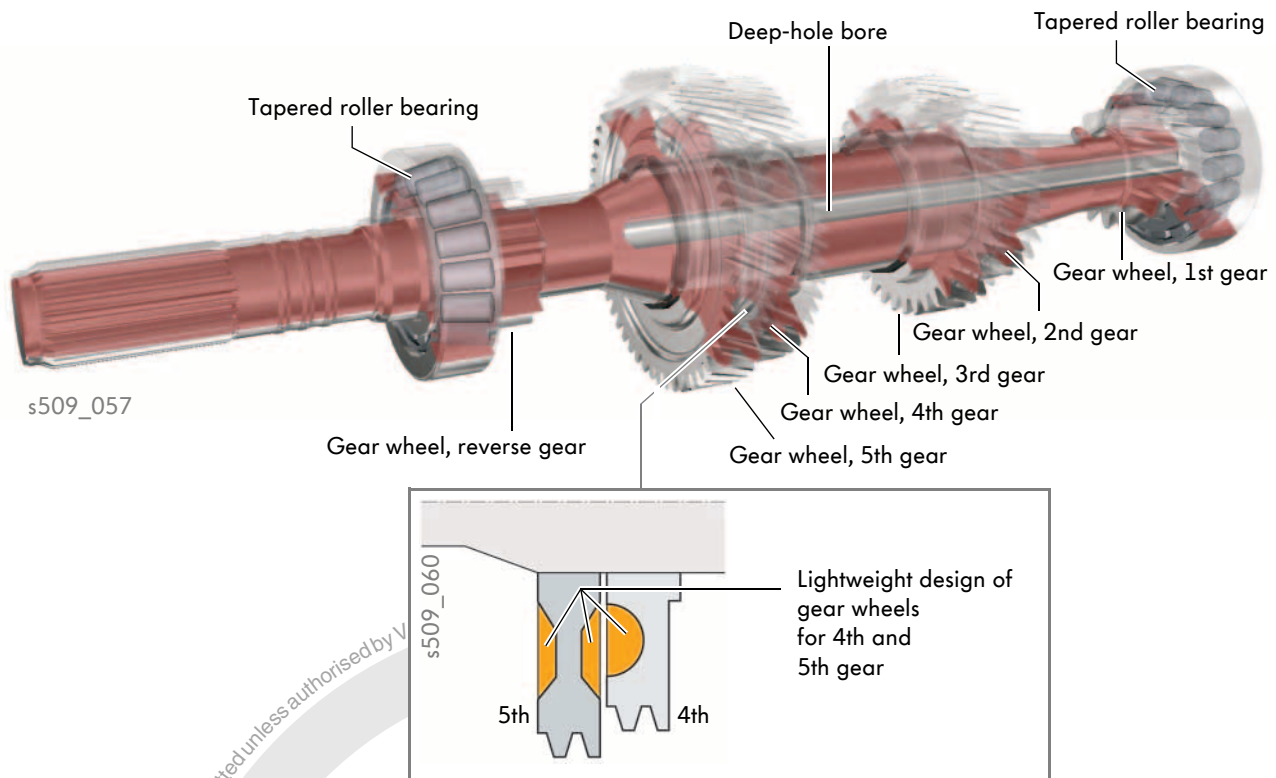


The single-piece gearbox housing is joined to the clutch housing which connects the gearbox to the engine. The selector turret transfers the position of the gear lever to the selector shaft via a cable system. Inside the gearbox, you will find the input shaft, the output shaft, the reverse gear shaft, the selector fork mechanism, the selector turret with selector shaft and the differential.

The reversing light switch F4 screws into the selector turret.

The gearbox neutral position sender G701 is only fitted in gearboxes destined for vehicles equipped with the start/stop system.

# Input shaft



## Design

The input shaft is mounted in two tapered roller bearings — one in the clutch housing and one in the gearbox housing.

During assembly, the bearings are fitted without preloading.

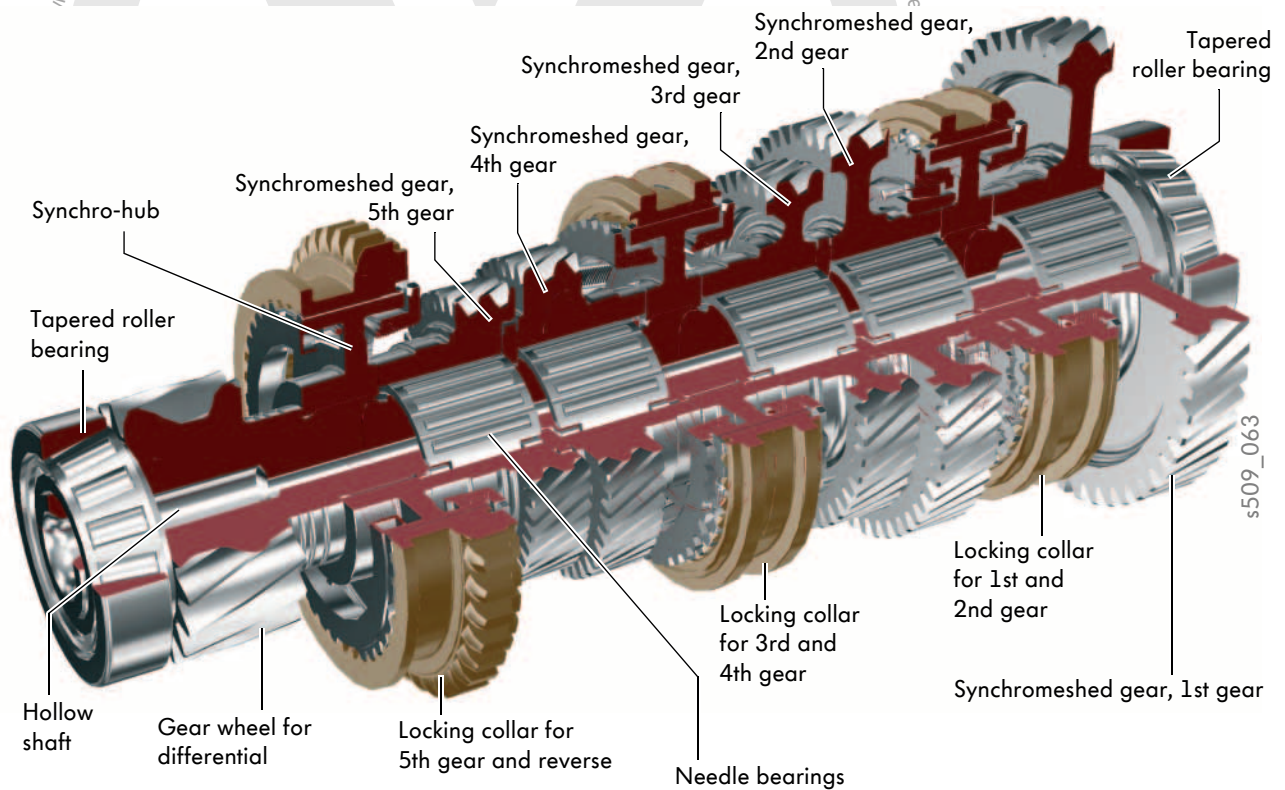
The input shaft and the gear wheels for first, second and reverse gear (fixed wheels) are made from the same piece of metal. The gear wheels for third, fourth and fifth gear are manufactured separately and pressed onto the input shaft. The designs of the fourth and fifth gear wheels along with the input shaft, which has a deep-hole bore, contribute to the reduction in weight.

## Task

The input shaft transfers the output from the engine via the selected gear to the output shaft and differential and then to the front wheels.



## Output shaft



### Design

The locking collars with synchro-hubs, synchroneshed gears and the gear wheel for the differential are located on the output shaft.

The output shaft has been hollowed out to reduce its weight. It is also equipped with the same tapered roller bearings as the input shaft and is mounted in the clutch and gearbox housings. The shaft is preloaded when it is fitted.

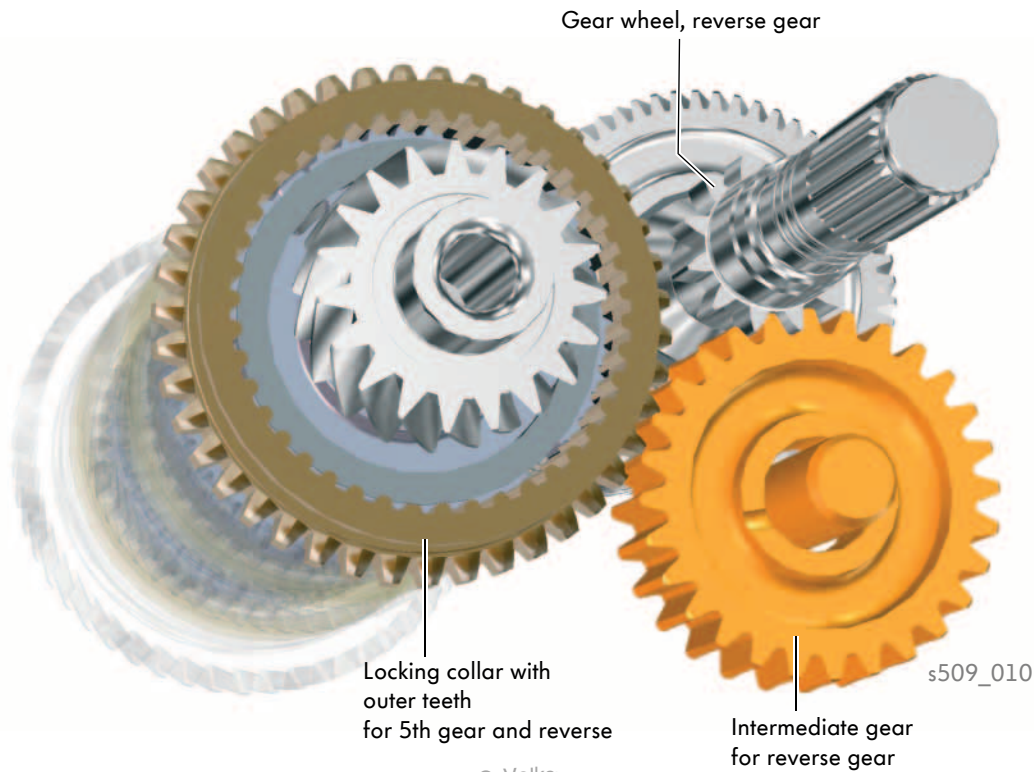
The output shaft does not vary in diameter. This means that all synchroneshed gear bearings are identical. The synchroneshed gears run on needle bearings and have been designed to reduce weight.

The first gear and the third, fourth and fifth gears have single synchronisation. The second gear has double synchronisation. The synchro-hubs are identical for first to fourth gears.

### Task

The output shaft produces the different transmission ratios of the individual gears with the aid of its synchroneshed gears.

# Reverse gear



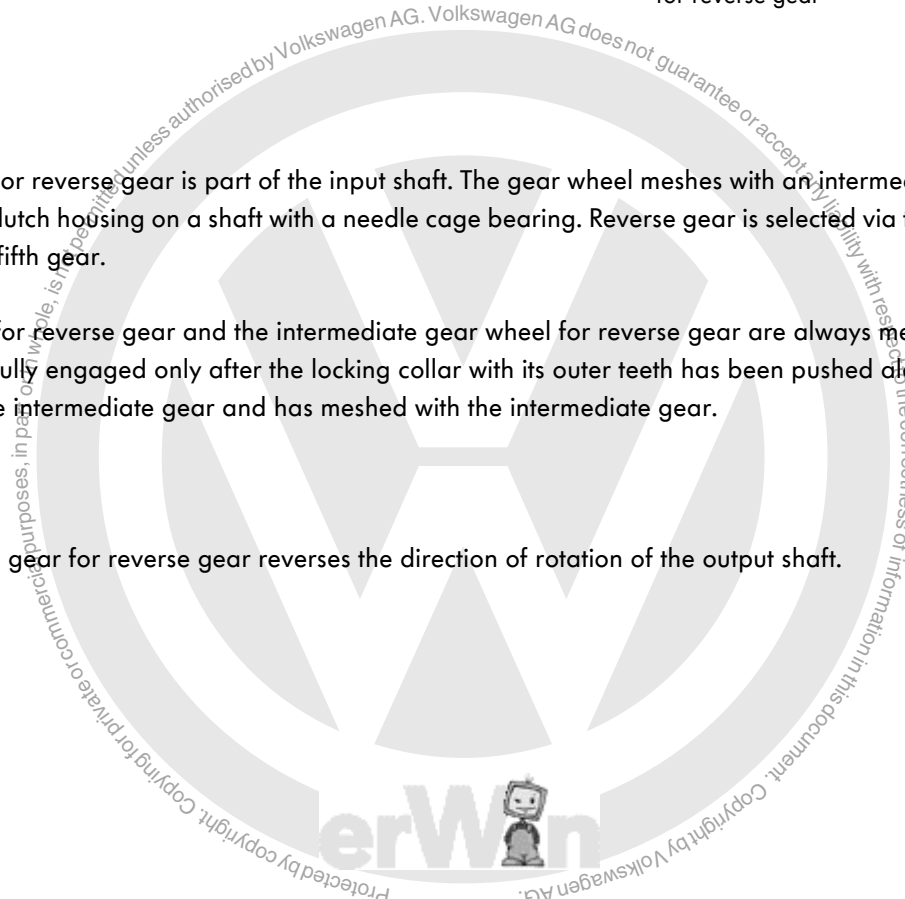
## Design

The gear wheel for reverse gear is part of the input shaft. The gear wheel meshes with an intermediate gear that is mounted in the clutch housing on a shaft with a needle cage bearing. Reverse gear is selected via the locking collar that also selects fifth gear.

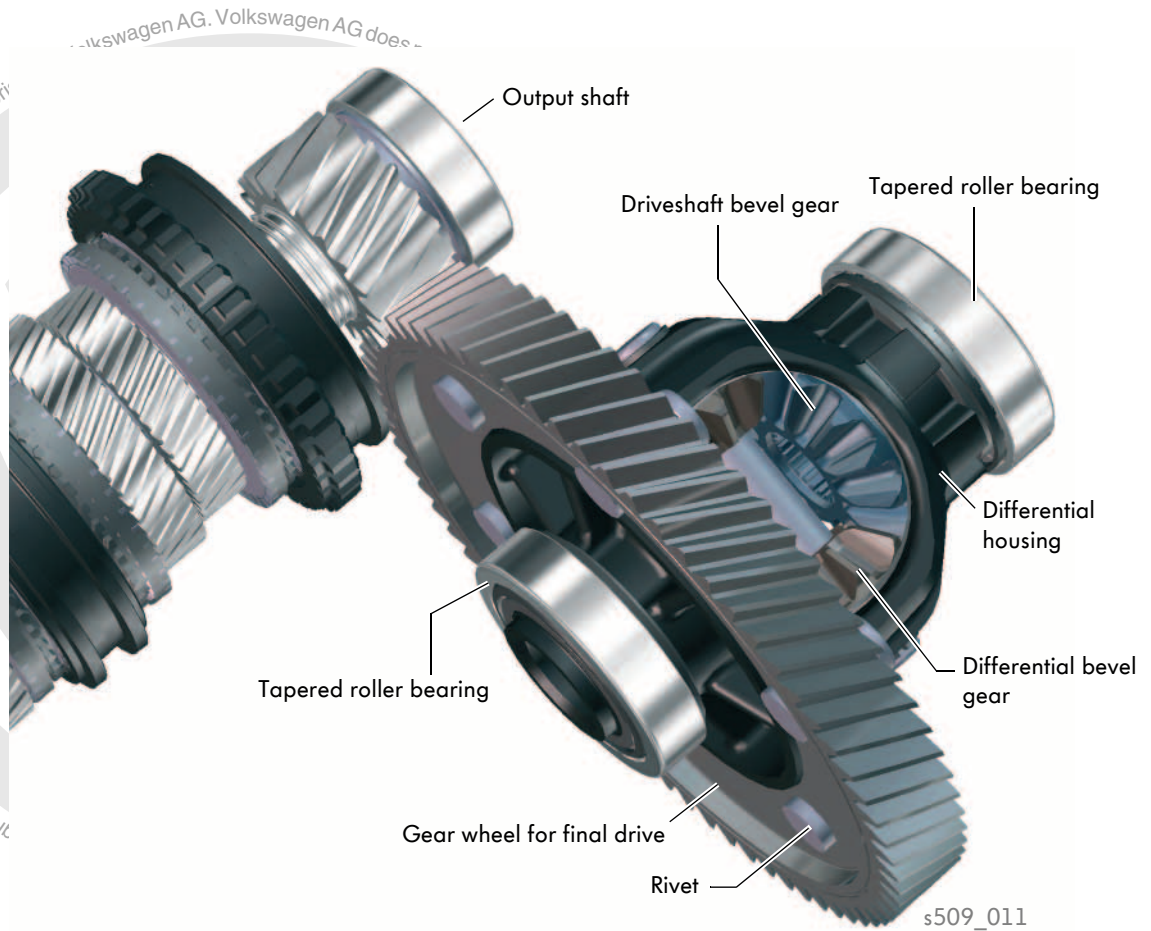
The gear wheel for reverse gear and the intermediate gear wheel for reverse gear are always meshed. Reverse gear is fully engaged only after the locking collar with its outer teeth has been pushed along the output shaft towards the intermediate gear and has meshed with the intermediate gear.

## Task

The intermediate gear for reverse gear reverses the direction of rotation of the output shaft.



## Differential



### Design

In contrast to the O2T manual gearbox, the differential housing is smaller and the gear wheel for final drive is narrower. This has made the differential lighter.

The gear wheel for final drive is joined to the differential housing by six rivets.

The differential is mounted on tapered roller bearings on both sides of the housing.

### Task

The differential has the task of compensating for differences in the speed of the inside and outside wheels on one axle, for example, in a curve. This prevents slippage between the tyres and the road.

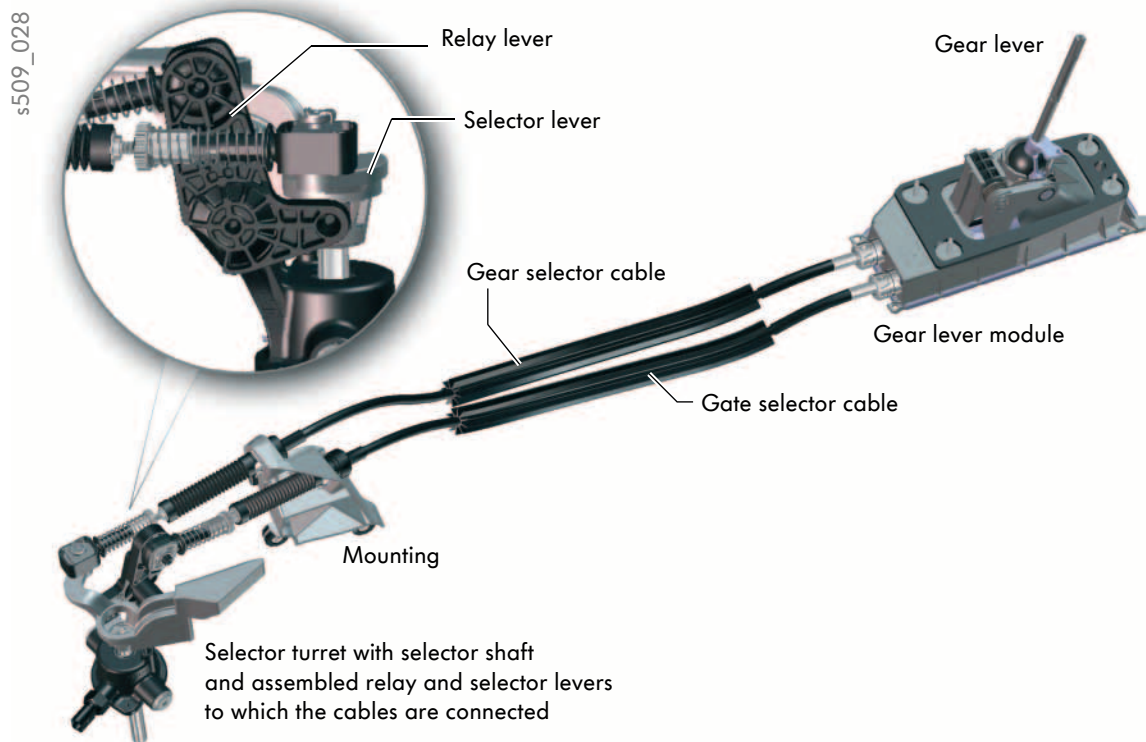
# Gearshift components

The gears are selected via the following components and assemblies:

- Cable selector system with gear lever
- Selector turret with selector shaft
- Selector fork mechanism for output shaft



## Cable selector system with gear lever



### Design

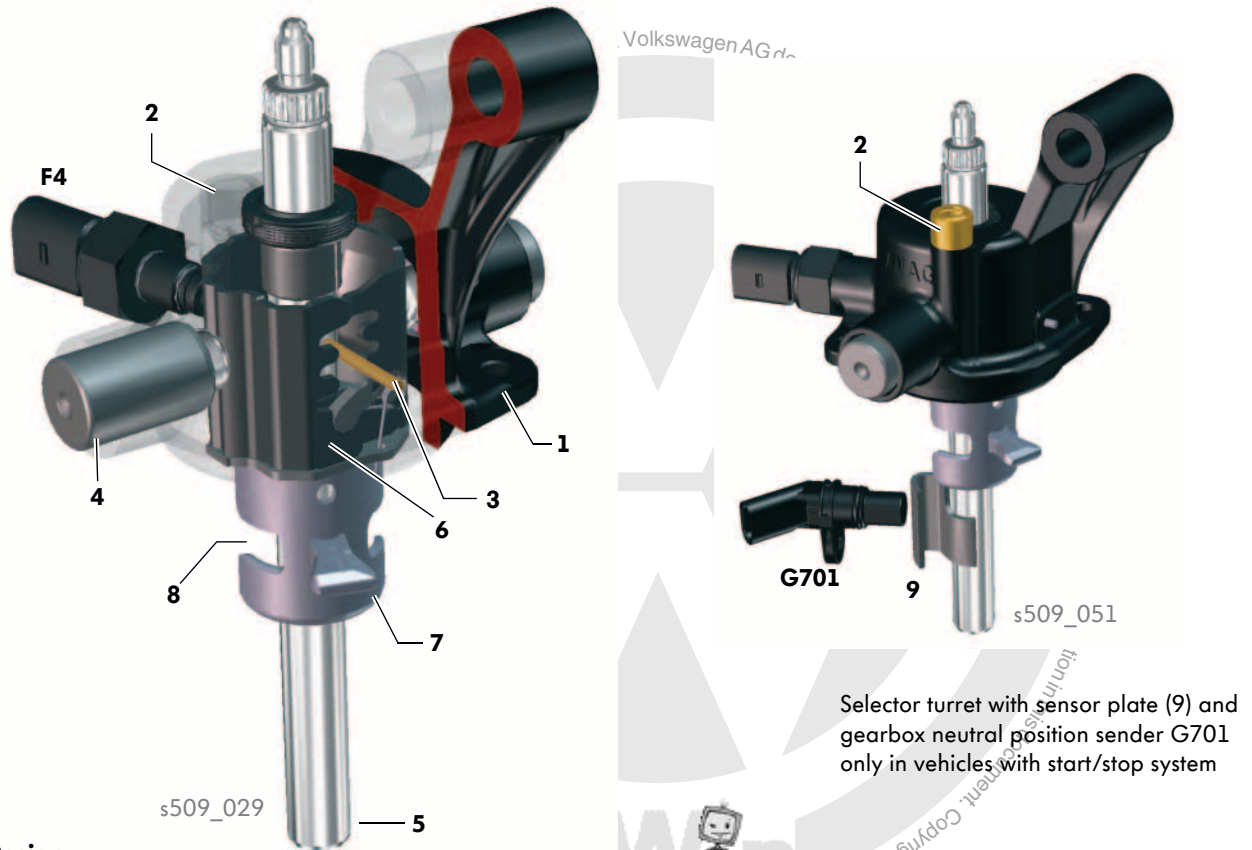
The cable selector system comprises the gear lever module, a gate selector cable and a gear selector cable with their connections to the selector turret and the mounting for the cables.

### Task

The two cables connect the gear lever and the gearbox. They transfer the selection and shift movements of the gear lever to the selector turret with the aid of the relay lever and the selector lever.

The cable selector system also reduces the transfer of vibrations from the drive train to the passenger compartment.

## Selector turret with selector shaft



### Design

The selector turret comprises:

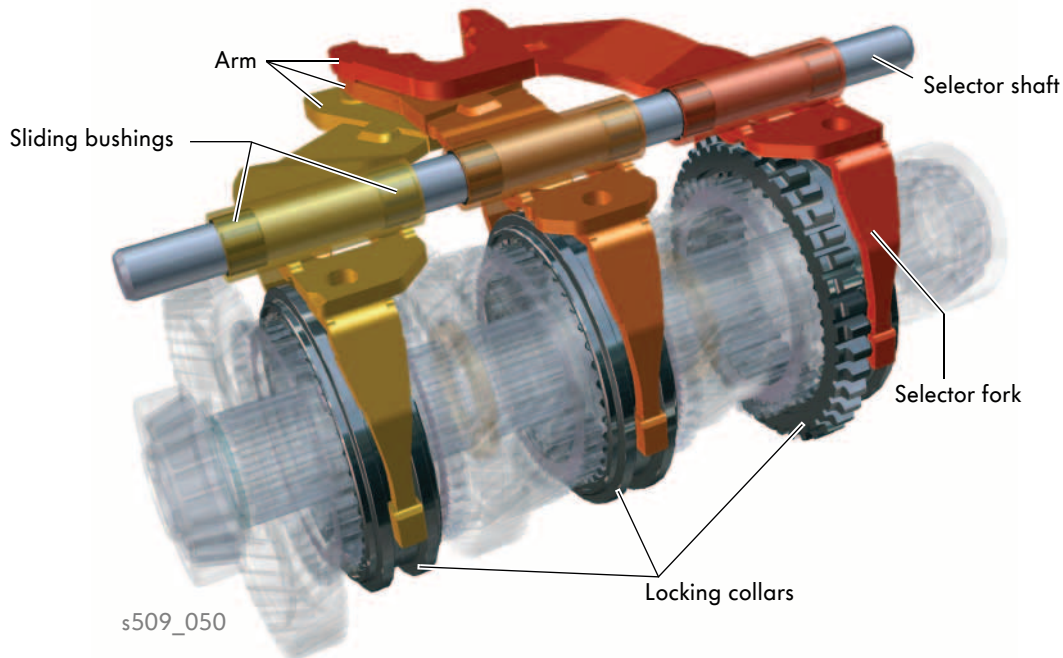
- the selector turret cover (1) with gearbox ventilation (2), gate pin (3) and locking sleeves (4)
- the selector shaft (5)
- the latching sleeve with gearshift gate and blocking sleeve (6) and the selector finger (7) with recesses (8)
- the reversing light switch F4

### Task

The selector turret transfers the movements of the gear selector cable and the gate selector cable to the selector fork mechanism. The travel of the selector shaft is limited by a gate pin that is fixed in the selector turret cover and extends into the gearshift gate in the latching sleeve.

The selector finger on the selector shaft engages in the selector fork mechanism and actuates the selector forks. Recesses in the locking sleeve on the left and right of the selector finger prevent two selector forks being operated at the same time.

## Selector fork mechanism



### Design

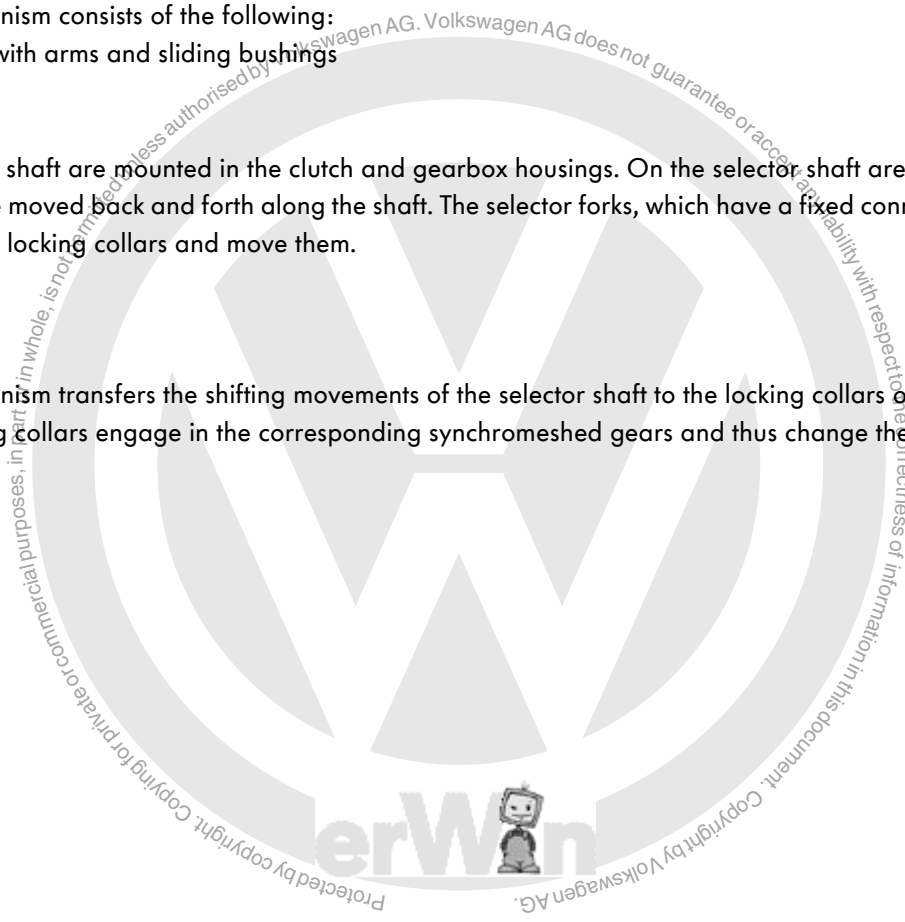
The selector fork mechanism consists of the following:

- three selector forks with arms and sliding bushings
- a selector shaft

The ends of the selector shaft are mounted in the clutch and gearbox housings. On the selector shaft are the selector forks, which are moved back and forth along the shaft. The selector forks, which have a fixed connection to the arms, engage in the locking collars and move them.

### Task

The selector fork mechanism transfers the shifting movements of the selector shaft to the locking collars on the output shaft. The locking collars engage in the corresponding synchromeshed gears and thus change the gears.

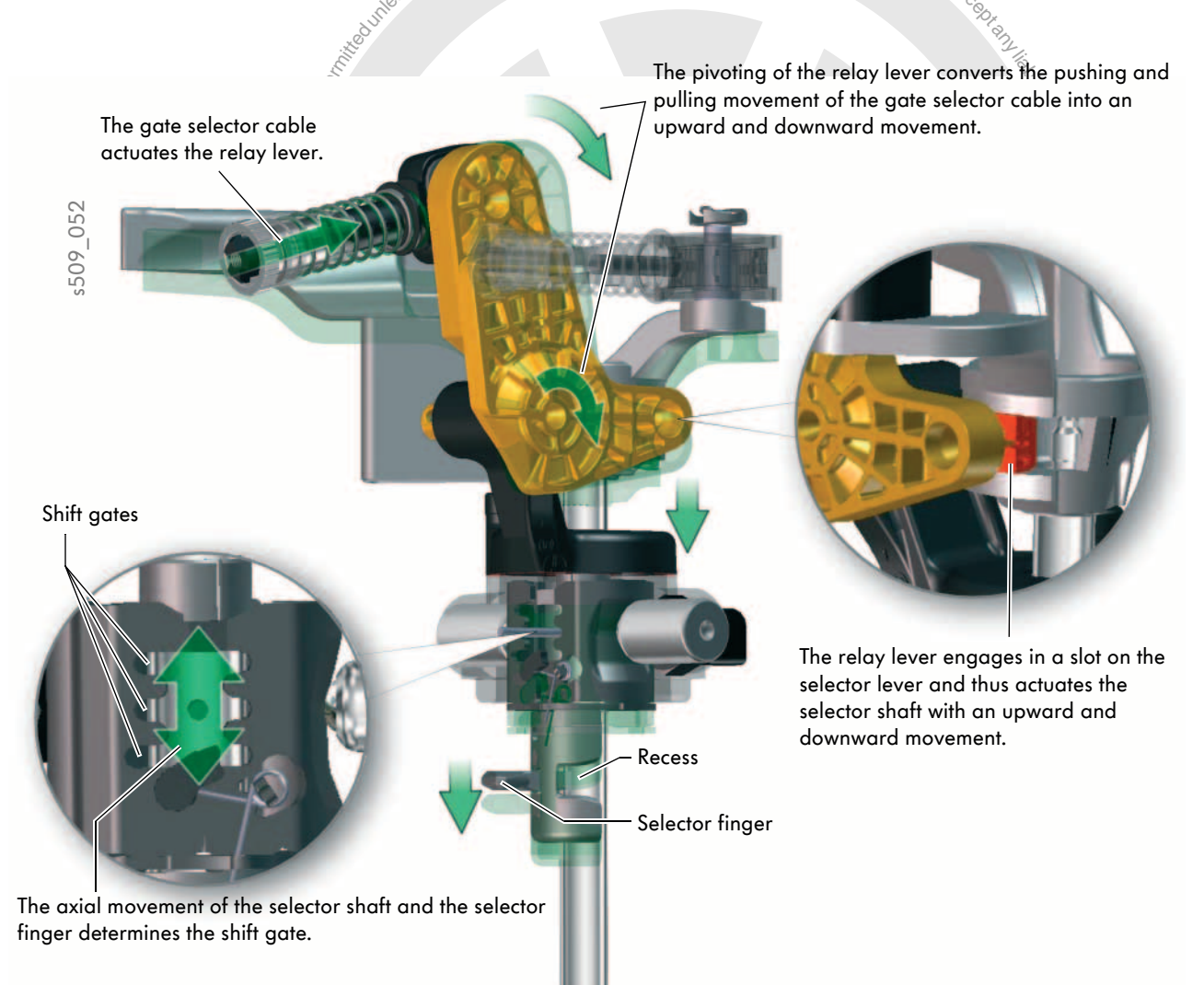


# Gearbox Function

## Gearshifts

During gear changes, the selector shaft performs two different movements. The axial movement is produced by the selection gate and the rotary movement by a shift gate inside the gear lever module.

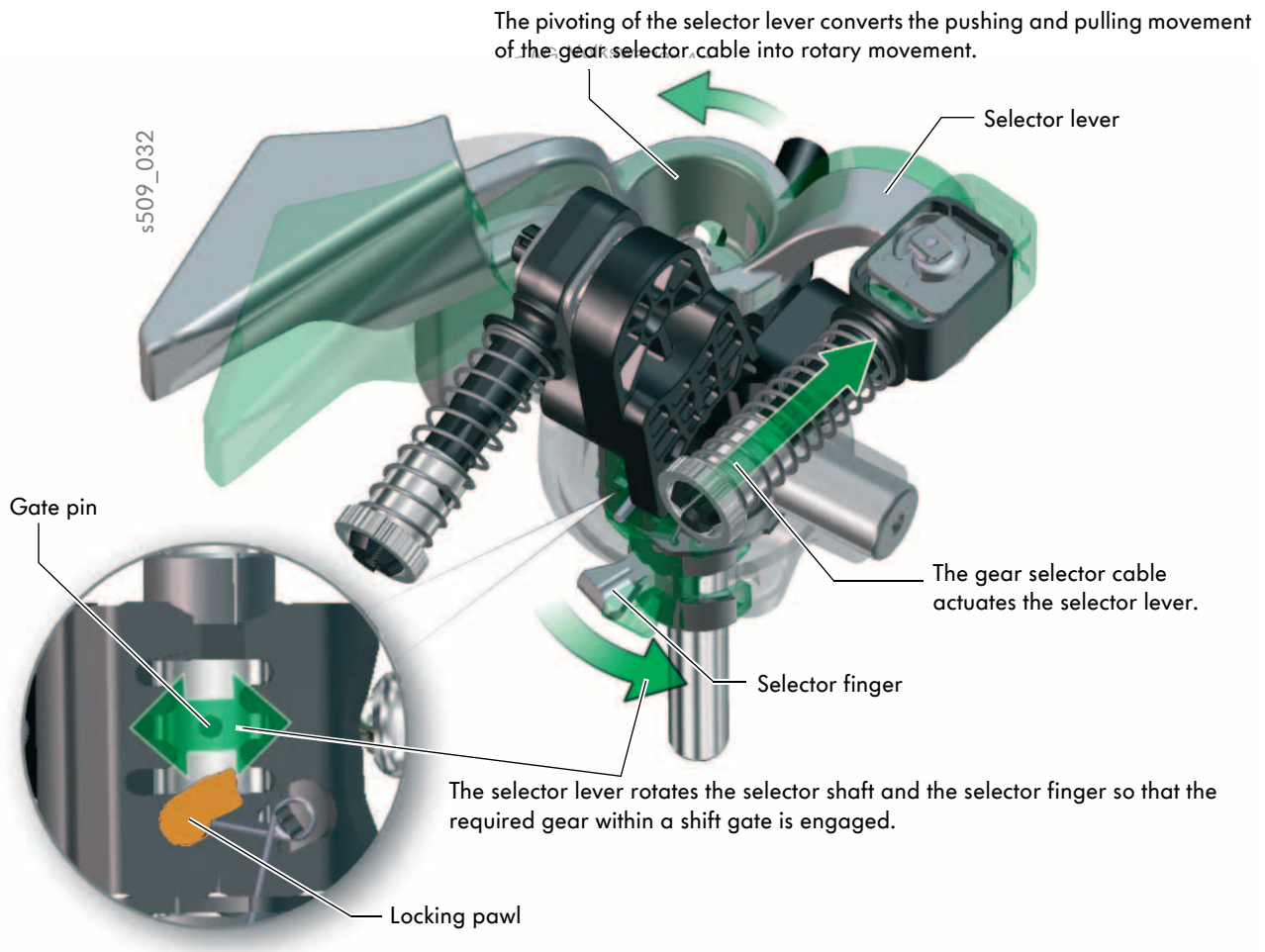
### Selecting the shift gate with the selection gate



The sideways movement of the gear lever is transferred to the selector turret via the gate selector cable and a relay lever. The relay lever engages in a slot in the selector lever on the selector turret. This allows the relay lever to lift and lower the selector shaft together with the gearshift gate and the selector finger.

This movement allows the selector finger on the selector shaft to engage in one of the three arms. The recesses on the side of the selector finger prevent the selector finger moving two arms at the same time.

## Selecting the required gear with the shift gate



The selection of a gear within a shift gate is performed by the rotary movement of the selector shaft and the selector finger in the selector turret. The forwards and backwards movement of the gear lever is transferred via the gear selector cable and the selector lever to the selector shaft. Inside the selector turret, the rotary movement of the selector shaft is limited by the gate pin that extends into the gearshift gate.

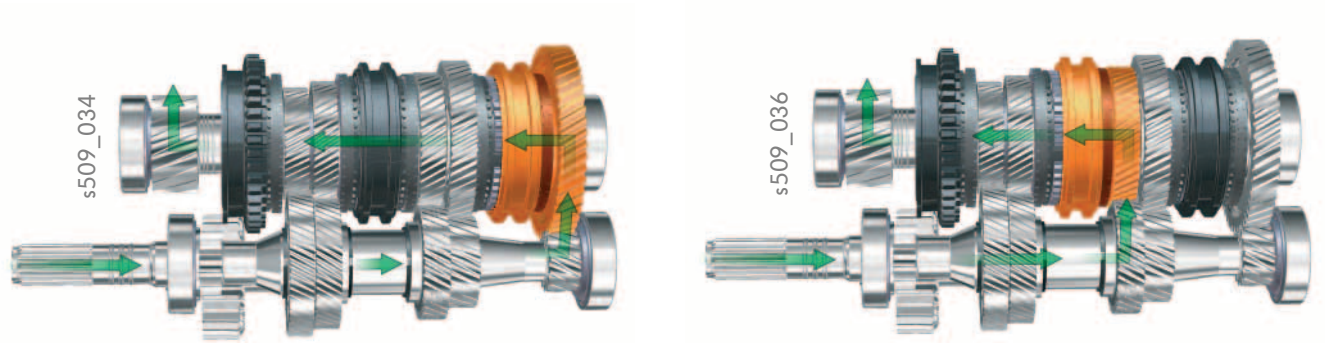
When the gear is selected, the selector finger moves the respective arm on the selector shaft so that the corresponding locking collar on the output shaft engages in the assigned synchromeshed gear.

A locking pawl on the gearshift gate prevents reverse gear being selected directly from fifth gear.



# Gearbox function

## Transmission of power between input shaft and output shaft

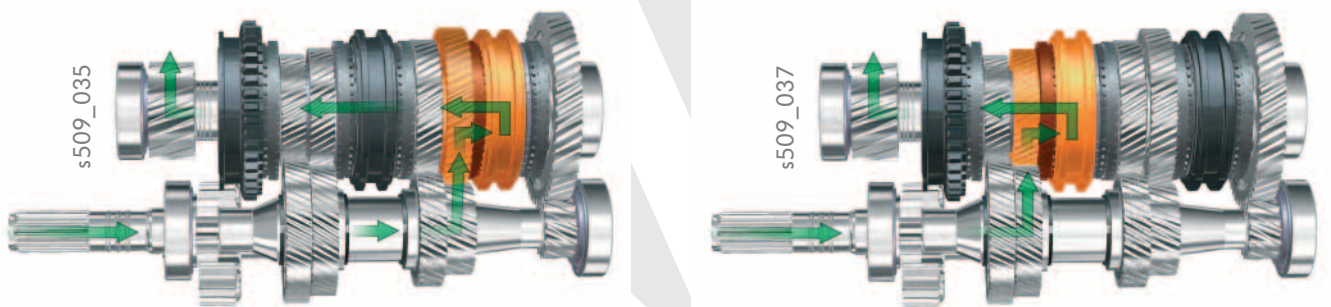


1st gear

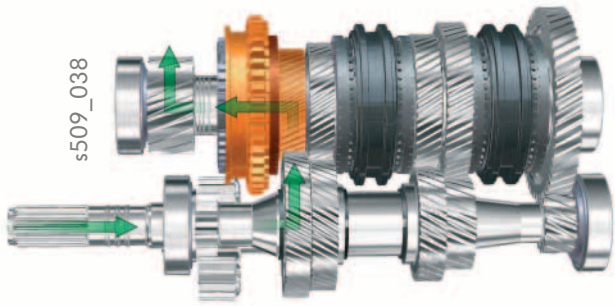
3rd gear

2nd gear

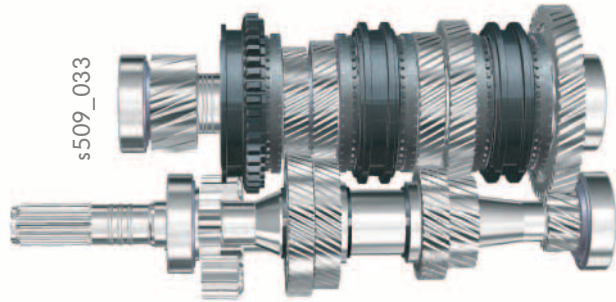
4th gear



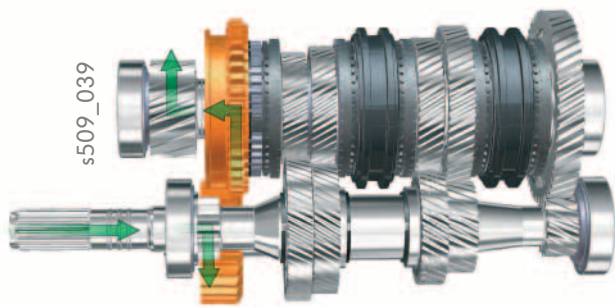
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**5th gear**



**Reverse gear**



**Gearbox neutral position**

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# Gearbox Management

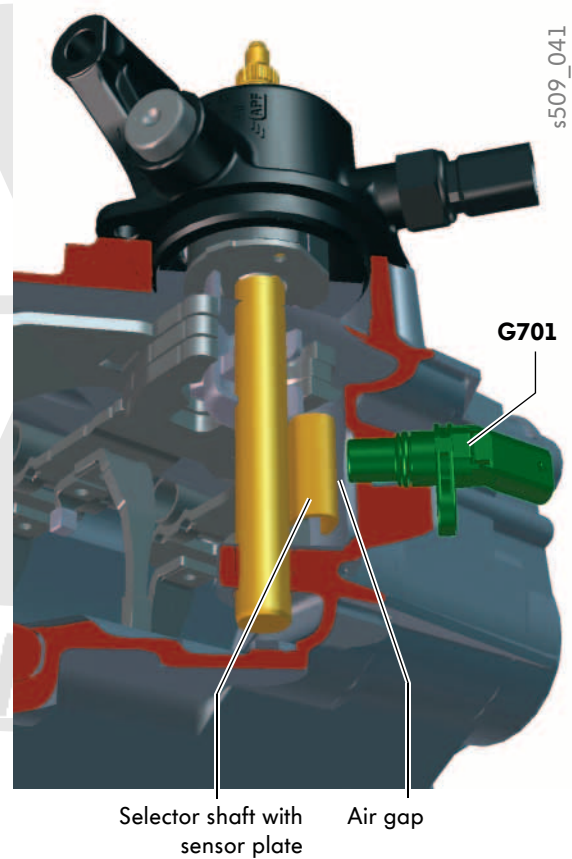
## Electronic components

### Sensors

#### Gearbox neutral position sender G701

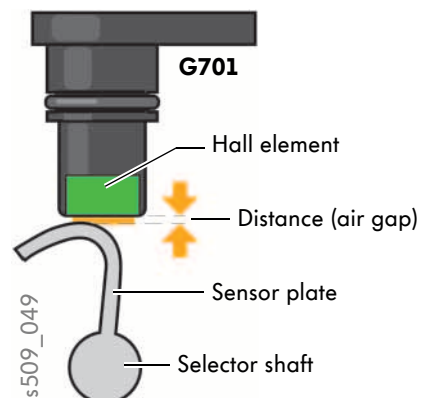
##### Location and task

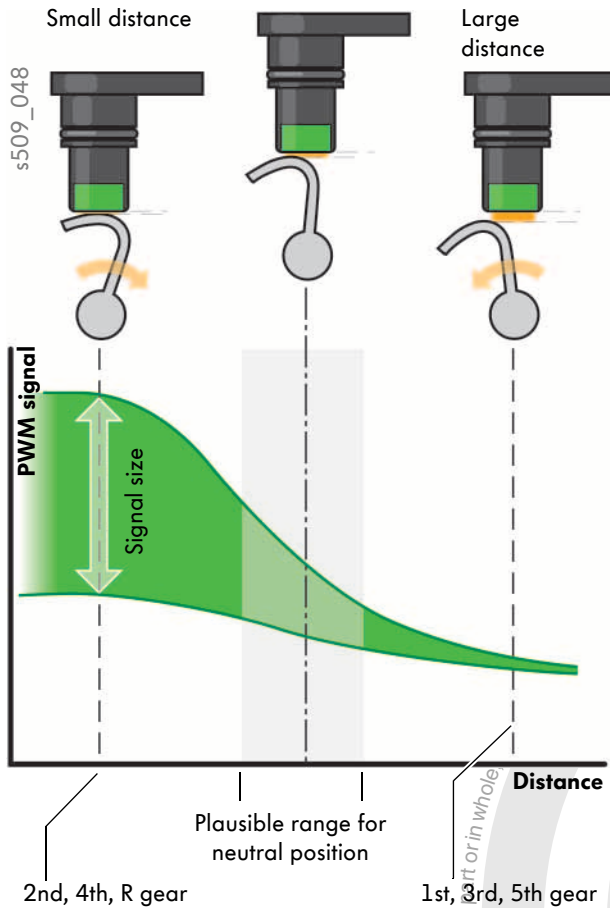
The gearbox neutral position sender G701 (neutral gate sensor) is located on the gearbox housing near to the selector turret in vehicles with the start/stop system. The sender measures its distance from a sensor plate on the selector shaft. The measured value is sent as a PWM signal to the engine control unit. The engine control unit recognises that the selector shaft is in the neutral position from the signal.



##### How it works

The gearbox neutral position sender G701 uses the Hall effect principle. The sender measures its distance from a sensor plate on the selector shaft. This distance changes as the selector shaft rotates from the neutral position. A different sized signal voltage is generated in the Hall element depending on the distance measured.





Behaviour of voltage signal as air gap changes

In other words, the greater the distance between the sender and the sensor plate, the smaller the PWM signal.

If the value of the PWM signal is within the plausible range, the engine control unit recognises that the gearbox is in the neutral position.

If necessary, the engine can now be restarted by the start/stop system without the clutch pedal being depressed (e.g. if the air conditioning is activated or if the battery voltage is too low).

### Effects of failure

If no signal is detected from the gearbox neutral position sender G701, the start/stop system is deactivated.




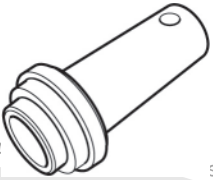

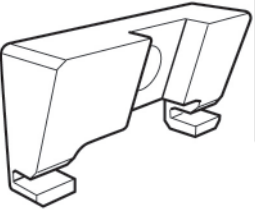
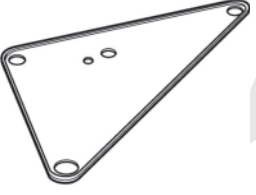
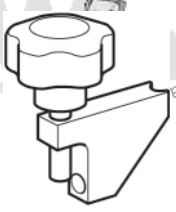
#### Please note:

The gearbox neutral position sender G701 and the sensor plate are installed only in manual gearboxes for vehicles equipped with a start/stop system. The manual gearbox OCF for vehicles without a start/stop system does not have this sensor. The selector shaft in the gearbox will also not have a sensor plate in this case.

Before the start/stop system is enabled, the engine management uses additional information to check the plausibility of the air gap in the three positions whenever the engine is started again after "ignition off".



## Special tools

Description	Tool	Usage
<b>T10027A</b> <b>Locking pin</b>	 <p>s509_042</p>	The locking pin is required to correctly adjust the selector mechanism.
<b>T10481/ T10482</b> <b>Thrust piece</b>	 <p>s509_045</p>	The thrust piece is used to drive in the seals for the cardan shafts.
<b>T10381/1</b> <b>Closure cap</b>	 <p>s509_047</p>	The closure caps protect the connecting flange for the drive shafts against damage once the drive shafts have been disconnected from the gearbox.
<b>10-222A/31-5</b> <b>Adapter</b>	 <p>s509_044</p>	This adapter is placed over the lid lock and supports the square tube T40091/1.
<b>3282/63</b> <b>Adjustment plate</b>	 <p>s509_046</p>	The adjustment plate is used to align the manual gearbox OCF. It is placed on the gearbox support.
<b>3282/64</b> <b>Adapter</b>	 <p>s509_043</p>	The adapter 3282/64 secures the gearbox during installation and removal.

## Service information

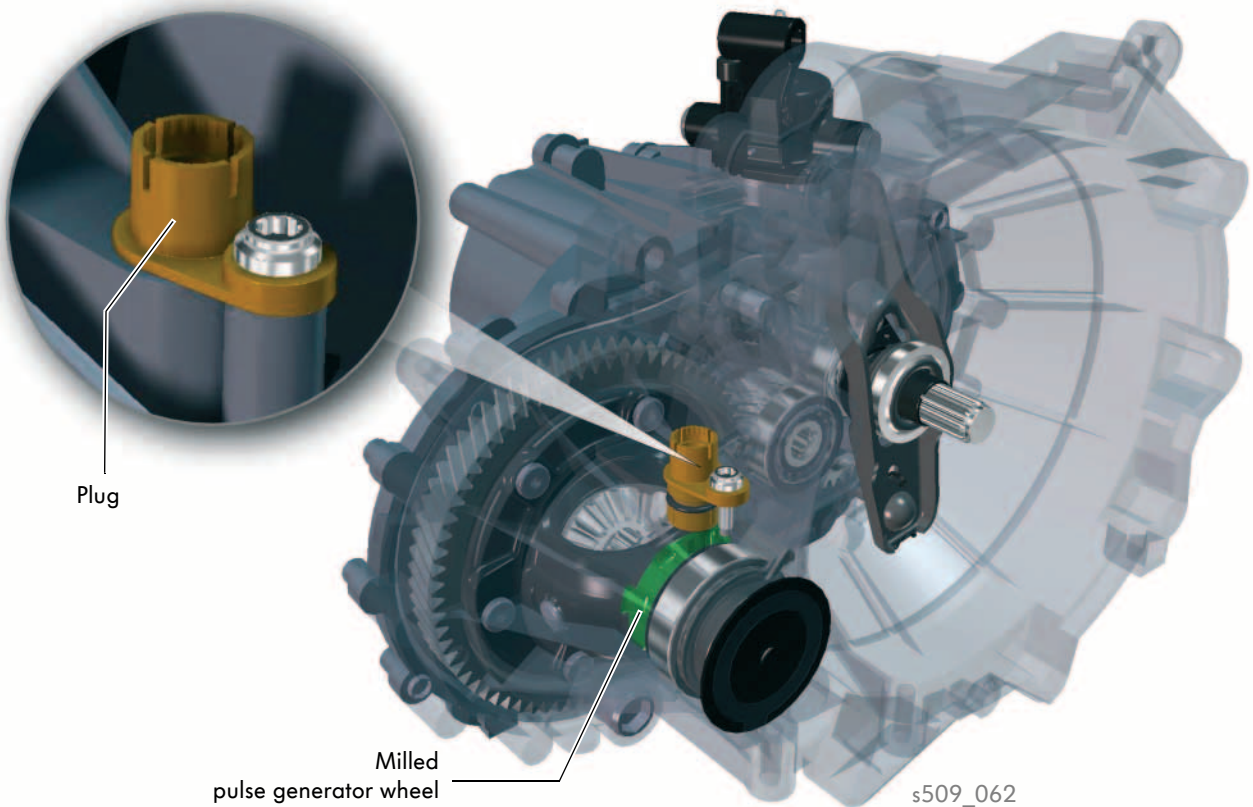


The gearbox oil must always be drained before the gearbox is removed.

Reason:

When the driveshafts are removed, the gearbox oil will flow out of the housing.

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The plug is bolted onto the clutch housing. The gearbox oil can be topped up here once the plug has been removed.

Note for vehicles without ABS:

If a vehicle does not have ABS, the speedometer sender G22 can be fitted in the hole in place of the plug.

The milled pulse generator wheel in the differential housing allows the sender to recognise the gearbox output speed and send it to the control unit in dash panel insert J285 as a speed signal.

# Test Yourself

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## Which answers are correct?

One or several of the given answers may be correct.

### 1. The manual gearbox OCF is...

- a) a 4-speed manual gearbox.
- b) a semi-automatic 5-speed gearbox with gearbox neutral position recognition.
- c) a 5-speed manual gearbox.

### 2. Which weight-reducing measures were used among others in the design of the manual gearbox OCF?

- a) Input shaft with deep-hole bore, hollow output shaft
- b) Weight-reduced gear wheels for 4th and 5th gear
- c) Weight-reduced gear wheels for all gears
- d) Gearbox and clutch housing made from aluminium
- e) Output shaft and additional shaft made from cold-sintered magnesium silicate
- f) Only one selector rail for all gears

### 3. The selector shaft with sensor plate and the gearbox neutral position sender G701 are fitted when...

- a) the gearbox is converted into a semi-automatic gearbox.
- b) the vehicle is equipped with a distance control system.
- c) the vehicle is delivered with the start/stop system.



**4. The manual gearbox OCF is operated via a gear selector cable and a gate selector cable.  
Which cable causes which movement on the selector shaft?**

- a) The selector shaft is rotated around its longitudinal axis by the gate selector cable via the selector lever.
- b) The selector shaft is moved up and down by the gate selector cable via the relay lever and the selector lever.
- c) The selector shaft is rotated around its longitudinal axis by the gear selector cable via the selector lever.
- d) The selector shaft is moved up and down by the gear selector cable via the relay lever and the selector lever.

**5. Which movement of the selector shaft causes which action in the gearbox?**

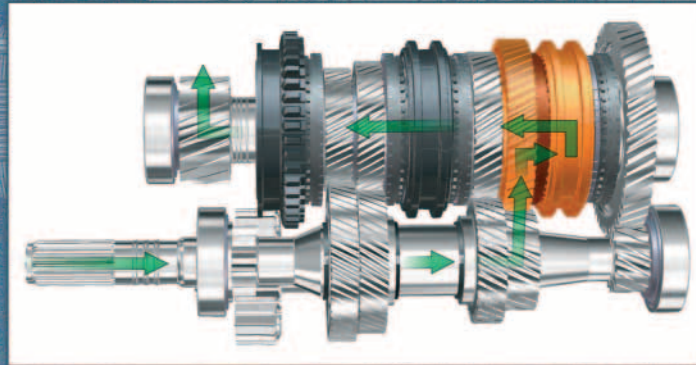
- a) The gear is engaged by the axial movement of the selector shaft.
- b) The shift gate is selected by the axial movement of the selector shaft.
- c) The gear is engaged by the rotary movement of the selector shaft.
- d) The shift gate is selected by the rotary movement of the selector shaft.

**6. The locking pawl on the gearshift gate in the selector dome...**

- a) locks the engaged reverse gear.
- b) ensures that you can shift into reverse gear only from 1st gear.
- c) prevents reverse gear being selected directly from 5th gear.



Answers: 1. c); 2. a), b), d); 3. c); 4. b), c); 5. b), c); 6. c)



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