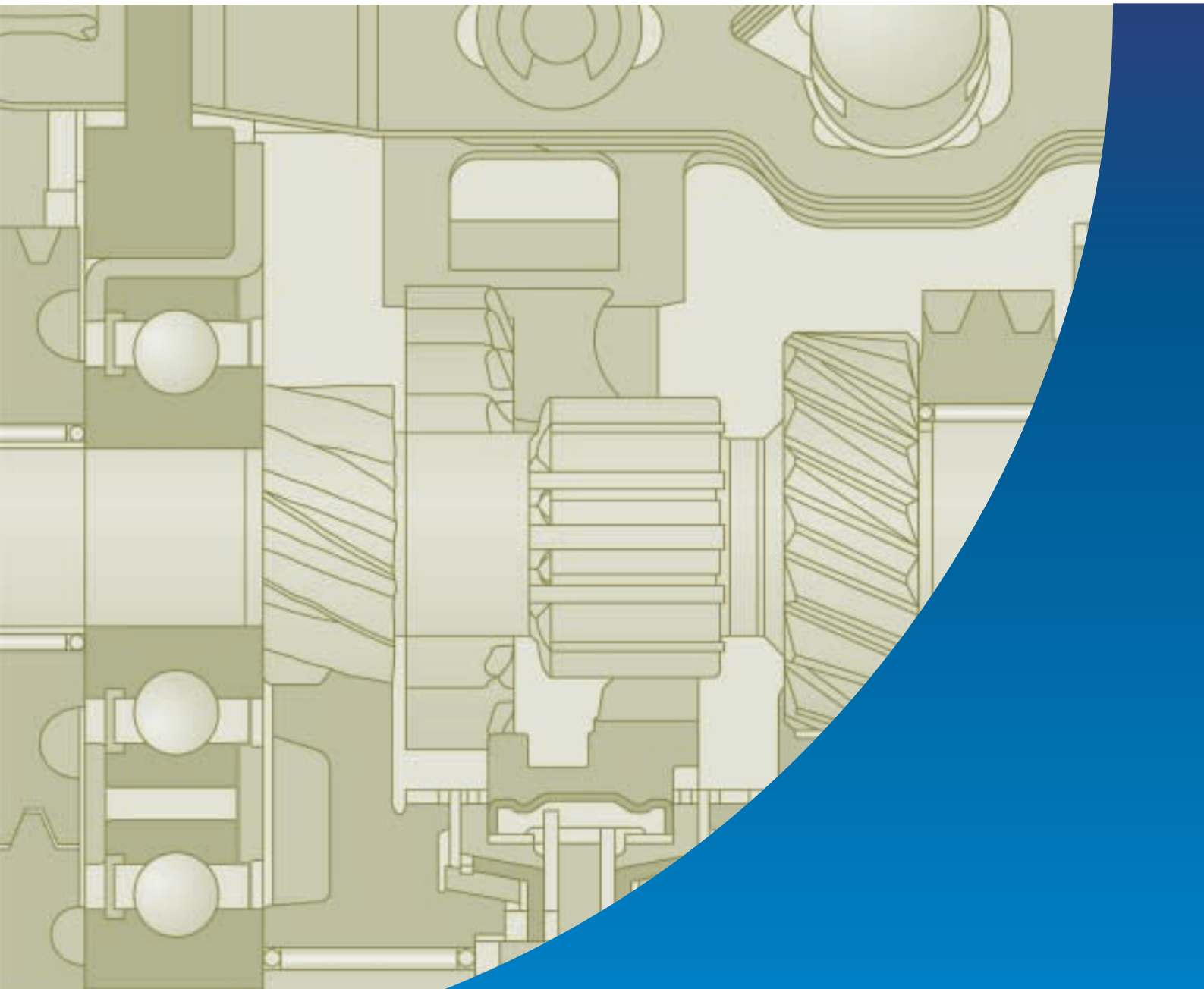
Service.

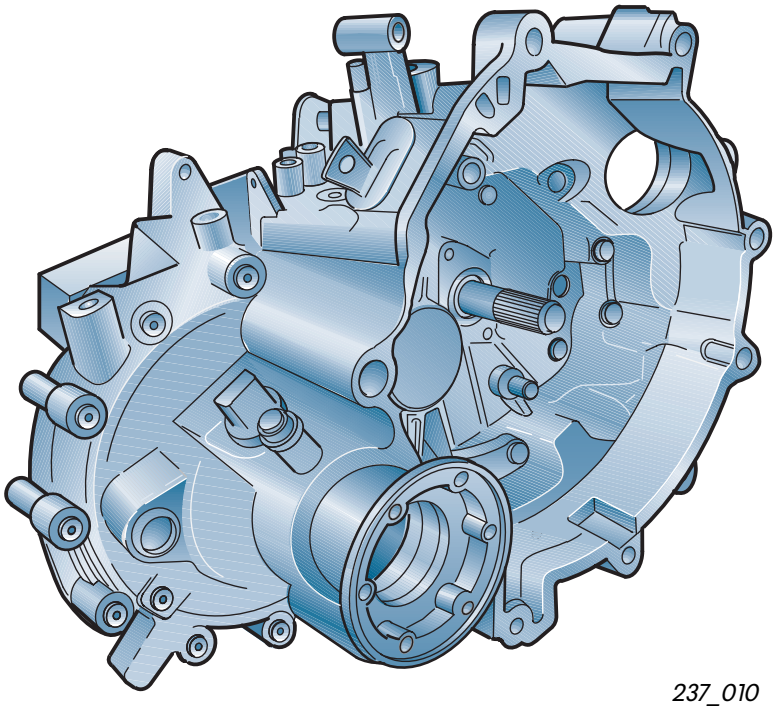
## Self-Study Programme 237

# Manual gearbox 02T

Design and Function



## The 02T 5/6-speed manual gearbox



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### Gearbox design

With the new 02T 5/6-speed manual gearbox of the MQ200 series, Volkswagen has succeeded in developing an ultra-light twin-shaft gearbox. The housing is manufactured from magnesium. The gearbox can transmit up to 200 Nm of torque and is used throughout the Group in combination with various engines ranging from the A00 class to the A class.

The final drive ratios and the ratios of the individual gears can be matched to the power outputs of the various engines.

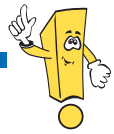
The type diversity within the gear and final drive ratios allows an optimum compromise to be found between sporty and economical gearbox design for all automotive applications.

The gearbox is operated by means of selector cables. The clutch control is hydraulic.

The development goals for the new gearbox were as follows:

- Easy and exact gear-changes
- Optimal efficiency
- Low weight
- Modular technology
- Standard cable-operated gearbox

New



Important Note

**The Self-Study Programme is not a Workshop Manual!**

Please always refer to the relevant Service Literature for all inspection, adjustment and repair instructions.

# Table of contents

# Introduction

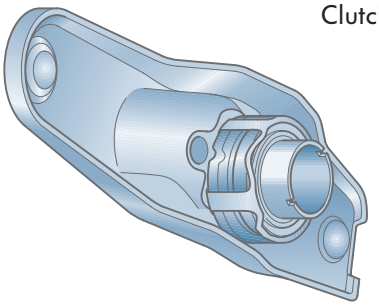
## The modular system

Individual modules are assembled in modular form.
This increases their functionality after assembly in series production and in the service workshop.

The modules are:

**Clutch release lever**

This module contains the clutch release lever, the release bearing and the guide sleeve.

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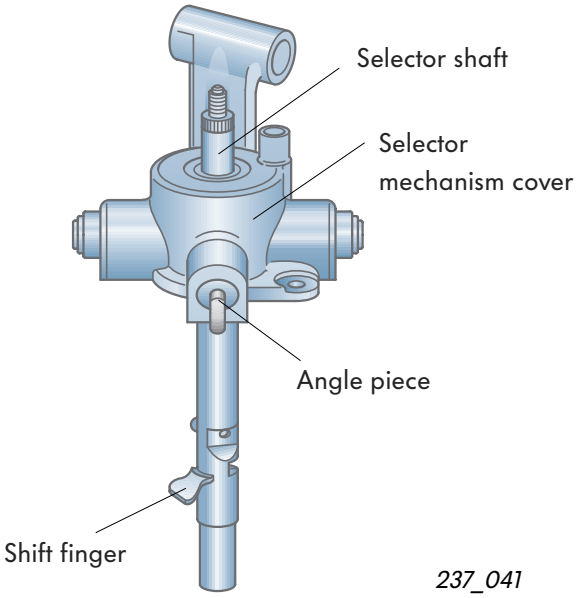
**Selector shaft with selector mechanism cover**

All blocking detent, spring and guide elements of the selector mechanism, as well as the angle piece for adjustment of the selector mechanism are accomodated in this module.

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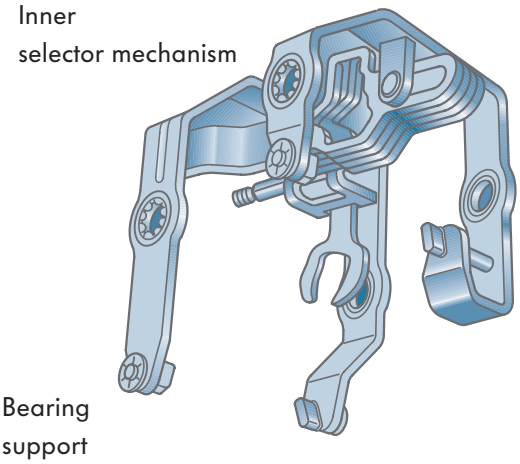
**The inner selector module**

with shift forks, selector plates and bearing.

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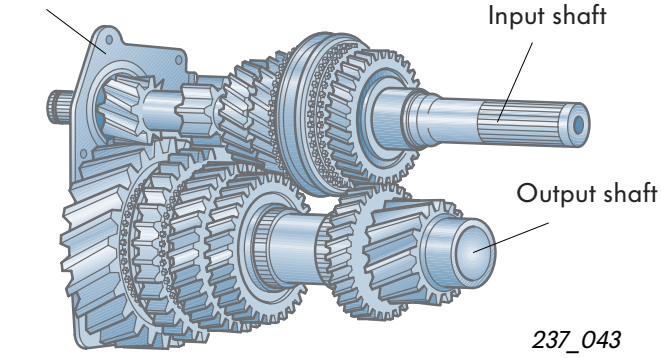
**The bearing support**

with the two grooved ball bearings and pre-assembled powertrain and output shaft.

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## The housing

is made from magnesium and consists of 2 parts (gearbox housing, clutch housing).
The gearbox housing is sealed off from the exterior by a cover.

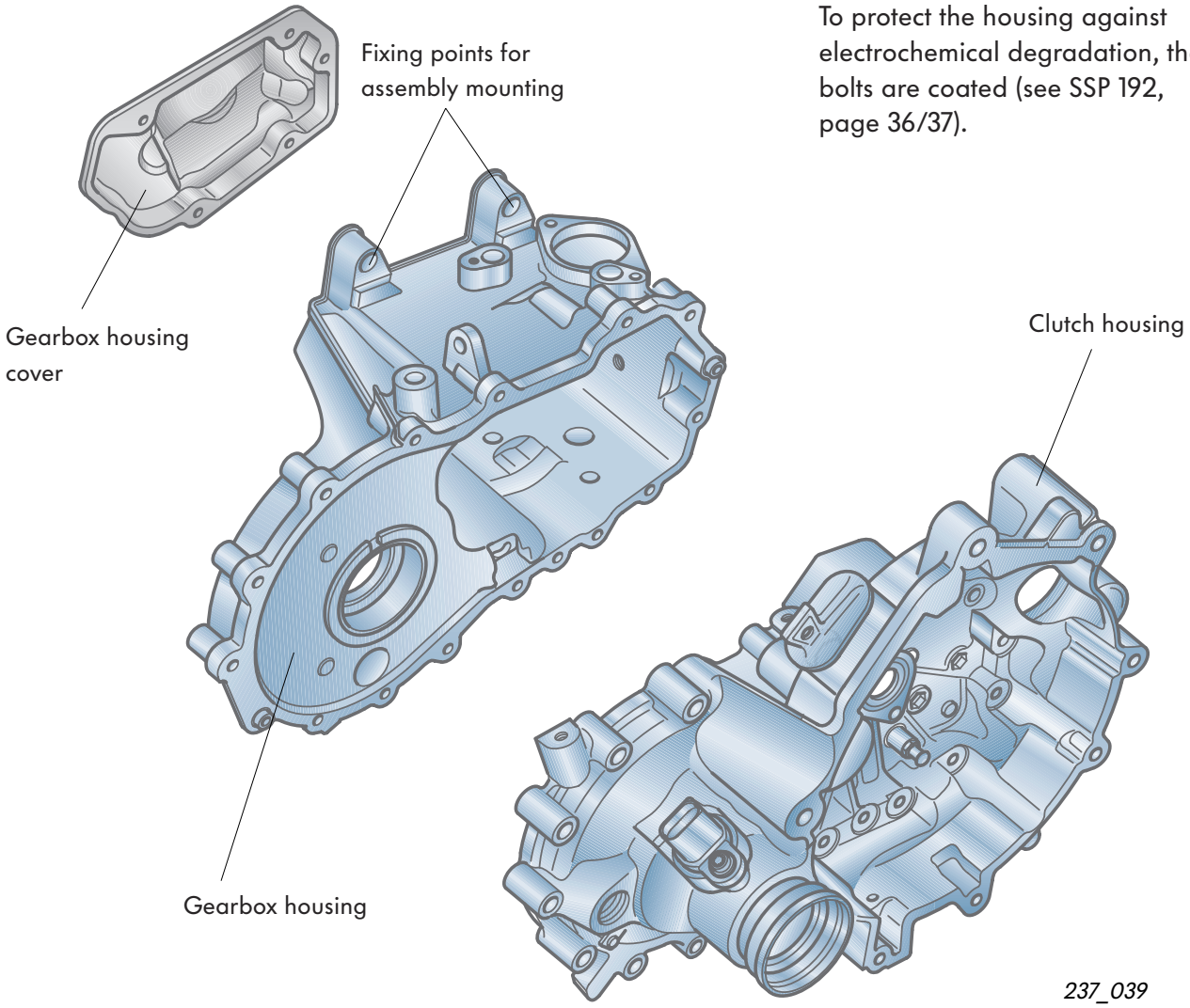
The fixing points for the left assembly mounting bracket are located at the top of the gearbox housing. The attachment points for the self-aligning bearing support are located at the bottom of the gearbox housing.

In comparison with aluminium, magnesium has a lower density and therefore also lower strength. This was compensated for by thicker ribbing and increased wall thickness.

The result is a mass reduction of 2.5 kg compared to the conventional aluminium construction.

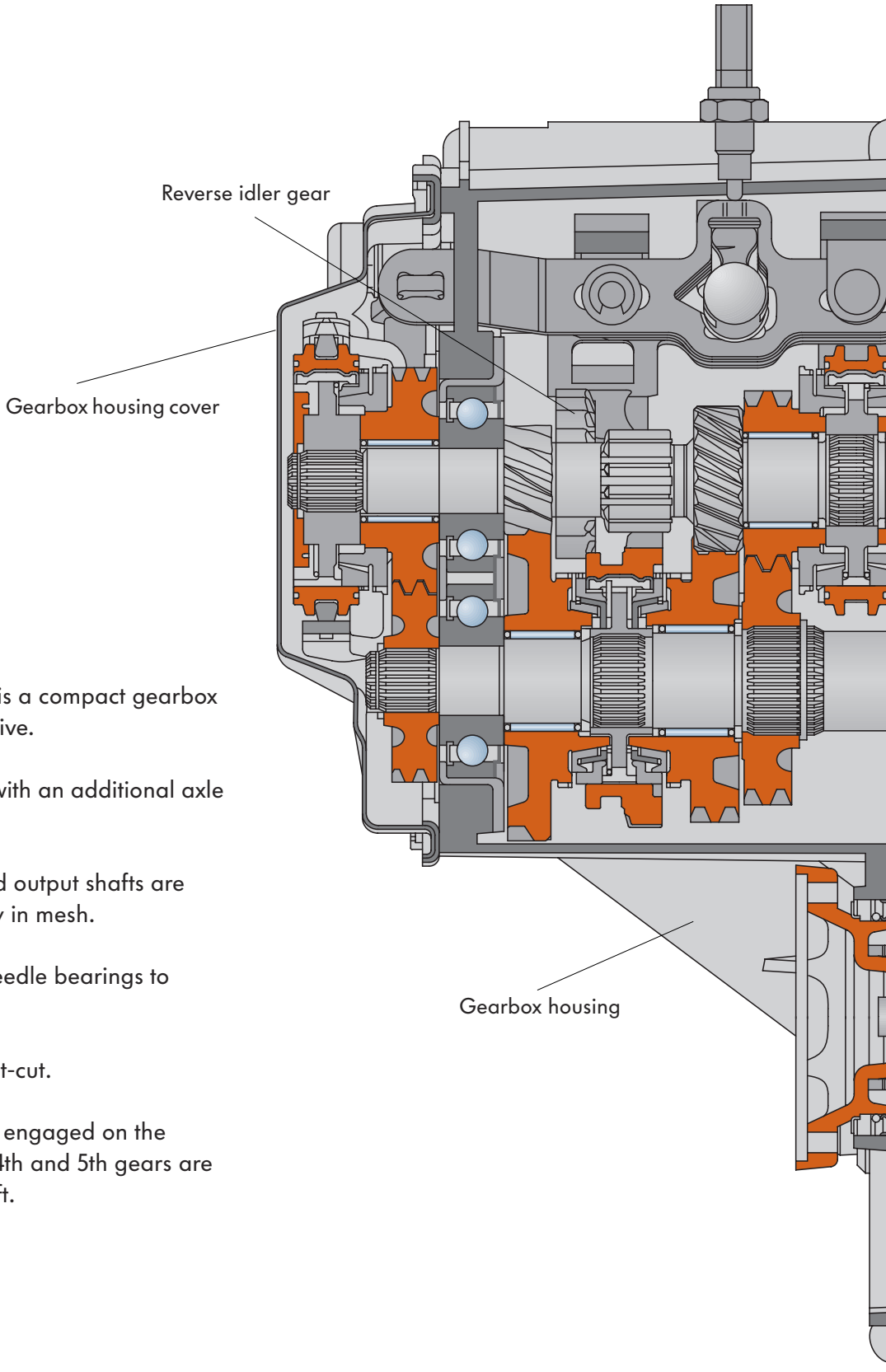
The lower material density of the housing necessitates increased bolt screw-in depths.

To protect the housing against electrochemical degradation, the bolts are coated (see SSP 192, page 36/37).



# Gearbox mechanicals

## Gearbox design




The 02T manual gearbox is a compact gearbox for 5-speed front wheel drive.

It is a twin-shaft gearbox with an additional axle for reverse gear.

The gears on the input and output shafts are helical-cut and continously in mesh.

All change gears run in needle bearings to maximise smoothness.

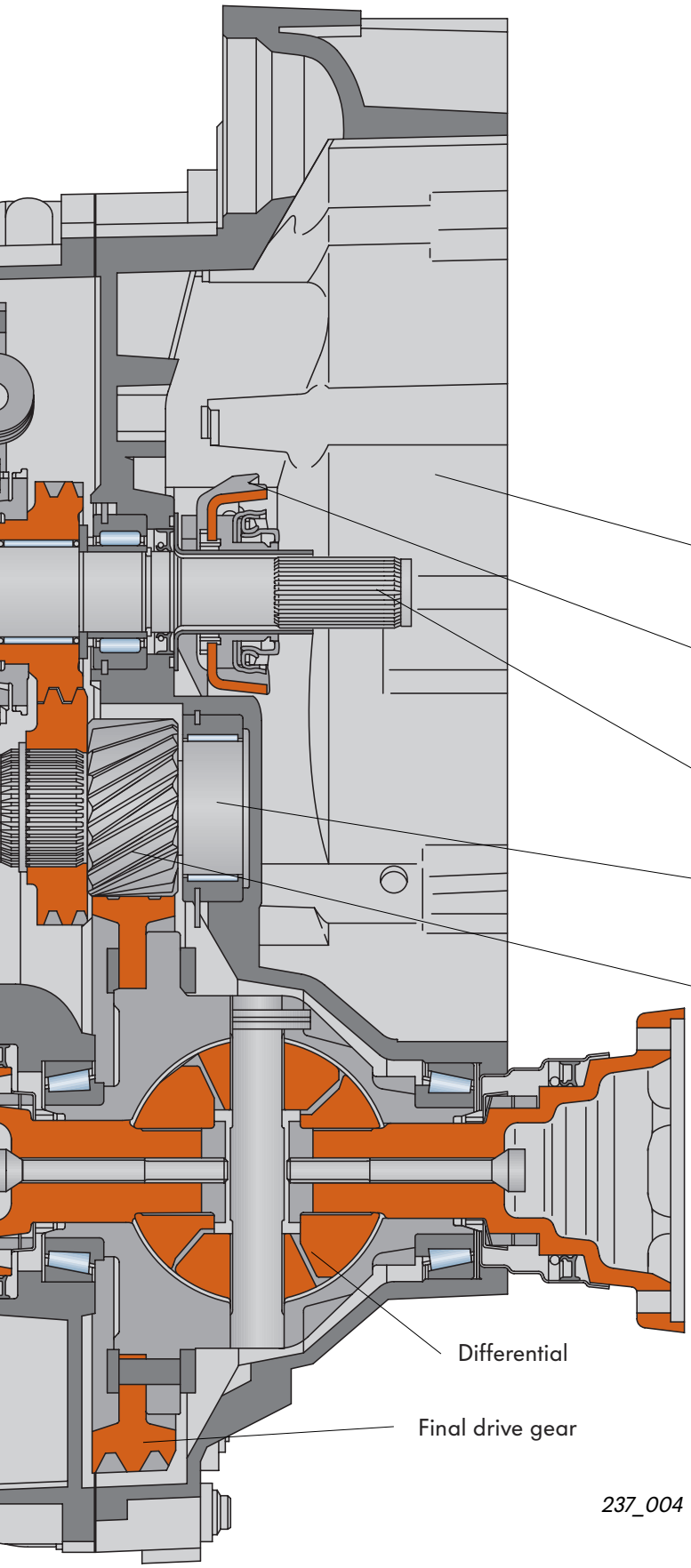
The reverse gear is straight-cut.

The 1st and 2nd gears are engaged on the output shaft and the 3rd, 4th and 5th gears are engaged on the input shaft.

When reverse gear is selected, the reverse idler gear is engaged on a separate shaft between the input and output shaft, and the direction of rotation the output shaft is changed.

All forward gears are synchronised. 1st and 2nd gears have double synchronisers.

Torque is transmitted to the final drive gear, and therefore also to the differential, via the output shaft gear.

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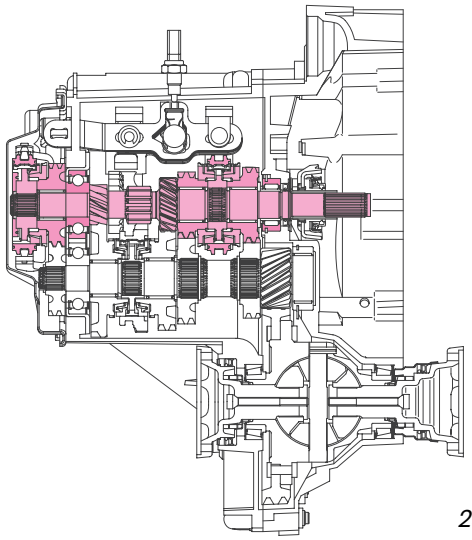
# Gearbox mechanism

## The input shaft

is mounted in a bearing assembly in the gearbox housing together with a cylindrical roller bearing in the clutch housing (loose bearing) and with a grooved ball bearing (fixed bearing).

For mass reduction, the input shaft has a deep bore.



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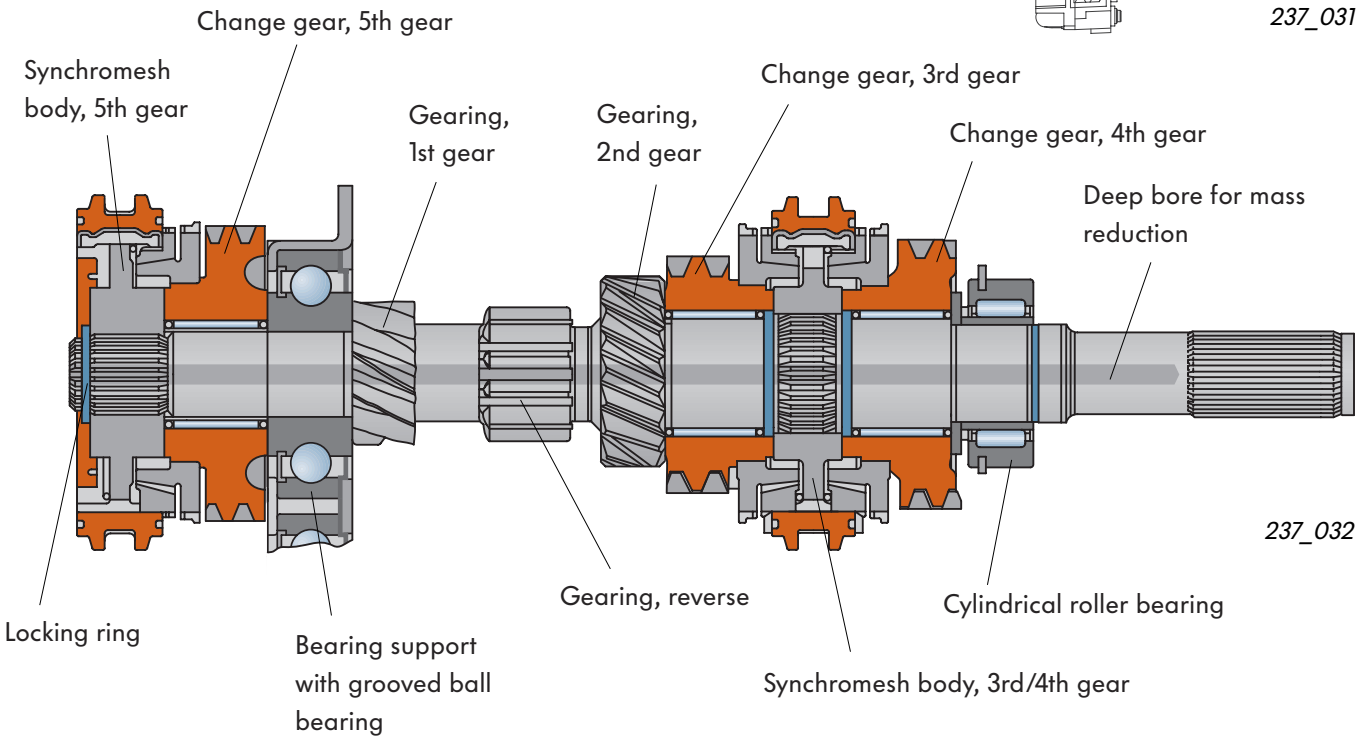



237_032

The 1st, 2nd and reverse gear wheels are connected positively to the input shaft.

The 3rd, 4th and 5th gear wheels are loose and run in needle bearings.

The synchromesh body of 3rd/4th gear and 5th gear are connected positively to the input shaft via a longitudinal grooved spline.

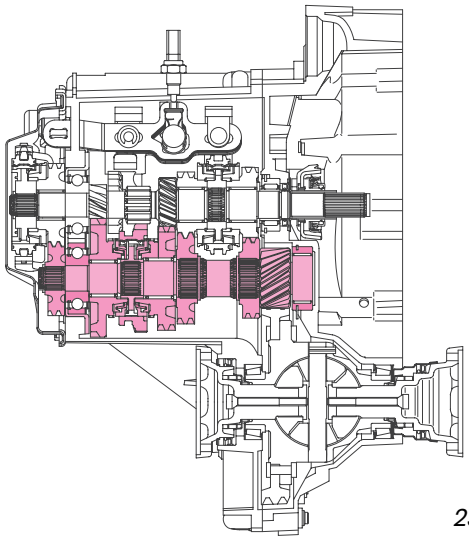
After one of the gears is engaged, the corresponding "idler gear" is also connected to the input shaft.

Locking rings hold the gears in position.

## The output shaft

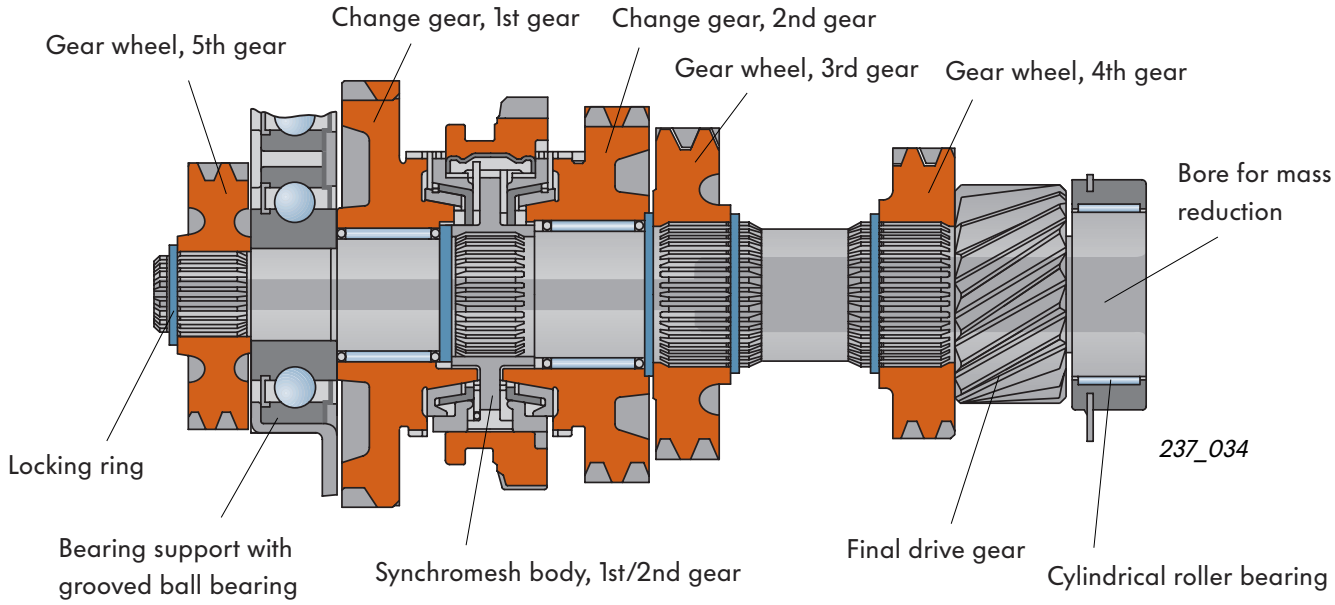
has a fixed / idler bearing.

As with the input shaft, the output shaft runs in bearings in the gearbox housing
- together with a cylindrical roller bearing (idling) in the clutch housing
- together with a grooved ball bearing (fixed) which is mounted together with the input shaft in the bearing assembly.



237_033

For mass reduction, the output shaft is hollow-drilled.




237_034

The 3rd, 4th and 5th gear wheels and the synchromesh body for 1st/2nd gear are positively connected to the output shaft in the direction of rotation by means of close-spaced gear teeth.

Locking rings hold the gears in position.

The 1st and 2nd gear wheels are idler gears and run in needle bearings on the output shaft.

# Gearbox mechanism

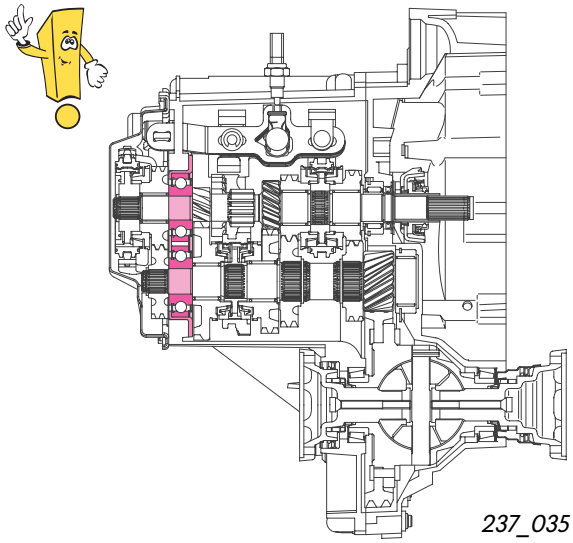
## The bearing support

The modular design is a new feature of the gearbox layout.

A module of this type is the bearing support with the two grooved ball bearings.

The grooved ball bearings are not mounted directly in the gearbox housing, they are seated in a separate bearing support.

**New**



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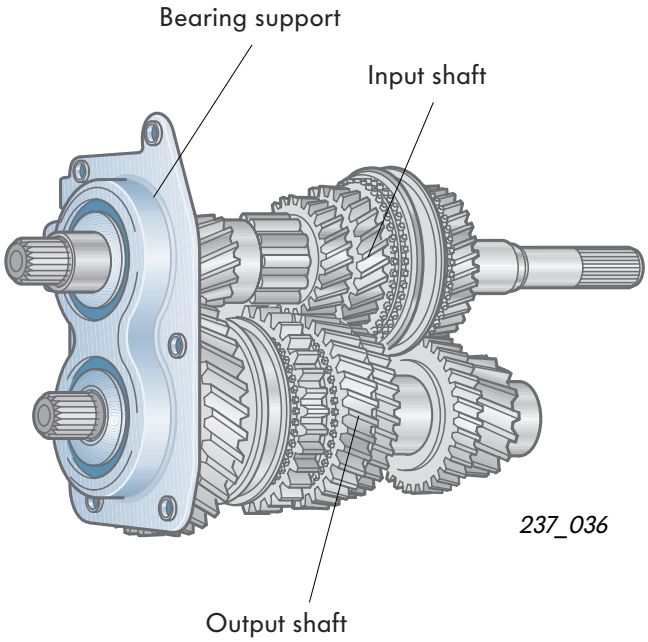
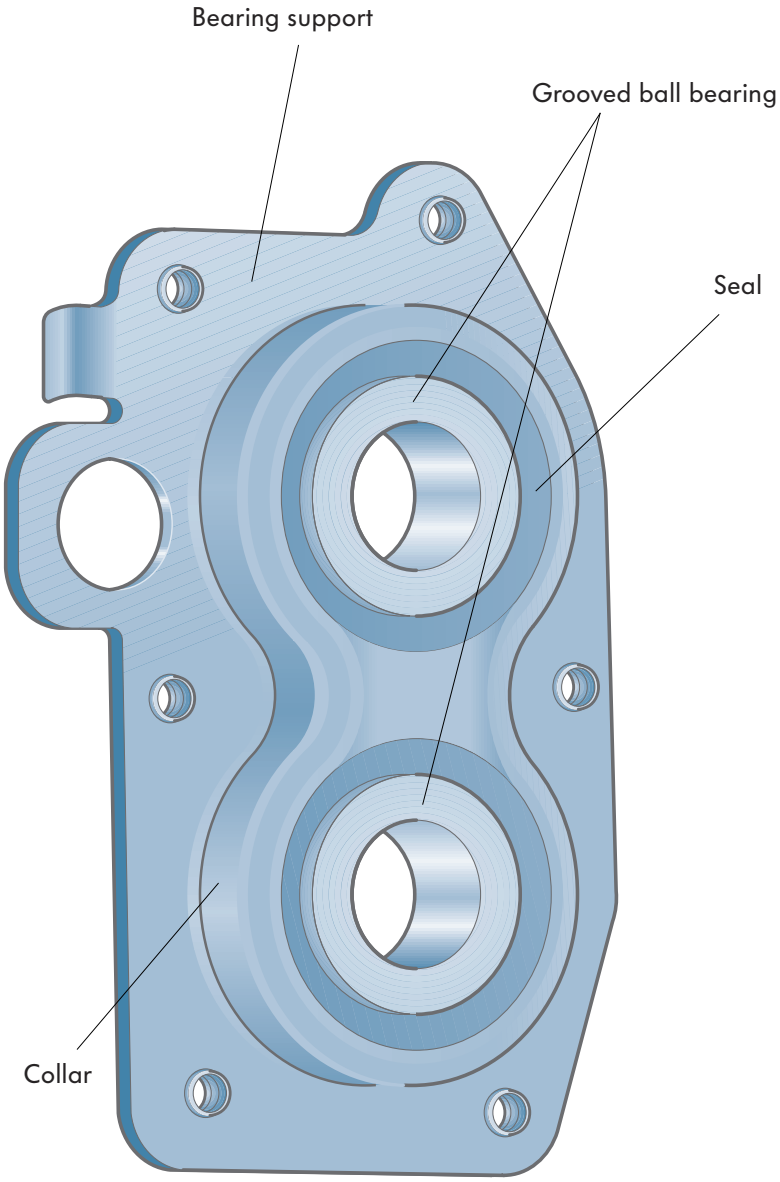



237_036

The complete shaft and gear packet of the input and output shaft is pre-assembled outside the gearbox housing in the bearing support and, thus, can easily be installed in the gearbox housing.

For repair work, the bearing support together with the two grooved ball bearings is replaced completely.
See also the instructions in the Workshop Manual.

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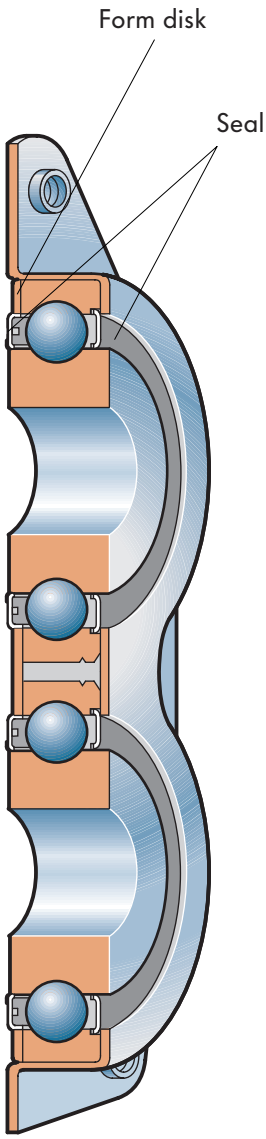



237_038

The two grooved ball bearings for the "fixing" the input and output shafts are an integral part of the compact bearing support and are press-fitted in it.

The grooved ball bearings are located in the design position using a form disk. The form disk is welded onto the bearing support.

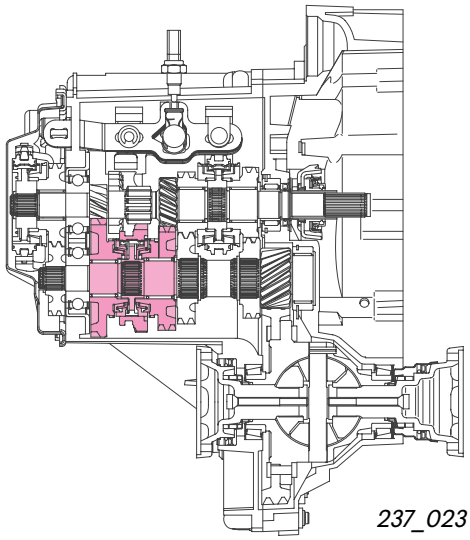
The grooved ball bearings are protected against abrasion residues in the gearbox oil by separate radial sealing rings.

The bearing support, with its spectacle type collar, is press-fitted in the gearbox housing and secured to the gearbox housing with six bolts.

# Gearbox mechanism

## Double synchroniser for 1st/2nd gear

Before a gear on the input shaft is engaged with a gear on the output shaft through the synchromesh body and the sliding sleeve, it is first of all necessary to synchronise the gears. The gears are synchronised during the gearshift via a taper on the gear and on the sliding sleeve of the synchromesh body.



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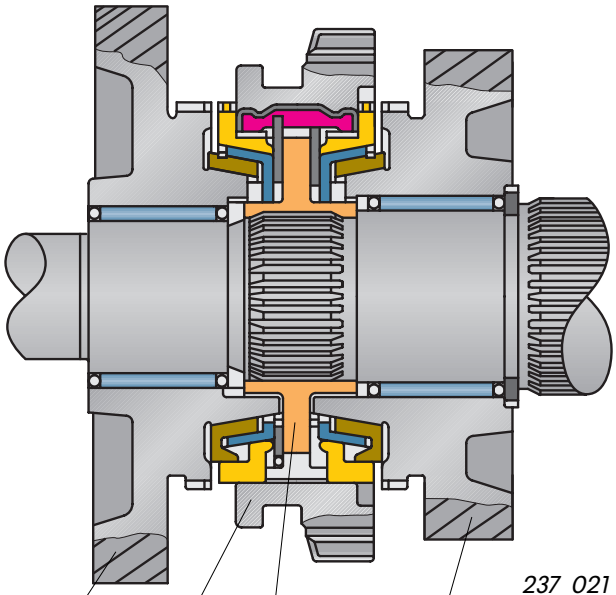
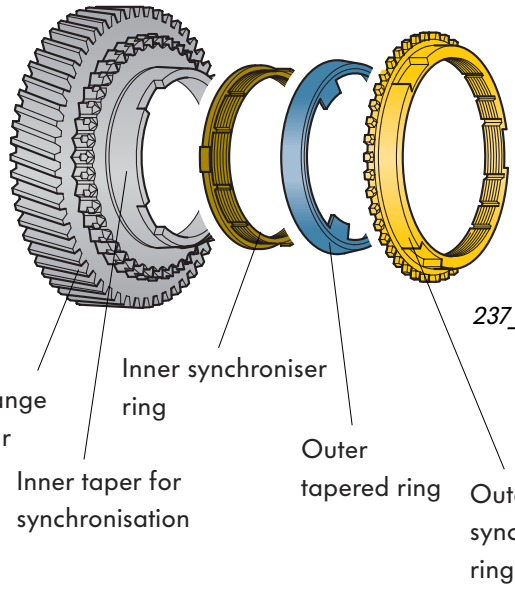



237_021

This near-doubling of the area of the tapered friction face increases synchroniser performance by approx. 50 % and almost halves the shifting effort required.

The result is an improvement in operating comfort during down-changes from 3rd gear into 2nd gear and from 2nd into 1st gear.




237_022

The double synchronisers for each gear consist of

- a synchroniser ring (inner)
- a tapered ring
- a synchroniser ring (exterior).

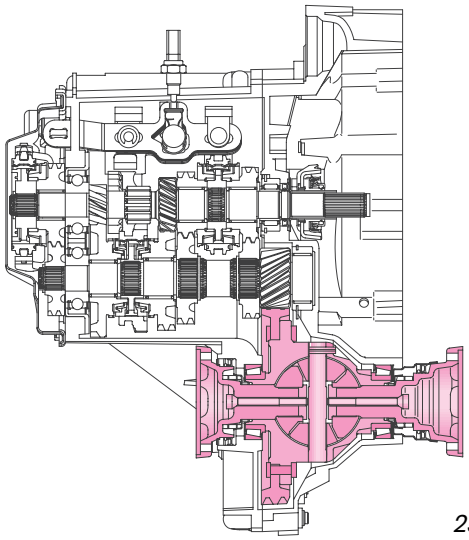
## The differential

Is combined with the manual gearbox to form a unit.

It is mounted in two optimised tapered roller bearings in the gearbox and clutch housing.

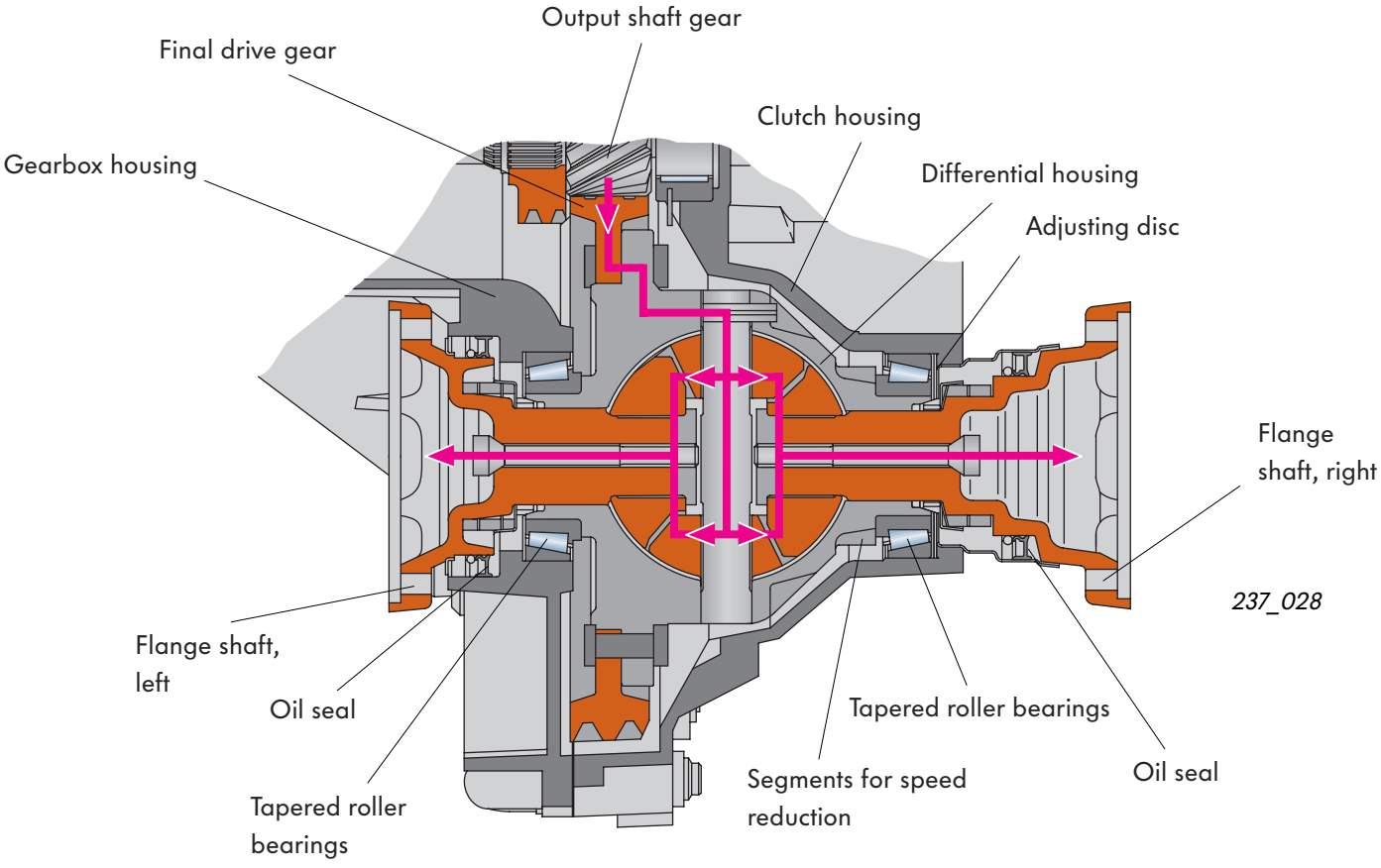
Two oil seals with different diameters seal the housing off from the exterior at the flange shafts.

The final drive gear is riveted to the differential housing and paired with the output shaft gear.



237_027

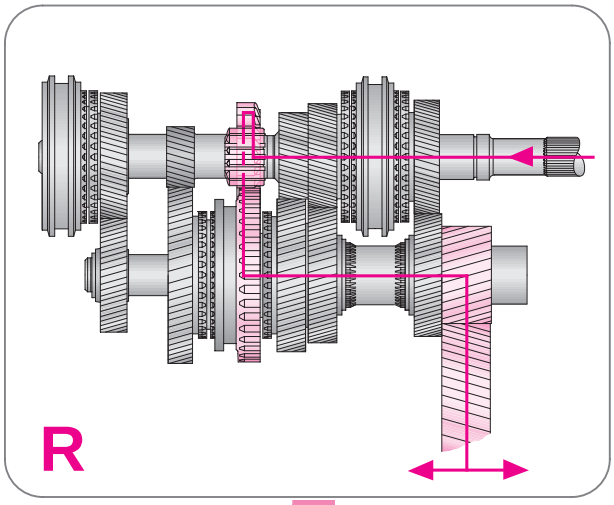
After replacing components, the differential is required to be readjusted axially in the clutch housing with an adjusting disc. Refer to the relevant Workshop Manual for instructions!



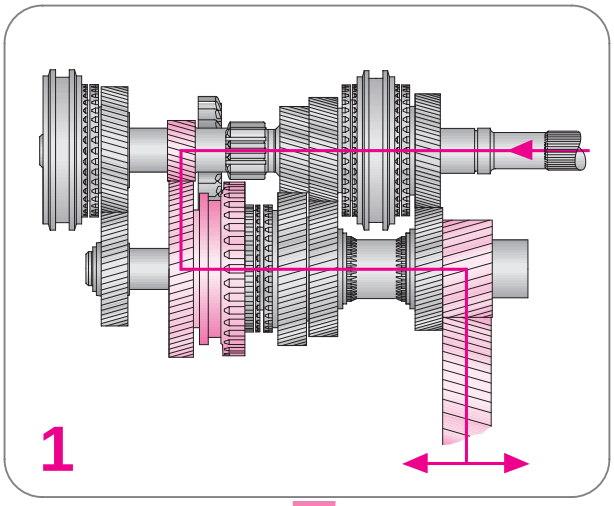

237_028

# Gearbox mechanism

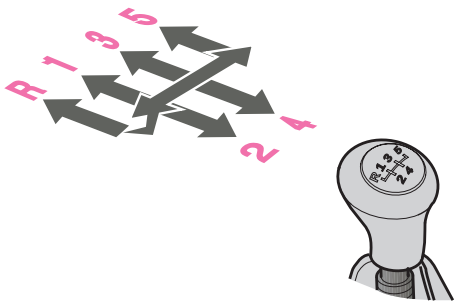
## Force path




237_011




237_005

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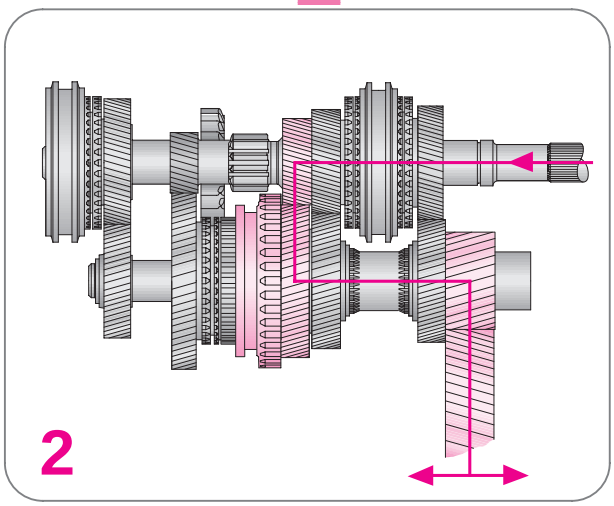


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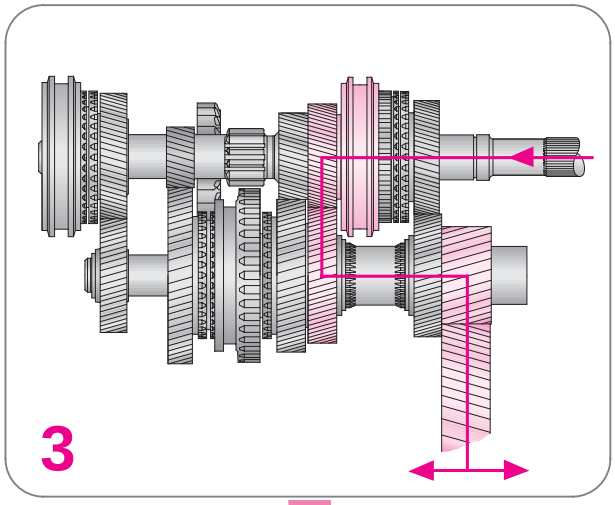
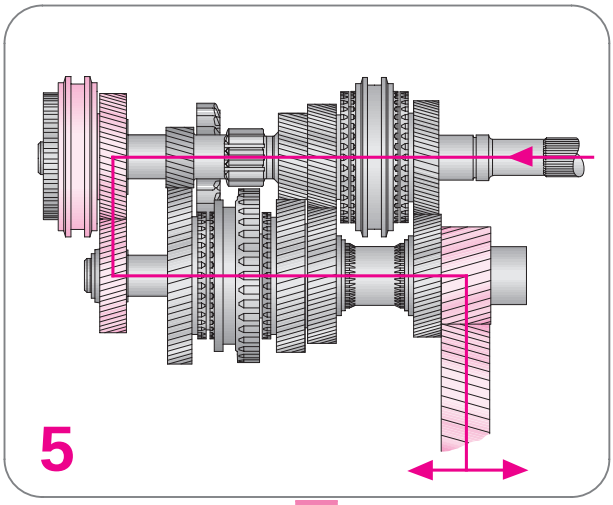



237_007

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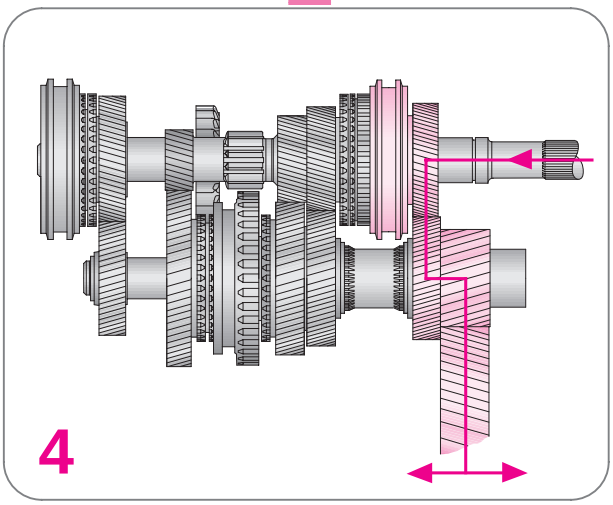



237_008

**The force path in the gearbox**

Engine torque is transferred to the gearbox via the input shaft.

In accordance with the gear selected, the torque is transferred via the relevant gear pair to the output shaft and from here to the final drive gear and differential.

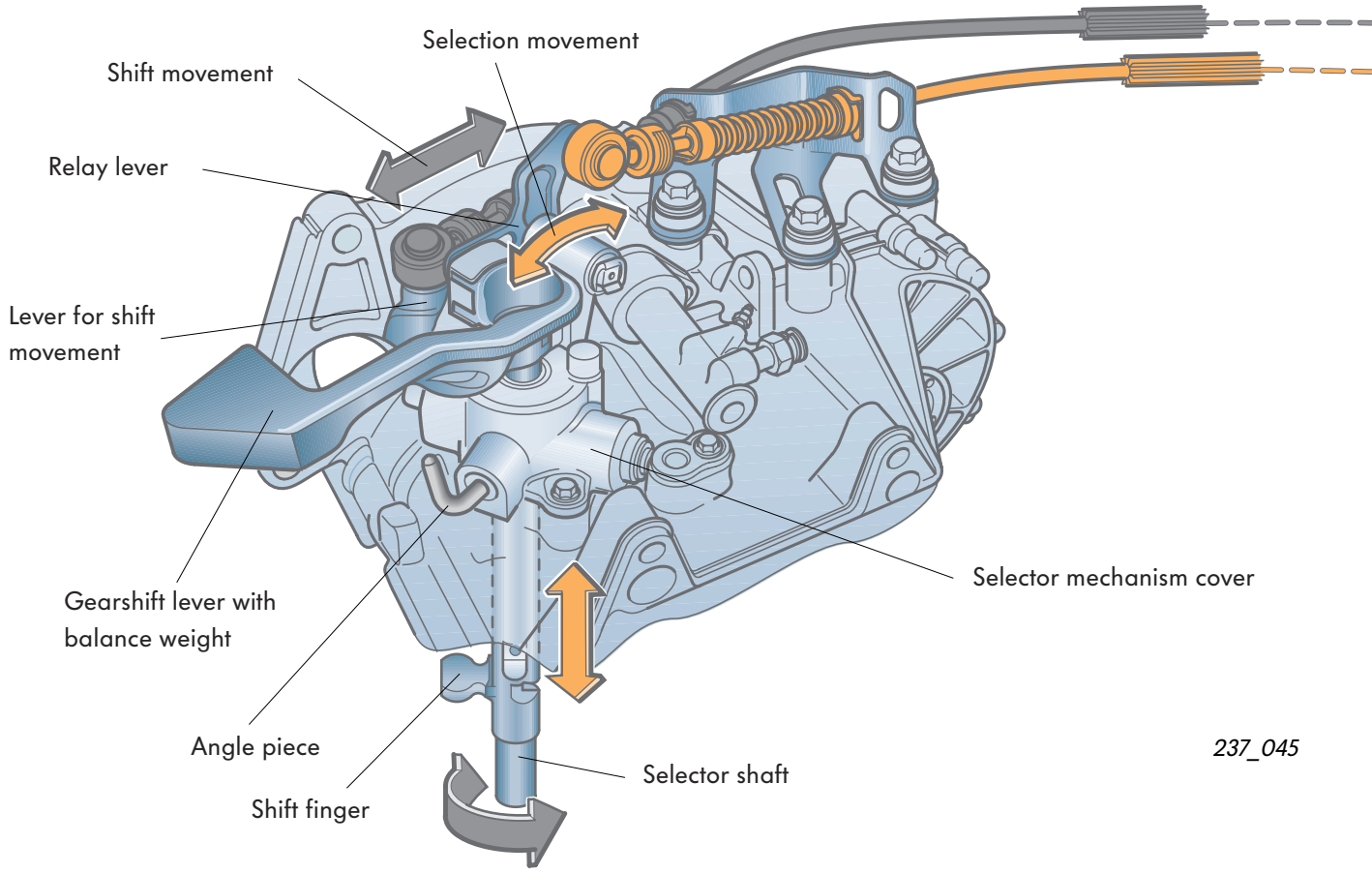
Torque and engine speed now act on the driven wheels in accordance with the shift position.

# Selector mechanism

## Outer selector mechanism

To isolate vibrations from the drive line region, the gearbox is equipped with a cable-operated transmission.

Two selector cables connect the gear lever (on board the vehicle) and gearbox.




The two selector cables transmit the selection and shift movements of the gear lever to the selector shaft.

The mechanism (relay lever and lever for shift movement) translates the movements of the 2 selector cables to forward, reverse and rotary movements of the selector shaft.

An angle piece is attached to the selector mechanism cover. It locates the selector shaft in a pre-defined position so that servicing work can be carried out.

As a result, the cable pull transmission is much easier to adjust (Page 22).