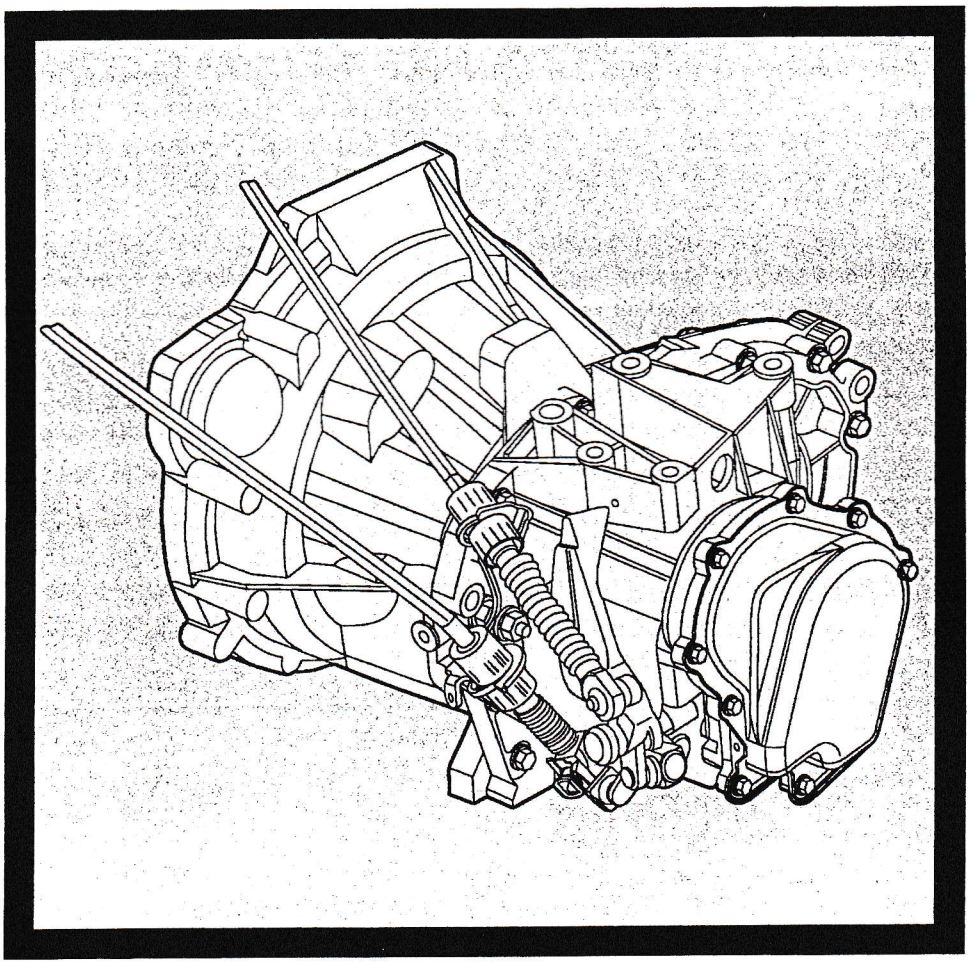
T7

Technical Service Training

iB5 Transmission

Curriculum Training TC3081008H



Student Information

CG 7791/S en 01/1999

This Student Information publication describes the design and the operation of a 5-gear manual transmission for vehicles with front wheel drive .

This transmission is used in the Ford Ka, Ford Fiesta, Ford Escort, Ford Puma and Ford Focus and is named the iB5 transmission (i = improved).

The iB5 transmission is characterized by its compact build, low weight and easy shifting. It is a "twoshaft transmission" combined with a differential.

Following the new Ford global training concept this Student Information is divided into lesssons. It can also be used as a self-study medium.

At the start of each lesson there is a list of objectives to be achieved in completing the lesson. At the end of the lesson there are a few test questions to check learning progress. The answers to the test questions are to be found at the end of the Student Information publication (behind the list of abbreviations).

The Student Information consists of six lessons dealing with the following subjects:

- General
- iB5 transmission with rod-operated shift mechanism
- iB5 transmission with cable-operated shift mechanism
- Shift mechanism
- Clutch mechanism
- Service instructions

NOTE: In the following lessons, especially in the lesson "Service instructions" only the basic elements of some important operations are covered (see also the notes in the following lesson).

Please remember that our training literature has been prepared solely for FORD TRAINING PURPOSES. Repair and adjustment operations **MUST** always be carried out according to the instructions and specifications in the workshop literature.
Please make extensive use of the training courses offered by Ford Technical Training Centres to gain extensive knowledge in both theory and practice.

Contents

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- In Lesson 1
  - the various stages of development, the characteristics and the modifications of the transmission are dealt with,
  - components which are used on all transmissions are described,
  - the power flow in the different gears is shown.

Design of the iB5 transmission up to the 1998 MY

- In Lesson 2
  - the design and operation of the iB5 transmission with rod-operated mechanism is described,
  - the design of the input and output shaft is shown.

Design of the iB5 transmission from the 1999 MY onwards

- In Lesson 3 the iB5 transmission with cable-operated mechanism is described and the changes from the transmission with rod-operated mechanism are discussed.

Shift mechanism

- In Lesson 4 the design, the operation and the adjustment of the rod-operated and the cable-operated mechanism is described.

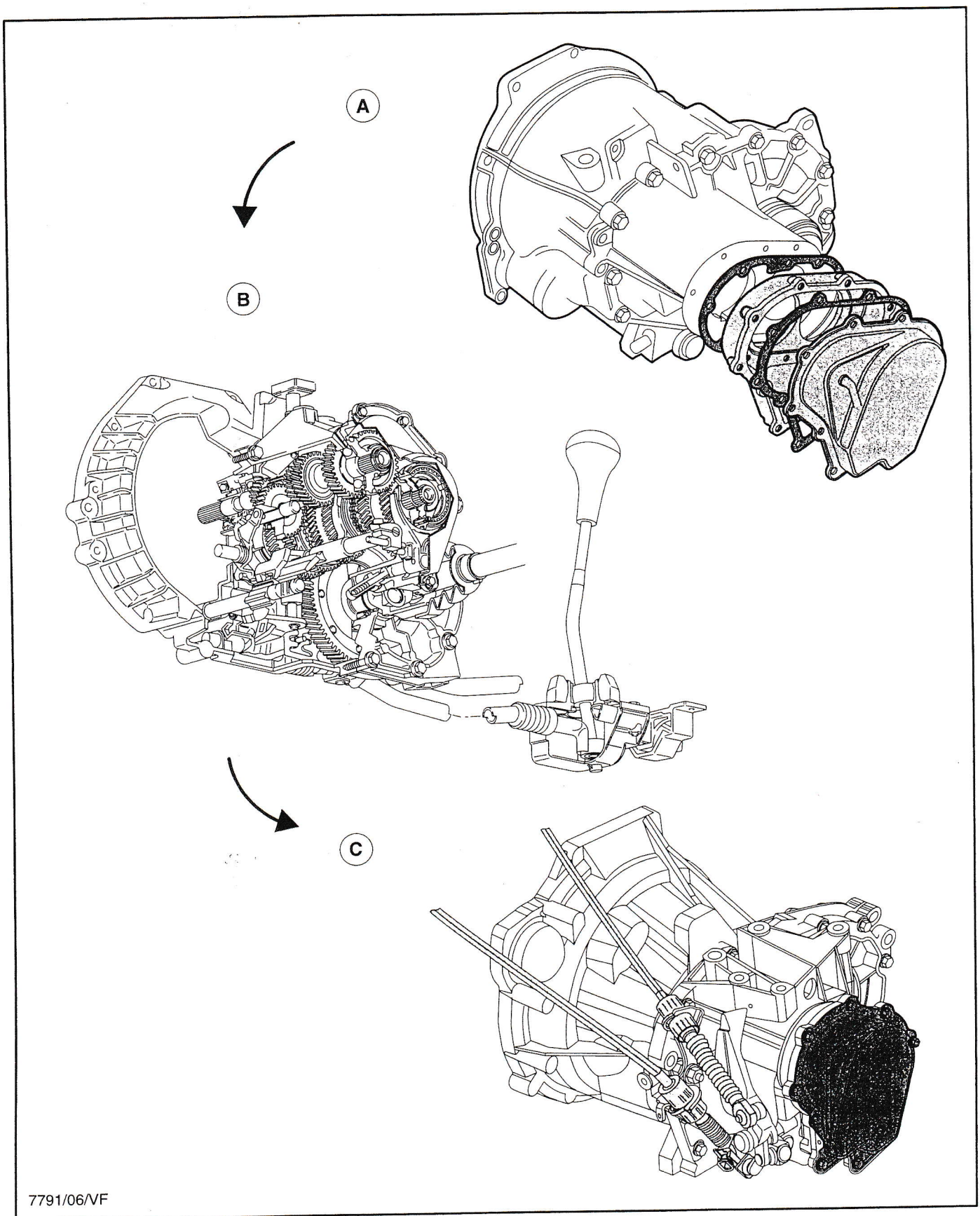
Clutch mechanism

- In Lesson 5 the different stages of development of the clutch mechanism are dealt with.

Service instructions

- In Lesson 6
  - there is information on how to determine the differential end float and the thickness of the shim,
  - there are general service instructions for 5th gear adjustment.

NOTE: Components which are the same on different transmissions are only described once. In other lessons there are cross-references.



From the B5 to the iB5 transmission

A B5 transmission

B iB5 transmission with rod shift mechanism

C iB5 transmission with cable shift mechanism

Objectives

On completing this lesson, you will be able to:

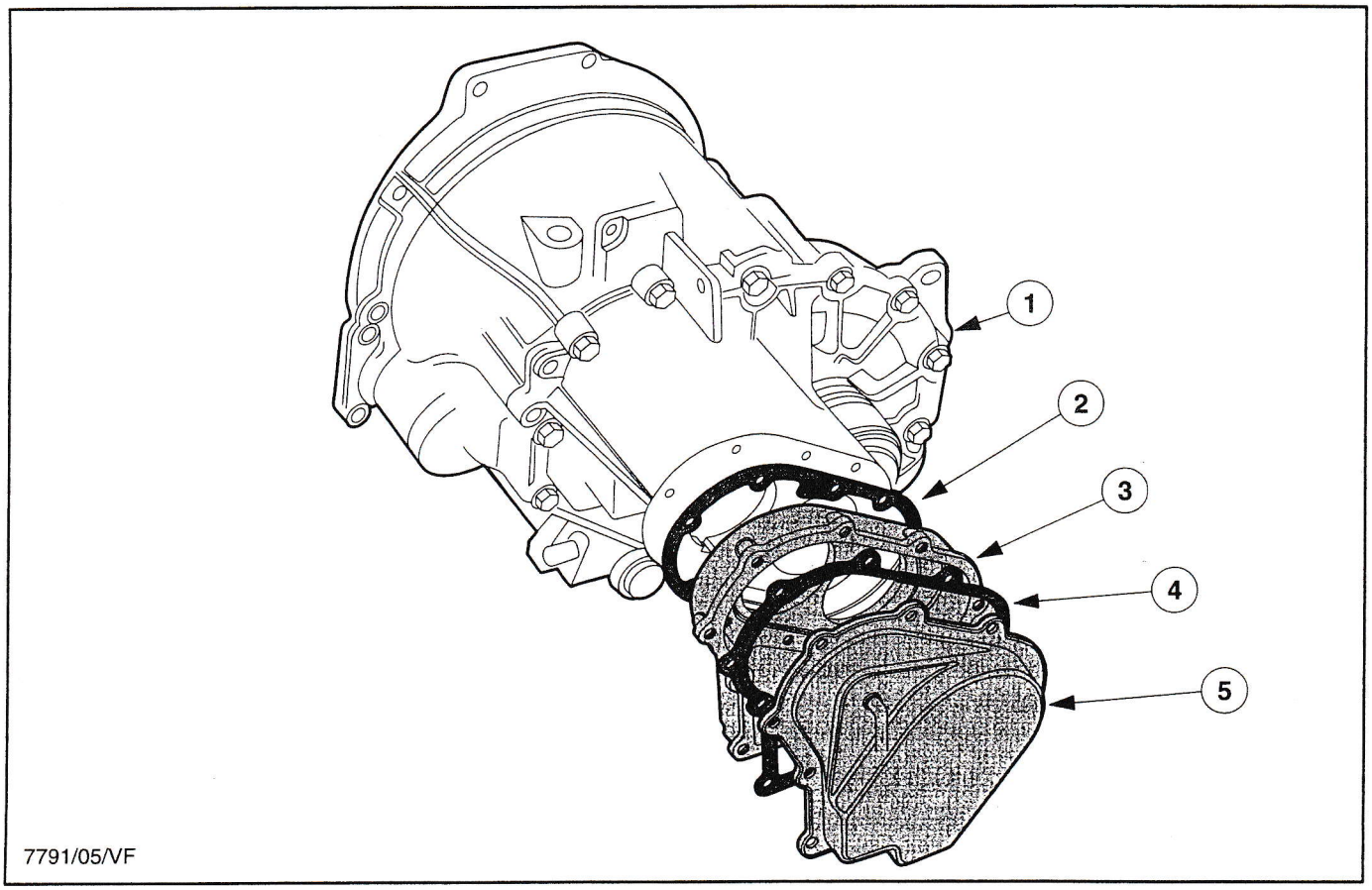
- explain the basics of the B5 and the iB5 transmissions
- describe the different stages of development of the transmissions
- describe the main features of the transmissions
- describe the differences and changes
- identify the transmissions clearly with reference to the type data sticker
- describe the different speedometer drives
- explain the power flow in the different gears

Basics

- The B5 and iB5 transmissions are based on the 4-speed manual transmissions employed originally.
- In 1982 customer demands for economy and environmental compatibility led to the introduction of a 5-speed manual transmission (B5 transmission) for the first time in the compact class.
- The B5 and iB5 transmissions are two-shaft transmissions (with an input and an output shaft) in which all the gear wheels sit on the output shaft.
- All the gear wheels – except for reverse gear – are constantly in mesh.
- All the forward gears are synchronized (from 1996 MY double synchronizer for some gears)
- Reverse gear is not synchronized.
- Originally, the clutch mechanism was cable-operated on all models; since the 1996 MY there is a hydraulic clutch mechanism on the Ford Fiesta.
- Continuous optimization of the B5/iB5 transmission has seen the input torque rise to 165 Nm on the Ford Focus without any increase in weight or increase in size.

Development of B5 transmission

- For the additional 5th gear the input shaft and the output shaft of the 4-speed transmission were lengthened. The 5th gear was placed on the lengthened output shaft and located in a separate housing.
- As a result of the separate housing for the 5th gear, the B5 transmission became approximately 50 mm longer than the 4-speed transmission. The housing for the 5th gear is mounted on the end of the transmission-end housing half and sealed with two gaskets. A blanking cover is fitted to close off the transmission.
- With the 5-speed transmission, when the 5th gear is engaged, the engine speed is reduced by approximately 800 rpm, depending on the ratio, compared with the 4-speed transmission at the same vehicle speed.
- The introduction of the B5 transmission produced considerable advantages in terms of performance, fuel consumption and acoustics.



1 Transmission-end housing half
2 Solid gasket of 5th gear housing
3 5th gear housing
4 Cork gasket of 5th gear blanking cover
5 5th gear blanking cover

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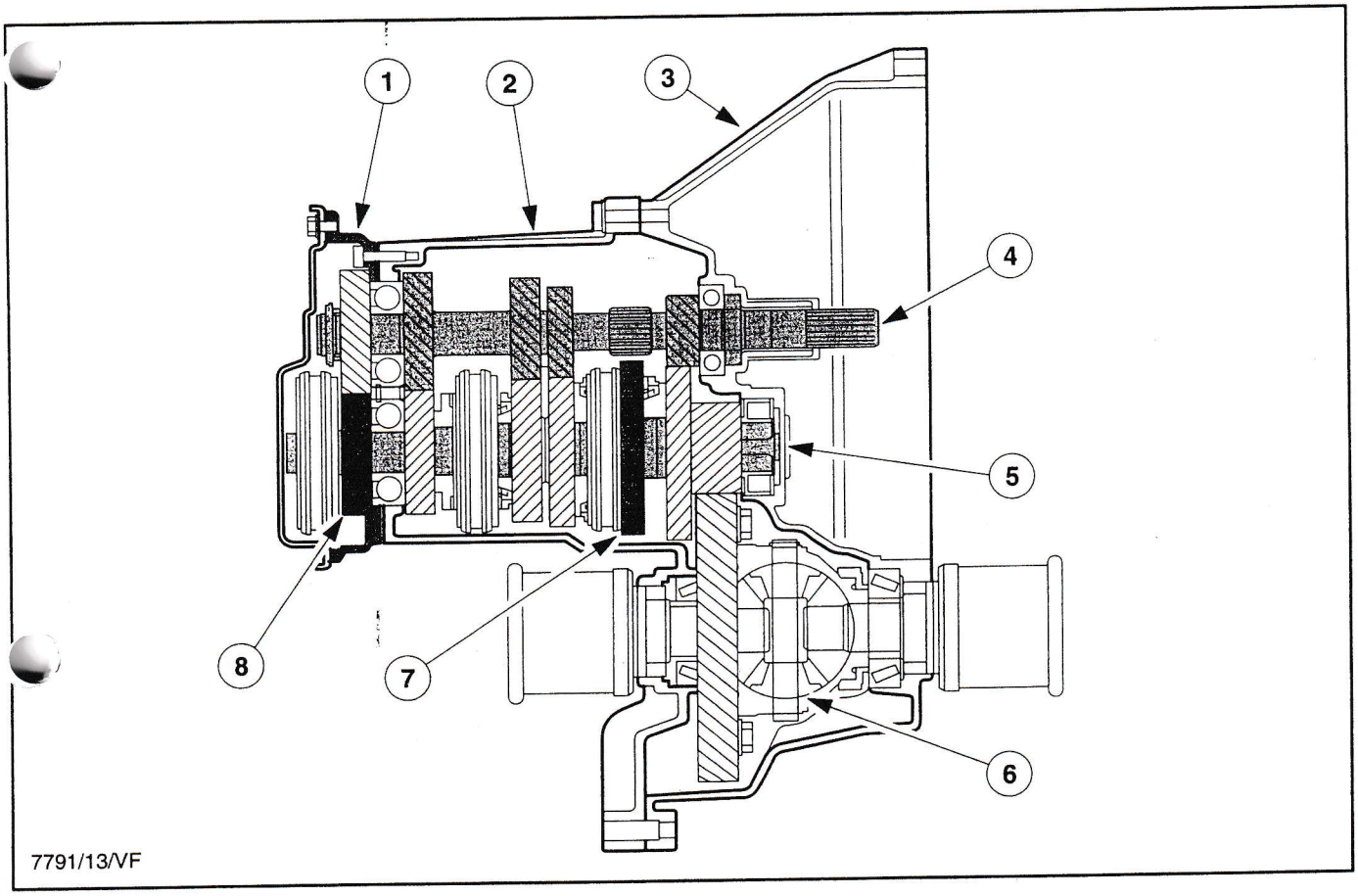
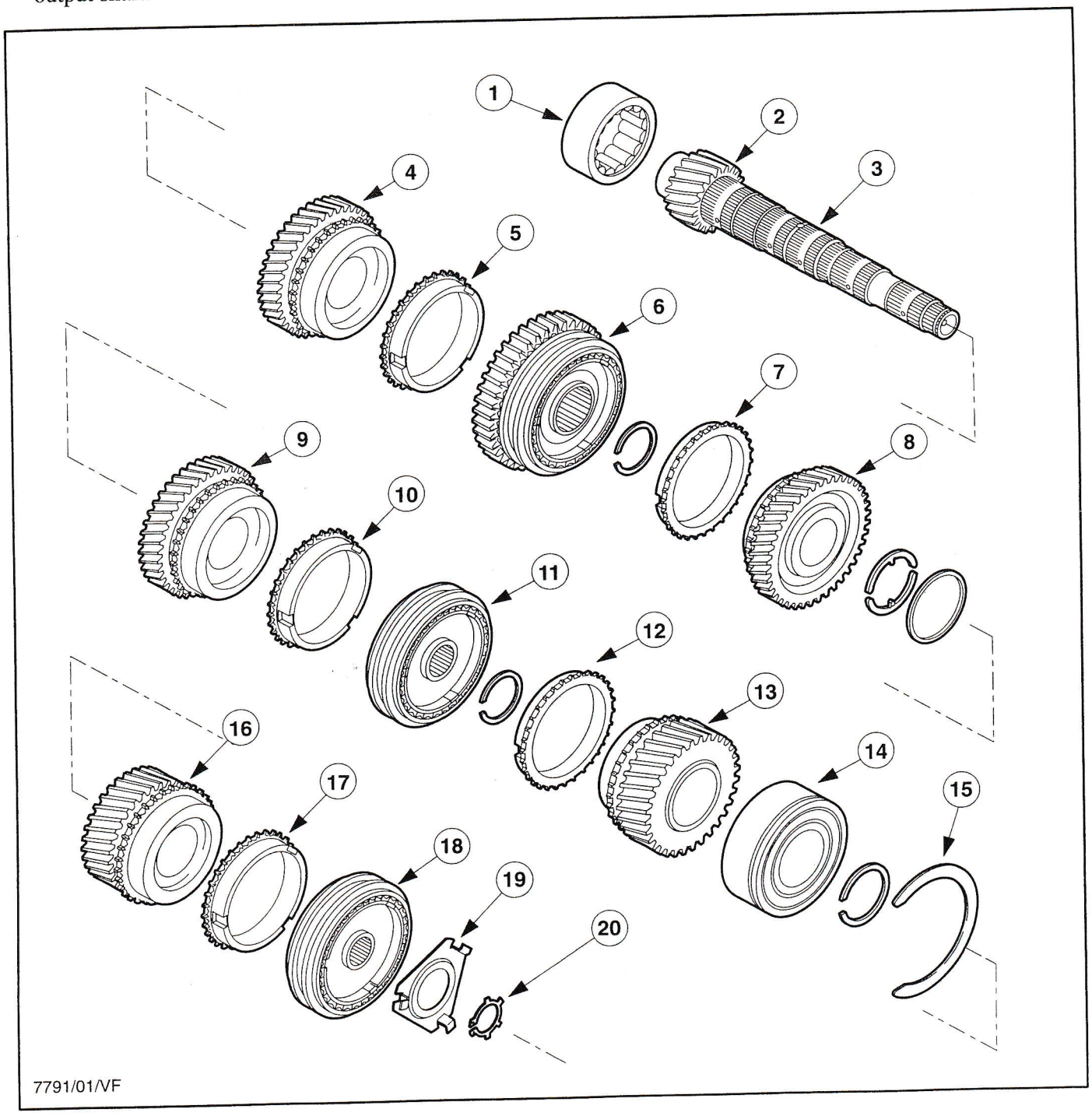
- The following illustration shows the B5 transmission as used **up to the 1995 MY.**
- From the output shaft the torque is transmitted to the differential and from there on to the front axle halfshafts.
- All the pairs of gears are constantly in mesh. The ratio in all the forward gears is achieved by a single pair of gears, the direction of the power flow is reversed in the transmission.
- In reverse gear the direction of rotation of the output shaft is reversed by an idler gear. The reverse gear is shifted by an idler gear.
- All the forward gears have helically-cut teeth, reverse gear has straight-cut teeth.
- The clutch is operated by cable on the Ford Fiesta up to the 1995 MY and on the Ford Escort.



1 5th gear housing
2 Transmission-end housing half
3 Clutch-end transmission housing half
4 Input shaft
5 Output shaft
6 Differential
7 Reverse gear
8 5th gear

Output shaft up to the 1995 MY

- In the B5 transmission the output shaft is mounted in the clutch-end housing half with an **open** roller bearing (1) and in the transmission-end housing half with a **closed** ball bearing (14).
- The gear driving (2) the differential is part of the output shaft.
- This means that all the components of the output shaft must be removed and installed from one side.
- In the B5 transmission **all** the forward gears have a single synchroniser. Reverse gear is unsynchronized.



to the illustration opposite

1 Cylindrical roller bearing (without inner ring)

2 Differential driving gear

3 Output shaft

4 1st gear wheel

5 1st gear synchronizer ring

6 1st/2nd gear synchronizer clutch and reverse gear wheel

7 2nd gear synchroniser ring

8 2nd gear wheel

9 3rd gear wheel

10 3rd gear synchronizer ring

11 3rd/4th gear synchronizer clutch

12 4th gear synchronizer ring

13 4th gear wheel

14 Ball bearing (closed on both sides)

15 Retaining clip

16 5th gear wheel

17 5th gear synchronizer ring

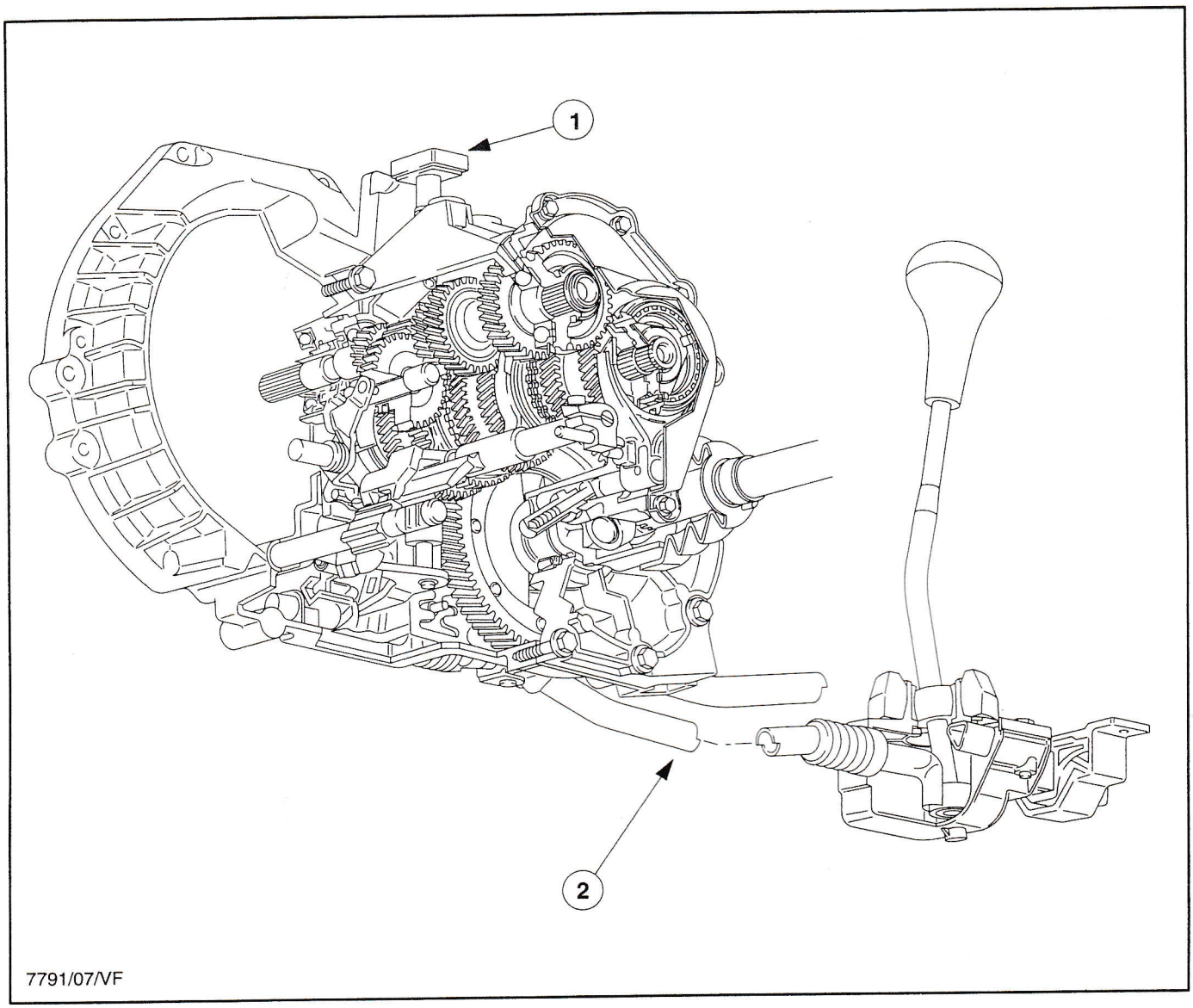
18 5th gear syncrhonizer clutch

19 Retaining plate

20 Circlip

Development of iB5 transmission

- A modified (iB5 = improved B5) transmission is fitted to the Ford Escort from the 1995 1/2 MY onwards and to the Ford Fiesta from the 1996 MY onwards.
- The iB5 transmission is identifiable externally by the improved transmission breather. The shift mechanism is still rod-operated.



1 Transmission breather

2 External shift mechanism with shift rod

Modifications to the iB5 transmission compared with the B5 transmission

- The clutch-end transmission housing half was adapted to the engine variants and provided with stiffening ribs which serve to reduce vibration.
- In addition, the clutch-end transmission housing halves were adapted to the differences in the location of the starter motor.
- On the iB5 transmission the transmission breather is located on the top of the transmission.
- In the iB5 transmission the output shaft is seated in the clutch-end transmission housing half in a roller bearing with a renewable bearing inner ring.
- The ball bearings of the input shaft and output shaft are closed. This results in a lower fluid temperature in the area of the bearings.
- 1st, 2nd and 3rd gears have double synchronisers for smooth gear shifting.
- The spring-loaded return slides – for the gearshift lever neutral position – were eliminated. Instead the selector relay lever is held in the transmission with a return spring.
- The auxiliary shift shaft is locked in position with a ball interlock.
- The external gear shift mechanism is mounted in a rubber damper (as in the Ford Mondeo). Rocking movements of the gear lever caused by rocking movements of the engine/transmission unit are reduced by the rubber damper.
- The iB5 transmission is filled for life with 75W90 synthetic transmission fluid.
- On the B5 transmission mineral oil SAE 80 was used until 1995. Since 1997 synthetic transmission fluid 75W90 is also used on the B5 transmission.
- The transmission fluid drain plug is only required when carrying out transmission repairs or disposing of the transmission.

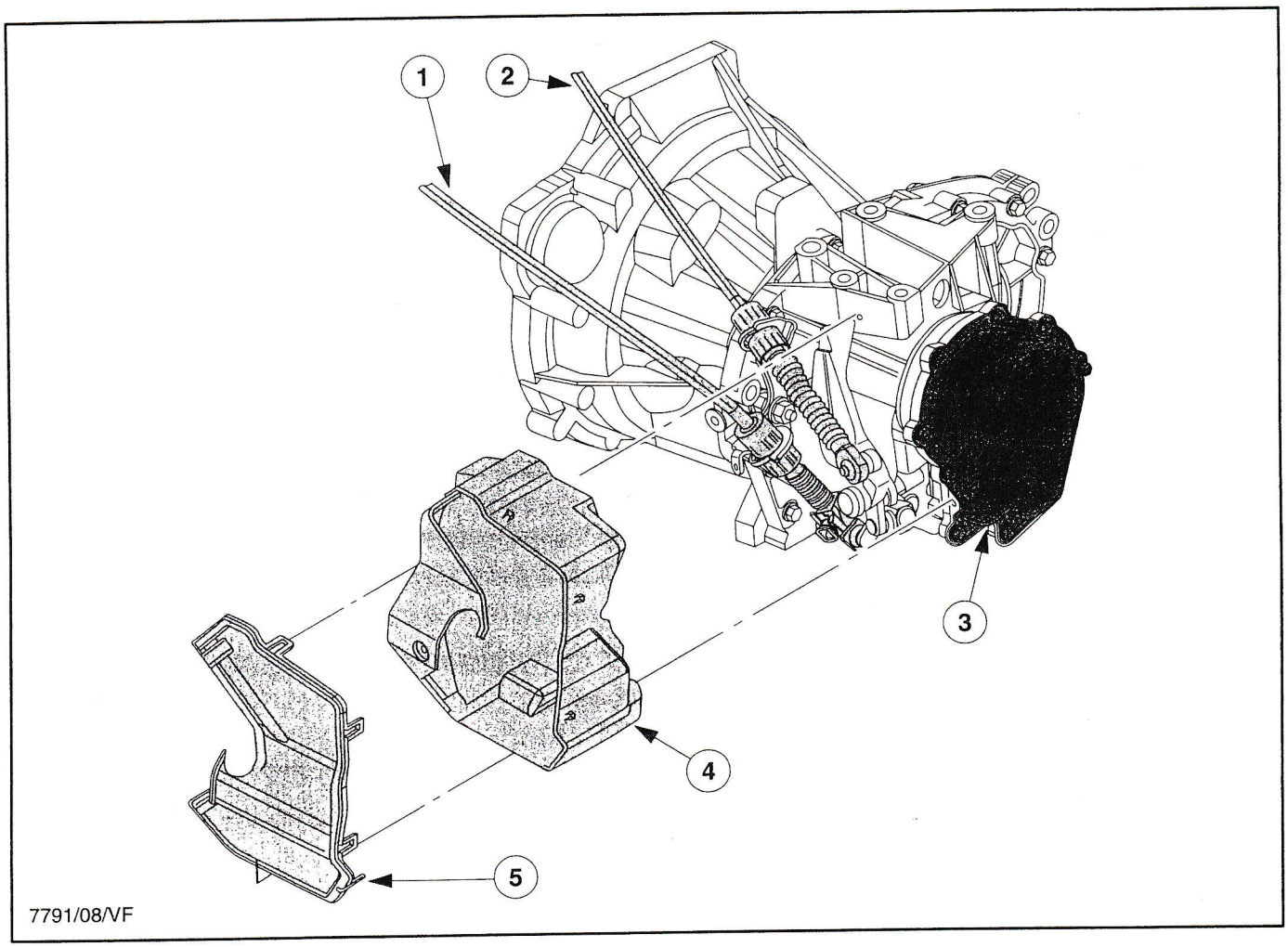
NOTE: After dismantling, the transmission must always be filled with new transmission fluid.

Additional features on the Ford Fiesta from the 1996 MY onwards:

- Instead of a cable-operated clutch mechanism, the Ford Fiesta is fitted with a hydraulic clutch mechanism with a central slave cylinder. With this, the clutch release bearing **can** be changed on its own.
- The oil seal of the input shaft in the clutch-end transmission housing half can be changed from the outside.
- For a time the Ford Fiesta was fitted with a multifunction switch which was seated on the auxiliary shift shaft and used for the reversing lights and to recognize neutral.

Modifications to the iB5 transmission from the 1999 MY onwards

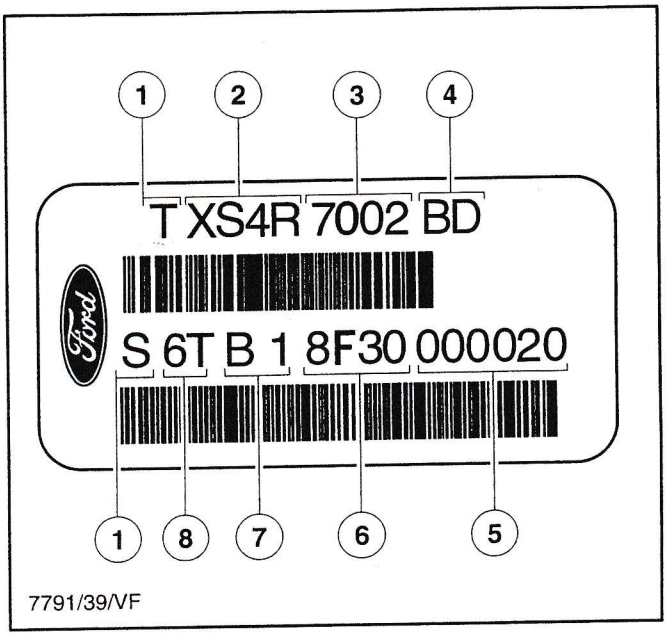
- The new iB5 transmission with the cable-operated shift mechanism is employed in the Ford Focus.
- The cables are now covered with a housing to protect them against dirt.
- On all iB5 transmissions a liquid sealer is used in place of the gasket between the two housing halves and the cork gasket for the 5th gear blanking cover.
- From the 1999 MY onwards, only 1st and 2nd gears have a double synchronizer.



1 Selector cable
2 Shift cable
3 5th gear blanking cover
4 Cable housing
5 Cable housing cover

ıype data sticker

- On earlier transmissions a metal tag was used for identification.
- New transmissions are clearly identified by the information given on the type data sticker.
- The bar code is used solely for production purposes.
- The sticker is located above the transmission breather on the clutch-end transmission housing half.



1 Additional code for production
2 Part number prefix
3 Master number
4 Part number suffix
5 Serial number
6 Build date
7 Build shift and transmission build line
8 Production location (plant)

Transmission fluid

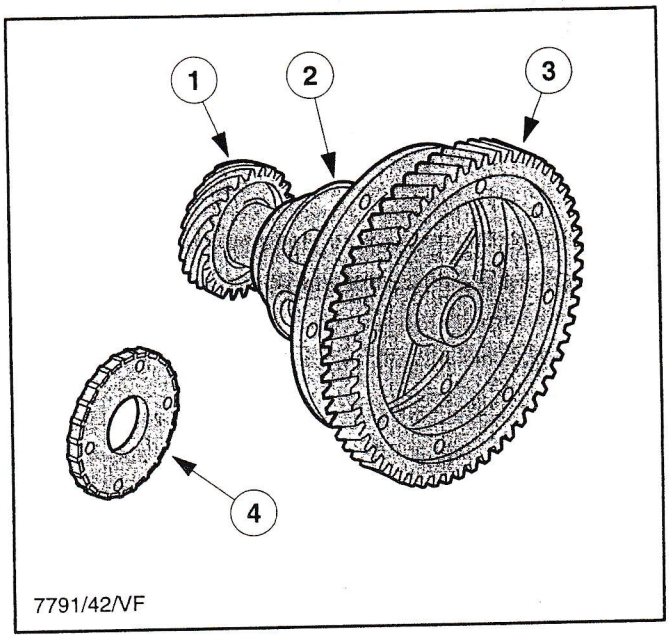
- Due to the nature of the transmission, the stresses ıd the different operating conditions, the transmission fluid must meet ever tougher requirements:
  - viscosity minimally affected by temperature
  - high resistance to ageing (lifetime filling)
  - low tendency to foaming
  - compatibility with different sealing materials

NOTE: Only transmission fluid which meets the specification must be used when filling up or after dismantling and reassembling. Refer to the current service literature for the fluid fill capacities and fluid specifications. Failure to do so can result in bearing and tooth flank damage.

- On the iB5 transmission synthetic transmission fluid 75W90 is used – the transmission is filled for life (see Lesson 6 – Service instructions).

Differential

- The differential is mounted in the transmission housing halves with two taper roller bearings and sealed externally with two oil seals.
- Strengthened transmissions are used on some models. In these transmissions the differential preload must be set. The preload is set with the aid of a shim (refer to Lesson 6 – Determining required shim thickness).
- On the Ford Focus the differential spur gear was widened by 5.5 mm so that a higher output torque can be transmitted.
- The Ford Focus is fitted with a sensor ring (4) for the vehicle speed sensor (VSS) in place of the speedometer drive worm gear (1) used previously.

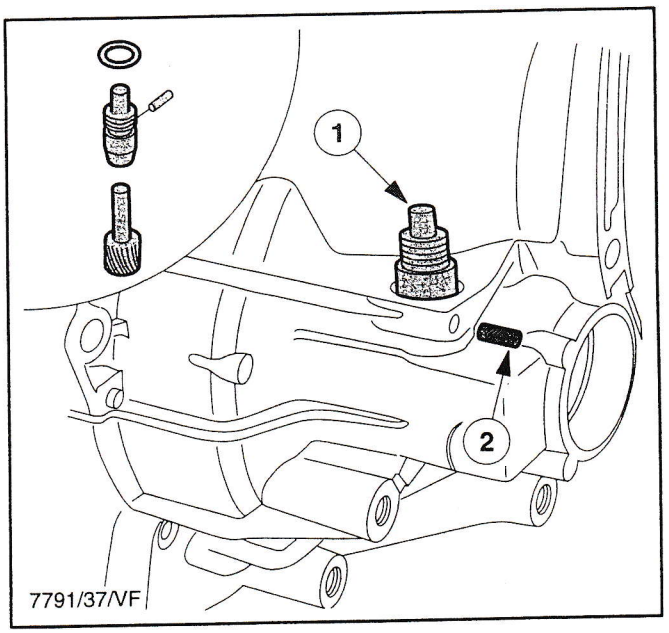


1 Worm gear
2 Differential
3 Spur gear
4 Sensor ring

Speedometer drive

Mechanical speedometer drive

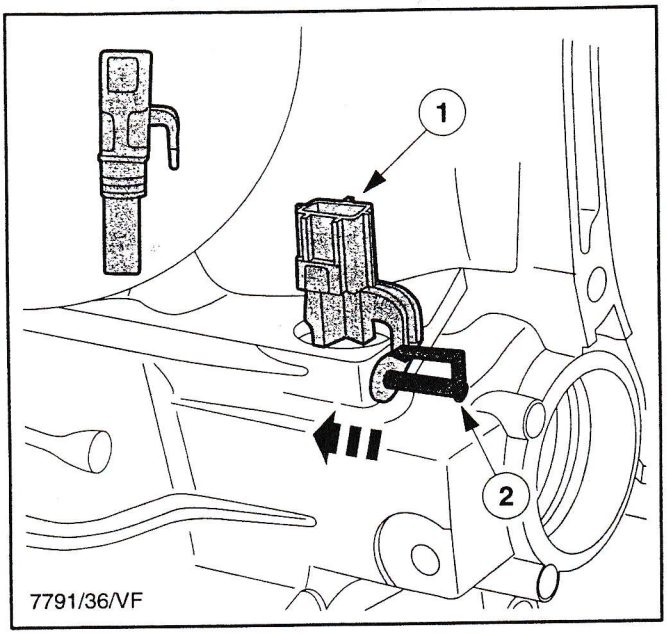
- The mechanical speedometer drive is located in the clutch-end transmission housing half. The installed position of the mechanical speedometer drive assembly is fixed in the transmission housing with a roll pin.
- Drive is through a worm gear which is seated on the output shaft of the differential.



1 Mechanical speedometer drive
2 Roll pin

Vehicle speed sensor (VSS)

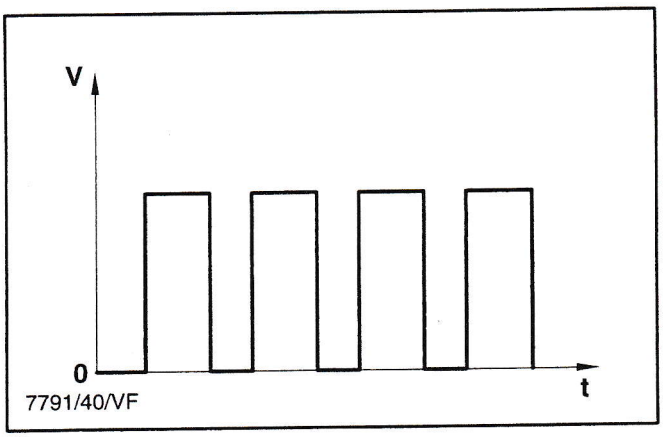
- The vehicle speed sensor (VSS) is located in the clutch-end transmission housing half. The position of the VSS is secured in the transmission housing with a roll pin.
- The VSS receives its signals from a sensor ring which is located on the output shaft of the differential.
- The VSS contains a magnet and a Hall integrated circuit (IC). It works on the Hall principle and sends a frequency to the powertrain control module (PCM).



1 Vehicle speed sensor (VSS)
2 Roll pin

Operation

- The VSS is supplied with a direct current (DC) voltage.
- When the output shaft turns, the sensor ring affects the density of the magnetic field.
- The Hall IC is located in the magnetic field and switched on and off by the change in the magnetic field.
- In this way the sensor produces a changing voltage the frequency of which is proportional to the vehicle speed.
- In the VSS the voltage is converted into a digital output signal and passed from there to the PCM.

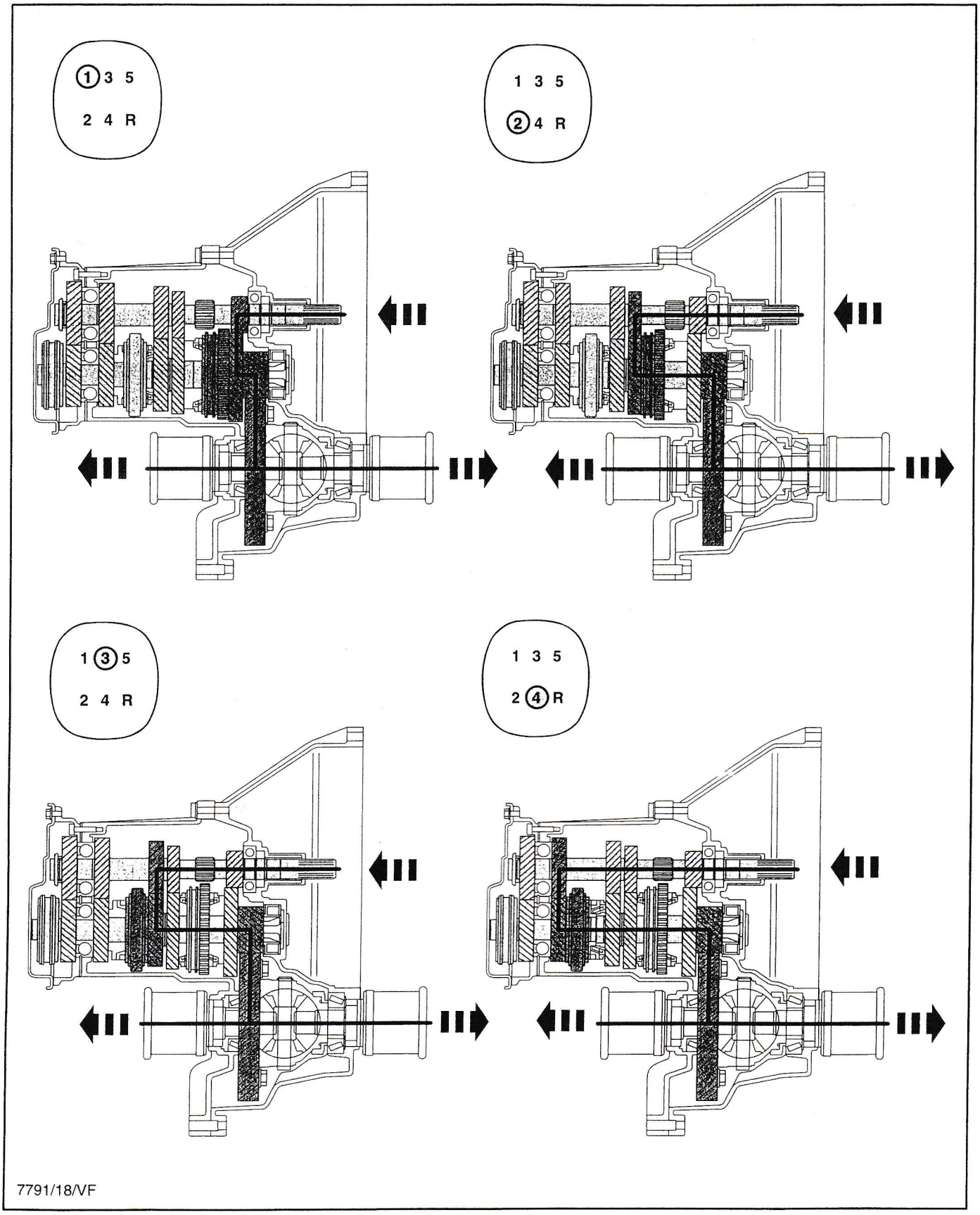


Output signal of VSS

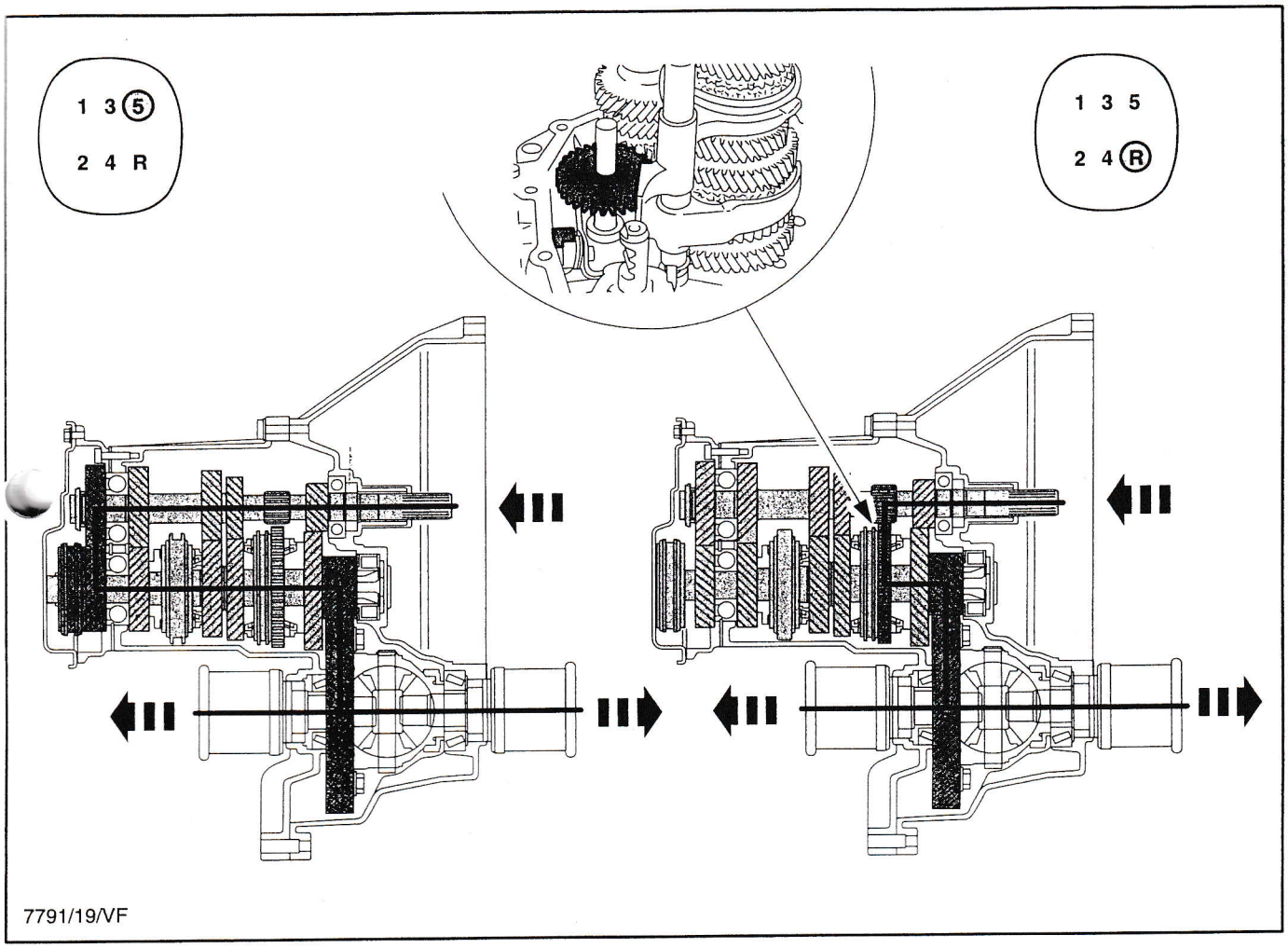
V = Voltage in volts

t = Time

Schematic of power flow in the gears



Schematic of power flow in the gears (continued)



Tick the correct answer or fill in the gaps.

1. **The B5 and iB5 transmissions are ...**

- ☐ a) two-shaft transmissions in which the gear wheels sit on the input and output shafts
- ☐ b) two-shaft transmissions in which the gear wheels sit on the input shaft
- ☐ c) two-shaft transmissions in which the gear wheels sit on the output shaft
- ☐ d) three-shaft transmissions in which the gear wheels sit on the input and output shafts

2. **What is the maximum transmittable torque of the iB5 transmission with the cable-operated shift mechanism?**

- ☐ a) 148 Nm
- ☐ b) 158 Nm
- ☐ c) 165 Nm
- ☐ d) 170 Nm

3. **When 5th gear is engaged, the engine speed is reduced by approximately**

_____ **compared to 4th gear at the same vehicle speed.**

4. **When was the iB5 transmission with the cable-operated shift mechanism introduced?**

- ☐ a) 1996 MY
- ☐ b) 1997 MY
- ☐ c) 1998 MY
- ☐ d) 1999 MY

5. **By what external feature can the iB5 transmission be distinguished from the B5 transmission?**

- ☐ a) By the transmission breather on the top of the transmission
- ☐ b) By the transmission breather on the side of the transmission
- ☐ c) By the black reversing light switch
- ☐ d) By the green reversing light switch

Objectives

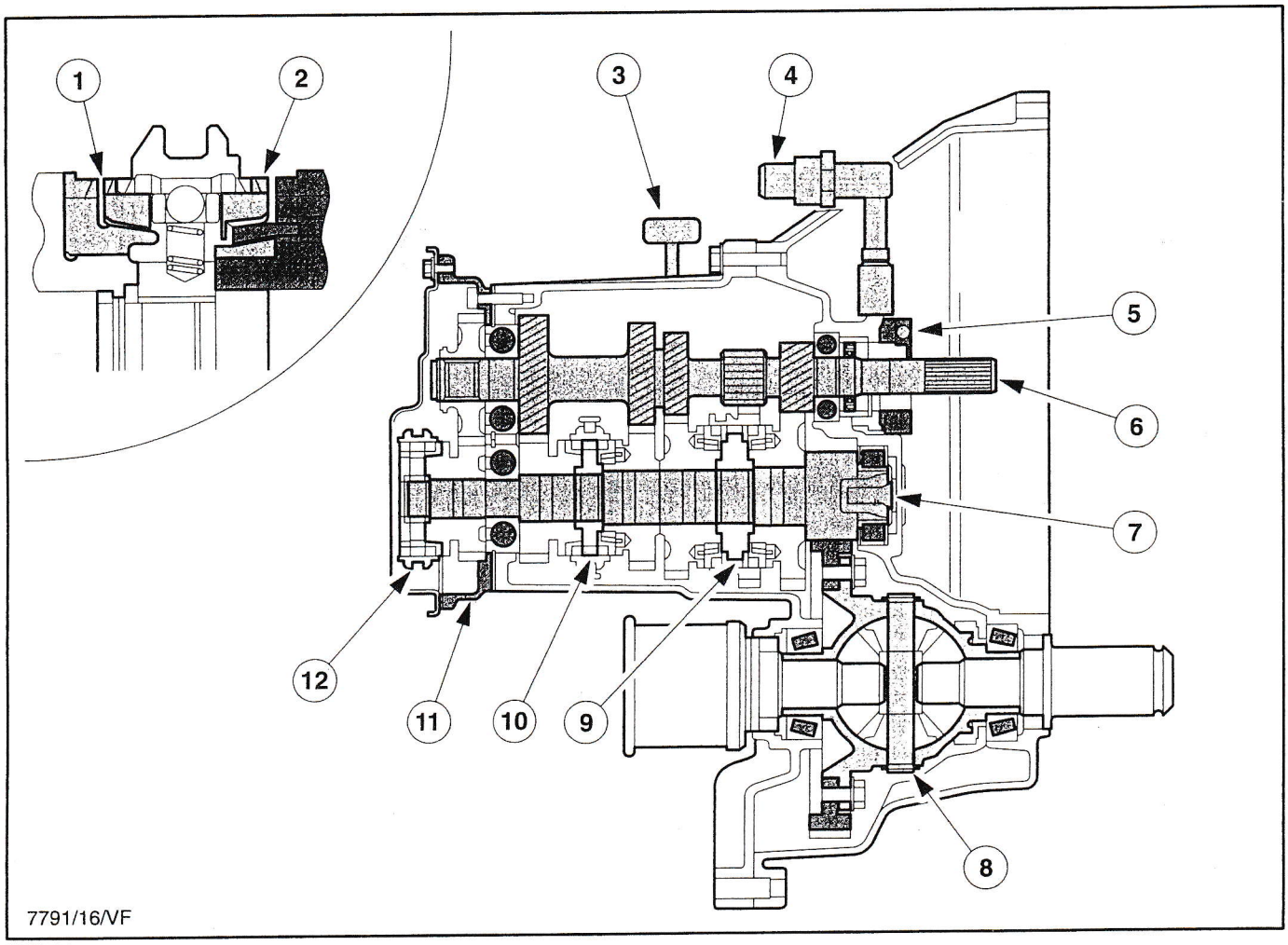
On completing this lesson, you will be able to:

- describe the design and the operation of the iB5 transmission up to the 1998 MY
- describe the sealing of the transmission housing halves and the sealing of the 5th gear housing
- explain the design of the reverse gear
- explain the design of the input shaft and output shaft
- explain how the individual gears are synchronized

Design and operation

- The following illustration shows the iB5 transmission with the rod-operated shift mechanism.
- The operation of the clutch is hydraulic on all models except Ford Escort.

NOTE: Refer to the current service literature for the transmission fluid specification and fill quantity.

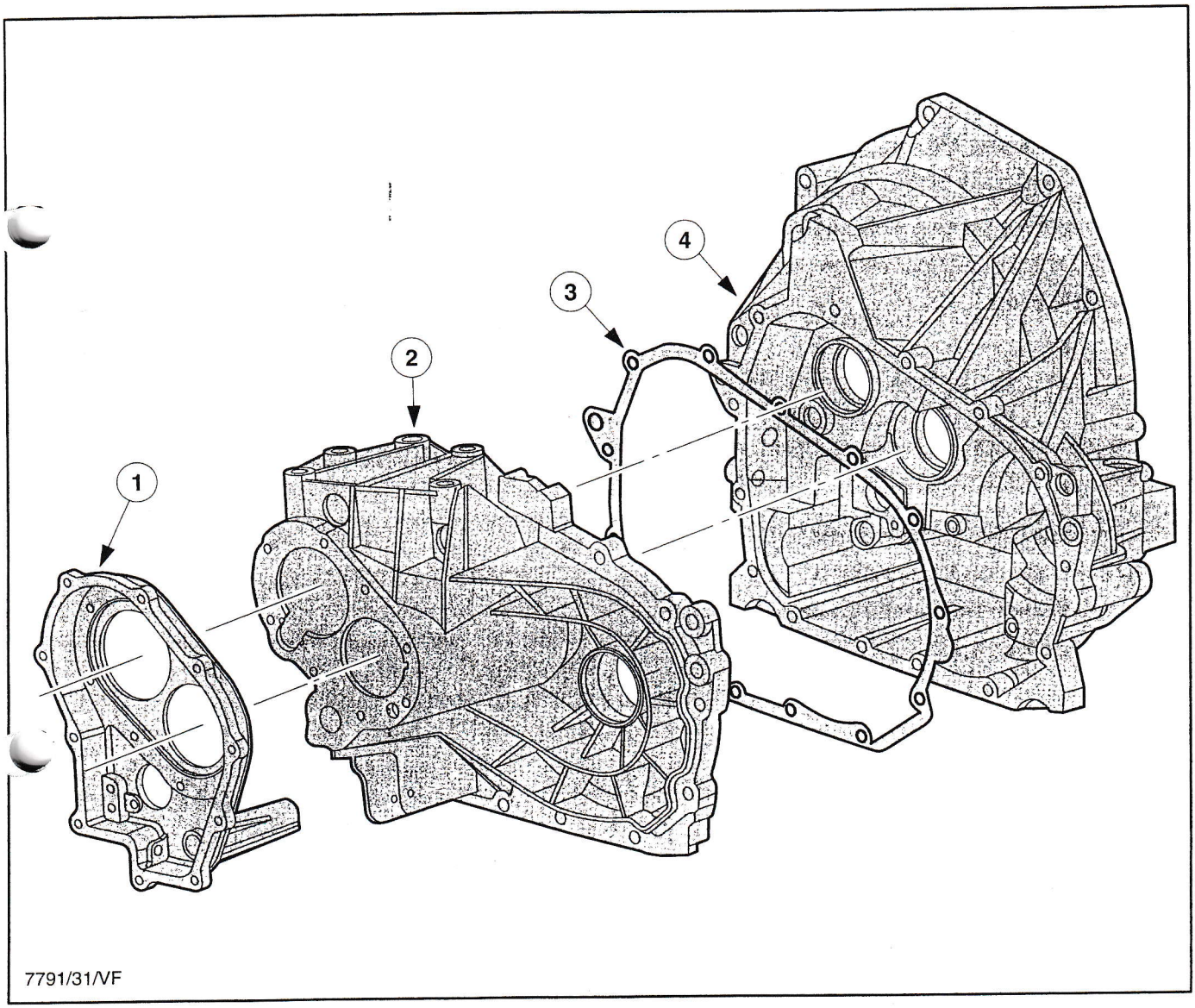


1 Single synchronizer (4th and 5th gears)
2 Double synchronizer (1st, 2nd and 3rd gears)
3 Transmission breather
4 Preload supply pressure valve
5 Release bearing (renewable)
6 Input shaft
7 Output shaft
8 Differential
9 1st/2nd gear synchronizer clutch
10 3rd/4th gear synchronizer clutch
11 5th gear housing
12 5th gear synchronizer clutch

Transmission housing

- The 3-part cast aluminium housing consists of the 5th gear housing and the two transmission housing halves.
- In production both transmission housing halves are drilled together.

NOTE: Because of the common drilling operation, the two transmission housing halves must be changed together in service.



1 5th gear housing
2 Transmission-end housing half
3 Steel gasket
4 Clutch-end transmission housing half

Sealing of the transmission housing halves

- On transmissions with the cable-operated shift mechanism and on transmissions with the rod-operated shift mechanism from No. 98WT... onwards a liquid sealer has taken the place of the steel gasket used until now between the two housing halves. The use of the liquid sealer is recognizable by the **black** 5th gear blanking cover.

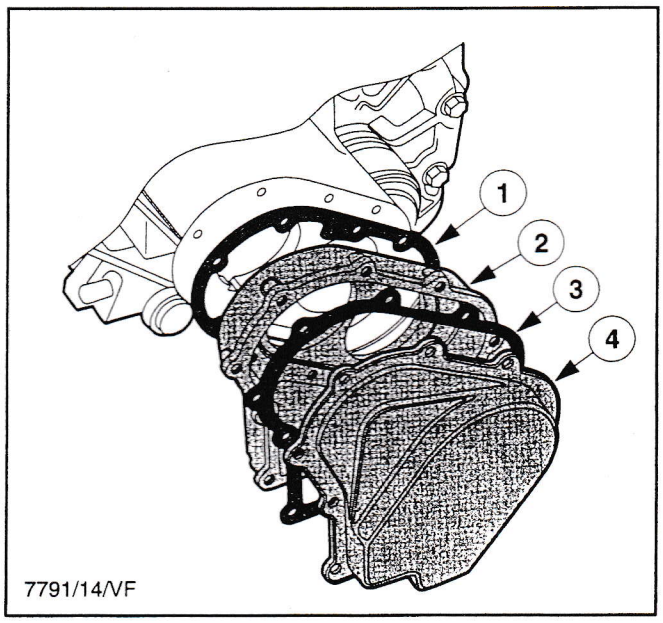
NOTE: On transmissions with a steel gasket the steel gasket must still be used between the housing halves. The liquid sealer must **never** be used as otherwise the operation of some components will be impaired and no end float will be present at the differential.

- Application of the liquid sealer (refer to Lesson 3 – Sealing of transmission housing halves).

NOTE: Some components of the internal shift mechanism have been changed in transmissions with the liquid sealer **and** the rod-operated shift mechanism (refer to Lesson 4 – Internal shift mechanism).

5th gear housing

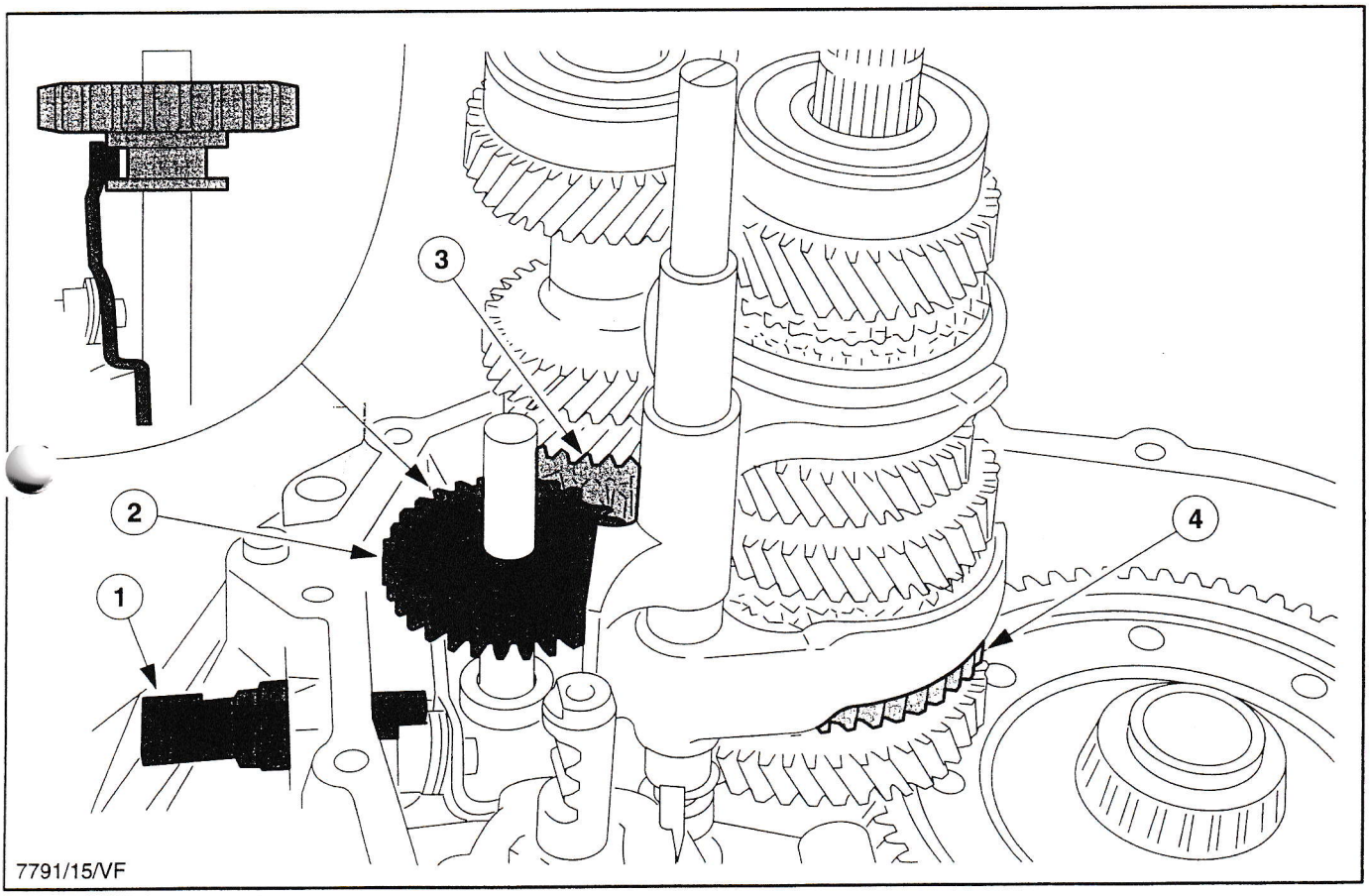
- On iB5 transmissions with a **brass-colored** 5th gear blanking cover the 5th gear housing is sealed to the transmission with a solid gasket and to the blanking cover with a cork gasket.
- From the 1999 MY onwards all iB5 transmissions are fitted with a **black** 5th gear blanking cover (refer to Lesson 3 – Sealing of 5th gear blanking cover).



1 Solid gasket of 5th gear housing
2 5th gear housing
3 Cork gasket of 5th gear blanking cover
4 5th gear blanking cover

Reverse gear idler

- The reverse gear idler (2) is mounted free to turn on the reverse gear idler shaft with a bearing seat.
- The reverse gear wheel (4) swivels on the output shaft as a part of the sliding sleeve 1st/2nd gear.
- The reverse gear driving gear (3) is secured on the input shaft.
- All three gear wheels have straight cut teeth. The reverse gear wheel has no synchronizer.
- The reverse gear idler is driven by the input shaft. As a result, the direction of rotation of the reverse gear idler is reversed.
- The reverse gear is shifted by the reverse gear idler.
- The reverse gear idler in turn drives the reverse gear wheel. This reverses the direction of rotation of the output shaft when reverse gear is engaged. This means:
  - the input direction of rotation of the input shaft = output direction of rotation of the output shaft
- The reversing light switch is located at the side.

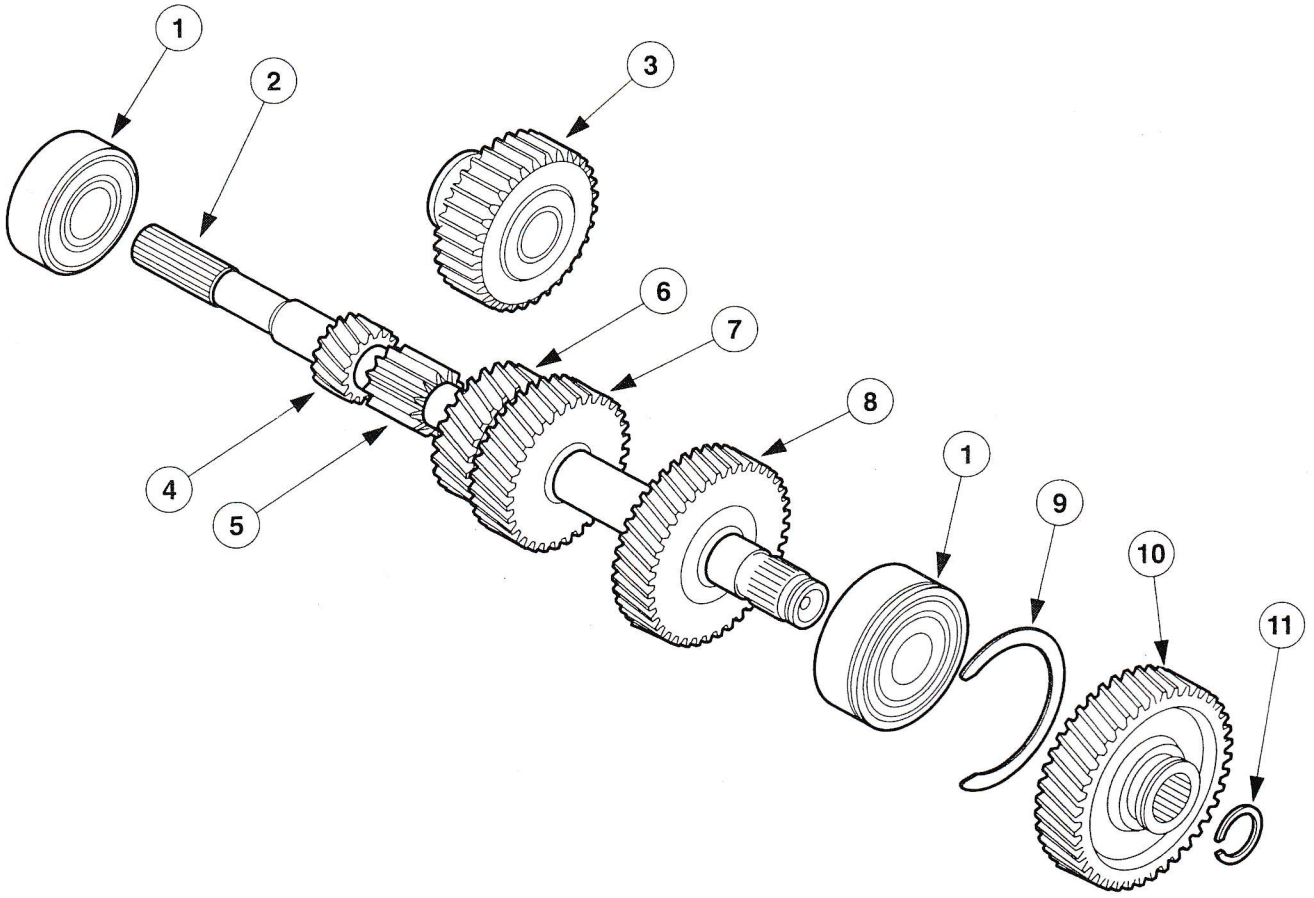


1 Reversing light switch
2 Reverse gear idler
3 Reverse gear driving gear
4 Reverse gear wheel

Input shaft

- The input shaft is mounted in the clutch-end and the transmission-end housing halves in a ball bearing.
- The input shaft carries the driving gears for 1st to 5th and reverse gears.
- The driving gear for 5th gear is a press-fit on the end of the input shaft and located in a separate housing.

NOTE: The input shaft is of the **same** design in **all** iB5 transmissions.



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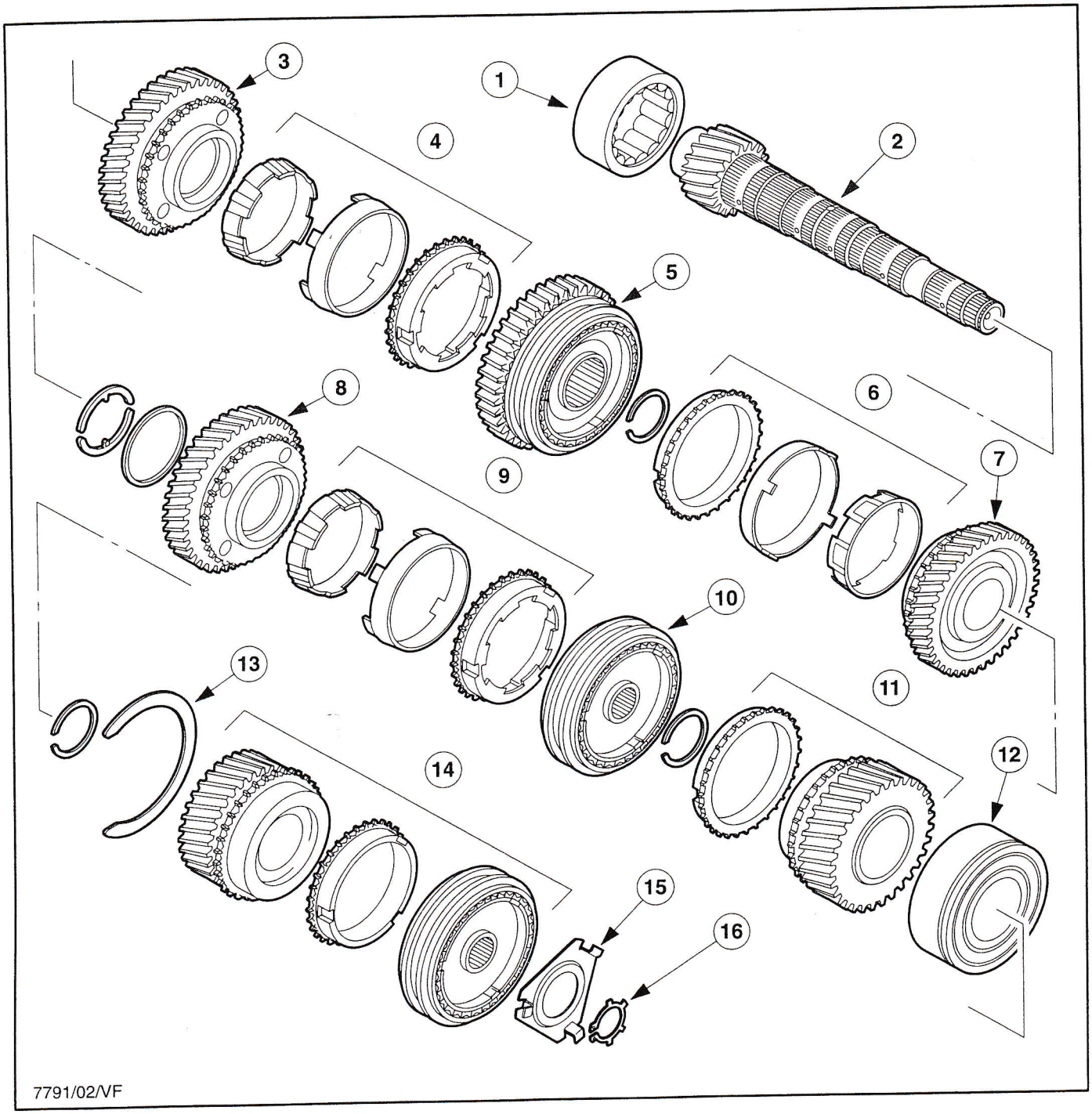
1 Ball bearing
2 Input shaft
3 Reverse gear idler
4 1st gear driving gear
5 Reverse gear driving gear
6 2nd gear driving gear
7 3rd gear driving gear
8 4th gear driving gear
9 Retaining clip
10 5th gear driving gear
11 Snap ring

Output Shaft

- The output shaft is mounted in the clutch-end housing half with an **open** cylindrical roller bearing and in the transmission-end housing half with a **closed** ball bearing.
- In the iB5 transmission up to the 1998 MY 1st, 2nd and 3rd gears have double synchronizers for smoother gear shifting.



to the illustration opposite

1 Open cylindrical roller bearing
2 Output shaft with differential driving gear
3 1st gear wheel
4 1st gear double synchronizer
5 1st/2nd gear synchroniser clutch and reverse gear wheel
6 2nd gear double synchronizer
7 2nd gear wheel
8 3rd gear wheel
9 3rd gear double synchronizer
10 3rd/4th gear synchronizer clutch
11 4th gear wheel single synchronizer
12 Ball bearing (closed on both sides)
13 Retaining clip
14 5th gear wheel single synchronizer
15 Retaining plate
16 Circlip

Tick the correct answer or fill in the gaps.

1. Which gears in the iB5 transmission have helically-cut teeth?

- ☐ a) 1st, 2nd and 3rd gears
- ☐ b) All the gears
- ☐ c) All the gears except reverse gear
- ☐ d) Reverse gear

2. Which gears in the iB5 transmission up to the 1998 MY have a double synchronizer?

- ☐ a) 1st and 2nd gears
- ☐ b) 1st, 2nd and 3rd gears
- ☐ c) 2nd, 3rd and 4th gears
- ☐ d) 3rd, 4th and 5th gears

3. The two housing halves of the iB5 transmission up to the 1998 MY are sealed with ...

- ☐ a) sealing compound
- ☐ b) a cork gasket
- ☐ c) a solid gasket
- ☐ d) a metal gasket

Objectives

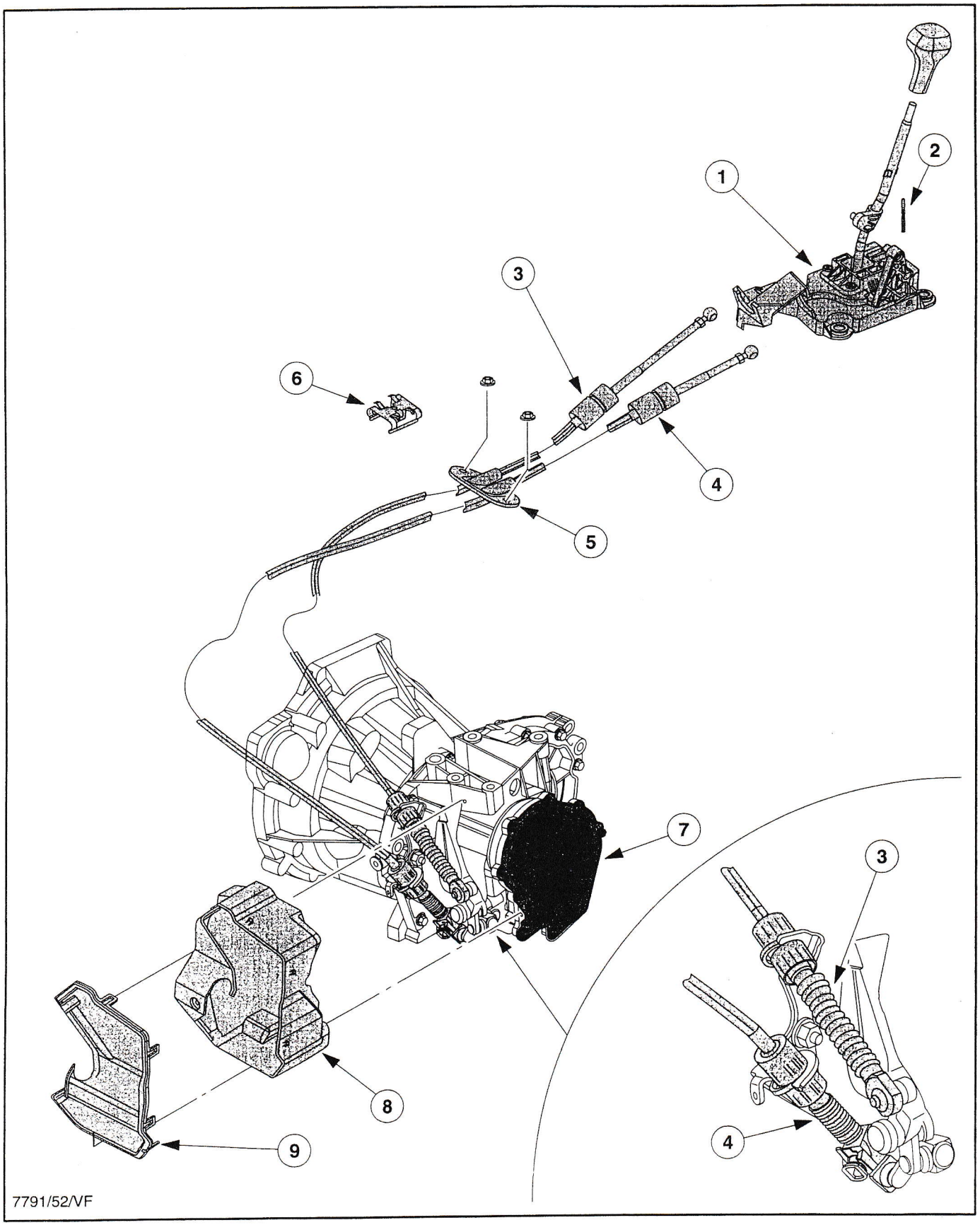
On completing this lesson, you will be able to:

- describe the design and the operation of the iB5 transmission from the 1999 MY onwards
- describe how the transmission housings are sealed
- describe how the 5th gear blanking cover is sealed and how the blanking cover can be identified
- describe the design of the input shaft and output shaft

Input shaft

- The input shaft of the iB5 transmission with the cable-operated shift mechanism is the same in design as that of the iB5 transmission with the rod-operated shift mechanism. The gear spacings may vary (refer to Lesson 2 – Input shaft).

Design and operation of iB5 transmission



Key to the illustration opposite

1 External shift mechanism

2 Drill bit (3 mm, required for adjustment operation)

3 Shift cable

4 Selector cable

5 Body seal

6 Cable retaining clamp

7 5th gear blanking cover

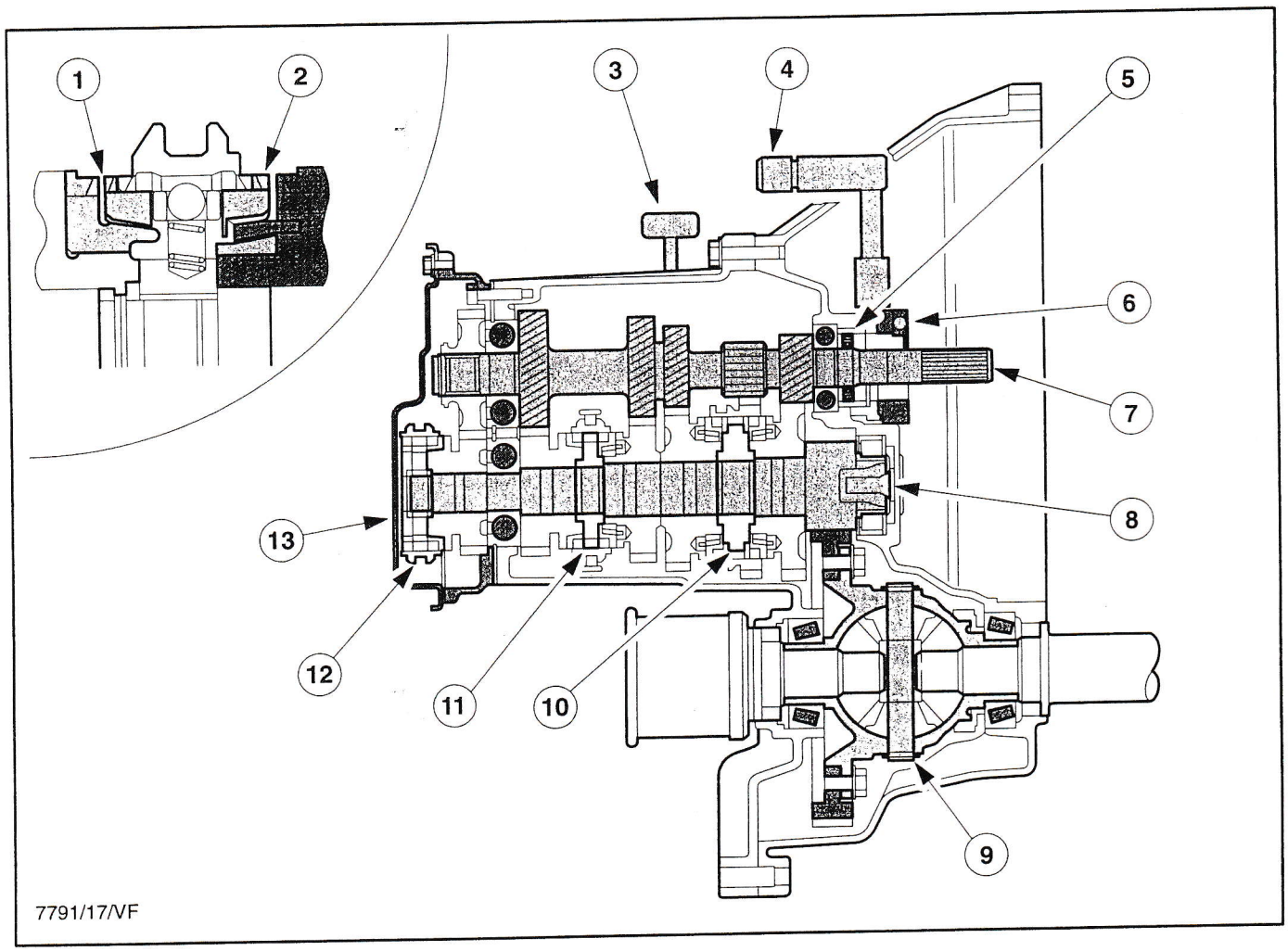
8 Cable housing

9 Cable housing cover

- The external shift mechanism consists of the gear shift lever housing with the gear shift lever and the two cables (refer to Lesson 4 – Cable-operated shift mechanism).
- The two cables (shift cable and selector cable) work in the push-pull direction. They are secured with abutment sleeves.
- The cable-operated shift mechanism allows the position of the transmission and external shift mechanism to be varied in the vehicle.
- In addition, the cables transmit less vibration and noise from the transmission to the passenger compartment.
- The internal shift mechanism has changed as a result of the cable mechanism (refer to Lesson 4 – Cable-operated shift mechanism).

Design and operation of iB5 transmission (continued)

- In the iB5 transmission with the cable-operated shift mechanism the tooth flanks on the gears were modified and the breadth of the differential spur gear and the breadth of the pinion were increased.
- These modifications and the additional stiffening of the transmission housing allowed the input torque to be increased to 165 Nm.
- The roller bearing in the clutch-end transmission housing half was also made wider. This improved durability.

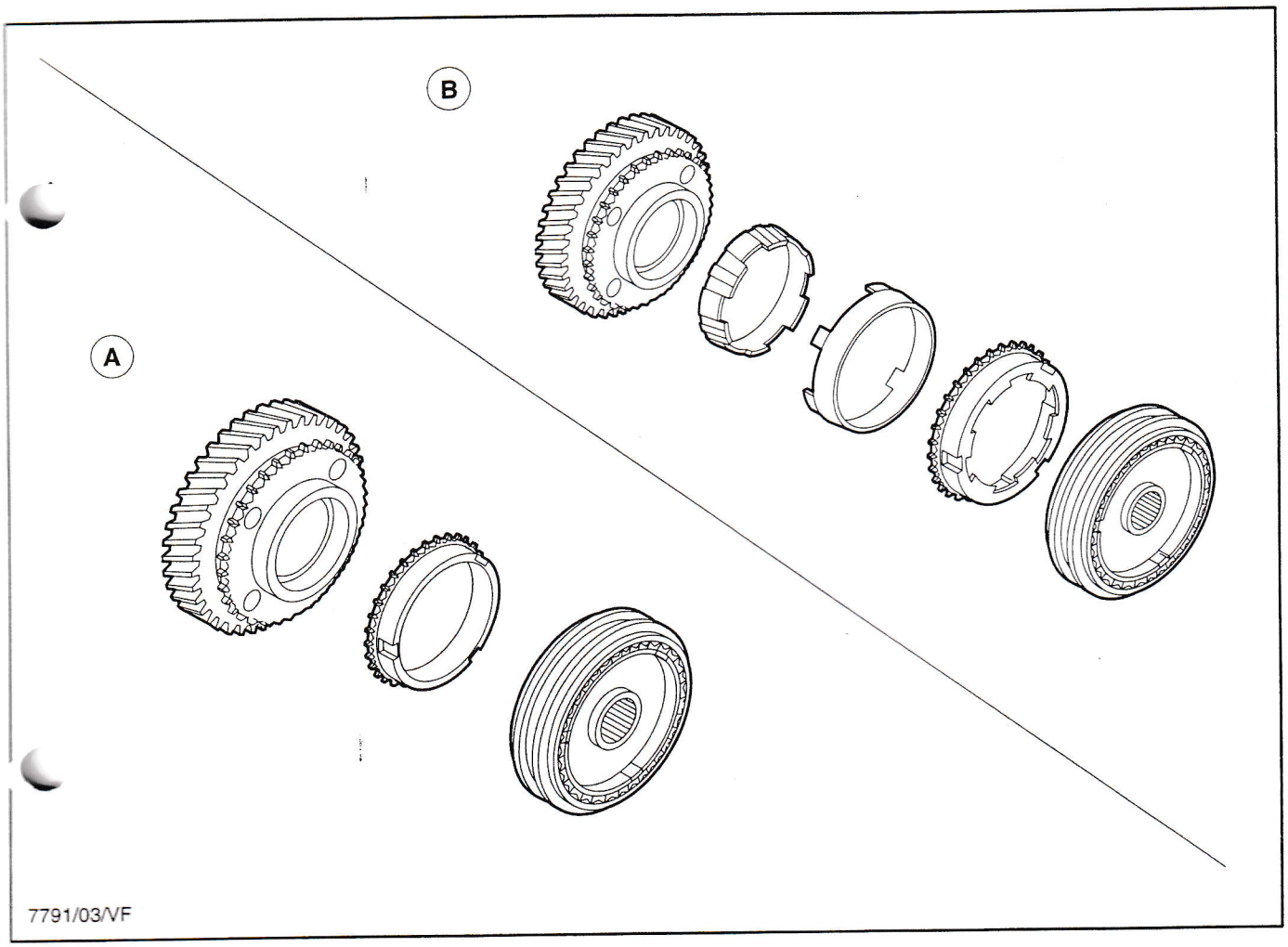


1 Single synchronizer (3rd, 4th and 5th gears)
2 Double synchronizer (1st and 2nd gears)
3 Transmission breather
4 Hydraulic clutch connection
5 Slave cylinder with integral clutch release bearing
6 Input shaft
7 Roller bearing with inner ring
8 Output shaft
9 Differential
10 1st/2nd gear synchronizer clutch
11 3rd/4th gear synchronizer clutch
12 5th gear synchronizer clutch
13 Blanking cover (black)

Output shaft/synchronizers

- The output shaft is of the same design as the output shaft used previously (refer to Lesson 2 – Output shaft) with one difference: in the iB5 transmission from the 1999 MY onwards now only 1st and 2nd gears have double synchronizers, 3rd gear has a single synchronizer.

NOTE: In service a double synchronizer (B) can be used in place of the single synchronizer (A). The gear wheel 3rd gear need not be renewed when this change takes place.



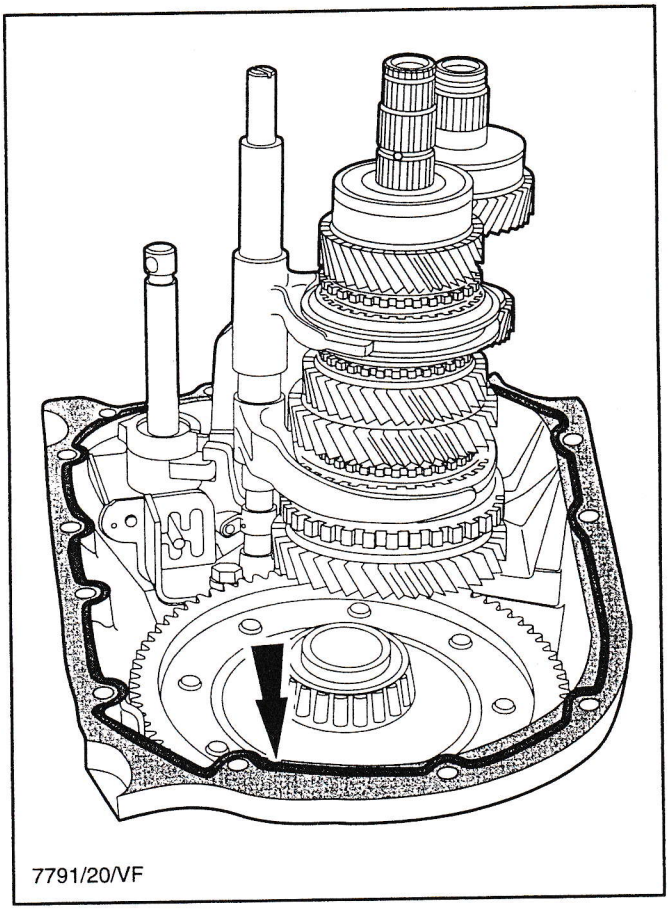
Sealing of transmission housing halves

- A liquid sealer has taken the place of the steel gasket used until now between the two housing halves.
- The liquid sealer is used on **all** iB5 transmissions from No. 98WT... onwards.

NOTE: The use of the liquid sealer can be recognized by the **black** 5th gear blanking cover. Refer to the current service literature for the specification of the sealer.

- The range of shims has been increased as a result of the liquid sealer.

NOTE: In transmissions with a steel gasket cover the steel gasket must still be used between the housing halves. The liquid sealer must **never** be used as otherwise the operation of some of the components will be impaired and there will be no end float at the differential.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Applying the liquid sealer:

- Before the liquid sealer is applied, the mating surfaces must be free of oil and dust.
- The bead of sealer (arrowed and 1.5 mm wide) must be applied on the inside.
- After the sealer has been applied, the housing halves must be assembled together within 60 minutes.
- Then the housing bolts must be tightened to the specified torque within five minutes.

Sealing of 5th gear blanking cover

- A liquid sealer has taken the place of the cork gasket used until now between the 5th gear housing and the 5th gear blanking cover.

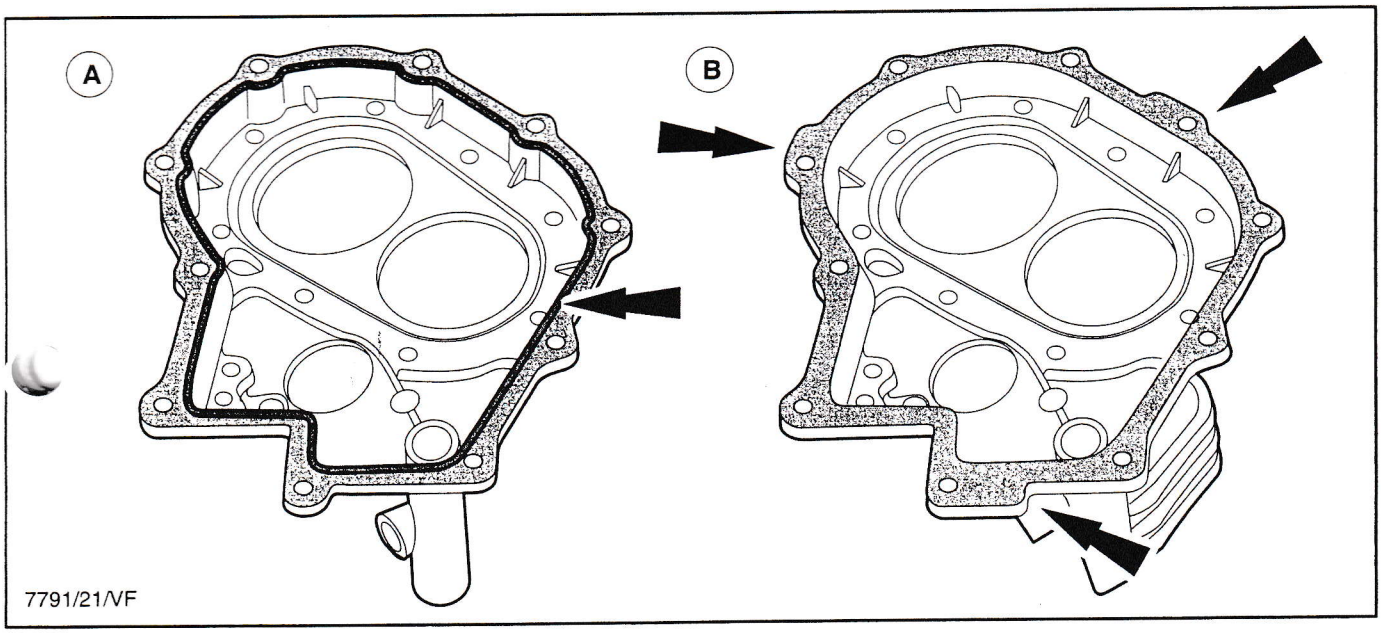
NOTE: The use of the liquid sealer can be recognized by the **black** 5th gear blanking cover. Refer to the current service literature for the specification of the sealer.

- The liquid sealer is a silicone sealer. It seals the housing with the rough mating face (previously smooth) to the black-painted 5th gear blanking cover.
- After application, the sealer forms a chemical compound with the black paint.

NOTE: The liquid sealers used for the housing halves and for the 5th gear housing are different.

Applying the liquid sealer:

- Before the liquid sealer is applied, the mating faces must be free of oil and dust.
- The bead of sealer (arrowed in Fig. A of the illustration – 1.5 mm wide) must be applied on the inside.
- After application of the sealer, the cover must be fitted and tightened to the specified torque within 10 minutes.



A New 5th gear housing with liquid sealer (arrowed), peripheral bevel and rough mating surface

B Old 5th gear housing with smooth mating surface and cast flanges (arrowed)

Tick the correct answer or fill in the gaps.

1. **The two housing halves of the iB5 transmission from the 1999 MY onwards are sealed with ...**

- ☐ a) a solid gasket
- ☐ b) a cork gasket
- ☐ c) a metal gasket
- ☐ d) liquid sealer

2. **Which gears in the iB5 transmission from the 1999 MY onwards have a double synchronizer?**

- ☐ a) 1st and 2nd gears
- ☐ b) 1st, 2nd and 3rd gears
- ☐ c) 2nd, 3rd and 4th gears
- ☐ d) 3rd, 4th and 5th gears

3. **iB5 transmissions in which liquid sealer is used are identifiable externally by**

_____.

4. **Name at least two modifications which allowed the input torque of the iB5 transmission to be increased to 165 Nm.**

_____

_____

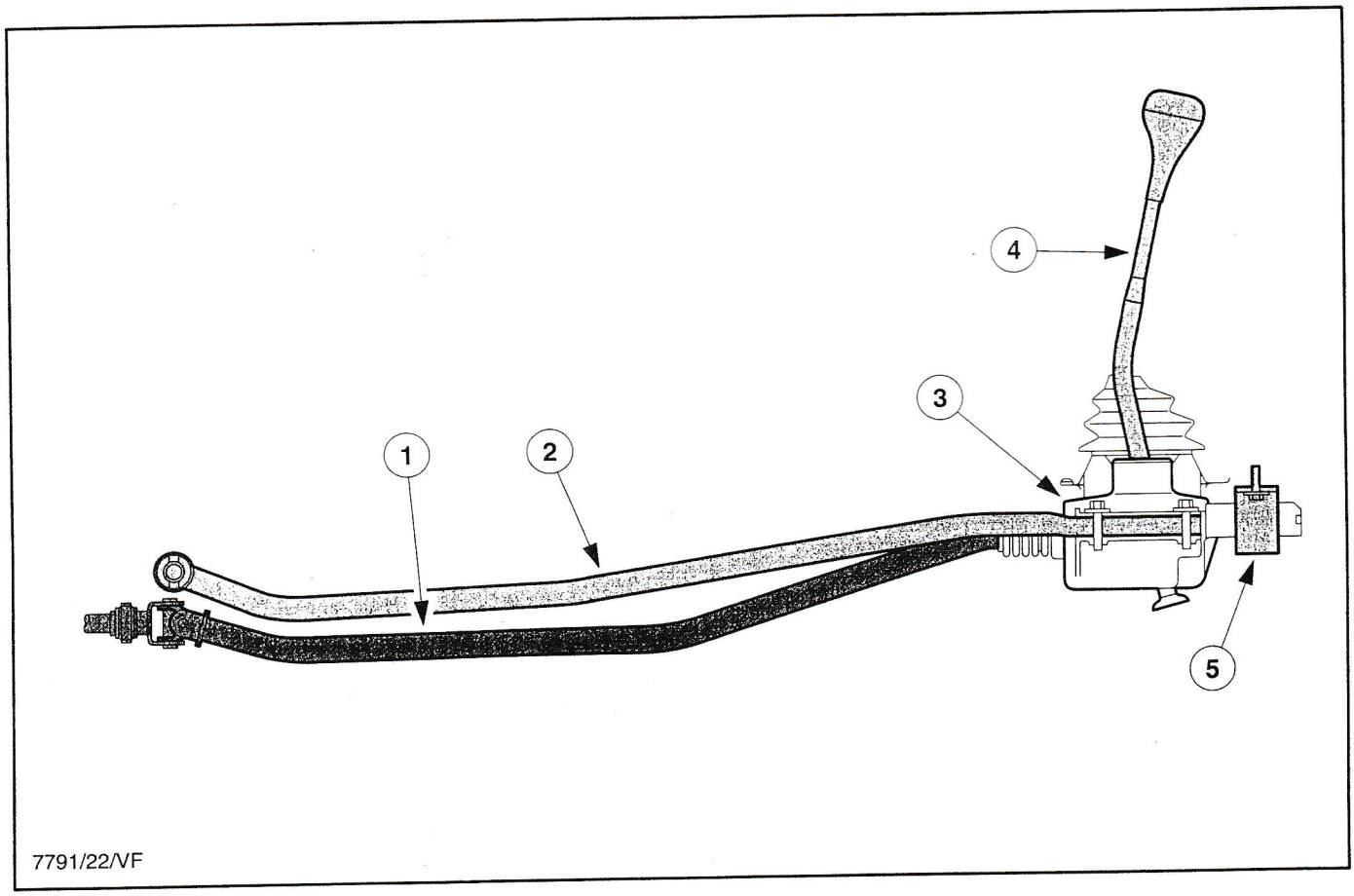
Objectives

On completing this lesson, you will be able to:

- describe the design of the internal and external shift mechanisms with the rod-operated shift mechanism
- explain the operation of the rod-operated shift mechanism
- explain how the rod-operated shift mechanism is adjusted
- describe the design of the internal and external shift mechanisms with the cable-operated shift mechanism
- explain the operation of the cable-operated shift mechanism
- explain how the cable-operated shift mechanism is adjusted

External shift mechanism

- The rod-operated shift mechanism is used on all models except on the Ford Focus.
- The gearshift lever housing is secured to the floor pan. It is connected to the transmission by means of a stabilizer to prevent longitudinal movement.
- The rubber insulator reduces engine vibration transmitted through the shift rod to the gearshift lever. In addition, the tilting movement of the gear shift lever due to the rocking movement of the power unit is reduced.



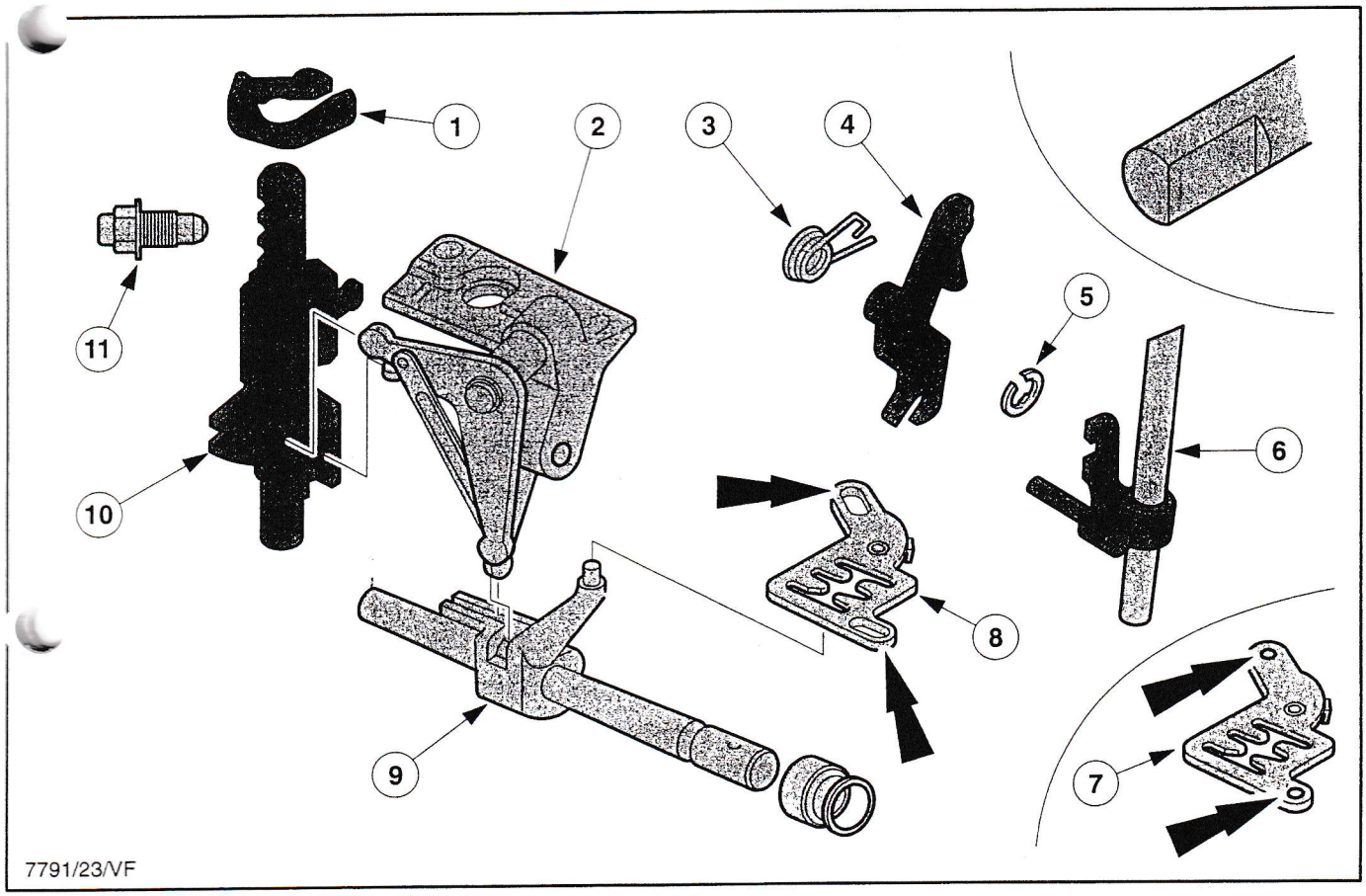
1 Shift rod
2 Stabilizer
3 Gearshift lever housing
4 Gearshift lever
5 Rubber insulator

ternal shift mechanism

NOTE: In transmissions with the liquid sealer **and** the rod-operated shift mechanism the components shown dark gray have been modified.

- The modifications to the components are **not** visible to the eye and have not led to any change in working procedures.
- The shift locking plate prevents simultaneous engagement of two gears.
- The shift interlock locks the selected gears and the neutral position.

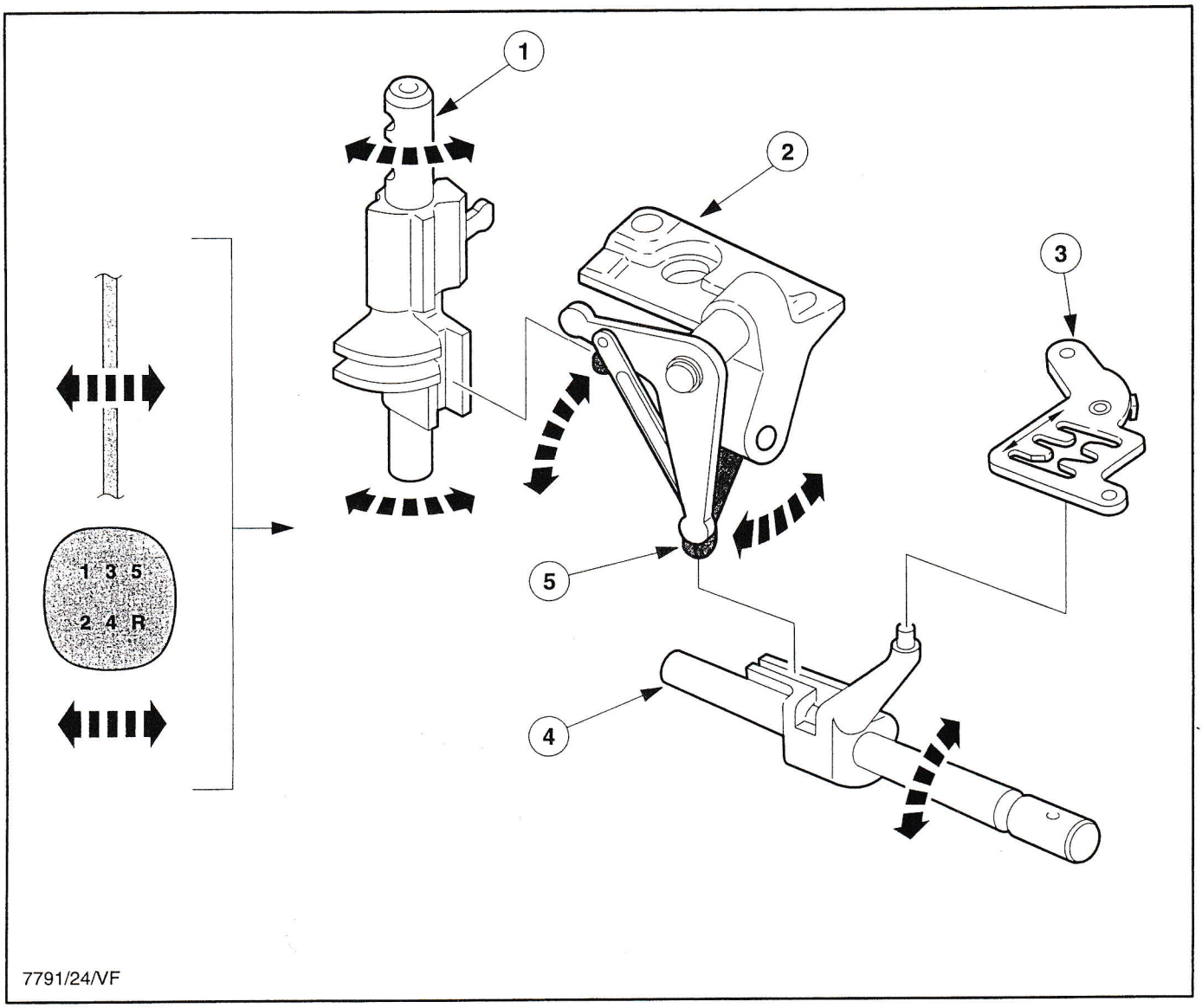
NOTE: A shift gate with slots (8) is used in production. In the event of concerns, a shift gate **without** slots (7) must be used in service as it is not possible to adjust the shift gate in service.



1 Shift locking plate
2 Shift and selector lever assembly
3 Return spring from reverse gear position
4 Reverse gear shift lever
5 C-clip
6 5th gear/reverse gear shift rod
7 Shift gate (service)
8 Shift gate (production)
9 Main shift shaft
10 Auxiliary shift shaft
11 Shift interlock

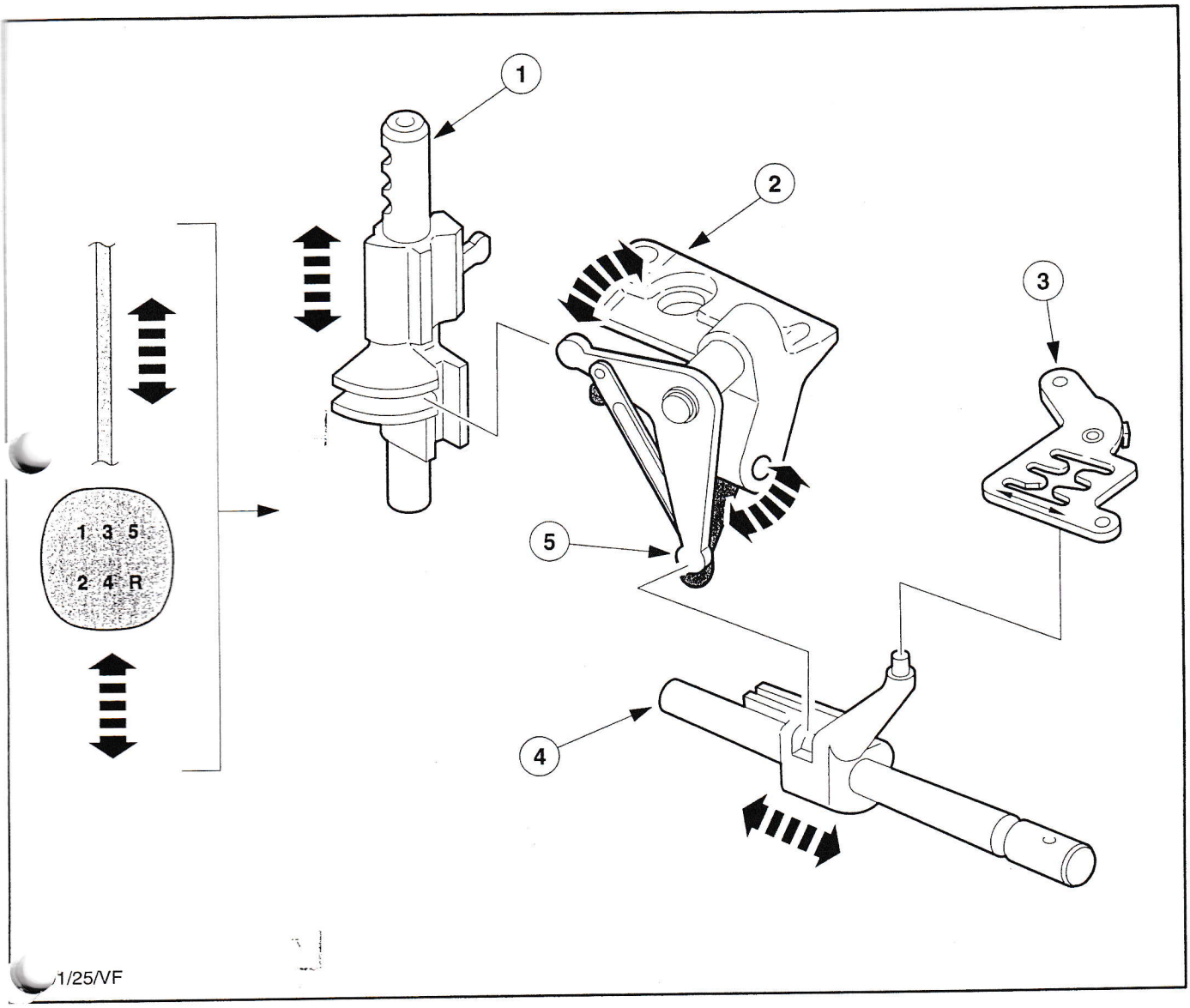
Operation

Selection movement at gear shift lever and in transmission



1 Auxiliary shift shaft
2 Shift and selector lever assembly
3 Shift gate
4 Main shift shaft
5 Selector lever

Shift movement at gear shift lever and in transmission



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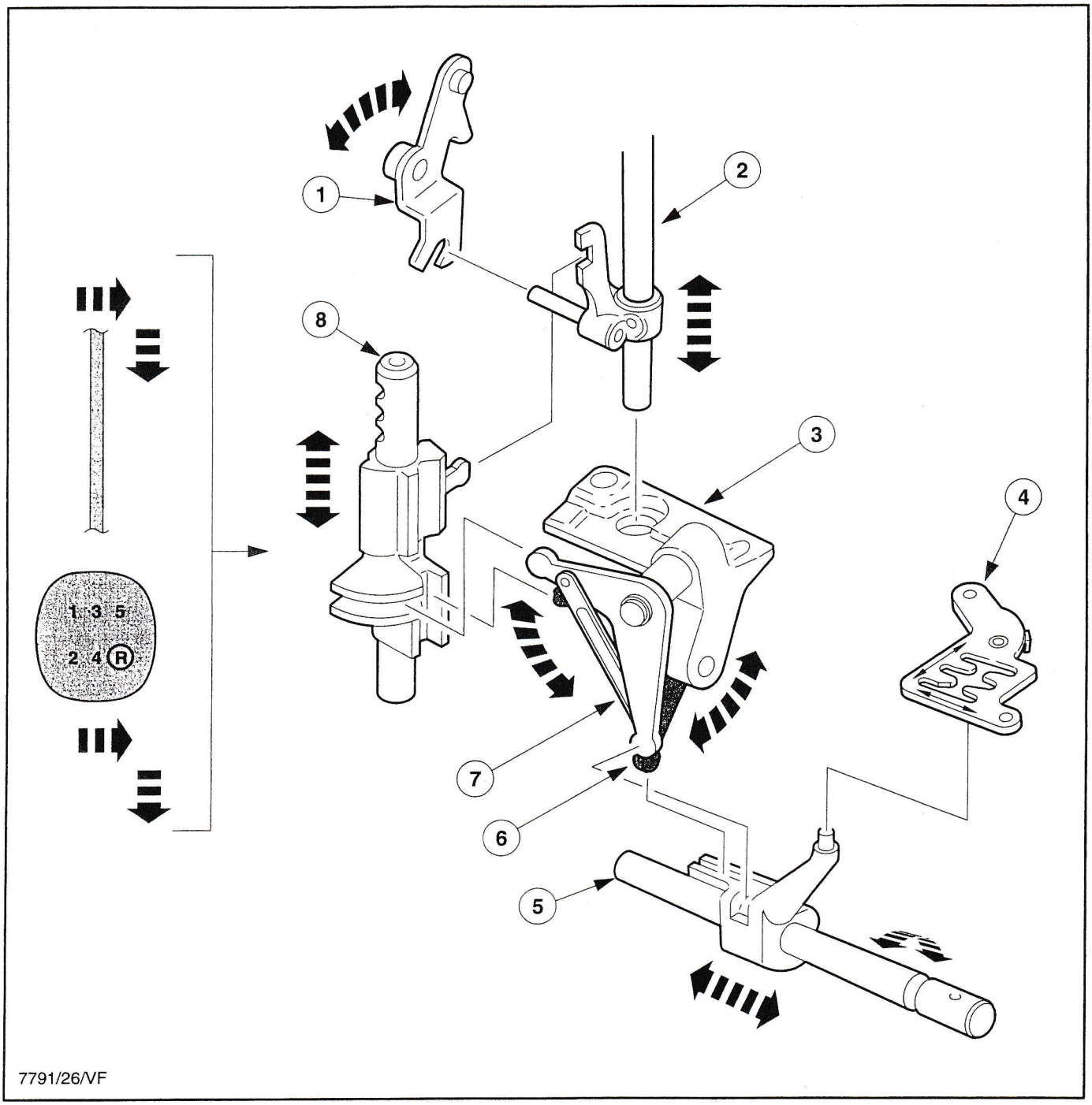
1 Auxiliary shift shaft
2 Shift and selector lever assembly
3 Shift gate
4 Main shift shaft
5 Shift lever

Engaging reverse gear



1 Reverse gear shift lever
2 5th gear/reverse gear shift rod
3 Shift and selector lever assembly
4 Shift gate
5 Main shift shaft
6 Selector lever
7 Shift lever
8 Auxiliary shift shaft

Shift interlock

- The interlock (1) serves to lock 5th gear. In **all** iB5 transmissions the interlock, spring and pin are shorter from August 1998 onwards.

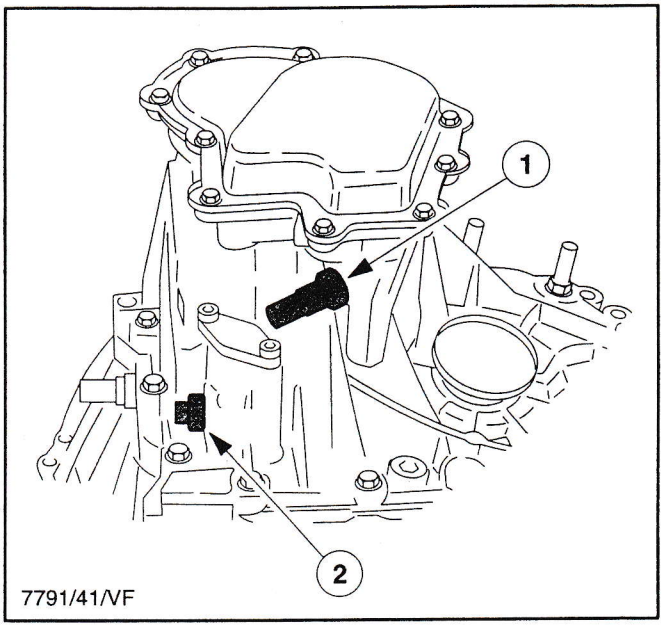
NOTE: The tightening torque for the interlock for 5th gear is unchanged – refer to the current service literature.

- In iB5 transmissions with a rod-operated shift mechanism the shift shaft interlock (2) locks the auxiliary shift shaft.

  – Rod-operated shift mechanism = 16 mm diameter thread

  – Cable-operated shift mechanism = 18 mm diameter thread

NOTE: The tightening torque of the shift shaft interlock is unchanged – refer to the current service literature.



1 5th gear interlock
2 Shift shaft interlock

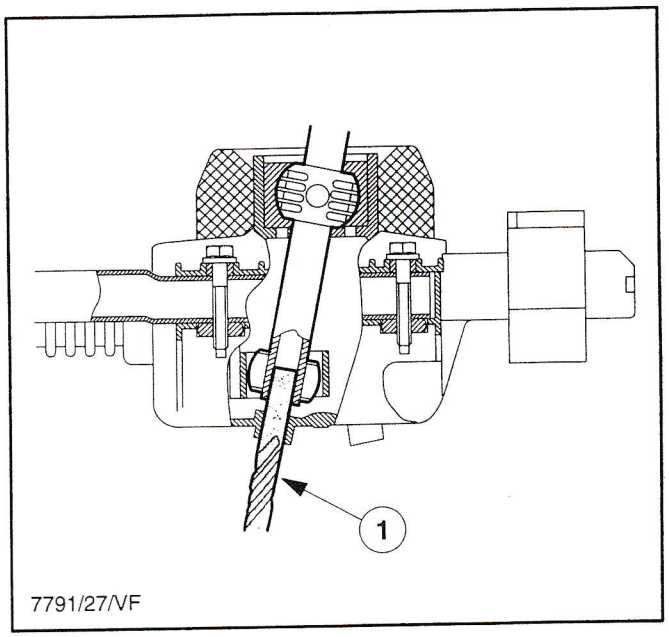
Adjustment of rod-operated shift mechanism

- Before the transmission is installed, 4th gear must be engaged in the transmission.
- After the transmission is installed completely, bring the external shift mechanism to the 4th gear position and lock it in the 4th gear position from below with the shank of a 9 mm drill bit.

NOTE: Tape the cutter end of the drill bit to secure it.

- When the shift mechanism has been immobilized, the bolts of the shift rod and stabilizer can be tightened to the specified torque.
- Operate the clutch and shift through all the gears several times.

NOTE: Refer to the current service literature for the complete procedure.

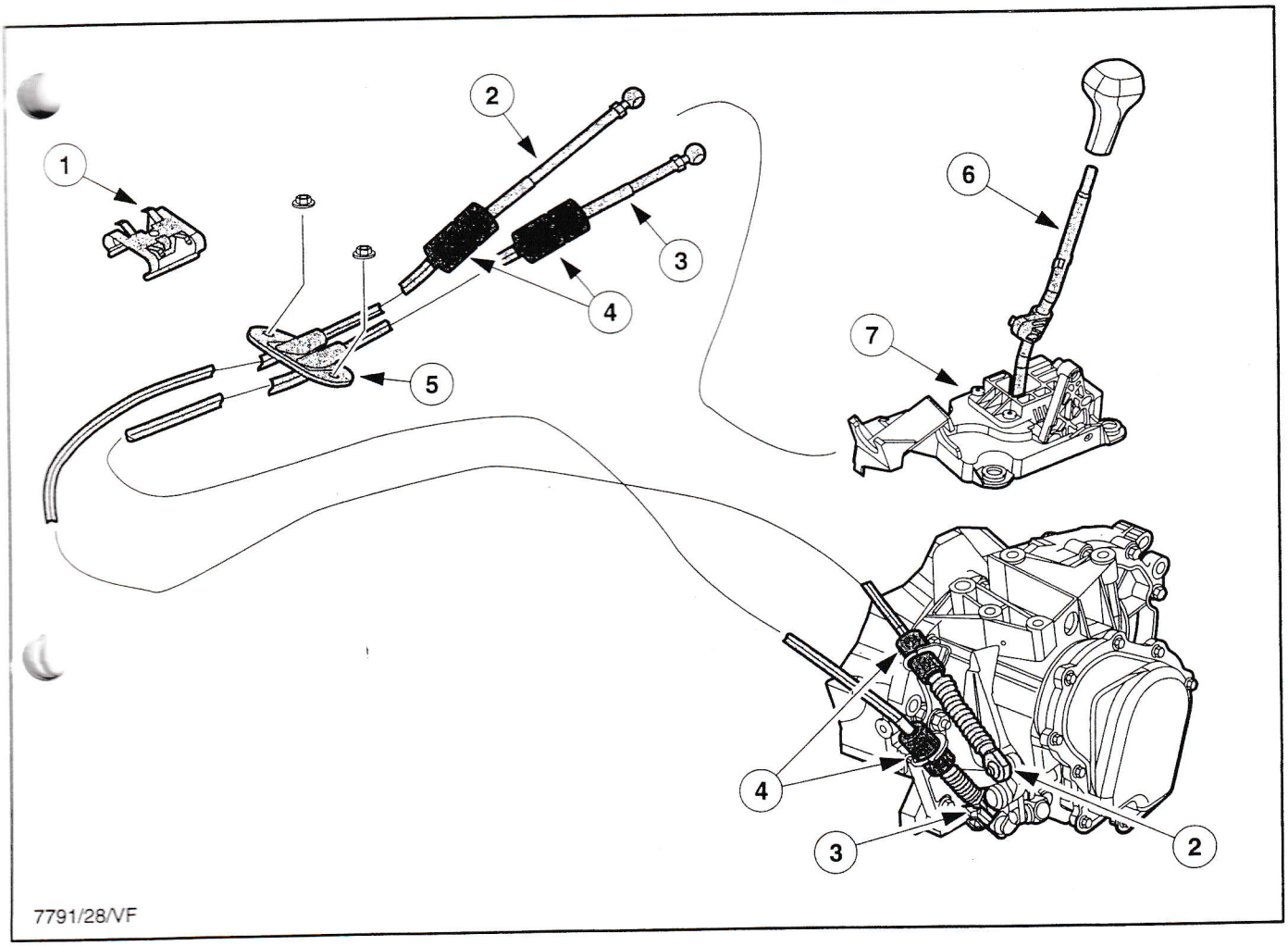


1 Drill bit (9 mm)

External shift mechanism

- At the gearshift lever end the abutment sleeves are secured to the gearshift lever housing in clamping slots. The gearshift lever housing is secured to the floor pan with four studs.
- At the transmission end the cables are secured to a bracket on the transmission housing by means of abutment sleeves and connected pivotably by means of an end fitting with a ball coupling.
- The cables are guided through the floor pan. The cables are run along the floor pan with an additional retaining clamp. The body seal provides the sealing at the engine compartment.

NOTE: The shift and selector cables can only be changed together due to the common body seal. They are designed so as to be installed and adjusted in one operation.



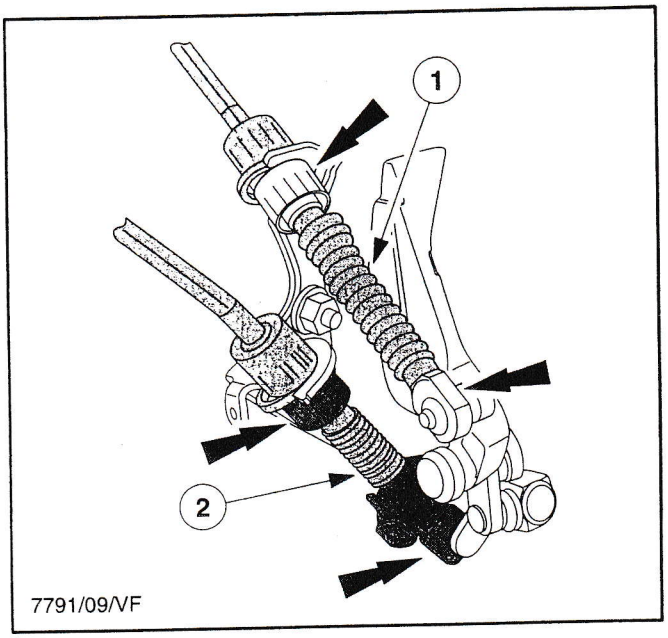
1 Cable retaining clamp
2 Shift cable
3 Selector cable
4 Abutment
5 Body seal
6 Gearshift lever
7 Gearshift lever housing

- The two halves of the abutments must be turned against each other to remove the cables from their brackets on the transmission and the gearshift lever housing.

NOTE: To avoid confusion during assembly, the end fittings on the cables are of different designs. In addition, the cables are color-coded (arrowed).

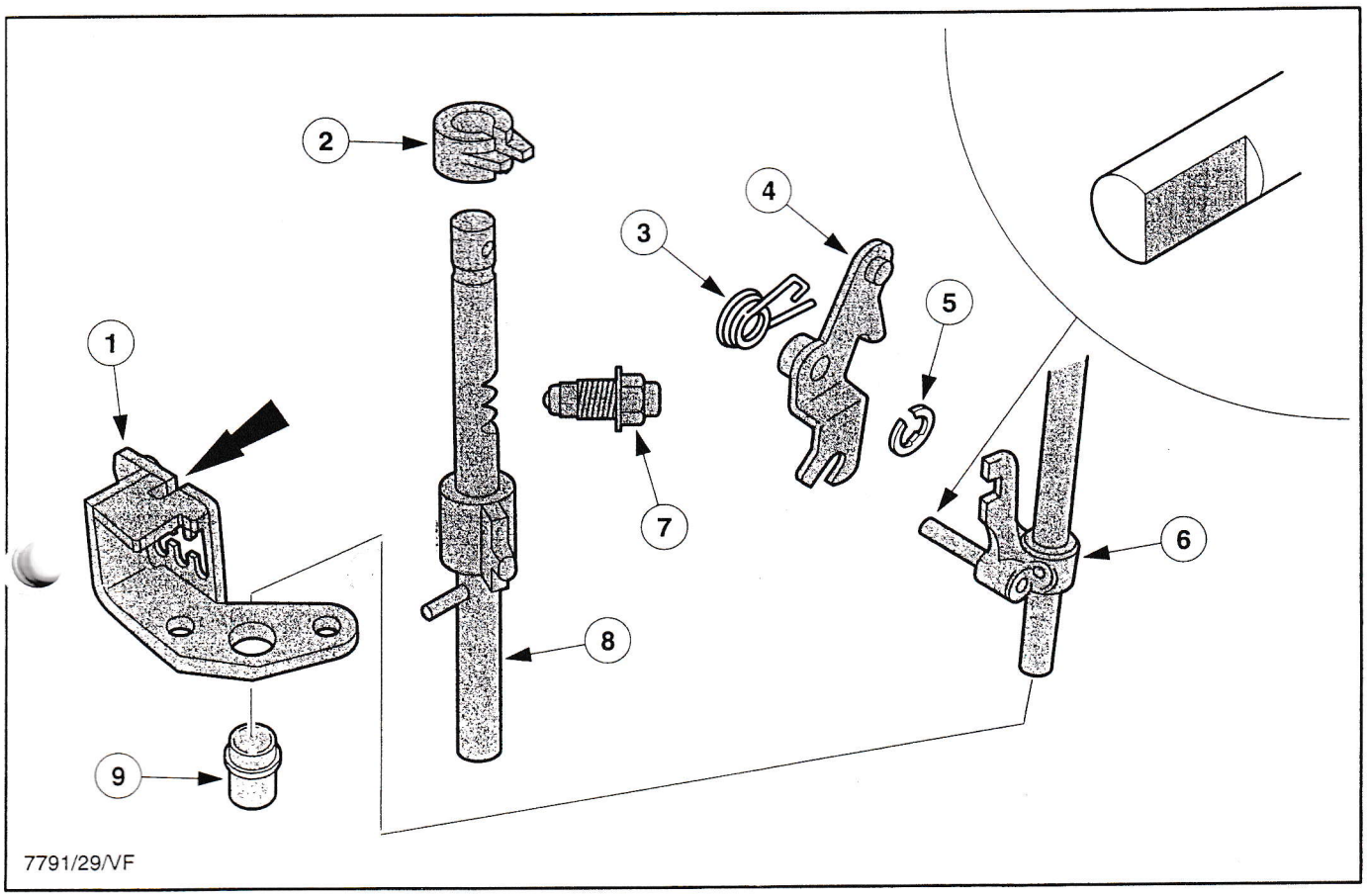
1 Shift cable – white

2 Selector cable – black



Internal shift mechanism

- With the cable-operated shift mechanism, the internal shift mechanism has fewer parts than with the rod-operated mechanism. Some components have been eliminated, others have been changed (refer to Lesson 4 – Rod-operated shift mechanism).
- The new shift locking bush (2) takes the place of the shift locking plate used until now. It prevents simultaneous engagement of two gears.
- The shift interlock (7) locks the shifted gears and the neutral position.
- With the cable-operated shift mechanism both the shift operation and the selection operation are carried out by means of the shift shaft.
- The location and the design of the shift gate (1) are new. It no longer has slots. The shift gate is open at the top (arrowed) to facilitate removal and installation of the shift shaft.
- The dimensions of the components of the reverse gear have changed. The operation has remained the same.

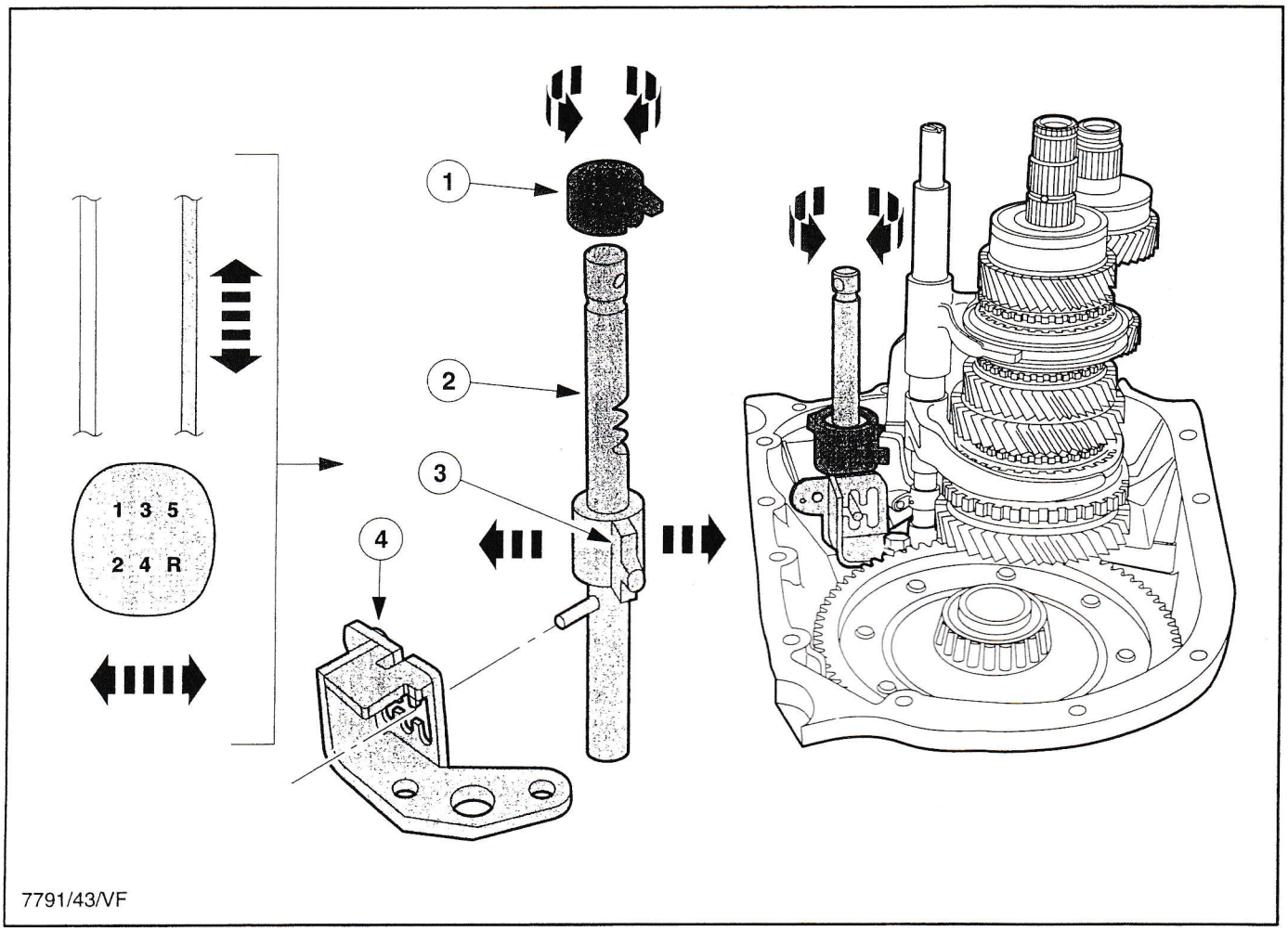


1 Shift gate
2 Shift locking sleeve
3 Return spring from reverse gear position
4 Reverse gear shift lever
5 C-clip
6 5th gear/reverse gear shift rod
7 Shift interlock
8 Shift shaft
9 Guide sleeve

Operation

Selection movement at the gearshift lever and in the transmission

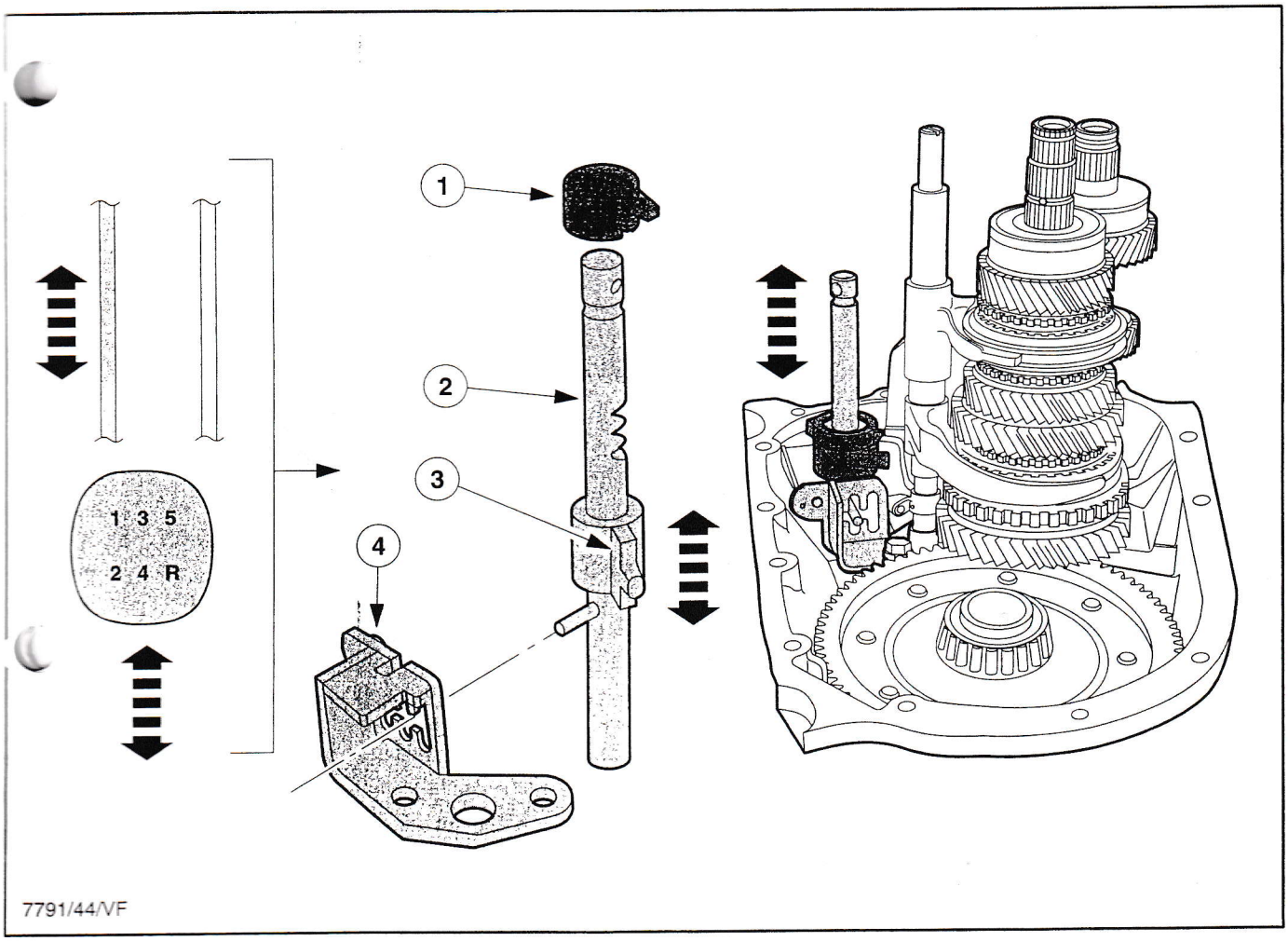
- The axial movement of the selector cable is transmitted to the pivotably mounted shift shaft at the transmission end.
- When the gearshift lever is moved to the left or the right, the shift shaft (2) and the shift finger (3) are also turned to the left or right.
- During this process the shift shaft is guided in the shift gate (4) by means of a pin.
- The desired shift fork is selected with the shift finger (3).
- The shift locking bush (1) locks out the other pairs of gears.



1 Shift locking bush
2 Shift shaft
3 Shift finger
4 Shift gate

movement at the gearshift lever and in the transmission

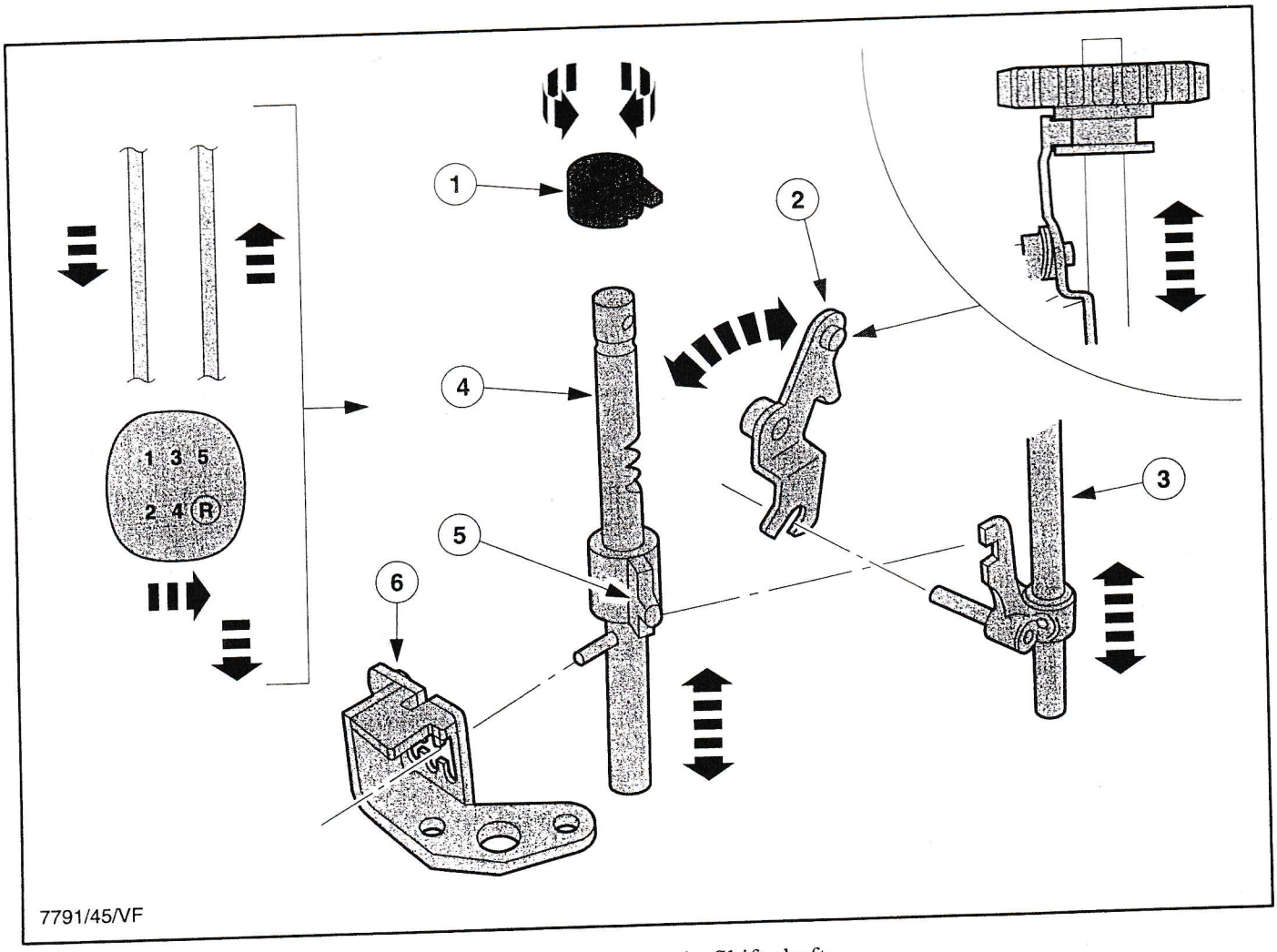
- When the pair of gears to be shifted has been selected, the shift operation takes place.
- The axial movement of the shift cable on the transmission causes an axial movement of the shift shaft.
- When the gearshift lever is moved to the front or rear, the shift shaft (2) and the shift finger (3) are also moved in the vertical direction.
- During this process the shift shaft is guided in the shift gate (4) by means of a pin.
- The desired shift fork is shifted by means of the shift finger (3).
- The shift locking bushing (1) locks out the other pairs of gears.



1 Shift locking bushing
2 Shift shaft
3 Shift finger
4 Shift gate

Engaging reverse gear

- To select reverse gear, the gearshift lever must be moved to the right past the reverse gear lock. When this is done, the axial movement of the selector cable is transmitted to the pivotably mounted shift shaft.
- When shifting into reverse gear, the gearshift lever is moved to the rear. The shift finger engages in the 5th gear/reverse gear shift rod (3) which in turn engages by means of a pin in the reverse gear shift lever (2).
- The shift shaft is guided in the shift gate (6) by means of a pin during the selection and shift operation.
- The reverse gear idler is forced vertically upwards by the reverse gear shift lever and reverse gear is shifted.
- The shift locking bush (1) locks out the other pairs of gears.

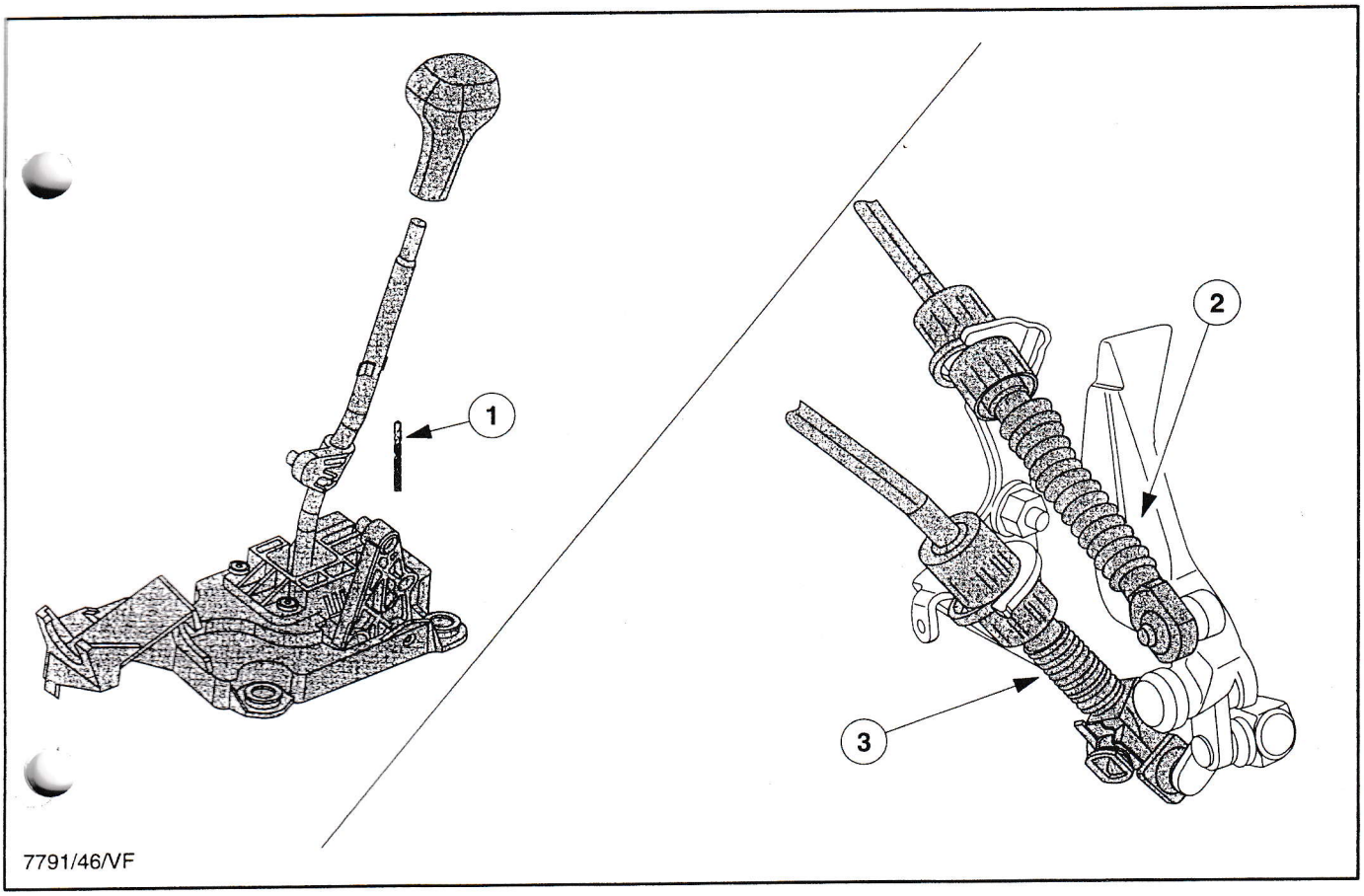


1 Shift locking bush
2 Reverse gear shift lever
3 5th gear/reverse gear shift rod
4 Shift shaft
5 Shift finger
6 Shift gate

Adjustment of cable-operated shift mechanism

- With the iB5 transmission **only** the selector cable (3) is adjusted. The shift cable (2) cannot be adjusted.
- A 3 mm drill bit is inserted to immobilize the gearshift lever in the 3rd/4th gear shift aisle.
- Once the gearshift lever has been immobilized, the selector lever on the transmission is brought into the central position and the selector cable is locked/unlocked at the transmission end as for the MTX-75 transmission.

NOTE: Please refer to the current service literature for the complete operation.



1 Drill bit (3 mm)
2 Shift cable
3 Selector cable

Tick the correct answer or fill in the gaps.

1. **In service a shift gate with slots is used in transmissions with the rod-operated shift mechanism.**

   ☐ a) Incorrect
   ☐ b) Correct

2. **A** _____ **must be inserted to adjust the shift rod mechanism.**

3. **How is the shift cable marked?** _____

   How is the selector cable marked? _____

   Which cable can be adjusted? _____

4. **The shift locking bushing prevents** _____

   _____.

jectives

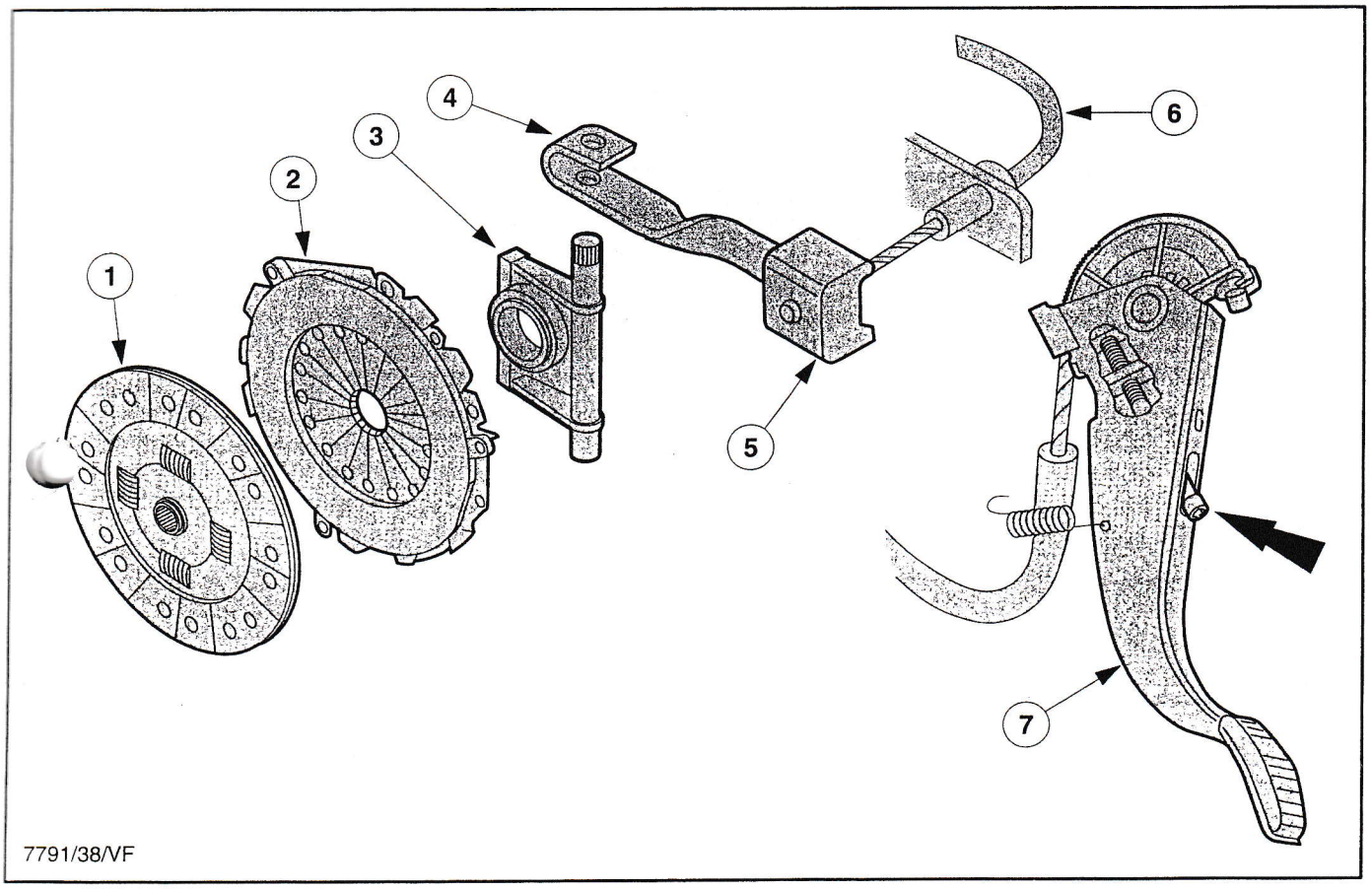
On completing this lesson, you will be able to:

- explain the design of the cable-operated clutch mechanism on the Ford Escort
- describe the design and operation of the various hydraulic clutch mechanisms
- explain the differences between the hydraulic clutch mechanisms on the Ford Fiesta (1996 MY onwards) and the Ford Focus

Cable-operated clutch mechanism (Ford Escort)

- With the cable-operated clutch mechanism the release bearing is guided on the input shaft on a ›el sleeve.
- The clutch is operated by the cable acting on the release lever which is secured to the release shaft.
- The pedal travel can be adjusted with the adjusting screw (arrowed).

NOTE: Refer to the current service literature for the procedure for checking and adjusting the pedal travel.



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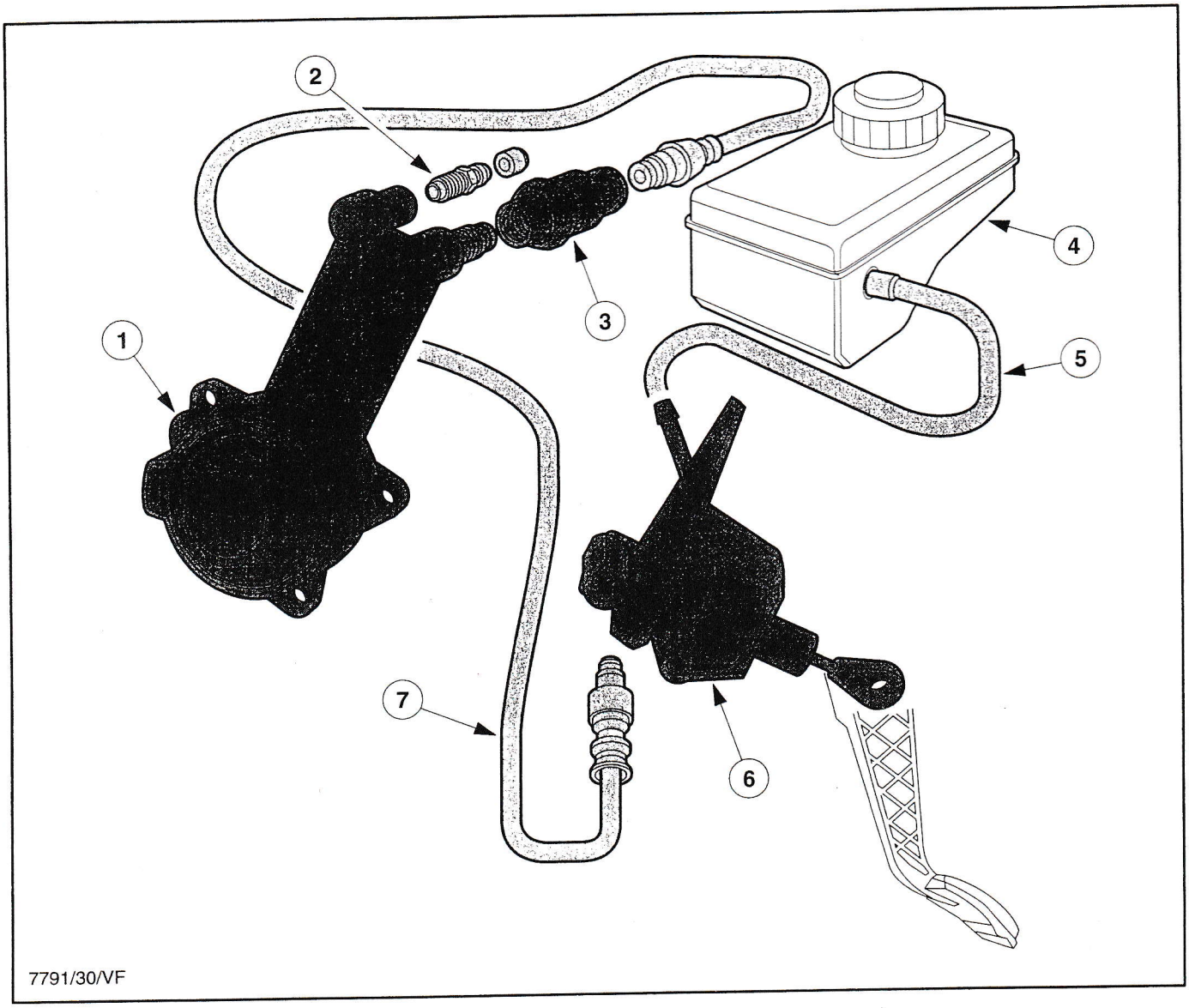
1 Clutch disc
2 Clutch pressure plate
3 Clutch release bearing and release shaft
4 Clutch release lever
5 Vibration damper
6 Clutch cable
7 Clutch pedal

Hydraulic clutch mechanism with renewable release bearing

- Since the 1996 MY the Ford Fiesta has been the first vehicle in this class to be equipped with a hydraulic clutch system. This clutch system is also used on the Ford Ka and the Ford Puma.

NOTE: In contrast to the known systems (MTX-75 and VXT transmission), the release bearing in this system can be renewed separately in service.



1 Slave cylinder with renewable release bearing
2 Bleed valve
3 Preloading supply pressure valve
4 Brake fluid reservoir
5 Replenishing hose
6 Master cylinder
7 High-pressure pipe

- The hydraulic clutch system is supplied from a separate chamber in the brake fluid reservoir.
- The separate chamber for the clutch system means that the operation of the braking system is not impaired if there is a leak in the clutch system.

NOTE: Refer to the current service literature for the charging and bleeding operation.

- When the clutch is operated, the brake fluid is forced out of the master cylinder by the piston and through the high-pressure pipe into the slave cylinder.
- The master cylinder is mounted on the pedal bracket. The connections for the supply pipe from the brake fluid reservoir and the high-pressure pipe are accessible from the engine compartment.
- The slave cylinder is mounted on the clutch-end transmission housing half with three bolts.
- The slave cylinder is sealed with a separate oil seal which is incorporated in the clutch-end transmission housing half.
- The system pressure is dependent on the counteracting force of the clutch diaphragm spring and the clutch wear.

NOTE: The clutch pedal travel is adjustable by means of a stop screw on the pedal bracket. It must be adjusted as specified in the service literature.

Preloading supply pressure valve

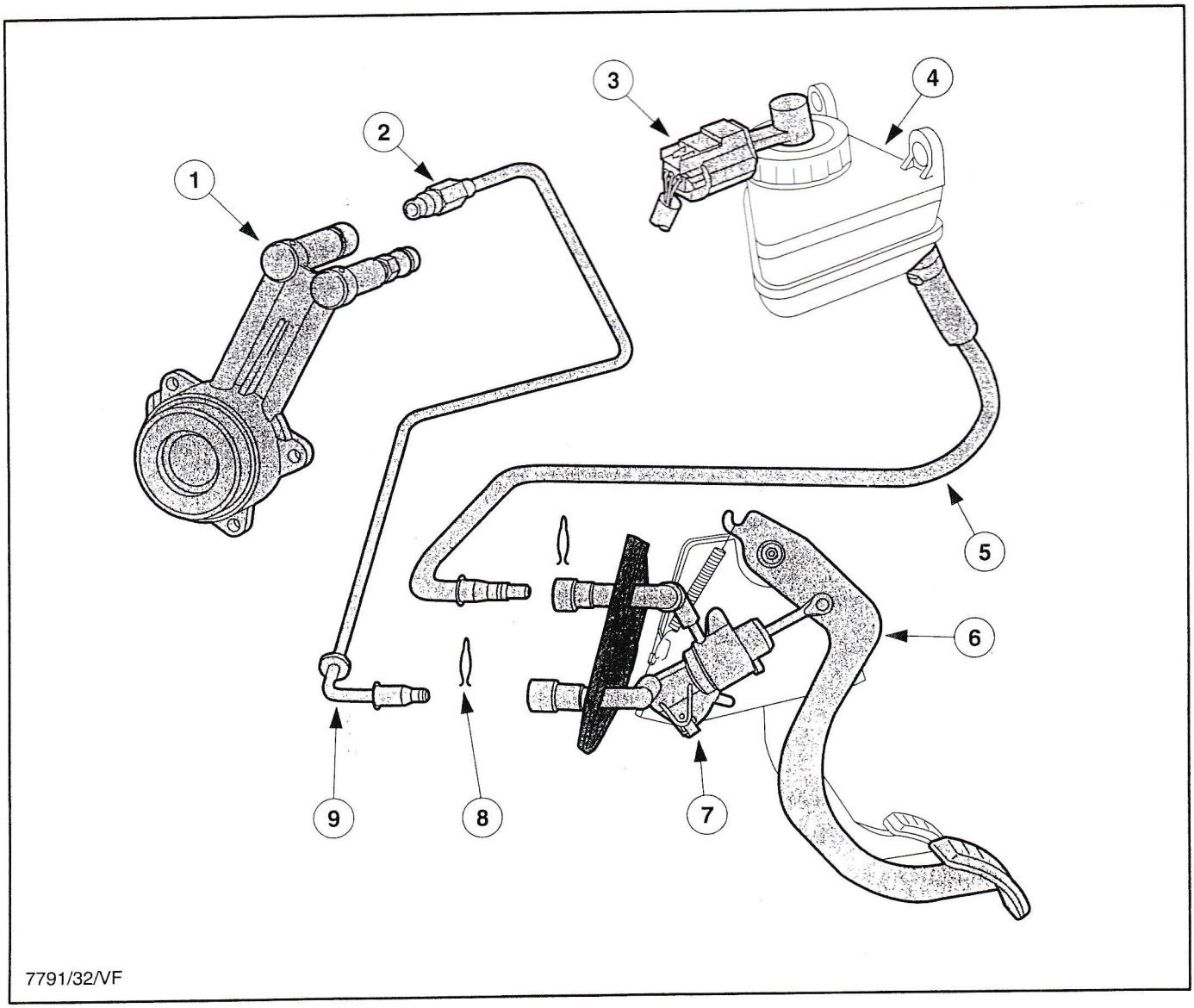
- The preloading supply pressure valve (3) is located between the high-pressure pipe and the slave cylinder.
- The preloading supply pressure valve maintains the pressure in the slave cylinder at a constant value of approximately 1 bar which ensures that the clutch release bearing remains in contact with the pressure plate at all times.
- Possible wear of the clutch plate is compensated by the preload.

NOTE: In service the tightening torque specified in the service literature **must** be applied as otherwise the results can be damage to the interior of the valve and a malfunction. In some circumstances this damage may not be recognizable from the outside.

Hydraulic clutch mechanism with integral release bearing (Ford Focus)

- The preloading supply pressure valve used until now with the iB5 transmission has been eliminated on the Ford Focus. Now the clutch release bearing is preloaded by a spring which is located in the slave cylinder.
- The preloading ensures that the clutch release bearing is constantly in contact with the pressure plate. Possible wear of the clutch plate is compensated by the preload.

NOTE: The pedal travel no longer requires adjustment.



1 Slave cylinder with integral release bearing
2 Connector with integral choke valve
3 Brake fluid level switch
4 Brake fluid reservoir
5 Replenishing pipe
6 Clutch pedal
7 Master cylinder
8 Retaining clip
9 High-pressure pipe

Choke valve

- On the Ford Focus the connector (2) of the high-pressure pipe incorporates a choke valve which is designed to ensure a smoother take up when pulling away.

- The choke valve reduces the cross-section of the high-pressure pipe **when the clutch is engaged**. The choke function delays the flow pressure of clutch fluid from the slave cylinder to the reservoir.

- This means that the clutch closing time is increased, resulting in smoother engagement of the clutch.

- The cross-section of the high-pressure pipe is not changed when the clutch is disengaged.

Bleeding the hydraulic system

NOTE: Refer to the current service literature for the charging and bleeding procedure.

Tick the correct answer or fill in the gaps.

1. **On which vehicle can the clutch release bearing only be changed together with the slave cylinder up to the 1999 MY?**

   ☐ a) Ford Escort
   ☐ b) Ford Fiesta
   ☐ c) Ford Puma
   ☐ d) Ford Focus

2. **What is achieved with the preloading supply pressure valve?**

   ☐ a) Reduced pedal effort
   ☐ b) The preloading supply pressure ensures that the clutch release bearing is always in contact with the pressure plate, the clutch play must still be adjusted
   ☐ c) The preloading supply pressure ensures that the clutch release bearing is always in contact with the pressure plate, the clutch play no longer has to be adjusted
   ☐ d) Higher pedal effort

3. **On the Ford Focus the choke valve reduces the** _____

   of the high-pressure pipe when the clutch is engaged.

4. **On the Ford Focus the choke valve produces** _____

   _____ **engagement of the clutch.**

Objectives

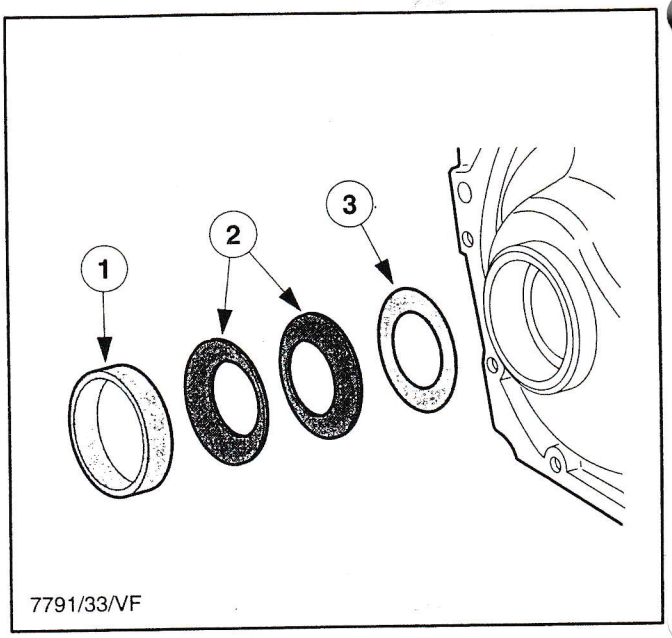
On completing this lesson, you will be able to:

- determine the end float of the differential
- explain how the required shim thickness is determined for the end float
- explain how 5th gear is adjusted and what should be noted
- name the fluid fill capacities of the individual transmissions
- check the transmission fluid level

Determining required shim thickness

NOTE: The required shim thickness is only determined for vehicles with uprated iB5 transmissions, for example diesel-engined vehicles.

- In production the transmission components are subject to manufacturing tolerances which are offset by shims. The shims ensure smooth quiet running in all operating conditions.
- In addition, the shims are used to produce a preload.

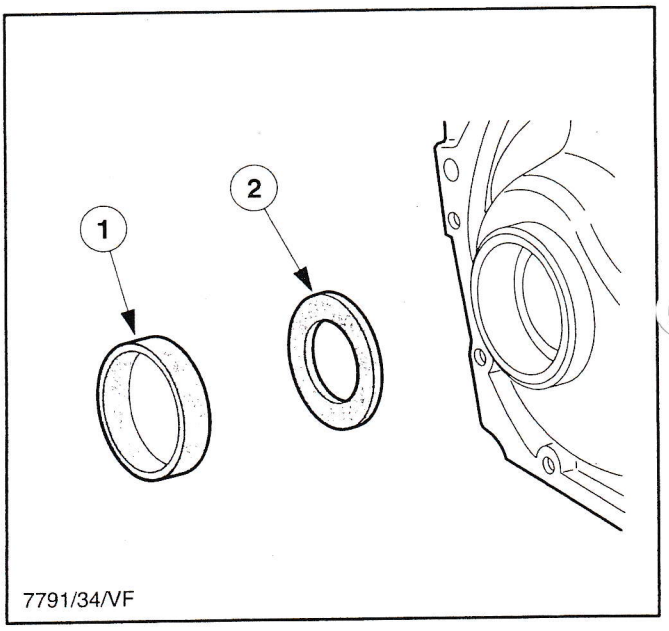


1 Bearing ring
2 Spring washers
3 Shim

Determining differential end float

NOTE: The following description only covers the key steps. Refer to the current service literature for the complete procedure.

- Before the measuring shim can be inserted in the transmission-end housing half, the components shown in the diagram must be removed.
- Fit the measuring shim (3.8 mm) in place of the spring washers.
- Fit the bearing ring and secure it with a blow from a punch on the edge of the housing.



1 Bearing ring
2 Measuring shim (3.8 mm)

- Insert the differential, assemble the two transmission housing halves – without the input shaft and output shaft – and tighten to the specified torque.
- Turn the differential clockwise and counterclockwise approximately 10 times by hand so that the bearing can settle.
- Fit the gauge fixture and set the dial gauge to "0".
- Lift the differential with a special tool, read off and note the measurement.

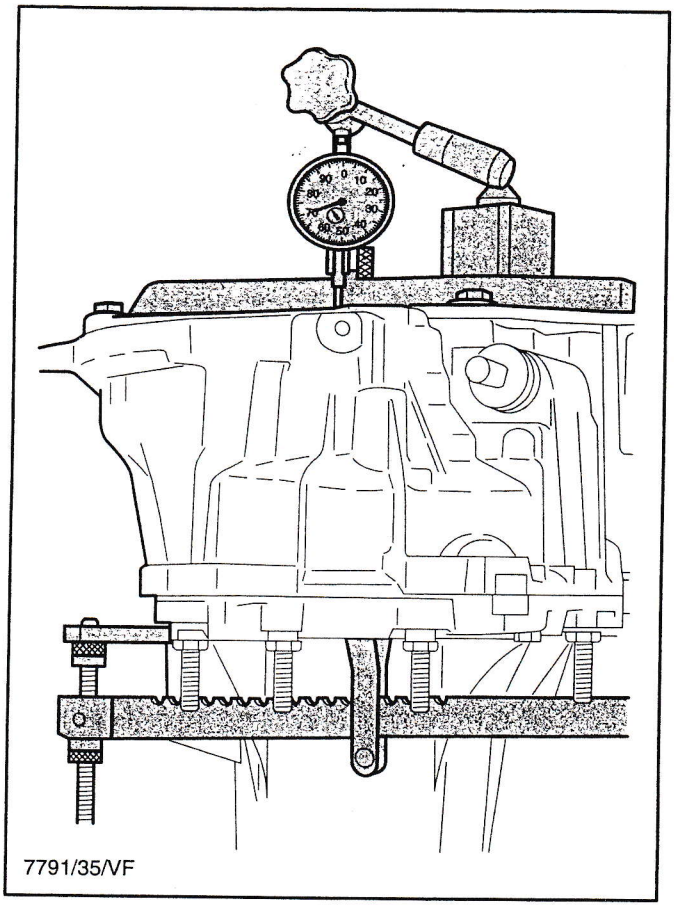
TE: The last three steps must be repeated three times.

- Establish the mean value of the measurements.
- **All figures shown here serve as examples:**
- (0.75 mm + 0.76 mm + 0.77 mm) ÷ 3 = 0.76 mm

• Mean measurement	0.76 mm
• Measuring shim	3.80 mm
• Preload	0.40 mm
• Total	4.96 mm
Subtract thickness of spring washers	– 4.42 mm
• Required shim thickness	0.54 mm

NOTE: The shims are available in thicknesses from 0.1 mm to 1.1 mm in steps of 0.1 mm. The required shim thickness should be rounded down to 0.05 mm and rounded up from 0.06 mm.

- Selected shim **0.50** mm

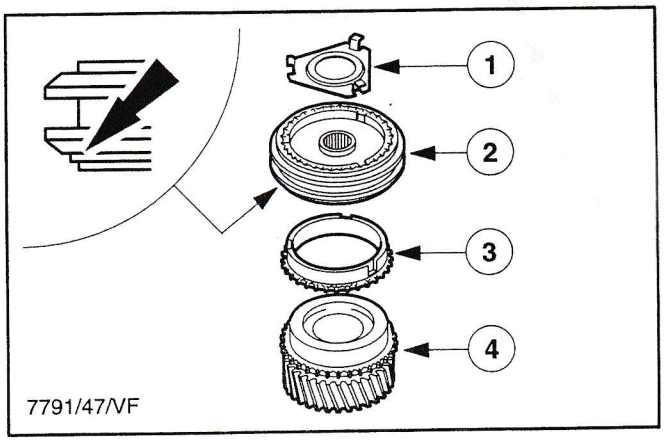


7791/35/VF

Adjustment of 5th gear

NOTE: The following description only covers the key steps. Refer to the current service literature for the complete procedure.

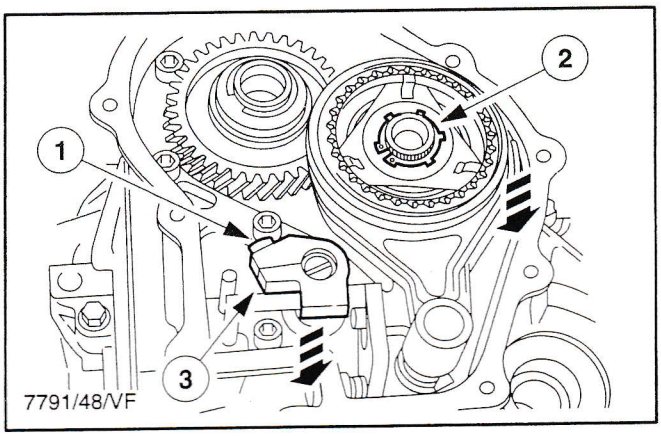
- Before the 5th gear synchronizer unit is installed, it is imperative to make sure that the synchronizer unit is fitted in the correct position.



1 Retaining plate
2 Synchronizer clutch
3 Synchronizer ring
4 5th gear wheel

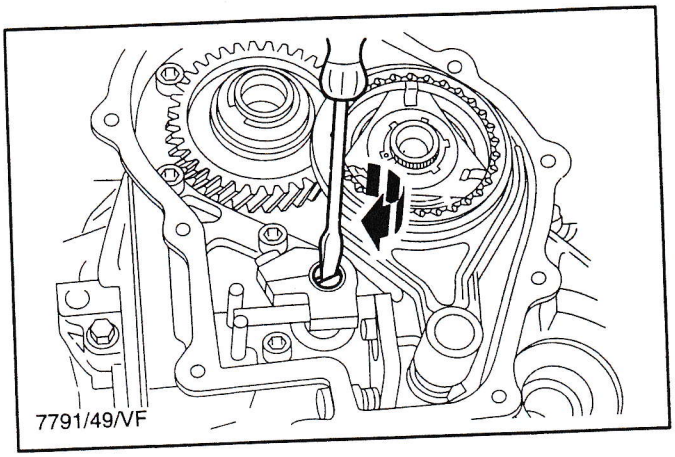
- Fit the circlip and insert the shift finger.

NOTE: Do not tighten the bolt of the shift finger yet.

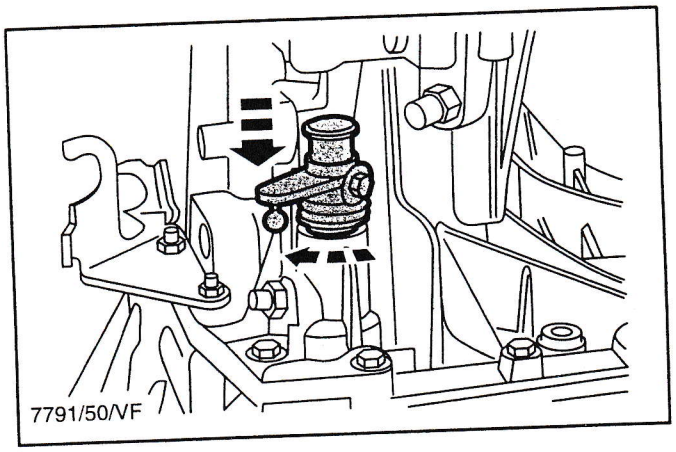


1 Bolt of shift finger
2 Circlip
3 Shift finger

- Install the main shift lock and shift interlock in the neutral position (refer to Lesson 4 – Shift interlock).
- Engage 5th gear and press the shift fork and shift finger down together.
- Turn the shift rod clockwise as far as the stop.

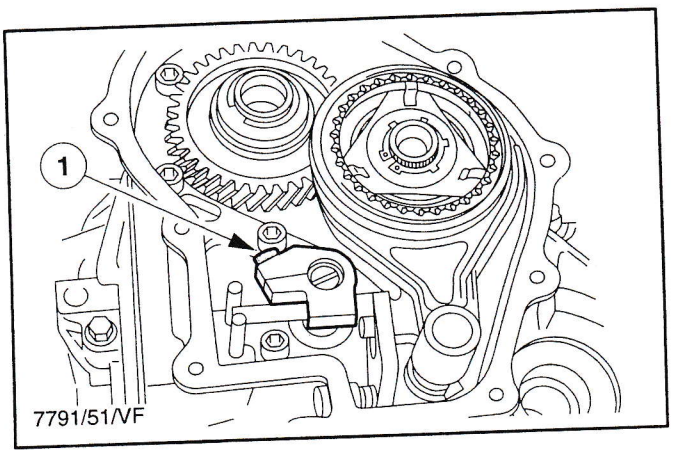


urn the shift shaft clockwise as far as the stop and press it in.



- Eliminate the shift finger end float by lifting it.

ighten the bolt of the shift finger in this position. Refer to the service literature for the specified torque.



1 Bolt of shift finger

General service instructions

- The iB5 transmission is filled for life with 75W90 synthetic transmission fluid.

NOTE: The transmission must always be filled with fresh transmission fluid after dismantling.

NOTE: The fill capacity of the iB5 transmission up to the 1998 MY is 2.8 liter.

NOTE: The fill capacity of the iB5 transmission with the cable-operated shift mechanism which was originally 2.8 liter has been reduced to 2.3 liter. However, the fluid level in the transmission is unchanged.

- The level for the fluid level check remains unchanged at 5 mm below the check bore.

Tick the correct answer or fill in the gaps.

1. **The shims produce** _____

   running characteristics in all operating conditions.

2. **How often must the end float at the differential be measured?**

   ☐ a) Once
   ☐ b) Twice
   ☐ c) Three times
   ☐ d) Four times

3. **You have found a required shim thickness of 0.56 mm, what thickness must the shim fitted in the transmission be?**

   ☐ a) 0.50 mm
   ☐ b) 0.55 mm
   ☐ c) 0.56 mm
   ☐ d) 0.60 mm

Lesson 1 – General

1 c

2 c

3 800 rpm

4 d

5 a

Lesson 2 – iB5 transmission with rod-operated mechanism

1 c

2 b

3 d

Lesson 3 – iB5 transmission with cable-operated shift mechanism

1 d

2 a

3 the black blanking cover

4 Tooth flanks of the gears, width of the differential spur gear, width of the drive pinion

Lesson 4 – Shift mechanism

1 a

2 9 mm drill bit

3 White – Black – Selector cable

4 engagement of two gears simultaneously

Lesson 5 – Clutch mechanism

1 d

2 c

3 cross-section

4 smoother

Lesson 6 – Service instructions

1 smooth

2 c

3 d