

**Cars • Transmission  
New Automatic Transmission 722.9  
NAG2 (7-Speed)  
Diagnosis, Repair  
Advanced Training**



As at 05/04

## Global Training.

The finest automotive learning



MBCL – Hong Kong Training Centre

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## Structure of the training for the new automatic transmission 722.9 NAT2 (7-Speed)

Learn targets: The participant can ...

- describe the parts as well as the design and function of the 722.9 automatic transmission.
- carry out testing, adjustment and repair work according to the manufacturer's specifications.
- describe the parts as well as the design and function of the system.
- recognize the system relationships and translate them for further work on the system.
- produce a system diagnosis in a purposeful and structured manner.
- recognize customer complaints as such and eliminate the as well as carry out testing, adjustment and repair work according to the manufacturer's specifications.
- recognize system malfunctions and eliminate them according to the manufacturer's regulations.

 **7G – Tronic, 7-Speed, NAG2, NAT2 and EAG are the names of automatic transmission**

## Task 1

- What do you have to do to get a gear ratio of 1:1 on a planetary gear set.



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## Task 2

- Explain the task of a multi-disk clutch and a multi-disk brake!

Multi-disk clutch



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Multi-disk brake



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## Task 3

- Which tasks does the automatic transmission fluid (ATF) take over?

- a) Transmit power
- b) Heat dissipation
- c) Parts lubrication
- d) Flushing and clean
- e) Create friction coefficient
- f) Carry out shifting

## Task 4

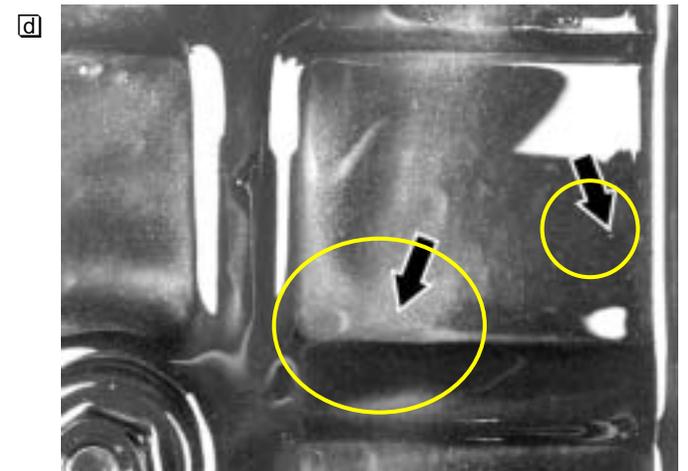
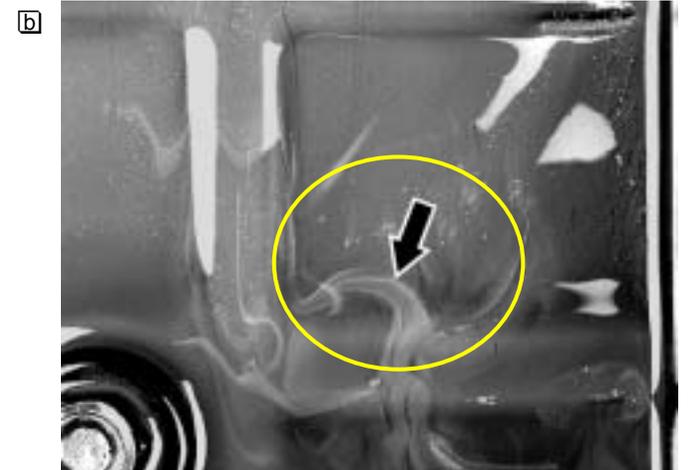
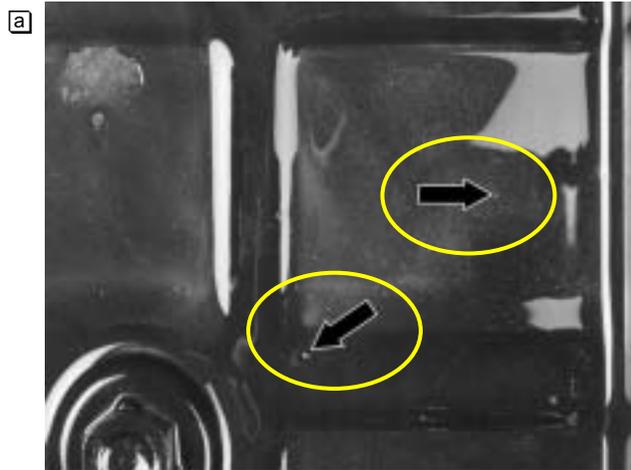
- Can a Mercedes Benz passenger car with 722.6 automatic transmission be pushed with the selector lever engaged in position "P"?



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Task 5

○ Which transmissions show mechanical damage?

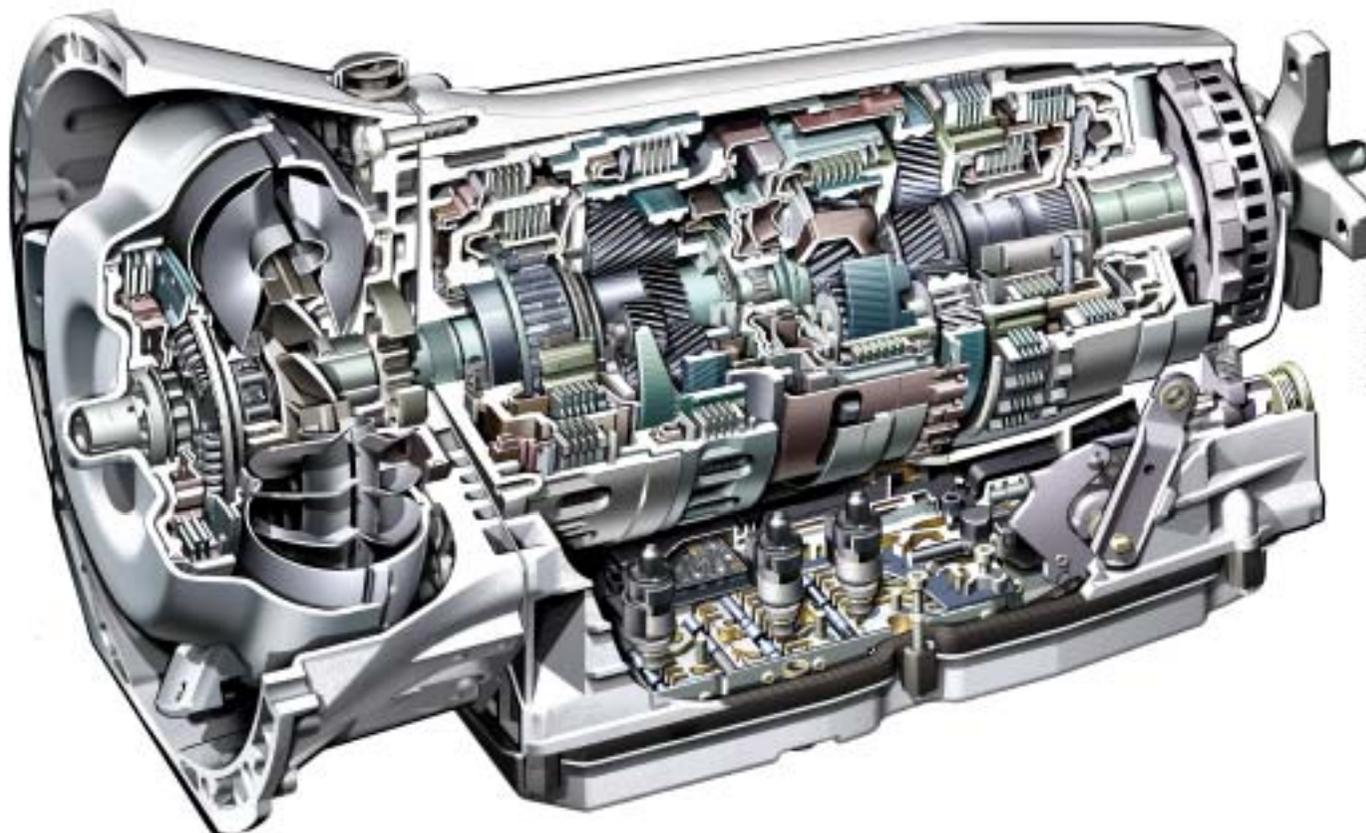


### Automatic transmission 722.9 (W7A 700 and W7A 400)

The newly developed 7 Speed planetary automatic transmission W7A 700 with seven forward and two reverse gears is based on the consistent further development of the previous 5-Speed automatic transmission W5A 580 (722.6) and supercedes it.

The high standards have been further improved with the fifth generation of Mercedes-Benz automatic transmissions. This takes place in the areas of:

- *Ease of shifting*
- *Light-weight design*
- *Fuel economy*
- *Increased driving pleasure*



Automatisches Getriebe W7A700 (BM 722.9)

P27.00-2153-76

### Market launch:

At the market launch in September 2003, the new automatic transmission with the engines M113 without Compressor in following model series will be used:

- *W 211 except 4MATIC*
- *C215*
- *W 220 except 4MATIC*
- *R 230*

The 722.9 transmission differs from the 722.6 auto-transmissions by the following features:

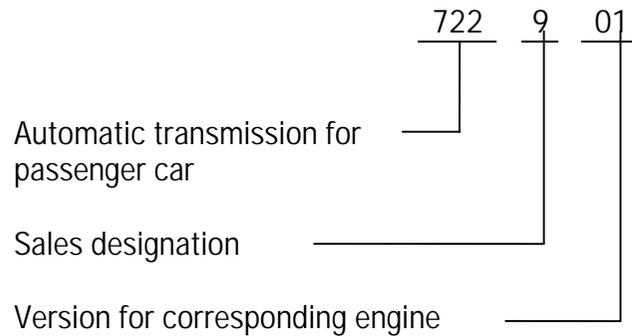
- *There are 7 forward and 2 reverse gears available.*
- *1 Ravigneaux gear set and 2 simple planetary gear sets are used.*
- *To achieve the gear ratios, 4 multi-disk brakes (B1, B2, B3, BR) and 3 multi-disk clutches (K1, K2, K3) are used.*
- *The fully-integrated transmission control (FTC) unit is kept in the electronic control module. Thus, the transmission oil is constantly flushed and cooled.*
- *The transmission oil temperature is measured by the transmission oil temperature sensor integrated in the transmission control unit. (Y3/8n4)*
- *The interfaces to the vehicle wiring harness have been reduced through the new position of the fully-integrated transmission control (FTC) unit.*
- *A torque converter lockup clutch with torsional damper is used, which is slip-controlled in all 7 forward gears.*
- *There are 3 speed sensors fitted for torque measurement and the ease of shifting and the reaction time of the shift processes is thus shortened.*
- *The 722.9 transmission can be updated the control units' software (flash). Flashing is carried out using STAR diagnosis. but necessary SCN CODE*

 **FTC, EGS, ETC and VGS are the names of transmission control unit**

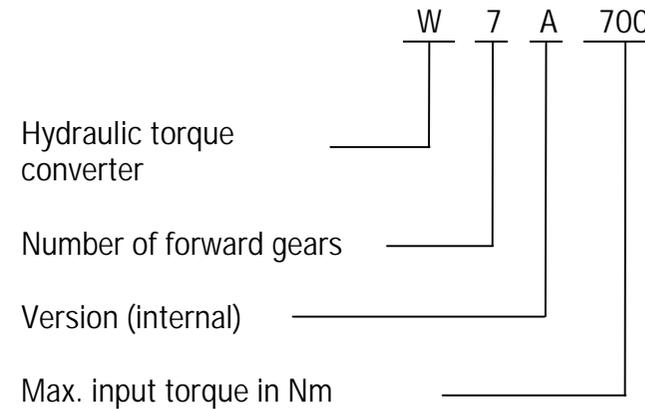
Due to the development from a simple planetary gear set to a Ravigneaux gear set, seven gears are now possible instead of the previous five gears. With this new transmission and the version W7A 400, to follow later, the rear wheel drive passenger cars can be equipped with seven forward gears throughout and thus set new standards in the power category of up to a maximum torque of 700 Nm. Divided into two power categories, up to 700 Nm can be transferred permanently on the 8 cylinder engines and, later, on other model series for the 4, 6-cylinder engines up to 400 Nm.

## Technical Details

### Transmission designation



### Sales designation



Lock-up clutch	1 <sup>st</sup> to 7 <sup>th</sup> gear slip-controlled
Overall length	621 mm (the overall length of the transmission is 41 mm longer than the 722.6)
Weight:	Approx. 82 kg, including converter and oil
Oil:	(ATF) approx. 9.7 l, lifetime filling
Control:	Fully integrated transmission control (FTC) in oil pan
Disk arrangement:	K1, K2, K3, B1 and B3 with Single-sided friction disks B2 and BR with Double-sided friction disks

## Hydraulic Fluid (ATF 3353)

A newly developed ATF (Automatic Transmission Fluid) is used for the hydraulic fluid. The development targets for the new ATF were the following:

- *Higher frictional constancy*
- *Higher thermal stability*
- *Improved temperature behavior*

The two suppliers intended for the new oil are:

- *Shell*
- *Fuchs Europe*

Use of the oil in the transmissions:

- 722.3 / .4 / .5     *possible*
- 722.6             *possible*
- 722.9             *must be used*



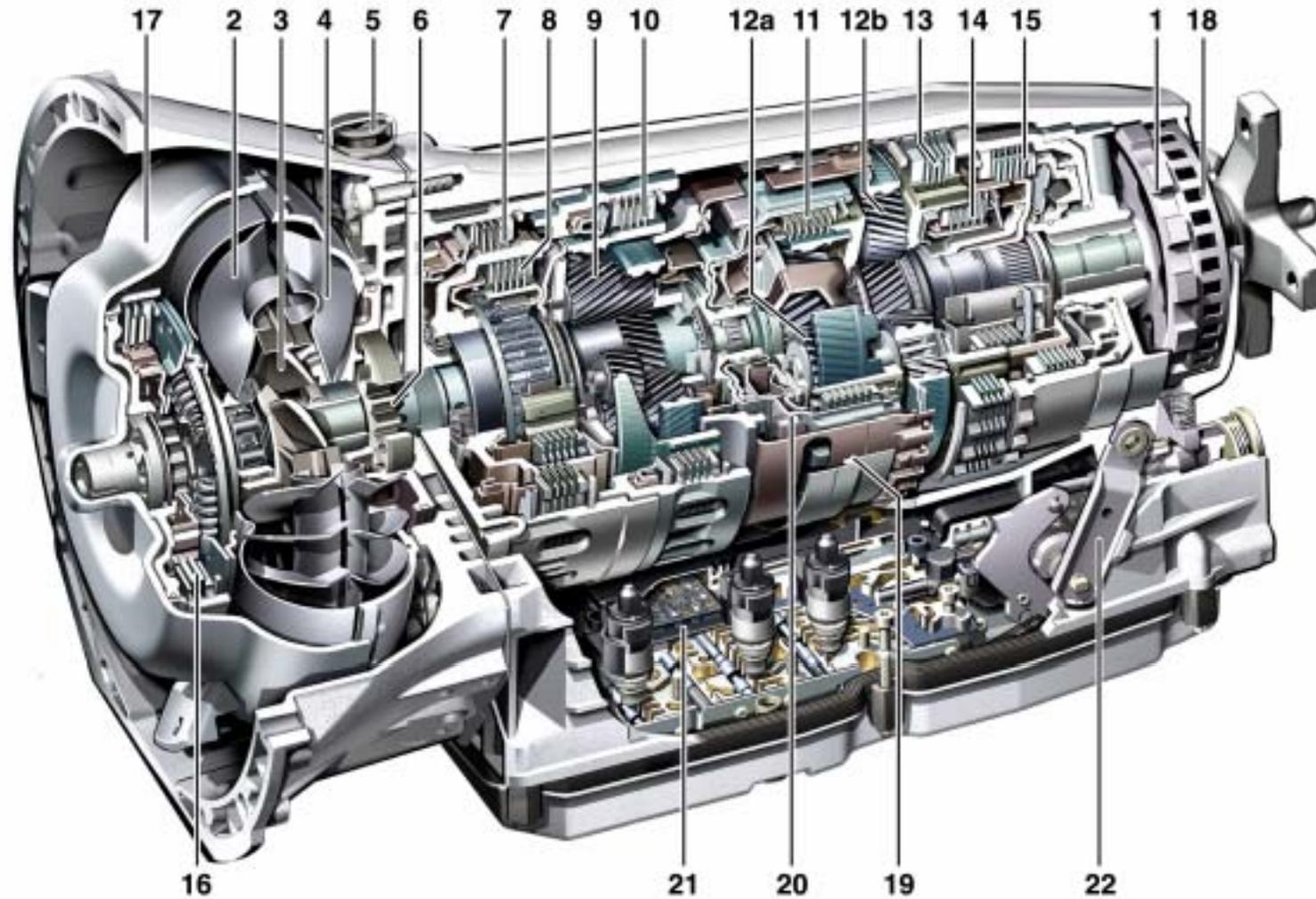
**Attention:** The oil may not be used in the 722.7 transmissions!!

**The Mercedes-Benz part number is: A 001 989 45 03**

To reduce power loss and prevent oil escape from the transmission with a oil level, the oil level is regulated by the float method known from the previous transmissions. Here, the openings between the oil gallery and the gear set chamber are closed by the floats. The floats thus separate the oil gallery and the gear set chamber. This prevents the rotating gear sets from splashing in oil. The 722.9 transmission is fitted with two floats.



**Attention:** Please observe the labor protection regulations for all operations carried out on there "**oil side**"!



P27.10-2107-79

**Task 1**

○ Complete the missing parts in the legend!

- 1 

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- 2 Turbine wheel
- 3 Stator
- 4 Impeller
- 5 Transmission housing ventilation
- 6 Oil pump
- 7 B1 multi-disk brake
- 8 K1 multi-disk clutch
- 9 

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- 10 B3 multi-disk brake
- 11 

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- 12a Front simple planetary gear set

- 12b Rear simple planetary gear set
- 13 

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- 14 K3 multi-disk clutch
- 15 

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- 16 Torque converter lockup clutch
- 17 

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- 18 

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- 19 

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- 20 

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- 21 Electrohydraulic control unit
- 22 Range selector lever

*Park pawl gear                      Ravigneaux gear set                      K2 multi-disk clutch                      Ring magnet for torque measurement*  
*Torque converter housing      BR multi-disk brake                      B2 multi-disk brake                      Exciter ring for torque measurement*  
*Ring magnet for torque measurement*

## Front/rear simple planetary gear set

### Arrangement:

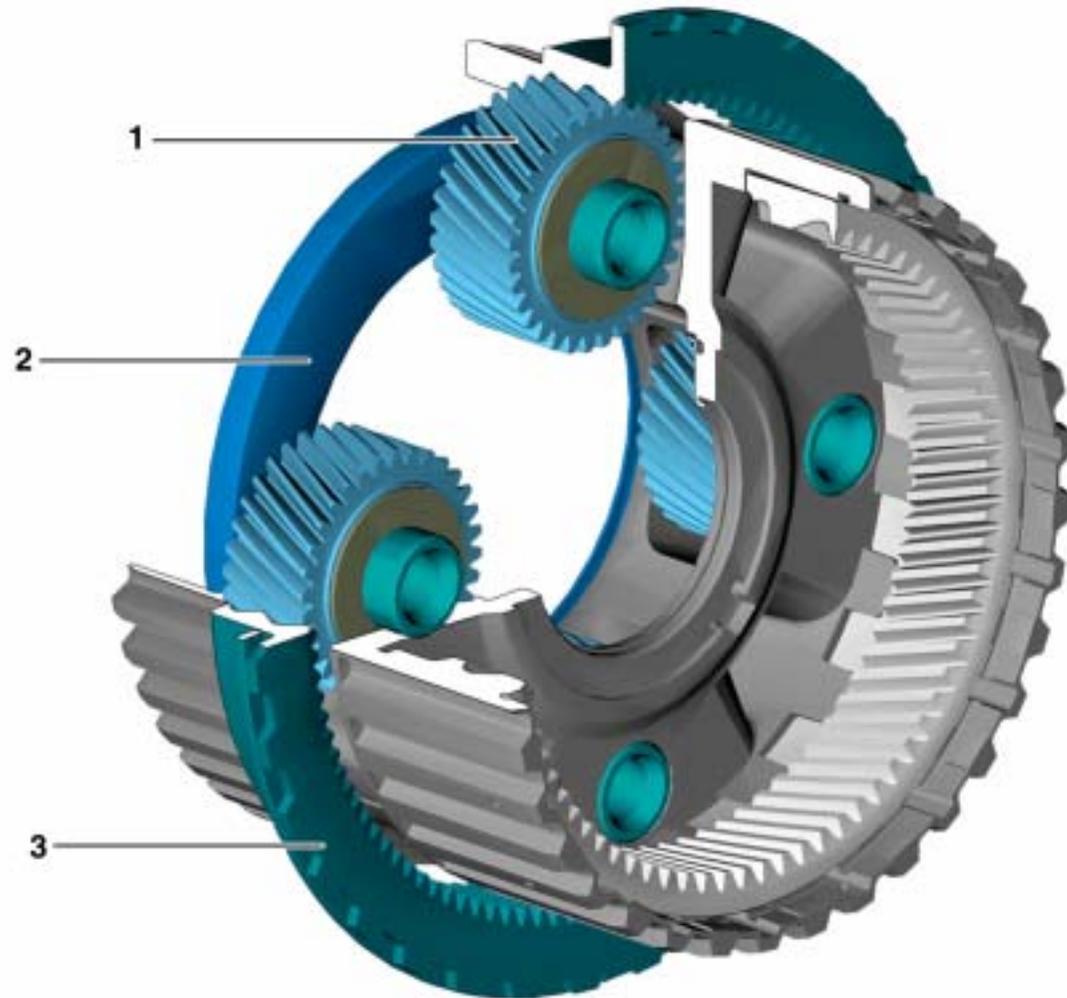
The front simple planetary gear set (12a) and the rear simple planetary gear set (12b) are arranged in the mechanical part of the transmission.

### Task:

Power transmission and formation of various gear ratios.

### Construction:

A simple planetary gear set consists of 1 annulus gear, the planetary gears mounted in the planet carrier and 1 sun gear.



- 1 Planetary gear
- 2 Planetary gear carrier
- 3 Annulus gear (hollow gear, ring gear)

P27.50-2098-76

**Function:**

The annulus gear (3), sun gear or planetary gear carrier (2) elements of a simple planetary gear set are either driven or held by the multi-disk clutch and multi-disk brake shift elements. The planetary gears (1) can thus turn on the internal toothing of the annulus gear (3) and on the external toothing of the sun gear. Therefore, various gear ratios and a reversal of the rotational direction can be achieved without having to slide gears or shift collars. If 2 parts of a simple planetary gear set are connected rigidly with each other this is blocked and turns as a single unit.

**Advantages of a simple planetary gear set:**

- *Shifting under load*
- *Production of several gear ratios*
- *Constant engagement of the gearing*
- *Easier reversal of the rotational direction*
- *High efficiency*
- *Coaxial location of input and output*
- *Compact construction*

## Ravigneaux Gear Set

### Arrangement:

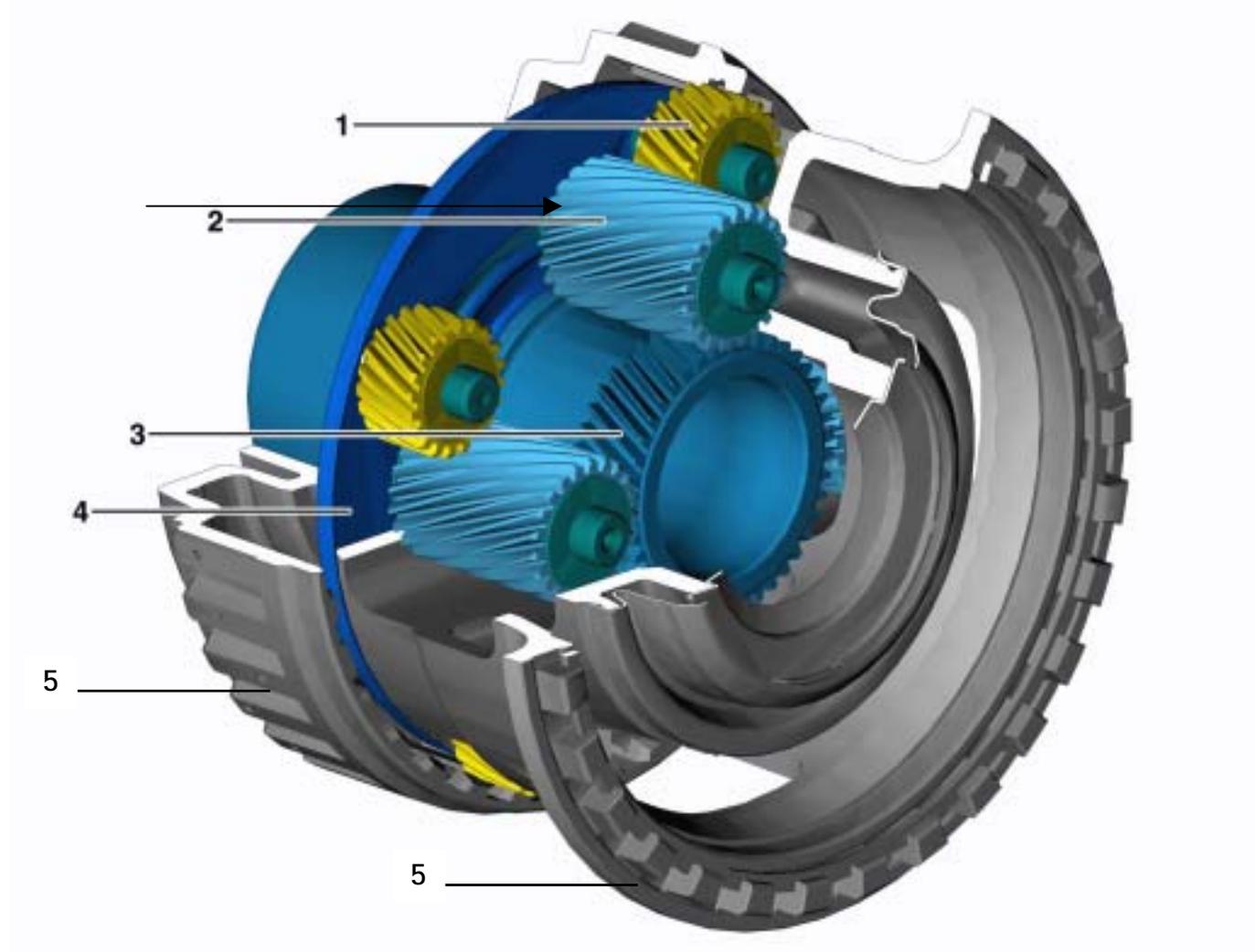
The Ravigneaux set is arranged in the mechanical part of the transmission.

### Task:

Power transmission and formation of various gear ratios.

### Construction:

The Ravigneaux set used consists of 2 annulus gears, 1 planetary gear carrier with 2 planetary gear sets and 1 sun gear.



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**Function:**

The annulus gear (5), sun gears or planetary gear carrier (4) elements of a Ravigneaux gear set are either driven or held by the multi-disk clutch and multi-disk brake shift elements. The planetary gears (3) can thus turn on the internal toothing of the annulus gears (5) and on the external toothing of the sun gear. Therefore, various gear ratios and a reversal of the rotational direction can be achieved without having to slide gears or shift collars. If 2 parts of the Ravigneaux gear set are connected rigidly with each other the planetary set is blocked and turns as a single unit.

**Advantages of a Ravigneaux gear:**

- *Shifting under load*
- *Production of several gear ratios*
- *Constant engagement of the gearing*
- *Easier reversal of the rotational direction*
- *High efficiency*
- *Coaxial location of input and output*
- *Compact construction*
- *Combines 2 simple planetary gear sets in one unit*

## Multi-disk Clutch/Brake

### Multi-disk clutch

Oil-lubricated hydraulically operated clutch multi-disk clutches are used as shift elements for shifting gear ratio steps (as with the previous Mercedes Benz automatic transmissions) . The transferable power of the multi-disk clutch has been increased. The friction disks of K1, K2 and K3 now only have a friction lining on one side (single-sided friction disks).

### Multi-disk brake

The multi-disk brake is used to hold a component of the planetary gear set fixed with the transmission housing. This allows a gear ratio in the planetary gear set. Either the annulus gear, the planetary gear carrier or the sun gear is held fixed. Also the friction disks of B1 and B3 now only have a friction lining on one side (single sided friction disks).

### Single-sided friction disks

The new single sided friction disks have several advantages:

- *A cost advantage because, in comparison to double sided friction disks, no fine pressing is required*
- *An installation space advantage because more friction surfaces allow a better heat dissipation in the disk package*
- *Higher load*
- *Lower mass*



The number of disks depends on the respective torque to be transferred. This means, more friction disks can transfer a higher torque.

Gear ratio/operated shift elements

Gear	Gear ratio W7A 700	B1	B2	B3	BR	K1	K2	K3
1	4.377		●	●				●
2	2.859	●	●					●
3	1.921		●			●		●
4	1.368		●			●	●	
5	1.000					●	●	●
6	0.820	●					●	●
7	0.728			●			●	●
N				●				●
R (S)	-3.416			●	●			●
R (C)	-2.231	●			●			●

## Park Pawl

### Arrangement:

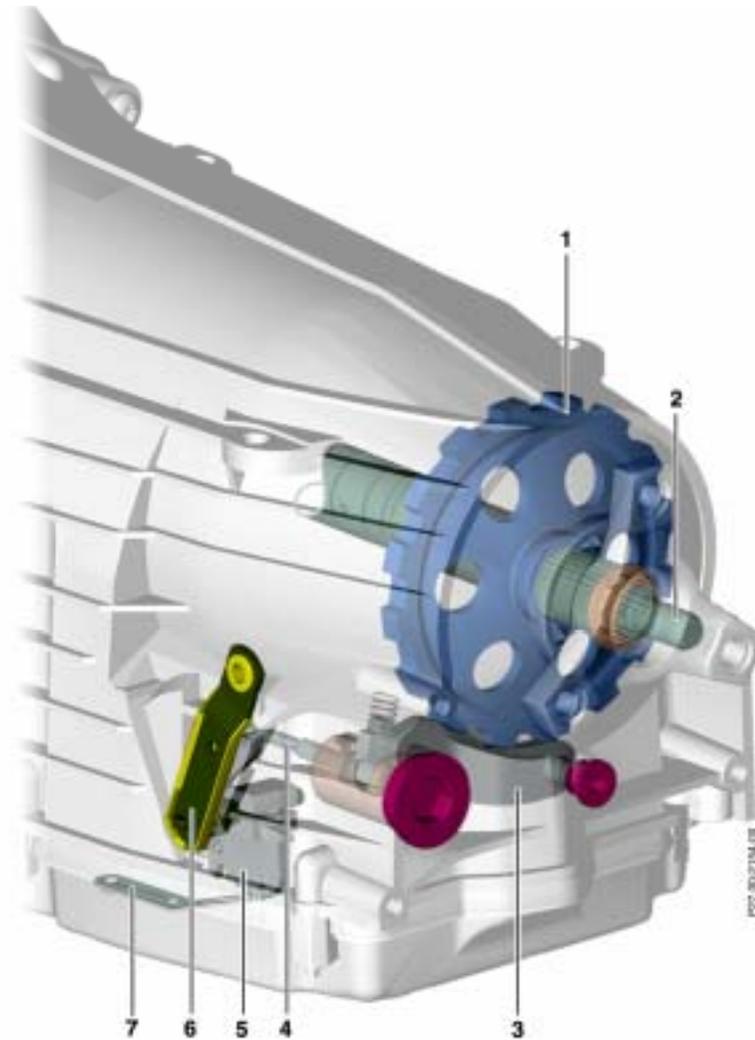
The park pawl gear (1) and the park pawl mechanism are located in the rear part of the transmission housing.

### Task:

The proven park pawl mechanism is used to protect the vehicle from rolling, in addition to the parking brake.

### Components:

- 1 Park pawl gear
- 2 Output shaft
- 3 Lock pawl
- 4 Rod
- 5 Detent plate
- 6 Range selector lever
- 7 Spring



P27.00-2154-00

Task 1

- The oil temperature on the 722.9 transmission can be determined from DAS. In which selector lever position must this take place?

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Task 2

- After reconditioning the transmission, it must filled with oil. Write down the procedure! Use the WIS to help you!

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**Task 3**

○ A customer comes to the workshop with a transmission complaint. For this reason you want test the oil level. Describe the procedure in keywords!

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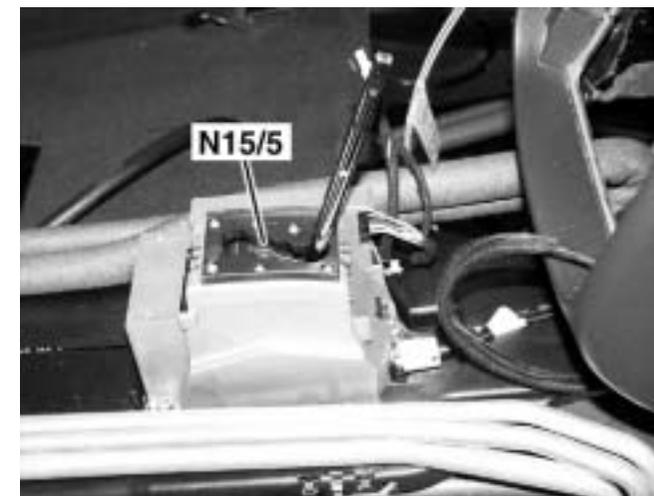
**Arrangement:**

The electronic selector lever module control module (N15/5) is located directly behind the center console in the middle of the vehicle between both front seats.

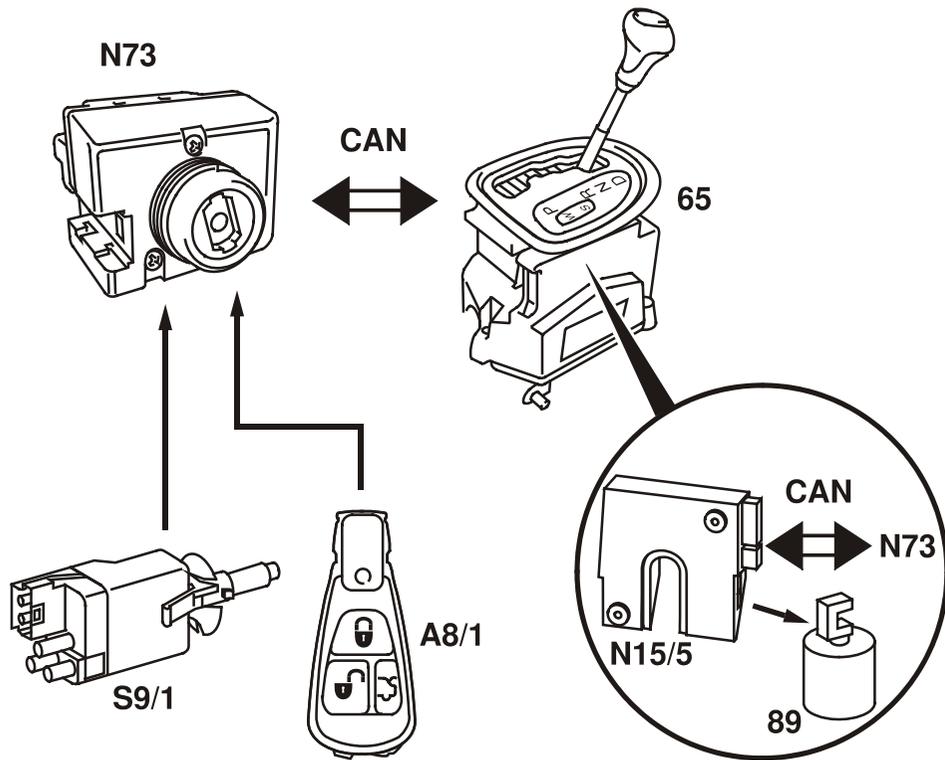
**Tasks:**

The electronic selector lever control module (N15/5) is an automatic selector lever module, which measures the selector lever positions without contact using photoelectric barriers and transmits them over the CAN C.

- Convey the selector lever position: "P", "R", "N", "D" and the touch shifts: 6, 5, 4, 3, 2, and 1
- Locking of the selector lever position "R" at a speed of approx. 8 km/h
- Reading in of the signal from the transmission mode switch (S16/5) "C", "S" with steering wheel operation "C", "S", "M"
- Reading in the steering wheel gear shifter "minus" (S110/1) and "plus" (S111/1)
- Locking the selector lever in "P" in dependence of the ignition switch position and operated brake pedal (shift lock)



P27.60-2079-01



P27.10-2016-11

- 65 Center shifter console
- 89 Backup / park pawl valve
- A8/1 Transmitter key
- CAN Engine compartment CAN bus
- N15/5 Electronic selector lever module control module (ESM)
- N73 Ignition/starter switch control unit
- S9/1 Stop lamp switch

On models C215, W220 and R230, there is **no** mechanical steering lock! The center shifter console is installed as a compact unit for anti-theft security, which only allows shifting out of "P" under certain conditions.

The conditions are:

- CAN signal "start enable" from the DAS
- Ignition switch position 2 "ignition ON"
- The service brake is operated

**i The center shifter console is dealt with as a theft-relevant part!**

**Operation description:**

The driver can engage the desired drive position ("P", "R", "N", "D") with the selector lever: He can choose between forwards and reverse, engage the park lock or, in the neutral position, interrupt the power transmission between the torque converter clutch. In Touch mode ("+" / "-"), the driver can limit the drive positions manually. To initiate a drive position limitation, the driver presses the selector lever to the right (permissible drive positions will be extended upwards) or presses it to the left (permissible drive positions limited downwards). A drive position limitation downwards (e.g. only 1st and 2nd drive positions are possible) is only accepted by the transmission control unit (Y3/8n4) when a possible downshift process can take place below the engine's rpm limit.

**Task 1**

Y3/8n4 and  
ESM N15/5

Which fuses protect the control units N15/5 and Y3/8n4 on the model W211 and W220?

 W211 \_\_\_\_\_

 W220 \_\_\_\_\_

**Task 2**

What must you observe when replacing an ESM in vehicles of the model series C215, W220 or R230?

 \_\_\_\_\_

**Task 3**

Please describe the function of the P/R lock!

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### Function description

The designation shift lock combines all functions that, in addition to the parking brake, protect the vehicle from unintended rolling off:

- *Park pawl in the transmission*
- *Locking of the "P" selector lever position*
- *Ignition switch locking*

Shift lock only allows the engagement of a drive position from the "P" selector lever position when the transmitter key is turned to the ignition "ON" position turned and the brake pedal is pressed. The securing of the vehicle takes place mechanically through a lockup of the park pawl gear. To ensure that selector lever is in the "P" selector lever position" when the vehicle is parked, the transmitter key can only be turned in the "0" direction and removed from the electronic ignition switch control unit, EIS (N73), in this position.

### Locking of the "P" selector lever position

The locking of the "P" selector lever position is a partial function of the shift lock function. It is controlled electronically. The selector lever remains locked in the position "P" when no enablement is granted from the drive authorization system or

- *the brake is not actuated or*
- *no power supply is present for the electronic selector lever module control unit (N15/5).*

On receiving a valid drive authorization code from the electronic ignition switch control unit, EIS (N73), over CAN-C, the electronic selector lever module control unit (N15/5) actuates the R /P locking solenoid when the brake pedal is operated. The stop lamp signal is also transmitted over CAN C to the electronic selector lever module control unit (N15/5). The R /P R/P locking solenoid enables the selector lever and thus allows shifting from the "P" selector lever position.

### Ignition switch locking

The ignition switch locking mechanism (Bowden cable) connects the selector lever of the center shifter console with the electronic ignition switch control unit, EIS (N73). It prevents the removal of the transmitter key (A8/1) when the "P" selector lever position is not engaged. The transmitter key (A8/1) can only be turned to the position "0" and removed in the "P" selector lever position.

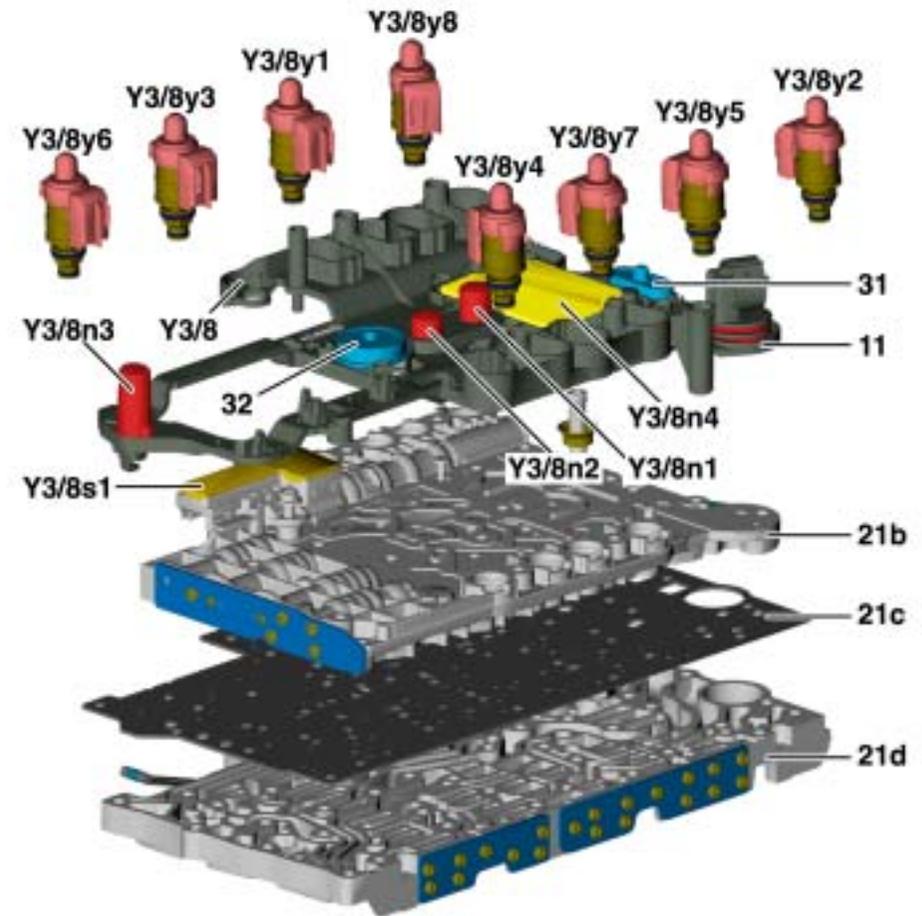
**Fully integrated transmission control (FTC):**

1. In contrast to NAG2, where the electronic FTC control unit is installed as a stand-alone control unit, the new fully electronic transmission control on NAG2 is mounted directly on the hydraulic control and is networked over the CAN data bus with the engine control module. This makes sensor signals, calculated data and control variables available simultaneously to all control units. Read into the transmission control unit over CAN are, among others:
  - *engine-relevant data, such as engine rpm, coolant temperature, accelerator pedal position, engine torque values*
  - *ESP signals about the engine and intervention by the brake system as well as the driving speed*
  - *cruise control signals*

Orders communicated bidirectionally between the engine control module and the transmission control unit are the decrease of the engine torque values during the shift processes and the moving of the shift point for faster catalytic converter heating-up time in the warm-up phase.

2. Directly acquired from the transmission control are:
  - *the position of the selector range switch*
  - *the transmission oil temperature*
  - *the transmission-internal revolutions*
  - *the transmission output rpm*
3. From the data, the transmission control unit calculates:
  - *the driver and vehicle-specific shift points*
  - *the various required specified transmission hydraulic pressures for the respective operating condition*
  - *the condition and control signals for the torque converter lockup clutch.*
4. The transmission control unit calculates further variables from the available data. Belonging to these are:
  - *Air drag and rolling resistance (influence of road gradient and payload)*
  - *The factor for the correction of parameters with variable atmospheric pressure (altitude correction) for the shift lines and pressure control*
  - *Driver actions (intensity of accelerator movement, frequency of manual touch shifts, vehicle longitudinal and lateral acceleration)*

- 11 Plug connection
- 21b Valve body
- 21c Intermediate panel
- 21d Shift housing
- 31 Float 1
- 32 Float 2
- Y3/8 Electro-hydraulic control unit
- Y3/8n1 Turbine rpm sensor
- Y3/8n2 Internal rpm sensor
- Y3/8n3 Output rpm sensor
- Y3/8n4 Fully integrated transmission control unit (FTC)
- Y3/8s1 Selection range sensor
- Y3/8y1 Working pressure control solenoid valve
- Y3/8y2 K1 clutch control solenoid valve
- Y3/8y3 K2 clutch control solenoid valve
- Y3/8y4 K3 clutch control solenoid valve
- Y3/8y5 B1 brake control solenoid valve
- Y3/8y6 B2 brake control solenoid valve
- Y3/8y7 B3 brake control solenoid valve
- Y3/8y8 Torque converter lockup clutch control solenoid valve



**Task 1**

- Replace the defective solenoid valve! Which special tool do you need for this?

 \_\_\_\_\_

**Task 2**

- Use EPC to find out the part number of solenoid valve?

 \_\_\_\_\_

## Function

The fully integrated transmission control (Y3/8n4) - new automatic transmission 2 (NAG2) monitors and shifts the transmission in dependence of:

- *the vehicle speed*
- *the vehicle payload*
- *the drive resistance*
- *the accelerator pedal position and operation speed*
- *the position of the selector lever*
- *the switch positions "C" (comfort drive program) / "S" (sport drive program) / "M" (manual drive program) on the electronic selector lever module control unit (N15/5)*
- *the condition of the transmission*
- *the CAN signals*

### Shifting processes

The transmission control unit (FTC) controls the actuators (control solenoid valves) electronically. The valves sit in the hydraulic shift plate.

This shift plate implements the hydraulic functionality. The oil feed of the hydraulic elements, such as the hydrodynamic torque converter, shift elements and hydraulic transmission control, takes place from an oil pump connected to the torque converter.

The electronic transmission control allows a precise adjustment of the pressures in the respective operating conditions and of the engine power during the shift phase, which leads to a significant increase in the shift quality.

The main function of the Y3/8n4 control unit (FTC) is the evaluation of various input signals relevant for the transmission function and the actuation of eight electromechanical hydraulic valves dependant on them (see internal output signals). These, in turn, set the working pressure and the bypass of the converter depending on the gear ratio of the transmission (gear selection).

#### Internal input signals:

- *Rpm sensor n\_turb (Y3/ 8 n1, input)*
- *Rpm sensor n\_2 (Y3/ 8 n2, internal)*
- *Rpm sensor n\_ab (Y3/ 8 n3, output)*
- *Transmission oil temperature sensor*

Selection range sensor (PLCD- Permanent Linear Contactless Displacement Sensor). The selection range sensor has the task of recognizing the selection ranges P, R, N, D and positions between

#### Internal output signal or direct actuation of the following control solenoid valves:

- *Working pressure valve*
- *K1 clutch valve*
- *B3 brake valve*
- *K3 clutch valve*
- *B2 brake valve*
- *K2 clutch valve*
- *B1 brake valve*
- *Torque converter lockup clutch valve*

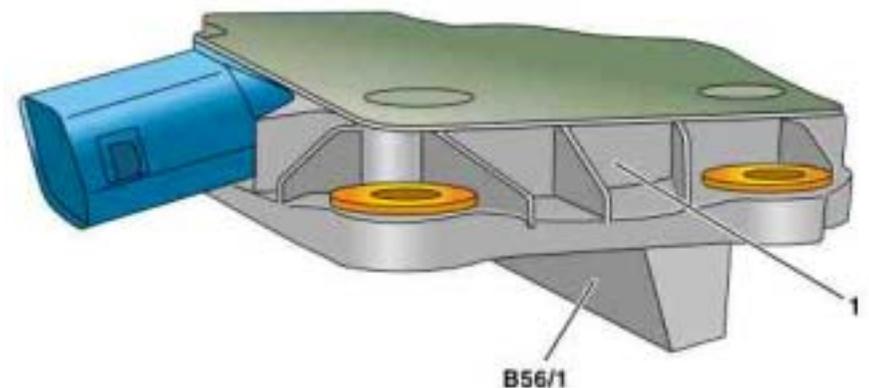
**Info:** The control unit Y3/8n4 as well as the sensors and actuators are integrated in one module (control module).

The basic shifting program contains up and down shift characteristics for all 7 speeds, designed for:

- *Empty vehicle*
- *Operating temperature (70- - 110°C)*
- *Smooth road*
- *Sea level*

#### **i** Gear recognition sensor, function (GF26.19-P-4007-02A)

The gear recognition sensor (B56/1) is a **PLCD** (*Permanent Linear Contactless Displacement Sensor*) position sensor. It operates according to the inductive principle. A magnet is passed before a fixed coil located in the sensor housing (1) splitting the coil into two zones of different length. The resultant saturations of the magnetic field are analyzed electronically and transmitted to the automated manual transmission control module (N15/6) in the form of an analog signal.



The adjustment of the shift programs takes place by moving the characteristic dependent on:

- *The vehicle payload. ( e.g Luggage)*
- *A change in the drive resistance (e.g Up/down hill airdrag)*
- *Pedal movement:*

<b>Slow:</b>	Unintended downshifts in the high vehicle speed range are prevented.
<b>Fast release of the accelerator:</b>	The upshift to the next gear is prevented and is only allowed again at low lateral vehicle acceleration.
<b>Kickdown:</b>	Bringing forward and raising of the downshift characteristic in the upper vehicle speed range.

The forced downshift to the next lowest gear is carried out at too-high transmission temperatures and lower vehicle speed.

The basic shifting program can be influenced by the driver using the program selector button (S16/12) on the electronic selector lever module control unit (N15/5). The driver can choose between the transmission modes "C" (Comfort) / "S" (Sport or Standard) or "M" (Manual). The transmission modes have different shifting strategies. In the transmission mode "S" (Sport or Standard), in contrast to the transmission mode "C" (Comfort), the engine rpm level is raised.

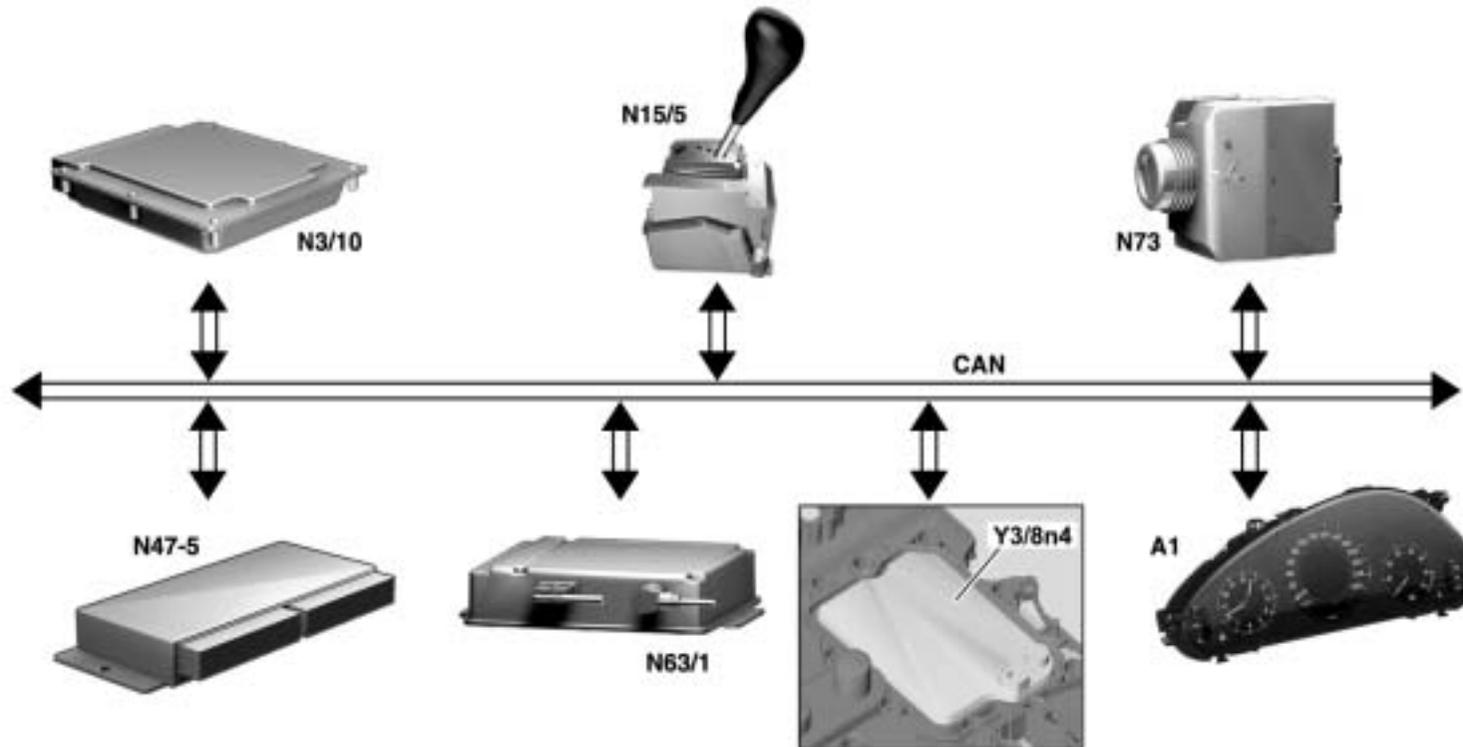
In the transmission mode "M", the driver has to initiate the shifts with the steering wheel buttons "+" and "-". In the exceptional situations "over rpm or under rpm" of the engine, the transmission shifts independently, also in "M". The gearshift linkage makes the mechanical connection between the electronic selector lever module control unit (N15/5) and the transmission in the selector lever positions "P", "R", "N" and "D". The shift range (1-6) is preselected by touching or holding the selector lever in direction "+" and "-" and displayed in the instrument cluster (A1) until upshift of the transmission is possible.

The shift ranges are transmitted by the electronic selector lever module control unit (N15/5) over CAN-C to the transmission control unit (Y3/8n4).

## Data exchange over CAN-C

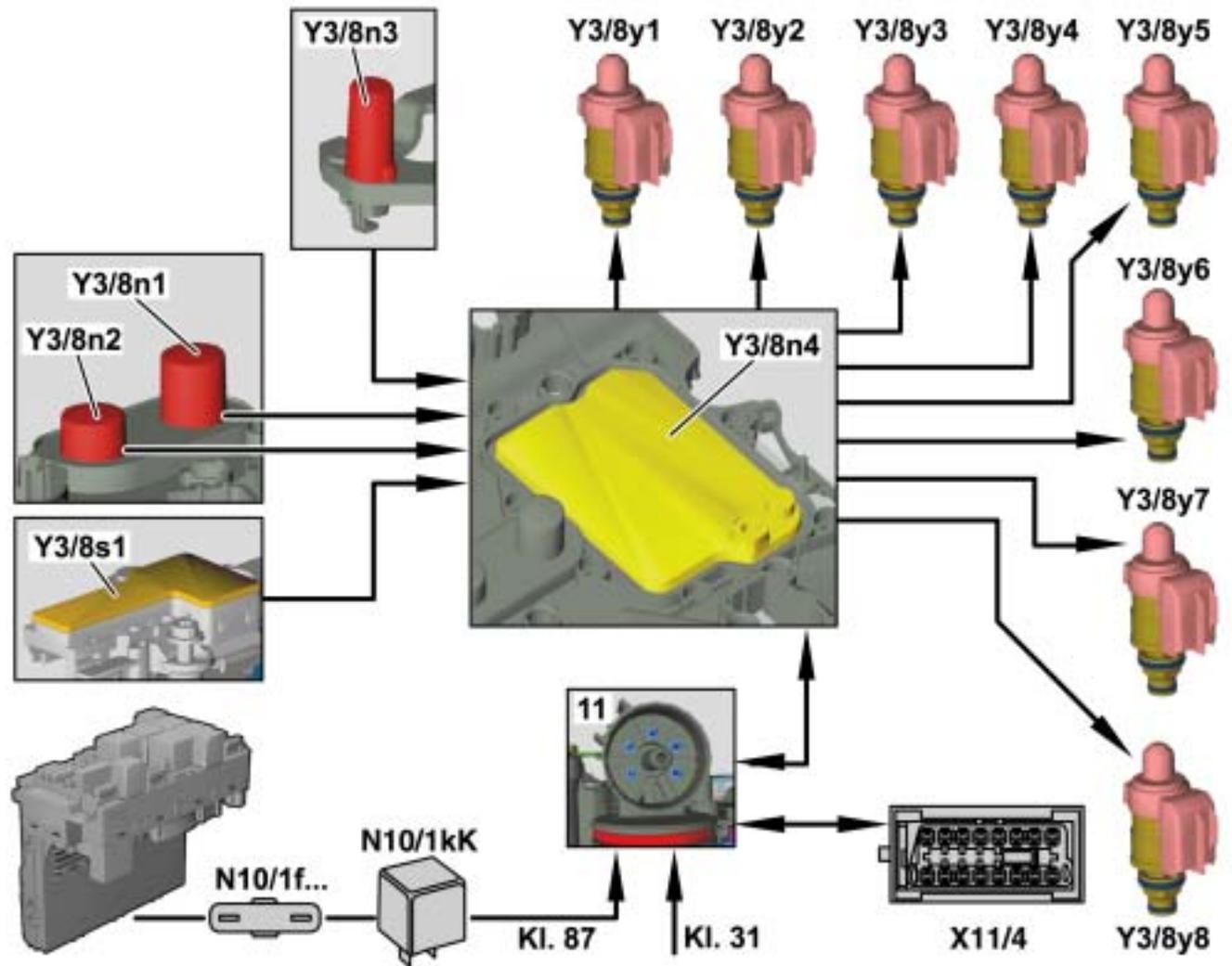
Exchange of data takes place over the engine compartment CAN (CAN-C) with the following control units:

- *Instrument cluster (A1)*
- *ME control unit (N3)*
- *Electronic selector lever module control unit (N15/5)*
- *ESP control unit, PML and BAS (N47-5)*
- *DTR control module (N63/1)*
- *EIS control unit (N73)*



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N10/f ...	Fuse
N10/1kK	Relay (W220)
X11/4	Diagnostic socket
Y3/8y1	Working pressure solenoid valve
Y3/8y2	K1 clutch solenoid valve
Y3/8y3	K2 clutch solenoid valve
Y3/8y4	K3 clutch solenoid valve
Y3/8y5	B1 brake solenoid valve
Y3/8y6	B2 brake solenoid valve
Y3/8y7	B3 brake solenoid valve
Y3/8y8	lockup clutch solenoid valve
Y3/8n1	Turbine rpm sensor solenoid valve
Y3/8n2	Internal rpm sensor solenoid valve
Y3/8n3	Output rpm sensor solenoid valve
Y3/8n4	FTC Control unit
Y3/8s1	Selection range sensor
11	Transmission plug



P27.60-2482-76

## Emergency Function

### Function description

To guarantee a safe driving condition and prevent damage to the automatic transmission, the transmission control unit (Y3/8n4) switches to emergency mode on critical faults.

- *With an electric fault, all valve power stages (control solenoid valves) are switched off, the transmission enters the emergency mode and switches spontaneously into 6th gear. After engaging the "P" drive position, "D" provides the 2nd gear and "R" a reverse gear.*
- *With hydraulic faults, the engaged gear is kept.*
- *With control solenoid valve faults, the affected gear is blocked and no longer actuated.*

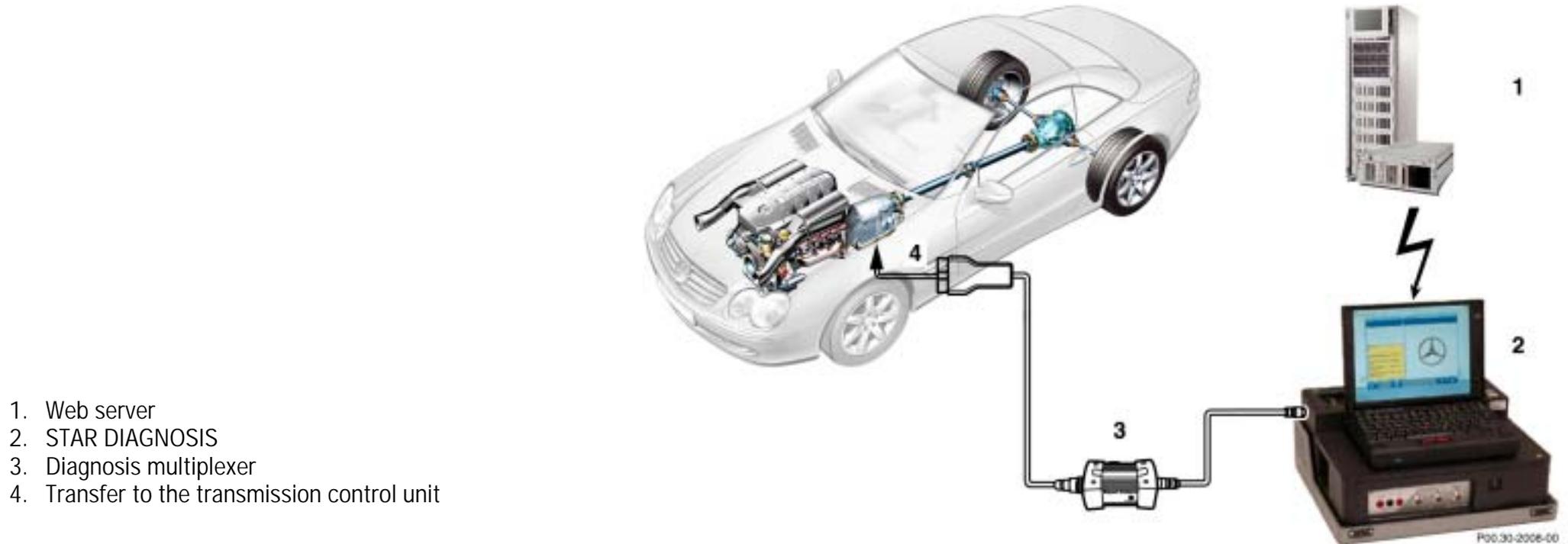
## Towing of vehicles with automatic transmission

If further driving is not possible for technical reasons you should proceed as described in the operating instructions.

In detail there are the following arrangements:

- *The transport on a special transporter or trailer is preferable to towing.*
- *If towing must take place we recommend that a tow bar be used.*
- *Conditions:*
  - *Turn the key in the steering wheel lock to position "2"*
  - *Shift the selector lever to position "N"*
  - *Max. towing speed 50 km/h*
  - *Max. towing distance 50 km*

If the towing speed or the towing distance are not adhered to it can lead to transmission damage. Over longer distances or with mechanical transmission damage, only tow with a lifted rear axle.



Previously, a control unit replacement was necessary in the case of errors or defects in the control unit, with FTC is now also possible to flash the control units' software. With STAR DIAGNOSIS, it is possible, with complaints, to overwrite the existing obsolete software in the control unit within a short time with the current "new" software release. This increases the customer satisfaction and means a further improvement in service friendliness:

- *Faster repair and shorter waiting time for the customers*
- *Reduction of material and wage costs*
- *Reduction of the control unit versions*
- *Reduction in the storage of control units*
- *Flashing the control units' software*

Task 1

- You have exchanged the electrohydraulic actuator on a 722.9 transmission. Which operations must you carry out afterwards?

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**Task 2**

○ A customer comes to you after a workshop visit with the complaint: "hard shifting".  
Remedy this fault and write down the procedure!

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**Task 3**

○ A vehicle (model 211) is towed to a workshop with the complaint that the “vehicle does not start and the shifter cannot be shifted out of the parked (P) position”  
Fix the cause and write down the procedure.

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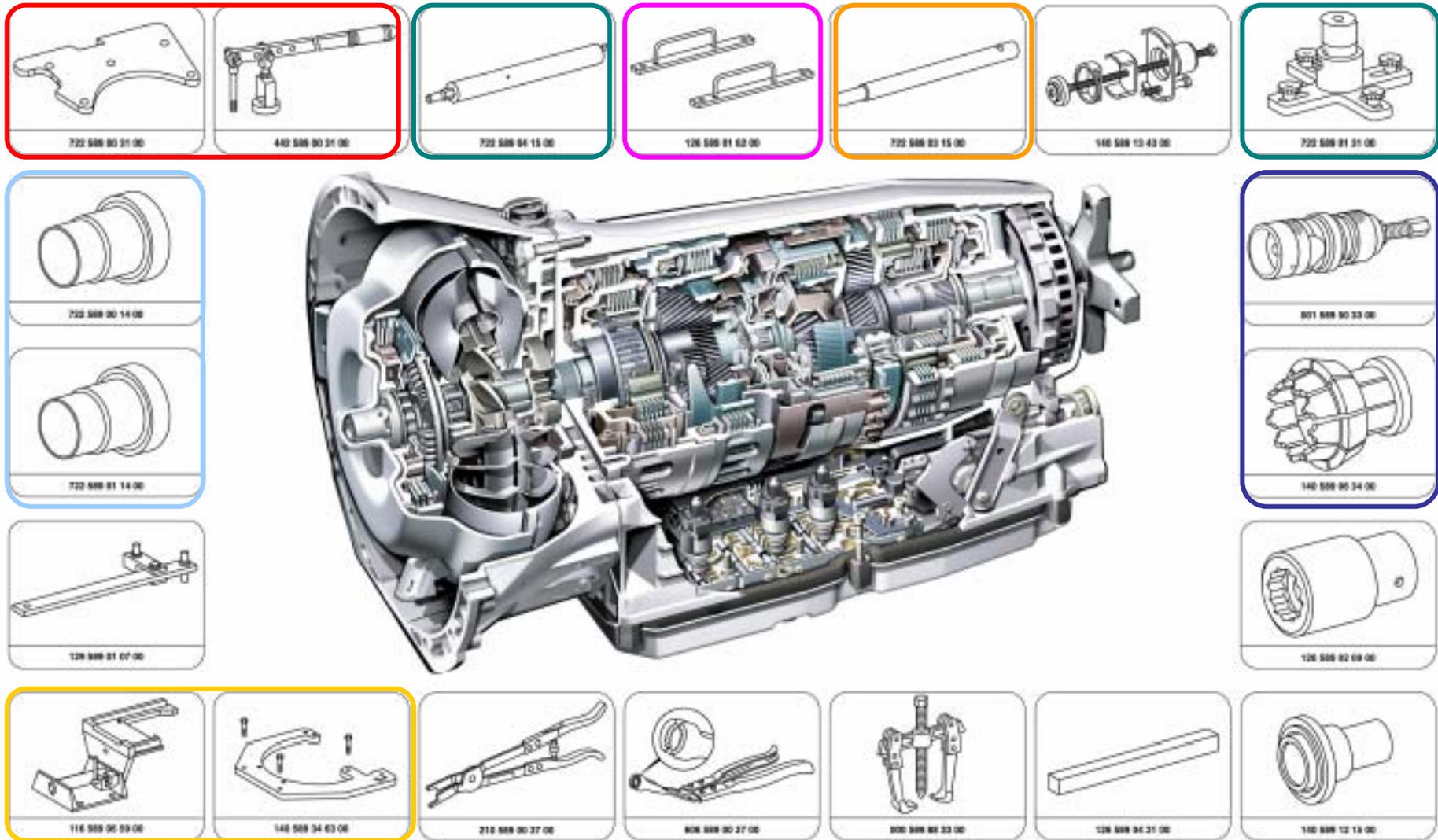
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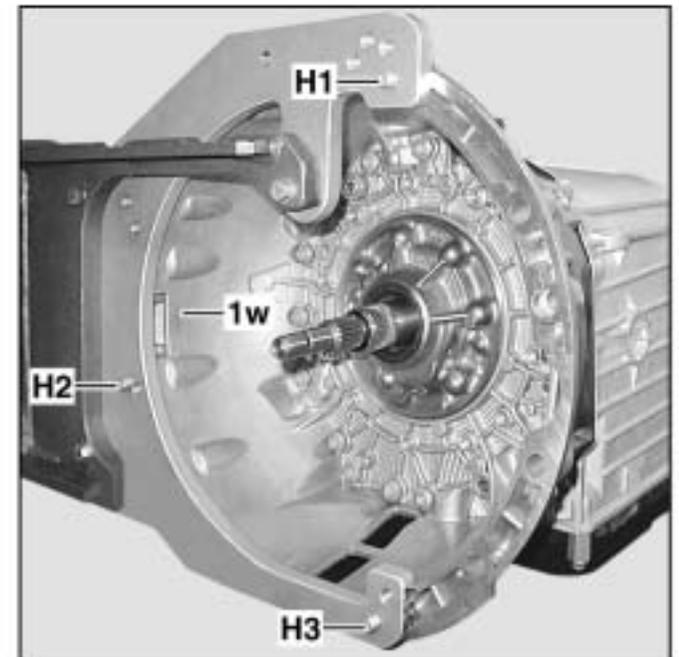
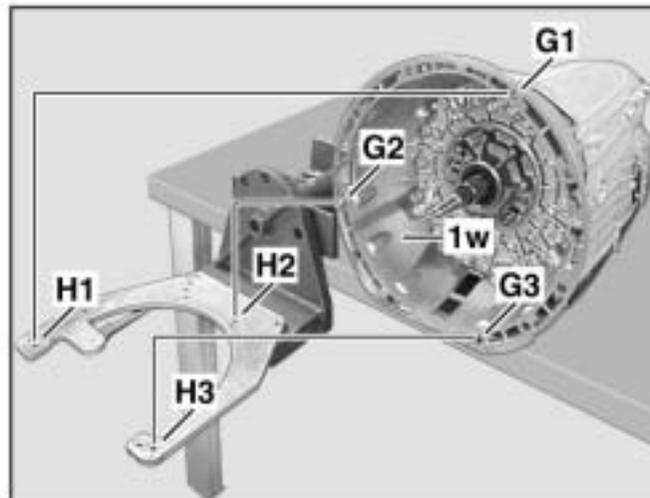
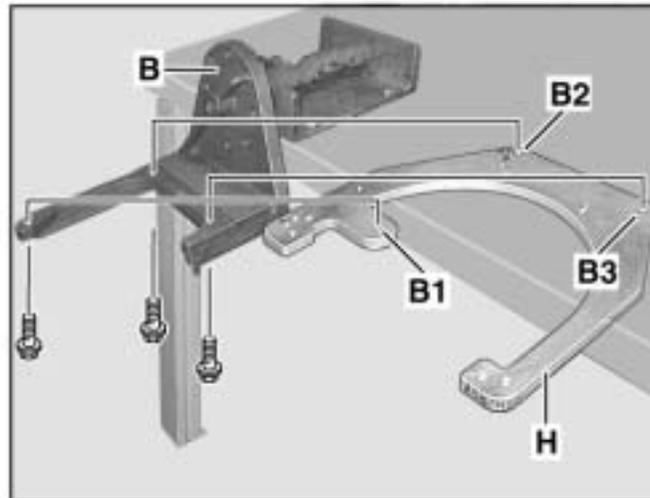
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**Task 1**

- Mount the 722.9 automatic transmission on the assembly frame!  
**Make sure you observe the safety regulations!**



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**Task 2**

○ A customer complains that the engine on his vehicle cuts out when a drive mode is engaged. Using STAR diagnosis you have found out that the "torque converter clutch control solenoid valve" is defective.

a) Which steps must you carry out first? Do you need a special tool for this?

 \_\_\_\_\_

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b) Remove the electrohydraulic control unit from the transmission!  
What must you observe during removal?

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**Task 3**

○ You have found oil leaks on the oil pump of a 722.9 automatic transmission. Remove the oil pump and change the sealing elements!

a) Why does the electrohydraulic control unit have to be removed before taking the transmission housing from the torque converter housing?

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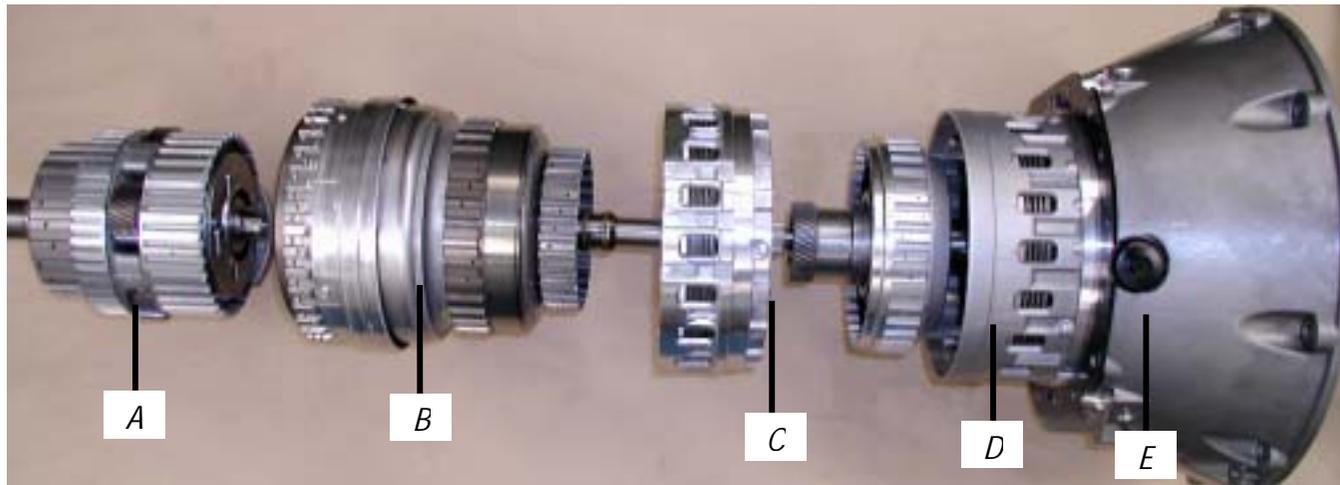
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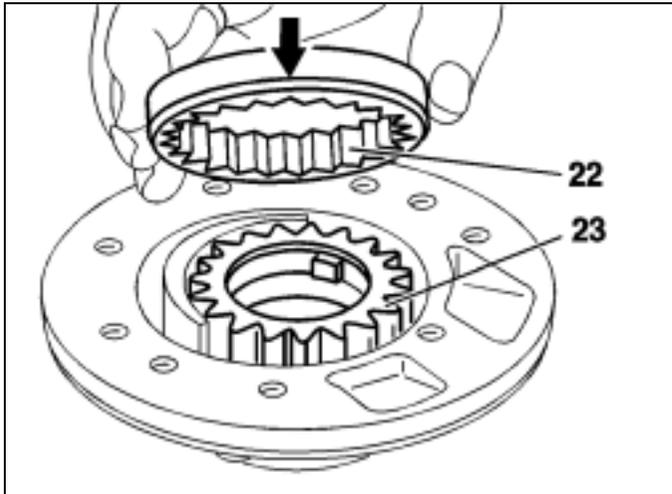
b) Which bolts have to be removed last when separate transmission housing from converter housing?

-  \_\_\_\_\_
-  \_\_\_\_\_
-  \_\_\_\_\_
-  \_\_\_\_\_

c) In which sequence are the transmission parts removed from the torque converter housing ?

-  A: \_\_\_\_\_
-  B: \_\_\_\_\_
-  C: \_\_\_\_\_
-  D: \_\_\_\_\_
-  E: \_\_\_\_\_





e) Remove / fit the oil pump. Dismantle and assemble the oil pump!How is the oil pump sealed?

✍ \_\_\_\_\_

✍ \_\_\_\_\_

f) What must be observed when inserting the internally toothed oil pump gear?

✍ \_\_\_\_\_

✍ \_\_\_\_\_

g) Remove the external disk carrier of the B1 multi-disk brake from the torque converter housing. Then mount the external plate carrier of the B1 multi-disk brake on the torque converter housing again!What must you observe when fitting?

✍ \_\_\_\_\_

✍ \_\_\_\_\_

✍ \_\_\_\_\_

**Task 4**

○ Carry out testing and repair of the B1 multi-disk brake!

a) Which special tools and aids do you need?

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 \_\_\_\_\_

b) For what possible damages do the multi-disk clutches and brakes have to be checked?

 \_\_\_\_\_

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c) Which sealing ring is used on the piston of B1?

 \_\_\_\_\_

d) When removing the friction disks, you notice that they are scorched.  
Which special features must be observed when replacing the friction disks? And why?

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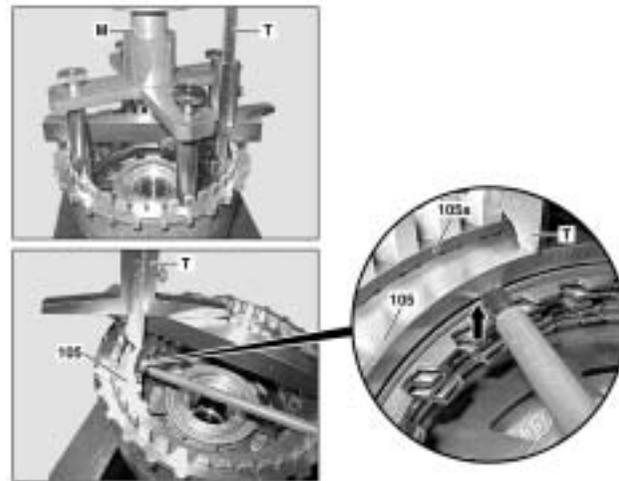


e) Which tools do you need for setting the clearance of the multi-disk brakes and multi-disk clutches?

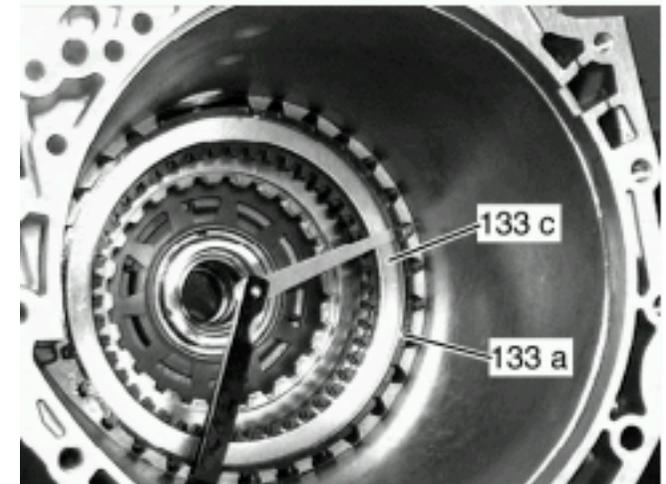
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**Task 5**

- A customer complains that the automatic transmission slips on a gear shift from 2 - 3.  
a) Which shift element can be the cause for this?

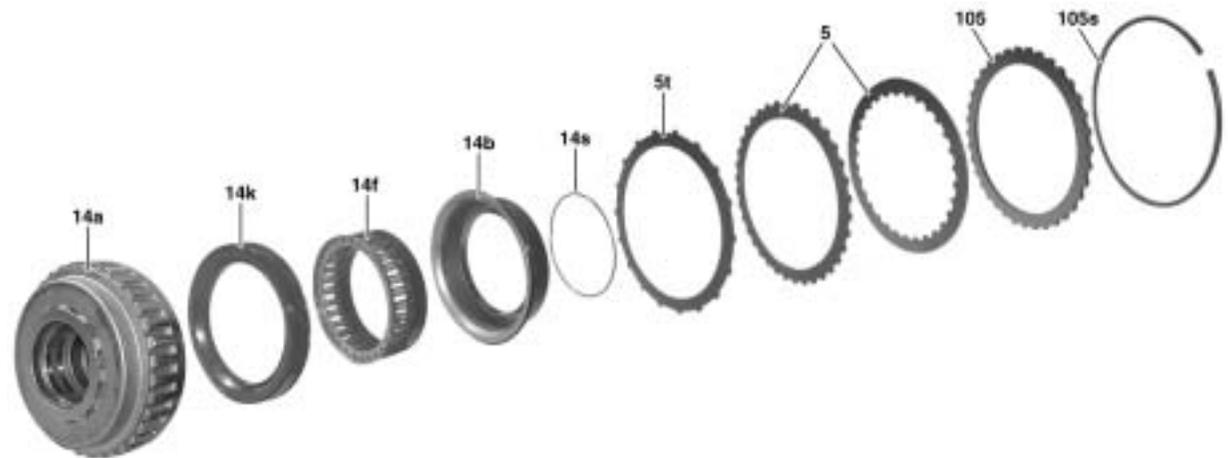
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- b) Dismantle the engaging shift element completely!
- c) Mount the K1 clutch! What must be observed when fitting?

 \_\_\_\_\_

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- d) Measure the clearance of the K1 clutch and set the play correctly!

 \_\_\_\_\_



e) What must be additionally observed with complaints about the K1 clutch?

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f) Fit the K1 clutch in the housing! What must be observed when fitting?

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 \_\_\_\_\_

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g) Which repair work may you carry out on the clutch K1 today ..... ?

 \_\_\_\_\_

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**Task 7**

○ Dismantle the input drive unit!

a) Of which individual components does the drive unit consist?

 \_\_\_\_\_

 \_\_\_\_\_

 \_\_\_\_\_

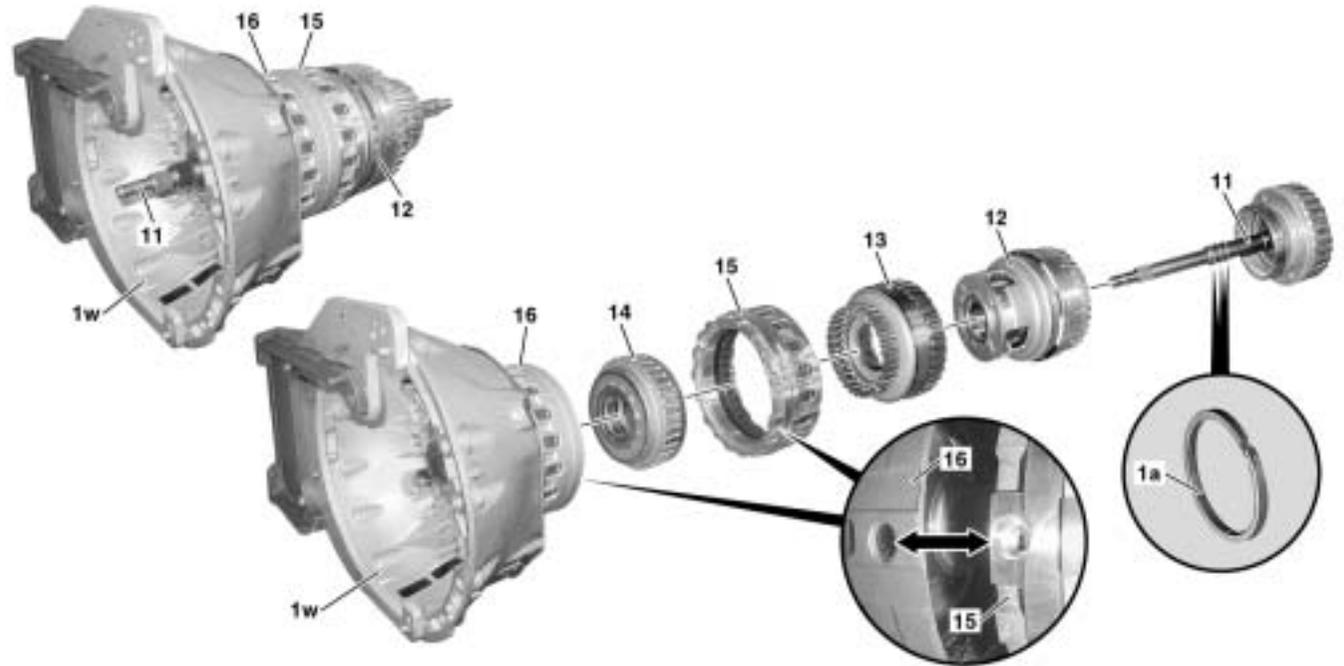
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b) Which special features do you recognize on the front planetary gear carrier?

 \_\_\_\_\_

c) How does one designate this planetary gear set?

 \_\_\_\_\_

d) Dismantle and assemble the K2 multi-disk clutch!  
Which special tools and aids do you need?

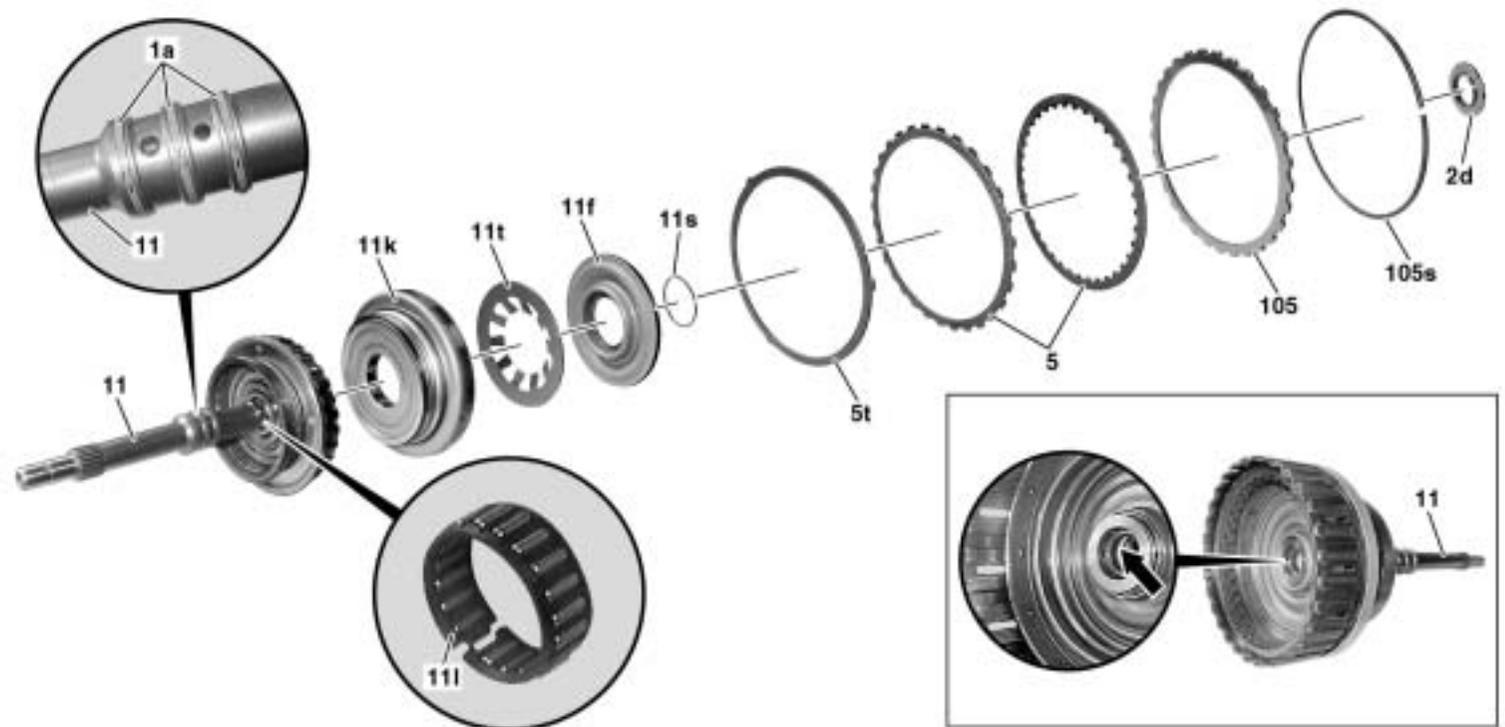
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e) To adjust the clearance of the K2 multi-disk clutch, the disk package must be pre-compressed. With which pressure are the friction disks pre-compressed?

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f) Assemble the drive unit again! What must you check before assembly?



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g) There are 3 Torlon rings on the drive unit. Which task do these 3 Torlon rings have?

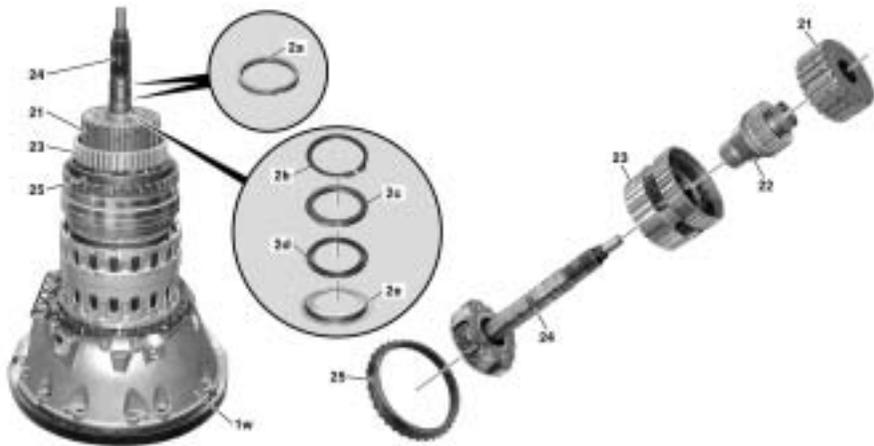


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**Task 8**



○ Dismantle and assemble the output drive unit!

a) Of which individual components does the drive unit consist?

-  \_\_\_\_\_
-  \_\_\_\_\_
-  \_\_\_\_\_
-  \_\_\_\_\_
-  \_\_\_\_\_

b) A special tool must be used to fit the Torlon rings on the output shaft. Which?

 \_\_\_\_\_

c) How many Torlon rings are mounted on the output shaft?

 \_\_\_\_\_

d) Which tasks do these Torlon rings have?

 \_\_\_\_\_

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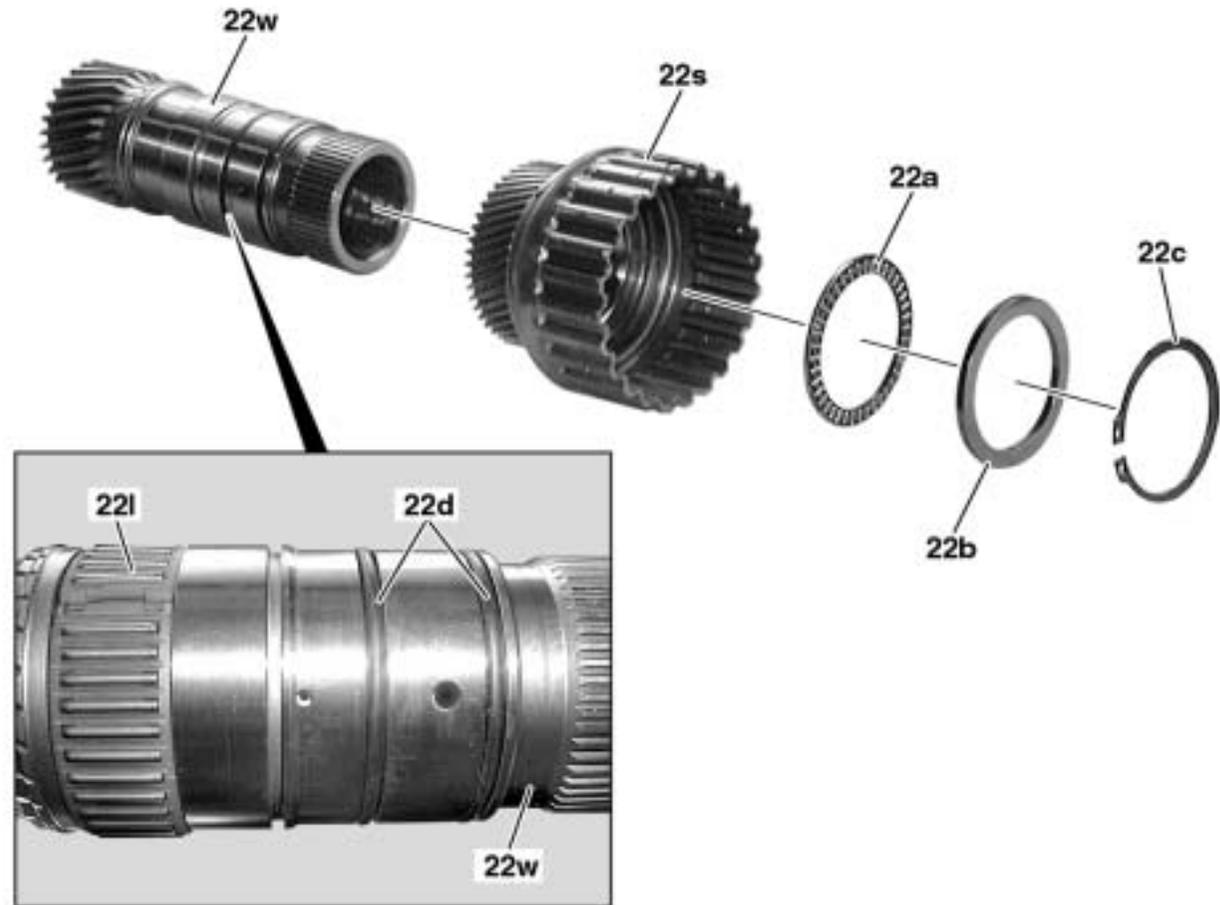
e) Are sealing elements present on the rear hollow shaft?



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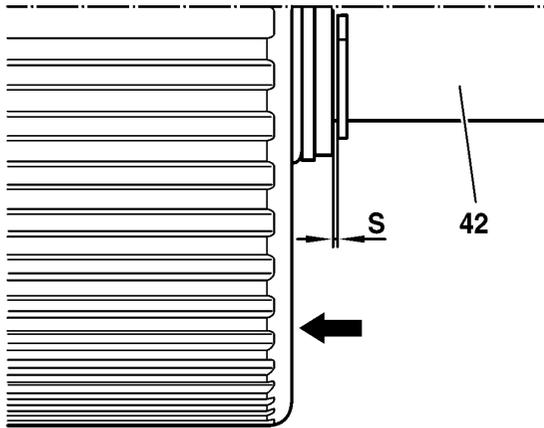


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- 22a Axial needle roller bearing
- 22b Compensation disk
- 22c Circlip
- 22d O-ring seal
- 22l Bearings
- 22s Sun gear
- 22w Hollow shaft

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- f) Test and set the axial play of the K3 multi-disk clutch on the output shaft!  
 Which measuring instruments do you need?  
 What is the axial play set with?

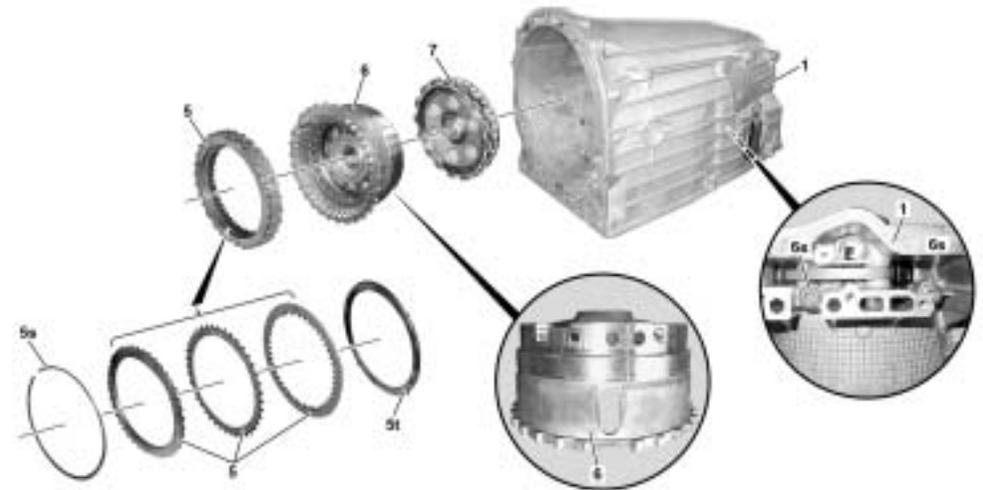
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**Task 9**

- Remove the B2/BR unit and the park pawl gear from the transmission housing!  
 a) Which special features do you recognize on the park pawl gear?

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b) Dismantle the B2 multi-disk brake! How do you proceed when dismantling?

Guide ring/B2 piston

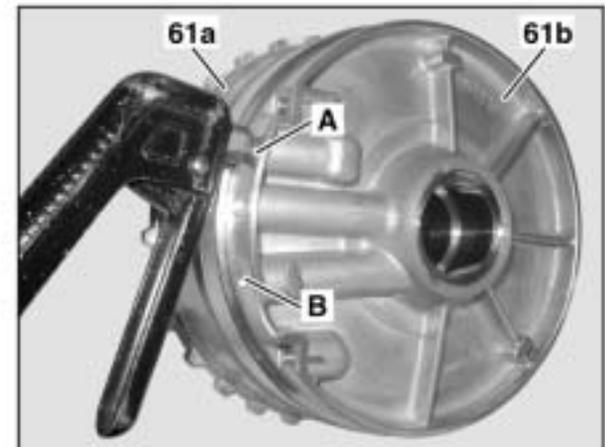
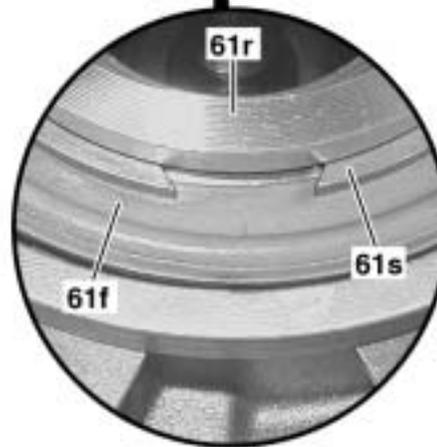
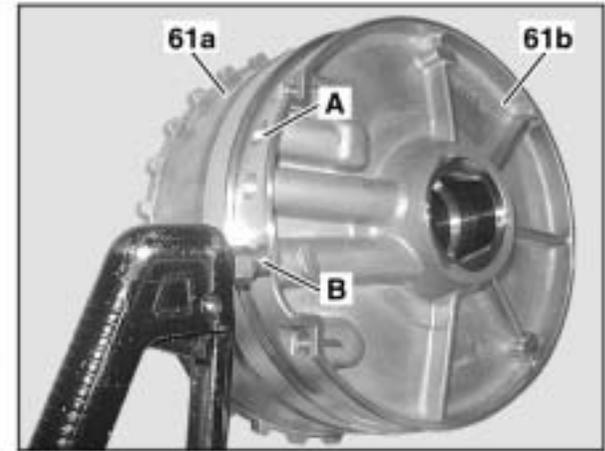
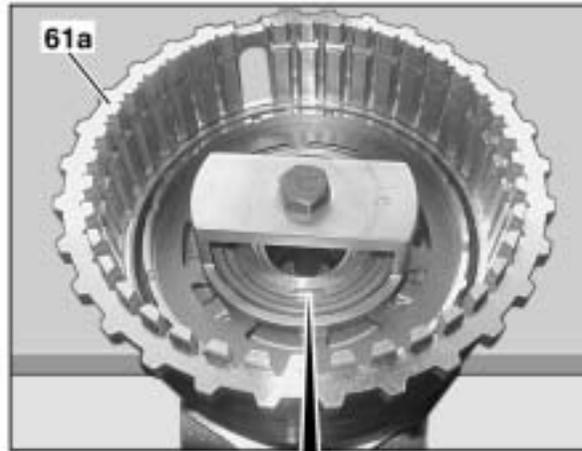


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BR piston



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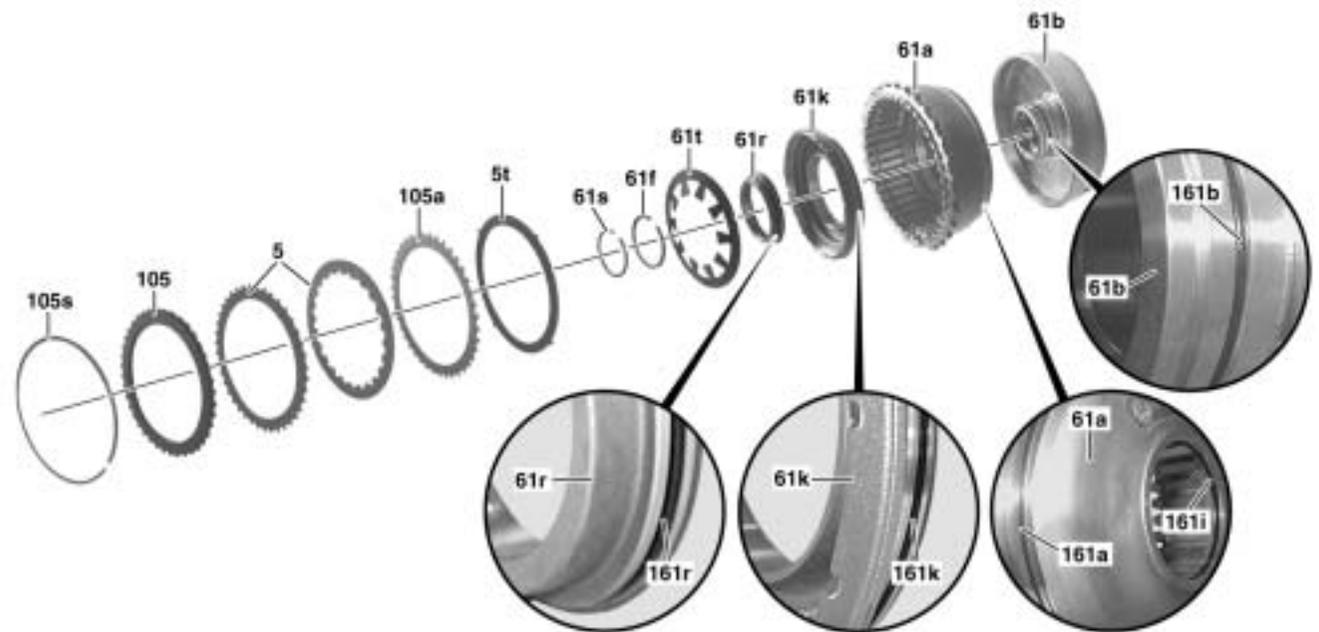
- c) Fit all the sealing rings on the B2/BR multi-disk brake!  
The installation location of the sealing rings must be observed!



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P27.51-2032-09

d) Before the final fitting of the BR multi-disk brake piston and the BR piston guide, the parts must be correctly positioned with each other.  
How must you proceed to align both parts with each other?

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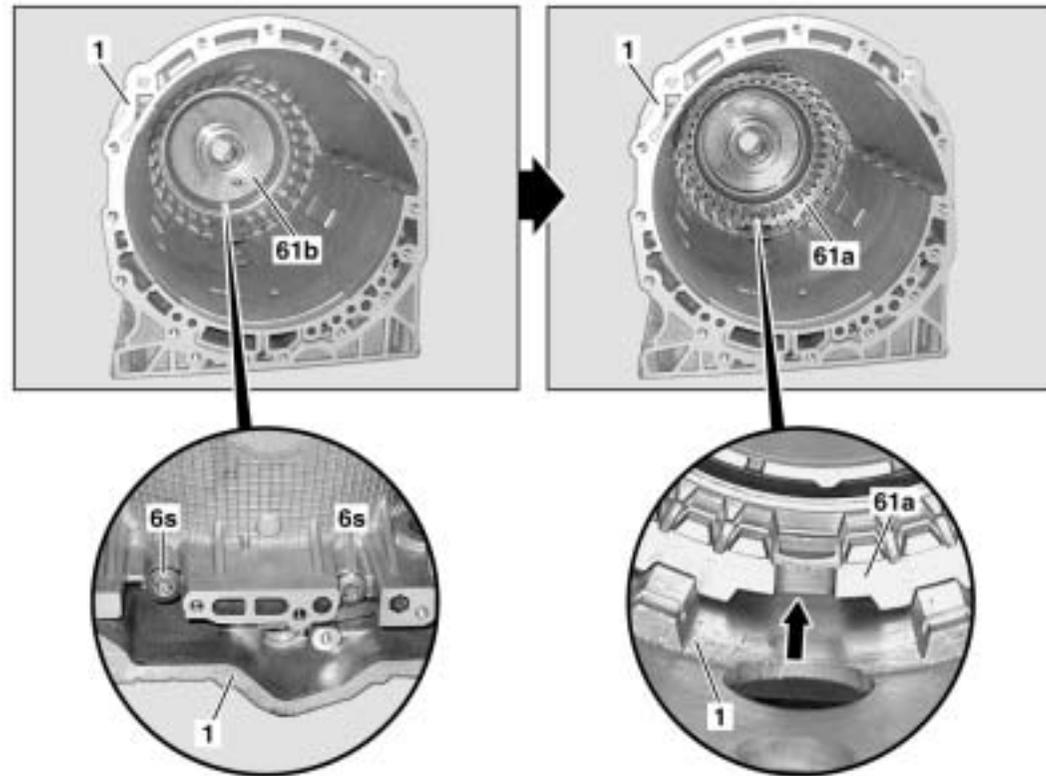
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e) Complete the B2/BR unit! Which installation position must the disk spring have for this?

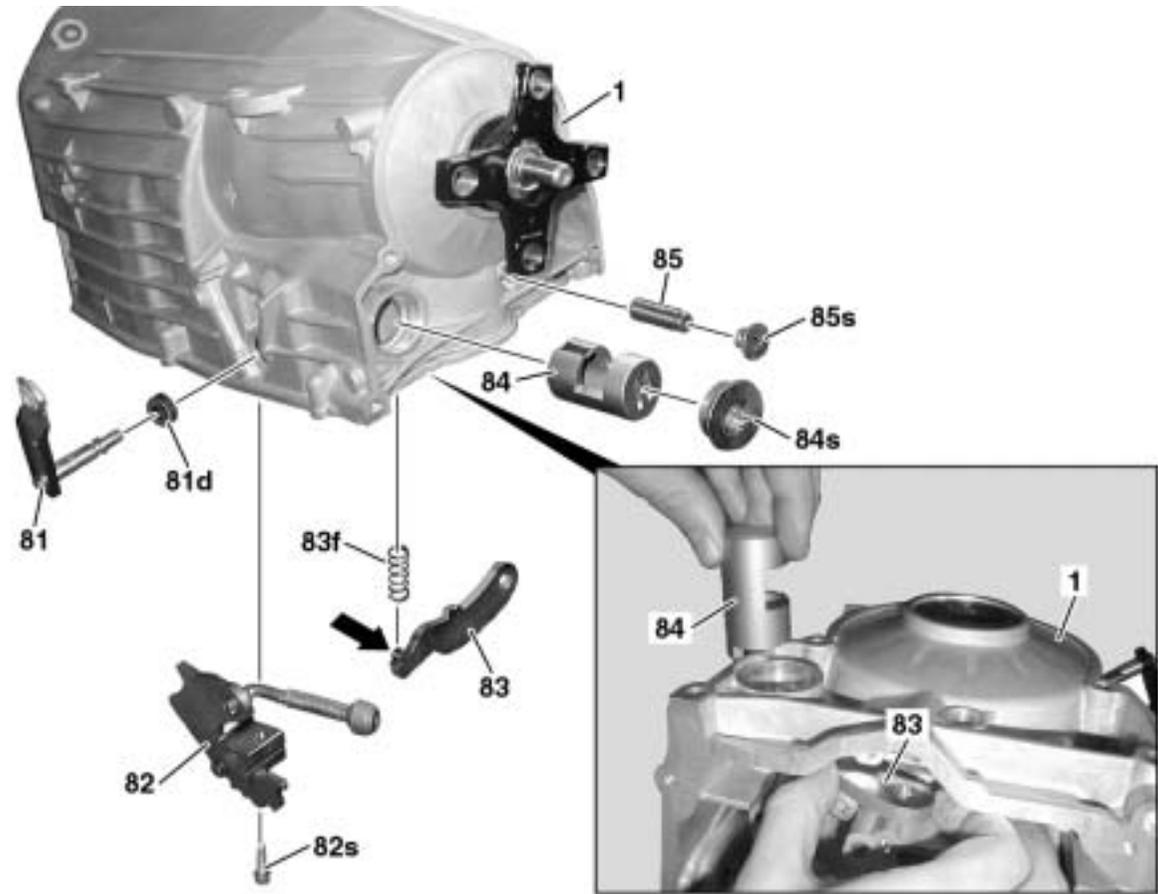
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f) Test the clearance the B2 multi-disk brake!  
Which measuring mark is important for the precompression of the B2 multi-disk brake?

 \_\_\_\_\_

**Task 10**

○ Remove and mount all parts of the park pawl mechanism! What must you observe?



- 1 Transmission housing
- 81 Range selector lever
- 81d Sealing ring
- 82 Detent plate
- 82s Bolt
- 83 Park detent
- 83f Spring
- 84 Pilot bushing
- 84s Screw plug
- 85 Pivot pin
- 85s Screw plug

P27.00-2151-06

**Task 11**

- Place the B2/BR unit in the housing. Mount the friction disks of the BR multi-disk brake. Test the clearance of the BR multi-disk brake. Which special features are there when measuring?



**Task 12**

- Mount the transmission housing with the torque converter housing. What must you observe when fitting?



**Task 13**

- Test and set the axial play between the park pawl gear and grooved ball bearing! Which play do you have to adjust on the 722.9 transmission?



**Task 14**

a) Place the grooved ball bearing in the housing! What must you observe when fitting?

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b) Mount the output flange on the housing!  
What must be observed when fitting the flange?

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**Task 15**

○ Complete the transmission entirely!

a) What must you observe when fitting the electrohydraulic control module?

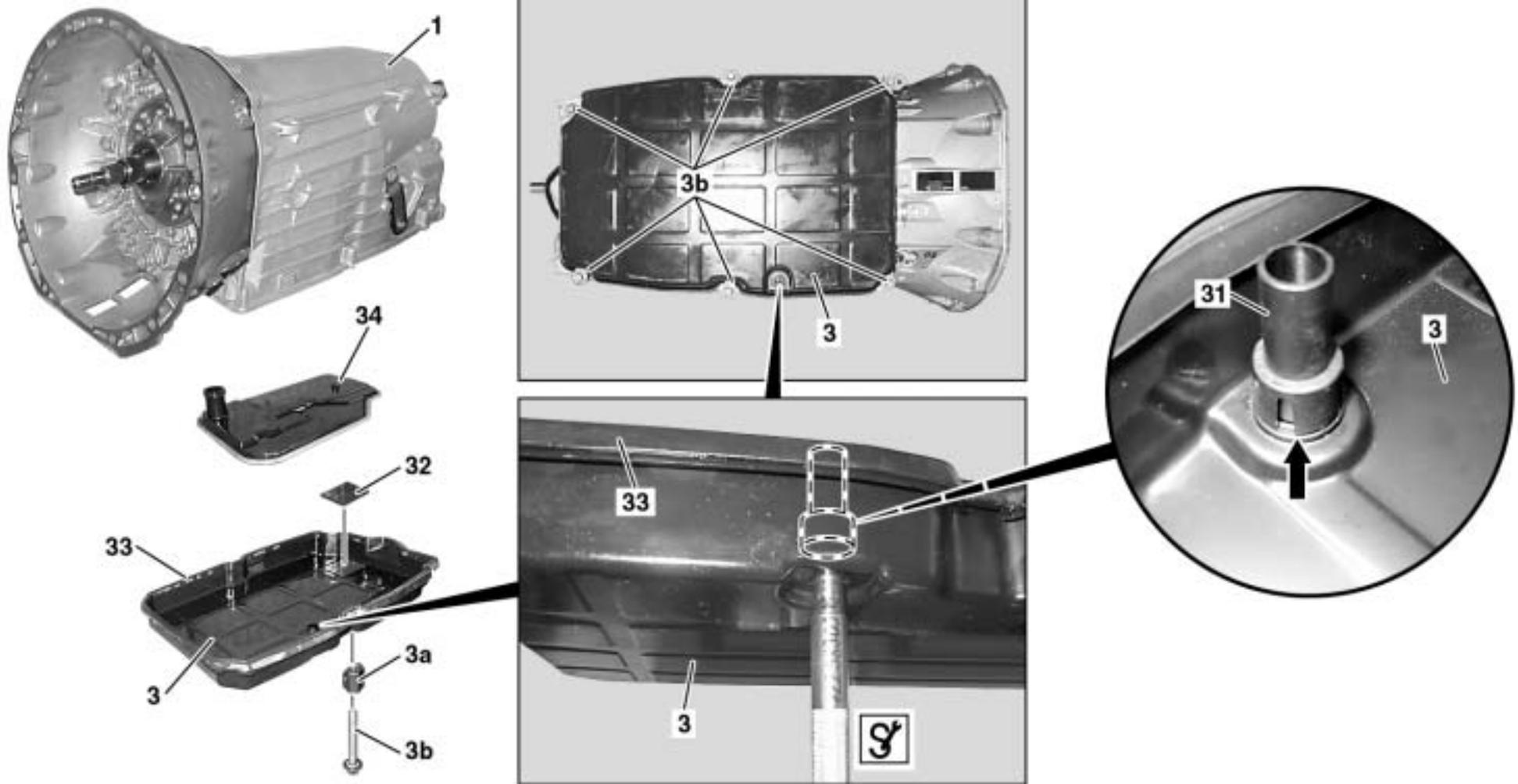
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b) Which work must be carried out on the oil pan before mounting the oil pan on the transmission housing?

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P27.00-2136-09

» ... Die Mitarbeiter werden zukünftig in die Rolle persönlicher Wissensmanager hineinwachsen müssen, die aktiv die Verantwortung für ihre Qualifizierung übernehmen ... « Jürgen E. Schrempp

» ... *Staff must in future assume the role of personal knowledge managers, who actively take responsibility for their own qualification ...* « Jürgen E. Schrempp

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